Hercules, LLC
Hercules Research Center
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Wilmington, DE 19808-1599
Writer's Direct Dial: 302-379-0512

August 19, 2022

VIA ELECTRONIC MAIL

Penny Gaynor
Georgia Environmental Protection Division
2 Martin Luther King, Jr. Dr. SE
Suite 1054, East Tower
Atlanta, GA 30334

RE: **Corrective Action Plan**
Hercules LLC/Pinova Inc. - Brunswick Facility
Hazardous Waste Facility Permit No. HW-52(D&S)-2,
EPA ID No. GAD00406065520

Dear Ms. Gaynor:

Enclosed for review and approval is an updated version of *Corrective Action Plan, Hercules/Pinova Facility, Brunswick, GA*, that Geosyntec Consultants, Inc. ("Geosyntec") prepared on behalf of Hercules LLC ("Hercules"). The enclosed Corrective Action Plan ("CAP") describes activities to implement the corrective action program pursuant to the Resource Conservation and Recovery Act ("RCRA") as administered by the Georgia Department of Natural Resources, Environmental Protection Division ("EPD") at an industrial facility located at 2801 Cook Street in Brunswick, Georgia ("the Brunswick facility"), and addresses comments received from EPD on June 17, 2022, regarding the CAP submitted to EPD on January 28, 2022. EPD's comments to the CAP were discussed during two teleconferences with EPD, Hercules and Geosyntec on July 26 and August 4, 2022. All changes were agreed to and the plan to provide replacement pages was finalized on August 11, 2022 during the regularly scheduled Triad call.

To assist with EPD's review, changes made to the CAP in response to EPD comments on the January 2022 submittal are attached to this letter as replacement pages. As requested by EPD, complete updated text, tables, and figures for the CAP is being provided electronically under separate cover. Replacement pages in both the electronic file and hard copies have an August 2022 date in the footer so it is clear which pages have been updated.

We appreciate the continued efforts that EPD is making to use adaptive management strategies with respect to the complex issues posed by releases from the historical operations at the Brunswick facility.

Please call me if you have any questions at (302) 379-0512.

Sincerely,

Timothy D. Hassett
Remediation Project Manager

Enclosure

cc: M. Crews – Pinova Inc., Brunswick, GA
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Prepared for

Hercules LLC
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CORRECTIVE ACTION PLAN

HERCULES LLC/PINOVA INC. FACILITY
BRUNSWICK, GEORGIA

Prepared by

Geosyntec consultants

engineers | scientists | innovators

1255 Roberts Boulevard, Suite 200
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Project Number GR6881D

August 2022

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

LIST OF ACRONYMS

ALM	asphalt-like material
AS	air sparging
BHHRA	baseline human health risk assessment
CAA	Central Accumulation Area
CAP	Corrective Action Plan
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CMC	carboxy methyl cellulose
COPC	constituents of potential concern
CRA	Conestoga-Rovers & Associates
CSM	Conceptual Site Model
CST	crude sulfate turpentine
DIB	diisopropylbenzene
EPD	Environmental Protection Division
HVAC	heating, ventilation, and air conditioning
ICM	Interim Corrective Measure
ISCO	*in situ* chemical oxidation
ISCR	*in situ* chemical reduction
ISS	*in situ* solidification
JWSC	Joint Water and Sewer Commission
MIBK	methyl isobutyl ketone
MNA	monitored natural attenuation
MSL	mean sea level
NAPL	non-aqueous phase liquid
NGVD	National Geodetic Vertical Datum
NPDES	National Pollutant Discharge Elimination System
NSZD	natural source zone depletion
OM&M	operation, maintenance, and monitoring
ORP	oxidation reduction potential
POTW	publicly-owned treatment works
PPE	personal protective equipment
PVC	polyvinyl chloride
QA/QC	quality assurance/quality control
RCRA	Resource Conservation Recovery Act
RFA	RCRA Facility Assessment
RFI	RCRA Facility Investigation
RML	removal management levels
SLERA	screening level ecological risk assessment

SSD	sub-slab depressurization
SVE	soil vapor extraction
SWMU	solid waste management unit
TCMHP	Terry Creek Mobile Home Park
TDS	total dissolved solids
UECA	Uniform Environmental Covenants Act
UIC	underground injection control
USEPA	United States Environmental Protection Agency
VISL	vapor intrusion screening levels

Hercules, LLC Certification

I certify under the penalty of law that this document and all attachments were prepared under my direction or supervision in according to a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Timothy D. Hassett
Remediation Project Manager

GROUNDWATER SCIENTIST CERTIFICATION

I certify that I am a qualified groundwater scientist who has received a baccalaureate or post-graduate degree in the natural sciences or engineering, and have sufficient training and experience in groundwater hydrology and related fields, as demonstrated by state registration and completion of accredited university courses, that enable me to make sound professional judgements regarding groundwater monitoring and contaminant fate and transport. I further certify that this report was prepared by myself or by a subordinate working under my direction.

Gregory P. Roush, P.G.
Professional Geologist # 73[illegible]

1. INTRODUCTION

This Corrective Action Plan (the "CAP") has been prepared by Geosyntec Consultants ("Geosyntec") on behalf of Hercules LLC ("Hercules") for submission to the Georgia Department of Natural Resources, Environmental Protection Division ("EPD") in connection with environmental conditions at an industrial facility located at 2801 Cook Street in Brunswick, Glynn County, Georgia (referred to hereinafter as the "Brunswick facility" or the "Site"). The Brunswick facility is subject to hazardous waste permit No. HW-052(D&S)-2 issued by EPD on November 2, 2020. Environmental conditions at the Brunswick facility are being addressed in accordance with the hazardous waste permit and the corrective action requirements under the Resource Conservation Recovery Act ("RCRA") as administered by EPD. An initial version of the CAP was submitted to EPD on February 1, 2021. Following a public comment period and a public meeting, EPD provided comments to Hercules in a letter dated October 20, 2021. Hercules submitted an updated version of the CAP to EPD to address EPD's comments on January 28, 2022. That version of the CAP included data and information in connection with the Brunswick facility from samples collected through December 1, 2021. EPD provided additional comments regarding the updated version of the CAP by letter dated June 17, 2022, and the updated version of the CAP has been further modified to address those comments.

To facilitate efficient investigation of soil and groundwater conditions and implementation of corrective actions at the Brunswick facility, Hercules in concert with EPD has used the Triad approach developed by the United States Environmental Protection Agency ("USEPA") to complete a multi-phased RCRA Facility Investigation ("RFI") to identify and delineate releases of chemicals regulated under RCRA from solid waste management units ("SMWUs") at the Brunswick facility. As described in reports documenting the results of the RFI for the Brunswick facility previously submitted to EPD, a total of 40 SWMUs have been identified. Due to the operational history of the Brunswick facility and the complex nature of releases of chemicals to soil and groundwater at the Brunswick facility, Hercules and EPD worked together and jointly determined that application of a comprehensive facility-wide, rather than SWMU-specific, approach to addressing environmental conditions at the Brunswick facility would provide the most effective method to evaluate the need for and implementation of corrective actions (i.e., corrective measures) to protect human health and the environment. Hercules and EPD have also agreed to utilize an adaptive management strategy in selecting and implementing corrective measures as more fully described hereinafter.

1.1 Purpose and Objectives

The purpose of this CAP is to provide a description of the corrective action program that Hercules intends to implement to address environmental conditions at the Brunswick facility in accordance with requirements, policies, and guidance under RCRA, and the requirements of hazardous waste permit No. HW-052(D&S)-2. Hercules has comprehensively investigated environmental conditions at the Brunswick facility and has performed extensive corrective measures to address conditions in portions of the Brunswick facility that were prioritized for action by Hercules and EPD. As described herein, significant work continues in other portions of the Brunswick facility, including additional sampling and evaluation activities that contribute to an evolving and improving understanding of environmental conditions at the Brunswick facility. The CAP also describes work that will be undertaken to refine the characterization of environmental conditions. The scope of additional corrective measures to be completed will rely, in part, on the additional information that is obtained in combination with the success of the corrective measures that have been completed, that are ongoing and that are expected to be undertaken in the near future. Considering that the corrective action process for a facility with this level of complexity is dynamic, the objective of the CAP is to present an adaptive management phased approach that allows for gathering additional information concurrently with implementing certain corrective measures and monitoring the performance of those corrective measures while working toward final corrective action objectives that are protective of human health and the environment based on current and projected future land use. Because sampling activities are ongoing, including undertaking routine semi-annual groundwater monitoring at the Brunswick facility, the CAP generally reflects sampling results that have been obtained from samples that were collected prior to December 1, 2021. Sampling results from samples collected after that date will be reported to EPD in reports pertinent to the objectives of the sampling together with sampling results from samples collected near to the cut-off date that were obtained too late to be included in the CAP.

1.2 Document Organization

The content and organization of the remainder of this CAP is described below.

- *Section 2 – Facility Background and History:* This section presents: (i) an overview of the Brunswick facility ((i.e., the location, ownership history, and history of operations at the Brunswick facility);) (ii) a summary of assessment and evaluation activities completed to characterize soil, groundwater, and soil gas conditions at the Brunswick facility, and to assess overall risk posed to potential receptors; and (iii) a summary of corrective actions and interim corrective measures previously completed at the Brunswick facility.

- *Section 3 – Conceptual Site Model:* This section presents the conceptual site model ("CSM") for the Brunswick facility pertaining to (i) soils, (ii) groundwater and (iii) soil gas. The CSM includes descriptions of current and anticipated future land uses, the nature and extent of primary constituents of potential concern ("COPCs") for each media, and potential receptors based on COPCs, media, and potential exposure pathways.

- *Section 4 – Corrective Action Objectives:* This section presents: (i) the overall objective for completing corrective measures at the Brunswick facility; and (ii) the approach that will be used in the development of final corrective action objectives through the implementation of activities described in Section 6 of the CAP.

- *Section 5 – Remedial Technologies:* This section presents an overview of remedial technologies screened for potential applicability and feasibility to use at the Brunswick facility to address soils, groundwater, and vapor intrusion (i.e., the "toolbox" of remedial technologies and approaches that may be used for particular corrective measures).

- *Section 6 – Corrective Action Plan:* This section presents (i) a summary of corrective measures currently in progress to address potential risks related to soils, groundwater, and vapor intrusion; (ii) a description of activities that will be completed to inform decisions regarding implementation of future corrective measures; (iii) the framework that will be used to select, communicate, and implement corrective measures based on media-specific CSMs updated throughout the corrective action process; and (iv) a description of the use and implementation of activity and use limitations in connection with the corrective action process. The process of identifying, implementing, and evaluating corrective measures has been divided into phases consistent with the adaptive management approach described in the CAP.

- *Section 7 – Groundwater Monitoring Program:* This section presents the groundwater monitoring program that will be implemented to monitor groundwater conditions and the effectiveness of corrective measures.

- *Section 8 – Schedule:* This section presents the schedule for ongoing and future corrective action activities at the Brunswick facility as described in this CAP. The presented schedule reflects the approximate timing and duration of activities described in this document, which may be adjusted as new data are acquired and evaluated using the phased approach described herein. The schedule will be re-evaluated as the investigative, sampling, and corrective action decision-making process progresses.

- *Section 9 – Costs:* This section presents costs that can be reasonably estimated for activities that are anticipated in connection with Phase 1 and Phase 2 of the corrective actions described in this CAP. Cost estimates will be re-evaluated and adjusted as the corrective action decision-making process progresses.

- *Section 10 – References:* This section presents the references used in the preparation of this CAP.

2. FACILITY BACKGROUND AND HISTORY

This section of the CAP provides information pertaining to the location of the Brunswick facility and surrounding land uses, summarizes the ownership and operational history of the Brunswick facility, and describes the SWMUs that have been identified at the Brunswick facility as listed in hazardous waste permit No. HW-052 (D&S)-2. This section of the CAP also presents a brief summary of assessment, corrective action, and risk assessment activities previously completed at the Brunswick facility along with key documents and reports previously submitted to EPD.

2.1 Location

The Brunswick facility is located at 2801 Cook Street, in Brunswick, Glynn County, Georgia. The Brunswick facility is located at latitude N31° 09' 57" and longitude W81° 28' 45", adjacent to U.S. Highway 17 and north of the Torras Causeway, within the Brunswick city limits as shown on **Figure 2-1**. The Brunswick facility consists of approximately 321 acres of property, portions of which are owned by Hercules and portions of which are owned by Pinova, Inc. ("Pinova"). Hercules owns approximately 169 acres within the northern and eastern portions of the Brunswick facility while Pinova owns the remaining approximately 152 acres of the Brunswick facility, including all of the active manufacturing areas as shown on **Figure 2-2**. The portion of the Brunswick facility owned by Hercules includes approximately 44 acres of property east of U.S. Highway 17, referred to as the "Terry Creek Property." Soils and sediments at the Terry Creek Property impacted by historical operations at the Brunswick facility are being addressed separately under requirements administered by Region 4 of USEPA pursuant to the Comprehensive Environmental Response, Compensation and Liability Act of 1980, as amended ("CERCLA"). No SWMUs or areas of concern ("AOCs") have been identified on the Terry Creek Property. Groundwater beneath the Terry Creek Property is being addressed as part of the overall corrective action process pursuant to the hazardous waste permit for the Brunswick facility.

The topography at the Brunswick facility and the surrounding area is shown on **Figure 2-1**. Properties to the north, west, and southwest of the Brunswick facility are primarily used for residential purposes and consist of single and multi-family residential properties. Properties to the south of the Brunswick facility are zoned for commercial use.

Commercial and industrial properties are located east of U.S. Highway 17 to the north and south of the easternmost portion of the Brunswick facility as shown in **Figure 2-2**. The properties immediately north of the easternmost portion of the Brunswick facility (referred to hereinafter as the "Adams Properties") have a long history of industrial activities dating back to the early 1900s, including box and veneer manufacturing, plywood manufacturing, paint manufacturing, fuel oil distribution, and automotive repair operations. [1] The area adjacent to the southern edge of the easternmost portion of the Brunswick facility along the U.S. Highway 17 corridor is being used for commercial purposes and is referred to as the "Southern Offsite Area." Both the Adams Properties and the Southern Offsite Area are shown on Figure 2-2.

A salt marsh area and surface water bodies, including Terry Creek and Dupree Creek, are located east of the Brunswick facility. A surface water conveyance referred to as the N Street Ditch passes through the Brunswick facility and ultimately discharges to the Outfall Ditch leading to Dupree Creek as shown on **Figure 2-2**. The N Street Ditch and Outfall Ditch carry stormwater runoff from the residential neighborhoods immediately west-northwest of the Brunswick facility and stormwater runoff and non-contact cooling water from the Brunswick facility to Dupree Creek.

2.2 Facility Ownership and History

2.2.1 Ownership

Yaryan Rosin and Turpentine Company began operations at the Brunswick facility in 1911, occupying a 70-acre parcel. The property was purchased by Hercules in 1920. Over time, Hercules acquired additional parcels of land. After several transactions reducing the overall size of the Brunswick facility from its greatest extent, the total area of the Brunswick facility is now approximately 321 acres of land. In January 2010, Hercules sold the southern portion of the Brunswick facility to Pinova, which continues to operate the manufacturing units for the production of wood rosins, resins, and terpene oils for a wide variety of end uses. Hercules continues to own the remaining portions of the Brunswick facility.

[1] The former industrial properties designated as the Adams Properties are currently owned by Ronald Adams, Walter Douglas Adams, and Anne Adams Rabbino individually and through their closely held corporations, Lanier Parkway Associates LLC and Adams Properties Associates LLC.

2.2.2 Operations

Other than a brief period during the Great Depression before World War II, the Brunswick facility has operated continuously since its start up in 1911. The original plant operated by Yaryan Rosin and Turpentine Company extracted rosin from pine stumps via a steam-solvent distillation process to manufacture wood rosins, turpentine, and pine oils. Following the purchase of the plant and property, Hercules continued manufacturing operations associated with the extraction of rosin and terpene oils from pine stumps generated from timber production operations in the southeastern United States. The stump extraction process consisted of grinding stumps into matchstick-sized pieces and using heat, steam, and solvents to extract crude pine resins that were then distilled and refined into a number of products. The solvents used in the extraction process have varied over the years, and have included gasoline, benzene, and, more recently, methyl isobutyl ketone ("MIBK"). Various commercial products produced from the wood and gum resins and terpene derivatives have included a wide variety of rosin-based resins used in the manufacture of soft drinks, adhesives, chewing gum, inks, and synthetic rubber.

In addition to producing wood rosin, rosin-derived resins, and terpene oils, the Brunswick facility produced the pesticide toxaphene between 1948 and 1980. Toxaphene was manufactured in a production area near the center of the Brunswick facility. Other previous manufacturing activities included the production of products such as Thanite®, CMC (carboxy methyl cellulose - a water-soluble polymer), diisopropylbenzene ("DIB") and Kymene (a wet-strength resin). In 2005, the distillation of crude sulfate turpentine ("CST") as well as the production of most of its distillation byproducts was discontinued.

Active manufacturing operations continue on the portion of the Brunswick facility owned by Pinova to the present day. Pinova produces wood rosin and terpene oils utilizing a milling and extraction process. Stumps are transported from locations in the southeastern United States to the Brunswick facility by truck. Soil and debris are mechanically separated from the stumps, and the stumps are reduced to wood chips by grinders. The wood chips are placed in a solvent solution of MIBK in an enclosed system to extract the rosin and oils. Following extraction, the spent wood chips and distillation residues are used to fuel onsite wood-fired boilers equipped with water scrubbers to remove particulate emissions. The wood ash from the boilers is sluiced into the mill room pond and the settled materials are dredged from the pond and disposed of offsite or appropriately reused as soil amendments consistent with environmental requirements.

The crude rosin/MIBK solution from extraction is refined into pale rosin and heavier or dark rosins (Belro® and Vinsol®) in the Pexite Plant. The terpene oils are subsequently extracted at the Stillhouse to remove MIBK and then shipped offsite for further processing and sale. Some components of these wood oils are received back from offsite processing for use in the production of polyterpene resins. The main products currently produced at the Brunswick facility are pale wood rosin, modified pale wood rosins, modified gum rosin, solvenol and polyterpenes. End users for these products include the adhesives, printing, building materials, and food additives industries. Pinova also manufactures phosphate esters in the chemical plant area for use in the manufacture of paint products. The Specialty Chemicals Plant, constructed in 1980, currently houses non-rosin-based processes.

No manufacturing operations are conducted on property currently owned by Hercules.

2.2.3 Solid Waste Management Units

EPD initially identified eleven SWMUs during a visual inspection Brunswick facility in 1992. EPD reported its findings in a RCRA Facility Assessment ("RFA") report in 1993. Subsequently, Hercules identified an additional 28 SWMUs at the Brunswick facility as part of the multi-phased RFI process. These additional SWMUs were described in the Phase II RCRA Facility Investigation ("RFI") Report that Hercules submitted to EPD in 2001 bringing the number of SWMUs to 39. Finally, in 2020 with the conversion of the former hazardous waste storage unit to a less than 90-day storage unit (i.e., the Central Accumulation Area ("CAA")), the CAA became the final SWMU identified at the Brunswick facility, bringing the total number of SWMUs at the facility to 40. Summaries of each SWMU are provided in **Table 2-1** with respect to location, dates of operation, contaminants detected during various investigation activities, and other pertinent details relating to each SWMU. The locations of the SWMUs are shown on **Figure 2-3**. No SWMUs or AOCs are located in the portion of the Brunswick facility east of Highway 17 referred to as the Terry Creek Property.

2.3 Summary of Previous Assessments, Evaluations, Corrective Measures, and Interim Corrective Measures

2.3.1 Overview

The history of investigation and evaluation activities at the Brunswick facility is extensive, and the knowledge gained from those activities serves as the foundation for the CSM presented in Section 3 of this CAP. The CSM provides the framework for making risk management and corrective action decisions for the Brunswick facility.

Investigation and risk assessment methods and findings have been detailed in other documents previously submitted to EPD. Multiple investigations to assess soils at the Brunswick facility have been completed. These investigation activities date as far back as 1983, beginning with the soil investigation activities that were performed in connection with the closure of surface impoundments that were located in the northern portion of the Brunswick facility.

Hercules has completed multiple subsurface investigations at the Brunswick facility to assess releases from SWMUs, to characterize the hydrogeology underlying the Brunswick facility, and to evaluate contaminant distributions in soils and groundwater. More than 100 monitoring wells and observation wells have been installed in the course of these investigation activities. Monitoring well and observation well locations are shown on **Figure 2-4** and well construction details are provided in **Table 2-2**. Groundwater monitoring activities remain ongoing at the Brunswick facility pursuant to hazardous waste permit No. HW-052(D&S)-2.

Corrective measures have been ongoing at the Brunswick facility since 1983. These corrective measures have been performed between and overlapping with different phases of the investigation activities. The corrective measures that have been completed to address soils at the Brunswick facility include removal of soils, structures, debris, and equipment for offsite disposal and more recently, in 2021, use of *in situ* solidification ("ISS") to address soils in the former toxaphene tank farm. These measures have improved groundwater conditions by removing or mitigating potential source materials. Other corrective measures have been conducted at the Brunswick facility to directly address groundwater conditions, including recovery and treatment of groundwater over a 14-year period and recovery of non-aqueous phase liquid ("NAPL") from multiple areas. The methods and results of these various corrective measures have been described in prior submissions to EPD. Many of these corrective measures were implemented as interim actions to address particular areas or conditions at the Brunswick facility while other work, including investigation activities and assessments of potential risks, was being performed. The locations at the Brunswick facility where corrective measures have been undertaken are shown on **Figure 2-5**.

Along with soils and groundwater, Hercules is evaluating potential vapor intrusion at the Brunswick facility. As part of ongoing activities, Hercules elected to install vapor intrusion mitigation systems at two buildings at the Brunswick facility rather than to conduct further assessment activities. These vapor mitigation systems were installed during March 2021, as Hercules' vapor intrusion evaluation continues.

2.3.2 Timeline of Major Investigative and Remediation Milestones

Major milestones in Hercules' investigation and remediation of the Brunswick facility are summarized below. Only significant submittals to EPD and remediation activities are mentioned. This section refers to several documents that have not been approved or denied by EPD and therefore the results and conclusions of these reports have not been fully agreed upon by the parties.

- *Investigation of Former Surface Impoundments (1983)*: Hercules performed soil investigations at the former surface impoundments (SWMU No. 10) in the northern portion of the Brunswick facility in 1983 as part of closing the surface impoundments in accordance with the relevant provisions of the hazardous waste regulations applicable to interim status facilities. The area formerly included five contiguous unlined surface impoundments used for management of wastewater containing diluted hydrochloric acid generated in connection with production of toxaphene between late 1971 and 1980. (Production of toxaphene ceased in 1980.)

- *Closure of Former Surface Impoundments (1984)*: In 1984, Hercules conducted extensive soil removal activities in the area where surface impoundments were historically located in the northern portion of the Brunswick facility as shown on **Figure 2-5**. Specifically, Hercules excavated soils down to the water table, and the excavated materials were disposed of offsite at a permitted landfill located in South Carolina. The area was backfilled with a mix of imported backfill and soil from the stump dirt removal process. The removal of soils from the surface impoundment area was part of efforts to meet the "closure by removal" standards then applicable in 40 C.F.R. Part 265 for the surface impoundments. Certification of closure of the surface impoundments by a certified professional engineer was completed in October 1984, and the closure certification was confirmed in a letter from EPD to Hercules dated December 14, 1984. Additional fill material was placed in the area in the early 1990s to create a mound-shaped feature to provide a sound barrier between the operational areas at the Brunswick facility and residential areas located to the north of the Brunswick facility.

- *Equalization Basin Investigation (1990)*: Hercules investigated the Equalization Basin (SWMU No. 11) in 1990 to determine whether the basin was impacting groundwater. As part of the work, three groundwater monitoring well clusters (POC-1, POC-2, and MW-3) were installed within the shallow and intermediate zones of the upper surficial aquifer. A follow-up to this investigation was conducted in September 1992. This work consisted of collecting multi-depth groundwater samples at 12 locations using hydropunch technology, re-sampling the previously installed monitoring wells, and collecting surface water samples from the equalization basin. Six new groundwater monitoring wells (MW-4, MW-5S, MW-5I, MW-6, MW-7, and MW-8) were also installed as part of the investigation activities.

- *RCRA Facility Assessment (1993)*: EPD performed a visual site inspection and identified the initial set of eleven SWMUs at the Brunswick facility as described in the RCRA Facility Assessment ("RFA") Report issued in 1993. EPD expressly concluded in the RFA Report that the groundwater in the surficial aquifer below the Brunswick facility is not potable due to brackish and saline conditions.

- *Hercules SWMU Assessment Report (1993)*: In response to EPD's identification of various SWMUs at the Brunswick facility, Hercules prepared assessment reports with background information regarding the identified SWMUs.

- *Phase I RCRA Facility Investigation and Phase II RCRA Facility Investigation Work Plan (1994)*: Hercules performed the first phase of the RFI for the Brunswick facility in 1993 and 1994 and presented the results of the initial soil and groundwater sampling activities at the eleven identified SWMUs in the Phase I RFI Report submitted to EPD in 1994. Hercules also submitted to EPD a work plan for the second phase of the RFI.

- *Facility Boundary Soil Sampling (1994-1996)*: Hercules investigated soils around the perimeter of the Brunswick facility between 1994 and 1996 to identify soils with toxaphene at concentrations greater than 2 milligrams per kilogram ("mg/kg"), a target level established by EPD, so that such soils could be excavated and properly disposed at an appropriate offsite solid waste landfill. The selection of excavation areas was made in consultation with EPD.

- *Groundwater Pump and Treat System (1995–2009)*: Hercules installed a groundwater pump and treat system east of the former surface impoundments in 1995 and operated the system until 2009 as an interim corrective measure to remove and treat groundwater from the area between the former surface impoundments and the former equalization basin in the northern portion of the Brunswick facility. The pump and treat system withdrew groundwater from a 55-foot deep well installed between SWMU No. 10 (the former surface impoundments) and SWMU No. 11 (the former equalization basin), operating at pumping rates ranging from 0.14 gallons per minute ("gpm") to around 8 gpm. The extracted water was processed through a green sand bed, a resin (PM100) bed, and two activated carbon treatment units to remove organic and inorganic constituents before discharging the extracted water to the local publicly-owned treatment works ("POTW"). The use of this system was suspended in 2009 when the local POTW informed Hercules that it would no longer accept the effluent from the treatment system.

- *Soil Removal from Mercury Absorber Area (1995–1996)*: The mercury absorber facility was removed between 1995 and 1996 and mercury contaminated debris and dirt on the concrete pad in the area was likewise removed. The former mercury absorber facility is designated as SWMU No. 31 and the area where soil removal activities took place is shown on **Figure 2-5**. The former mercury absorber facility operated between 1967 and 1993 for the purpose of purifying hydrogen by removing mercury from the hydrogen gas that was supplied via pipeline from the former Brunswick Linden Chemicals and Plastics plant located several miles from the Brunswick facility. No records of the removal action are available.

- *Perimeter Soil Excavation Activities (1996–1998)*: Soil excavation activities were performed between 1996 and 1998 in five locations around the perimeter of the Brunswick facility to address soils containing toxaphene at concentrations in excess of 2 mg/kg as identified in a soil sampling event performed in April 1996. The selection of excavation areas was made in consultation with EPD. The soils that were excavated were shipped to an appropriate offsite solid waste landfill. The excavation depths varied from 0.5 to 1 foot below ground surface ("bgs"). Based on currently available documents, no further information regarding the removal action has been identified. Areas where soils were excavated along the northern and southern boundaries of the Brunswick facility are shown on **Figure 2-5**.

- *Y Tank Farm Demolition and Excavation (1996)*: A tank farm containing what were designated as the Y-1, Y-2, and Y-3 tanks was removed in 1996 after the tanks were taken out of service in January 1996. This former tank farm is designated as SWMU No. 8 and is shown on **Figure 2-5**. Cleaning and removal of the tanks was initiated in August 1996. Thereafter, soils in the area of the former tank farm were excavated down to the groundwater table after the tank foundations and earthen dikes were removed. These activities occurred between December 1996 and January 1997. Based on currently available documents, no further information regarding the removal action has been identified.

- *Truck Unloading Area Excavation (1996)*: Visually impacted soils were excavated in 1996 in an area referred to as the former truck unloading area. This area is designated as SWMU No. 3 and is shown on **Figure 2-5**. Soils were excavated to depths ranging from 4.5 to 6.5 feet bgs. Contaminated soils and wood debris were removed from a concrete containment vault approximately 30 feet by 10 feet in size and from the adjacent areas; the excavated areas were then backfilled with clean soil. Based on currently available documents, no further information regarding the removal action has been identified.

- *Drum Crusher Area Excavation (1996)*: In 1996, stained soils in an area approximately 10 feet by 20 feet in size were removed from a location where a drum crushing unit had been located. Specifically, a small hydraulic machine for crushing empty drums was located in this area (which is now designated as SWMU No. 4) as shown on **Figure 2-5,** and drums were crushed from approximately 1980 until 1992. After soil removal activities were completed, a curbed concrete pad was installed over the excavated area and extended another 40 feet to the east. Subsequently, drum crushing operations were relocated from this area. Based on currently available documents, no further information regarding the removal action has been identified.

- *Stillhouse Pipe Rack Excavation and Containment Construction (1996)*: Soils were removed in the area of the Y tank farm (designated as SWMU No. 6) to facilitate construction of the secondary containment area elements installed under the pipe rack for the Stillhouse on the south side of the Y tank farm in 1996. This pipe rack location is shown on **Figure 2-5**. At the same time, a curbed concrete pad with sampling ports was also installed to mitigate the potential for spills or leaks to reach the surrounding soils. Based on currently available documents, no further information regarding the removal action has been identified.

- *Former Toxaphene Production Area (1997)*: Significant soil removal activities were completed in the former toxaphene production area (designated as SWMU No. 5) in 1997. Soils within the footprint of the former toxaphene production area were excavated to the groundwater table over an area that was approximately 100 feet by 300 feet in size. Over 2,200 cubic yards of soils were removed. The excavated soils were disposed of at an appropriate offsite facility, and clean fill was placed in the excavated area. Based on currently available documents, no further information regarding the removal action has been identified. The area where soils were removed is depicted on **Figure 2-5** as the Toxaphene Plant Soil Removal Area.

- *Soil Removal from SWMU No. 13 Area (1999-2001):* SWMU No. 13 consists of an area where five aboveground steel tanks (designated as tanks F-1 through F-5) with capacities ranging between 5,000 gallons and 10,000 gallons were located on pedestals within a concrete secondary containment system approximately 80 feet long and 50 feet wide. The tanks were reportedly installed in the 1930s for storing various chemicals. The tanks were dismantled and removed between 1999 and 2001, and soils were removed from around each tank down to the groundwater table between 1999 and 2001. The area where soil removal activities took place is shown on **Figure 2-5**. The area was backfilled with clean soil. This SWMU is listed in hazardous waste permit No. HW-052 (D&S)-2 as requiring no further action.

- *Phase II RCRA Facility Investigation (2000-2001)*: Hercules performed further soil and groundwater investigation activities in 2000 to delineate the extent of releases from SWMUs present at the Brunswick facility. Hercules installed additional monitoring wells to delineate releases to groundwater including a series of groundwater monitoring wells around the perimeter of the Brunswick facility for the purpose of evaluating USEPA environmental indicators, aimed at controlling groundwater migration and preventing human exposure to historical contamination. As part of this work, Hercules identified an additional 28 SWMUs, bringing the total number of SWMUs identified at the Brunswick facility to 39. Hercules presented the results of its investigation activities to EPD in a report titled *Phase II RFI Report Hercules Brunswick Facility* (the Phase II

RFI Report") dated June 2001. The Phase II RFI Report included a preliminary risk assessment. Risks associated with potential exposure to contaminated groundwater in the surficial aquifer through ingestion were not evaluated because the surficial aquifer at the Brunswick facility is not a current or reasonably foreseeable future source of drinking water.

- *Former Toxaphene Production Area and N Street Ditch (2007-2010)*: In September 2007, Hercules submitted to EPD a corrective action plan for SWMU No. 5. Work was conducted under the corrective action plan from March 2008 to January 2010. The corrective measures included remediating approximately 300,000 square feet of surface area associated with the former toxaphene production area, the N Street Ditch, and the Vinsol Building. The area where these corrective measures were conducted is labeled as the SWMU No. 5 Corrective Action on **Figure 2-5**. All major structures were removed in this area and soils were excavated and disposed of at an appropriate offsite facility. Additionally, concrete revetment matting (fabriform) lining was installed in the N Street ditch as part of this work. The fabriform lining project was completed in November 2009. The corrective measures were documented in a report titled *Corrective Action Report, Solid Waste Management Unit No. 5 Area* that Hercules submitted to EPD in July 2010 and that EPD approved in December 2010.

- *Phase III RCRA Facility Investigation (2012–2015)*: Between 2012 and 2014, Hercules performed the third phase of the RFI at the Brunswick facility involving additional soil and groundwater investigation activities. The investigation activities for soils were performed utilizing the Triad approach. The Triad approach utilized systematic project planning initiated in 2009 and involved preparing a CSM to develop the key elements of the soil investigation scope of work. Soil sampling results collected from 2012 to 2014 are considered Triad data, and soil sampling results collected prior to 2012 are considered pre-Triad data. The Triad approach used three components: (1) systematic project planning, (2) dynamic work plans, and (3) real-time measurement technologies to plan and implement data collection and effective decision-making in the face of uncertainties regarding conditions at the Brunswick facility. During the Triad process, the SWMUs were grouped into four decision units (exposure domains) for further characterization as part of the third phase of the RFI based on the close proximity of the SWMUs to one another and common types of activities and land uses within the Brunswick facility. The SWMUs and the overlapping exposure domains are illustrated on **Figure 2-6**. The four exposure domains were subsequently used during the baseline human health risk assessment and screening level ecological risk assessment (discussed in Section 2.4 of this CAP) to evaluate potential risks to various receptors in each exposure domain. The four exposure domains were described as follows:

- Exposure Domain 1 – Stump Grinding Area (including the Mill Room).
- Exposure Domain 2 – Outside Storage Area (stumps, sawdust, brown soil, and black soil).
- Exposure Domain 3 – Wastewater Treatment Area (encompassing the closed surface impoundments that were used for managing wastewater from historical toxaphene production operations); and
- Exposure Domain 4 – Operational Area (rosin extracting and reacting).

On February 4, 2015, Hercules submitted to EPD a report titled *RCRA Facility Investigation for Soils Using Triad Approach, Hercules/Pinova Facility* (the "Phase III RFI Report for Soils") which delineated the extent of releases from SWMUs to soils at the Brunswick facility (NewFields, 2015a). In a letter dated April 29, 2015, EPD approved the Phase III RFI Report for Soils that documented the extent of releases to soils.

On February 26, 2015, Hercules submitted to EPD a report titled *Brunswick Groundwater RFI III Report* (the "Phase III RFI Report for Groundwater") which presented data to sufficiently delineate the extent of the releases to groundwater (NewFields, 2015b). In a letter dated April 29, 2015, EPD approved the Phase III RFI Report for Groundwater.

- *NAPL Recovery System Northwest of the Stillhouse (2012 – 2020):* In December 2012, Hercules installed a NAPL recovery system utilizing a hydrophobic skimmer in proximity to monitoring well MW-48D in the southern production area at the Brunswick facility. The physical properties of the NAPL where the recovery system is located make the NAPL indistinguishable from water when gauged with an oil-water interface probe. Operation of the recovery system was discontinued in 2020, after those operations reached the point of diminishing returns.

- *Glynn Brunswick Memorial Hospital Soil Sampling Activities (2013):* Hercules collected seven soil samples in 2013 from an approximately 8.5-acre parcel of land located immediately north of the current boundaries of the Brunswick facility that Hercules sold to the Glynn Brunswick Memorial Hospital to provide additional parking areas. The soil sampling results demonstrated that metals and polycyclic aromatic hydrocarbons ("PAHs") detected in the soils were present at background concentrations. Based on the sampling results, no further actions or investigation steps were warranted. The property is no longer considered a part of the Brunswick facility that is subject to hazardous waste permit No. HW-052 (D&S)-2.

- *Environmental Background Analysis (2014):* Hercules collected on-site soil samples in 2014 in an area unaffected by operations at the Brunswick facility to develop background concentration levels for target analytes in soils. Facility-specific background concentrations for soils were calculated using the USEPA Background Statistical Software package (ProUCL Version 4.1.01). Background concentrations were calculated for a variety of constituents detected in soils at the Brunswick facility, including toxaphene. These calculations established a background concentration of toxaphene in soils in the Brunswick area of 2.4 mg/kg which was endorsed by EPD. The background study results were incorporated into the Phase III RFI Report for Soils discussed above.

- *Brunswick Interim Measures Plan for Groundwater (2014):* Hercules developed a preliminary plan titled *Brunswick Interim Measures Plan for Groundwater* (the "Interim Measures Plan") to address the discovery through the Phase III RFI of the presence of low concentrations of COPCs in offsite groundwater in the deep zone of the upper surficial aquifer. The Interim Measures Plan proposed evaluating the feasibility and effectiveness of two remedial technologies, phytoremediation and an enhanced biobarrier approach involving Plume Stop™ technologies. The Interim Measures Plan was submitted to EPD on August 21, 2014, and detailed a series of screening, bench, and pilot scale tests to evaluate the technologies. The Interim Measures Plan was approved by EPD on September 7, 2014.

- *Modification of the Brunswick Interim Measures Plan for Groundwater to Include Hydraulic Control (2015):* As described above, between 1995 and 2009, Hercules operated a groundwater pump and treat system in the northeastern portion of the

Brunswick facility west of U.S. Highway 17. Operation of the pump and treat system was suspended in 2009 based on the inability to permissibly discharge groundwater from the system to the local POTW for treatment. In a letter dated July 16, 2015, Hercules proposed revising the Interim Measures Plan for groundwater to include installation of two extraction and hydraulic control pumping wells east of the closed surface impoundments screened in the shallow zone of the upper surficial aquifer to control the potential migration of COPCs downgradient from the closed surface impoundments, similar to the extraction well that Hercules had operated from 1995 to 2009. This interim measure was designed to replace the phytoremediation technology proposed by the original version of the Interim Measures Plan, as Hercules' continued evaluation of that technology concluded that the depth of the plume, the hydraulic gradient, and the impact of sodium and chloride levels in groundwater made this technology unsuitable. On July 27, 2015, EPD approved the modification to the Interim Measures Plan. However, on July 29, 2015, the Glynn County Joint Water and Sewer Commission ("JWSC") denied permission to discharge recovered groundwater into the sewer system for treatment at the local POTW.

- *Revised Hydraulic Control Basis of Design Report (2016):* In response to JWSC denying permission to discharge recovered groundwater into the sewer system for treatment at the local POTW, Hercules evaluated an alternative for handling recovered groundwater from the proposed hydraulic control system involving infiltration of recovered groundwater. Hercules presented its evaluation in a document titled *Revised Basis of Design Report, Interim Corrective Measures, Groundwater Hydraulic Control System, Former Hercules Facility, Brunswick, Georgia (Antea, 2016d)* that Hercules submitted to EPD in September 2016 and revised in November 2016. The proposed technology was dependent upon authorization from the local POTW to discharge treated groundwater or the issuance of an underground injection control ("UIC") permit. EPD approved the submission by letter dated November 15, 2016, but noted the unresolved issues regarding discharge of the treated groundwater. Due to the shallow depth of groundwater, the projected volume of recovered groundwater, and data supporting the conclusion that the closed surface impoundments were no longer a source of COPCs potentially affecting groundwater in offsite areas, Hercules ultimately concluded that the proposed interim measures would not be effective or necessary to control migration of COPCs in the upper surficial aquifer in this area.

- *Mass Flux Study (2016):* Hercules completed in 2016 a mass flux study of groundwater conditions at the Brunswick facility on the western side of U.S. Highway 17. The mass flux study utilized screening-level analytical methods to assess groundwater quality and a hydraulic profiling tool to evaluate the hydraulic conductivity of the subsurface. The study's methodology allowed for a qualitative analysis of the presence and movement of COPCs, but it did not reliably evaluate information regarding concentrations of COPCs. The results of the mass flux study were presented in a report that Hercules submitted to EPD in 2016 in revised form titled *Revised Mass Flux Determination Hercules/Pinova – Brunswick Facility (Antea, 2016b)*.

- *Enhanced Biobarrier Pilot Test (2016):* Hercules completed a pilot test to evaluate potentially installing an enhanced biobarrier using Plume Stop™ technologies. The results of the pilot study were presented in a report that Hercules submitted to EPD in 2016 titled *Enhanced Biobarrier Pilot Test – Summary and Conclusions*. In response to a letter from EPD regarding this report dated January 25, 2017, Hercules submitted a letter to EPD dated March 31, 2017, explaining that the pilot study of Plume Stop™ technologies did not produce reductions in contaminant mass flux in the range that were targeted. Based on the pilot study, Hercules concluded that further study of the use of Plume Stop™ technologies would be required before potentially applying the technologies on a large-scale basis (a conclusion that has since been ratified by the results of recent groundwater treatability studies discussed in Section 6.1.4 of this CAP).

- *Groundwater Technical Summary Report (2016):* Hercules presented a CSM for groundwater conditions at the Brunswick facility in a document titled *Groundwater Technical Summary Report* that was submitted to EPD on September 23, 2016. The report included an updated groundwater flow model as well as the results of the mass flux study and the enhanced biobarrier pilot study using Plume Stop™ technologies. EPD provided comments regarding the Groundwater Technical Summary Report on February 2, 2017. Hercules provided EPD with additional information addressing those comments via e-mail on March 8, 2017.

- *Salinity Sampling Results Report (2017):* In 2017, Hercules conducted sampling activities in the upper surficial aquifer beneath the eastern portion of the Brunswick facility and in offsite areas to the east of U.S. Highway 17 pursuant to a work plan approved by EPD by letter dated May 15, 2017. Hercules presented the results of these sampling activities in a technical memorandum to EPD dated July 31, 2017, which concluded that groundwater in the upper surficial aquifer in the area beneath and adjacent to the eastern portion of the Brunswick facility is naturally brackish due to the presence of a salt wedge and the proximity of adjacent saltwater bodies and is therefore not suitable to serve as a source of drinking water supplies (Integral, 2017).

- *Potability Assessment Report (2018):* On July 13, 2018, in response to EPD's comments regarding the technical memorandum that had been submitted to EPD in July 2017 and EPD's invitation to submit additional information, Hercules submitted to EPD a report titled *Potability Assessment of Groundwater in the Area Downgradient of the Hercules/Pinova Brunswick Facility, Brunswick, Georgia* (the "Potability Assessment Report") which evaluated multiple lines of evidence regarding the brackish to saline conditions that are naturally present in groundwater in the upper surficial aquifer in the area proximate to the eastern portion of the Brunswick facility. The Potability Assessment Report also addressed questions raised by EPD in connection with the technical memorandum that Hercules submitted to EPD on July 31, 2017. Hercules concluded that groundwater in the upper surficial aquifer in the study area east of the Brunswick facility cannot serve as a sustainable source of potable water because such groundwater is naturally brackish to saline due to the proximity of and hydraulic connection to the adjacent saltwater bodies. Hercules also concluded that fresh water lenses that might be present in certain discrete areas were insufficient to serve as a sustainable source of drinking water for a potable water supply well that might be theoretically installed because such a well would quickly draw brackish to saline water into the well. Hercules augmented the Potability Assessment Report with a submission to EPD titled *Follow-Up to July 23, 2008 Groundwater Potability Meeting* and a report titled *Groundwater Model Update for the Hercules/Pinova Brunswick Facility, Brunswick, Georgia*.

- *Refined Conceptual Site Model (2019):* On March 15, 2019, Hercules submitted to EPD a report presenting an updated and refined CSM for groundwater. This report identified source areas, potential preferential groundwater flow paths, and degradation processes. The report also presented the results of updated groundwater modeling performed at the Brunswick facility.

- *Baseline Human Health Risk Assessment and Screening Level Ecological Risk Assessment, Hercules/Pinova Brunswick Facility (2019):* As discussed in Section 2.4 of this CAP, on March 22, 2019, Hercules submitted to EPD a detailed report titled *Baseline Human Health Risk Assessment and Screening Level Ecological Risk Assessment, Hercules/Pinova Brunswick Facility* presenting an evaluation of potential risks associated with environmental conditions at the Brunswick facility, including soils in the four exposure domains that had previously been established.

- *Vapor Intrusion Pathway Evaluation Work Plan (March 2019):* On March 22, 2019, Hercules submitted a work plan to EPD titled *Vapor Intrusion Pathway Evaluation Work Plan, Hercules/Pinova Facility, Brunswick, GA* (the "Vapor Intrusion Work Plan") presenting a preliminary vapor intrusion CSM for the Brunswick facility, identifying buildings at the Brunswick facility susceptible to vapor intrusion, and describing the methods and steps to complete the vapor intrusion evaluation at the Brunswick facility. As part of preparing the Vapor Intrusion Work Plan, all of the buildings at the Brunswick facility were assessed for potential susceptibility to vapor intrusion. EPD approved the Vapor Intrusion Work Plan by e-mail dated April 4, 2019.

- *Onsite Vapor Intrusion Sampling Plan (June 2019):* On June 4, 2019, Hercules submitted a work plan to EPD titled *Onsite Vapor Intrusion Sampling Plan, Hercules/Pinova Facility, Brunswick, GA* (the "Vapor Intrusion Sampling Plan") describing proposed field investigation activities to assess shallow groundwater conditions upgradient and downgradient of the buildings at the Brunswick facility susceptible to vapor intrusion to support the vapor intrusion evaluation. Following an onsite meeting with EPD on June 18, 2019, Hercules submitted to EPD an addendum to the Vapor Intrusion Sampling Plan on July 10, 2019, containing certain additional information requested by EPD. EPD subsequently approved the Vapor Intrusion Sampling Plan (as amended) by e-mail and letter dated July 16, 2019.

- *Supplemental Offsite Groundwater Investigation Activities (2019 –2020):* On May 17, 2019, Hercules submitted to EPD a work plan titled *Southern Offsite Area Monitoring Well Installation and Groundwater Monitoring Work Plan* providing for the installation and sampling of three nested pairs of groundwater monitoring wells in an offsite area along the southern boundary of the Brunswick facility referred to as the Southern Offsite Area. EPD provided comments regarding the work plan in a letter dated June 26, 2019. Hercules submitted a revised version of the work plan to EPD addressing EPD's comments on July 26, 2019. EPD approved the revised version of the work plan by letter dated August 8, 2019. The monitoring wells provided for in the work plan were installed in November 2019 and were sampled in December 2019 and February 2020. The monitoring well clusters were installed to refine information concerning contaminant distributions in the upper surficial aquifer. On March 27, 2020, Hercules submitted a report to EPD titled *Southern Offsite Area Monitoring Well Installation and Groundwater Monitoring Report* presenting the results of the supplemental investigation activities in the Southern Offsite Area. The boring logs and well construction diagrams for the new monitoring wells are provided in **Appendix A.**

- *SWMU 6 – Former Toxaphene Tank Farm: Interim Corrective Measure Work Plans (September 2019 and October 2020) and Implementation of Corrective Measures (October 2019 – January 2022):* Hercules completed the field work associated with corrective measures at the former toxaphene tank farm, which is located within the area designated as SWMU No. 6 (the Y tank farm) in the central portion of the main operational area of the Brunswick facility. The area associated with the former toxaphene tank farm is approximately 140 feet wide and 260 feet long and is located within a concrete containment wall. On September 24, 2019, Hercules submitted a letter to EPD describing a two-phased approach for implementing interim corrective measures in the former toxaphene tank farm area. The letter provided in detail the planned approach for implementing the first phase of the interim corrective measures, including the removal of asphalt-like material ("ALM") classified as a listed hazardous waste with a waste classification code of P123 (toxaphene) from within the former toxaphene tank farm area. EPD approved the proposed plan in a letter dated October 1, 2019. Based on this approval, Hercules removed ALM and related materials from the former toxaphene tank farm area between October 24, 2019 and November 22, 2019. This work included the removal of 280 cubic yards of concrete visibly impacted by ALM and 68 tons of ALM-impacted soils, as well as the removal, via scarification, of six drums of ALM from selected concrete surfaces. The removal activities completed during the first phase of the interim corrective measures in the former toxaphene tank farm area were documented in a report prepared by Geosyntec and titled *Interim Corrective Measure SWMU No. 6 P123 Removal Completion Report for the Toxaphene Tank Farm Area* (Geosyntec, 2020a) which

Hercules submitted to EPD on February 14, 2020 and amended in April 2020. In a letter dated May 5, 2020, EPD acknowledged receipt and review of the report and provided notification to Hercules that no comments or deficiencies in the report were identified.

The second phase of the interim corrective measures at the former toxaphene tank farm focused on addressing residual concentrations of toxaphene present in shallow soils within the former toxaphene tank farm area from the ground surface to a depth of five feet bgs (equating to approximately 7,000 cubic yards of soil). In conjunction with the second phase of the interim corrective measures, Hercules submitted to EPD a document titled *Interim Corrective Measure Plan, SWMU 6, Former Toxaphene Tank Farm, Hercules/Pinova Brunswick Facility, Brunswick, Georgia* on July 2, 2020. In response to limited comments from EPD, Hercules made minor revisions to the proposed work plan and submitted to EPD a document titled *Revised Interim Corrective Measure Work Plan, SWMU No. 6 - Former Toxaphene Tank Farm, Hercules/Pinova Brunswick Facility, Brunswick, Georgia* (the "Former Toxaphene Tank Farm ICM Work Plan") on October 9, 2020, which was approved by EPD in a letter dated October 22, 2020. The Former Toxaphene Tank Farm ICM Work Plan included a detailed discussion of various remedial alternatives that were assessed for possible deployment at the former toxaphene tank farm, treatability studies that were performed to assess the viability of certain of the remedial alternatives, the basis for selecting ISS (*in situ* solidification) as the remedial alternative to be implemented, and the details describing the manner in which ISS would be implemented.

The contractor selected by Hercules to implement ISS at the former toxaphene tank farm mobilized to the former toxaphene tank farm in April 2021 and completed the field work in January 2022, as described in detail in Section 6.1.1 of this CAP. Post-implementation inspections and maintenance (as needed) will be performed to maintain the integrity of the interim corrective measures completed at the former toxaphene tank farm.

- *Vapor Intrusion – Revised Preliminary Conceptual Site Model and Data Gap Analysis (December 2019):* In August 2019, Hercules conducted sampling to assess shallow groundwater conditions at the Brunswick facility in areas in proximity to buildings at the Brunswick facility susceptible to vapor intrusion. These shallow groundwater sampling locations are shown on **Figure 2-7**. The sampling results and other selected lines of evidence were used to prioritize susceptible buildings (designated as Tier 1 and Tier 2 buildings) for follow up investigation activities and to determine that other buildings (designated as Tier 3 buildings) did not need to be evaluated further to conclude that the vapor intrusion pathway is incomplete as described in a document titled *Revised Vapor Intrusion Conceptual Site Model and Data Gap Analysis Report* (the "Revised Vapor Intrusion CSM Report") that Hercules submitted to EPD on December 23, 2019. EPD approved the Revised Vapor Intrusion CSM Report in a Triad call on March 23, 2020.

- *Site-Wide Soils - Interim Corrective Measures (April 2020 – Current):* In April 2020, Hercules began delineating surface soils at the Brunswick facility at specific target locations with elevated concentrations of toxaphene so that such soils can be removed as part of the interim corrective measures that are being implemented. The overarching objective of removing such surface soils is to reduce potential carcinogenic risks and non-carcinogenic hazards associated with direct contact to those surface soils by onsite workers, construction workers, and trespassers at the Brunswick facility (i.e., through inhalation, dermal contact, and ingestion) under current and anticipated future industrial land use scenarios. Soil delineation sampling activities were complete in October 2021, and a work plan describing the soil removal activities that are expected to be conducted is being prepared. The planned soil removal activities are also discussed in more detail in Section 6.1.2 of this CAP.

- *NAPL Recovery System Northeast of the Stillhouse (June 2020 – Current):* In June 2020, Hercules installed an oil recovery skimmer system at piezometer PZ1-6R to remove pine oil-like NAPL from the top of the groundwater table. The skimmer system is a solar-powered belt skimmer unit housed inside a small trailer and is operated on a timer system. The skimmer system includes a 55-gallon drum for storage of recovered liquid situated within a spill containment structure, and the drum has a high-level switch to turn the system off when the storage capacity has been reached. The skimmer system efficacy will inform future corrective action decisions for areas where NAPL is suspected to be present.

- *Supplemental Offsite Groundwater Investigation Activities (July 2020):* On July 23, 2020, Hercules submitted to EPD a proposed scope of work to install three additional nested pairs of groundwater monitoring wells in the Southern Offsite

Area. EPD approved the scope of work by letter dated July 28, 2020. Despite diligent efforts, Hercules has been unable to obtain access to proceed with installation of two of the three additional nested pairs of monitoring wells. The remaining nested pair of monitoring wells was installed during the week of November 9, 2020. The boring logs and well construction diagrams for the new monitoring wells are provided in **Appendix A.**

- *Additional Onsite Groundwater Monitoring Wells (November 2, 2020)*: On November 2, 2020, Hercules submitted to EPD a proposed scope of work to install two additional groundwater monitoring wells at the Brunswick facility. EPD approved the scope of work by e-mail November 3, 3020. Subsequently, monitoring wells MW-35I and MW-53D were installed pursuant to the approved scope of work during the week of November 9, 2020. The boring logs and well construction diagrams for the new monitoring wells are provided in **Appendix A.**

- *Vapor Intrusion Pathway: Tier 1 Building Investigation (August 2020 – January 2021):* On April 22, 2020, Hercules submitted to EPD a document titled *Vapor Intrusion Pathway Tier 1 Building Investigation Work Plan* (the "Tier 1 Work Plan"). Following receipt of comments from EPD on May 20, 2020 and August 3, 2020, Hercules submitted to EPD the Tier 1 Work Plan in revised form on August 5, 2020. EPD approved the Tier 1 Work Plan by e-mail dated August 5, 2020. The Tier 1 Work Plan described plans to collect building-specific soil vapor samples from buildings with the greatest potential to have a complete vapor intrusion pathway (i.e., Tier 1 buildings).

  On January 12, 2021, Hercules submitted to EPD a report titled *Vapor Intrusion Tier 1 Investigation Report, Hercules/Pinova Facility, Brunswick, Georgia* (the "Tier 1 Report") which summarized the results of sampling activities conducted to implement the Tier 1 Work Plan. The Tier 1 Report also described additional planned activities at certain Tier 1 buildings and supplemental assessment activities at Tier 2 buildings at the Brunswick facility. The Tier 1 Report is further discussed in Section 6.1.5 of this CAP.

- *Vapor Intrusion Pathway: Mitigation Measures for Tier 1 Buildings (August 2020 – Current)*: Mitigation measures for the vapor intrusion pathway at Tier 1 buildings were addressed through a series of actions as reflected in various documents that were submitted to EPD.

- On August 20, 2020, Hercules submitted to EPD a document titled *Vapor Intrusion Mitigation Work Plan Hercules/Pinova Facility, Brunswick, Georgia* (the "Mitigation Work Plan"). EPD approved the Mitigation Work Plan via e-mail and letter dated September 9, 2020. The Mitigation Work Plan described plans to design and install sub-slab depressurization ("SSD") systems at the Stillhouse Control Room and Chemical Plant Control Room and Laboratory. The two SSD systems were installed and commissioned in March 2021 as described in a report that Hercules submitted to EPD titled *Construction Completion Report, Stillhouse Control Room and Chemical Plant Control Room and Laboratory, Sub-Slab Depressurization Systems, Hercules/Pinova Facility, Brunswick, Georgia* (the "Construction Completion Report"). Hercules submitted the Construction Completion Report to EPD on April 13, 2021, and EPD approved the Construction Completion Report via e-mail and letter dated May 12, 2021. The two SSD systems are operating and are monitored monthly.

- On May 12, 2021 Hercules submitted to EPD a letter captioned *Completion Letter - Liquid Loading Shed Office Demolition Hercules/Pinova Brunswick, Georgia Plant* (the "Liquid Loading Shed Letter") which described demolition of unused office space located at the eastern end of the Liquid Loading Shed. The office demolition plan was proposed and accepted by EPD with the approval of the Tier 1 Work Plan.

- The Tier 1 Report also recommended mitigating the vapor intrusion pathway at five additional Tier 1 buildings. The mitigation measures for the Terpenes Resins Building, the Refrigeration Shop, the Office Trailer, and Small Office (North of the Storeroom) involve ventilation or demolition of the building envelope to render them not susceptible to vapor intrusion. The modifications to these four buildings were discussed with EPD during an onsite meeting at the Brunswick facility on September 8, 2021. They were approved by EPD verbally during the onsite meeting and in writing by follow-up e-mail on September 24, 2021. Mitigation of the vapor intrusion pathway at the E&I Shop as discussed in the Tier 1 Report was addressed in detail in a work plan titled *Vapor Intrusion E&I Shop Mitigation System Work Plan, Hercules/Pinova Facility, Brunswick, Georgia* (the "E&I Shop Mitigation Plan") that Hercules submitted to EPD on September 17, 2021. EPD approved the E&I Shop Mitigation Plan via e-mail and letter on September 30, 2021.

The E&I Shop Mitigation Plan provides for installation of an SSD system at the E&I Shop. The mitigation measures at the Terpenes Resins Building, the Refrigeration Shop, the Office Trailer, and Small Office (North of the Storeroom) were completed in January 2022, and the SSD system at the E&I Shop is anticipated to be installed in the second quarter of 2022.

- *Soil Sampling Activities on Triangle Parcel (October 2020):* On October 27, 2020, Hercules submitted a report to EPD presenting the sampling results of a soil assessment performed on a small parcel of land along the southern boundary of the Brunswick facility referred to as the "Triangle parcel." The Triangle parcel is located along the southern edge of the Brunswick facility directly east of U.S. Highway 17. Soil sampling activities were performed to demonstrate that no releases had occurred on the Triangle parcel thereby supporting acquisition of the Triangle parcel by a third party for future development. The soil sampling results confirmed that no releases had occurred on the Triangle parcel. EPD therefore removed the Triangle parcel from the universe of property at the Brunswick facility that is subject to hazardous waste permit No. HW-052 (D&S)-2.

- *Groundwater in Shallow Zone of Upper Surficial Aquifer - Interim Corrective Measures using In Situ Chemical Oxidation (April 2021 – Current)*: Based on the results from pilot tests and treatability studies, Hercules selected *in situ* chemical oxidation ("ISCO") as the remedial technology to address COPCs in groundwater in the shallow zone of the upper surficial aquifer in the area of the Stillhouse Control Room. ISCO is an *in situ*, aggressive remedial technology that can be used in this area with readily available contractors and materials. On April 14, 2021, Hercules submitted to EPD an interim corrective measure work plan titled *Interim Corrective Measure Work Plan, Shallow Zone of Upper Surficial Aquifer, Stillhouse Control Room Area, Hercules/Pinova Brunswick Facility, Brunswick, Georgia* (the "ISCO ICM Work Plan") to address benzene and other COPCs in the shallow zone of the upper surficial aquifer in the area of the Stillhouse Control Room. On July 6, 2021, EPD provided written comments to Hercules regarding the ISCO ICM Work Plan. In response to EPD's comments, Hercules submitted a revised version of the ISCO ICM Work Plan on August 5, 2021. EPD approved the ISCO ICM Work Plan in revised form by letter dated August 17, 2021.

  ISCO is being implemented in the area of the Stillhouse Control Room via a series of ten injection wells and twenty observation wells installed throughout the gravel area north of the Stillhouse Control Room. The wells were installed in December 2021. The first injection event occurred in January, 2022. Base activated persulfate was injected via the injection wells to treat COPCs in groundwater in the shallow zone of the upper surficial aquifer from approximately 5 feet to 20 feet bgs. Observation wells are being used to monitor the distribution of the base activated persulfate in the treatment area as the base activated persulfate moves away from the injection wells within the treatment area. Groundwater samples will be collected for laboratory analysis of COPCs to monitor the progress in reducing concentrations and mass of COPCs in the treatment zone. A second application of base activated persulfate within the area of the Stillhouse Control Room is planned for later in 2022 based on the results of the initial application. Additional details regarding the use of ISCO to treat COPCs in the shallow zone of the upper surficial aquifer are provided in Section 6.1.3 of this CAP.

- *Tidal Evaluation (April – May 2021):* During April and May 2021, Geosyntec conducted a tidal evaluation on behalf of Hercules to assess the influence of diurnal tide cycles on groundwater conditions in the upper surficial aquifer underlying the eastern portion of the Brunswick facility near the Outfall Ditch. The tidal evaluation was performed to further refine the CSM for the Brunswick facility and to support the design for interim corrective measures to address COPCs in the deep zone of the upper surficial aquifer underlying the northern portion of the Brunswick facility near the U.S. Highway 17 corridor. Thirteen new wells were installed on the portion of the Brunswick facility to the east of U.S. Highway 17 and two new wells were installed at the Brunswick facility west of U.S. Highway 17 in support of the tidal evaluation. On October 22, 2021, Hercules presented the results of the tidal evaluation to EPD in a report that was included as an appendix to the document titled *Groundwater Monitoring Report, Semi-Annual Groundwater Monitoring Event – June 2021*. The boring logs and well construction diagrams for the new wells are provided in **Appendix A.** Additional information regarding the tidal evaluation is provided in Sections 3.1.5.5 and 6.1.4.4 of this CAP.

- *Groundwater in Deep Zone of Upper Surficial Aquifer - Interim Corrective Measures using In Situ Enhanced Bioremediation via Anaerobic Biobarrier (June 2021 – Current):* Hercules conducted an extensive evaluation of potential remedial alternatives to address the presence of COPCs in the deep zone of the upper surficial aquifer underlying the U.S. Highway 17 corridor near the southern boundary of the Brunswick facility. The evaluation included conducting treatability studies to assess specific remedial approaches. Based on this evaluation, Hercules selected *in situ* anaerobic bioremediation in the form of a linear biologically active permeable treatment zone perpendicular to the direction of groundwater flow (commonly referred to as a biobarrier) to treat COPCs in the target zone (focusing primarily on chloroform and methylene chloride). On June 18, 2021, Hercules submitted to EPD a document titled *Interim Corrective Measure Plan, Deep Zone of Upper Surficial Aquifer-Anaerobic Biobarrier, Hercules/Pinova Brunswick Facility, Brunswick, Georgia* (the "Anaerobic Biobarrier ICM Work Plan"). EPD provided comments regarding the Anaerobic Biobarrier ICM Work Plan by letter dated August 27, 2021. In response to EPD's comments, Hercules submitted to EPD a revised version of the Anaerobic Biobarrier ICM Work Plan on September 24, 2021. EPD approved the Anaerobic Biobarrier ICM Work Plan by letter dated October 14, 2021. Installation of the anaerobic biobarrier is currently ongoing. The Anaerobic Biobarrier ICM Work Plan and the alternatives assessment performed prior to development of that document are described in more detail in Section 6.1.4 of this CAP.

- *Vapor Intrusion Pathway: Tier 2 Investigation Work Plan (September 2021)*: On May 12, 2021, Hercules submitted to EPD a document titled *Vapor Intrusion - Tier 2 Buildings Investigation Work Plan, Hercules/Pinova Facility, Brunswick, Georgia* (the "Tier 2 Work Plan"). EPD provided Hercules with comments regarding the Tier 2 Work Plan via e-mail dated June 21, 2021, and provided Hercules with additional comments during a conference call and via e-mail on July 2, 2021. Hercules and EPD also discussed the Tier 2 Work Plan during the onsite meeting that took place at the Brunswick facility on September 8, 2021. In response to EPD's collective comments, Hercules submitted to EPD the Tier 2 Work Plan in revised form on September 14, 2021. EPD approved the Tier 2 Work Plan via e-mail and letter on September 28, 2021. The Tier 2 Work Plan describes the collection of building-specific sub-slab soil gas samples from certain Tier 2 buildings, consisting of a subset of buildings at the Brunswick facility with a lower priority than Tier 1 buildings but where the vapor intrusion pathway has not yet been determined to be complete or incomplete. In October 2021 and January 2022, Geosyntec collected sub-slab soil gas samples from 13 sub-slab probes installed within seven Tier 2 buildings - the Firehouse, the Crown/Pexite Bathroom (formerly referred to as the Crown Control Room), the Pexite Control Room, Breakroom No. 5, the O&M Team Building, the Staybelite Control Room, and Breakroom No. 2. Review of the data from the investigation activities at Tier 2 buildings is ongoing. Additional details are provided in Section 6.2.5 of this CAP.

- *Investigation Activities Near Monitoring Well MW-35I (October – December 2021):* On August 3, 2021, Hercules submitted to EPD a document titled *Work Plan for Proposed Groundwater Investigation Activities – Area Near Monitoring Well MW-35I* (the "MW-35I Investigation Work Plan"). EPD approved the MW-35I Investigation Work Plan by letter dated August 11, 2021. The MW-35I Investigation Work Plan focused on steps to assess groundwater conditions adjacent to and downgradient of monitoring well MW-35I located near the southern border of the Brunswick facility. The investigation activities pursuant to the MW-35I Investigation Work Plan were completed between October 2021 and December 2021. The results of the investigation activities are expected to be included in the next semi-annual groundwater monitoring report to be submitted to EPD in April 2022. Boring logs and well construction diagrams for new monitoring wells installed as part of the investigation activities are provided in **Appendix A**. Additional details regarding the investigation activities are provided in Section 6.2.2.2 of this CAP.

- *Groundwater in Deep Zone of Upper Surficial Aquifer - Interim Corrective Measures using In Situ Enhanced Bioremediation via Aerobic Biobarrier (November 2021 - Current):* Hercules conducted an extensive evaluation of potential remedial alternatives to address the presence of COPCs in the deep zone of the upper surficial aquifer underlying the U.S. Highway 17 corridor near the northern boundary of the Brunswick facility. The evaluation included performing treatability studies and field pilot tests to assess specific remedial approaches. Based on this evaluation, Hercules selected *in situ* aerobic bioremediation in the form of a biobarrier to treat COPCs (primarily benzene and chlorobenzene) in the target zone. On November 19, 2021, Hercules submitted to EPD a document titled *Interim Corrective Measure Plan, Deep Zone of Upper Surficial Aquifer-Aerobic Biobarrier, Hercules/Pinova Brunswick Facility, Brunswick, Georgia* (the "Aerobic Biobarrier ICM Work Plan") to address benzene and chlorobenzene in the deep zone of upper surficial aquifer near the northern boundary of the Brunswick facility to the east of U.S. Highway 17. The Aerobic Biobarrier ICM Work Plan is under review by EPD. The alternatives assessment performed prior to development of that document is described further in Section 6.1.4 of this CAP.

2.4 Baseline Risk Assessment

Based on EPD's approval of the RFI for the Brunswick facility in 2015 and taking into account both the interim corrective measures that had been completed and the results of supplemental sampling activities, Hercules initiated preparation of a baseline human health risk assessment ("BHHRA") and screening level ecological risk assessment ("SLERA"). As part of the Triad process, Hercules prepared in cooperation with EPD a memorandum titled *Draft Human Health Risk Assessment and Eco Screening Procedures* dated July 17, 2015, describing procedures to be used in undertaking the BHHRA and SLERA for the Brunswick facility.

On March 22, 2019, Hercules submitted to EPD a detailed report titled *Baseline Human Health Risk Assessment and Screening Level Ecological Risk Assessment, Hercules/Pinova Brunswick Facility* (the "BHHRA and SLERA Report") (NewFields, 2019). The BHHRA and SLERA Report reflected extensive discussions between Hercules and EPD regarding the risk assessment approaches contained in the document. As discussed in Section 6.2.7 of this CAP, Hercules anticipates working with EPD to update the BHHRA and SLERA Report to address questions that EPD has raised while concurrently implementing the ongoing and future corrective measures at the Brunswick facility.

3. CONCEPTUAL SITE MODEL

A conceptual site model provides a framework for understanding physical, chemical, and biological processes that affect the presence, migration, and potential impacts of contamination on human or ecological receptors. A conceptual site model typically includes various components that are synthesized to serve as a tool to assist in making decisions regarding characterization and remediation of environmental conditions. These components generally include information about the physical characteristics and uses of the site being evaluated, the setting of the site (including surrounding land uses and the underlying geology and hydrogeology), potential receptors, sources of contamination, the particular types of contaminants that may have been released, the characteristics and mobility of those contaminants, and potential pathways of exposure. A conceptual site model is dynamic and iterative. A conceptual site model will necessarily evolve as additional information becomes available. As a result, conceptual site models are routinely revised and refined, particularly at complex sites, as additional data and information are obtained.

The CSM for the Brunswick facility contained in this section of the CAP summarizes currently available information regarding the setting and characteristics of the Brunswick facility and adjacent areas, the geology and hydrogeology underlying the Brunswick facility, potential receptors, contaminant source(s), the nature and extent of primary COPCs in applicable media, and recent risk characterizations for the respective media, where appropriate. The environmental media at the Brunswick facility on which the CSM focuses are soils, groundwater, and soil gas. The CSM for the Brunswick facility presented herein builds on previous versions of the CSM for the Brunswick facility that have been presented to EPD while incorporating additional information that has become available through the extensive work that has been occurring at the Brunswick facility. Hercules expects that the CSM for the Brunswick facility will continue to evolve as further information is obtained through implementation of the corrective action process.

3.1 Site Description and Setting

The location of the Brunswick facility is described in Section 2.1, and the operational history of the Brunswick facility is described in Section 2.2 of this CAP. Additional information regarding the setting and use of the Brunswick facility is presented below.

3.1.1 Current and Future Land Uses

The Brunswick facility is currently used for industrial purposes, consistent with its use for the past 110 years. The industrial use of the Brunswick facility is consistent with the City of Brunswick's zoning ordinances. Based on the historical use of the Brunswick facility and land uses in the vicinity of the Brunswick facility, it is reasonable to anticipate that the future use of the current operational areas of the Brunswick facility will remain industrial. In addition, Hercules expects that activity and use limitations in the form of environmental covenants will preclude future residential use throughout portions of the Brunswick facility located west of U.S. Highway 17, where all of the SWMUs and AOCs are located. These anticipated activity and use limitations are discussed in greater detail in Section 6.4 of this CAP.

U.S. Highway 17 runs through the Brunswick facility in a north-south direction. West of U.S. Highway 17, property usage in the vicinity of the Brunswick facility is primarily residential, with the exception of the land to the south of the Brunswick facility which is zoned for commercial purposes. East of U.S. Highway 17, commercial and industrial zoned properties are located both to the north and south of the Brunswick facility.

3.1.2 Topography

The Brunswick facility is located on the Brunswick Peninsula and bounded to the east by tidal creeks and a large salt marsh complex. The topography at the Brunswick facility is generally flat with gently sloping natural relief across the Brunswick facility of approximately fourteen feet as shown on **Figure 2-1**. The ground surface of the Brunswick facility ranges in elevation from approximately 5 to 19 feet above mean sea level ("MSL") based on the National Geodetic Vertical Datum of 1929 (NGVD 1929). The topographic high (~19 feet above MSL) at the Brunswick facility is located in the northwest portion of the Brunswick facility and the topographic low (~5 feet above MSL) is located in the eastern portion of the Brunswick facility. Additional topographic relief is present in the form of several soil berms constructed on the north and west sides of the Brunswick facility to reduce noise in residential areas.

3.1.3 Surface Water

Surface water is present near the Brunswick facility in the form of tidal creeks and salt marshes. The primary surface water features near the Brunswick facility include tidally influenced Dupree Creek, Terry Creek, and the N Street Ditch which is connected to

Dupree Creek via a feature referred to as the Outfall Ditch as shown on **Figure 2-2**. Surface water is saline in Dupree Creek and Terry Creek (Integral, 2019). Surface water in the N Street Ditch is brackish, ranging from 3 to 22 percent seawater (Integral, 2019). During high tides, saline surface water from Dupree Creek can move more than 1,000 feet westward up the N Street Ditch into the Brunswick facility. The N Street Ditch is hydraulically connected to the underlying shallow zone of the upper surficial aquifer through weep holes in the concrete liner system that was installed in the N Street Ditch.

Stormwater runoff and non-contact cooling water from the Brunswick facility generally flows eastward and discharges into the N Street Ditch. These stormwater and non-contact cooling water discharges are regulated by a permit issued to Pinova under the National Pollutant Discharge Elimination System ("NPDES") permitting program for the Brunswick facility (NPDES Permit No. GA0003735). The discharge monitoring point for the NPDES permit is located in the N Street Ditch on the upstream side of U.S. Highway 17 (Glynn Avenue). The N Street Ditch also conveys stormwater from the residential neighborhoods immediately west-northwest of the Brunswick facility.

3.1.4 Regional Geology and Hydrogeology

The Brunswick facility is located in Glynn County which lies in the Lower Coastal Plain physiographic province. Geologic deposits in the Lower Coastal Plain physiographic province consist of unconsolidated to semi-consolidated layers of sand and clay, and semi-consolidated to very dense layers of limestone and dolomite. The ages of these deposits range from the Late Cretaceous Period to the Post-Miocene Period. The deposits generally strike southwest-northeast and dip to the southeast. Geologic units in the coastal plain gradually thicken downdip toward the coast and can reach a maximum thickness of up to 5,500 feet in Camden County, which is south of Glynn County (Clarke, et al., 1990).

The post-Miocene surficial strata consist of recent to Pliocene-age undifferentiated deposits. Miocene Epoch strata comprising a number of non-conforming formations underlie the post-Miocene units to depths exceeding 500 feet bgs in the Brunswick area. The underlying Miocene strata include the Hawthorn Formation, which consists of clay, sandy silt, sand, limestone beds, and silty sands (Clarke, et al., 1990). Deeper in the stratigraphic column, an Oligocene Epoch confining unit is present underlain by the Oligocene Epoch Suwannee Limestone and the Eocene Ocala Limestone.

Five aquifers[2] are present within the geologic strata underlying the Brunswick facility specifically and the Brunswick area more generally (Clarke, et al., 1990; Integral, 2019). From shallowest to deepest, the aquifers and their generalized depths are as follows:

1. Surficial Aquifer (~0 to ~200 feet bgs);
2. Upper Brunswick Aquifer (~280 to ~355 feet bgs);
3. Lower Brunswick Aquifer (~400 to ~475 feet bgs);
4. Upper Floridan Aquifer (~500 to ~970 feet bgs); and
5. Lower Floridan Aquifer (~ greater than 1,000 feet bgs).

For reference, aquifers and confining units are shown on **Figure 3-1**.

The surficial aquifer occurs within the post-Miocene age deposits and is divided into two units referred to as the upper surficial aquifer and the lower surficial aquifer. The Upper Brunswick and Lower Brunswick aquifers are encountered within a series of Miocene-age formations. The Lower Brunswick aquifer is also encountered in upper Oligocene deposits. The Upper Floridan aquifer is primarily encountered in the Eocene-age Ocala Limestone, and the Lower Floridan aquifer is encountered within deeper Eocene and Paleocene units.

The surficial aquifer is comprised primarily of interlayered gravel, sand, silt, clay, and thin limestone beds. In the Brunswick area, the upper surficial aquifer is generally unconfined. Portions of the upper surficial aquifer are tidally influenced by adjacent or nearby tidal creeks and salt marshes. Clay and silt layers and lenses ranging between five feet and 40 feet in thickness generally separate the upper surficial aquifer from the lower surficial aquifer. Where these clay and silt layers and lenses are laterally extensive, they can create localized areas of semiconfined or confined conditions (Clarke, et al., 1990). Aquifer test and water level data in the Brunswick area indicate that the lower surficial

[2] Note that the above aquifer depth intervals are approximate and meant to illustrate the general depths of the aquifers at the Brunswick facility. Depths are generally estimated from Clarke et al. (1990; see Plate 2, Brunswick Pulp and Paper Co., Glynn County Cross Section, boring 33H206). The bottom of the upper surficial aquifer is approximated from the boring log for monitoring well MW-52D.

aquifer is semi-confined to confined due to the presence of localized silt and clay confining units (Clarke, et al., 1990; Antea, 2016c; Integral, 2019).

The lower surficial aquifer is underlain by a unit composed of phosphatic silty clay and dense phosphatic limestone or dolomite. This phosphatic unit acts as the confining unit for the underlying Upper Brunswick Aquifer. In the Brunswick area, laboratory analysis from a single well (34H132) indicates that vertical conductivity for the confining unit can range from 5.3 $x10^{-5}$ to 1.3 x 10^{-4} feet/day ("ft/d") (Clarke, et al., 1990).

In the Brunswick area, the Upper and Lower Brunswick Aquifers both contain fresh water and are generally present in units consisting of poorly sorted, fine to coarse, slightly phosphatic to dolomitic quartz sand. A confining unit composed of silty clay and dense phosphatic limestone or dolomite separates the Upper Brunswick Aquifer from the Lower Brunswick Aquifer. Both aquifers exist under confined conditions (Clarke, et al., 1990).

The Upper and Lower Floridan Aquifers are encountered below the Upper Floridan Confining Unit. The confining unit is composed of silty clay and dense phosphatic limestone or dolomite. Both aquifers exist under confined conditions, contain fresh water, and are present in units generally composed of limestone and dolomite. (Clarke, et al., 1990).

3.1.5 Site-Specific Geology and Hydrogeology

This section of the CAP includes an overview of the upper and lower units of surficial aquifer underlying the Brunswick facility. In addition, this section of the CAP presents information regarding groundwater flow directions and rates, hydraulic conductivity, groundwater flow velocities, and tidal influences.

3.1.5.1 Surficial Aquifer

The following geologic and hydrogeologic units underlie the Brunswick facility to a depth of approximately 200 feet bgs: the upper surficial aquifer (which includes shallow, intermediate, and deep zones), the confining to semi-confining unit separating the upper surficial aquifer from the lower surficial aquifer, and the lower surficial aquifer.

At the Brunswick facility, the upper surficial aquifer is divided into three zones: shallow (~ 0–40 feet bgs), intermediate (~ 40–70 feet bgs), and deep (~70–100 feet bgs) as shown on **Figure 3-1**. The aquifer zones were defined by previous consultants (Antea, 2016c;

Integral, 2019) and are generally based on differences in geologic materials, hydraulic conductivities, and the vertical distribution of volatile organic compounds ("VOCs") in groundwater. Laterally continuous confining or semi-confining units have not been identified that separate the shallow zone from the intermediate zone, or the intermediate zone from the deep zone within the upper surficial aquifer. However, interbedded and discontinuous layers and lenses of fine-grained and consolidated materials are present at various locations that can locally influence hydrogeologic characteristics of the aquifer zones. A brief summary of the hydrogeologic characteristics for each zone is provided below:

- <u>Shallow Zone</u>: The shallow zone of the upper surficial aquifer is generally composed of interbedded clays, silts, silty sands, clayey sands, and light brown/tan or gray fine to coarse sands. The upper 10 feet of soils at the Brunswick facility generally consists of loose, fine to medium sands with minor amounts of silt and naturally occurring organic material. Hydraulic conductivity in the shallow zone of the upper surficial aquifer is on average 10 ft/d (**Table 3-1)**. The shallow zone of the upper surficial aquifer exists under unconfined conditions.

- <u>Intermediate Zone</u>: The intermediate zone of the upper surficial aquifer is primarily composed of gray fine to coarse sand, interbedded with varying amounts of clays, silts, silty sands, clayey sands, and gravel. Cemented sands are also encountered within the intermediate zone of the upper surficial aquifer. Hydraulic conductivity is on average 27.0 ft/d **(Table 3-1)**. The intermediate zone of the upper surficial aquifer generally exists under unconfined conditions; however, a few locations exist where semi-confining conditions occur.

- <u>Deep Zone</u>: Overall, the deep zone of the upper surficial aquifer can be characterized as containing generally coarser materials than the shallow and intermediate zones of the upper surficial aquifer. The deep zone of the upper surficial aquifer is composed of gray, fine to coarse sand, with relatively lesser amounts of clayey sands, silty sands, silts, and clays. Another characteristic of the deep zone of the upper surficial aquifer is the prevalence of coarse sand and sand with gravel intervals, including channel deposits, that tend to occur in the central and southeastern portions of the Brunswick facility. These coarse sands and gravel may provide preferential groundwater flow pathways where they are linearly continuous. Hydraulic conductivity in the deep zone of the upper surficial aquifer is on average 32 ft/d (**Table 3-1)**. Based on groundwater elevation measurements across the Brunswick facility and aquifer testing conducted in 2020 by Geosyntec (Geosyntec, 2020b), conditions in the deep zone of the upper surficial aquifer range between unconfined and semi-confined.

Monitoring wells and observation wells screened in the upper surficial aquifer are generally notated with an S for shallow, I for intermediate, and D for deep, to distinguish which zone the monitoring wells and observation wells are screened within. However, there are several exceptions to this general convention. The monitoring wells and observation wells that have been installed at and adjacent to the Brunswick facility are listed in **Table 2-2** which also includes information about the aquifer zones in which the wells are screened.

The lower surficial aquifer beneath the Brunswick facility is present generally under semi-confined or confined conditions in strata generally composed of olive green to gray fine sands, silty sands, clayey sands, and silts. The upper surficial aquifer is separated from the lower surficial aquifer by a unit consisting primarily of silts and clays. However, in a few discrete locations, this unit is composed of silty sands or clayey sands (e.g., at the location of monitoring well MW-44D in the central portion of the facility). Based on groundwater elevations and the vertical distribution of VOCs discussed hereinafter, the unit in the area of monitoring well MW-44D allows groundwater communication to occur between the upper and lower surficial aquifers in that area. In other areas, the unit limits groundwater communication between the upper and lower surficial aquifers.

To support the CAP, cross sections of the geology and aquifers at the Brunswick facility have been generated from a three-dimensional geologic model created using Leapfrog Works software (version 3.1.0). The locations of the cross sections are shown on **Figure 3-2**; the cross sections themselves are shown on **Figure 3-3** to **Figure 3-6**. Clays, silts, clayey sands, silty sands, and sandstone and mudstone were consolidated into a single category, labeled “Lower Permeability Soils.” This approach was used due to the interbedded and discontinuous nature of fine-grained materials in the upper surficial aquifer, and to assist with interpolation of the characteristics of the subsurface soils.

3.1.5.2 Groundwater Recharge, Flow Direction, and Discharge

Groundwater at the Brunswick facility is recharged primarily through precipitation. Precipitation that falls on the Brunswick facility is diverted to surface water runoff, lost through evapotranspiration, or infiltrates through unsaturated soils to the shallow zone of the upper surficial aquifer.

Within the upper surficial aquifer, the prevailing direction of groundwater flow is generally to the east-southeast. This flow direction is based on groundwater elevation measurements summarized in **Table 3-2** and interpreted potentiometric surface contour maps presented as **Figures 3-7 through 3-9**. There are local variations in the groundwater flow directions in the upper surficial aquifer due to heterogeneities in the aquifer, surface water features and tidal influences. As shown on **Figure 3-7**, the direction of groundwater flow in the shallow zone of the upper surficial aquifer underlying the portion of the Brunswick facility east of U.S. Highway 17 is influenced by the Outfall Ditch and/or a potential groundwater recharge area located on the Adams property. As a result, groundwater in the shallow zone from neighboring properties along the northern boundary of the Brunswick facility (including the Adams Properties) flows to the south under the Brunswick facility toward the Outfall Ditch.

In the central and western portions of the Brunswick facility, fresh water recharge from precipitation infiltrates downward through the soil in areas where no semi-confining units are present. Groundwater then generally migrates eastward toward the salt marsh. As groundwater flows east-southeast, fresh groundwater mixes with saline groundwater east of U.S. Highway 17 and beneath the salt marshes and the saline surface water bodies further to the east including Dupree Creek and Terry Creek. The upper surficial aquifer beneath and in the vicinity of the eastern portion of the Brunswick facility is in communication with brackish to saline surface water present in Dupree Creek, in the Outfall Ditch, and in the N Street Ditch (via weep holes in the liner that was installed in 2009 in portions of the N Street Ditch). In addition, as discussed in detail in Section 3.1.5.5 of this CAP, it is well established that the upper surficial aquifer is tidally influenced in the vicinity of the Brunswick facility. The presence of saline surface water adjacent to groundwater at the Brunswick facility, combined with the presence of a wedge of saltwater resulting from the density contrast between fresh groundwater migrating eastward and saline water beneath the salt marsh, creates a brackish groundwater transition zone beneath the eastern portion of the Brunswick facility (Integral, 2019), generally located between U.S. Highway 17 and Dupree Creek.

Groundwater in the upper surficial aquifer is expected to diffusely discharge into surface water bodies (e.g., Terry Creek or the salt marshes) to the east of the Brunswick facility. The diffuse discharge of groundwater to surface water is supported by modeling performed by Antea Group ("Antea") and Integral Consulting Inc. ("Integral") and by the tidal influence observed in monitoring wells screened in the upper surficial aquifer during multiple rounds of investigations (Antea, 2016c; Integral, 2019; Geosyntec, 2020b; Geosyntec 2021e).

Within the lower surficial aquifer, groundwater flow is toward the southeast as shown on **Figure 3-10**.

3.1.5.3 Hydraulic Conductivity

Multiple tests have been performed to evaluate the hydraulic conductivity of the hydrogeologic units beneath the Brunswick facility. During February 2020, aquifer test well APT-01 was installed in the area where the pilot study of Plume Stop^{TM} technologies was performed near monitoring wells MW-5S and MW-5I for the purpose of conducting an aquifer step test in the deep zone of the upper surficial aquifer. Aquifer test well APT-01 was installed to a depth of 97 feet bgs and is screened from 75 to 95 feet bgs. Two aquifer test observation wells (designated as wells PWOW-01 and PWOW-02) were installed in early March 2020 to support the testing activities. Both of these aquifer test observation wells were installed to a depth of 90 feet bgs and are screened from 80 to 90 feet bgs. Certain wells installed as part of the Plume Stop^{TM} pilot study were also used as observation wells during the aquifer step test.

The aquifer step test was performed at aquifer test well APT-01 between March 12, 2020 and March 13, 2020. The results of the aquifer step test are included in **Appendix B**. A near-instantaneous response to pumping was observed in performance monitoring wells during the step test, indicating that the deep zone of the upper surficial aquifer is semi-confined to confined in the area where the aquifer step test was performed, which is consistent with observations of sandy lean clay and lean clay units during well drilling activities. A summary of the available historical hydraulic conductivity test results and step test results is provided on **Table 3-1** and indicates that horizontal hydraulic conductivity generally increases with depth in the upper surficial aquifer, with estimated average hydraulic conductivity values of approximately 10 ft/day for the shallow zone of the upper surficial aquifer, 27 ft/day for the intermediate zone of the upper surficial aquifer, and 32 ft/day for the deep zone of the upper surficial aquifer.

Based on laboratory permeability testing conducted on Shelby tube samples that were previously collected, the average vertical hydraulic conductivity of the confining unit between the upper surficial aquifer and the lower surficial aquifer was estimated to be 0.014 ft/day.

3.1.5.4 Hydraulic Gradients and Groundwater Flow Velocities

Groundwater linear flow velocity is defined as the flow rate per unit of a cross sectional area of a porous medium. The linear groundwater flow velocity for the upper surficial aquifer is estimated using the modified Darcy equation:

$$v = (K/n)*i$$

where:

K is the average hydraulic conductivity (units of length per time);

n is the estimated effective porosity (unitless); and

i (also referred to as $\Delta h/\Delta l$) is the hydraulic gradient (unitless).

Using information from groundwater gauging events in December 2020 and June 2021, groundwater linear flow velocities were calculated for each zone of the upper surficial aquifer. The calculations are shown and summarized in **Tables 3-3a** and **3-3b**. Using the average hydraulic conductivity values presented in **Table 3-1**, horizontal groundwater gradients based on the potentiometric surface maps presented in **Figures 3-7 through 3-9**, and an effective porosity of n = 0.25 (Domenico and Schwartz, 1990), the linear flow velocities for the December 2020 and June 2021 groundwater monitoring events were estimated for the shallow, intermediate, and deep zones of the upper surficial aquifer. Groundwater flow was estimated to be approximately 26 ft/year and 30 ft/year in the shallow zone in December 2020 and June 2021, respectively. Groundwater flow was estimated to be approximately 38 ft/year and 50 ft/year in the intermediate zone in December 2020 and June 2021, respectively. Groundwater flow in the deep zone of the upper surficial aquifer was estimated to be approximately 34 ft/year and 47 ft/year in December 2020 and June 2021, respectively.

Vertical hydraulic gradients reflect the upward or downward potential for groundwater to flow within and across the shallow, intermediate, and deep zones of the upper surficial aquifer. Vertical gradients were calculated using groundwater elevations measured in clustered monitoring wells which are screened in more than one zone at the same location (i.e., at the clustered monitoring well locations). The calculated vertical hydraulic gradients based on information from the groundwater gauging events in December 2020 and June 2021 are summarized in **Tables 3-4a and 3-4b**. Vertical gradients are variable but generally there is a downward gradient from the shallow to the intermediate, and from the intermediate to the deep zones of the upper surficial aquifer in areas underlying the western and central portions of the Brunswick facility. Vertical groundwater gradient directions within the upper surficial aquifer between the shallow, intermediate, and deep zones based on groundwater elevation data collected in June 2021 are shown on **Figure 3-3** to **Figure 3-6**. A comparison of the June 2021 vertical gradients to the vertical gradients using December 2020 groundwater elevation data indicates little to no seasonal variability in vertical gradients.

Additional discussion of tidal influence on horizontal and vertical hydraulic gradients and groundwater flow in the central portion of the Brunswick facility and in the eastern portion of the Brunswick facility near the Outfall Ditch is provided in the following section of this CAP.

3.1.5.5 Tidal Influence

Multiple studies have been conducted on behalf of Hercules to understand the relationship between tidal influence and horizontal and vertical hydraulic gradients in the upper surficial aquifer (Antea, 2015; Geosyntec, 2021e). A discussion regarding the tidal influence from nearby creeks and marshes on the groundwater regime at the Brunswick facility based on studies conducted by Antea in 2010 and 2012 is provided in the Phase III RFI Report for Groundwater (Antea, 2015). As discussed in Section 2.3.2 of this CAP, the Phase III RFI Report for Groundwater was submitted to EPD on February 26, 2015 and approved by EPD by letter dated April 29, 2015.

During the tidal studies that Antea conducted, groundwater levels were measured over a one-week period in July 2010 at the monitoring well MW-44 cluster, located near the central portion of the Brunswick facility approximately 250 feet south of the N Street Ditch and more than 1,500 west of Dupree Creek. The monitoring wells in this cluster represent the shallow (MW-44S), intermediate (MW-44I), and deep (MW-44ID) groundwater zones of the upper surficial aquifer. Time series plots of the groundwater levels and tidal range during the period of study are presented on **Figure 3-11.** Although tidal efficiency, which represents the ratio of tidal amplitude at each groundwater monitoring location relative to the tidal amplitude at the surface water monitoring location, is generally low at the monitoring well MW-44 cluster, groundwater levels in all three zones of the upper surficial aquifer at this location exhibit clear semidiurnal sinusoidal waves, indicating that the upper surficial aquifer beneath and in the vicinity of the central portion of the Brunswick facility is tidally influenced. As shown on **Figure 3-11**, tidal influences at the monitoring well MW-44 cluster within the shallow zone are more muted than those observed within the intermediate and deep zones of the upper surficial aquifer. These groundwater and surface water elevation measurements demonstrate that the upper surficial aquifer beneath and in the vicinity of the eastern portion of the Brunswick facility is hydraulically connected to the brackish and salt water in Dupree Creek, Terry Creek, and the salt marshes to the east of the Brunswick facility.

As indicated in Section 2.3.2 of this CAP, Geosyntec completed a tidal evaluation at the Brunswick facility in 2021 focusing on the eastern portion of the Brunswick facility north of the Outfall Ditch to assess effects of diurnal tidal cycles on groundwater conditions. The tidal evaluation was undertaken to support the design of the aerobic biobarrier that is proposed to be installed in the deep zone of the upper surficial aquifer in this portion of the Brunswick facility. The evaluation covered a study area bounded by Dupree Creek to the east, the edge of the Brunswick facility to the north, and the N Street Ditch and the Outfall Ditch to the south. The study area extended approximately 420 feet to the west of U.S. Highway 17. The tidal evaluation included obtaining gauging measurements from existing monitoring wells within and proximate to the study area, together with gauging measurements from 15 new monitoring and observation wells that were installed in conjunction with the tidal evaluation. The tidal evaluation took place during the period between April 14, 2021 and May 17, 2021. The duration of the tidal evaluation was sufficient to monitor one full lunar tidal cycle, including a spring tide event. Over the monitoring period, a maximum tidal differential of 9.2 feet in Dupree Creek was observed between high and low tide coinciding with the onset of the spring tide on April 27, 2021.

The results of the tidal evaluation performed by Geosyntec, including information regarding monitoring wells and observation wells installed in 2021 to support the evaluation, and the specific results of the tidal evaluation, were provided to EPD as an appendix to a document titled *Groundwater Monitoring Report, Semi-Annual Groundwater Monitoring Event – June 2021* (Geosyntec, 2021e) that Hercules submitted to EPD on October 22, 2021. A copy of the tidal evaluation summary report was also included as Appendix A of the Aerobic Biobarrier ICM Work Plan that Hercules submitted to EPD on November 19, 2021, and that is included as **Appendix C** to this CAP. Variations in horizontal and vertical hydraulic gradients and groundwater flow directions, and tidal lag times and tidal efficiency during the period of evaluation are presented in a series of figures and tables in the summary report.

Consistent with the results that Antea obtained from its tidal investigations, groundwater levels in all three zones of the upper surficial aquifer in the study area assessed during the 2021 tidal evaluation exhibit clear semidiurnal sinusoidal waves, with tidal influence less pronounced within the shallow zone than in the intermediate and deep zones of the upper surficial aquifer in the study area. Generally, the results of the 2021 tidal evaluation indicate that during the period of evaluation, groundwater flow in the shallow zone of the upper surficial aquifer in the study area was consistently to the south from areas north of the Brunswick facility toward the Outfall Ditch under both high and low tide conditions. Horizontal groundwater flow directions in the intermediate zone of the upper surficial aquifer were observed to vary based on the tidal cycle. Tidal influence is sufficient to reverse the generally prevailing horizontal hydraulic gradient and cause groundwater flow directions to oscillate from west to east and from east to west in the intermediate zone of the upper surficial aquifer, indicating the significant effect that tidal cycles have on groundwater flow in the intermediate zone of the upper surficial aquifer, particularly in proximity to Dupree Creek but also extending further to the west in the study area. During low tide periods, the direction of groundwater flow was toward Dupree Creek while during high tide periods, the direction of groundwater flow was inland away from Dupree Creek. These observations are similar to the results that Antea obtained from its tidal studies which also indicated that a hydraulic gradient reversal occurred at high tide during each tidal cycle, but in the deep zone of the upper surficial aquifer. Horizontal groundwater flow directions in the deep zone of the upper surficial aquifer within the study area for the 2021 tidal evaluation also varied with tidal cycles but groundwater in the deep zone of the upper surficial aquifer generally flowed toward the east/southeast.

Vertical groundwater gradients were generally upward from the intermediate zone to the shallow zone of the upper surficial aquifer during the period of the 2021 tidal evaluation except in response to a precipitation event that occurred during the period of evaluation, when the vertical gradients between the shallow and intermediate zones were observed to reverse from upward to downward. A slight average downward gradient was generally observed between the intermediate and deep zones of the upper surficial aquifer, with generally weak upward vertical gradients during high tide and weak downward vertical gradients during low tide.

The maximum tidal-efficiency ratios that were observed during the 2021 tidal evaluation in the shallow, intermediate, and deep zones of the upper surficial aquifer were 0.13 at monitoring well MW-55S, 0.20 at monitoring well MW-55I, and 0.19 at monitoring well MW-55D, respectively, further confirming the hydraulic connection between groundwater beneath the eastern portion of the Brunswick facility and brackish and salt water in Dupree Creek, Terry Creek and the salt marshes to the east of the Brunswick facility, particularly in the intermediate and deep zones of the upper surficial aquifer. In all zones of the upper surficial aquifer, tidal efficiency generally decreased with distance from the surface water bodies and tidal lag times increased with distance from the surface water bodies.

Graphs depicting groundwater levels and surface water levels at locations evaluated as part of the 2021 tidal evaluation, and details regarding horizontal and vertical gradients, groundwater flow directions, and tidal efficiency and tidal lag times are provided in **Appendix C**.

3.2 Potential Receptors

3.2.1 Soils

As previously discussed, the Brunswick facility is an industrial facility with active manufacturing operations occurring in portions of the Brunswick facility. A total of 40 SWMUs have been identified at the Brunswick facility. All of these SWMUs are located in the portion of the Brunswick facility on the west side of U.S. Highway 17. That portion of the Brunswick facility is fenced to limit access for security purposes and to prevent trespassing by third parties. Receptors with potential exposure to soils at the Brunswick facility consist of onsite industrial workers and construction workers who may be engaged to perform specific construction or repair activities having a limited duration. Even though the Brunswick facility is fenced to limit access, trespassers are also considered to be potential receptors. Potential exposure to soils can occur through incidental ingestion, dermal contact, inhalation of particulates, and inhalation of volatile organic vapors.

3.2.2 Groundwater

Groundwater in the surficial aquifer (i.e., the upper surficial aquifer and the lower surficial aquifer) beneath the Brunswick facility and adjacent areas is not used as a source of drinking water, meaning that the direct exposure pathway between potential receptors and such groundwater is incomplete (i.e., there are no receptors). Instead, the Brunswick facility and adjacent areas are served by the public water supply system operated by the Brunswick – Glynn County Joint Water and Sewer Commission. The public water supply system obtains its water from the Floridan Aquifer which is separated from the surficial aquifer by hundreds of feet of subsurface soils and multiple confining layers.

Several residential properties in the general vicinity of the Brunswick facility are located outside of the service area for the public water supply system. These residential properties are located along Terry Creek Road approximately 3,500 feet southeast of source areas at the Brunswick facility. A total of five private water supply wells are present at these residential properties. As a precaution, Hercules has been sampling these five private water supply wells on an annual basis since 2015, and the sampling results indicate that the water supplies are unimpacted by the Brunswick facility.

In August 2021, personnel from Geosyntec and Woodrow Sapp Well Drilling ("Woodrow Sapp"), a water supply well drilling firm located in Brunswick, performed a field survey of the five private water supply wells to evaluate the feasibility and potential methodology to assess the construction and completion depth of each of the private water supply wells. In addition, Woodrow Sapp located in its files a well installation data record from 1963 which is for the well that services the Terry Creek Mobile Home Park ("TCMHP") on Terry Creek Road, and indicates that the well was installed in the Upper Floridan aquifer, with the well casing extending to 518 feet bgs and the open borehole further extending to a depth of 740 feet bgs.

Four of the five private water supply wells are constructed with steel casings (including the well for which the well installation record is available). The fifth private water supply well is constructed with polyvinyl chloride ("PVC") casing. On January 25, 2022, Woodrow Sapp (in coordination with Geosyntec) obtained access to that private water supply well, removed the downhole plumbing equipment, and measured the depth of the well. The private water supply well is 284 feet deep, meaning that it is withdrawing water from the Brunswick aquifer system and not the surficial aquifer. Direct measurements of the depths of the four private water supply wells constructed with steel casings were not obtained because of the risks associated with encrustation and the potential for damaging the wells during removal of downhole plumbing equipment. Accordingly, the depths of these wells (particularly the three wells for which installation records are currently unavailable) have been determined using geochemical "fingerprinting" techniques as described below.

In December 2021, Geosyntec collected water samples from all five private supply wells, two production wells at the Brunswick facility (the "L well" and "V well") completed in the Floridan aquifer, three monitoring wells screened in the upper surficial aquifer (monitoring wells MW-50D, MW-51D, and MW-61D), one monitoring well screened in the lower surficial aquifer (monitoring well MW-13), and surface water from Dupree Creek, to conduct geochemical "fingerprinting" analysis. Such analysis allows the geochemical signature of the groundwater samples collected from each private water supply well to be compared to the geochemical signature of groundwater samples collected from wells constructed at known depths in the upper surficial aquifer, the lower surficial aquifer, and the Floridan aquifer. In addition, geochemical data were obtained from a municipal production well for the City of Brunswick (well J-52) installed in the Brunswick aquifer system. A detailed analysis of the geochemical evaluations and investigations is provided in **Appendix D**.

As presented in **Appendix D**, the information that has been obtained from the assessment of the five private water supply wells southeast of the Brunswick facility confirms that these wells do not draw water supplies from either the upper surficial aquifer or the lower surficial aquifer. Instead, they draw water supplies from deeper aquifers that are protected by extensive confining layers that are present as shown on **Figure 3-1**. Specifically, water samples from three of the private water supply wells (including the private well that is installed in the Upper Floridan aquifer based on the installation record) have geochemical fingerprints that are virtually identical to each other and to the fingerprint from the V well (a production well at the Brunswick facility installed in the Upper Floridan aquifer to a depth of 750 feet bgs). This information indicates that these three private water supply wells are drawing water from the Upper Floridan aquifer and not from the surficial aquifer. The water samples from the other two private water supply wells (including the one with the PVC well casing that was directly measured to be 284 feet deep) have geochemical fingerprints that are very similar and also match quite well with the geochemical data for the groundwater collected from well J-52 at a depth interval consistent with the Brunswick aquifer system. Out of an abundance of caution, however, Hercules abandoned these two private water supply wells and replaced them with water supply wells installed in the Floridan aquifer during June and July 2022, thereby ensuring that all five private water supply wells southeast of the Brunswick facility are drawing water from the Floridan aquifer.

Installation of new private water supply wells at the Brunswick facility and in adjacent areas is currently prohibited by municipal ordinance because these areas are located within the service area of the public water supply system. Specifically, under the City of Brunswick Water and Sewer Ordinance, "[n]o person shall install or operate a private well within an established service area for the purpose of obtaining potable water when utility water service is available." City of Brunswick Code § 22-7. The City of Brunswick controls whether the requirements in the ordinance may change in the future.

In addition, under the Georgia Water Well Standards Act, any public or commercial water supply well must be installed by a licensed water well contractor, who must comply with a variety of well construction standards and bonding requirements per O.C.G.A. §§ 125-134 and 12-5-134(1). These standards include sealing off groundwater of unacceptable water quality during well installation, installing the well at least five feet into bedrock, and ensuring that the well is protected from contamination by surface waters. See O.C.G.A. § 12 5 134(1) and Ga. Rule § 391-3-5-.07.

With respect to the Brunswick facility itself, Pinova and Herucles currently prohibit use of groundwater from the surficial aquifer. As described in Section 6.4 of the CAP, activity and use limitations will be used as part of the corrective measures for the Brunswick facility. As Pinova and Hercules have discussed with EPD, these activity and use limitations will continue to prohibit the use of groundwater from the surficial aquifer. The activity and use limitations will be included in environmental covenants for the Brunswick facility. Environmental covenants have been recorded for the parcels comprising the portion of the Brunswick facility located east of U.S. Highway 17 in conjunction with implementation of the Interim Record of Decision issued by USEPA under CERCLA for Operable Unit 1 (the Outfall Ditch) of the Terry Creek Site. The environmental covenants were recorded on November 5, 2021. Environmental covenants were also recorded for the Stripling's property located downgradient of the Brunswick facility at 2304 Glynn Avenue on February 10, 2022. The environmental covenants prohibit the use or extraction of groundwater for drinking water purposes.

In addition to the existing and pending layers of legal protection which foreclose use of groundwater from either the upper surficial aquifer or lower surficial aquifer at the Brunswick facility and adjacent downgradient areas, practical considerations lead to the same outcome. The natural quality of groundwater in the surficial aquifer in the area of the eastern portion of the Brunswick facility is generally brackish to saline. By contrast, sources of high-quality drinking water are readily available in the deeper aquifers that are present underlying these same locations (assuming that it were legally permissible to install a drinking water well).

3.2.3 Soil Gas

Soil gas is the gas phase material (e.g., air) that occupies pores in soils between the water table and ground surface. Typically, these soil pores are occupied by some amount of water bound to soil particles and by air comprising mostly nitrogen (up to 78%) and oxygen (up to 20.9%) from the atmosphere. Depending on the presence and concentration of naturally occurring organic compounds and organic contaminants, other components of soil gas can include significant concentrations of carbon dioxide or methane. Finally, soil gas can include minor concentrations (typically much less than 1% by volume) of volatile contaminants present in soil or shallow groundwater or that are present in the atmosphere. The presence of contaminants in soil gas can lead to exposure in occupied buildings via "a migration of volatile chemicals from groundwater contamination or contaminated soil into an overlying building" (USEPA, 2020). Accordingly, potential receptors to soil gas are individuals who may be exposed to soil gas through vapor intrusion into occupied buildings.

3.3 Potential Sources of COPCs

3.3.1 Soils

Industrial activities have taken place at the Brunswick facility for more than a century. As part of the corrective action process, 40 SWMUs have been identified at the Brunswick facility. Investigation activities have taken place to evaluate the potential for releases to have occurred from the SWMUs or otherwise in connection with historical operations. As discussed in more detail in Section 3.4.1 of this CAP, over 4,000 soil samples have been collected to characterize conditions in soils at the Brunswick facility and to identify potential sources of COPCs, including 275 soil samples that were collected to delineate targeted soils to implement interim corrective measures for sitewide soils as discussed in Section 6.1.2 of the CAP.

3.3.2 Groundwater

This section presents a summary of potential source areas that have contributed COPCs to groundwater including a brief description of their historical operations, past/current corrective actions, current conditions, and the potential for these locations to contribute to mass transport of COPCs to groundwater in the downgradient direction. Based on the processes used at the Brunswick facility and changes over time in waste handling practices, three source areas at the Brunswick facility were identified in the Phase III RFI Report for Groundwater submitted in 2015 and the refined groundwater CSM report submitted in 2019: the former surface impoundment area, the former toxaphene production area, and the southern production area. In addition to those three source areas, the terpene resins area has also been included as a potential source area for evaluation based on concentrations of para-cymene detected in shallow groundwater samples collected as part of the assessment of potential vapor intrusion into occupied buildings at the Brunswick facility. These onsite source areas are shown on **Figure 3-12**. In addition to these onsite source areas, there are also offsite sources of COPCs to groundwater near the Brunswick facility, which are discussed in Section 3.3.2.4 of this CAP.

3.3.2.1 Former Surface Impoundments

The former surface impoundment area (SWMU No. 10) in the northern portion of the Brunswick facility was the subject of soil and groundwater corrective actions beginning in 1984. Historically, wastewater surface impoundments, an equalization basin, and a tank farm containing what were designated as the Y-1, Y-2, and Y-3 tanks (SWMU No. 8) were formerly located in this area, as shown in **Figure 3-12**. During former operations, wastewater flowed into the surface impoundments where clays were used to flocculate and settle residuals from the toxaphene production process. In 1984, the wastewater surface impoundments were excavated down to the water table and backfilled, and a certification of closure was provided by a certified professional engineer.

Groundwater conditions in shallow monitoring wells in the former surface impoundment area near the former tank farm containing what were designated as the Y-1, Y-2, and Y-3 tanks are defined by higher concentrations of xylene relative to other COPCs, including chlorobenzene and benzene. Xylenes in shallow groundwater underlying the former surface impoundment area naturally attenuate before crossing the downgradient facility boundary, as shown in **Figures 3-13a, 3-13b, and 3-13c,** whereas concentrations of benzene and chlorobenzene attenuate downgradient before comingling with the plume from the former toxaphene production plant) , as shown in **Figures 3-14a, 3-14b, 3-14c, 3-15a, 3-15b, and 3-15c**. This observation is consistent with the fact that biodegradability of xylenes is generally faster than biodegradability of benzene and chlorobenzene (Field and Sierra-Alvarez, 2008; Borden et al., 1997; Howard et al., 1991).

The former surface impoundment area is considered a source of COPCs to groundwater; however, concentrations of COPCs in groundwater associated with the former surface impoundment area are much lower compared to the other source areas and key COPCs attenuate over a short distance downgradient from the former surface impoundment area.

3.3.2.2 Former Toxaphene Production Area

The former toxaphene production area is located in the central portion of the Brunswick facility and designated as SWMU No. 5. Releases to the environment occurred in two locations, both of which were subject to extensive corrective measures to remove soils and other unsaturated materials as discussed in Section 2.3.2 of this CAP and shown on **Figure 2-5**. The first location is in the northeastern portion of the former toxaphene production area along the N Street Ditch, where lime neutralization tanks were located, and wastewater was discharged to the ditch prior to the 1970s. The second location is the carbon tetrachloride tank area in the southwestern portion of the former toxaphene production area, where aboveground storage tanks once existed. Both locations have been subject to prior soil removal actions.

Groundwater monitoring data indicate that the vast majority of carbon tetrachloride that was released in the former toxaphene production area has degraded to chloroform, and then to methylene chloride (i.e., dichloromethane), and ultimately to carbon dioxide and organic acids. Methane is usually not a primary product of chloroform dechlorination (as demonstrated in the 2020 treatability studies discussed in Section 6.1.4 of this CAP). Chloroform, benzene, and chlorobenzene in groundwater extend east of U.S. Highway 17. Monitoring well MW-42S and temporary well point SGW-31 are located near the former toxaphene production area and groundwater samples collected from these two locations have exhibited elevated concentrations of benzene, chlorobenzene, chloroform, methylene chloride, and para-cymene in groundwater that could be a potential continuing source of COPCs to groundwater in the deep zone of the upper surficial aquifer in downgradient areas as shown on **Figures 3-14a, 3-14b, 3-14c, 3-15a, 3-15b, 3-15c, 3-16a, 3-16b, 3-16c, 3-17a, 3-17b, 3-17c, 3-18a, 3-18b, and 3-18c**. Additionally, a separately identifiable layer has been identified on the water surface at monitoring well MW-42S, but preliminary analysis indicated that this layer consisted of aqueous phase liquid rather than NAPL. This area will be further evaluated and, if appropriate, will be subject to further corrective measures as discussed in Section 6 of this CAP.

3.3.2.3 Southern Production Area

The southern production area is located within the main operational area at the Brunswick facility south of the former toxaphene production area. Solvents were used in the extraction process conducted in this area, including benzene, methyl isobutyl ketone, and toluene. Corrective measures that have been conducted in this area are described in Section 2.3.2 of this CAP.

Groundwater quality in monitoring wells MW-21, MW-22, MW-23, and MW-24 in the shallow zone of the upper surficial aquifer underlying the southern production area is defined by high concentrations of benzene, and to a lesser extent para-cymene, relative to other VOCs found in the plume of VOCs in the deep zone of the upper surficial aquifer. Benzene and para-cymene from this area have the potential to migrate downward into the deep zone of the upper surficial aquifer and commingle with the VOCs from the former toxaphene production area as shown in **Figure 3-14a, 3-14b, 3-14c, 3-18a, 3-18b, and 3-18c**. Carbon tetrachloride, chloroform, and chlorobenzene are not observed in groundwater in the southern production area; those compounds are located farther north and are associated with the former toxaphene production source area. Corrective measures are being implemented in the area of monitoring wells MW-21, MW-22, MW-23, and MW-24 as discussed in Section 6.1.3 of this CAP.

NAPL has been previously identified in monitoring well MW-48S, piezometer PZ1-6R, and temporary well point SGW-23. The viscosity of the NAPL that has been observed varies among the locations, and some areas are dominated by a pine oil substance with lower concentrations of COPCs. This area will be further evaluated and likely will be subject to further corrective actions as described Section 6 of this CAP.

3.3.2.4 Terpene Resins Area

The terpene resins area is located within the main operational area at the Brunswick facility west of the former toxaphene production area as shown on **Figure 3-12**. Elevated concentrations of para-cymene, xylene, and ethylbenzene were detected in shallow groundwater samples and sub-slab soil gas samples collected in the terpenes resins area as part of the vapor intrusion evaluation. The concentrations of para-cymene that were detected at temporary well points SGW-5 and SGW-8 were the highest concentrations of para-cymene that were found during the shallow groundwater investigation, as shown on **Figure 3-18a.** Accordingly, the terpenes resins area has been included as a potential source area for COPCs in groundwater in that area.

The terpenes resins area includes areas identified as SWMU No. 22 (the terpene resins area) and SWMU No. 33 (the tank car liquid loading area). SWMU No. 22 (the terpene resins area) was constructed sometime between 1979 and 1980 and remains in service as part of Pinova’s terpene resins operations. SWMU No. 22 consists of a process area with tanks, vessels, pipes, and pumps with concrete secondary containment including in-floor concrete trenches and curbing. SWMU No. 33 (the tank car liquid loading area) was constructed in the 1980s and remains in service as part of Pinova’s terpene resins operations. Liquid products from the terpenes production area are loaded into tanker trailers in this area. During loading, trucks are parked on a concrete pad adjacent to the west side of Dubignon Street which is surrounded by curbing with a raised concrete berm at each end. The pad drains to a sump where liquids are pumped to a lift station, as necessary.

The terpenes resins area will be further evaluated as discussed in Section 6.2.1 of this CAP.

3.3.2.5 Offsite Sources to Groundwater

As part of the groundwater investigation activities, monitoring wells have been installed in offsite locations. Some of these offsite locations are on adjacent properties with significant histories of past industrial and commercial uses that have contributed VOCs to groundwater (i.e., the Adams Properties). These former industrial/commercial properties are located immediately east of U.S. Highway 17 and north of the eastern portion of the Brunswick facility where past activities have resulted in releases of VOCs, including benzene, toluene, ethylbenzene, and xylenes (BTEX compounds) to groundwater. These former industrial/commercial properties collectively comprise approximately 14 acres and include the former O'Brien Corporation paint factory (parcel numbers 01-03943 and 01-07336), and the former Nesmith Oil gasoline station (parcel number 01-03942).

Historical and recent investigation activities have identified VOCs and other contaminants in soil and groundwater at these offsite properties. For example, at the former O'Brien Corporation paint factory, sampling conducted on behalf of the current owners in March 2019 identified chlorobenzene in three monitoring wells that contained no benzene, signaling contributions from an onsite source rather than the Brunswick facility. In addition, BTEX compounds are present in groundwater underlying the former Nesmith Oil parcel. For example, a shallow grab groundwater sample collected by Antea and Integral in the spring of 2018 at the western edge of the former Nesmith Oil parcel immediately north of the Brunswick facility contained benzene at a concentration of 990 micrograms per liter ("µg/L") (Integral, 2019). The groundwater sample was collected in proximity to the location where underground storage tank removal activities were previously conducted at the Nesmith Oil parcel. BTEX compounds have also been detected in a groundwater well installed in the deep zone of the upper surficial aquifer downgradient of this location, along the southern property boundary and immediately north of the eastern portion of the Brunswick facility. The exact source of chlorobenzene and BTEX compounds at these offsite properties and the vertical and lateral extent of the associated groundwater impacts have not been fully delineated. Additional details regarding the historical uses of and investigation results from the Adams Properties are included in Appendix B of the Aerobic Biobarrier ICM Work Plan included as **Appendix C** to this CAP.

3.3.3 Soil Gas

Sources of soil gas are typically associated with releases of VOCs to soils and/or groundwater. As described hereinafter, soil and groundwater sampling results have been used in tandem with building surveys at the Brunswick facility to identify potential sources of COPCs to soil gas.

3.4 Primary COPCs

3.4.1 Soils

3.4.1.1 Primary COPCs

To date, over 4,000 soil samples have been collected for laboratory analysis as part of the RFI process and supplemental investigation activities after the completion of the RFI, producing an extensive array of data related to soil conditions at the Brunswick facility. These soil samples were collected to investigate potential releases at the Brunswick facility, to assess various SWMUs that have been identified at the Brunswick facility, and to support the development of interim corrective measures.

As discussed in Section 2.3.2 of this CAP, Hercules completed the third phase of the RFI at the Brunswick facility using the Triad approach. The decision unit concept was introduced in 2012 during this process. Four decision units were developed and were used to help characterize soil conditions at the Brunswick facility (NewFields, 2012). The decision units were approved by EPD in the Phase III RFI Report for Soils with minor modifications and were then utilized as exposure domains as presented in the BHHRA and SLERA Report discussed in Section 2.4 of this CAP with the goal of evaluating potential risks from soils in each of the four exposure domains versus on a SWMU-by-SWMU basis. The exposure domains were based on proximity of the SWMUs to one another, and common types of activities and land uses within the Brunswick facility. The exposure domains are identified on **Figure 3-19**. The SWMUs located within each exposure domain are included on **Table 2-1** and shown on **Figure 2-6.**

The BHHRA and SLERA Report identified multiple COPCs in soils in each of the exposure domains using a conservative risk-based screening process; however, toxaphene was identified as the primary COPC in soils, contributing over 90% of the potential carcinogenic risk and/or non-carcinogenic hazard in each of the four exposure domains at the Brunswick facility. Other COPCs identified in the BHHRA and SLERA Report that contributed at least one percent (1%) of the risk from soils in any of the exposure domains at the Brunswick facility include: dieldrin, alpha-hexachlorocyclohexane ("alpha-BHC"), chlorobenzilate, polychlorinated biphenyls ("PCBs") (specifically Aroclor 1254 and Aroclor 1260), and arsenic. These constituents are considered primary COPCs in soils for the purpose of understanding contaminant distributions in this CAP. In addition, certain chemicals not meeting the foregoing threshold of risk contribution were also considered primary COPCs in soils primarily due to their presence in groundwater. These other constituents considered to be primary COPCs in soils include benzene, chlorobenzene, chloroform, methylene chloride, para-cymene, and xylene. In summary the following 13 chemicals are considered to be the primary COPCs in soils for the purpose of presenting general contaminant distributions at the Brunswick facility:

Direct-Contact COPCs	**Groundwater-Related COPCs**
Alpha-BHC	Benzene
Aroclor 1254	Chlorobenzene
Aroclor 1260	Chloroform
Arsenic	Methylene chloride
Chlorobenzilate	Para-cymene
Dieldrin	Xylene
Toxaphene	

The primary COPCs listed above reflect those constituents that have actually been detected in soils. Because of matrix interference and laboratory analytical procedures, the detection limits for certain analytes in certain soil samples are above risk-based screening levels. In some instances, the analytes are not associated with historical operations at the Brunswick facility but instead simply were included in the broad universe of target analytes deployed during various phases of investigation activities. In other instances, the elevated detection limits for a particular soil sample are associated with high levels of COPCs present in that soil sample. It is therefore currently unknown whether the elevated detection limits mask the presence of additional constituents in soils that might materially contribute to potential excess risk or simply are artifacts of the investigation process. Further evaluation will be undertaken in conjunction with implementing the CAP to address this issue and additional COPCs may be identified during this process.

The sitewide distribution of each primary COPC in surface soil samples (defined as samples collected between 0 and 2 feet bgs) and subsurface soil samples (defined as samples collected deeper than 2 feet bgs) are summarized on **Figure 3-20** through **Figure 3-43.** The figures present available current and historical analytical soil data collected between 1994 and 2021. The color coding used in the figures reflects the magnitude of the detected concentrations of COPCs in individual soil samples to gain an understanding of contaminant distributions and do not necessarily imply potential excess risk. The color coding for detected concentrations of COPCs is based on regional screening levels ("RSLs") for industrial receptors that are published and periodically updated by USEPA, with different colors bracketing concentration ranges that typically cover one order of magnitude based on the relevant RSLs. In addition to presenting detected concentrations of COPCs in soils, **Figure 3-20** through **Figure 3-43** present sampling results for COPCs where the COPCs were not detected. Those results are likewise color coded but use different color coding (again based on the relevant RSLs) to distinguish from locations where COPCs were actually detected. This method of data presentation facilitates visualizing where elevated detection limits relative to the RSLs have been observed in comparison to the detected values for various COPCs.

Toxaphene is the most frequently detected COPC in soils at the Brunswick facility. As can be observed on **Figure 3-20**, showing the distribution of sampling results for toxaphene in surface soils, the majority of the elevated concentrations of toxaphene are located within Exposure Domain 4 and more specifically associated with relatively small volumes of soil located adjacent to structures (e.g., building foundations and roadways) within the active manufacturing area at the Brunswick facility.

3.4.1.2 Summary of Risk Management for Soils

As indicated above, Hercules will work with EPD during implementation of the CAP to further evaluate potential risks associated with soils at the Brunswick facility following the completion of interim corrective measures for soils as described in this CAP. In the meantime, Hercules and Pinova will continue to implement facility-wide safety training, requirements mandating use of personal protective equipment ("PPE"), and other requirements contained in the Soil Management Plan for the Brunswick facility. The Soil Management Plan contains procedures governing all soil disturbing activities ("SDAs") at the Brunswick facility to limit potential direct contact exposure to soils by current and future workers. A copy of the Soil Management Plan is included in **Appendix E** to this CAP. The Soil Management Plan may be updated from time to time to reflect current conditions and relevant changes to procedures. In addition, activity and use limitations are expected to be included in environmental covenants for the Brunswick facility to prohibit residential use of the portions of the Brunswick facility where SWMUs and AOCs are located as discussed in Section 6.4 of the CAP. Finally, as previously indicated, the Brunswick facility is fenced with 24-hour security which precludes any likely exposure to onsite soils by potential trespasser receptors.

As discussed in detail in Section 6.1 of the CAP, corrective measures have recently been completed that address soils in the former toxaphene tank farm. Additional corrective measures are planned to address soils in other portions of the Brunswick facility to further reduce potential risks posed by direct contact exposure to such soils. Sampling to delineate the areas that are targeted for soil removal activities was recently completed and a work plan describing the removal and proper disposal of soils from the targeted areas is being prepared for submission to EPD.

3.4.2 Groundwater

3.4.2.1 Nature and Extent of Primary COPCs in Groundwater

Multiple constituents have been detected in groundwater based on groundwater quality data obtained during a long history of groundwater monitoring at the Brunswick facility. A summary of groundwater quality is provided on **Table 3-5** which represents groundwater quality data from the December 2020 and June 2021 sitewide groundwater monitoring events. **Table 3-6** provides groundwater quality data collected from the water table in the shallow zone of the upper surficial aquifer during investigation activities to support vapor intrusion evaluations in August 2019. While multiple constituents have been detected in groundwater at the Brunswick facility, the focus in this CAP is on constituents that are migrating laterally within the upper surficial aquifer (shallow, intermediate, and deep zones) with the potential to migrate downgradient and potentially affect groundwater quality in offsite areas. Other constituents such as pesticides, metals, and certain semi-volatile organic compounds that may be detected in groundwater beneath internal portions of the Brunswick facility tend to sorb to the soil matrix in the subsurface which retards their movement. The primary COPCs in groundwater are generally those detected in monitoring wells located along the U.S. Highway 17 corridor and include the constituents listed below:

- Benzene;
- Chlorobenzene;
- Chloroform;
- Methylene chloride (dichloromethane);
- Para-cymene (p-isopropyltoluene); and
- Xylenes.

With respect to the migration of COPCs in groundwater, as discussed previously, a groundwater mound exists in the western-central portion of the Brunswick facility where shallow groundwater is recharged from precipitation and migrates vertically downward to the deep zone of the upper surficial aquifer and then flows horizontally eastward, mixing with saline water to the east of U.S. Highway 17. Likewise, the primary COPCs dissolved in groundwater migrate downward from source areas and then move horizontally toward the east, primarily within the deep zone of the upper surficial aquifer. Coarse grained sand and gravel lenses within the deep zone of the upper surficial aquifer may provide preferential pathways for groundwater flow and transport of COPCs where they are laterally continuous. A block diagram presenting the conceptual site model for migration of COPCs in groundwater is presented on **Figure 3-44.**

Naturally occurring processes affect the migration of the COPCs along the flow path in the aquifer system including sorption, dispersion, dilution, and degradation. These natural attenuation processes reduce COPC mass in the groundwater and slow down the migration of COPCs relative to groundwater flow velocities. For example, the presence of chloroform and methylene chloride in groundwater in the vicinity of U.S. Highway 17 is consistent with the reductive dechlorination of carbon tetrachloride released upgradient in the former toxaphene production area. Carbon tetrachloride degrades sequentially to chloroform, then methylene chloride (dichloromethane), and finally to organic acids and carbon dioxide under anaerobic conditions.

Geochemical parameters affect the natural degradation processes in the aquifer. Key geochemical parameters and their range in the monitoring wells are summarized here. Data reflecting the geochemistry of groundwater beneath the Brunswick facility are included in Table F-1 and shown on Figures F-1 through F-4 included in **Appendix F**. For groundwater in the shallow zone of the upper surficial aquifer, the groundwater pH generally ranges from approximately 5.5 to 6.5 standard units. The pH levels in the intermediate zone and deep zone of the upper surficial aquifer are slightly higher compared to the shallow zone, and groundwater pH is generally between 6.0 and 7.5 standard units. The groundwater in the shallow zone of the upper surficial aquifer is slightly to moderately reducing within the plume of VOCs with oxidation reduction potentials ("ORP") generally ranging from -20 mV to -100 mV. Monitoring wells where more reducing (lower ORP) groundwater conditions have been observed in the shallow zone of the upper surficial aquifer are generally located closer to the source areas (e.g., monitoring wells MW-21 and MW-23). ORP measurements indicate slightly more reducing conditions in the intermediate and deep zones of the upper surficial aquifer with ORP values generally ranging between -50 mV and -150 mV. In the monitoring well cluster located upgradient of the closed surface impoundments, the ORP values are positive in the shallow and deep zones of the upper surficial aquifer with values in the range of 50 mV. Dissolved oxygen is generally less than 2 milligrams per liter ("mg/L") in all zones of the upper surficial aquifer, which is consistent with the ORP values. Nitrates are not detected. Sulfate is generally not detected or detected at low concentrations (<20 mg/L). Hardness (as $CaCO_3$) was measured in groundwater samples collected from the deep zone of the upper surficial aquifer at concentrations greater than 5,000 mg/L, consistent with results of groundwater samples collected during the 2020 aquifer test from the same aquifer zone. Hardness values greater than 180 mg/L are considered to be indicative of very hard water. Iron concentrations in the upper and lower surficial aquifer units vary significantly from not detected to 110 mg/L.

Iso-concentration maps for the six primary COPCs in groundwater were developed for each of the three zones in the upper surficial aquifer, using the most recent groundwater monitoring result for each well location and the shallow groundwater data obtained in 2019 as part of the vapor intrusion investigation from hand auger borings. The iso-concentration maps are presented as **Figure 3-13a, 3-13b, 3-13c, 3-14a, 3-14b, 3-14c, 3-15a, 3-15b, 3-15c, 3-16a, 3-16b, 3-16c, 3-17a, 3-17b, 3-17c, 3-18a, 3-18b, and 3-18c**.

The data presented on the figures are mostly generated from sampling events completed since January 2015. As indicted on the referenced figures, there are some monitoring wells where the data that were used were generated from sampling events occurring prior to 2015.

In general, the following observations are applicable with respect to the iso-concentration figures:

- The shallow groundwater samples collected for the vapor intrusion investigation greatly improved the understanding of the distribution of primary COPCs in the shallow zone of the upper surficial aquifer at the Brunswick facility.

- Elevated concentrations of the primary COPCs in the shallow zone of the upper surficial aquifer are generally limited to the source areas described above and COPCs have not migrated offsite in the shallow zone of the upper surficial aquifer.

- Generally, the highest concentrations of the primary COPCs are located in the deep zone of the upper surficial aquifer, where the plume of VOCs has migrated downgradient from identified source areas and partially attenuated. The plume of VOCs in the deep and intermediate zones of the upper surficial aquifer extends under certain offsite properties as shown on the iso-concentration figures (**Figures 3-13a to Figure 3-18c**).

- The concentrations of chloroform in the shallow zone of the upper surficial aquifer in the former toxaphene production plant area (i.e., at monitoring well MW-42S) are greatly diminished in comparison to concentrations of chloroform in the deep zone of the upper surficial aquifer further downgradient indicating that natural attenuation is occurring. Additionally, as indicated above, methylene chloride is present in the deep zone of the upper surficial aquifer downgradient of source areas indicating ongoing intrinsic degradation of chloroform.

- Concentrations of benzene in the shallow zone of the upper surficial aquifer in the former toxaphene production area remain elevated but the concentrations attenuate significantly in a downgradient direction before reaching U.S. Highway 17 along the northern flow path from monitoring well MW-42S to monitoring well MW-11DD.

- Recent groundwater monitoring data indicate an enrichment in concentrations of benzene and other petroleum-related constituents (including toluene, xylene, and ethylbenzene) in the deep zone of the upper surficial aquifer east of U.S. Highway 17 on the north side of the Outfall Ditch downgradient from monitoring well cluster MW-11DD (i.e., in monitoring wells MW-29D, MW-38D and MW-55D). As part of conducting the air sparging pilot test for the planned aerobic biobarrier in that area and as part of the tidal study discussed in Section 3.1.5.5 of this CAP, Hercules installed 19 new monitoring wells and observation wells during the spring of 2021. These new monitoring wells and observation wells are located in proximity to the northern edge of the Brunswick facility. Hercules collected groundwater quality samples from 17 of these monitoring wells and observation wells along with groundwater quality samples from existing monitoring wells in the area. The monitoring results were included in a document titled *Groundwater Monitoring Report, Semi-Annual Groundwater Monitoring Event – June 2021* (Geosyntec, 2021e) that Hercules submitted to EPD on October 22, 2021.

3.4.2.2 Summary of Groundwater Risk Characterization

The direct exposure pathway to COPCs in groundwater at the Brunswick facility is incomplete because groundwater underlying the Brunswick facility is not utilized as a source of potable water. Additionally, the direct exposure pathway for groundwater at the Brunswick facility will remain incomplete in the future because, among other things, activity and use limitations will prohibit the use of groundwater from the upper surficial aquifer and the lower surficial aquifer. The activity and use limitations will be included in environmental covenants that will be recorded with the real property records for the Brunswick facility. As discussed in Section 3.2.2 of the CAP, environmental covenants were recorded on November 5, 2021, for the portion of the Brunswick facility east of U.S. Highway 17 (i.e., the Terry Creek Property) that prohibit the use or extraction of groundwater for drinking water purposes.

With respect to the direct exposure pathway to COPCs in groundwater in adjacent offsite areas downgradient of the Brunswick facility, no such pathway currently exists and is highly unlikely to exist in the future for multiple reasons as discussed below.

- As discussed previously, the City of Brunswick currently has an ordinance that bars installing potable water supply wells in areas that are served by the public water supply system. Because the Brunswick facility and adjacent areas are already served by the public water supply system, this provision legally prohibits installation of private potable water supply wells within the Brunswick facility and surrounding areas.

- As currently provided in the Georgia Water Well Standards Act, any public or commercial water supply well must be installed by a licensed water well contractor, who must comply with a variety of well construction standards and bonding requirements. These standards include sealing off groundwater of unacceptable water quality during well installation, installing the well at least five feet into bedrock, and ensuring that the well is protected from contamination by surface waters. The upper surficial aquifer in areas east of U.S. Highway 17 (downgradient of the Brunswick facility) is susceptible to saltwater intrusion from Dupree and Terry Creeks, the salt marsh, and the Back River. As discussed in Section 3.2.2 of this CAP, five private water supply wells are located at properties along Terry Creek Road approximately 3,500 feet southeast of source areas at the Brunswick facility. Hercules has been sampling these private water supply wells on an annual basis as a precaution since 2015. The groundwater sampling results indicate that the water supply wells are not impacted by the Brunswick facility. In addition, Hercules has assessed the depths of the private water supply wells. This assessment has demonstrated that the private water supply wells do not draw water from either the upper surficial aquifer or the lower surficial aquifer but instead draw water from deeper aquifers (including three of the private water supply wells that draw water from the Floridan aquifer). In June and July 2022, Hercules abandoned the other two private water supply wells and replaced them with new water supply wells installed in the Floridan aquifer.

- Finally, it is highly unlikely that a well driller would install a water supply well in the future in either the upper surficial aquifer or lower surficial aquifer in the area of the properties along Terry Creek Road due to the close proximity of Terry Creek, the potential for saltwater intrusion into such a well, and the requirements under the Georgia Water Well Standards Act described above that would need to be followed.

As discussed in Section 6 of this CAP, multiple corrective measures are in progress to further reduce the mass of COPCs in groundwater in source areas at the Brunswick facility and in the deep zone of the upper surficial aquifer.

3.4.3 Vapor Intrusion

The following sections of this CAP describe the elements of the CSM for soil gas and vapor intrusion. The approach to evaluating the vapor intrusion pathway was presented in the Vapor Intrusion Work Plan (Geosyntec, 2019a) and the Vapor Intrusion Sampling Plan (Geosyntec, 2019b) and is consistent with technical guidance issued by USEPA titled *OSWER Technical Guide for Assessing and Mitigating the Vapor Intrusion Pathway from Subsurface Vapor Sources to Indoor Air* (the "USEPA VI Guide") (USEPA, 2015), and technical guidance issued by the Georgia Department of Natural Resources titled *Guidance for Evaluating the Vapor Intrusion Exposure Pathway* (the "Georgia VI Guide") (Georgia DNR, 2021). USEPA's approach is reflected in Georgia's approach and is illustrated in the VI Pathway Investigation Flowchart on **Figure 3-45**. The approach began by considering all structures at the Brunswick facility, narrowed the investigation down to buildings that are susceptible to vapor intrusion, and then prioritized susceptible buildings for further evaluation. Hercules also evaluated the potential for vapor intrusion to be a concern in offsite areas. Based on the assessment that it has conducted, Hercules has not identified any conditions that would pose a potential vapor intrusion concern in offsite areas.

3.4.3.1 Buildings Susceptible to Vapor Intrusion

At the Brunswick facility, buildings that are susceptible to vapor intrusion are those that: (i) are proximate to VOCs in the shallow subsurface, (ii) are currently occupied or could be occupied under reasonably expected future conditions, and (iii) are enclosed or readily enclosable by closing existing doors or windows. A ground-floor room that is enclosed and occupiable inside of a larger building may be susceptible to vapor intrusion, even if the larger building is not.

Dissolved VOCs are known to be present in the shallow zone of the upper surficial aquifer beneath the Brunswick facility, as described above. Where VOCs are present at the water table, these chemicals can partition to the gas phase and then migrate in the vadose zone by diffusion in response to a concentration gradient. In areas where VOCs are present in shallow groundwater underneath or in proximity to a building, the VOCs may be advected into the structure and mixed (often referred to as "attenuated") with indoor air. These relationships and processes are shown in the schematic on **Figure 3-46**.

Rainfall infiltrating through clean soil to groundwater may create a clean water lens at the water table. When present, the clean water lens (shown in schematic on the right side of **Figure 3-46**), is generally sufficient to eliminate the vapor intrusion pathway because VOCs are not present at the water table to partition into the gas phase in the vadose zone.

Buildings can apply both vacuum and pressure on subsurface soils immediately adjacent to their foundations, depending on temperature differentials between indoors and outdoors; operation of heating, ventilation, and air conditioning ("HVAC") systems; wind loading; operation of exhaust fans and other mechanisms. Where present, the vacuum and/or pressure can drive both sub-slab soil gas into indoor air (vapor intrusion) and indoor air into the shallow subsurface (vapor extrusion) through cracks, joints, and openings in the floor. When this air exchange occurs, VOCs present in one medium, whether from subsurface sources or from chemicals or consumer products indoors, can be detected in the other medium.

In June 2019, Hercules, Geosyntec, and EPD reviewed all building structures at the Brunswick facility, and following discussions, reached consensus on a building-by-building basis regarding the susceptibility of each building to VI. Each building was evaluated for general construction type, qualitative leakiness of the building enclosure, potential vapor entry routes including cracks and gaps within floors, competency of building slabs, presence of insulation, and types of ventilation systems. Information obtained during previous building surveys at the Brunswick facility was used as part of the evaluation process. Ultimately, 35 buildings within the Brunswick facility, and one offsite apartment building near the northern edge of the Brunswick facility, were identified as potentially susceptible to VI and retained for further investigation. Buildings susceptible to VI are shown on **Figure 3-47**.

The site reconnaissance activities also yielded important additional information relevant to background sources of chemicals in the air that are relevant to the vapor intrusion conceptual site model. The Brunswick facility is an active manufacturing business with continuous operations in multiple areas. Manufacturing processes at the Brunswick facility extract and distill various resins which result in odors throughout the operational portions of the facility, including notably limonene, which has a citrus odor. Moreover, MIBK is used in some manufacturing processes and unused MIBK is stored in drums in a building directly west of Breakroom No. 2. Additionally, several buildings at the Brunswick facility are used for maintenance activities. Specifically, Pinova performs maintenance activities, stores petroleum products, and maintains fire cabinets to store flammable goods and materials in the Combined Shops, the E&I Shop, and the E&I

Building. Some or all of these materials and processes may contribute COPCs for the vapor intrusion pathway to both indoor air and outdoor air at the Brunswick facility.

3.4.3.2 Vapor Intrusion COPCs

Historical groundwater sampling results from 2010 to 2018 were reviewed to identify volatile compounds that have been detected in groundwater beneath the Brunswick facility and to identify which compounds are more likely to be part of a completed vapor intrusion pathway, if any. As a conservative measure for this screening process, all groundwater data were considered, irrespective of groundwater depth or the distance between groundwater monitoring wells and onsite buildings.

In addition, soil sampling results obtained from historical sitewide soil sampling activities performed as part of the RFI at the Brunswick facility were also considered when developing the list of VI COPCs. Historical soil sampling results obtained from locations within 25 feet of each of the susceptible buildings were extracted from the sitewide soils database and screened for detections of VOCs. The sitewide soils database consisted of analytical results obtained from pre-Triad soil samples (1994-2012), Triad soil samples (2012-2014), and post-Triad supplemental soil samples (post-2014).

Ultimately, 31 VOCs were identified that were historically detected in groundwater or soils adjacent to buildings. Three of the 31 compounds (isopropylbenzene [i.e., cumene], heptachlor, and 1,2-dichloroethane) were detected only once or twice in groundwater monitoring samples collected from the shallow zone of the upper surficial aquifer at the Brunswick facility from 2010 to 2018 and were therefore removed from the COPC list for the vapor intrusion pathway as approved by EPD on July 16, 2019. Thus, the resulting VI COPC list for initial soil and groundwater screening activities consisted of 28 compounds. The VI COPC list was modified again following the submission of the Revised Vapor Intrusion CSM Report to EPD on December 23, 2019. Specifically, formic acid, formaldehyde, and aldrin were removed from the list of VI COPCs because their detection frequencies were very low and they were detected in the temporary shallow groundwater samples at very low concentrations. The final list of VI COPCs consists of 25 compounds, as summarized on **Table 3-7**.

3.4.3.3 Nature and Extent of VI COPCs

Historical groundwater data for the Brunswick facility was not well suited for evaluating the completeness of the vapor intrusion pathway because groundwater investigation activities had not focused on groundwater quality at the water table or in proximity to susceptible structures. Therefore, the Vapor Intrusion Sampling Plan presented a shallow groundwater investigation plan to characterize concentrations of COPCs for the vapor intrusion pathway present at or near the water table immediately upgradient and downgradient of susceptible buildings, or as close as could be achieved based on specific access limitations. Geosyntec collected shallow groundwater samples in August 2019 at the locations shown on **Figure 2-7**. A summary of the shallow groundwater sampling results is provided on **Table 3-6**. Groundwater analytical results were normalized by dividing the detected concentrations of COPCs by their respective USEPA groundwater vapor intrusion screening levels ("VISLs"). The normalized values, or "VISL exceedance factors," were then summed for each groundwater sample to give a unitless scalar that facilitated quantitative comparisons of each sample for all analytes. The spatial distribution of the summed VISL exceedance factors is shown on **Figure 3-48.**

The new shallow groundwater sampling dataset shed light on the presence or absence of COPCs for the vapor intrusion pathway beneath each susceptible building. Fourteen of the 28 COPCs then targeted for analysis for the VI pathway were detected in shallow groundwater samples collected at 35 of the 53 locations sampled in August 2019 near buildings susceptible to VI. The detected VI COPCs in groundwater included acetone, benzene, chlorobenzene, chloroform, ethylbenzene, methyl isobutyl ketone, para-cymene, toluene, xylenes, 1,2,3-trichloropropane, naphthalene, vinyl chloride, formaldehyde and aldrin. In February 2020, additional shallow groundwater samples were collected along the northern property line near the offsite apartment building to close data gaps based on elevated reporting limits for certain VI COPCs from prior sampling events.

Following the August 2019 shallow groundwater sampling event, formaldehyde, formic acid, and aldrin were eliminated from the list of VI COPCs, reducing the list to 25 compounds. Excluding formic acid, formaldehyde and aldrin from the list of VI COPCs rested on multiple factors. First, formic acid was not detected in any of the groundwater samples collected during the August 2019 shallow groundwater sampling event. Second, formaldehyde and aldrin were detected at very low frequencies in groundwater samples collected from the shallow zone of the upper surficial aquifer between 2010 and 2018 (i.e., they were generally not detected in groundwater samples collected from the shallow zone of the upper surficial aquifer during that time period). Third, the maximum concentrations of formaldehyde and aldrin that were reported from the August 2019 shallow groundwater sampling event were significantly below their respective VISLs.

In June 2020, Geosyntec reviewed and updated the VI CSM for the offsite apartment building by combining groundwater analytical data with groundwater elevation measurements (Geosyntec, 2019c) and concluded with concurrence from EPD that the VI pathway to the apartment building is incomplete with respect to sources of VI COPCs associated with the Brunswick facility. An interpretation of the potentiometric surface and the direction of groundwater flow in the shallow zone of the upper surficial aquifer together with relevant groundwater sampling results are presented on **Figure 3-49**. Together, these data indicate that the lateral edge of the plume of dissolved VOCs in the shallow zone of the upper surficial aquifer beneath the northern portion of the Brunswick facility remains onsite and that no dissolved VOCs are expected to be present adjacent to or underneath the apartment building. VI COPCs have not been detected in groundwater samples from monitoring wells MW-30S and MW-3S since 2016, and VI COPCs were not detected in temporary wells TW-1RR and TW-3/3R. At its nearest point, the lateral edge of the plume as shown on **Figure 3-49** is approximately 70 feet from the southwest corner of the apartment building. Without a pathway for VI COPCs to migrate near the apartment building in shallow groundwater, VI COPCs would need to diffuse laterally in the vadose zone from the edge of the plume to reach the apartment building. However, such lateral diffusion is highly unlikely because the vadose zone is very thin (approximately 1 foot thick) over much of the intervening distance, and a drainage ditch is present along the boundary of the Brunswick facility that almost certainly pinches the vadose zone to a thickness of zero between the edge of the plume and the apartment building. To the east, near temporary wells TW-3/3R and monitoring well MW-3S, the ditch has year-round standing or flowing water; to the west, near temporary wells TW-2/2R and TW-1RR, the ditch is marshy and periodically contains standing water.

Based on this revised VI CSM for the offsite apartment building, the VI pathway to the apartment building is incomplete with respect to sources of VI COPCs associated with the Brunswick facility. EPD concurred that no further actions with respect to the potential VI pathway at the offsite apartment building are necessary via e-mail on July 1, 2020.

3.4.3.4 Prioritization of Susceptible Buildings

Groundwater sampling results from shallow groundwater greatly improved the VI CSM and were used to prioritize susceptible buildings for investigation. The shallow groundwater sampling results from August 2019 and February 2020 provided substantial additional information regarding the nature and extent of COPCs in the subsurface that may act as sources for the VI pathway to susceptible buildings at the Brunswick facility.

Geosyntec used these groundwater sampling results, observed building conditions, plus the historical soil sampling data to screen the susceptible buildings and to prioritize them for future investigation. Susceptible buildings for which further information was needed to evaluate the VI pathway were designated as either “Tier 1” or “Tier 2” buildings. Tier 1 buildings were prioritized for additional investigation in the next step of the vapor intrusion assessment process. Tier 2 buildings are being evaluated based on updates to the VI CSM to reflect information collected from Tier 1 buildings. The approach to Tier 2 buildings is presented in Section 6.2.5 of the CAP. Buildings for which no further information is needed to conclude that the VI pathway is incomplete were designated as “Tier 3” buildings.

Three criteria were used to prioritize susceptible buildings for additional investigation, including (i) the presence of NAPL in proximity to the buildings, (ii) relatively high concentrations of COPCs for the VI pathway in shallow groundwater in proximity to the buildings, and (iii) uncertainty in the distribution of COPCs for the VI pathway in shallow groundwater in proximity to the buildings.

As described above, groundwater sampling results were normalized by dividing the detected concentrations of COPCs by their respective groundwater VISLs (**Figure 3-48**). Ten susceptible buildings were classified as Tier 1 buildings because they had either summed VISL exceedance factors greater than 5 based on detected COPCs or had NAPL observed in nearby temporary groundwater monitoring points. The VI pathway was not complete at six susceptible buildings at the Brunswick facility, including the Changing Room, the Gate House, the Lab Storage Building, the Main Office Building, the Maintenance Shop, and the offsite apartment building. No additional investigations are necessary at these six buildings. The remaining 20 susceptible buildings at the Brunswick facility were classified as Tier 2 buildings. In contrast to Tier 1 buildings, the summed VISL exceedance factors for detected COPCs for Tier 2 buildings range from 0.01 to just under 3, including many with an exceedance factor of less than 1. No COPCs were detected in shallow groundwater in proximity to two of the Tier 2 buildings. Each of the 20 buildings were included in Tier 2 because a COPC was detected in an adjacent groundwater sample or in an historical soil sample collected within 25 feet of the building, or both. Several buildings were classified as Tier 2 buildings, rather than Tier 3 buildings, solely because the laboratory reporting limits for specific COPCs in shallow groundwater samples near the buildings exceeded the corresponding groundwater VISLs, even if the COPCs were not detected in the groundwater samples.

In summary, of the 36 buildings that were identified as potentially susceptible to vapor intrusion, the VI pathway was incomplete for six buildings, ten buildings were retained as Tier 1 buildings, and 20 buildings were retained as Tier 2 buildings. The locations of the VI susceptible buildings and their prioritization are provided on **Figure 3-50**. As of the preparation of this CAP, the investigation activities at Tier 1 buildings are complete, and the investigation activities at Tier 2 buildings are ongoing.

3.4.3.5 Summary of Vapor Intrusion Risk Characterization

Geosyntec collected building-specific samples from eight Tier 1 buildings in September 2020 to investigate whether the vapor intrusion pathway is complete at those buildings. Validated laboratory results were transmitted to EPD in November 2020. On January 12, 2021, Hercules submitted the Tier 1 Report as referenced in Section 2.3.2 of this CAP. Out of an abundance of caution, Hercules is implementing or has implemented mitigation measures consisting of sub-slab depressurization systems at three of the ten Tier 1 buildings (the Stillhouse Control Room, the Chemical Plant Control Room and Laboratory, and the E&I Shop). Hercules also has implemented steps at five other Tier 1 buildings to improve ventilation or demolish certain features to render the buildings not susceptible to vapor intrusion. These actions are described in more detail in Section 6.1.5 of this CAP. Tier 2 buildings are currently being evaluated as described in Section 6.2.5 of this CAP.

4. CORRECTIVE ACTION OBJECTIVES

Corrective action objectives ("CAOs") for a site are typically developed following the completion of a risk assessment in those cases where the risk assessment identifies chemicals that have been released to the environment that contribute to potential risks for one or more receptor exposure scenarios that exceed regulatory thresholds above which corrective action is required. CAOs are narrative statements that describe what the remedial actions that are proposed for a site are expected to accomplish, help guide the development of specific remedial alternatives for applicable media and/or units and provide for an appropriate level of protection for human health and the environment once the selected remedy(ies) is fully implemented.

In this particular matter, the primary CAOs for the Brunswick facility are to protect human health and the environment, taking into account both the environmental setting and the current and anticipated future uses of the Brunswick facility and surrounding area. The goal of the corrective measures collectively is to prevent human exposure to onsite contaminated media posing potential risks above acceptable risk ranges (a cancer risk of 1×10^{-4} to 1×10^{-6} for carcinogens and a hazard index of less than 3 for non-carcinogens (with a target hazard index less than 1). The corrective measures will also address chemicals of concern in groundwater that may potentially migrate offsite and pose unacceptable risks under current and anticipated land and groundwater use scenarios. Hercules will implement appropriate remedial technologies, combined with monitored natural attenuation, engineering controls, and institutional controls to meet the CAOs.

As presented in Section 2.3 of this CAP, significant investigative activities and corrective measures have been completed at the Brunswick facility. An adaptive management approach is being utilized for this CAP that allows for certain corrective measures to be implemented at the Brunswick facility while concurrently completing additional assessment activities and iteratively evaluating potential risks. With this results-oriented approach in mind, Hercules has completed or is in process of completing multiple interim corrective measures as discussed in Section 6.1 of this CAP that will build upon previous corrective measures and further reduce potential risks associated with environmental conditions at the Brunswick facility. Likewise, as discussed below, Hercules is committed to working with EPD to resolve outstanding issues relating to the BHHRA and SLERA Report and to develop final CAOs for the Brunswick facility.

Various work plans for interim corrective measures have been submitted to EPD and have been either approved by EPD or are under review by EPD. Copies of these work plans are appended to this CAP and incorporated by reference. The work plan describing corrective measures for soils at the former toxaphene tank farm has been implemented. Field work pursuant to that work plan was completed as of January 3, 2022, and a completion report is being prepared for submission to EPD. In addition, two of the work plans describing corrective measures for groundwater are currently being implemented in the field. As Hercules progresses further through this process, Hercules will work with EPD to implement additional interim corrective measures as may be necessary. Hercules will prepare individual work plans for such additional interim corrective measures for review and approval by EPD. Each such work plan will include performance metrics to evaluate the efficacy of the interim corrective measures covered by the work plan. Section 6.3 of this CAP further discusses the framework for these additional corrective measures and requirements for future interim corrective measures work plans that will be submitted to EPD for approval prior to implementation. Section 6.3 of this CAP also discusses informational meetings that will be held to keep the public and local stakeholders informed regarding progress implementing pending interim corrective measures as well as plans for additional interim corrective measures.

Ultimately, once interim corrective measures have been implemented to address identified potential risks and the CAOs are finalized, Hercules will submit an application for a permit modification to incorporate into the CAP (i) the final CAOs that are developed, (ii) documentation regarding the implemented interim corrective measures, and (iii) a description of any additional corrective measures and/or operation, maintenance, and monitoring ("OM&M") requirements that may be necessary to meet the CAOs and to verify the effectiveness of the implemented corrective measures.

A process flow chart showing this adaptive management framework for the corrective action process for the Brunswick facility is provided on **Figure 4-1.**

More specifically, additional development of final CAOs will take place during the corrective action process and will be informed by the following:

- the progress and effectiveness of the ongoing corrective measures discussed in Section 6.1 of this CAP;

- the information obtained through proposed investigation activities to refine the CSM as discussed in Section 6.2 of this CAP;
- the outcomes from completed additional corrective measures as discussed in Section 6.3 of this CAP; and
- the results of risk-based analyses of chemicals of concern utilizing EPD and USEPA guidance for various receptors and media under current and potential future land use scenarios, taking into account activity and use limitations as discussed in Section 6.4 of this CAP.

5. REMEDIAL TECHNOLOGIES, ENGINEERING CONTROLS, AND INSTITUTIONAL CONTROLS

Corrective action can be accomplished through implementation of a variety of remedial technologies, engineering controls and institutional controls. Remedial technologies that have been preliminarily screened for potential use at the Brunswick facility are presented in Section 5.1. Engineering controls for soils and groundwater are briefly discussed Section 5.2. Various types of institutional controls that can be utilized to prevent or control exposure to COPCs are described in Section 5.3. Collectively, Sections 5.1, 5.2 and 5.3 of this CAP provide a "toolkit" from which to select future corrective measures to deploy at the Brunswick facility to protect human health and the environment. The identification and selection of additional corrective measures to implement at the Brunswick facility will take into account the performance of the ongoing interim corrective measures discussed in Section 6.1, the activities to inform future corrective measures as discussed in Section 6.2 and the activity and use limitations as described in Section 6.4. The framework for implementing future corrective measures is discussed in Section 6.3.

5.1 Remedial Technologies Potentially Suitable for Corrective Measures

Hercules has identified and preliminarily screened multiple corrective measure technologies for potential use at the Brunswick facility. Hercules focused on remedial technologies that are reasonably feasible to implement and capable of addressing the types of environmental conditions present at the Brunswick facility. Hercules then preliminarily screened those remedial technologies using a scoring system based on their effectiveness, implementability, remedial timeframe and relative cost. Sections 5.1.1, 5.1.2,5.1.3 and 5.1.4 of this CAP provide brief descriptions of the remedial technologies for soils, groundwater, NAPL, and vapor intrusion, respectively, that have been retained for potential future use at the Brunswick facility based on the preliminary screening process that Hercules completed. For most of the remedial technologies described below, pre-design investigations (including a treatability study and/or a pilot study) will likely be useful and/or necessary to refine design parameters for full scale implementation of the particular technology being considered that take into account the environmental conditions at the specific area that is targeted for corrective measures using that technology.

5.1.1 Remedial Technologies for Soils

Applicable remedial technologies to address COPCs in soils at the Brunswick facility are screened in **Table 5.1**. The following remedial technologies have been retained to address COPCs in soils at the Brunswick facility and are briefly described below:

- Excavation and offsite disposal;
- Solidification/stabilization;
- Thermal treatment;
- Soil vapor extraction; and
- *In situ* chemical oxidation.

5.1.1.1 Excavation and Offsite Disposal

Excavation and offsite disposal is a remedial technology that is commonly used to address COPCs in soils, particularly where COPCs are present in discrete areas of limited size. Excavation and offsite disposal involves removing targeted soils and transporting those soils to a permitted offsite facility for disposal. Excavated areas are then restored to grade, typically using clean soil as a backfill material within the excavated areas.

Selection of the offsite disposal facility to receive the excavated soils turns in large measure on the waste characterization of the soils. Soils that qualify as non-hazardous waste typically may be disposed of at a RCRA Subtitle D landfill (i.e., a solid waste landfill). Soils classified as hazardous waste must be disposed of at a permitted RCRA Subtitle C disposal facility. Soils classified as hazardous waste must meet the land disposal restrictions set forth in 40 C.F.R. Part 268. Soils containing hazardous constituents typically can be disposed of at a RCRA Subtitle C landfill provided that the concentrations of such constituents are no more than 10 times the universal treatment standards set forth in 40 C.F.R. § 268.48. If the concentrations of such constituents exceed 10 times the universal treatment standards or other land disposal restrictions that are applicable, the soils must be treated (typically incinerated) prior to disposal at the landfill. Testing to evaluate whether soils qualify as characteristic hazardous wastes utilizes the methods described in 40 C.F.R. Part 261, Subpart C.

Use of excavation and offsite disposal as a remedial technology typically also triggers the need to prepare erosion and sediment control plans, stormwater management plans, as necessary, and appropriate health and safety protocols. Other key factors that must be evaluated as part of implementing excavation and offsite disposal include protection of facility infrastructure, excavation slopes, soil stockpile management, heavy truck traffic, dewatering of excavated areas (as necessary), generation of multiple waste streams, fugitive dust, and potential vapors.

5.1.1.2 Solidification/Stabilization

Solidification/stabilization of soils is a remedial technology that encapsulates COPCs in the soil matrix by forming a solidified monolith. The generated monolith has a high compressive strength and a low hydraulic conductivity which reduces direct exposure pathways and potential leaching of COPCs to groundwater. Solidification/stabilization uses physical processes and/or chemical reactions between the soil matrix and the binding reagents, such as cement and slag, to immobilize the chemicals of potential concern. The remedial technology can be applied on an *in situ* or *ex situ* basis. *In situ* implementation does not require excavation of impacted soil. *Ex situ* implementation of this technology includes excavation and consolidation of the impacted soil in a containment cell prior to treatment.

For both *in situ* and *ex situ* implementation of solidification/stabilization, the impacted soil is blended with appropriate doses of a binding or solidifying agent(s) and water. Portland cement, slag and bentonite are typically used as solidifying reagents for *in situ* solidification/stabilization applications In addition to solidifying reagents, other additives can be used, such as an oxidant to reduce the mass of COPCs in the impacted soils through chemical destruction (oxidation) or activated carbon to reduce the potential leachability of COPCs in the resulting solidified monolith.

For shallow implementation (e.g., depths less than 15 feet bgs), conventional equipment (e.g., an excavator bucket) can be used to blend impacted soil with the solidifying reagents. For deeper implementation (e.g., depths greater than 15 feet bgs), an auger or a dual axis blender can be used to blend the impacted soils with the solidifying reagents.

As discussed in Section 6.1.1 of this CAP, *in situ* solidification has been used to address soils in the former toxaphene tank farm pursuant to a work plan titled *Revised Interim Corrective Measure Work Plan, SWMU No. 6 – Former Toxaphene Tank Farm,* *Hercules/Pinova Brunswick Facility, Brunswick, Georgia* which EPD approved by letter dated October 22, 2020. That work plan included the results of a treatability study that Hercules performed to evaluate the performance of solidification/stabilization technology on impacted soils from the former toxaphene tank farm.

5.1.1.3 Thermal Treatment

Thermal treatment of soils is a remedial technology that uses heat to physically separate COPCs from the impacted soils so that the COPCs can be captured and treated or destroyed. This technology is generally effective in treating soils impacted by organic contaminants (e.g., pesticides, PCBs, and VOCs). The volatilized contaminants generated by the heating process are captured with a vapor extraction system. The captured vapor is then treated via vapor treatment technologies such as thermal oxidation and/or vapor phase sorption to activated carbon. Thermal treatment can be applied on an *in situ* or *ex situ* basis. For *in situ* implementation of the technology, heat is indirectly applied to the impacted treatment zone by conduction or electrical resistance heaters or by convection of a heated gas stream. For *ex situ* implementation of the technology, the impacted soil is excavated and placed in a treatment unit. Heat is applied to the excavated soil directly (i.e., by using a heating chamber or burner) or indirectly (i.e., by using a heated gas stream, thermal conduction, or electrical resistance heating).

Thermal treatment can also be used to destroy COPCs directly. For example, smoldering combustion is a thermal treatment process, which is commercially called STAR or STARx for *in situ* and *ex situ* applications, respectively. In this process, organic contaminants are destroyed with a smoldering combustion process, which is sustained by addition of air to combust those contaminants in soils. The organic contaminants typically serve as the combustion fuel.

Thermal treatment technologies are expected to be effective in addressing organic COPCs at the Brunswick facility. The implementation of *in situ* thermal treatment is relatively complicated for some areas of the Brunswick facility due to safety considerations (e.g., designated Class I Division 2 areas with ignitable concentrations of the flammable gases) and shallow depths to groundwater (i.e., a limited vadose zone for purposes of installing an effective vapor extraction system). Use of thermal treatment technology on an *ex-situ* basis requires large areas for stockpiling of excavated soils and poses potential challenges with respect to fugitive dust and vapor management during soil excavation activities and during the *ex-situ* heating of impacted soils.

As discussed in a work plan titled *Revised Interim Corrective Measure Work Plan, SWMU No. 6 – Former Toxaphene Tank Farm, Hercules/Pinova Brunswick Facility, Brunswick, Georgia* which EPD approved by letter dated October 22, 2020, Hercules conducted a treatability study of the potential use of STARx Hottpad™ technology on an *ex-situ* basis to thermally treat impacted soils from the former toxaphene tank farm. While Hercules ultimately chose not to use the technology for the former toxaphene tank farm, the results of the treatability study are included in the work plan.

5.1.1.4 Soil Vapor Extraction

Soil vapor extraction is a remedial technology for COPCs in soils that involves extraction of soil vapors (COPCs with high vapor pressures) under an induced vacuum. Extraction wells can be installed with vertical, angled, or horizontal orientations; however, given the shallow depth to groundwater at the Brunswick facility, extraction wells for a soil vapor extraction system at the Brunswick facility would likely involve installation of horizontal wells. In such an application, a horizontal well would be installed for extraction of vapors and a vacuum blower would be used to apply a vacuum through the well screen. Soil vapor extraction technology is effective in removing VOCs, but is not effective for pesticides, PCBs and/or metals such as arsenic due to their low vapor pressure (less than 1 millimeter mercury). Contaminants in the extracted vapor are typically treated above ground with thermal oxidation and/or activated carbon prior to discharge of the treated vapor to the atmosphere. Given that groundwater is relatively shallow at the Brunswick facility, the implementability of this technology has certain limitations due to the potential for upwelling of groundwater into the vapor extraction wells and the limited thickness of vadose zone in which to install the vapor extraction wells.

5.1.1.5 In Situ Chemical Oxidation (ISCO)

In situ chemical oxidation ("ISCO") is a remedial technology for COPCs in soils that involves destruction of organic contaminants through chemical oxidation. An oxidant (such as persulfate or hydrogen peroxide) and in some cases an activator (such as a base or iron) is delivered to the treatment zone either by a soil mixing method or injection wells to destroy organic contaminants by oxidizing those contaminants *in situ*. Effective use of ISCO treatment requires direct contact between organic contaminants and the oxidant for a complete oxidation reaction to occur. The selection of an oxidant is a function of multiple parameters including the target COPCs, the lithology of the treatment zone, the natural oxidant demand of the soils to be treated, contaminant mass, the volumetric extent of COPCs and the presence of residual NAPL. Shallow groundwater levels and the high natural organic content in the soils at the Brunswick facility are limitations to be considered in connection with potentially applying this technology to impacted soils at the Brunswick facility.

5.1.2 Remedial Technologies for Groundwater

Potential remedial technologies to address COPCs in groundwater at the Brunswick facility are screened in **Table 5.2**. The following remedial technologies have been retained to address COPCs in groundwater at the Brunswick facility and are briefly described below:

- Groundwater extraction and treatment;
- Monitored natural attenuation;
- *In situ* chemical reduction;
- Air sparging and soil vapor extraction;
- Non-aqueous phase liquid recovery;
- Multi-phase extraction;
- *In situ* carbon injection;
- *In situ* chemical oxidation;
- Enhanced *in situ* bioremediation; and
- *In situ* thermal treatment.

5.1.2.1 Groundwater Extraction and Treatment

Groundwater extraction and treatment (commonly referred to as pump and treat) is a remedial technology for groundwater that involves the extraction of groundwater using vertical or horizontal extraction wells to capture groundwater containing COPCs from a particular target zone. The extracted groundwater is then treated in an aboveground treatment system before being discharged. Management of treated groundwater typically involves discharging the treated groundwater to a surface water body pursuant to an appropriate permit, discharging the treated groundwater to an offsite water treatment plant such as a POTW, or discharging the treated groundwater to the subsurface through underground injection wells or injection galleries. Aboveground treatment systems of the type that would be needed for use at the Brunswick facility typically include an equalization tank, a solids removal system such as an inclined plate clarifier, bag filters, liquid phase activated carbon to treat COPCs, a removed solids dewatering system, and various tanks and metering pumps for pH adjustment and dosing amendments (such as soda ash and lime) to remove solids.

The primary technical limitations in the effectiveness of groundwater extraction and treatment as a remedial technology involve subsurface heterogeneities, capture zone limitations, potential scaling/corrosion of aboveground equipment due to very hard or brackish water of the type found in the deep zone of upper surficial aquifer underlying portions of the Brunswick facility, and limitations on the discharge of the treated water. In addition, the technology can result in faster migration of COPCs from source areas to downgradient areas if the technology is implemented primarily as a hydraulic containment system without first addressing upgradient source areas. The use of groundwater extraction and treatment can also induce flow in a groundwater system that has unintended or adverse consequences such as drawing salt water or brackish water into fresh water zones. Groundwater extraction and treatment systems require long timeframes to improve groundwater quality because they require multiple pore volume flushes to achieve the desired results.

Potential use of a groundwater extraction and treatment system to address COPCs in groundwater in the deep zone of the upper surficial aquifer underlying the U.S. Highway 17 corridor at the Brunswick facility is discussed in greater detail in Section 6.1.4.1 of this CAP. In addition, as discussed in Section 2.3.2 of this CAP, Hercules evaluated implementing a groundwater extraction and treatment system for groundwater in the intermediate zone of the upper surficial aquifer underlying the northern portion of the Brunswick facility in 2015 and 2016, but ultimately concluded that such a system would not be effective or necessary.

5.1.2.2 Monitored Natural Attenuation

Monitored natural attenuation ("MNA") is a remedial technology for COPCs in groundwater that relies on natural biotic and abiotic processes to decrease concentrations of contaminants in groundwater over time. Natural attenuation processes include sorption, dilution, dispersion, and biological degradation. The technology includes implementing a monitoring program to document the natural attenuation of contaminants in the subsurface and to evaluate the plume geometry and stability over time. A typical monitoring program associated with implementation of MNA includes sampling for COPCs, various field parameters (such as depth to water measurements, oxidation-reduction potential, dissolved oxygen, temperature, pH, specific conductivity and turbidity), biological parameters including target genes known to degrade COPCs, anions (such as sulfate, sulfide, nitrate, nitrite, and chloride), cations (such as iron, magnesium, sodium, and potassium), alkalinity, total organic carbon, dissolved organic carbon, dissolved hydrocarbons, and total dissolved solids. The monitoring program is typically tailored to the specific conditions that are being addressed and the characteristics of the groundwater in that area. MNA can be combined with active remedial technologies like those currently being implemented at the Brunswick facility and/or used in conjunction with institutional controls to achieve desired results.

Natural attenuation of COPCs in groundwater is already occurring at the Brunswick facility as evident from the degradation of carbon tetrachloride to chloroform to methylene chloride. However, additional studies and groundwater monitoring consistent with various EPA guidance documents relating to implementation of MNA would be needed to demonstrate the efficacy of MNA for achieving corrective action objectives associated with COPCs in groundwater.

5.1.2.3 In Situ Chemical Reduction

In situ chemical reduction ("ISCR") is a remedial technology for COPCs in groundwater that involves injecting a reductant (e.g., zero valent iron or ferrous sulfide) into the subsurface to reduce COPCs abiotically. Instead of injecting a reductant, ISCR can also involve promoting, on an *in situ* basis, generation of a reductant (i.e., iron sulfides) through injection of a carbon substrate and soluble ferrous iron. ISCR is expected to be effective in treating chloroform but is unlikely to be able to treat other primary COPCs in groundwater at the Brunswick facility.

5.1.2.4 Air Sparging and Soil Vapor Extraction (AS/SVE)

Air sparging and soil vapor extraction is a remedial technology for volatile COPCs (generally VOCs) in groundwater that involves injection of a gas (usually air or oxygen) into the subsurface through vertical, angled, or horizontal wells to promote volatilization and removal of VOCs that are dissolved in groundwater, sorbed to subsurface soils, or present in the form of a residual NAPL. The volatilized contaminants rise through the saturated zone into the vadose zone, where they are captured by soil vapor extraction wells and conveyed to an above ground treatment system (i.e., an air-pollution control system) for treatment. Following treatment, the gas phase vapor is emitted into the atmosphere.

Air sparging and soil vapor extraction is expected to be an effective remedial technology to use to remove VOCs from groundwater at the Brunswick facility. The primary limitation to using air sparging and soil vapor extraction is the shallow depth to groundwater at the Brunswick facility. The shallow depth to groundwater results in a limited vadose zone in which to install a vapor collection system. In addition, groundwater mounding from operation of an air sparging and soil vapor extraction system can cause upwelling of groundwater into the vapor extraction wells or surfacing at the ground surface where the vadose zone is limited and groundwater is shallow.

5.1.2.5 Multi-Phase Extraction

Multi-phase extraction is a remedial technology for COPCs in groundwater that uses a high vacuum air/fluid extraction system to remove a “multi-phase” stream from the groundwater treatment target zone (i.e., the recovered stream consists of contaminated groundwater, NAPL (if present), and soil vapor). The extracted fluids (vapor, NAPL, and groundwater) are treated in aboveground treatment systems. Gas phase fluids are emitted to the atmosphere following treatment. Liquid phase fluids are separated into NAPL and groundwater. The groundwater is treated and can be managed by discharging the treated groundwater to a surface water body pursuant to an appropriate permit, to an offsite water treatment plant such as a POTW, or to the subsurface through underground injection wells or injection galleries. NAPL is collected and typically shipped for recycling or disposal at an appropriate offsite facility. Multi-phase extraction is usually deployed when conventional soil vapor extraction and NAPL recovery technologies are impractical and/or inefficient to use (i.e., where lower permeability subsurface conditions exist and/or the vadose zone has limited thickness). Multi-phase extraction systems can be installed as permanent recovery systems or implemented intermittently using specialized remediation vendors with portable extraction and treatment equipment. Often, if using specialized vendors for intermittent extraction, recovered NAPL is partially treated within the above ground treatment system and the remaining portions of the NAPL are sent offsite with the groundwater for disposal.

Hercules has conducted a pilot test of multi-phase extraction to address COPCs in the shallow zone of the upper surficial aquifer underlying the central portion of the Brunswick facility. The results are presented in Section 6.1.3 of this CAP.

5.1.2.6 In Situ Carbon Injection

In situ carbon injection is a remedial technology for COPCs in groundwater that involves the injection of activated carbon into the saturated zone to adsorb/trap aqueous phase contaminants. Effectuating the distribution of the activated carbon in the subsurface and the potential back diffusion of contaminants from the activated carbon back into groundwater over the long term are challenges and limitations to using this technology. To overcome the potential back diffusion of contaminants that initially adsorb to the activated carbon, a secondary amendment (e.g., zero-valent iron, an electron donor, or an electron acceptor) can be applied with the activated carbon to promote the destruction of contaminants adsorbed onto the activated carbon. While use of this technology was deemed unsuccessful in one portion of the Brunswick facility, it may have specialized use in other areas of the Brunswick facility.

5.1.2.7 In Situ Chemical Oxidation

ISCO is a remedial technology for COPCs in groundwater that involves destruction of organic contaminants by injecting an oxidant into the groundwater treatment zone through injection wells or direct push injection probes to oxidize the contaminants. As with soils, effective use of ISCO in groundwater requires direct contact between organic contaminants and the oxidant for a complete oxidation reaction to occur. Oxidants that are commonly used for remediation of groundwater include permanganate, persulfate (often combined with activators), ozone, percarbonate, and peroxide (e.g., Fenton's reagent, calcium peroxide). Certain oxidants can also be combined for enhanced effects. The selection of an oxidant is a function of multiple parameters including the target COPCs, the lithology of the treatment zone, the soil natural oxidant demand present in the treatment zone, contaminant mass, the volumetric extent of COPCs and the presence of residual NAPL.

ISCO is not typically used as a plume containment technology. Instead, ISCO is typically applied to source areas with high concentrations of COPCs. A solvent or surfactant can be used to increase the mobility of adsorbed COPCs in the saturated zone to increase the effectiveness of ISCO by facilitating the movement of sorbed COPCs from soil particles to the dissolved phase where they can be more easily be oxidized and destroyed.

As discussed in Section 6.1.3 of this CAP, *in situ* chemical oxidation is being used to address shallow groundwater near monitoring wells MW-21, MW-22, MW-23 and MW-24 in the area of the Stillhouse Control Room within the southern production area pursuant to a work plan titled *Interim Corrective Measure Work Plan, Shallow Zone of Upper Surficial Aquifer, Stillhouse Control Room Area, Hercules/Pinova Brunswick Facility, Brunswick, Georgia* which EPD approved by letter dated August 17, 2021. That work plan included the results of a treatability study that Hercules performed to evaluate the performance of the ISCO technology to address COPCs in the shallow zone of the upper surficial aquifer underlying the central portion of the Brunswick facility. The results are presented in Section 6.1.3 of this CAP.

5.1.2.8 Enhanced In Situ Bioremediation

Enhanced *in situ* bioremediation is a remedial technology for COPCs in groundwater that involves the addition of amendments and possibly a bacteria consortium to enhance *in situ* biodegradation of COPCs in groundwater. Enhanced *in situ* bioremediation can be achieved by aerobic processes or anaerobic processes. In aerobic processes, microorganisms use COPCs as a carbon source and oxygen as an electron acceptor. For instance, benzene and chlorobenzene can be degraded by aerobic processes in the presence of oxygen. Anaerobic processes usually include addition of a carbon substrate. In anaerobic processes, microorganisms use COPCs as a terminal electron acceptor and hydrogen, which is generated from the fermentation of the carbon substrate, as an electron donor. For example, chloroform and methylene chloride can be degraded using anaerobic reductive processes. In anaerobic processes, microorganisms can also use other amendments (e.g., carbon dioxide, nitrate, sulfate, and iron) as an electron acceptor and COPCs as a carbon source (electron donor). The selection of a particular enhanced *in situ* bioremediation process depends on multiple parameters including but not limited to the contaminant type, subsurface geochemistry and biochemistry, and the available delivery techniques for the various bioremediation amendments. Most bioremediation amendments can be injected into the subsurface in solution. However, oxygen can be injected directly as air (i.e., using biosparging techniques) or indirectly as a solution, which is usually a byproduct of another amendment (such as hydrogen peroxide or calcium peroxide).

Enhanced *in situ* bioremediation can be applied to source areas and/or configured to create a linear biologically active permeable treatment zone perpendicular to the direction of groundwater flow (commonly referred to as a biobarrier) to treat contaminants as they flow with groundwater though the biobarrier.

Hercules has conducted multiple treatability studies to evaluate the use of enhanced *in situ* bioremediation to address COPCs in the shallow zone of the upper surficial aquifer underlying the central portion of the Brunswick facility and in the deep zone of the upper surficial aquifer underlying the U.S. Highway 17 corridor at the Brunswick facility. The results of the treatability studies are discussed in detail in Sections 6.1.3 and 6.1.4 of this CAP.

5.1.2.9 In Situ Thermal Treatment

In situ thermal treatment is a remedial technology for COPCs in groundwater that uses heat to physically separate COPCs from impacted groundwater so that the COPCs can be captured and treated or destroyed. *In situ* thermal treatment methods and typical heat applications processes are described in detail in Section 5.1.1.3, above. *In situ* thermal treatment is generally most effective in source areas to address impacts in shallow groundwater and contaminant mass adsorbed to the aquifer matrix.

5.1.3 Remedial Technologies Applicable to Non-Aqueous Phase Liquid

Many of the remedial technologies for soils and groundwater discussed in Sections 5.1.1 and 5.1.2 of this CAP are also applicable to the remediation of NAPL, depending on where NAPL is present. In situations where NAPL is present in soils in the vadose zone or in soils at the top of the water table (i.e., at the interface between unsaturated and saturated soils) particularly where the water table is shallow, it may be feasible to address the NAPL using excavation and offsite disposal, solidification/stabilization, thermal treatment or *in situ* chemical oxidation. While SVE could be applied in an area where NAPL is present, SVE would likely require a long operational period to be effective alone in reducing the mass of NAPL.

If NAPL is present at the water table or below the water table, it may be feasible to address the NAPL using a recovery system designed specifically for NAPL or as part of implementing a groundwater treatment technology. The selection of the remedial technology for a specific area will depend heavily on the physical characteristics (e.g., transmissivity, mobility, and thickness) of the NAPL, the chemical characteristics of the

NAPL (including the concentrations of COPCs in the NAPL), and the physical location of the NAPL relative to aboveground structures and subsurface features.

5.1.3.1 Non-Aqueous Phase Liquid Recovery Systems

NAPL recovery is a remedial technology that removes NAPL from the subsurface (generally at the groundwater table) and reduces the potential for the NAPL to serve as a continuing source of COPCs to groundwater. NAPL recovery is typically used in source areas where measurable thicknesses of NAPL are present. This technology is limited to addressing mobile NAPL in the subsurface and cannot remove residual NAPL trapped in soil pore spaces. NAPL recovery can be enhanced by applying heat or injecting a surfactant in the treatment zone, which increases the mobility and recoverability of the NAPL but may also increase its solubility in groundwater.

Various systems can be used to remove NAPL. These systems generally include physical removal of NAPL using skimmer systems (NAPL only), absorbent socks (NAPL only), and/or multi-phase extraction systems (where both NAPL and groundwater are extracted). A multi-phase extraction system for NAPL lowers the groundwater level at the extraction point to induce a NAPL gradient toward the extraction point. Such a system is similar to the multi-phase extraction system described in Section 5.1.2.5 of this CAP. Once the NAPL and groundwater are extracted, post-extraction treatment options typically must address separating the NAPL from the groundwater, so that those liquid streams can be managed separately.

5.1.3.2 Remedial Technologies for Non-Aqueous Phase Liquid Other than Recovery

As discussed below, many of the groundwater remedial technologies discussed in Section 5.1.2 of this CAP are applicable to NAPL in the saturated zone.

The *in situ* amendment-based groundwater remedial technologies such as *in situ* chemical reduction, *in situ* carbon injection, *in situ* chemical oxidation, and enhanced *in situ* bioremediation are potentially applicable to NAPL present within a groundwater remediation area. Deployment of such technologies to address NAPL is similar to the use of such technologies to address groundwater only as described in Sections 5.1.2.3, 5.1.2.6, 5.1.2.7, and 5.1.2.8 of this CAP, respectively; however, the technology selection and design for a specific area depends on considerations such soil oxidant demand, chemical oxygen demand, groundwater geochemistry, NAPL thicknesses, and the chemical composition and physical characteristics of the NAPL.

Use of air sparging/soil vapor extraction to address NAPL that is present within a groundwater remediation area may be feasible. The technology has the potential to transfer COPCs from the NAPL to the vapor phase for collection, as discussed in Section 5.1.2.4 of this CAP. The remedial process may involve longer implementation periods when NAPL is present rather than only dissolved phase COPCs. In addition, water level mounding must be minimized to avoid inducing undesirable NAPL movement. If air sparging/soil vapor extraction is used in circumstances where NAPL is present, the post-extraction treatment system must be designed to manage higher loads of COPCs than in circumstances where only groundwater containing dissolved COPCs is being addressed.

Thermal treatment of NAPL present in the saturated zone may be feasible. Thermal treatment has the potential to remove or destroy COPCs in NAPL in the same way that it removes or destroys COPCs in groundwater, as discussed in Section 5.1.2.9 of this CAP. Key considerations in the design of a thermal treatment system for NAPL include the duration of thermal heating and the post-extraction treatment of COPCs from the NAPL in addition to groundwater.

When monitored natural attenuation as described in Section 5.1.2.2 of this CAP is applied to NAPL areas, it is commonly referred to as natural source zone depletion (“NSZD”) and can be used as a basis for comparing the performance and relative benefits of other remediation options. NSZD is often useful because engineered systems are often not capable of removing NAPL entirely. NSZD is most applicable in circumstances where the mobility and transmissivity of the NAPL are low and the NAPL is not moving or impacting receptors. The application of NSZD to an area where NAPL is present typically is coupled with the use of institutional controls such as a soil management plan and activity and use limitations implemented through an environmental covenant, as described in Section 5.3 of this CAP.

5.1.4 Remedial Technologies for Vapor Intrusion

Remedial technologies for addressing vapor intrusion typically involve mitigating or eliminating pathways whereby soil vapor containing COPCs from soil or groundwater can enter occupied buildings. Mitigation measures can be accomplished through a variety of approaches that can be categorized as either engineering controls or institutional controls. Engineering controls include active mitigation systems, passive mitigation systems, and building modifications so as to render a building no longer susceptible to vapor intrusion. In certain instances, vapor intrusion is addressed by remediating or eliminating the conditions that serve as a source of COPCs to soil vapor. Selecting an appropriate mitigation or remedial measure depends on building-specific factors and the site-specific conceptual site model including considerations such as depth to groundwater, building construction type, and building use and occupancy.

5.1.4.1 Active Mitigation Systems

Active vapor intrusion mitigation systems employ mechanical devices powered by electricity to prevent the migration of vapors containing COPCs from entering into a building or structure. Active mitigation is applicable for both new construction and existing buildings. Primary examples of active vapor intrusion mitigation systems are discussed below:

- Aerobic Vapor Migration Barrier – An aerobic vapor migration barrier is a method of injecting outdoor air under and around a building foundation to enhance the *in situ* rate of microbial degradation of COPCs in the subsurface, thereby establishing an aerobic barrier to the migration of volatile and degradable COPCs. This novel approach also has some potential application for source remediation (ITRC, 2020a).

- Block Wall Depressurization – Block wall depressurization creates a depressurized zone within hollow block foundation walls to mitigate the potential for vapor intrusion through walls. This approach is typically only recommended to supplement a traditional sub-slab depressurization system where appropriate (ITRC, 2020b).

- Building pressurization – Building pressurization involves modifying the operation of the HVAC system for a building where vapor intrusion is a potential concern to create and maintain greater pressure in indoor air than in the sub-slab air. By creating such a pressure differential, soil gas is prevented from migrating into the building. Building pressurization often requires modifications to the building enclosure to reduce its leakiness (ITRC, 2020b).

- Crawlspace ventilation – Crawlspace ventilation involves using a fan to ventilate the crawlspace under a building where vapor intrusion is a potential concern and thereby reduce concentrations of COPCs in either accessible (from inside or outside a building) or inaccessible crawlspaces. Dilution of COPCs in the crawlspace from soil vapors is accomplished by establishing a sufficient air exchange rate based on the areal limits of the crawlspace (ITRC, 2020c).

- Drain Tile Depressurization – Drain tile depressurization utilizes existing sub-slab sumps and associated drain tile systems to depressurize building slabs (similar to how sub-slab depressurization systems function). Sub-slab depressurization may be necessary to supplement drain tile depressurization if the drain tile system is inadequate to cover the entire slab where vapor intrusion mitigation is targeted (ITRC, 2020b).

- Sub-membrane depressurization – Sub-membrane depressurization involves use of a fan to depressurize soil or a small air space below a sealed membrane barrier. Sub-membrane depressurization is typically used over bare dirt in basements or accessible crawlspaces and is a cost-effective alternative to crawlspace ventilation if the cost of heat loss is a negative factor (ITRC, 2020d).

- Sub-slab depressurization – Sub-slab depressurization involves use of suction points and piping connected to a fan or blower to draw air from below a building slab. The fan creates a vacuum in the sub-slab soil relative to indoor spaces, induces air flow from below the slab, and conveys extracted soil gas through piping to the atmosphere such that soil gas is interrupted from flowing into indoor air in areas targeted in the design. A sub-slab depressurization system is designed to achieve a minimum differential pressure between sub-slab soil gas and indoor air across the area targeted by the design (ITRC, 2020e).

- Sub-slab ventilation – A sub-slab ventilation system is similar, by design and construction, to a sub-slab depressurization system except that a sub-slab ventilation system is designed to achieve a minimum exchange rate of sub-slab soil gas over the area targeted in the design, rather than to achieve a specified differential pressure as described above (ITRC, 2020f).

5.1.4.2 Passive Mitigation Systems

Passive vapor intrusion mitigation systems block the potential migration of subsurface vapors containing COPCs from entering into overlying buildings with the use of mechanical devices. Passive mitigation systems are generally used in new construction but does have limited applications in existing buildings (e.g., building slab replacement). Primary examples of passive mitigation systems are discussed below:

- Aerated Floor Void Space Systems – Aerated floor void space systems are concrete slabs that are constructed to have a continuous void space under the slab that is utilized for sub-slab venting or depressurization in lieu of the sand or gravel venting layer typically found with traditional mitigation systems (ITRC, 2020g).

- Building Design Approaches – While not as well-documented as other passive mitigation systems, specific building design approaches can be very effective at mitigating the vapor intrusion pathway. The most common building design utilized for vapor intrusion mitigation (ITRC, 2020h) that is applicable to the Brunswick facility is to construct buildings with raised foundations such as block-and-beam construction or buildings constructed over a crawlspace that is open to outdoor air.

- Epoxy Floor Coatings – While often used as a decorative finish, epoxy products can also be applied to existing concrete slabs as a passive barrier system. Epoxy floor coatings can bond with the concrete floor to seal porous concrete, are chemically resistant to VOCs or other vapor contaminants, and can reduce the potential for advective and diffusive transport (ITRC, 2020i).

- Passive Barrier Systems – Passive barrier systems are designed to prevent and/or reduce the entry of vapors into a building and are commonly associated with both active and passive vapor intrusion mitigation systems. Three categories of passive barrier systems currently available are asphalt latex membranes (spray-on asphalt latex material), thermoplastic membranes (geomembranes composed of resins, primarily high-density polyethylene), and composite membranes (multilayered systems composed of varying passive barrier materials and designed to improve chemical resistance, constructability, and durability) (ITRC, 2020j).

- Passive Sub-Slab Venting Systems – Sub-slab venting systems allow subsurface vapors to vent passively to the exterior atmosphere utilizing wind effects, thermal effects, and pressure differences to induce airflow without the use of mechanical devices. Sub-slab venting systems are typically installed in new construction with a passive barrier and a sub-slab collection network consisting of horizontal vent piping surrounded by a layer of permeable fill material (ITRC, 2020k).

5.1.4.3 Remediation as Vapor Intrusion Mitigation

Technologies designed for remediation of sources of COPCs in soils or groundwater can also serve to mitigate or eliminate potential vapor intrusion into occupied buildings. The primary examples of remedial technologies that can serve to mitigate potential vapor intrusion are discussed below:

- Multi-Phase Extraction – Multi-phase extraction is a source remediation technology designed to extract both liquids and soil vapor from the subsurface to reduce or eliminate contaminants. The negative pressure created in the vadose zone by multi-phase extraction can also protect buildings from the VI pathway depending on the location of extraction wells and trenches (ITRC, 2020l).

- Soil Vapor Extraction – Soil vapor extraction is a source remediation technology that extracts soil vapor containing COPCs from the subsurface through extraction wells or trenches connected to blowers. While the principal purpose is to reduce the mass of volatile COPCs in the subsurface, soil vapor extraction can also act as a vapor intrusion mitigation technology by intercepting soil vapors containing COPCs below a potentially impacted building (ITRC, 2020m).

5.1.4.4 Modifying the Building Enclosure as Vapor Intrusion Mitigation

Modifying a building's enclosure or modifying or demolishing the walls of an enclosed space inside of a larger building may serve to mitigate potential vapor intrusion concerns if such steps make the building or enclosed space no longer susceptible to vapor intrusion. As described in the Vapor Intrusion Work Plan that was submitted to USEPA on March 22, 2019, and approved by EPD on April 4, 2019, buildings that are susceptible to vapor intrusion are those that: (i) are proximate to VOCs present in the shallow subsurface, (ii) are currently occupied or could be occupied under reasonably expected future conditions, and (iii) are enclosed or readily enclosed by closing existing doors or windows. A ground-floor room that is enclosed and occupiable inside of a larger building may be susceptible to vapor intrusion, even if the larger building is not. Many existing buildings at the Brunswick facility are not susceptible to vapor intrusion because their exterior walls have gaps where the floor or roof meets the walls. These openings are fixed and cannot be closed as simply as closing a door or window. Similar modifications can be made to a susceptible building or crawlspace to make the building no longer susceptible to vapor intrusion.

5.2 Engineering Controls

Engineering controls such as fencing and capping are physical systems that block pathways of exposure or limit the potential for contaminant migration to locations where pathways of exposure may exist. Caps or covers are common types of engineering controls. Caps can be constructed from various materials including soils, crushed stone, asphalt, concrete, clay, and synthetic membranes, depending on the purpose that a cap is to serve. Buildings, parking lots, roads and other forms of infrastructure can also function as caps. A cap can simply eliminate the direct contact pathway to soils and other materials located beneath the cap. A cap can also be designed to limit infiltration of precipitation where potential transport of contaminants leaching from soils into groundwater is a primary concern. Capping can also be considered a remedial technology.

Engineering controls can also include mechanisms to divert or block groundwater movement. For example, groundwater extraction is sometimes undertaken to alter groundwater flow conditions and restrict migration of groundwater containing COPCs. Pump and treat can also be considered a hydraulic control engineering technology.

Engineering controls are typically coupled with institutional controls specifying measures to protect the engineering controls that have been implemented and to ensure that they are properly operated and maintained.

5.3 Institutional Controls

Institutional controls are a form of restrictions or land use controls that mitigate potential risks from human exposure to COPCs present in environmental media. As indicated above, engineering controls are often combined with institutional controls to provide multiple layers of protection, to protect and maintain the functionality of the engineering controls themselves, and/or to address pathways or media not addressed by an engineering control.

There are four basic types of institutional controls:

- **Government controls** include zoning ordinances, restrictive covenants, building codes, environmental restrictions, or land development regulations that are implemented and enforced by federal, state, or local government.

- **Proprietary controls** are property rights established by an agreement between the property owner and one or more outside parties. Proprietary controls are often referred to as deed restrictions which describe property rights that restrict the use of the property. Proprietary controls can also be implemented through a declaration of restrictive covenant or through an environmental covenant.

- **Enforcement or permit mechanisms** include government agency–issued permits, administrative orders, and consent decrees that are enforced by state or federal agencies.

- **Information devices** provide information about particular risks from contamination present at a site so that appropriate precautions can be taken. The information can be conveyed through deed notices, state registries, advisories, onsite notifications, and community participation requirements.

Institutional controls that will be implemented at the Brunswick facility are discussed in more detail in Section 6.4 of this CAP. Institutional controls that are already in place that restrict land and groundwater use at the Brunswick facility and surrounding areas are discussed as part of the conceptual site model presented in Section 3 of this CAP.

6. CORRECTIVE ACTION PLAN

This section of the CAP describes the process for implementing the remaining components of the RCRA corrective action program at the Brunswick facility, including various corrective measures that are currently being undertaken and that are expected to be undertaken in the future. Adaptive management techniques will be used at the Brunswick facility to advance the corrective action process in a phased manner. Information that is developed through corrective measures that are currently being implemented will be utilized in tandem with the extensive platform of characterization information that already exists and information that will be developed through targeted investigation activities to identify, select, design and implement further corrective measures that may be necessary to address environmental conditions at the Brunswick facility in a manner that is protective of human health and the environment, taking into account current and projected future land uses and the environmental setting of the Brunswick facility. The CAP is designed to be a “living” document, providing flexibility to tailor corrective measures to reflect ongoing work and to develop and implement additional corrective measures that may be necessary in an administratively efficient manner.

6.1 Phase 1 - Ongoing Corrective Measures

Hercules is currently implementing multiple corrective measures at the Brunswick facility. These corrective measures – commonly referred to as interim corrective measures or ICMs – have been designed in close coordination with EPD and are being implemented under EPD’s oversight. The objectives of these corrective measures are to achieve reductions in the mass of COPCs present in groundwater in the upper surficial aquifer, to achieve reductions in potential risks associated with direct exposure to COPCs in soils by onsite workers and construction workers, and to mitigate possible risks posed by potential vapor intrusion into occupied buildings at the Brunswick facility where the vapor intrusion pathway has been determined to be complete. The ongoing corrective measures constitute Phase 1 of the corrective action process at the Brunswick facility. The ongoing corrective measures for soils are described in Section 6.1.1 (soils in the former toxaphene tank farm) and Section 6.1.2 (sitewide soils) of this CAP. The ongoing corrective measures for groundwater are described in Section 6.1.3 (groundwater in the shallow zone of the upper surficial aquifer) and Section 6.1.4 (groundwater in the deep zone of the upper surficial aquifer) of this CAP. Finally, the ongoing corrective measures that address potential vapor intrusion into occupied buildings at the Brunswick facility are described in Section 6.1.5 of this CAP.

6.1.1 Corrective Measures for the Former Toxaphene Tank Farm

Hercules has completed the field work associated with corrective measures at the former toxaphene tank farm, which is located within the area designated as SWMU No. 6 (the Y tank farm) in the central portion of the main operational area of the Brunswick facility as shown on **Figure 6-1**. The area associated with the former toxaphene tank farm is approximately 140 feet wide and 260 feet long, and is located within a concrete containment wall.

On September 24, 2019, Hercules submitted a letter to EPD describing a two-phased approach for implementing interim corrective measures in the former toxaphene tank farm area. The letter provided in detail the planned approach for implementing the first phase of the interim corrective measures, including the removal of ALM (asphalt-like material) classified as a listed hazardous waste with a waste classification code of P123 (toxaphene) from within the former toxaphene tank farm area. EPD approved the proposed plan in a letter dated October 1, 2019.

As part of the first phase of the interim corrective measures at the former toxaphene tank farm, Hercules removed ALM and related materials from the former toxaphene tank farm area between October 24, 2019 and November 22, 2019. This work included the removal of 280 cubic yards of concrete visibly impacted by ALM and 68 tons of ALM-impacted soils, as well as the removal, via scarification, of six drums of ALM from selected concrete surfaces. Other miscellaneous wastes, ancillary to the performance of the work, were also managed including storm water (50,000 gallons), non-hazardous debris (100 tons), resin (18 tons), and rinse waters (825 gallons). The removal activities completed during the first phase of the interim corrective measures in the former toxaphene tank farm area were documented in a report prepared by Geosyntec and titled *Interim Corrective Measure SWMU No. 6 P123 Removal Completion Report for the Toxaphene Tank Farm Area* (Geosyntec, 2020a) which Hercules submitted to EPD on February 14, 2020. Hercules submitted to EPD in April 2020 minor revisions to two appendices of the report. In a letter dated May 5, 2020, EPD acknowledged receipt and review of the report and provided notification to Hercules that no comments or deficiencies in the report were identified.

The second phase of the interim corrective measures at the former toxaphene tank farm focused on addressing residual concentrations of toxaphene present in shallow soils within the former toxaphene tank farm area from the ground surface to a depth of five feet bgs (equating to approximately 7,000 cubic yards of soils).

Geosyntec performed a focused feasibility study to evaluate applicable remedial technologies for the second phase of the interim corrective measures to address residual concentrations of toxaphene in shallow soils within the former toxaphene tank farm area. The focused feasibility study screened potentially applicable technologies including excavation and offsite disposal, chemical reduction with zero valent iron, chemical reduction/bioremediation, ISS (*in situ* solidification), *ex situ* thermal treatment and onsite thermal direct desorption. Based on the results from the focused feasibility study, three technologies including ISS, *ex situ* thermal treatment and chemical reduction/bioremediation were selected for comparative analysis and further evaluation through treatability studies. The treatability studies were designed to assess at a laboratory scale, the performance of the three remedial technologies that were selected for further evaluation using soils from the former toxaphene tank farm area. The retained remedial technologies also were compared with each other based on multiple evaluation factors including overall protection of human health and environment; long term effectiveness and permanence; reduction of toxicity, mobility or volume of COPCs; short term effectiveness; and implementability. Based on the results of the focused feasibility study that was performed, the treatability studies that were completed, and the comparative analysis of the retained remedial technologies that was undertaken, ISS was selected as the remediation technology to use for the second phase of the interim corrective measures to address shallow soils at the former toxaphene tank farm.

In conjunction with the second phase of the interim corrective measures, Hercules submitted to EPD a document titled *Interim Corrective Measure Plan, SWMU 6, Former Toxaphene Tank Farm, Hercules/Pinova Brunswick Facility, Brunswick, Georgia* on July 2, 2020. In response to limited comments from EPD, Hercules made minor revisions to the proposed work plan and submitted to EPD a document titled *Revised Interim Corrective Measure Work Plan, SWMU No. 6 – Former Toxaphene Tank Farm, Hercules/Pinova Brunswick Facility, Brunswick, Georgia* (i.e., the Former Toxaphene Tank Farm ICM Work Plan) on October 9, 2020, which was approved by EPD in a letter dated October 22, 2020. The Former Toxaphene Tank Farm ICM Work Plan included a detailed discussion of the various remedial alternatives that were assessed for possible deployment at the former toxaphene tank farm, the treatability studies that were performed to assess the viability of certain of the remedial alternatives, the basis for selecting ISS as the remedial alternative to be implemented, and the details describing the manner in which ISS would be implemented. A copy of the Former Toxaphene Tank Farm ICM Work Plan as approved by EPD is attached hereto as **Appendix G**.

Implementation of ISS in the area of the former toxaphene tank farm has involved three key components:

- Solidified monolith: ISS encapsulates contaminants (i.e., toxaphene) in the soil matrix by forming a solidified monolith. The monolith that has been generated using ISS has high compressive strength and low hydraulic conductivity that minimizes the potential for direct contact exposure to soils as well as reduces the mobility and leaching potential of toxaphene in the treated soils. The monolith has been created by mixing soils with Portland cement and other mixing reagents, including granulated blast furnace slag.

- Vegetated soil layer: A vegetated soil layer has been placed over the solidified monolith as a physical barrier to help protect the monolith from potential disturbance.

- Institutional controls: As discussed in more detail in Section 5.3 of this CAP, institutional controls are non-engineered mechanisms, such as administrative controls and/or legal instruments, that place activity and use limitations on land use. Institutional controls will be implemented to protect the solidified monolith from potential disturbance.

Following EPD's approval of the Former Toxaphene Tank ICM Work Plan, Hercules completed a bidding process and contracted with Remedial Construction Services, L.P. (the "ISS Contractor") to implement the ISS remedy at the former toxaphene tank farm. In preparation for field work, supports for an overhead pipe rack located along the eastern side of the former toxaphene tank farm was relocated between mid-December 2020 and February 19, 2021 to facilitate ISS implementation along the eastern part of the former toxaphene tank farm.

The ISS Contractor mobilized to the former toxaphene tank farm area in April 2021 to stage equipment, install erosion and sediment control measures and prepare the former toxaphene tank farm area for ISS mixing (i.e., mixing impacted soils with the selected additives to produce the solid monolith). Prior to ISS mixing, the ISS Contractor performed pilot tests between May 2021 and August 2021 at several locations within the former toxaphene tank farm. The pilot tests were performed using various mixes of water, Portland cement and granulated blast furnace slag to confirm that the field application of the mix design that was developed based on the results of the laboratory treatability studies would meet the performance criteria approved by EPD. After completing the pilot tests and making adjustments to the final mix design, the ISS Contractor started full-scale ISS mixing in September 2021. The process in which ISS mixing has been implemented at the former toxaphene tank farm is described in more detail in the Former Toxaphene Tank Farm ICM Work Plan included in **Appendix G**, including provisions for dividing the area into mixing cells, performing the ISS mixing and grading activities, and performing quality control ("QC") and quality assurance ("QA") activities during implementation of ISS. The QA/QC activities focused on confirming that the selected mix of water, Portland cement and granulated blast furnace slag achieved a resulting ISS monolith that meets the performance criteria approved by EPD.

The approved Former Toxaphene Tank Farm ICM Work Plan also included authorization for Hercules to excavate certain soils in SWMU No. 6 and to place those soils in the former toxaphene tank farm area where those soils could be solidified using ISS technology pursuant to the Area of Contamination Policy developed by USEPA (USEPA, 1996). Under the Area of Contamination Policy, soils that are part of a single "area of contamination" and that otherwise would qualify as hazardous wastes may be excavated, moved and treated without triggering permitting requirements, land disposal restrictions, or minimum technology requirements. Following delineation of the areas targeted for excavation in SWMU No. 6, Hercules submitted a document to EPD titled *Addendum to Former Toxaphene Tank Farm Interim Corrective Measures Work Plan, Hercules/Pinova Brunswick Facility, Brunswick, Georgia* on August 11, 2021. The addendum described in detail the locations and extent of the areas in SWMU No. 6 to be excavated. The addendum was approved by EPD in a letter dated August 13, 2021. The approved addendum to the Former Toxaphene Tank Farm ICM Work Plan is attached hereto as part of **Appendix G.** Subsequently, between August 19, 2021 and August 26, 2021, approximately 460 cubic yards of soils were excavated from within SWMU No. 6 and consolidated in the former toxaphene tank farm area for solidification using ISS together with impacted soils present in the former toxaphene tank farm area. The areas in SWMU No. 6 from which soils were removed are shown on **Figure 6-1**.

Full-scale implementation of ISS at the former toxaphene tank farm area was completed in November 2021. All QA/QC results were received at the end of December 2021 and confirmed that the solidified monolith meets applicable performance standards. Site restoration activities were completed in early January 2022. Hercules is currently preparing a construction completion report for submission to EPD describing the details of the activities that were undertaken.

Post-implementation inspections and maintenance (as needed) will be performed to maintain the integrity of the interim corrective measures completed at the former toxaphene tank farm area as described in **Appendix G**. Specifically, the focus of these activities will be to ensure that the ISS monolith is not damaged or disturbed in a manner that increases the potential risk of exposure to toxaphene. At the same time, it should be noted that the structural characteristics of the ISS monolith are expected to be sufficient to accommodate the placement of buildings or structures over the monolith without negatively affecting the monolith. In other words, there are a broad array of activities and uses that can safely occur over the ISS monolith and that are compatible with the ISS monolith. Should inspections identify the need for maintenance activities or other measures, those activities or measures will be promptly undertaken. In addition, such inspection and maintenance requirements along with other activity and use limitations applicable to the Brunswick facility are expected to be included in the environmental covenants that are being prepared.

6.1.2 Corrective Measures for Sitewide Soils

Corrective measures are currently being implemented to address sitewide soils at the Brunswick facility. The overarching objective of these corrective measures is to reduce potential carcinogenic risks and non-carcinogenic hazards associated with direct contact by onsite workers, construction workers, and trespassers to surface soils[3] at the Brunswick facility (i.e., through inhalation, dermal contact and ingestion) under current and anticipated future industrial land use scenarios. These potential risks will be reduced by targeting the removal of soils containing toxaphene (and other primary COPCs described in Section 3.4.1 of this CAP) at concentrations greater than USEPA's removal management levels ("RMLs") for industrial workers. The RMLs are risk-based screening levels similar to USEPA's RSLs but are based on a target carcinogenic risk level of 1×10^{-4} and a target non-carcinogenic hazard quotient of 3. Hercules recognizes that the RMLs

[3] In the context of this objective, surface soils are considered to be soils from 0-2 feet bgs.

are preliminary targets for interim corrective measures for sitewide soils and that additional risk management/mitigation measures may be required to address sitewide soils.

The RMLs are identified in technical guidance issued by EPD in 2020 titled *Area Averaging Approach to Soil Compliance for Direct Contact Exposure Scenarios* (the "Area Averaging Guidance") as thresholds to use for purposes of identifying soils that may warrant corrective measures regardless of the outcome of risk or hazard calculations based on area averaging approaches (EPD, 2021). Using the RMLs as preliminary action levels allows for more timely risk reduction with interim corrective measures before reassessing risks through the corrective action process and before final corrective measures to address soils can be evaluated and implemented.

It should be noted and as referenced previously, Hercules and Pinova have developed a Soil Management Plan that describes procedures to be followed for all soil disturbing activities at the Brunswick facility that are undertaken to facilitate ongoing operations at the Brunswick facility. Pinova has integrated the Soil Management Plan into its health and safety protocols for the Brunswick facility that must be followed prior to conducting work that requires soil disturbance. The procedures in the Soil Management Plan are designed to minimize and mitigate potential direct contact exposures to impacted soils by onsite workers. It is anticipated that the Soil Management Plan will continue to be updated and utilized in this capacity for the foreseeable future and will continue to provide mitigation for potential worker exposure to residual soil contamination at locations that are not currently accessible to perform active remediation. A copy of the Soil Management Plan is included as **Appendix E**. The Soil Management Plan may be revised from time to time to reflect current conditions and relevant changes to procedures.

The process and approach for evaluating corrective measures for sitewide soils at the Brunswick facility was summarized in a work plan titled *Site-Wide Soils Interim Corrective Measures Delineation Sampling Plan, Hercules/Pinova Brunswick Facility, Brunswick, Georgia* (the "Delineation Sampling Plan") that Hercules submitted to EPD on September 23, 2020 (Geosyntec, 2020c). Following that submittal, Hercules submitted via e-mail a revised version of the Delineation Sampling Plan to EPD on November 10, 2020. EPD approved the revised Delineation Sampling Plan by e-mail dated November 12, 2020.

The approach presented in the Delineation Sampling Plan included a review of the existing soil sampling results that have been obtained at the Brunswick facility over time to identify areas in each exposure domain for targeted removal of surface soils exceeding the RMLs developed by USEPA for soils at industrial facilities. Once these target surface soil locations were identified through the comprehensive screening of existing soil sampling results, the target locations were assessed to determine current conditions, including performing further sampling at those locations that were accessible. Based on the results of such assessment activities, delineation sampling was performed to define the extent of soils at target locations to be removed. These steps are described in greater detail in the following sections of this CAP. A work plan describing interim corrective measures for sitewide soils based on the sampling results obtained through these steps is being prepared for submission to EPD.

6.1.2.1 Screening of Surface Soil Sampling Results

All available surface soil sampling results obtained at the Brunswick facility were reviewed. As previously discussed, the database of soil sampling results for the Brunswick facility contains more than 4,000 sampling results. Locations where one or more of the primary COPCs were detected in surface soils at concentrations above the RMLs for industrial workers were identified and evaluated as described below.

Toxaphene is the most frequently detected primary COPC at the Brunswick facility. The RML for toxaphene developed by USEPA for soils at industrial facilities is 210 mg/kg. Toxaphene was detected in surface soils at the Brunswick facility in multiple locations at concentrations exceeding the relevant RML. In addition, PCBs (specifically Aroclor 1254) were detected at two surface soil samples at concentrations above the relevant RML (44 mg/kg) for soils at industrial facilities.

Certain surface soil samples containing primary COPCs (principally toxaphene) at concentrations exceeding the RMLs for soils at industrial facilities were excluded from the screening process because those surface soil samples were collected from locations that are not currently accessible for further remediation and are being managed pursuant to the Soil Management Plan for the Brunswick facility (i.e., the Soil Management Plan provides appropriate risk mitigation measures to the extent that direct contact with such surface soils is possible). These surface soil samples were collected from “inaccessible” locations within the footprint of the area where extensive corrective actions for SWMU No. 5 were previously performed. The soils were inaccessible for further excavation due to the presence of building structures, containment walls, and overhead pipe racks. Such locations where toxaphene at concentrations in confirmation samples were greater than 210 mg/kg in surface soils is present are shown as bold black dots on **Figure 6-2**. Hercules acknowledges that soils associated with inaccessible locations in the area of SWMU No. 5 will remain in place and may present a potential risk under hypothetical future use scenarios for the Brunswick facility. These inaccessible locations are more fully described below.

Extensive corrective actions were implemented between May 2008 and January 2010 at SWMU No. 5. SWMU No. 5 is located in the central portion of the Brunswick facility. The corrective actions were designed to address soils and sediment in the N Street ditch related to the former toxaphene production plant and several adjacent areas. The work was performed in accordance with an EPD-approved corrective action work plan titled *Final Soil and Sediment Corrective Action Plan (September 2007).* The total surface area that was remediated was approximately 300,000 square feet (almost seven acres) in size. Soils were excavated down to the groundwater surface in most of the excavation footprint. As part of completing the corrective actions, a total of 46,700 tons of soil and concrete were excavated and disposed offsite, including 13,405 tons of material that was managed as hazardous waste. All remediated areas were backfilled with clean fill material and restored to surrounding grades. The "footprint" of the area remediated as part of corrective actions relating to SWMU No. 5 is shown as the green-hatched area in **Figure 6-2**. The corrective actions performed in the area of SWMU No. 5 were documented in a report titled *Corrective Action Report Solid Waste Management Unit No. 5 Area* that was prepared by Conestoga-Rovers & Associates ("CRA") on behalf of Hercules and submitted to EPD in July 2010. EPD approved the completion report in December 2010.

In addition, soil samples collected in the former toxaphene tank farm area (SWMU No. 6) were excluded from the screening process for site-wide soils. As discussed in detail in Section 6.1.1 of this CAP, such soils have been the subject of separate corrective measures and therefore do not need to be considered as part of the evaluation of site-wide soils at the Brunswick facility. The soil samples collected in the former toxaphene tank farm area are shown in blue on **Figure 6-2**.

Based on the screening process described above, a total of 34 historical surface soil sample locations were identified with COPCs at concentrations exceeding the RMLs developed by USEPA for industrial soils outside of areas at the Brunswick facility that have been addressed through corrective measures associated with SWMU No. 5 and the former toxaphene tank farm area. The 34 target locations are listed in **Table 6-1** and shown on **Figure 6-3**. The historical surface soil sampling results for these 34 target locations indicate that toxaphene was detected at concentrations of 210 mg/kg or greater at 32 of these locations while PCBs were detected at the other two locations at concentrations exceeding the corresponding RMLs. Note that these two locations (D4-21 and D4-22) were identified based on data collected in 1994 which locations have since been covered with a geosynthetic liner in the bottom of a tank containment structure.

6.1.2.2 Assessment Activities at Target Surface Soil Locations

Following the identification of the 34 target locations shown on **Figure 6-3**, each of the target locations was further assessed through field reconnaissance and sampling activities. Field reconnaissance activities were conducted between April 27 and April 29, 2020, and on June 16, 2020. The objective of the field reconnaissance activities was to locate, observe and photograph the target locations to assess which locations are currently inaccessible for sampling and/or excavation due to obstructions such as tanks, lined containment areas, large stump piles, adjacent building foundations, or paving. Because most of the target locations were last sampled between 10 and 25 years ago, a second objective of the field reconnaissance was to collect a surface soil sample at each accessible target location to verify concentrations of the primary COPCs listed in Section 3.4 of this CAP, including toxaphene and PCBs.

Of the 34 target locations listed in **Table 6-1** and shown on **Figure 6-3**, 11 locations were determined to be inaccessible for soil excavation under current site conditions. These current conditions also generally precluded collection of soil samples at the target locations. Of the 11 target locations that were determined to be inaccessible, five are situated under lined tank containment areas, three are situated within the Vinsol containment area, two are situated under large stump piles, and one is situated under concrete paving or structures. Very soft ground conditions exist in the Vinsol containment area during certain times of the year making removal of soils in that area difficult with conventional excavation equipment. Consequently, risks from potential exposure to soils in the Vinsol containment area and other inaccessible areas will continue to be managed via the Soil Management Plan for the Brunswick facility while other locations are addressed through interim corrective measures.

During the spring of 2020, surface soil samples (*i.e.,* from the interval from 0-2 feet bgs) were collected from the remaining 23 accessible target locations where collecting soil samples was feasible (e.g., where the locations were not obstructed). Of the 23 accessible target locations where these samples were collected, toxaphene was detected at six locations at concentrations above 210 mg/kg[4] as shown in **Table 6-2**. No other COPCs were detected in the soil samples that were collected from the 17 remaining accessible target locations at concentrations exceeding the corresponding RMLs for industrial soils.

Additional soil sampling was performed at the 23 target locations where toxaphene was detected in either the historical or recent (spring 2020) samples at concentrations above 210 mg/kg.[5] Specifically, three additional surface soil samples were collected, as feasible, from 0-2 feet bgs approximately three feet from the original target sample location, generally triangulated around the original target sample location. The additional surface soil samples were analyzed for toxaphene. In addition to the six locations originally identified, toxaphene was detected at concentrations exceeding the RML of 210 mg/kg in one or more of the triangulated samples collected per location at six additional target locations. At the location associated with sample D4-01, one of the triangulated soil samples contained toxaphene at a concentration exceeding the corresponding RML for industrial soils but at a location next to a building which precluded further delineation. The remaining five additional target locations were designated for further delineation. The results obtained from the triangulated soil samples are shown in **Table 6-3**.

By contrast, toxaphene was detected at concentrations at or below the RML of 210 mg/kg in the additional soil samples collected at the remaining 11 accessible target locations as shown in **Table 6-3**. Accordingly, no further assessment activities were conducted at those 11 accessible target locations and they are no longer considered to be potential candidate locations for the interim corrective measures being evaluated for sitewide soils.

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[4] These six locations include five locations where the reporting limits for PCBs exceeded the applicable RMLs for PCBs.

[5] There are multiple factors that could potentially contribute to the observed differences between the historical and more recent analytical results for toxaphene in the soil samples that were collected at certain of the accessible target locations, including the significant time period between the sampling events (as long as 25 years at some locations), typical spatial heterogeneity of analytical results for soils particularly in the context of less precise geographic coordinate information for older soil samples, and sample depth variability between the historical and current sampling events (all of the current soil samples were collected from the surface soil depth interval of 0-2 feet bgs while the historical soil samples were collected at varying intervals within the surface soil stratum).

6.1.2.3 Delineation Soil Sampling Activities at Target Surface Soil Locations

Consistent with the EPD-approved Delineation Sampling Plan, Hercules conducted delineation sampling around the 11 accessible target locations retained for further evaluation. Delineation sampling was performed to define the areas surrounding the 11 accessible target locations so that soils may be excavated from those areas and properly managed without the need to collect sidewall post-excavation samples to verify the adequacy of the corrective measures in meeting the RMLs. The spacing of the delineation samples was completed in general accordance with excavation confirmation sampling guidance described in a technical guidance document issued by EPD titled *Guidance for Demonstrating Completion of Soil Removal Actions at Corrective Action Sites in Georgia, July 2017*.

In accordance with the Delineation Sampling Plan, Hercules collected step-out delineation soil samples until delineation was complete. In certain instances, this process required collecting and analyzing multiple rounds of step-out delineation soil samples. Five of the target areas (i.e., areas surrounding target sample locations D4-04, D4-06, D4-08, D4-09 and D4-23) were located in SWMU No. 6 and soils at those target areas have already been remediated through excavation and consolidation with the soils in the former toxaphene tank farm area as described in Section 6.1.1 of this CAP and shown on **Figure 6-4**. The remaining six target areas are delineated and will be addressed as part of the interim corrective measures for sitewide soils at the Brunswick facility. The locations from which soil samples were collected for delineation purposes are shown on **Figures 6-5, 6-6, 6-7, 6-8, 6-9, and 6-10.** The complete delineation sampling results are summarized on **Table 6-3**. Note that one of the target areas (i.e., the area surrounding target sample location D2-01 shown on **Figure 6-6**) could not be fully delineated due to access limitations relating to its proximity to stump piles.

6.1.2.4 Risk Reduction Steps and Additional Corrective Measures

Based on the completion of delineation sampling as described in Section 6.1.2.3 of this CAP, surface soils in the seven target areas that have been delineated and that have not already been addressed as part of the corrective measures for the former toxaphene tank farm will be remediated. Specifically, the goal is to excavate the surface soils shown in the "hatched" areas on **Figures 6-5, 6-6, 6-7, 6-8, 6-9, and 6-10**, subject to any access constraints, and transport the soils to a permitted offsite treatment or disposal facility. If the soils cannot be excavated due to access constraints, then a protective layer (such as gravel) will be placed over the area to minimize any direct exposure to the surface soils by industrial workers. Surface soils in these locations and subsurface soils will continue to be managed through soil management plan.

Hercules is preparing a work plan describing the interim corrective measures that will be undertaken at the seven target areas. Hercules will submit the work plan to EPD for review and approval. With the removal of surface soils from the seven target areas in tandem with (i) the recently completed corrective measures at the former toxaphene tank farm in SWMU No. 6, (ii) the corrective measures that have already been performed at SWMU No. 5 and surrounding areas, and (iii) implementation of the Soil Management Plan, Hercules anticipates that the overarching objective of significantly reducing potential carcinogenic risks and non-carcinogenic hazards associated with toxaphene in surface soils at the Brunswick facility can be achieved.

6.1.3 Corrective Measures for Groundwater in the Shallow Zone of the Upper Surficial Aquifer

Hercules is implementing multiple interim corrective measures for groundwater in the shallow zone of the upper surficial aquifer underlying the Brunswick facility. Each of the interim corrective measures for groundwater in the shallow zone of the upper surficial aquifer is focused on reducing the mass and concentrations of COPCs in the shallow zone of the upper surficial aquifer thereby reducing the potential mass flux of COPCs to groundwater in the deep zone of the upper surficial aquifer.

As discussed in Section 2.3.2 of this CAP, Hercules is recovering NAPL from the Brunswick facility. In addition, Hercules is implementing *in situ* treatment of groundwater in a portion of the shallow zone of the upper surficial aquifer underlying an area near the Stillhouse Control Room (Building No. 13 shown **Figure 3-48**) using ISCO (*in situ* chemical oxidation) technology. The Stillhouse Control Room is located in the area where active manufacturing activities are continuing to take place at the Brunswick facility. This portion of the Brunswick facility is referred to as the southern production area. Construction of the infrastructure necessary for ISCO treatments was completed in December 2021, and the first round of injection of oxidant took place in January 2022.

A combination of desktop, laboratory, and field evaluations were performed that led to the selection of ISCO as the remedial technology to be used for groundwater in the shallow zone of the upper surficial aquifer underlying the southern production area near the Stillhouse Control Room. Groundwater in the area shown on **Figures 6-11 and 6-12** was targeted for interim corrective measures based on observations of subsurface conditions during the installation of temporary well point SGW-23 during the vapor intrusion investigation and the detection of elevated concentrations of VOCs in groundwater, specifically benzene, para-cymene, and toluene, in monitoring wells MW-21, MW-22, MW-23, and MW-24. In particular, benzene has been detected in the shallow zone of the upper surficial aquifer at concentrations as high as 36,000 ug/L in monitoring well MW-21 and is the primary target COPC for the interim corrective measure in this area.

The interim corrective measure for groundwater in the shallow zone of the upper surficial aquifer near the Stillhouse Control Room is intended to serve two purposes:

- To reduce the mass of COPCs in groundwater within the target treatment area which may contribute to the plume of VOCs in the deep zone of the upper surficial aquifer; and.

- To provide information regarding best practices for addressing targeted COPCs in groundwater in the shallow zone of the upper surficial aquifer which practices potentially can then be expanded to address COPCs in groundwater in other locations within the Brunswick facility as necessary.

Benzene is the primary COPC in groundwater in the shallow zone of the upper surficial aquifer near the Stillhouse Control Room targeted for treatment using ISCO. The initial objective to determine the efficacy of the technology is to reduce the average concentration of benzene in groundwater in that area by 50%. This objective will be modified. as appropriate, based on updates and refinements to the CSM and appropriate fate and transport evaluations, taking into account, among other things, groundwater modeling and source area investigations as discussed in Section 6.2 of this CAP, and performance of ongoing interim corrective measures in the source areas.

Initially, a desktop technology screening evaluation was completed prior to implementation of laboratory and field tests to refine potential options for interim corrective measures for the shallow zone of the upper surficial aquifer. Ultimately, field pilot tests and bench scale studies were performed to further evaluate three remedial technologies: multi-phase extraction and injection techniques, enhanced *in situ* bioremediation, and ISCO. The results from the pilot test of multi-phase extraction and injection techniques are included in **Appendix H**. The results from the ISCO treatability study are included as an attachment to the ICM Work Plan in **Appendix I**. The results from the treatability studies of enhanced *in situ* bioremediation for groundwater in the shallow zone of the upper surficial aquifer are included in **Appendix J**. Constraints specific to the targeted treatment area that potentially limit the application of various remedial technologies include: (i) an electrical classification of Class 1 Division 2 (presence of explosive gases) which complicates the installation of systems requiring mechanical/electrical controls; (ii) the shallow depth of groundwater (approximately 2 feet to 3 feet bgs) which complicates any remedial technologies that require the injection of amendments or air under significant pressure (e.g., use of air sparging and soil vapor extraction), and (iii) the presence of underground and above ground physical infrastructure.

A brief summary of key findings from the field and laboratory testing that was performed is summarized below.

6.1.3.1 Pilot Test: In Situ Injection

An *in situ* injection pilot test was performed in the area of temporary well point SGW-23 to evaluate physical injection characteristics and to gauge the feasibility of *in situ* injection of liquids into the shallow zone of the upper surficial aquifer for purposes of corrective measures. The methods, results, and well layout of the pilot test are included in **Appendix H**. The results of the pilot test indicate that *in situ* injection is feasible and can be implemented via gravity infiltration or an applied low pressure. The observed flow rates of 0.6 to 1.7 gallons per minute per well indicate that a maximum daily injection volume of 500-700 gallons of liquid per well per day with a radius of influence of approximately 10 feet from the injection well can be achieved.

6.1.3.2 Pilot Test: Multi-Phase Extraction

A multi-phase extraction pilot test was performed in the area of temporary well point SGW-23 to (i) evaluate the physical characteristics of multi-phase extraction in the hydrogeologic setting of that area and (ii) provide data to evaluate and inform the potential feasibility of using multi-phase extraction technology for future corrective measures. The methods, results, and well layout for pilot test are included in **Appendix H**. The results of the pilot test indicate that multi-phase extraction technology is capable of producing localized groundwater drawdown to expose additional portions of the soil column and to facilitate extraction of soil vapors. The pilot study showed that multi-phase extraction technology is feasible for use in removing COPCs from groundwater in the shallow zone of the upper surficial aquifer. However, this technology was not selected due to (i) the complexities and constraints associated with meeting the Class I Division 2 requirements for mechanical/electrical equipment needed for the extraction system and above ground treatment systems for recovered vapors and groundwater, and (ii) the associated ongoing operation and maintenance requirements for the extraction and treatment system for three different waste streams (water, vapors/soil gas, and potentially NAPL).

6.1.3.3 Treatability Study: In Situ Chemical Oxidation

A treatability study for ISCO was performed by SiREM Laboratory ("SiREM") to assess the base demand and soil oxidant demand for groundwater in the shallow zone of the upper surficial aquifer in the area of temporary well point SGW-23, as described in detail in **Appendix I.** The treatability study evaluated base activated persulfate using sodium persulfate as an oxidant and sodium hydroxide solution as an activator. The treatability study also included base titration and soil oxidant demand testing. The treatability study showed that ISCO is effective in reducing concentrations of benzene in groundwater. A reduction of greater than 90% in concentrations of benzene was observed in the laboratory-controlled environment. The results of the treatability study demonstrate that ISCO is feasible to use as a remedial technology for COPCs in groundwater in the shallow zone of the upper surficial aquifer near the Stillhouse Control Room, but that multiple rounds of injections may be needed to reduce concentrations of benzene to the desired levels. Multiple injections are often a component of ISCO remedies due to rebound in concentrations of COPCs following initial treatment as COPCs desorb from the aquifer matrix or are carried into the treatment zone from upgradient areas that may be impacted.

6.1.3.4 Treatability Study: Enhanced In Situ Bioremediation (Aerobic and Anaerobic Conditions)

Bench scale biotreatability studies using groundwater from the shallow zone of the upper surficial aquifer in proximity to temporary well point SGW-23 were performed by SiREM to evaluate degradation of benzene via: (i) the anaerobic pathway, specifically under nitrate reduction and methanogenic reduction conditions, and (ii) the aerobic pathway (i.e., biodegradation in the presence of oxygen).. Details associated with the bench scale biotreatability studies including microcosm setup, sampling methods and analytical results are provided in the SiREM treatability study reports included in **Appendix J**. Key findings from the biotreatability studies are summarized below.

Anaerobic Biotreatability Study: Five groups of testing conditions were prepared and evaluated as part of the anaerobic biotreatability study, with triplicate microcosms prepared for each condition. The anaerobic biotreatability study used two forms of control and three combinations of amendments, as follows:

- Anaerobic sterile control;
- Intrinsic control (no amendments);
- Amended with nitrate (biostimulation) and bioaugmented with a nitrate reducing bacteria culture;
- Amended with nitrate and diammonium phosphate (biostimulation and nutrient amended); and
- Amended with a methanogenic benzene degrading culture (DGG-B™) (bioaugmented).

Key findings from the anaerobic biotreatability study were as follows:

- Benzene degrading ORM2 organisms were detected in the groundwater from the shallow zone of the upper surficial aquifer at low concentrations suggesting that anaerobic biodegradation of benzene might be possible under sulfate reducing or methanogenic conditions. No nitrate reducing microbial populations were detected at the onset of the study.
- Nitrate reducing conditions were not established in the treatment microcosms with or without the addition of nutrients.
- Degradation of benzene and para-cymene was not achieved over the incubation period. Potential degradation may have been inhibited by suboptimal conditions. For the study evaluating methanogenic degradation of benzene, the incubation period may not have been long enough to allow benzene degradation activity to get established.

In summary, no significant degradation of benzene was observed under the tested conditions within the incubation period of 225 days for the nitrate amended microcosms and 103 days for the DGG-B™ bioaugmented microcosms, indicating that anaerobic biodegradation of benzene in groundwater in the shallow zone of the upper surficial aquifer would require additional testing and investigation to confirm its viability for use as a feasible remedial technology.

Aerobic Biotreatability Study: Two groups of testing conditions were prepared and evaluated as part of the aerobic biotreatability study, with triplicate microcosms prepared for each condition. The aerobic biotreatability study used one form of control and one set of amendments, as follows:

- Aerobic sterile control; and
- Aerobic treatment (amended with oxygen).

Key findings from the aerobic biotreatability study were as follows:

- In the sterile control microcosms, concentrations of benzene and chlorobenzene remained essentially the same throughout the study period (80 days); and
- In the aerobic treatment microcosms, benzene degraded from 4.9 mg/L to 0.22 mg/L) within 80 days.

In summary, significant degradation of benzene was observed via the aerobic pathway in the presence of oxygen. However, while the aerobic biotreatability study provided successful results in terms of reducing concentrations of benzene in groundwater, aerobic biodegradation was not selected for use due to (i) potential complications and constraints associated with meeting the Class I Division 2 requirements for mechanical/electrical equipment needed to inject/deliver oxygen (i.e., air sparging) into the subsurface and capture vapors created as a result of the biosparging process and (ii) the potential for shallow groundwater surfacing at the ground surface considering the injection pressures needed to deliver sufficient oxygen to support aerobic biodegradation.

6.1.3.5 Interim Corrective Measures - Source Area near Stillhouse Control Room

Based on the results from the pilot tests and treatability studies described above and taking into account the various constraints that exist in the area to be addressed, Hercules selected *in situ* chemical oxidation as the remedial technology to address COPCs in groundwater in the shallow zone of the upper surficial aquifer in the area of the Stillhouse Control Room. ISCO is an *in situ*, aggressive, and implementable remedial technology for use in this area with readily available contractors and materials. ISCO can also be optimized to achieve varying levels of contaminant mass reduction.

On April 14, 2021, Hercules submitted to EPD an interim corrective measure work plan titled *Interim Corrective Measure Work Plan, Shallow Zone of Upper Surficial Aquifer, Stillhouse Control Room Area, Hercules/Pinova Brunswick Facility, Brunswick, Georgia* (the "ISCO ICM Work Plan") to address benzene and other COPCs in the shallow zone of the upper surficial aquifer in the area of the Stillhouse Control Room. In response to comments that EPD provided to Hercules regarding the ISCO ICM Work Plan, Hercules submitted a revised version of the ISCO ICM Work Plan to EPD on August 5, 2021. EPD approved the ISCO ICM Work Plan as revised in a letter dated August 17, 2021. The approved version of the ISCO ICM Work Plan is attached hereto as **Appendix I**.

ISCO is being implemented in the area of the Stillhouse Control Room via a series of ten injection wells and twenty observation wells located throughout the gravel area north of the Stillhouse Control Room. The wells were installed in December 2021 in the locations shown on **Figure 5** of the ISCO ICM Work Plan in **Appendix I.** The ISCO injections are being performed in two phases. Due to the presence of numerous utilities adjacent to the treatment area, the initial injections (Stage 1) have taken place toward the center of the treatment area shown on **Figure 6-11.** The second injections (Stage 2) will move outward from the center of the treatment area as shown on **Figure 6-12.** The first injections occurred in January 2022. Base activated persulfate was injected to target groundwater in the shallow zone of the upper surficial aquifer. Observation wells are being used to monitor the distribution of the base activated persulfate as the base activated persulfate moves beyond the injection wells within the treatment area. Groundwater samples will be collected for laboratory analysis of COPCs to monitor the progress in reducing concentrations and mass of COPCs in the shallow zone of the upper surficial aquifer in the treatment area. A second application of base activated persulfate within the treatment area is planned for later in 2022 based on the results of the initial application. Additional details regarding the design and approach for ISCO injections, performance monitoring to evaluate the results of ISCO injections, and associated permitting steps are included in the approved ISCO ICM Work Plan contained in **Appendix I**.

6.1.3.6 Interim Corrective Measures - NAPL Recovery Northeast of the Stillhouse

Along with the treatment of groundwater in the shallow zone of the upper surficial aquifer using ISCO, additional focused recovery of NAPL is being performed at piezometer PZ1-6R located in the southern production area at the Brunswick facility as discussed in Section 2.3.2 of this CAP. Based on field observations, the NAPL consists of a highly viscous material similar to pine resin. A solar powered belt skimmer housed in a mobile trailer is being used to collect NAPL from the piezometer. The NAPL recovery system became operable during the week of June 15, 2020. Due to the high viscosity of the NAPL and corresponding slow recharge of NAPL into the piezometer, the amount of NAPL being recovered by the system has been relatively small. Hercules is continuing to assess the recoverability potential of this NAPL and whether alternatives to using the belt skimmer may be appropriate or necessary.

6.1.4 Corrective Measures for Groundwater in the Deep Zone of the Upper Surficial Aquifer

Hercules is implementing interim corrective measures for groundwater in the deep zone of the upper surficial aquifer underlying the portion of the Brunswick facility along the U.S. Highway 17 corridor. The groundwater in the deep zone of the upper surficial aquifer along the U.S. Highway 17 corridor tends to have higher concentrations of chloroform and methylene chloride in the southern portion of the plume and higher concentrations of benzene and chlorobenzene in the northern portion of the plume. The primary objective of the planned interim corrective measures is to reduce the mass flux and concentrations of key COPCs migrating in the downgradient direction in the deep zone of the upper surficial aquifer. The initial target is to reduce by 50% the mass flux and/or concentrations of the primary COPCs in the treatment area (i.e., chloroform and methylene chloride in the southern portion of the plume, and benzene and chlorobenzene in the northern portion of the plume). This target will be modified as necessary and appropriate, subject to review and approval by EPD. Any modifications to the target that are proposed will be based on updates and refinements to the CSM taking into account, among other things, groundwater modeling and source area investigations, risk evaluations, fate and transport evaluations, and performance of ongoing interim corrective measures in source areas.

Hercules screened various remedial technologies, including but not limited to, groundwater extraction and treatment (i.e., pump and treat), *in situ* chemical oxidation, *in situ* chemical reduction, enhanced *in situ* bioremediation and phytoremediation using a desktop feasibility study to consider their effectiveness and implementability. Based on this initial technology screening process, Hercules selected enhanced *in situ* bioremediation in the form of a biologically active permeable barrier (commonly referred to as a biobarrier) and groundwater extraction with above ground treatment (i.e., a form of pump and treat) for further evaluation with field pilot and bench scale treatability studies. The studies have included:

- An aquifer test and collection of key groundwater quality and geochemistry parameters to evaluate the feasibility of utilizing a pump and treat system;
- A reductive dechlorination biotreatability study to assess the use of enhanced *in situ* bioremediation to address chloroform and methylene chloride;
- Anaerobic (nitrate and methanogenic reduction) and aerobic (oxygen) biotreatability studies to assess the use of enhanced *in situ* bioremediation for benzene and chlorobenzene;
- A biosparging pilot test to evaluate design parameters for a biosparging system to deliver oxygen to the deep zone of the upper surficial aquifer for enhanced *in situ* bioremediation; and
- A tidal evaluation to assess the impact that diurnal tidal cycles have on groundwater conditions near the northern edge of the Brunswick facility east of U.S. Highway 17.

The following sections of this CAP summarize the field pilot and bench scale treatability studies, including the biosparging pilot test and the tidal evaluation, that were performed.

6.1.4.1 Aquifer Test and Water Treatment Evaluation

Geosyntec performed a field aquifer test (including an aquifer step-drawdown test and laboratory analysis of groundwater samples) to provide information and data to inform future corrective measures. Details of the aquifer test are included in **Appendix B,** including a summary of the groundwater quality results from samples collected during the aquifer test. The groundwater samples collected during the aquifer test were sent to an analytical laboratory for analysis of volatile organic compounds, hardness, alkalinity, total dissolved solids ("TDS") and other groundwater quality parameters**.** The location where the field aquifer test was performed is shown on **Figure 2-4**.

Based on the groundwater quality analytical results, several factors were identified that impact the feasibility of using a pump and treat system to address conditions in the deep zone of the upper surficial aquifer. Groundwater in the target treatment zone of the deep zone of the upper surficial aquifer, where tested, has high alkalinity (approximately 310 mg/L) and high hardness (greater than 5,000 mg/L), indicating that the groundwater is very likely to cause physical buildup (scaling) within piping and equipment that would be necessary as part of a pump and treat system. A hardness value of greater than 180 mg/L is considered an indicator of "very hard" water. As noted in Section 3.4.2 of this CAP and in **Appendix F**, results for hardness in groundwater samples collected during the 2020 aquifer pumping test are generally consistent with results measured in samples collected from groundwater monitoring wells in the eastern and southern portion of the Brunswick facility with all of the values indicating that groundwater is very hard (with the exception of a groundwater sample from monitoring well MW-9D that had a hardness value of 78 mg/L). In addition, groundwater in the target treatment zone of the deep zone of the upper surficial aquifer has high concentrations of chloride (approximately 4,100 mg/L), indicating that the groundwater is very likely to quickly corrode and impair equipment necessary as part of a pump and treat system (e.g., pumps, pipes, tanks, and similar components). Groundwater in the target treatment zone of the deep zone of the upper surficial aquifer also contains very high levels of TDS with TDS measurements of approximately 8,400 mg/L. The dissolved solids will precipitate and result in clogging of the mechanical components of a pump and treat system. Furthermore, the high levels of TDS will result in the generation of a large amount of solids (sludge) requiring dewatering and offsite disposal. The presence of elevated levels of TDS in groundwater in the deep zone of the upper surficial aquifer along the U.S. Highway 17 corridor is consistent with the studies and investigation activities that Hercules has performed showing the degree to which groundwater in this area is naturally brackish to saline given the proximity of tidal creeks and large saltwater surface water bodies. Considering the high scaling and corrosion potential of the groundwater in the target treatment zone of the deep zone of the upper surficial aquifer, and the generation of a significant amount solids that would be expected, a pump and treat system would necessarily require intensive maintenance and repair, which in turn would lead to long downtimes for maintenance during which the pump and treat system could not operate thereby impairing the efficient treatment of groundwater in the deep zone of the upper surficial aquifer.

In addition to the foregoing issues, use of a pump and treat system would require resolution of how groundwater extracted from the deep zone of the upper surficial aquifer would ultimately be managed. Three options exist – a direct discharge to surface water following treatment pursuant to a permit issued under the NPDES program, a discharge to the local POTW for further treatment, or onsite management utilizing some form of infiltration galleries or injection wells. If a direct discharge under the NPDES program to surface water following treatment were to be selected for a pump and treat system, the existing NPDES permit issued to the Brunswick facility would need to be modified to incorporate effluent limits for additional constituents detected in groundwater that are not currently listed in the NPDES permit. The City of Brunswick has previously denied permission to discharge groundwater into the local wastewater collection system for treatment at the POTW. Given the volume (and flow rate) of groundwater that would be required to be recovered to achieve containment, re-injection of the recovered and treated groundwater into the subsurface is likely not feasible considering the shallow groundwater table. Re-injection would also require obtaining a permit from EPD pursuant to the underground injection control program.

Given the array of significant implementability challenges as described above, using a pump and treat system to address groundwater in the deep zone of the upper surficial aquifer was not selected to use for interim corrective measures.

6.1.4.2 Treatability Study: Reductive Dechlorination of Chloroform and Methylene Chloride

SiREM performed a bench-scale biotreatability study on behalf of Hercules to evaluate the effectiveness of reductive dechlorination of chloroform and methylene chloride present in groundwater in the deep zone of the upper surficial aquifer beneath the Brunswick facility along the U.S. Highway 17 corridor. The biotreatability study involved the preparation of microcosms using groundwater and aquifer solids from the target treatment zone to test the dechlorination potential of using an electron donor (i.e., lactate) and a bioaugmentation culture (KB-1 Plus). Groundwater for the biotreatability study was collected from monitoring well MW-28D and soils (aquifer solids) for the biotreatability study were collected from a soil boring drilled near monitoring well MW-28D. The soils were collected at a depth between 78 feet and 90 feet bgs corresponding to the deep zone of the upper surficial aquifer.

Four groups of testing conditions were prepared and evaluated as part of the reductive dechlorination biotreatability study, with triplicate microcosms prepared for each condition. The biotreatability study used two forms of control and two combinations of amendments, as follows:

- Anaerobic sterile control;
- Intrinsic control (no amendments);
- Amended with lactate, as an electron donor (biostimulation only); and
- Amended with lactate (biostimulation) and bioaugmented with a reductive dechlorinating microbial bacteria KB-1 Plus.

Details associated with the reductive dechlorination biotreatability study, including microcosm setup, sampling methods and analytical results, are provided in a treatability study report prepared by SiREM. The treatability study report is included as part of Anaerobic Biobarrier ICM Work Plan in **Appendix L**. Key findings from the reductive dechlorination biotreatability study were as follows:

- In the anaerobic sterile control and intrinsic control microcosms, the concentrations of chloroform remained essentially the same throughout the duration of the biotreatability study.
- In the lactate amended microcosms, decreases in concentrations of chloroform were observed within the first 50 days of the biotreatability study with accumulation of methylene chloride during that same time period. Degradation of chloroform slowed down between 50 days and 100 days from the start of the study. At that point in the study, the microcosms were re-amended with lactate. At the end of the study, chloroform had degraded to the point of not being detectable. A significant accumulation of methylene chloride was present, however. These results indicate that the native bacterial populations appear to be capable of dechlorinating chloroform to produce methylene chloride when an electron donor is available but were not able to degrade methylene chloride within the timeframe of the study.
- In the bioaugmented microcosms, complete dechlorination of chloroform and methylene chloride was achieved.

In summary, the biostimulated microcosms (without bioaugmentation) biologically transformed chloroform to methylene chloride but failed to complete the dechlorination of methylene chloride. By contrast, complete reductive dechlorination of chloroform and its by-product (i.e., methylene chloride) was observed in the bioaugmented microcosms that were amended with the reductive dechlorinating microbial bacteria KB-1 Plus. Therefore, Hercules has selected enhanced *in situ* bioremediation via the anaerobic pathway bioaugmented with KB-1 Plus as the remediation technology to be used for interim corrective measures to address chloroform and methylene chloride in groundwater in the deep zone of upper surficial aquifer.

6.1.4.3 Treatability Study: Anaerobic and Aerobic Biotreatability Studies for Benzene and Chlorobenzene

SiREM performed bench scale biotreatability studies to evaluate degradation of benzene and chlorobenzene in groundwater in the deep zone of the upper surficial aquifer beneath the Brunswick facility along the U.S. Highway 17 corridor under (i) anaerobic conditions (specifically under nitrate reduction and methanogenic reduction conditions) and (ii) aerobic conditions in the presence of oxygen.

Groundwater for the biotreatability studies was collected from monitoring well MW-29D and soils (aquifer solids) for the biotreatability studies were collected from a soil boring drilled near monitoring well MW-29D. The soils were collected at a depth between 78 feet and 90 feet bgs corresponding to the deep zone of the upper surficial aquifer.

Anaerobic Biotreatability Study: Five groups of testing conditions were prepared and evaluated as part of the anaerobic biotreatability study, with triplicate microcosms prepared for each condition. The anaerobic treatability study used two forms of control and three combinations of amendments, as follows:

- Anaerobic sterile control;
- Intrinsic control (no amendments);
- Amended with nitrate (biostimulation) and bioaugmented with a nitrate reducing bacteria culture;
- Amended with nitrate and diammonium phosphate (biostimulation and nutrient amended); and

- Amended with a methanogenic benzene degrading culture (DGG-B™) (bioaugmented).

Details associated with the bench scale biotreatability studies, including microcosm setup, sampling methods and analytical results, are provided in a treatability study report prepared by SiREM. The treatability study report is included in **Appendix K**. Key findings from the anaerobic biotreatability study were as follows:

- Neither benzene degrading ORM2 organisms nor nitrate reducing microbial populations were detected in groundwater from the deep zone of the upper surficial aquifer in the baseline analyses that were performed.

- Benzene degradation was beginning to occur in the microcosms amended with DGG-B™ (a methanogenic benzene degrading culture) at day 112 of the study. The shorter incubation period that was evaluated might not have been long enough to allow methanogenic degradation of benzene to get fully established.

- Although benzene degradation was observed in one replicate of the triplicate microcosms amended with nitrate and bioaugmented with a nitrate reducing bacterial culture, additional incubation together with benzene degradation in all three replicates would need to be confirmed to show that the combination of such amendments and bioaugmentation produces meaningful degradation of benzene.

- Chlorobenzene degradation may have been occurring in the microcosms amended with nitrate and bioaugmented with a nitrate reducing bacterial culture, but additional incubation time is needed to confirm this trend.

In summary, no significant degradation of either benzene or chlorobenzene was observed under the tested conditions within the incubation period of 192 days for the nitrate amended microcosms and 112 days for the DGG-B™ bioaugmented microcosms, indicating that anaerobic biodegradation of benzene and chlorobenzene in groundwater in the deep zone of the upper surficial aquifer would require additional testing and investigation to confirm its viability for use as a feasible remedial technology.

Aerobic Biotreatability Study: Two groups of testing conditions were prepared and evaluated as part of the aerobic biotreatability study, with triplicate microcosms prepared for each condition. The aerobic biotreatability study used one form of control and one set of amendments, as follows:

- Aerobic sterile control; and

- Aerobic treatment (amended with oxygen).

Details associated with the aerobic biotreatability studies, including microcosm setup, sampling methods and analytical results, are provided in a treatability study report prepared by SiREM and included in **Appendix C** as part of the Aerobic Barrier ICM Work Plan. Key findings from the aerobic treatability study were as follows:

- In the sterile control microcosms, concentrations of benzene and chlorobenzene remained essentially the same throughout the study period (80 days).

- In the aerobic treatment microcosms, benzene degraded from 3 mg/L to non-detectable levels (less than 0.020 mg/L), and chlorobenzene degraded from 0.82 mg/L to 0.081 mg/L within 80 days.

In summary, significant degradation of benzene and chlorobenzene was observed via the aerobic pathway in the presence of oxygen. Therefore, enhanced *in situ* bioremediation via the aerobic pathway was selected as the remediation technology to be used for interim corrective measures to address benzene and chlorobenzene in the deep zone of the upper surficial aquifer.

6.1.4.4 Biosparging Pilot Test and Tidal Evaluation

Geosyntec performed a biosparging pilot test between February 2021 and April 2021 to assess the feasibility of using biosparging in the deep zone of the upper surficial aquifer, in which air is injected (sparged) at a low flow rate into the target treatment zone to produce aerobic conditions (i.e., dissolved oxygen concentrations higher than 2 mg/L). The biosparging pilot test enabled Geosyntec to evaluate key design parameters associated with the use of biosparging in the deep zone of the upper surficial aquifer. The pilot test was performed in the northern portion of the Brunswick facility on the east side of the U.S. Highway 17 corridor.

Based on the results obtained from the biosparging pilot test, the typical well head sparging pressures ranged between 38 and 42 pounds per square inch ("psi") at a sparging depth of 99 feet bgs. Within this pressure range, a sparging rate ranging between 1.5 standard cubic feet per minute ("scfm") and 3 scfm was achievable. The estimated radius of influence achieved during the biosparging pilot test was approximately 7.5 feet. The dissolved oxygen content in the deep zone of the upper surficial aquifer increased during the biosparging pilot test from 0.03 milligrams per liter ("mg/L") up to 26.08 mg/L, which is slightly below the theoretical oxygen solubility limit at the measured depth. The dissolved oxygen consumption rate was approximately 6 mg/L per day meaning that the injected oxygen (via the biosparging process) may stay in the subsurface for up to four days before being utilized by indigenous bacteria.

In addition to the biosparging pilot test, Geosyntec completed a tidal evaluation during April and May 2021 in the general area where the biosparging pilot test was performed to assess the influence that diurnal tidal cycles have on groundwater conditions in the upper surficial aquifer near the northern edge of the Brunswick facility, including horizontal and vertical groundwater gradients and flow directions. The details of the tidal evaluation were presented to EPD in a report that was included as appendix to the document titled *Groundwater Monitoring Report, Semi-Annual Groundwater Monitoring Event – June 2021* which Hercules submitted to EPD on October 22, 2021. The details of the tidal evaluation are also discussed in Section 3.1.5.5 of this CAP.

Consistent with the objectives of the tidal evaluation, a range of hydraulic and tidal conditions were assessed during the tidal evaluation. The duration of the tidal evaluation was sufficient to monitor one full lunar tidal cycle. The conditions that were assessed included initial conditions (baseline conditions) and conditions associated with a two-inch rainfall event that coincided with a spring tide (i.e., a tide coinciding with a new moon or a full moon).

Generally, the results of the tidal evaluation indicate that during the period of evaluation, groundwater flow in the shallow zone of the upper surficial aquifer beneath the eastern portion of the Brunswick facility north of the Outfall Ditch was consistently to the south toward the Outfall Ditch from offsite areas north of the Brunswick facility under both high and low tide conditions. Horizontal groundwater flow directions in the intermediate zone of the upper surficial aquifer were observed to vary based on the tidal cycle. Tidal influence is sufficient to reverse the generally prevailing hydraulic gradient and cause groundwater flow directions to oscillate from west to east (toward Dupree Creek) and from east to west (away from Dupree Creek) in the intermediate zone of the upper surficial aquifer. The results of the tidal evaluation underscore the significant effect that tidal cycles have on groundwater flow in the intermediate zone of the upper surficial aquifer, particularly in proximity to Dupree Creek but extending further to the west toward U.S. Highway 17. Horizontal groundwater flow directions in the deep zone of the upper surficial aquifer in the general area that was evaluated also vary with tidal cycles but generally are toward the east/southeast under various hydraulic and tidal conditions.

6.1.4.5 Interim Corrective Measures - Deep Zone of the Upper Surficial Aquifer

The results of the treatability studies and the biosparging pilot test discussed above have demonstrated the effectiveness of two remediation technologies using enhanced *in situ* bioremediation for specific COPCs present in the deep zone of the upper surficial aquifer – specifically, reductive dechlorination for chloroform and methylene chloride and aerobic bioremediation for benzene and chlorobenzene in groundwater. Based on these findings, Hercules prepared during 2021 two work plans for interim corrective measures to target COPCs present in the deep zone of upper surficial aquifer underlying the U.S. Highway 17 corridor in the eastern portion of the Brunswick facility.

On June 18, 2021, Hercules submitted to EPD a document titled *Interim Corrective Measure Plan, Deep Zone of Upper Surficial Aquifer-Anaerobic Biobarrier, Hercules/Pinova Brunswick Facility, Brunswick, Georgia* (i.e., the Anaerobic Biobarrier ICM Work Plan) to address chloroform and methylene chloride in the deep zone of upper surficial aquifer underlying the U.S. Highway 17 corridor near the southern boundary of the Brunswick facility. EPD provided comments regarding the Anaerobic Biobarrier ICM Work Plan by letter dated August 27, 2021.In response to EPD’s comments, Hercules submitted to EPD a revised version of the Anaerobic Biobarrier ICM Work Plan on September 24, 2021. EPD approved the Anaerobic Biobarrier ICM Work Plan by letter dated October 14, 2021. A copy of the approved Anaerobic Biobarrier Work Plan is attached herein as **Appendix L.**

On November 19, 2021, Hercules submitted to EPD a document titled *Interim Corrective Measure Plan, Deep Zone of Upper Surficial Aquifer-Aerobic Biobarrier, Hercules/Pinova Brunswick Facility, Brunswick, Georgia* (i.e., the Aerobic Biobarrier ICM Work Plan) to address benzene and chlorobenzene in the deep zone of upper surficial aquifer underlying the U.S. Highway 17 corridor near the northern boundary of the Brunswick facility. The Aerobic Biobarrier ICM Work Plan is under review by EPD. A copy of the Aerobic Biobarrier ICM Work Plan is attached herein as **Appendix C**. The Aerobic Biobarrier ICM Work Plan includes detailed information regarding the biosparging pilot test and the tidal evaluation discussed in Section 6.1.4.4 of this CAP

The next two subsections of this CAP (Sections 6.1.4.5.1 and 6.1.4.5.2) describe the two planned interim corrective measures for groundwater in the deep zone of upper surficial aquifer.

6.1.4.5.1 Overview of the Anaerobic Biobarrier for Chloroform and Methylene Chloride

Hercules is currently installing a biologically reactive biobarrier utilizing enhanced *in situ* anaerobic bioremediation (i.e., an anaerobic biobarrier) as an interim corrective measure to address chloroform and methylene chloride in the deep zone of the upper surficial aquifer underlying the U.S. Highway 17 corridor near the southern boundary of the Brunswick facility. The purpose of this interim corrective measure is to reduce the mass flux and concentrations of chloroform and methylene chloride that have been detected in groundwater in the deep zone of the upper surficial aquifer underlying this portion of the Brunswick facility. Although the anaerobic biobarrier specifically targets methylene chloride and chloroform in the deep zone of the upper surficial aquifer, other VOCs will also be monitored to evaluate the effect of the anaerobic biobarrier on those VOCs. As detailed in the approved Anaerobic Barrier ICM Work Plan in **Appendix L**, the implementation of the anaerobic biobarrier includes injecting a long-lasting electron donor (i.e., emulsified vegetable oil) and a bioaugmentation culture (KB-1 Plus) through a series of injection wells to deliver the amendments into the deep zone of the upper surficial aquifer. A deoxygenating amendment will also be mixed with the bioaugmentation culture and a pH buffer (i.e., food grade sodium bicarbonate) will be used to adjust the pH of the groundwater, if needed. These amendments are expected to create a zone of enhanced biological activity around the injection wells. The injection well network is being installed perpendicular to the natural groundwater flow path. As impacted groundwater flows through this zone of enhanced biological activity, chloroform and methylene chloride are expected to be biologically degraded.

In January 2022, Hercules began activities to install injection wells and performance monitoring wells for the anaerobic biobarrier. As designed, the anaerobic biobarrier is expected to include up to 18 injection well clusters (i.e., 36 injection wells) at the locations shown on **Figure 6-13a** targeting a treatment zone between approximately 70 feet bgs and 95 feet bgs. Existing monitoring well MW-10D together with 13 new performance monitoring wells located upgradient and downgradient of the anaerobic biobarrier will be used to monitor the effectiveness of the anaerobic biobarrier in reducing the mass flux and concentrations of chloroform, methylene chloride and other VOCs.

The locations of the performance monitoring wells are shown on **Figure 6-13b**. Once the injection wells and performance monitoring wells are installed, a baseline sampling event will be performed before injections take place and four post-injection sampling events will be performed at intervals of three months, six months, nine months, and twelve months after the injections are completed.

Progress reports will be submitted to EPD following the 6-month and 9-month performance monitoring events. The progress reports will briefly summarize the data collection activities, the analytical results that are obtained, and any key field observations obtained during the performance monitoring events.

An initial corrective action effectiveness report for the anaerobic biobarrier will be prepared following the 12-month performance monitoring event. The report will present the analytical data that were obtained, the analyses of reductions in concentrations and mass flux of COPCs, the relative progress towards meeting the objectives of the interim corrective measure, and the proposed long-term monitoring plan to be implemented. The corrective action effectiveness report may also include recommendations for future actions consistent with the data and observations that are presented.

Implementation of the anaerobic biobarrier in the deep zone of the upper surficial aquifer is described in more detail in the Anaerobic Biobarrier ICM Work Plan included in **Appendix L**, including a detailed implementation and reporting schedule.

6.1.4.5.2 Overview of the Aerobic Biobarrier for Chlorobenzene and Benzene

Hercules plans to install a biologically active permeable reactive barrier utilizing enhanced *in situ* aerobic bioremediation (i.e., an aerobic biobarrier) to address chlorobenzene and benzene in groundwater in the deep zone of the upper surficial aquifer underlying northern portion of the Brunswick facility on the east side of the U.S. Highway 17 corridor as shown on **Figure 6-14a**. As detailed in the Aerobic Biobarrier ICM Work Plan in **Appendix C**, creation of the aerobic biobarrier involves injecting oxygen in the form of air into the groundwater treatment zone through injection wells (referred as "biosparging wells") installed perpendicular to the prevailing groundwater flow path. The biosparging wells will be used to promote a zone of aerobic conditions (i.e., groundwater containing robust levels of dissolved oxygen) to stimulate enhanced biological activity. As impacted groundwater flows through this zone of enhanced biological activity, benzene and chlorobenzene in the groundwater are expected to be biologically degraded. The exact location and geometry of the planned aerobic biobarrier may be subject to further refinements based on the results from additional assessment activities that are expected to take place over the next several months to further evaluate the impacts that historical operations and releases at the neighboring Adams Properties may be having on groundwater quality in the general area where the aerobic biobarrier is planned to be installed. A report titled *Historical Activities and Releases on Neighboring Properties* is included as Appendix B of the Aerobic Biobarrier ICM Work Plan which presents in detail currently available documentation regarding historical activities and known chemical releases at the Adams Properties.

As discussed in Section 6.1.4.4 of this CAP, Hercules performed a biosparging pilot test and a tidal evaluation study to evaluate key design parameters associated with aerobic biobarrier. The design parameters include the radius of influence that can be achieved by the proposed biosparging wells, air injection pressures that will be necessary, and air injection flow rates that will need to be maintained. The biosparging pilot test and tidal evaluation study also provided important information for consideration in assessing the orientation of the well network for the aerobic biobarrier system.

As described in the Aerobic Barrier ICM Work Plan, the initial segment of the aerobic biobarrier is expected to involve installation of a network of up to 12 biosparging wells (10 new wells and two existing wells), a biosparging system housed in an equipment enclosure, and a network of performance monitoring wells. A total of nine performance monitoring wells will be used to evaluate the effectiveness of the aerobic biobarrier. The performance monitoring wells are shown on **Figure 6-14b**. A baseline monitoring event and five post-startup performance monitoring events will be performed. The post-startup performance monitoring events will be performed at intervals of one month, three months, six months, nine months, and twelve months after the aerobic biobarrier is placed into operation.

As described in more detailed in the Aerobic Biobarrier ICM Work Plan, steps that will be completed as part of constructing and implementing the aerobic biobarrier include obtaining a permit from EPD pursuant to the underground injection control program, selecting and procuring a contractor to install the aerobic biobarrier, installing monitoring and biosparging wells for the aerobic biobarrier, fabricating the equipment for the aerobic biobarrier, installing the biosparging system, and conducting monitoring and maintenance activities associated with the aerobic biobarrier. A detailed implementation and reporting schedule associated with constructing and implementing the aerobic biobarrier is included in the Aerobic Biobarrier ICM Work Plan.

Similar to reporting associated with the anaerobic biobarrier, Hercules will submit progress reports to EPD following the performance monitoring events conducted six months and nine months after the aerobic biobarrier is placed into operation. In addition, Hercules will submit an initial corrective action effectiveness report for the aerobic biobarrier following the 12-month performance monitoring event. The interim corrective action effectiveness report will present the analytical data that were obtained, the analyses of reductions in concentrations of COPCs (primarily benzene and chlorobenzene), the relative progress in meeting the objectives of the interim corrective measure, and the proposed long-term monitoring plan to be implemented. The corrective action effectiveness report may also include recommendations for future actions consistent with the data and observations that are presented.

6.1.5 Vapor Intrusion Mitigation

Hercules has installed and is operating vapor intrusion mitigation systems at two Tier 1 buildings (the Stillhouse Control Room and the Chemical Plant Control Room and Laboratory). The vapor intrusion mitigation systems that are being used at the two Tier 1 buildings are SSD (sub-slab depressurization) systems. Hercules elected to install the SSD systems out of an abundance of caution after observing NAPL at the shallow groundwater sampling location adjacent to the Stillhouse Control Room and detecting relatively high concentrations of VI COPCs near the surface of the groundwater table in proximity to the Chemical Plant Control Room and Laboratory as described in the Revised Vapor Intrusion CSM Report that Hercules submitted to EPD on December 23, 2019, and that EPD subsequently approved.

On August 20, 2020, Hercules submitted to EPD the Mitigation Work Plan describing the design and installation of the SSD systems for the Stillhouse Control Room and the Chemical Plant Control Room and Laboratory. EPD approved the Mitigation Work Plan by e-mail and letter dated September 9, 2020. The two SSD systems were installed and commissioned in March 2021 as described in the Construction Completion Report that Hercules submitted to EPD on April 13, 2021. EPD approved the Construction Completion Report by e-mail and letter dated May 12, 2021. The SSD systems are operating and are being monitored on a monthly basis.

In addition, an enclosed unused office space along the eastern side of the Liquid Loading Shed was demolished in February 2021 to render that space no longer susceptible to vapor intrusion. This work was documented in a letter that Hercules submitted to EPD on May 12, 2021 (referred to as the Liquid Loading Shed Letter).

Copies of the approved Construction Completion Report and Liquid Loading Letter are included in **Appendix M and N,** respectively.

As described in Section 2.3.2 of this CAP, Hercules has also undertaken mitigation measures at certain other Tier 1 buildings. The plans for these mitigation measures were described in the report titled *Vapor Intrusion Tier 1 Investigation Report, Hercules/Pinova Facility, Brunswick, Georgia* (i.e., the Tier 1 Report) that Hercules submitted to EPD on January 12, 2021. A copy of the Tier 1 Report is included in **Appendix O**. In addition to describing such mitigation measures, the Tier 1 Report presented the results of the investigation activities that were undertaken at Tier 1 buildings at the Brunswick facility.

Consistent with the Tier 1 Report, Hercules implemented mitigation measures at the Terpenes Resins Building, the Refrigeration Shop, and the Office Trailer to modify these buildings so as to increase ventilation and render them no longer susceptible to vapor intrusion. In addition, Hercules demolished the Small Office (North of the Storeroom). The modifications to these four buildings were discussed with EPD during an onsite meeting at the Brunswick facility on September 8, 2021. They were approved by EPD verbally during the onsite meeting and in writing by follow-up e-mail on September 24, 2021. The foregoing activities were completed in January 2022.

Based on conditions found at the E&I Shop, Hercules elected to install an SSD system at the E&I Shop out of an abundance of caution. The SSD system for the E&I Shop is described in the E&I Shop Mitigation Plan that Hercules submitted to EPD on September 17, 2021. EPD approved the E&I Shop Mitigation Plan via e-mail and letter on September 30, 2021. The SSD system at the E&I Shop is expected to be installed in the second quarter of 2022.

Following the completion of investigation activities at Tier 1 buildings at the Brunswick facility as described in the Tier 1 Report, Hercules initiated steps to assess Tier 2 buildings at the Brunswick facility. These steps are described in the work plan titled *Vapor Intrusion - Tier 2 Buildings Investigation Work Plan, Hercules/Pinova Facility,* *Brunswick, Georgia* (i.e., the Tier 2 Work Plan). Hercules submitted the initial version of the Tier 2 Work Plan to EPD on May 12, 2021. EPD provided Hercules with comments regarding the Tier 2 Work Plan via e-mail dated June 21, 2021, and provided Hercules with additional comments during a conference call on July 2, 2021. Hercules and EPD also discussed the Tier 2 Work Plan during the onsite meeting that took place at the Brunswick facility on September 8, 2021. In response to EPD's collective comments, Hercules submitted to EPD the Tier 2 Work Plan in revised form on September 14, 2021. EPD approved the Tier 2 Work Plan via e-mail and letter on September 28, 2021.

The Tier 2 Work Plan, as approved, describes steps to conduct intrusive sampling at seven Tier 2 buildings, consisting of a subset of buildings at the Brunswick facility with a lower priority than Tier 1 buildings but where the vapor intrusion pathway has not yet been determined to be complete or incomplete. Based on the prioritization process discussed with EPD during a meeting on March 11, 2021, Hercules is investigating the potential for vapor intrusion at the Firehouse, the Crown/Pexite Bathroom (formerly referred to as the Crown Control Room), the Pexite Control Room, Breakroom No. 5, the O&M Team Building, the Staybelite Control Room, and Breakroom No. 2 by collecting and analyzing two rounds of samples of sub-slab soil gas. The first round of sub-slab soil gas samples was collected in October 2021 and the results were provided to EPD by letter dated December 13, 2021. The second round of sub-slab soil gas samples was collected during the week of January 24, 2022. The results that are obtained from the seven Tier 2 buildings that are being assessed will be used to evaluate whether intrusive sampling is warranted at any of the remaining 13 Tier 2 buildings. In addition, the results that are obtained from the seven Tier 2 buildings that are being assessed will be used to evaluate whether mitigation measures may be necessary or prudent at any of those buildings.

6.2 Phase 2 – Activities to Inform Future Corrective Measures

While the corrective measures described above are ongoing, Hercules will continue to evaluate environmental conditions associated with the Brunswick facility and prioritize future activities to account for new information that is obtained. These assessment activities are described below and constitute Phase 2 of the work provided for under the CAP. The goal of these assessment activities is to incrementally reduce uncertainties regarding the need for, and locations of, additional corrective measures at the Brunswick facility.

6.2.1 Source Area Investigations

Field and laboratory work will be performed to further identify and evaluate potential source areas where COPCs are present in the shallow zone of the upper surficial aquifer. Based on the investigation results, Hercules and EPD will work collaboratively to prioritize source areas for further actions. A program to characterize shallow groundwater conditions and the physical and chemical properties of NAPL that may be present will be implemented as described below. Based on these investigation results, remedial technologies from the toolkit described in Section 5 of this CAP will be screened to select technologies that may be appropriate for use. Pre-design investigation activities will then be implemented as described in Section 6.2.6 of this CAP to provide design parameters and to select the interim corrective measures that will be used to reduce contaminant mass in the source areas that are identified. Following completion of pre-design investigation activities, one or more work plans for additional corrective measures specific to the source areas that may be identified will be prepared and submitted to EPD for review and approval prior to implementation as discussed in Section 6.3 of this CAP.

6.2.1.1 Shallow Groundwater Characterization

Characterization of shallow groundwater conditions in potential source areas will be performed initially using temporary groundwater sampling locations to inform the placement of additional monitoring wells as described below. As described elsewhere in this CAP, Hercules has already conducted extensive groundwater sampling activities to evaluate conditions in the shallow zone of the upper surficial aquifer. The characterization activities described below are intended to more intensively evaluate conditions in potential source areas and to augment the information that has already been developed regarding conditions in the shallow zone of the upper surficial aquifer. The areas targeted for investigation include the southern production area and former toxaphene production area as shown on **Figure 6-15.**

- Shallow groundwater characterization will be performed using a membrane interface probe coupled with a hydraulic profiling tool ("MiHPT") that will be used to generate information to inform the placement of additional permanent groundwater monitoring wells. Use of MiHPT technology enables significant amounts of data to be collected quickly and efficiently regarding subsurface conditions. The investigation activities will focus on delineation of source areas as represented by high concentrations of primary COPCs in the shallow zone of the upper surficial aquifer.

- The MiHPT data will be used to select the locations where temporary monitoring well clusters will be installed. It is anticipated that two temporary monitoring wells will be installed in each cluster at varying depths in the shallow zone of the upper surficial aquifer. If NAPL is anticipated or encountered at a temporary monitoring well cluster, then an additional temporary monitoring well may be installed to bracket the water table.

- After installation of temporary monitoring wells, groundwater samples will be collected for laboratory analysis of primary COPCs. In addition, if NAPL is encountered, it will be sampled for laboratory analysis as further described in Section 6.2.1.2 of this CAP.

- Information gained in the steps described above will be used to select locations for installation of permanent monitoring well clusters. In this regard, the temporary monitoring wells may be converted to permanent monitoring wells and/or additional permanent monitoring wells may be installed. It is anticipated that locations where COPCs are found with significantly elevated concentrations will be selected for installation of permanent monitoring wells in connection with source areas that are identified. These monitoring wells will be installed in accordance with monitoring well installation procedures described in technical guidance issued in 2018 by the Science and Ecosystem Support Division of USEPA ("SESD") titled *Design and Installation of Monitoring Wells, SESDGUID-101-R2* (USEPA, 2018).

- After additional monitoring wells are installed, they will be surveyed and used to monitor concentrations of COPCs and horizontal and vertical hydraulic gradients in the shallow zone of the upper surficial aquifer in source areas that are identified.

- If necessary, additional deeper monitoring wells may be installed to further assess vertical hydraulic gradients in proximity to the source areas that are identified.

The groundwater quality and vertical hydraulic gradient data collected from the foregoing investigation activities will be used to prioritize the implementation of additional corrective measures to address areas with elevated concentrations of COPCs and/or NAPL that are contributing to the presence of COPCs in the deep zone of the upper surficial aquifer. Hercules will work collaboratively with EPD to identify and prioritize locations where additional corrective measures are needed to address conditions in the shallow zone of the upper surficial aquifer.

6.2.1.2 Physical and Chemical Properties of NAPL

Laboratory analyses will be performed to obtain additional information about the physical and chemical properties of NAPL at the Brunswick facility because this information is necessary to assess the need for and selection of remediation technologies for corrective measures. Prior groundwater monitoring events have identified NAPL that has varying characteristics depending on location. In general, three types of NAPL have been described in prior investigative reports: a high-viscosity NAPL, a low-viscosity NAPL, and a separately identifiable layer that upon further laboratory analysis has been characterized as an aqueous phase liquid rather than a non-aqueous phase liquid.

Samples of NAPL (or separate phase liquid), if present, will be collected for laboratory analysis from a subset of the proposed locations described in Section 6.2.1.1 of this CAP. In addition, samples of NAPL or separate phase liquid, if present, will be collected for laboratory analysis from piezometer PZ1-6R and monitoring wells MW-42S and MW-48S where separate phase layers previously interpreted to be NAPL have been identified.

Monitoring well MW-42S is located near the former toxaphene production area. A sample of a dark liquid was collected from monitoring well MW-42S in December 2018. VOCs that were identified in the sample of dark liquid from monitoring well MW-42S included acetone (at a concentration of 5,960 µg/L), chloroform (at a concentration of 28,700 µg/L), benzene (at a concentration of 4,280 µg/L), chlorobenzene (at a concentration of 1,980 µg/L), and para-cymene (at a concentration of 1,050 µg/L). The specific gravity of the sample of dark liquid collected from monitoring well MW-42S was slightly greater than 1 (1.0068), which, along with the compositional analysis and the fact that the sample was fully miscible with water, indicates that the dark liquid is not NAPL.

Monitoring well MW-48S is located in proximity to the former NAPL recovery system northwest of the Stillhouse. A sample of a dark liquid was collected from monitoring well MW-48S in December 2018. VOCs that were identified in the sample of dark liquid from monitoring well MW-48S included benzene (at a concentration of 4,590 µg/L), para-cymene (at a concentration of 2,710 µg/L), and acetone (at a concentration of 6,140 µg/L). By contrast, carbon tetrachloride, chloroform, and chlorobenzene were not detected in the sample of the dark liquid.

Piezometer PZ1-6R is located in the area northeast of the Stillhouse. This is the location that was outfitted with an oil recovery skimmer system in 2020. Laboratory analysis of the NAPL from piezometer PZ1-6R has not been performed previously. However, the NAPL at that location appears to have a high viscosity and corresponding low mobility. A sample of NAPL from piezometer PZ1-6R will be collected and analyzed for VOCs, SVOCs, pesticides, density, and viscosity.

6.2.1.3 Evaluation of NAPL Mobility and Recoverability

If NAPL containing hazardous constituents is encountered, additional testing may be performed to evaluate whether the identified NAPL is mobile and/or recoverable. When NAPL is present in the subsurface, it is distributed in the pore spaces between the soil particles, and its mobility is a function of its saturation in the subsurface. NAPL saturation greater than residual saturation can cause the NAPL to be mobile, whereas NAPL saturation less than residual saturation will result in the NAPL being immobile (USEPA, 2005).

Additional NAPL bail-down tests may be used to understand the recoverability of NAPL. A bail-down test is conducted by removing all accumulated NAPL in a well and recording the rate at which NAPL recharges into the well. Field data are analyzed in a fashion similar to the analysis of field data from groundwater bail-down tests or slug tests. The results of the bail-down test(s) allow NAPL conductivity to be estimated and the local transmissivity of the formation for NAPL to be determined. The NAPL recovery rate can then be estimated from the transmissivity data and a determination made if the NAPL is recoverable.

The extent and success of NAPL recovery is, in large part, defined by the geology that is present, the fluid properties of the NAPL itself, and the technology that is implemented. Recovery of NAPL is limited by residual saturation, the influence of the recovery system on groundwater, and NAPL movement to the recovery wells. Recovery of NAPL from the subsurface reduces its saturation, making the NAPL less mobile, but also less recoverable. Therefore, as NAPL recovery progresses, it becomes less effective, and the actual recovery rate diminishes. If a NAPL recovery system is operating and the recovery is approaching a low rate, the design, installation, and operating parameters and procedures can be reviewed to assess whether changes in operation should be implemented. If after this review, the system is determined to be operating effectively, then it is likely that the remaining NAPL is essentially immobile.

6.2.2 Additional Investigations Involving the Upper Surficial Aquifer

Additional investigation activities will be implemented to refine the CSM with respect to the distribution of COPCs in the upper surficial aquifer, to better understand the geochemistry in the upper surficial aquifer, and to collect additional hydrogeologic data. Collectively this information will help inform fate and transport modeling of the movement of COPCs in groundwater, assist in evaluating the performance of ongoing corrective measures, and assist in evaluating the need for additional corrective measures. In accordance with hazardous waste permit No. HW-052(D&S)-2, work plans describing the design, location and installation of additional monitoring wells used to evaluate groundwater flow conditions and the extent of primary COPCs in groundwater will be submitted to EPD prior to installation of the additional monitoring wells.

A summary of the additional investigation activities and proposed monitoring wells is presented below. The need for additional characterization activities will be continually assessed throughout the corrective action process. Additional characterization activities may include but not be limited to installing additional monitoring wells beyond those described below, performing hydraulic conductivity testing, conducting mass flux analyses, and using MiHPT technology to further investigate subsurface conditions. Work plans for the additional investigation activities will be provided to EPD for review and approval prior to implementation of those activities.

6.2.2.1 Shallow Zone of the Upper Surficial Aquifer

As described in Section 6.2.1.1 of this CAP, shallow groundwater characterization will be performed using MiHPT methods in potential source areas, the results of which will be used to inform the placement of additional permanent groundwater monitoring wells. The additional monitoring wells will supplement the existing monitoring well network and will be used to monitor COPCs in the shallow zone of the upper surficial aquifer. The additional monitoring wells may also be used for corrective action performance monitoring if located in the vicinity of areas where future corrective actions are implemented.

As noted in Section 3.1.5.5 of this CAP, two additional monitoring wells (i.e., monitoring wells MW-29S and MW-62S) were installed in the shallow zone of the upper surficial aquifer in March 2021 as part of the tidal evaluation conducted in the eastern portion of the Brunswick facility near the Outfall Ditch. The locations of these new monitoring wells are shown on **Figure 6-16**. The boring logs and well construction diagrams for these new monitoring wells are provided in **Appendix A.**

Aquifer characterization activities, such as slug testing, will be conducted at existing and new monitoring wells to further refine the understanding of hydrogeologic conditions. Collection of groundwater elevation data will be used to evaluate horizontal hydraulic gradients and vertical hydraulic gradients between the shallow zone and deeper zones of the upper surficial aquifer if deemed necessary to support refinement of the CSM and/or selection of corrective measures. Groundwater samples from selected monitoring wells will also be collected to better understand the groundwater geochemistry and to further evaluate plume characteristics, natural attenuation processes, and performance of corrective measures.

6.2.2.2 Intermediate Zone of the Upper Surficial Aquifer

Two additional monitoring wells (i.e., monitoring wells MW-35I and MW-61I) were installed in the intermediate zone of the upper surficial aquifer in November 2020 at the locations shown on **Figure 6-16**. The boring logs and well construction diagrams for these new monitoring wells are provided in **Appendix A.** The monitoring wells were sampled during the December 2020 and June 2021 semi-annual groundwater monitoring events. Based on groundwater analytical results obtained at monitoring well MW-35I, Hercules prepared and submitted to EPD the MW-35I Investigation Work Plan (Geosyntec, 2021b) described in Section 2.3.2 of this CAP, which EPD approved by letter dated August 11, 2021. Subsequently, an investigation to evaluate groundwater conditions in the upper surficial aquifer underlying the area southeast of monitoring well MW-35I was conducted in October and November 2021 in accordance with the MW-35I Investigation Work Plan. Based on the results of the investigation, two groundwater monitoring wells designated as monitoring wells MW-63I and MW-64I were installed in the intermediate zone of the upper surficial aquifer at the offsite locations shown on **Figure 6-16**. The monitoring wells were sampled in mid-December 2021 and the results of the analyses are pending. Details of the groundwater investigation activities and the groundwater analytical results from those activities will be provided to EPD in an upcoming submittal. Additional monitoring wells may be installed in the intermediate zone of the upper surficial aquifer in the area southeast of monitoring well MW-35I investigated during 2021 to support refinement of the CSM, pending evaluation of data collected from monitoring wells MW-63I and MW-64I.

As noted in Section 3.1.5.5 of this CAP, one additional monitoring well (i.e., monitoring well MW-62I) was installed in the intermediate zone of the upper surficial aquifer in March 2021 as part of the tidal evaluation conducted in the eastern portion of the Brunswick facility near the Outfall Ditch. The location of this new monitoring well is shown on **Figure 6-16**. The boring log and well construction diagram for the new monitoring well is provided in **Appendix A.**

Hercules also previously proposed to install two additional offsite monitoring wells in the intermediate zone of the upper surficial aquifer to further refine distributions of COPCs in groundwater near the southern boundary of the Brunswick facility. Specifically, installation of these two additional monitoring wells was originally planned at an offsite property to the south of the Brunswick facility and east of U.S. Highway 17 subject to obtaining access to the offsite property as discussed in correspondence from Hercules to EPD dated July 23, 2020. However, Hercules has been unable to obtain access to this property despite repeated efforts. As discussed with EPD, Hercules now is planning to install one monitoring well designated as monitoring well MW-65I in the intermediate zone of the upper surficial aquifer at an onsite location near the boundary of the Brunswick facility along the west side of U.S. Highway 17 as shown on **Figure 6-16** in lieu of the two proposed offsite monitoring wells due to lack of access.

As described in Section 6.2.1.1 of this CAP, additional monitoring wells may be installed in the intermediate zone of the upper surficial aquifer in areas investigated as part of the assessment of potential source areas to evaluate COPC distributions and horizontal and vertical hydraulic gradients, and to support refinement of the CSM and/or selection of corrective measures.

Aquifer characterization activities, such as slug testing, may be conducted at existing and new monitoring wells in the intermediate zone of the upper surficial aquifer to better understand hydrogeologic conditions. Groundwater samples will also be collected to better understand the groundwater geochemistry and to further evaluate plume characteristics, natural attenuation processes, and performance of corrective measures.

6.2.2.3 Deep Zone of the Upper Surficial Aquifer

Two additional monitoring wells (i.e., monitoring wells MW-53D and MW-61D) were installed in the deep zone of the upper surficial aquifer in November 2020 at the locations shown on **Figure 6-16**. The boring logs and well construction diagrams for these new monitoring wells are provided in **Appendix A.** The monitoring wells were sampled during the December 2020 and June 2021 semi-annual groundwater monitoring events.

As noted in Section 3.1.5.5 of this CAP, one additional monitoring well (i.e., monitoring well MW-62D) was installed in the deep zone of the upper surficial aquifer in March 2021 as part of the tidal evaluation conducted in the eastern portion of the Brunswick facility near the Outfall Ditch. At this time, Hercules is proposing to install a total of four additional monitoring wells in the deep zone of the upper surficial aquifer to help further refine distributions of COPCs in groundwater. Hercules previously proposed to install two additional monitoring wells in the deep zone of the upper surficial aquifer at an offsite property to the south of the Brunswick facility and east of U.S. Highway 17 subject to obtaining access to the offsite property as discussed in correspondence from Hercules to EPD dated July 23, 2020. However, Hercules has been unable to obtain access to this property despite repeated efforts. As discussed with EPD, Hercules now is planning to install one monitoring well designated as monitoring well MW-65D in the deep zone of the upper surficial aquifer at an onsite location along the west side of U.S. Highway 17 as shown on **Figure 6-16** in lieu of the two proposed offsite monitoring wells due to lack of access. Hercules is also proposing to install three other monitoring wells in the deep zone of the upper surficial aquifer (designated as monitoring wells MW-66D, MW-67D and MW-68D) at locations in the eastern portions of the Brunswick facility near U.S. Highway 17 and between U.S. Highway 17 and Dupree Creek. Such groundwater monitoring wells are in addition to the groundwater monitoring wells that will be installed as part of the implementation of interim corrective measures for the deep zone of the upper surficial aquifer discussed in Section 6.1.4 of this CAP.

Groundwater elevation measurements and groundwater sampling results from the additional monitoring wells will be used to further refine the CSM and to evaluate groundwater flow and the distribution of COPCs in groundwater in the deep zone of the upper surficial aquifer. Groundwater samples will also be collected from select monitoring wells to better understand the groundwater geochemistry and to further evaluate plume characteristics, natural attenuation processes, and performance of corrective measures.

6.2.3 Additional Investigation in the Lower Surficial Aquifer

Additional investigation activities will be implemented to refine the understanding of the extent of COPCs in the lower surficial aquifer and to obtain additional hydrogeologic data to support the refinement of the CSM. COPCs at low levels have been detected in one monitoring well (i.e., monitoring well MW-44D) in the lower surficial aquifer. An additional monitoring well designated as monitoring well MW-66DD will be installed downgradient from monitoring well MW-44D to assess the horizontal extent of COPCs in the lower surficial aquifer and to supplement the existing monitoring well network in the lower surficial aquifer. The location of monitoring well MW-66DD is shown on **Figure 6-16**.

In accordance with hazardous waste permit No. HW-052(D&S)-2, a plan for the design, location and installation of any additional monitoring wells in the lower surficial aquifer used to evaluate groundwater flow conditions and the extent of primary COPCs in groundwater will be submitted to EPD prior to installation of such monitoring wells.

6.2.4 Fate and Transport Groundwater Model

The existing groundwater model for the Brunswick facility will be further refined to simulate the fate and transport of COPCs in groundwater beneath the Brunswick facility. A groundwater flow model for the Brunswick facility was initially developed by Antea to evaluate flow pathways and groundwater/surface water interactions (Antea, 2016a). The groundwater flow model was then updated by Integral to simulate, among other things, the fresh water/saltwater interactions within the upper surficial aquifer (Integral, 2018).

As part of further refinement of the groundwater flow model for the Brunswick facility, the model layering and hydraulic conductivity zonation will be updated to include lower permeability units (where present) which have been interpreted to separate the shallow, intermediate, and deep zones of the upper surficial aquifer. The model grid will also be refined to increase grid resolution in key areas of the Brunswick facility and to expand the model boundaries as shown on **Figure 6-17**. The groundwater flow model will then be recalibrated to reflect recent groundwater elevation measurements and sampling results for TDS (or salinity, as appropriate), under steady state conditions, in order to establish a groundwater flow field. Once the groundwater flow field has been finalized, the groundwater flow model will be updated with additional sampling results for COPCs and associated fate and transport parameters. The groundwater flow model will then be calibrated using observed concentration data for the following four COPCs: benzene, chlorobenzene, chloroform, and methylene chloride. Following calibration of the groundwater flow model, the model will be used to assess fate and transport of COPCs in groundwater. This information will help inform the selection and design of further groundwater corrective measures as appropriate.

6.2.5 Vapor Intrusion Evaluation of Tier 2 Buildings

Sampling results from shallow groundwater samples at the Brunswick facility have provided a useful guide to direct the vapor intrusion investigation toward buildings with the potential for a completed VI pathway to be present. Tier 2 buildings were differentiated from Tier 1 buildings at the Brunswick facility largely on the basis of the concentrations of VI COPCs measured in shallow groundwater samples collected from temporary well points near the buildings. Concentrations of VI COPCs in shallow groundwater in proximity to the ten buildings designated as Tier 1 buildings exceeded cumulative groundwater exceedance factors based on USEPA commercial (i.e., non-residential) VISLs for groundwater by a factor of at least five while concentrations of VI COPCs in shallow groundwater in proximity to the 20 buildings designated as Tier 2 buildings exceeded the USEPA commercial (non-residential) VISLs for groundwater by a factor of less than three.

Investigation activities at Tier 1 buildings have been completed. As described in Section 6.1.5 of this CAP, the results of those investigation activities were presented in the Tier 1 Report. Various mitigation measures for Tier 1 buildings have been identified. Certain of those mitigation measures have already been completed such as the installation and operation of SSD systems at the Stillhouse Control Room and the Chemical Plant Control Room and Laboratory, and demolition of a former office space in the Liquid Loading Shed. Modifications to the Terpenes Resins Building, the Refrigeration Shop and the Office Trailer were completed in January 2022 to increase ventilation at these buildings and render them not susceptible to vapor intrusion. In addition, the Small Office (North of the Storeroom) was demolished in January 2022. Hercules is installing an SSD system at the E&I Shop out of an abundance of caution. The SSD system at the E&I Shop is expected to be installed in the second quarter of 2022 in accordance with the approved E&I Shop Mitigation Plan.

Assessment activities relating to potential vapor intrusion at the Brunswick facility that remain in progress are limited to assessment activities at Tier 2 buildings that are being performed pursuant to the version of the Tier 2 Work Plan approved by EPD via e-mail and letter on September 28, 2021. The Tier 2 Work Plan, as approved, describes steps to conduct intrusive sampling from seven Tier 2 buildings where the vapor intrusion pathway has not yet been determined to be complete or incomplete. Based on the prioritization process discussed with EPD during a meeting on March 11, 2021, Hercules is investigating the potential for vapor intrusion at the Firehouse, the Crown/Pexite Bathroom (formerly referred to as the Crown Control Room), the Pexite Control Room, Breakroom No. 5, the O&M Team Building, the Staybelite Control Room, and Breakroom No. 2 by collecting and analyzing two rounds of samples of sub-slab soil gas. The first round of sub-slab soil gas samples was collected in October 2021 and the results were provided to EPD by letter dated December 13, 2021. The second round of sub-slab soil gas samples was collected during the week of January 24, 2022. The results that are obtained from the seven Tier 2 buildings that are being assessed will be used to evaluate whether intrusive sampling is warranted at any of the remaining 13 Tier 2 buildings. In addition, the results that are obtained from the seven Tier 2 buildings that are being assessed will be used to evaluate whether mitigation measures may be necessary or prudent at any of those buildings.

6.2.6 Process to Refine Applicable Remedial Technologies

Applicable remedial technologies identified for potential use at the Brunswick facility are presented in Section 5 of this CAP. Based on the results of the investigation activities described in Section 6.2, corrective measures will likely be necessary at additional areas of the Brunswick facility. This section summarizes the process that will be used to select and implement additional corrective measures. As part of that process, Hercules will undertake the following steps:

- Identify a remedial technology or a combination of technologies from Section 5 of this CAP based on the potential of such a remedial technology or technologies to achieve the selected objectives for the specific area, taking into account the affected media and the COPCs that are present;

- Perform a desktop focused feasibility study to compare remedial alternatives based on their implementability, effectiveness, and cost (assuming that more than one remedial alternative is identified);

- Perform a treatability study, if applicable, to demonstrate the feasibility of deploying a particular remedial technology at a specific area using a bench scale study;

- Perform a pre-design investigation including, as applicable, field pilot tests and a data gap evaluation/investigation relating to design parameters; and

Prepare a work plan describing the selected corrective measures (together with a monitoring plan and reporting plan as appropriate) for submission to EPD for review and approval prior to implementation, as discussed in Section 6.3 of this CAP.

6.2.7 Refining the Risk Assessment and Corrective Action Objectives

As previously discussed in this CAP, Hercules submitted to EPD the BHHRA and SLERA Report for the Brunswick facility on March 22, 2019. Hercules' goal is to work with EPD to address questions and comments, as appropriate, regarding the BHHRA and SLERA Report while concurrently implementing the ongoing and future corrective measures at the Brunswick facility.

The interim corrective measures that have been completed and that are in progress have reduced and will continue to reduce potential risks to human health on a sitewide basis. Those interim corrective measures will also continue to reduce contaminant mass and the volume of impacted media at the Brunswick facility and demonstrate Hercules' commitment to protecting human health and the environment.

The approach of using interim corrective measures in tandem with risk evaluation is consistent with adaptive management principles by advancing corrective measures while Hercules and EPD work cooperatively to resolve outstanding issues related to the risk assessment and corrective action objectives. To this end, Hercules proposes to engage with EPD in a series of technical meetings focusing on particular questions and issues identified by EPD in connection with the BHHRA and SLERA Report with the goal of developing consensus on specific refinements to the risk assessment process that will support decisions relating to risk management and corrective action at the Brunswick facility. Hercules envisions that such risk assessment technical meetings will be organized by topic, generally following the steps of the risk assessment process, as shown in the following bullets, with the goal of reaching consensus among the parties at each step prior to advancing to the next step.

- Data quality/usability issues and selection of COPCs;
- Receptors and exposure pathways;
- Exposure point concentration calculations (including exposure point concentrations reflecting the evaluation of the soil to groundwater pathway – leachability); and
- Groundwater usability and corrective action objectives.

Significant work has already been completed in connection with each of these steps. There are large areas of agreement between Hercules and EPD regarding the approaches that should be taken as part of each of the steps. The process that is described above is designed to resolve specific questions and issues in light of the work that is ongoing and the role that the risk assessment process may play in determining the need for additional corrective measures and risk management strategies.

6.3 Phase 3 – Framework for Future Corrective Measures

It is anticipated that the ongoing interim corrective measures described in Section 6.1 of this CAP will contribute significantly toward meeting final sitewide corrective action objectives. For example, the vapor intrusion pathway investigation activities at the Brunswick facility will be complete and vapor intrusion mitigation systems or measures will be installed or implemented as necessary at certain buildings as a precautionary step (many of these actions have already been completed). Soils in the former toxaphene tank farm area have been addressed using *in situ* stabilization to preclude current and potential future exposure pathways to those soils. Further reductions in potential risks will be achieved with the implementation of interim corrective measures targeting surface soils containing toxaphene at elevated concentrations in various locations at the Brunswick facility. Implementation of corrective measures to address groundwater conditions in the shallow and deep zones of the upper surficial aquifer was initiated in December 2021 and January 2022, respectively, using multiple technologies.

With that being said, Hercules recognizes that additional corrective measures may be necessary, particularly based on the information that is developed as part of Phase 2 of the work provided for under this CAP as described in Section 6.2 of this CAP. Identification of such additional corrective measures is not possible at this point in the corrective action process. However, such additional corrective measures will be identified and implemented at the Brunswick facility, as necessary, as part of Phase 3 of the work provided for under the CAP. The additional corrective measures will be informed by the following:

- Lessons learned from and the effectiveness of the ongoing corrective measures (interim measures) discussed in Section 6.1 of this CAP with respect to conditions in the shallow and deep zones of the upper surficial aquifer;
- The CSM for the Brunswick facility as updated by the evaluations discussed in Section 6.2 of this CAP, including the risk assessment and development of CAOs;
- The results of fate and transport modeling using an updated and refined groundwater flow model; and
- The results of additional investigation activities to fill data gaps, further refine groundwater conditions and further characterize potential source areas.

Work plan(s) for additional corrective measures that are undertaken as part of Phase 3 of the work under this CAP will be developed and submitted to EPD for review and approval prior to implementation. The work plan(s) will utilize remedial technologies presented in Section 5 of this CAP. The use of a technology that is not in Section 5 will require a permit modification unless otherwise determined by EPD. The work plan(s)will include:

- the scope of the proposed corrective measures;
- a detailed performance monitoring plan to monitor and optimize the corrective measures toward meeting the corrective action objectives;
- criteria that will be used to determine the effectiveness of the corrective measures; and
- a milestone implementation schedule.

Hercules will provide to EPD on an annual basis a summary of estimated costs to implement investigations and corrective measures at the Brunswick facility. The costs will include capital costs as well as foreseeable operation, maintenance, and monitoring costs. Annual updates to the costs will coincide with the annual update to the implementation schedule as discussed in Section 8 of this CAP. The corrective action cost estimates will also be included in the Brunswick facility's annual inflation adjusted financial assurance.

Ultimately, as discussed in Section 4 of this CAP, once CAOs are finalized through the risk assessment process and interim corrective measures have been implemented to address identified potential risks, Hercules will prepare an updated version of this CAP to be incorporated into the hazardous waste permit for the Brunswick facility. The updated version of the CAP will describe (i) the risk assessment and final CAOs that were developed during the process described in this CAP, (ii) documentation regarding the interim corrective measures and/or engineering/institutional controls that were implemented to address identified potential risks, and (iii) additional corrective measures and/or OM&M requirements that may be necessary to meet the CAOs and to verify the effectiveness of the implemented corrective measures. The updated version of the CAP will be submitted to EPD as part of an application for a Class 3 permit modification so that the updated version of the CAP can be incorporated into the hazardous waste permit for the Brunswick facility. Such a permit modification process triggers a public comment period and typically includes a public meeting for soliciting comments regarding the proposed permit modification.

The public will be kept informed of the corrective action process via formal and informal methods as summarized below.

- Hercules will host public informational meetings on a regular basis. Hercules will host at least two informational meetings within the first year after EPD approves this CAP. Following the first year after approval of this CAP, Hercules will host informational meetings at least once per year. To the extent practical, such meetings will be timed to coincide with major milestones in the project (such as technology changes or implementation of a new interim corrective measure). The informational meetings will be held at a local, publicly available venue. Notice will be provided to the public approximately 30 days in advance of the meeting through the local newspaper for the Brunswick area as well as through personal communication to local interested stakeholders (such as the Urbana Perry Park Neighborhood Association).

- Hercules has developed a website (HerculesBrunswick.com) to help keep the public informed regarding the corrective action process for the Brunswick facility. Hercules will post to the website the EPD-approved version of this CAP, EPD-approved work plans for corrective measures submitted following approval of the CAP, progress reports regarding implementation of interim corrective measures, groundwater monitoring reports, and other pertinent documents and information.

A wealth of information has already been included on the website regarding the operational and environmental history of the Brunswick facility together with the extensive environmental work that Hercules has previously undertaken and is currently performing.

- Hercules will submit an application for a RCRA Class 3 permit modification to EPD to incorporate into the hazardous waste permit for the Brunswick facility the updated version of the CAP as discussed above that will be prepared after the Phase 2 and Phase 3 activities described in Sections 6.2 and 6.3 of this CAP are completed. The process for considering a Class 3 permit modification includes a public comment period and typically includes a public meeting for soliciting comments regarding the proposed permit modification. These steps will provide the public with the opportunity to review and comment on the updated version of the CAP reflecting the final risk evaluation for the Brunswick facility, the corrective active objectives, the interim corrective measures and engineering/institutional controls that have been implemented, and any ongoing OM&M requirements.

6.4 Activity and Use Limitations

Activity and use limitations serve as an important component of the toolbox of options to address environmental conditions that may pose unacceptable risks to human health or the environment. Activity and use limitations may be used independently or in tandem with other forms of remediation or controls to mitigate risks. For example, activity and use limitations may preclude certain types of activities that would potentially lead to unacceptable risks or be used to support engineering controls that are designed to eliminate pathways of exposure.

Activity and use limitations are typically implemented through declarations of restrictive covenants, restrictions that are imposed through provisions in deeds, or environmental covenants. With respect to environmental covenants, Georgia has adopted the Uniform Environmental Covenants Act ("UECA"), O.C.G.A. § 44-16-1 *et. seq*. The Georgia version of UECA became effective on July 1, 2008. UECA describes the contents of environmental covenants and provides for enforcement, notice, recording, amendment, and termination of environmental covenants. Since Georgia's adoption of UECA, use of environmental covenants has become the primary mechanism for implementing activity and use limitations to address environmental conditions because environmental covenants provide greater certainty regarding their legal status than declarations of restrictive covenants and deed restrictions (although both alternatives remain available). In addition, environmental covenants are readily enforceable by those designated in the environmental covenants to have such authority.

Activity and use limitations are and will continue to be an important element of the mechanisms that are used to mitigate potential risks at the Brunswick facility as part of the corrective action process. Hercules, Pinova and EPD have already discussed and reached agreement regarding certain activity and use limitations that prohibit or restrict activities that may interfere with an implemented engineered remedy and/or that restrict or prevent activities that may result in unacceptable risks to human health and the environment. Hercules, Pinova and EPD have also agreed that such activity and use limitations will be included, to the extent practicable, in environmental covenants that are recorded with the real property records for the Brunswick facility. Environmental covenants have already been prepared and recorded for the parcels comprising the portion of the Brunswick facility located east of U.S. Highway 17 (i.e., the Terry Creek Properties). Those environmental covenants, among other things, prohibit the use or extraction of groundwater for drinking water purposes.

Activity and use limitations that have been discussed and that are anticipated to be implemented at the Brunswick facility include, but are not limited to, those that do the following:

- Prohibit the use for residential purposes (including single family homes, multiple family dwellings, schools, day care centers, childcare centers, and apartment buildings) of those portions of the Brunswick facility where SWMUs and AOCs are located (i.e., those portions of the Brunswick facility where impacts to soils have been identified that could potentially pose unacceptable risks to residential receptors);

- Prohibit the use of groundwater in the upper surficial aquifer and lower surficial aquifer from beneath the Brunswick facility;

- Require implementation of a Soil Management Plan setting forth processes and procedures to protect potential receptors (onsite and construction workers) in connection with activities at the Brunswick facility that involve soil disturbance, including worker exposure to potential vapor inhalation in an excavation; and

- Restrict activities that would interfere with or adversely impact the integrity of constructed corrective measures such as the monolith from the *in situ* solidification of soils at the former toxaphene tank farm.

Additional activity and use limitations may be identified as the corrective action process continues. To the extent that environmental covenants are already in place, those environmental covenants can easily be modified to incorporate such additional activity and use limitations.

Additional activity and use limitations may be identified in the future for offsite properties as the corrective action process continues. Currently, there is a City of Brunswick ordinance restricting the installation of water supply wells and Hercules is aggressively implementing corrective measures to reduce contaminant mass and concentrations in groundwater migrating offsite. Depending on the effectiveness of the interim corrective measures and the timing, if ever, of the repeal of the City of Brunswick ordinance restricting the installation of water supply wells, Hercules may approach the owners of particular offsite properties regarding the imposition of activity and use limitations for those properties that may still have impacted groundwater beneath the properties. For example, in the context of a recent transaction, Hercules was able to arrange for environmental covenants to be recorded for the Stripling's property located downgradient of the Brunswick facility at 2304 Glynn Avenue on February 10, 2022. Those environmental covenants prohibit the use of groundwater for potable purposes. Hercules has not, to date, discussed activity and use limitations with other offsite property owners because those property owners are currently prohibited from installing water supply wells.

7. GROUNDWATER MONITORING PROGRAM

A holistic approach to groundwater monitoring will be implemented at the Brunswick facility to integrate the requirements of post closure care monitoring for the closed surface impoundment with sitewide corrective action groundwater monitoring. Routine groundwater monitoring using the groundwater monitoring well network that has been installed at and adjacent to the Brunswick facility will be performed on a semi-annual basis to assess the presence and extent of COPCs in groundwater resulting from releases from the various SWMUs that have been identified and investigated at the Brunswick facility. Groundwater levels will be gauged at all accessible groundwater monitoring wells at and adjacent to the Brunswick facility during each semi-annual event.

Groundwater monitoring requirements pursuant to hazardous waste permit No. HW-052(D&S)-2 are summarized in **Tables 7-1** (monitoring wells and frequency) and **Table 7-2** (target analytes for groundwater samples). **Table 7-1** includes the monitoring wells listed in hazardous waste permit No. HW-052(D&S)-2 with the following exceptions: monitoring wells MW-61I and MW-61D have been added to monitor groundwater quality downgradient of the southern portion of the plume of VOCs, and monitoring well MW-26D has been added to monitor groundwater quality near the northern edge of the plume of VOCs. Monitoring well MW-52D remains on the monitoring list; however, the property owner where monitoring well MW-52D is located has consistently denied Hercules access to the property for groundwater level monitoring and sample collection activities over the past several years. Accordingly, monitoring well MW-52D will only be sampled if access is granted. Groundwater samples will be collected and analyzed in accordance with the procedures specified in Section IV.C of hazardous waste permit No. HW-052(D&S)-2.

In addition to the groundwater monitoring activities described above pursuant to hazardous waste permit No. HW-052(D&S)-2, Hercules may voluntarily collect groundwater samples from additional monitoring wells to monitor the concentrations and extent of COPCs in groundwater as needed to evaluate concentration trends and to assess potential changes in aquifer conditions. Additionally, each work plan for individual interim corrective measures addressing groundwater conditions has included and will include provisions describing groundwater monitoring to evaluate the effectiveness of the corrective measures. As a component of such work plans, observation wells have been and may be installed to evaluate the performance of groundwater corrective measures. Observation wells that have been installed at the Brunswick facility during the past year have been described in various submissions to EPD and in this CAP. If further observation wells are installed in the future, the specific locations and purpose of such observation wells will be described in work plans that are developed for review and approval by EPD relating to the groundwater corrective measures. Laboratory analyses of groundwater samples collected from monitoring wells on a voluntary basis may include a selection of the COPCs in groundwater and additional parameters that Hercules may need for identification and selection of additional corrective measures and/or for evaluating performance of corrective measures that have been implemented.

Hercules will regularly review the groundwater monitoring program required under hazardous waste permit No. HW-052(D&S)-2 to help ensure that the groundwater monitoring program is optimized to provide data needed to effectively monitor and assess groundwater conditions, groundwater quality, and changes in the distribution of primary COPCs.

Reports documenting semi-annual groundwater monitoring events pursuant to hazardous waste permit No. HW-052(D&S)-2 will be submitted to EPD within 120 days after completion of each semi-annual groundwater monitoring event. The reports will include sampling methodologies, tabulated groundwater elevations and analytical data, groundwater contour maps, groundwater quality maps, trend graphs for certain monitoring wells, a summary of sampling results, and recommendations for ongoing monitoring and optimization of the groundwater monitoring well network. Reports regarding the effectiveness of corrective measures will ultimately coincide with the semi-annual groundwater monitoring reports.

Finally, as described in Section 3.2.2 of this CAP, Hercules has voluntarily collected groundwater samples on an annual basis from five private water supply wells located along Terry Creek Road to the southeast of the Brunswick facility since 2015. The sampling results have confirmed that the Brunswick facility has not impacted those private water supply wells. Because Hercules has been able to confirm that the private water supply wells are not installed in the surficial aquifer but instead withdraw water from deeper aquifers that are protected from any impacts from the Brunswick facility by multiple confining layers, Hercules plans to discontinue sampling the wells.

8. SCHEDULE

Hercules has prepared a projected schedule of activities that are described in Sections 6.1 and 6.2 of the CAP. The estimated schedule of activities is provided in the form of a Gantt chart on **Figure 8-1**. The schedule on **Figure 8-1** is a continuation of the schedule submitted with the prior version of the CAP in February 2021 because assessment and corrective measures work has continued at the Brunswick facility and many of the activities are in "mid-stream" (i.e., in progress). For the Phase 2 and Phase 3 activities described in Sections 6.2 and 6.3 of this CAP, the schedule contemplates that those activities will culminate in preparing a revised version of this CAP in the future that will ultimately be incorporated into the hazardous waste permit for the Brunswick facility. The schedule presented on **Figure 8-1** extends for a period of two years from the submission of this CAP. The ability to project the timing of work over the course of that two-year period diminishes the further into the future that the schedule goes. Moreover, as discussed in Section 6.3 of the CAP, decisions regarding additional longer-term corrective measures are dependent on the results of future investigation activities and the effectiveness of the interim corrective measures that are in progress as discussed in Section 6.1 of the CAP.

Because of the dynamic process associated with the adaptive management approach that is occurring in connection with implementing corrective action requirements at the Brunswick facility, Hercules will provide EPD updates to the projected schedule of activities on an annual basis. As with the version of the projected schedule of activities set forth herein, Hercules will attempt to cover activities in the annual update that are anticipated to take place in the subsequent two-year period. If longer projections are feasible, Hercules will include them in the updates. Quarterly schedule updates will also be provided to EPD in letter format regarding activities completed during the previous quarter and activities anticipated to be completed or initiated in the following quarter. Such quarterly updates are expected to be brief and will augment the communications between EPD and Hercules that have been taking place on a routine basis as part of the monthly Triad meetings that have been occurring.

Because work will continue to advance at the Brunswick facility during EPD's review of this CAP and the associated public comment process, a schedule update in the form of a Gannt Chart similar to the one attached to this CAP will be provided to EPD for approval and incorporation into the CAP prior to its final approval so that the CAP reflects, to the degree reasonably practicable, the schedule of activities at the time of final approval of the CAP. In addition, Hercules expects that work plans that are submitted to EPD for review and approval covering particular tasks and activities, including but not limited to future corrective measures as described in Section 6.3 of this CAP, will include detailed estimated implementation schedules as part of those work plans. Such implementation schedules will enable EPD to track progress relating to particular tasks and activities. Hercules also expects to keep EPD apprised of the progress of the work at the Brunswick facility and any significant changes in the projected schedule through the ongoing Triad process and routine meetings.

The projected schedule of activities provided on **Figure 8-1** includes estimated durations for various tasks and steps. The estimated durations for those tasks and steps are approximated because they are dependent upon many factors including but not limited to contractor availability, inclement weather, field implementation and laboratory analytical results, local and state permitting requirements, timeframes for review of submissions by EPD, and other matters beyond the reasonable control of Hercules such as restrictions and limitations associated with the COVID-19 pandemic and disruptions to the supply chain that have been prevalent.

9. COSTS

Hercules has prepared a summary of anticipated costs that it expects to expend to implement the actions described in Sections 6.1 and 6.2 of the CAP. This summary of anticipated costs is provided on **Table 9-1**. Costs for actions described in Section 6.3 of this CAP cannot be projected at this time. As reflected in the projected schedule of activities discussed in Section 8 of this CAP, many of the anticipated costs summarized in **Table 9-1** will be incurred before this CAP is expected to be finalized, approved by EPD, and incorporated under the hazardous waste permit for the Brunswick facility. Hercules anticipates that it will periodically provide EPD with updated projections of the costs that it anticipates incurring on a prospective basis in connection with implementing the corrective action process at the Brunswick facility.

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TABLES

Table 2-1
Solid Waste Management Units Summary
Hercules/Pinova Facility, Brunswick, Georgia

SWMU ID	SWMU Name	Exposure Domain	Operation Period	Dimension/Size/Container	Operation	Contaminant Information
SWMU 1	Mill Room Pond	1	1953 - Present	40ft. by 100ft. by 8ft. Deep	Settling basin for stump dirt and boiler ash recovered from raw materials used at the plant. Unlined.	Sulfuric Acid is used as a neutralizing agent for the boiler ash sluices. No solvents or Toxaphene have been processed or stored. Volatile Organic Compounds (VOCs), semi-volatile organic compounds ("SVOCs"), metals, and pesticides (including toxaphene) have been detected in soil samples collected at SWMU #1.
SWMU 2	Plant Clarifier	1	1972 - Present	76-ft. in diameter and 15-ft. deep and has a 3,500-gpm capacity	Clarifies the overflow water pumped from the Millroom Pond (SWMU #1). Sediment pumped from the clarifier is recycled to the Millroom Pond for recovery. Above ground unit	No known releases of hazardous waste; leakage from slurry pump is caught on the pump pad and recycled. No solvents processed or stored. VOCs, SVOCs, toxapene, and furans have been detected in soil samples collected at SWMU #2.
SWMU 3	Former Truck Dumper Area	1	1987 - 2004	20ft. by 10 ft. concrete pad was installed after the truck dumper was removed	Used to unload 20-ton trailers containing stumps to a conveyor for processing. Hydraulic oil for the dumper was stored in a small tank on a concrete pad and pumped to this unit. Visually impacted soils were excavated in 1996.	In 1996, visually impacted soils resulting from hydraulic oil leakage were removed in a 30 ft by 10 ft concrete containment vault. Possible leakage of hydraulic oil also appeared to have impacted the concrete pad and its adjacent soil. An Organic Vapor Analyzer (OVA) was reportedly used to confirm removal of any soil that exhibited readings greater than 10 ppm total VOCs. Soils were excavated to depths ranging from 4.5 feet to 6.5 feet bgs. The excavated areas were then backfilled with clean soil. Additional containment was installed, including a new dike around the tanks, in the formerly graveled area. VOCs, SVOCs, metals, and toxaphene were historically detected in soil samples collected at SWMU #3.
SWMU 4	Drum Crushing Unit	4	1980 - 1992	--	Consists of the concrete pad east of the Nitroform Warehouse which is currently used as a truck loading, scrap material, and empty drum accumulation area. A small hydraulic machine for crushing empty drums was located in this area (now SWMU #4) and drums were crushed from approximately 1980 until 1992. After a May 1992 EPD inspection, a 10 ft by 20 ft area of stained soils was removed until visual staining was no longer apparent. After soil removal activities were completed, a curbed concrete pad was installed over the excavated area and extended another 40 feet to the east. The soil removal activities were completed as part of the SWMU 5 Corrective Action Plan (CAP) implementation. EPD approved in December 2010 Hercules' completion of the SWMU 5 CAP soil remediation.	Stains on the pad and nearby soil are the reason the area is suspected to have had a release. The crushed drums were empty prior to crushing. Soil contamination in areas surrounding the drum crushing unit were remediated during implementation of the SWMU #5 CAP. VOCs, SVOCs, metals, pesticides (including toxaphene), herbicides, polychlorinated biphenyls, and furans were historically detected in soil samples collected at SWMU #4 and were the target of the remedial excavation activities. EPD approved the CAP soil remediation in December 2010.
SWMU 5	Former Toxaphene Plant Site	4	1948 - 1980	Approximately 23,000 square feet	The Toxaphene Plant produced the chlorinated camphene pesticide, Toxaphene. Significant soil removal activities were completed in the former toxaphene production area (designated as SWMU No. 5) in 1997. Soils within the footprint of the former toxaphene production area were excavated to the groundwater table over an area that was approximately 100 feet by 300 feet in size. The excavated soils were disposed of at an appropriate off-site facility, and clean fill was placed in the excavated area. Approximately 3000 cubic yards of soil were removed and sent off-site for disposal. In September 2007, Hercules submitted to EPD a corrective action plan for SWMU No. 5 and work was conducted under the corrective action plan from March 2008 to January 2010. The corrective measures included remediating approximately 300,000 square feet of surface area associated with the former toxaphene production area, the N Street Ditch, and the Vinsol building area. The scope of work expanded due to the results from confirmation sampling and eventually achieved the remediation of soils in SWMUs 4, 5, 29, and 30. All major structures were removed in this area and soils were excavated and disposed at an appropriate off-site facility. EPD approved in December 2010 Hercules' completion	VOCs, SVOCs, metals, pesticides (including toxaphene), and herbicides were hisotrically detected in soil samples collected at SWMU #5. Soils were excavated down to the groundwater surface from SWMU #5 during implementation of the CAP which was approved by EPD in December 2010.

Table 2-1
Solid Waste Management Units Summary
Hercules/Pinova Facility, Brunswick, Georgia

SWMU ID	SWMU Name	Exposure Domain	Operation Period	Dimension/Size/Container	Operation	Contaminant Information
SWMU 6	Y Tank Farm	4	1924 - Present	8.5 acres (approximately 18 ASTs with capacities ranging from 25,000 to 500,000 gallons)	The Y Tank Farm is the storage area for much of the facility's liquid products and raw materials. Each tank is isolated by earthen or concrete secondary containment. This SWMU also includes the piping area south and southeast of the tank farm. Soils were removed in the area of the Y tank farm to facilitate construction of the secondary containment area elements installed under the stillhouse pipe rack on the south side of the Y tank farm in 1996. At the same time, a curbed concrete pad with sampling ports was also installed to mitigate the potential for spills or leaks to reach the surrounding soils.	Materials currently stored in this area are wood oils and terpenes. Previously, materials stored in this area included turpentine; pine oil and solvenol; intermediate products including many distillation cuts; and solvents including MIBK and Soltrol 10 (petroleum distillate). Raw materials previously stored in this area included crude sulfate turpentine. Over 95% of the volumes of organic liquids stored and handled at the facility are terpene-related compounds including turpentine, pine oil, and solvenol. No hazardous wastes have been managed in the tanks. Accidental spills have occurred in the Y tank farm area between 1988 and present. Prior to that time no regular records are available. Spills to the diked containments, ranging from 2 to 10,000 gallons, were routinely cleaned up with a vacuum truck when they occurred. Secondary containment has been installed under the Still House pipe rack on the south side of the Y tank farm. After simplifying piping on the rack, a curbed concrete pad was installed to collect any potential spills or leaks. Prior to covering the area, residues on the surface of the ground were removed by washing. Toxaphene and VOCs had been detected in soils samples from the Y tank farm. Toxaphene is most prevalent in soil on the northeast portion of the SWMU in the fomrer toxaphene tank farm. On September 24, 2019 Hercules submitted an Interim Corrective Measures Plan to EPD summarizing a phased approach to address the former toxaphene tank farm in the northeast portion of the SWMU. Phase 1 of the approach involved removing the asphalt-like material from the SWMU that was considered by EPD to be a listed hazardous waste (hazardous waste code P123) followed by Phase 2 that would address residual toxaphene concentrations in shallow soils. EPD approved the plan in a letter dated October 1, 2019. Phase 1 was completed in December 2019 and approved by EPD in a letter dated May 5, 2020. An Interim Corrective Measures(ICM) Plan was submitted to EPD to address residual contamination in soils during Phase 2 using insitu solidification technologies. The Phase 2 ICM plan was approved by EPD in a letter dated October 22, 2020. Following contractor bidding and procurement, Phase 2 addressing residual soil contamination was implemented from April 2021 to December 2021. The construction completion report summarizing the insitu solidification of soils in the toxaphene tank farm is currently in progress.
SWMU 7	Vinsol® Bins	4	1938 - Mid-1990s	Six above ground, diked, and uncovered areas used to store the product Vinsol	The Vinsol Bins are six above ground, diked, and uncovered areas used to store the product Vinsol®. Vinsol® is used as a binder and is described as a dark, insoluble, fraction of wood rosin generated at the facility's Pexite Plant. It is also used in the construction industry. This material is a solid at room temperature. Excess production of Vinsol® is pumped in molten form into the bins. Upon cooling, Vinsol® is reclaimed with a front-end loader. The Vinsol bins were built in 1938. The 1994 aerial photograph shows all six bins and an additional bin north of the man bin area. The bin in the northwest corner of the area was used for drum storage before 1974 and became a Vinsol® bin between 1974 and 1981. Two empty bins (200 ft. by 150 ft. by 8 ft. high) were used for temporary drum storage of non-hazardous scrap rosin and soil mixed with rosin from 1991 to 1993 (The southwest bin and the bin directly east of the southwest bin).	Four of these bins were used as a pilot test facility for the toxaphene wastewater neutralization process circa 1970. Upon successful conclusion of the pilot test, the toxaphene surface impoundments (SWMU#10) were designed and constructed. The contents of drums of non-hazardous wastes stored in 1991 included sawdust, gravel, distillation column residues, solvenol and dirt, clean and off-spec resins, Kymene, piccolyte oils, spent sugartex lube oil, and terpin hydrate. These drums were removed during the mid 1990s. VOCs, SVOCs, metals, pesticides (including toxaphene), herbicides, furans, and dioxins have been detected in soil samples collected at SWMU #7.

Table 2-1
Solid Waste Management Units Summary
Hercules/Pinova Facility, Brunswick, Georgia

SWMU ID	SWMU Name	Exposure Domain	Operation Period	Dimension/Size/Container	Operation	Contaminant Information
SWMU 8	Y-1, Y-2, Y-3 Tank Farm	3	1940 - 1996	(3) 250,000 gallon ASTs, each surrounded by 100 ft. by 100 ft. earthen containment structures	Process lines from the plant process areas were used to transfer materials to these tanks. There was no tank truck access to these tanks. Some accidental spills have occurred in this tank farm area. Leakage at transfer pumps west of the tank dikes was mostly contained in a small sump. Releases have ranged from 2 to 150 gallons. There have been no known releases from the containment area. Cleaning and removal of the tanks was initiated in August 1996. Thereafter, soils in the area of the former tank farm were excavated down to the groundwater table after the tank foundations and earthen dikes were removed. These activities occurred between December 1996	These tanks were used by the Still House and Power House to store liquid residual fuels (Y-1 and Y-2) with a flash point greater than 140°F and pulp mill liquor, a raw material, (Y-3). Soils were excavated from the Y-1, Y-2, and Y-3 tank farm down to the groundwater table in December 1996 and Janaury 1997 and backfilled with stump dirt. VOCs, SVOCs, metals, pesticides (including toxaphene), and herbicides were historically detected in soil samples collected at SWMU #8.
SWMU 9	Chemical Plant	4	1940 - Present	Approximately 90 ft. by 125 ft.	The plant formerly manufactured synthetic pine oil, synthetic solvenol, and camphene. Crude sulfate turpentine was distilled in the area next to the Chemical Plant. Manufacture of synthetic pine oil, synthetic solvenol, and camphene; as well as crude sulfate distillation, was discontinued in 2006. Crude sulfate turpentine was distilled in the area next to the Chemical Plant.In 2007, the plant was converted to phosphate ester production. Secondary containment upgrades to the area have been	VOCs, SVOCs, metals, pesticides (including toxaphene), polychlorinated biphenyls, and furans have been detected in soil samples collected at SWMU #9.
SWMU 10	Former Surface Impoundments	3	1971 - 1980	Five impoundments, covering about 8 acres	Used for the equalization and settling of wastewater from the toxaphene manufacturing process. In 1980, the production of toxaphene ceased. In 1984, Hercules conducted extensive soil removal activities in the area where surface impoundments were historically located in the northern portion of the Brunswick facility. Specifically, Hercules excavated soils down to the water table, and the excavated materials were disposed off-site at a permitted landfill located in South Carolina. The area was backfilled with a mix of imported backfill and soil from the stump dirt removal process. The removal of soils from the surface impoundment area was part of efforts to meet the "closure by removal" standards then applicable in 40 C.F.R. Part 265 for the surface impoundments. Certification of closure of the surface impoundments by a certified professional engineer was completed in October 1984, and the closure certification was confirmed in a letter from EPD to Hercules dated December 14, 1984. Additional fill material was placed in the area in the early 1990s to create a mound shape to provide a sound barrier between the operational areas at the Brunswick facility and residential areas located to the north of the Brunswick facility.	Hercules installed a groundwater pump and treat system east of the former surface impoundments in 1995 and operated the system until 2009 as an interim corrective measure to remove and treat groundwater from the area between the former surface impoundments and the former equalization basin in the northern portion of the Brunswick facility. The pump and treat system withdrew groundwater from a 55-foot deep well installed between SWMU No. 10 (the former surface impoundments) and SWMU No. 11 (the former equalization basin). The extracted water was processed through a green sand bed, a resin (PM100) bed, and two activated carbon treatment units to remove organic and inorganic constituents before discharging the extracted water to the local publicly-owned treatment works ("POTW"). The use of this system was suspended in 2009 when the local POTW informed Hercules that it would no longer accept the effluent from the treatment system. Hercules later evaluated reactivating the pump and treat system but concluded through intervening groundwater monitoring that the prior closure of the surface impoundments and the previous 14 years of pumping had been effective in this case and was no longer necessary to address potential offsite groundwater impacts in the deep zone of the upper surficial aquifer. VOCs, SVOCs, metals, and pesticides (including toxaphene) were historically detected in soil samples collected at SWMU #10.
SWMU 11	Former Equalization Basin	3	1971 - 1998	2-acres in area and 6-ft. deep and had a capacity of 2,000,000 gallons.	Used for equalizing the flow of process wastewater that is discharged to the City of Brunswick Publicly Owned Treatment Works (POTW). Hercules investigated the Equalization Basin in 1990 to determine whether the basin was impacting groundwater. As part of the work, three groundwater monitoring well clusters (POC-1, POC-2 and MW-3) were installed within the shallow and intermediate zones of the upper surficial aquifer. A follow-up to this investigation was conducted in September 1992. This work consisted of collecting multi-depth groundwater samples at 12 locations using hydropunch technology, re-sampling the previously installed monitoring wells, and collecting surface water samples from the equalization basin. Six new groundwater monitoring wells (MW-4, MW-5S, MW-5I, MW-6, MW-7, and MW-8) were also installed as part of the investigation activities. In mid-1998, this system was replaced with two, aboveground equalization tanks (T-3 and T-4) and a lined one million gallon equalization basin,	In 2000, the water, sludge, liner, and berms were removed from the former equalization basin, backfilled with clean soil, graded and vegetated. The excavated material was disposed off-site. At the time of the removal of the liner in 2000, it showed no signs of breaches or other wear. VOCs, SVOCs, metals, herbicides, furans, and toxaphene were histroically detected in soil samples collected at SWMU #11. Some of these detections were the target of the remedial excavation actions.
SWMU 12	Former Tank Car Percolation Pits	2	1965-1968 to 1979-1980	(5) surface impoundments approximately 16 to 22 ft wide and 3-5 ft deep, having a total length of approximately 1,000 ft	These impoundments received wastewater from tank car cleaning. At the time of their closure in 1979-1980, the remaining water in the impoundments was discharged to the N Street Ditch. Two feet of sludge was allowed to dry in place and stump dirt was used to fill in the impoundments level with the ground surface.	These impoundments were closed in place in 1979-1980. VOCs, SVOCs, metals, pesticides (including toxaphene), herbicides, furans, and dioxins have been detected in soil samples collected at SWMU #12.

Table 2-1
Solid Waste Management Units Summary
Hercules/Pinova Facility, Brunswick, Georgia

SWMU ID	SWMU Name	Exposure Domain	Operation Period	Dimension/Size/Container	Operation	Contaminant Information
SWMU 13	Residue Fuel Tanks Area	4	1930s - 2001	5,000-10,000 gallon steel tanks on approximately 80 ft. long and 50 ft. wide secondary containment concrete	This area, part of the plant Stillhouse, was reportedly constructed in the 1930s and was formerly used for chemical storage in tanks. The tanks in this area were used to store chemicals, including terpene resins, gum, various rosins, pine oils, turpentines, diisopropylbenzene, Kymene, and fatty acid esters. All of the tanks were dismantled and removed between 1999 and 2001.	Soil was removed from around each tank down to the groundwater table between 1999 and 2001 and the area was backfilled with clean soil. No further action is required at this SWMU. VOCs SVOCs, metals, and pesticides (including toxaphene) have been detected in soil samples collected at SWMU #13.
SWMU 14	Stillhouse Railcar Loading Area	4	1950 - 1980s	Consisted 70 ft. long by 30 ft. wide concrete pad with curbing and an associated sump	The area was used to load and unload solvents and distillates into rail cars. Some minor spillage was previously observed on the concrete pad. The area is no longer in service.	Materials historically managed in the Stillhouse near this area included benzene and xylenes. Some minor spillage was observed on the concrete pad in 2000. NAPL may be present on the groundwater surface in this area. VOCs and metals have been detected in soil samples collected at SWMU #14.
SWMU 15	Old Extractor Bldg & Tank Area	4	1920s - 1989	200 ft. long and 60 ft. wide steel building on a concrete pad	This area consisted of a 200 ft. long and 60 ft. wide steel building on a concrete pad enclosing a process area with 34 reactor vessels for extracting rosin. Concrete in the area has been observed to be degraded in several places.In the late 1990s, most (80%) of the building was torn down to the concrete pad. Above ground storage tanks present on these concrete pads, used to store solvents, are currently still in	Materials managed in the area include benzene (until 1970), MIBK, and extracted wood rosin solution. VOCs, SVOCs, metals, pesticides (including toxaphene), and polychlorinated biphenyls have been detected in soil samples collected at SWMU #15.
SWMU 16	Sawdust Pile	2	mid to late 1980s - Present	Sawdust pile 700 ft. long, and 350 ft. wide on the east side and 50 ft. wide on the west side	This area is located southwest of the Pexite Plant. The sawdust is used for power house fuel for the plant. The pile varies in size over time depending on supply and demand.	In the past and on rare occasion, wood pulp with trace amounts of MIBK from the extractor was stored in the area along with wood chips, pine bark and wood shavings. This practice no longer occurs. VOCs, SVOCs, metals, pesticides (including toxaphene), polychlorinated biphenyls, furans, and dioxins have been detected in soil samples collected at SWMU #16.
SWMU 17	Former Sand Blasting Area	1	Prior to 1981	Two open areas	Two open areas (for rail cars and structural steel) for sand blasting and painting. In 1981, the rail car sandblasting was discontinued (building with a concrete floor was constructed in the area). Structural steel sandblasting at the site was discontinued in 2004.	Materials managed in the area include VOCs from painting operations and lead from sand abrasives and paint chips. VOCs, SVOCs, metals, and pesticides (including toxaphene) have been detected in soil samples collected at SWMU #17.
SWMU 18	Former Sludge Tank Area	1	1983 - 1987	(1) 10,000 gallon steel aboveground storage tank (AST) with a 50 ft. by 50 ft. by 4 ft. concrete containment structure	Used to store sludge from SWMU #11 (Equalization Basin). The area included one 10,000 gallon steel aboveground storage tank (AST) with a 50 ft. by 50 ft. by 4 ft. concrete containment structure. The tank has been removed, but the containment structure remains. An aerial photo from 1981 shows no sign of this tank and containment area. The 1994 aerial photograph shows the tank in place. The 2008 aerial photograph shows the area covered with stump dirt.	The equalization basin sludge contained wood pulp and resins. VOCs, SVOCs, metals, and pesticides (including toxaphene) have been detected in soil samples collected at SWMU #18.
SWMU 19	Sand Filter Drying Bed and Pads	3	1989 - January 2009	50 ft. by 20 ft. pad and 18 ft. by 110 ft. (long pad)	Consisted of a subsurface concrete vault with a sand and rock filter bed, a sloped concrete bottom, and a drain discharging to a nearby sump. The associated concrete drying pads are constructed of concrete and sloped to drain excess moisture. No cracks are evident on either pad. Methanol was handled at the long pad when it was used as a truck unloading area for the solvent tanks at SWMU #20 (Amberlite Treatment Unit). SWMU #11 (Equalization Basin) sludge was previously dried on the sand filter drying bed.	Wood pulp, sludges from sumps containing hydrocarbons, and rosins were dried in the sand filter drying beds. Sometimes a Geotube was used to dry wet materials. VOCs, SVOCs, metals and toxaphene have been detected in soil samples collected at SWMU #19.
SWMU 20	Former Amberlite Treatment System	3	1977 - 1982	Four sand and carbon filter tanks, (2) 3,400-gallon steel absorber (resin) tanks, and (2) 7,000-gallon steel tanks	Totally enclosed wastewater treatment system for toxaphene. The area consisted of ASTs (since removed) mounted on either concrete pads or in the case of the solvent tanks, in a secondary containment basin. The system included a feed tank and pump that moved wastewater from the toxaphene surface impoundments to four sand and carbon filter tanks, then into two 3,400-gallon steel absorber (amberlite resin) tanks before discharging to the N Street ditch. Two 7,000-gallon steel tanks were used to store methanol and the contaminated solvent prior to disposal.	Chemicals managed in the surface impoundments include wastewater from the former toxaphene plant including: toxaphene, benzene, ethylbenzene, carbon tetrachloride, xylenes, and chloroform. VOCs, SVOCs, metals, pesticides (including toxaphene), furans and dioxins have been detected in soil samples collected at SWMU #20.
SWMU 21	Hard Resins Tank Farm Area	4	1964-1969 to Present	17 ft. long, 13 ft. wide, and 15 ft. deep concrete sump	The unit consists of a tank farm and piping with secondary containment including in-floor trenches and pipes discharging to a concrete in-ground sump and oil recovery unit. The concrete sump is 17 ft. long, 13 ft. wide, and 15 ft. deep and is in good condition.	Materials managed in the area include wood rosins, glycerin, glycols, pentaerythritol, esters, abietic alcohols, and maleic anhydride. VOCs, SVOCs, metals, pesticides (including toxaphene), and herbicides have been detected in soil samples collected at SWMU #21.
SWMU 22	Terpene Resins Area	4	1979-1980 to Present	--	The unit consists of a process area with tanks, vessels, pipes, and pumps with concrete secondary containment including in-floor concrete trenches and curbing. Materials managed in the area include styrene, polyterpene resins, terpenes, aluminum chloride and xylenes.	Local areas of slightly corroded concrete are present where aluminum chloride had reportably been spilled. VOCs, SVOCs, metals, and pesticides (including toxaphene) have been detected in soil samples collected at SWMU #22.

Table 2-1
Solid Waste Management Units Summary
Hercules/Pinova Facility, Brunswick, Georgia

SWMU ID	SWMU Name	Exposure Domain	Operation Period	Dimension/Size/Container	Operation	Contaminant Information
SWMU 23	Pexite Plant Blowdown Area	4	1985 - Present	9 ft. by 9 ft. concrete pad with a 1ft. high berm on three sides	Consists of a 2 inch diameter pipe from the Pexite processing area discharging onto a 9 ft. by 9 ft. concrete pad with a 1ft. high berm on three sides.	Pale wood rosin accumulates on the concrete pad before it is removed for recycling or offsite disposal. VOCs, SVOCs, metals and toxaphene have been detected in soil samples collected at SWMU #23.
SWMU 24	Toxaphene Stormwater Collection Sump	3	1971 - 1982	First vault (18 ft.by 18 ft. by 10 ft. deep), second vault (12 ft.by 6 ft.)	This unit was constructed in 1971 and consists of a number of storm water drains in the area of the former toxaphene production and storage areas that flowed to a concrete divided in-ground vault. Sediment settled into the first vault (18 ft.by 18 ft. by 10 ft. deep) and then the remaining water flowed into the second vault (12 ft.by 6 ft.). At the time of toxaphene production, storm water was pumped to the former surface impoundments (SWMU#10). This system discontinued discharging to the former surface impoundments prior to 1982.	The SWMU #24 stormwater sump was cleaned out, pressure-washed, and plugged and a roof was installed on the sump to prevent it from filling during rain events. The soil surrounding SWMU #24 was excavated and removed from the site as part of the SWMU #5 CAP implementation. The excavation was backfilled with clean soil. The extent of this excavation was the rail lines to the east and N Street to the south. Metals and toxaphene were detected in soil samples collected at SWMU #24 and were the target of the remedial excavation activities.
SWMU 25	Tank Car Cleaning Area	2	1951 - (Before) 2008	12,000-gallon steel tank	This inactive unit was constructed in 1951 and consists of a concrete sump with an in-ground 12,000-gallon steel tank. Constituents managed include terpenes and pine oils. The only discernable photo of this operation in place is the 1994 aerial photograph. The 2008 aerial photograph shows that all of the SWMU features have	Some stained soils have been observed in the area. VOCs, SVOCs, metals, pesticides (including toxaphene), polychlorinated biphenyls, herbicides, furans, and dioxins have been detected in soil samples collected at SWMU #25.
SWMU 26	Pexite Building Area	4	1920s - Present	--	The unit receives rosin from the extraction area and further processes it into Vinsol® and crude pale rosin. Two solvents are used and recycled in the process.	Materials managed include Soltrol® 10 and Furfural. Records have documented releases in this area. VOCs, SVOCs, metals, and pesticides (including toxaphene) have been detected in soil samples collected at SWMU #26.
SWMU 27	Resin Remelt & Drum Storage	4	1970 - Present	over 100 drums	The unit was used for reworking various resins from the plant and for melting imported rosin materials. The area is covered by a concrete pad and is fenced off to the south.	Drums were temporarily stored in this area containing a variety of materials including waste oil and solvents. VOCs, SVOCs, metals, pesticides (including toxaphene), and polychlorinated biphenyls have been detected in soil samples
SWMU 28	Intermediate Vinsol® Bin	4	1970s - Present	--	The unit is used for storing Vinsol® during process interruptions from the Pexite Building. The bin has three concrete sides and a floor. One side is earthen to enable a loader to periodically remove accumulated Vinsol®. Although Vinsol® contains small amounts of process solvents, the material has no leaching characteristics because it solidifies at ambient temperatures. Review of aerial photography does not reveal any discernable information regarding when the facility was constructed.	Solidified Vinsol with small amounts of solvents. There are no soil sampling results specific to SWMU #28.
SWMU 29	N-Street Ditch, South Ditch, & Small Branch Ditch	1	1945 - Present	--	This active area is the plant-wide system of underground piping; concrete swales and earthen ditches that drain storm water, cooling water, and boiler blowdown water off of the plant property through an NPDES permitted discharge into Dupree Creek. Previous investigations have identified Toxaphene contamination in the plant ditches. Aerial photographs indicate the use of this ditch since at least 1945.	Sediments in SWMU #29 have been excavated and removed from the site as part of the SWMU #5 CAP implementation. The channel is now lined with a concrete revetment and the NPDES discharge point is protected by surface skimmers. EPD approved in December 2010 Hercules' completion of the SWMU 5 CAP soil remediation activities including SWMU 29. VOCs, SVOCs, metals, and pesticides (including toxaphene) were detected in soil samples collected at SWMU #29.
SWMU 30	Non-Hazardous Waste Storage	3	1980s - Present	--	This active area was constructed in the 1980s. The area consists of a raised and curbed concrete pad surrounded by a locked chain-link fence. The pad drains to a sump at the northeast corner of the area and then through an overflow into a storm water swale. Some drums are currently stored in a roofed shed on pallets in the area. Two covered roll-off boxes inside the facility are being used for the collection of oil-contaminated soils and solid materials. Occasionally, drums have been temporarily stored just outside of the facility area.	Materials managed in the area include used oils, nonhazardous waste drums, and asbestos. Impacted soils around the storage area were excvated during the implementation of the SWMU#5 CAP. EPD approved in December 2010 Hercules' completion of the SWMU 5 CAP soil remediation activites including SWMU 30. VOCs, SVOCs, metals, pesticides (including toxaphene), polychlorinated biphenyls, furans, and dioxins have been detected in soil samples collected at SWMU #30.
SWMU 31	Former Mercury Absorber Area	4	1967 - 1993	--	The Mercury Absorber operated between 1967 and 1993 for the purpose of purifying hydrogen. The absorber was used to remove mercury from the hydrogen gas supplied via pipeline from the Brunswick LCP plant located several miles from the Hercules plant. The absorber facility was removed between 1995 and 1996 and mercury contaminated debris and dirt on the concrete pad in the area was removed.	Mercury was the only hazardous constituent handled at this unit. The absorber facility was removed between 1995 and 1996 and mercury contaminated debris and dirt on the concrete pad in the area was removed. No records of the removal action are available. Mercury has been detected in soil samples collected at SWMU #31.
SWMU 32	Staybellite Area	4	late 1960s - Present	--	In this area, crude pale rosin from the Pexite area is processed by hydrogenation and catalytic reaction to produce Staybelite and Foral. Hydrogen is produced as a by-product of the process and is compressed and stored in the area. In 2000, concrete pads were added under the process area.	Materials managed in the area include palladium catalyst, wood resins, compressor oil, and heat exchanger fluids. There have been documented releases of non-hazardous product from this area in the past. VOCs, SVOCs, metals, pesticides (including toxaphene), furans, and dioxins have been detected in soil samples collected at SWMU #32.

Table 2-1
Solid Waste Management Units Summary
Hercules/Pinova Facility, Brunswick, Georgia

SWMU ID	SWMU Name	Exposure Domain	Operation Period	Dimension/Size/Container	Operation	Contaminant Information
SWMU 33	Tank Truck Liquid Loading Area	4	1980s - Present	--	In this area, liquid products from the terpenes production area are loaded into tanker trailers. A concrete pad adjacent to the west side of Dubignon Street is surrounded by curbing with a raised concrete berm at each end. The trucks are parked in this area during loading. The pad drains to a sump where liquids are pumped to a lift station, as necessary. Aerial photography confirmed no previous industrial activity in this	Staining was previously observed on the ground around the containment area. VOCs, SVOCs, metals, pesticides (including toxaphene), polychlorinated biphenyls, furans and dioxins have been detected in soil samples collected at SWMU #33.
SWMU 34	Product & Wastewater Piping	Multiple	Unknown-present	--	This SWMU includes the product and wastwater pipelines in the production area of the facilty.	Releases from this SWMU were addressed on a sitewide basis. Soil samples have not been collected to assess releases from this SWMU.
SWMU 35	Former Drum Storage Area	4	1970s - 1999	As many as 600 drums	This unit was used to temporarily store material that was to be reworked in the crown extractor. During previous inspections, this area contained as many as 600 drums containing terpin hydrate, pale wood rosin, and waste material from the process areas. The area also contained a melter, which has since been removed. Presently, all of the material in the drums has been reworked and the area is no longer used for drum storage. The area has never been paved and no soil staining is evident.	Materials managed in the area have included terpin hydrate, pale wood rosin, and process area cleanings. No documented releases have occurred in this area. VOCs, SVOCs, metals, pesticides (Including toxaphene), and polychlorinated biphenyls have been detected in soil samples collected at SWMU #35.
SWMU 36	Former Kymene Production Area and Tank Farm	4	1977 - 1985	--	Kymene, a chemical that adds strength to wet paper, was produced in this area. It was produced via reactions of various chemicals not related to the wood resins that are extracted in the rest of the plant. Chemicals used in the process were either part of the final product or were recycled. Distillation heels were pumped to the area lift station. The process equipment has been removed, but most of the tank farm is still in place. The tank farm is divided into two areas; one surrounded by a tall concrete wall and the other surrounded by a curb. The wall and curb are in good condition except for a few cracks that have been patched. Both areas have concrete floors and two of the tanks in the high walled area are in use by other processes. All other tanks are empty. Materials were delivered by tanker truck and offloaded on a containment	Materials previously managed at the facility included Allyl chloride, monomethyl amine, caustic soda, hydrochloric acid, epichlorohydrin, sodium bisulfate, and t-butyl hydroperoxide. A hydrochloric acid spill occurred in this area at an unspecified date prior to 2010. The spill was neutralized and washed into the lift station. VOCs, SVOCs, metals, pesticides (including toxaphene) and polychlorinated biphenyls were detected in soil samples collected at SWMU #36.
SWMU 37	Basin/Impoundments West of Lift Station 17	3	1950s - 1998	(2) earthen/concrete basins	The unit was first constructed as two earthen basins. These impoundments were used for drying sludge from the API oil skimmer prior to sludge disposal. In the early 1970s, these earthen impoundments were replaced by concrete walls and floors. Currently, the west wall is open to facilitate ingress/egress.	Materials managed at the facility include wastewater sludge containing oils and solvents and non-hazardous materials included soaps, wood products, and soils. There is no record of any releases from this area. Soil sampling have not been performed specific to SWMU #37.
SWMU 38	ICM Recovery Well Area	3	1995 - 2009	--	A pilot groundwater pump and treat system was installed as an interim corrective measure (ICM) in 1995 to test the effectiveness of carbon adsorption on the contaminated groundwater in the area between the former toxaphene surface impoundments (SWMU #10) and the former equalization basin (SWMU #11).	A leak occurred in the treatment system in late 1999 during which some untreated groundwater drained onto the soil near the ICM recovery well. VOCs, metals and toxaphene have been detected in soil samples collected at SWMU #38.
SWMU 39	Refinery Process Building	4	1911 - Present (Portion built in the early 1900s)	--	A multi-floor building is utilized during the refining of wood rosins and pine oils derived from the extraction of pine stumps. Rosins, oils and the system solvent (MIBK) are separated through various evaporation stages. A portion of the original facility was built in the early 1900s. Several modifications have been made to the building. Concrete flooring exists throughout the entire working floor of the refinery. However, some cracks exist due to its age.	Materials managed at the facility include wood rosins, pine oils, and MIBK. Prior to 1970, gasoline and benzene were utilized as the system solvents and were processed in the area. Internal reported releases evidence spills having occurred on the concrete floor (near cracks in concrete). Containment concrete was added to the tank area in the southwest corner of the refinery. No records exist of sampling in this area during facility modifications.
SWMU 40	Central Accumulation Area (Former Hazardous Waste Storage Unit)	2	1981 to present	No more than 48 drums	The Central Accumulation Area (CAA) is a less than 90-day storage area and is designed to store up to 48 drums of hazardous waste (55 gallons x 48). Because the CAA is now being used solely to temporarily store investigation-derived wastes ("IDW") qualifying as hazardous wastes from the corrective action process at the Facility, the actual volumes of hazardous wastes currently being temporarily stored at the CAA are approximately 1,760 gallons or less.	The CAA is subbject to closure requirements as specified in the Hazardous Waste Permit.

Table 2-2
Monitoring Well and Observation Well Construction Details
Hercules/Pinova Facility, Brunswick, Georgia

Well ID	Easting	Northing	Hydrogeologic Unit		Top of Casing (ft MSL)	Ground Surface (ft MSL)	Well Depth (ft bgs)	Screened Interval (ft bgs)	Top of Screen Depth (ft bgs)	Bottom of Screen Depth (ft bgs)	Top Screen Elevation (ft MSL)	Bottom Screen Elevation (ft MSL)
			Aquifer Unit	Aquifer Zone								
Groundwater Monitoring Wells												
MW-1S	425325.8	871609.6	Upper Surficial Aquifer	Shallow	9.21	6.7	10.5	0.5 - 10.5	0.5	10.5	6.20	-3.80
MW-1D	425321.9	871608.5	Upper Surficial Aquifer	Shallow	9.50	6.7	30.2	20.2 - 30.2	20.2	30.2	-12.01	-22.01
MW-2S	425200.9	871588.9	Upper Surficial Aquifer	Shallow	8.99	6.8	10.8	3.8 - 10.8	3.8	10.8	2.98	-4.02
MW-2D	425195.9	871588.6	Upper Surficial Aquifer	Intermediate	9.05	6.8	34.5	24.5 - 34.5	24.5	34.5	-13.94	-23.94
MW-3S	425718.1	871407.6	Upper Surficial Aquifer	Shallow	10.84	8.4	13.0	3.1 - 13	3.1	13.0	5.26	-4.64
MW-3D	425716.7	871412.0	Upper Surficial Aquifer	Intermediate	10.88	8.4	35.0	25.1 - 35	25.0	35.0	-16.62	-26.62
MW-4	425431.1	871896.2	Upper Surficial Aquifer	Shallow	9.24	6.8	25.0	15 - 25	15.0	25.0	-8.17	-18.17
MW-5S	425252.0	871894.8	Upper Surficial Aquifer	Shallow	9.31	6.7	25.5	15.5 - 25.5	15.5	25.5	-8.77	-18.77
MW-5I	425247.6	871894.8	Upper Surficial Aquifer	Intermediate	9.10	6.7	35.5	25 - 35	25.0	35.0	-18.30	-28.30
MW-7	425478.6	871672.0	Upper Surficial Aquifer	Shallow	9.06	6.6	25.5	15.5 - 25.5	15.5	25.5	-8.87	-18.87
MW-8	425018.4	871655.8	Upper Surficial Aquifer	Shallow	9.97	7.4	25.5	15.5 - 25.5	15.5	25.5	-8.14	-18.14
MW-9S	423982.6	872055.0	Upper Surficial Aquifer	Shallow	8.42	6.0	20.5	13.2 - 20.5	13.2	20.5	-7.24	-14.54
MW-9D	423987.6	872053.1	Upper Surficial Aquifer	Deep	8.82	5.5	83.2	76.1 - 83.2	76.1	83.2	-70.64	-77.74
MW-10S	424312.9	872320.2	Upper Surficial Aquifer	Shallow	8.87	6.4	18.0	10.0-18.0	9.8	17.5	-3.43	-11.13
MW-10D	424316.0	872323.5	Upper Surficial Aquifer	Deep	9.31	6.0	95.5	87.8 - 95.4	87.8	95.4	-81.84	-89.44
MW-11S	424867.8	872437.5	Upper Surficial Aquifer	Shallow	7.82	5.4	20.5	13.8 - 20.5	13.8	20.5	-8.44	-15.14
MW-11D	424864.6	872440.5	Upper Surficial Aquifer	Intermediate	8.26	4.9	55.0	48.5 - 55	48.5	55.0	-43.64	-50.14
MW-11DD	424866.6	872461.5	Upper Surficial Aquifer	Deep	8.23	5.20	91.0	81 - 91	81.0	91.0	-75.80	-85.80
MW-12S	425600.7	872109.7	Upper Surficial Aquifer	Shallow	10.18	7.6	20.5	11.6 - 20.5	11.6	20.5	-4.00	-12.90
MW-12D	425596.4	872108.9	Upper Surficial Aquifer	Deep	10.72	7.5	104.5	95.4 - 104.5	95.4	104.5	-87.93	-97.03
MW-13	424302.4	872746.7	Lower Surficial Aquifer	--	10.64	7.7	132.0	122 - 132	122.0	132.0	-114.26	-124.26
MW-14S	423982.7	871201.5	Upper Surficial Aquifer	Shallow	7.85	7.6	15.0	5 - 15	5.0	15.0	2.56	-7.44
MW-14D	423979.9	871193.7	Upper Surficial Aquifer	Deep	7.64	7.3	87.0	77-87	77.0	87.0	-69.69	-79.69
MW-15S	424830.1	871272.9	Upper Surficial Aquifer	Shallow	10.18	7.8	15.0	5 - 15	5.0	15.0	2.75	-7.25
MW-15D	424927.8	871264.2	Upper Surficial Aquifer	Deep	9.98	7.4	90.0	80 - 90	80.0	90.0	-72.55	-82.55
MW-16S	423507.4	869672.3	Upper Surficial Aquifer	Shallow	13.80	10.8	15.0	5 - 15	5.0	15.0	5.79	-4.21
MW-16D	423499.7	869670.8	Upper Surficial Aquifer	Deep	13.80	11.13	80.0	70-80	70.0	80.0	-58.87	-68.87
MW-17S	424809.7	869189.6	Upper Surficial Aquifer	Shallow	14.13	11.12	15.0	5 - 15	5.0	15.0	6.12	-3.88
MW-17D	424803.6	869192.6	Upper Surficial Aquifer	Deep	14.49	11.82	85.0	75-85	75.0	85.0	-63.18	-73.18
MW-18	426528.7	868825.3	Lower Surficial Aquifer	--	21.76	17.87	132.0	122 - 132	122.0	132.0	-104.13	-114.13
MW-19S	426289.5	868932.3	Upper Surficial Aquifer	Shallow	20.66	18.56	15.0	5 - 15	5.0	15.0	13.56	3.56
MW-19I	426287.3	868927.3	Upper Surficial Aquifer	Intermediate	20.61	17.52	45.0	35 - 45	35.0	45.0	-17.48	-27.48
MW-19D	426291.8	868940.2	Upper Surficial Aquifer	Deep	20.99	18.03	83.0	71-83	71.0	83.0	-52.97	-64.97
MW-20S	424176.2	872825.8	Upper Surficial Aquifer	Shallow	10.25	7.08	15.3	5 - 15	5.0	15.0	2.08	-7.92
MW-20I	424179.8	872823.8	Upper Surficial Aquifer	Intermediate	10.23	8.02	45.0	35 - 45	35.0	45.0	-26.98	-36.98
MW-20D	424185.0	872819.9	Upper Surficial Aquifer	Deep	9.69	7.68	90.0	80 - 90	80.0	90.0	-72.32	-82.32
MW-21	424317.0	870454.1	Upper Surficial Aquifer	Shallow	9.83	10.02	15.0	5.0 - 15.0	5.0	15.0	5.02	-4.98
MW-22	424347.0	870491.1	Upper Surficial Aquifer	Shallow	9.70	9.94	14.7	4.67 - 14.67	4.7	14.7	5.27	-4.73
MW-23	424392.1	870474.3	Upper Surficial Aquifer	Shallow	9.64	9.87	14.0	4.0 - 14.0	4.0	14.0	5.87	-4.13
MW-24	424374.6	870415.9	Upper Surficial Aquifer	Shallow	9.72	10.00	15.0	4.8 - 14.8	4.8	14.8	5.20	-4.80
MW-25S	423393.4	870992.3	Upper Surficial Aquifer	Shallow	10.40	11.53	15.0	5-15	5.0	15.0	6.53	-3.47
MW-25D	423393.3	870982.2	Upper Surficial Aquifer	Deep	10.30	11.23	80.0	70-80	70.0	80.0	-58.77	-68.77
MW-26S	425332.2	872431.3	Upper Surficial Aquifer	Shallow	7.25	7.43	15.0	5 - 15	5.0	15.0	2.43	-7.57
MW-26D	425330.3	872441.3	Upper Surficial Aquifer	Deep	7.11	7.38	90.0	80 - 90	80.0	90.0	-72.62	-82.62
MW-27D	424775.7	868899.2	Upper Surficial Aquifer	Deep	14.78	12.56	90.5	80.5 - 90.5	80.5	90.5	-67.94	-77.94
MW-28D	424096.6	872456.4	Upper Surficial Aquifer	Deep	8.65	5.91	91.0	81 - 91	81.0	91.0	-75.09	-85.09
MW-29S	424982.5	872671.3	Upper Surficial Aquifer	Shallow	8.95	5.68	25.3	15-25	15.0	25.0	-9.32	-19.32
MW-29I	424954.4	872667.9	Upper Surficial Aquifer	Intermediate	8.74	6.14	50.5	40.5 - 50.5	40.5	50.5	-34.36	-44.36
MW-29D	424964.1	872668.0	Upper Surficial Aquifer	Deep	9.12	6.37	89.8	79.75 - 89.75	79.8	89.8	-73.38	-83.38
MW-30S	426102.4	870791.0	Upper Surficial Aquifer	Shallow	12.36	9.96	15.0	5 - 15	5.0	15.0	4.96	-5.04
MW-30D	426101.7	870800.9	Upper Surficial Aquifer	Deep	12.38	9.90	90.5	80.5 - 90.5	80.5	90.5	-70.60	-80.60
MW-31D	425661.3	869693.6	Upper Surficial Aquifer	Deep	16.30	13.84	90.5	80.2 - 90.2	80.2	90.2	-66.36	-76.36
MW-32D	425877.6	871596.9	Upper Surficial Aquifer	Deep	12.50	10.07	90.0	79.8 - 89.8	79.8	89.8	-69.73	-79.73
MW-33	424112.7	871782.1	Lower Surficial Aquifer	--	9.17	6.57	130.0	120 - 130	120	130.0	-113.43	-123.43
MW-34	425390.4	870377.0	Lower Surficial Aquifer	--	13.95	11.35	130.2	120.2 - 130.2	120.2	130.2	-108.85	-118.85
MW-35I	423541.7	871546.4	Upper Surficial Aquifer	Intermediate	10.52	7.42	52.2	42.2-52.2	42.2	52.2	-34.78	-44.78
MW-35D	423542.9	871554.9	Upper Surficial Aquifer	Deep	10.18	7.76	91.0	80.7 - 90.7	80.7	90.7	-72.94	-82.94
MW-36D	425660.7	868489.0	Upper Surficial Aquifer	Deep	15.74	13.22	91.0	81 - 91	81.0	91.0	-67.78	-77.78

Table 2-2
Monitoring Well and Observation Well Construction Details
Hercules/Pinova Facility, Brunswick, Georgia

Well ID	Easting	Northing	Hydrogeologic Unit		Top of Casing (ft MSL)	Ground Surface (ft MSL)	Well Depth (ft bgs)	Screened Interval (ft bgs)	Top of Screen Depth (ft bgs)	Bottom of Screen Depth (ft bgs)	Top Screen Elevation (ft MSL)	Bottom Screen Elevation (ft MSL)
			Aquifer Unit	Aquifer Zone								
Groundwater Monitoring Wells												
MW-37S	427021.4	867926.2	Upper Surficial Aquifer	Shallow	17.15	14.28	25.0	15-25	15.0	25.0	-0.72	-10.72
MW-37I	427022.2	867920.7	Upper Surficial Aquifer	Intermediate	16.91	14.17	75.0	60-75	60.0	75.0	-45.83	-60.83
MW-37D	427022.6	867917.2	Lower Surficial Aquifer	--	17.79	14.37	110.0	100-110	100.0	110.0	-85.63	-95.63
MW-38S	424935.4	873054.8	Upper Surficial Aquifer	Shallow	8.64	5.83	25.0	10-25	10.0	25.0	-4.17	-19.17
MW-38I	424936.7	873051.9	Upper Surficial Aquifer	Intermediate	8.75	5.81	55.0	40-55	40.0	55.0	-34.19	-49.19
MW-38D	424939.0	873047.6	Upper Surficial Aquifer	Deep	8.69	5.76	85.0	75-85	75.0	85.0	-69.24	-79.24
MW-39S	424321.7	873717.4	Upper Surficial Aquifer	Shallow	9.38	6.92	21.0	6-21	6.0	21.0	0.92	-14.08
MW-39I	424316.0	873719.3	Upper Surficial Aquifer	Intermediate	9.51	6.85	55.0	45-55	45.0	55.0	-38.15	-48.15
MW-39D	424309.7	873721.5	Upper Surficial Aquifer	Deep	9.79	6.87	85.0	75-85	75.0	85.0	-68.14	-78.14
MW-40S	424370.1	869355.2	Upper Surficial Aquifer	Shallow	14.15	11.65	25.0	10-25	10.0	25.0	1.65	-13.35
MW-40I	424365.4	869354.6	Upper Surficial Aquifer	Intermediate	14.05	11.69	55.0	40-55	40.0	55.0	-28.31	-43.31
MW-40D	424362.7	869354.3	Lower Surficial Aquifer	--	14.11	11.67	110.0	100-110	100.0	110.0	-88.33	-98.33
MW-41I	425872.1	871633.3	Upper Surficial Aquifer	Intermediate	12.36	9.66	48.0	38-48	38.0	48.0	-28.34	-38.34
MW-42S	424651.6	870489.3	Upper Surficial Aquifer	Shallow	11.52	8.80	20.0	10-20	10.0	20.0	-1.20	-11.20
MW-42I	424643.9	870491.4	Upper Surficial Aquifer	Intermediate	11.43	8.80	50.0	40-50	40.0	50.0	-31.20	-41.20
MW-42D	424657.9	870487.0	Upper Surficial Aquifer	Deep	11.54	8.70	98.0	88-98	88.0	98.0	-79.30	-89.30
MW-43S	424639.3	871552.9	Upper Surficial Aquifer	Shallow	9.94	7.00	20.0	10-20	10.0	20.0	-3.00	-13.00
MW-43I	424637.4	871545.2	Upper Surficial Aquifer	Intermediate	9.93	7.10	50.0	40-50	40.0	50.0	-32.90	-42.90
MW-43D	424636.8	871537.0	Upper Surficial Aquifer	Deep	9.96	7.10	99.0	89-99	89.0	99.0	-81.90	-91.90
MW-44S	424874.7	871756.3	Upper Surficial Aquifer	Shallow	11.75	9.18	21.0	11-21	11.0	21.0	-1.82	-11.82
MW-44I	424877.6	871754.9	Upper Surficial Aquifer	Intermediate	11.77	9.26	55.0	40-55	40.0	55.0	-30.74	-45.74
MW-44ID	424880.1	871753.3	Upper Surficial Aquifer	Deep	11.77	8.94	100.0	90-100	90.0	100.0	-81.06	-91.06
MW-44D	424883.5	871751.7	Lower Surficial Aquifer	--	11.79	8.95	130.0	120-130	120.0	130.0	-111.05	-121.05
MW-45I	423892.0	870162.2	Upper Surficial Aquifer	Intermediate	13.74	10.98	55.0	40-55	40.0	55.0	-29.02	-44.02
MW-46I	423608.1	871022.7	Upper Surficial Aquifer	Intermediate	10.92	8.32	55.0	40-55	40.0	55.0	-31.68	-46.68
MW-48S	424383.3	870157.6	Upper Surficial Aquifer	Shallow	11.04	8.83	25.0	10-25	10.0	25.0	-1.17	-16.17
MW-48I	424390.9	870164.9	Upper Surficial Aquifer	Intermediate	10.94	8.75	55.0	40-55	40.0	55.0	-31.26	-46.26
MW-48D	424392.8	870154.6	Upper Surficial Aquifer	Deep	10.99	9.01	91.0	81-91	81.0	91.0	-71.99	-81.99
MW-49S	424230.9	870730.9	Upper Surficial Aquifer	Shallow	10.00	10.10	20.0	10-20	10.0	20.0	0.10	-9.90
MW-49I	424229.7	870726.5	Upper Surficial Aquifer	Intermediate	9.85	10.10	67.0	57-67	57.0	67.0	-46.90	-56.90
MW-49D	424232.1	870735.1	Upper Surficial Aquifer	Deep	9.79	10.10	96.0	86-96	86.0	96.0	-75.90	-85.90
MW-50S	422953.1	872360.3	Upper Surficial Aquifer	Shallow	7.82	7.80	20.0	10-20	10.0	20.0	-2.20	-12.20
MW-50I	422952.7	872366.4	Upper Surficial Aquifer	Intermediate	7.88	7.90	46.0	36-46	36.0	46.0	-28.10	-38.10
MW-50D	422952.2	872372.5	Upper Surficial Aquifer	Deep	8.01	8.10	88.0	78-88	78.0	88.0	-69.90	-79.90
MW-51S	423424.6	872733.4	Upper Surficial Aquifer	Shallow	6.71	7.00	20.0	10-20	10.0	20.0	-3.00	-13.00
MW-51I	423430.1	872734.5	Upper Surficial Aquifer	Intermediate	6.75	7.10	50.0	40-50	40.0	50.0	-32.90	-42.90
MW-51D	423435.3	872735.5	Upper Surficial Aquifer	Deep	6.68	7.10	86.0	76-86	76.0	86.0	-68.90	-78.90
MW-52S	425611.9	872662.5	Upper Surficial Aquifer	Shallow	7.26	7.60	20.0	10-20	10.0	20.0	-2.40	-12.40
MW-52I	425604.1	872662.9	Upper Surficial Aquifer	Intermediate	7.33	7.50	50.0	40-50	40.0	50.0	-32.50	-42.50
MW-52D	425608.4	872668.8	Upper Surficial Aquifer	Deep	7.41	7.50	89.0	79-89	79.0	89.0	-71.50	-81.50
MW-53S	424165.6	871731.4	Upper Surficial Aquifer	Shallow	10.01	7.01	21.0	6-21	6.0	21.0	1.01	-13.99
MW-53D	424155.5	871740.3	Upper Surficial Aquifer	Deep	9.36	6.69	91.0	81-91	81.0	91.0	-74.31	-84.31
MW-54S	424965.8	870896.4	Upper Surficial Aquifer	Shallow	11.16	8.82	25.0	10-25	10.0	25.0	-1.18	-16.18
MW-54I	424962.3	870897.8	Upper Surficial Aquifer	Intermediate	11.09	8.78	55.0	40-55	40.0	55.0	-31.22	-46.22
MW-54D	424957.9	870899.8	Upper Surficial Aquifer	Deep	11.11	8.81	90.0	80-90	80.0	90.0	-71.19	-81.19
MW-55S	873353.4	424924.4	Upper Surficial Aquifer	Shallow	8.07	5.28	25.0	10-25	10.0	25.0	-4.72	-19.72
MW-55I	873363.2	424922.8	Upper Surficial Aquifer	Intermediate	7.92	5.07	55.0	40-55	40.0	55.0	-34.93	-49.93
MW-55D	873358.3	424923.6	Upper Surficial Aquifer	Deep	7.81	5.31	85.0	75-85	75.0	85.0	-69.69	-79.69
MW-56D	425400.1	873176.7	Upper Surficial Aquifer	Deep	5.58	5.90	103.0	93-103	93.0	103.0	-87.10	-97.10
MW-57D	425877.6	872717.1	Upper Surficial Aquifer	Deep	6.90	7.30	92.0	82-92	82.0	92.0	-74.70	-84.70
MW-58I	423939.7	872395.2	Upper Surficial Aquifer	Intermediate	7.30	7.74	49.7	39.7-49.7	39.7	49.7	-31.96	-41.96
MW-58D	423941.3	872389.5	Upper Surficial Aquifer	Deep	7.26	7.72	83.1	73.1-83.1	73.1	83.1	-65.38	-75.38
MW-59I	423799.3	872634.9	Upper Surficial Aquifer	Intermediate	6.02	6.47	48.2	38.2-48.2	38.2	48.2	-31.73	-41.73
MW-59D	423794.2	872633.2	Upper Surficial Aquifer	Deep	6.18	6.51	90.5	80.5-90.5	80.5	90.5	-73.99	-83.99
MW-60I	423984.4	872709.7	Upper Surficial Aquifer	Intermediate	6.10	6.44	49.8	39.8-49.8	39.8	49.8	-33.36	-43.36
MW-60D	423989.9	872710.4	Upper Surficial Aquifer	Deep	5.91	6.32	95.3	85.3-95.3	85.3	95.3	-78.98	-88.98
MW-61I	423958.1	873293.8	Upper Surficial Aquifer	Intermediate	8.76	6.13	49.0	39-49	39.0	49.0	-32.87	-42.87
MW-61D	423960.9	873282.0	Upper Surficial Aquifer	Deep	9.07	6.28	87.0	77-87	77.0	87.0	-70.72	-80.72

Table 2-2
Monitoring Well and Observation Well Construction Details
Hercules/Pinova Facility, Brunswick, Georgia

Well ID	Easting	Northing	Hydrogeologic Unit		Top of Casing (ft MSL)	Ground Surface (ft MSL)	Well Depth (ft bgs)	Screened Interval (ft bgs)	Top of Screen Depth (ft bgs)	Bottom of Screen Depth (ft bgs)	Top Screen Elevation (ft MSL)	Bottom Screen Elevation (ft MSL)
			Aquifer Unit	Aquifer Zone								
Groundwater Monitoring Wells												
MW-62S	424825.2	872646.6	Upper Surficial Aquifer	Shallow	9.11	6.00	21.3	11-21	11.0	21.0	-5.00	-15.00
MW-62I	424820.8	872637.9	Upper Surficial Aquifer	Intermediate	9.12	5.92	48.3	38-48	38.0	48.0	-32.08	-42.08
MW-62D	424832.3	872639.4	Upper Surficial Aquifer	Deep	8.90	5.92	90.3	80-90	80.0	90.0	-74.08	-84.08
MW-63I	423050.3	871689.4	Upper Surficial Aquifer	Intermediate	6.41	6.70	45.8	35.8 - 45.8	35.8	45.8	-29.1	-39.1
MW-63D	423040.1	871691.3	Upper Surficial Aquifer	Deep	6.10	6.77	87.5	77.5 - 87.5	77.5	87.5	-70.7	-80.7
MW-64I	423317.2	871892.4	Upper Surficial Aquifer	Intermediate	6.01	6.40	50.0	40 - 50	40.0	50.0	-33.6	-43.6
POC-1S	425678.7	871047.2	Upper Surficial Aquifer	Shallow	15.70	13.66	20.0	10.0 - 20.0	10.0	20.0	3.66	-6.34
POC-1D	425687.8	871049.2	Upper Surficial Aquifer	Deep	14.74	13.06	103.0	93 - 103	93.0	103.0	-79.94	-89.94
POC-2S	425519.6	871187.1	Upper Surficial Aquifer	Shallow	18.13	16.55	23.0	13 - 23	13.0	23.0	3.55	-6.45
POC-2D	425529.0	871189.3	Upper Surficial Aquifer	Deep	18.54	16.35	103.6	97 - 107	93.6	103.6	-77.25	-87.25
POC-3S	425382.1	871181.3	Upper Surficial Aquifer	Shallow	10.75	8.76	13.5	3 - 13	3.0	13.5	5.76	-4.74
POC-3D	425392.1	871180.7	Upper Surficial Aquifer	Deep	11.57	9.65	91.6	81.8 - 91.6	81.8	91.6	-72.15	-81.95
UP-1S	426133.2	869994.0	Upper Surficial Aquifer	Shallow	15.23	12.89	14.0	2.5 - 12.5	2.5	14.0	10.39	-1.11
UP-1D-R	426123.3	869993.2	Upper Surficial Aquifer	Deep	15.00	12.90	92.0	82 - 92	82.0	92.0	-69.10	-79.10
Observation Wells												
OW-Q1S	425014.4	872814.8	Upper Surficial Aquifer	Shallow	7.80	4.98	15.3	5-15	5.0	15.0	-0.02	-10.02
OW-Q1I	425013.6	872825.3	Upper Surficial Aquifer	Intermediate	7.71	5.14	50.3	40-50	40.0	50.0	-34.86	-44.86
OW-Q1D	425011.9	872833.5	Upper Surficial Aquifer	Deep	7.80	5.11	90.3	80-90	80.0	90.0	-74.89	-84.89
OW-Q2S	425012.4	872666.2	Upper Surficial Aquifer	Shallow	8.28	5.35	17.3	7-17	7.0	17.0	-1.65	-11.65
OW-Q2I	425034.3	872667.1	Upper Surficial Aquifer	Intermediate	8.93	5.91	50.3	40-50	40.0	50.0	-34.09	-44.09
OW-Q2D	425022.9	872666.3	Upper Surficial Aquifer	Deep	8.41	5.60	90.3	80-90	80.0	90.0	-74.40	-84.40
OW-Q3S	425163.6	872110.1	Upper Surficial Aquifer	Shallow	6.07	6.35	25.3	15-25	15.0	25.0	-8.65	-18.65
OW-Q3I	425158.3	872102.6	Upper Surficial Aquifer	Intermediate	6.15	6.35	65.3	57-65	57.0	65.0	-50.65	-58.65
OW-Q4S	424992.4	872980.0	Upper Surficial Aquifer	Shallow	7.80	4.77	15.3	5-15	5.0	15.0	-0.23	-10.23
OW-Q4I	424990.9	872990.2	Upper Surficial Aquifer	Intermediate	7.84	4.86	51.3	41-51	41.0	51.0	-36.14	-46.14
OW-Q4D	424987.6	873000.7	Upper Surficial Aquifer	Deep	7.98	5.28	90.3	80-90	80.0	90.0	-74.72	-84.72
PSOW-11	425175.6	872111.1	Upper Surficial Aquifer	Deep	6.64	6.90	83.0	78-83	78.0	83.0	-71.10	-76.10
PSOW-12	425175.6	872111.1	Upper Surficial Aquifer	Deep	6.62	6.90	89.0	84-89	84.0	89.0	-77.10	-82.10
Aerobic Biorenediation Pilot Test Wells												
BS-1	424973.1	872676.5	Upper Surficial Aquifer	Deep	9.00	5.77	95.0	92-94	92.0	94.0	-86.23	-88.23
BS-2	424947.7	872676.0	Upper Surficial Aquifer	Deep	8.85	5.54	95.0	92-94	92.0	94.0	-86.46	-88.46
BS-3	424949.8	872680.6	Upper Surficial Aquifer	Deep	8.63	5.50	99.0	98-99	98.0	99.0	-92.50	-93.50
BS-OW-1	424941.2	872681.2	Upper Surficial Aquifer	Deep	8.22	5.12	93.0	80-90	80.0	90.0	-74.88	-84.88
BS-OW-2	424985.1	872686.1	Upper Surficial Aquifer	Deep	8.50	5.63	93.0	82-92	82.0	92.0	-76.37	-86.37
BS-OW-3I	424967.0	872691.4	Upper Surficial Aquifer	Intermediate	8.42	5.03	61.0	50-60	50.0	60.0	-44.97	-54.97
BS-OW-3D	424959.7	872691.1	Upper Surficial Aquifer	Deep	8.70	5.03	93.0	82-92	82.0	92.0	-76.97	-86.97

Notes:
ID - Identification
ft - feet
ft MSL - feet above mean sea level
ft bgs - feet below ground surface
-- - Not applicable
MW - Monitoring Well
POC - Point of Compliance
UP - Upgradient location representative of background conditions
OW - Observation Well
PSOW - PlumeStop® Observation Well installed in 2015 as part of a pilot test to evaluate PlumeStop® as potential remedial option.
BS - Biosparge

Table 3-1
Summary of Hydraulic Conductivity Data
Hercules/Pinova Facility, Brunswick, Georgia

Aquifer Zone	Well ID	Northing	Easting	Screened Interval (ft bgs)	Hydraulic Conductivity		Average Hydraulic Conductivity					
							ft/day			cm/sec		
					ft/day	cm/sec	Average	Minimum	Maximum	Average	Minimum	Maximum
Horizontal Hydraulic Conductivity												
Shallow	UP-1S[1][2]	426133.2	869994.0	2.5-12.5	6.5	2.3E-03	9.8	3.4	32.3	2.2E-03	1.1E-03	4.5E-03
	POC-1S[1][2]	425678.7	871047.2	10-20	5.1	1.8E-03						
	POC-2S[1][2]	425519.6	871187.1	13-23	4.2	1.5E-03						
	POC-3S[1][2]	425382.1	871181.3	3-13	3.4	1.2E-03						
	ICMRW-02[5]	--	--	15-25	12.7	4.5E-03						
	ICMRW-02[6]	--	--	15-25	6.0	2.1E-03						
	ICMRW-03[5]	425630.8	871368.9	15-25	8.5	3.0E-03						
	HPT Average[4]	--	--	~5-20	32.3	1.1E-03						
Intermediate	MW-20I[1][3]	424179.8	872823.8	35-45	27.0	9.5E-03	27.0	8.4	45.7	5.2E-03	3.0E-03	9.5E-03
	MW-11D[1][3]	424864.6	872440.5	48.5-55	8.4	3.0E-03						
	HPT Average[4]	--	--	~35-45	45.7	3.0E-03						
Deep	MW-36D[1][3]	425660.7	868489.0	81-91	0.8	2.8E-04	32.0	0.8	105.0	1.1E-02	2.8E-04	3.7E-02
	POC-1D[1][2]	425687.8	871049.2	93-103	1.7	6.0E-04						
	POC-2D[1][2]	425529.0	871189.3	97-107	4.5	1.6E-03						
	POC-3D[1][2]	425392.1	871180.7	81.8-91.6	4.0	1.4E-03						
	UP-1D[1][2]	426123.3	869993.2	85-95	1.6	5.6E-04						
	UP-1D(R)[1][2]	426123.3	869993.2	82-92	9.8	3.5E-03						
	PSOW-1[5]	425193.8	872077.3	78-83	19.7	6.9E-03						
	PSOW-2[5]	425193.8	872077.3	84-89	25.8	9.1E-03						
	PSOW-7[5]	425176.6	872101.3	78-83	28.7	1.0E-02						
	PSOW-8[5]	425176.6	872101.3	84-89	69.9	2.5E-02						
	PSINJ-1[5]	425195.3	872088.3	75-90	40.9	1.4E-02						
	PSINJ-2[5]	425175.7	872082.1	75-90	75.5	2.7E-02						
	HPT Average[4]	--	--	~70-100	59.7	2.1E-02						
	APT-01[7]	425185.29	872100.41	75-95	105.0	3.7E-02						
Vertical Hydraulic Conductivity												
Semi-Confining Unit	MW-43D[8]	424636.8	871537.0	105-107[9]	0.026	9.19E-06	0.014	0.0027	0.026	5.07E-06	9.51E-07	9.19E-06
	MW-49D[8]	424232.1	870735.1	101-103[9]	0.0027	9.51E-07						

Notes:

(1) Based on individual well aquifer test using a solid slug
(2) NewFields, 2001
(3) Antea, 2016c
(4) Antea, 2015 Hydraulic Profiling, MF-5 is coincident to PSOW-7/8.
(5) Antea, 2015 Pneumatic Slug Testing
(6) Antea, 2015 Pump Test
(7) Geosyntec, 2020 Pump Test
(8) Antea, 2015 Shelby Tube Permeability Test
(9) Depth range represents Shelby Tube sample interval

ID - Identification
cm/sec - centimeter per second
ft bgs - feet below ground surface
ft/day - feet per day

Table 3-2
Summary of Recent Groundwater Elevations
Hercules/Pinova Facility, Brunswick, Georgia

Well ID	Northing	Easting	Hydrogeologic Unit		Top of Casing (ft MSL)		Ground Surface (ft MSL)	Well Depth (ft bgs)	Screened Interval (ft bgs)	Top Screen Elevation (ft MSL)	Bottom Screen Elevation (ft MSL)	December 2020 [1]		June 2021 [2]	
			Aquifer Unit	Aquifer Zone	December 2020	June 2021						Depth to Water (ft bgs)	Groundwater Elevation (ft MSL)	Depth to Water (ft bgs)	Groundwater Elevation (ft MSL)
MW-1S	425325.8	871609.6	Upper Surficial Aquifer	Shallow	9.21	9.21	6.70	10.5	0.5-10.5	6.20	-3.80	5.25	3.96	NM	--
MW-1D	425321.9	871608.5	Upper Surficial Aquifer	Shallow	9.50	9.50	6.70	30.2	20.2-30.2	-13.50	-23.50	5.25	4.25	5.92	3.58
MW-2S	425200.9	871588.9	Upper Surficial Aquifer	Shallow	8.99	8.99	6.80	10.8	3.8-10.8	3.00	-4.00	5.68	3.31	6.03	2.96
MW-2D	425195.9	871588.6	Upper Surficial Aquifer	Intermediate	9.05	9.05	6.80	34.5	24.5-34.5	-17.70	-27.70	5.13	3.92	5.68	3.37
MW-3S	425718.1	871407.6	Upper Surficial Aquifer	Shallow	10.84	10.84	8.40	13.0	3.1-13	5.30	-4.60	4.14	6.70	4.81	6.03
MW-3D	425716.7	871412.0	Upper Surficial Aquifer	Intermediate	10.88	10.88	8.40	35.0	25.1-35	-16.60	-26.60	5.07	5.81	6.00	4.88
MW-4	425431.1	871896.2	Upper Surficial Aquifer	Shallow	9.24	9.24	6.80	25.0	15-25	-8.20	-18.20	5.17	4.07	5.97	3.27
MW-5S	425252.0	871894.8	Upper Surficial Aquifer	Shallow	9.31	9.31	6.70	25.5	15.5-25.5	-8.80	-18.80	5.82	3.49	6.43	2.88
MW-5I	425247.6	871894.8	Upper Surficial Aquifer	Intermediate	9.10	9.10	6.70	35.5	25-35	-18.30	-28.30	5.35	3.75	6.14	2.96
MW-7	425478.6	871672.0	Upper Surficial Aquifer	Shallow	9.06	9.06	6.60	25.5	15.5-25.5	-8.90	-18.90	4.49	4.57	5.25	3.81
MW-8	425018.4	871655.8	Upper Surficial Aquifer	Shallow	9.97	9.97	7.40	25.5	15.5-25.5	-8.10	-18.10	6.35	3.62	6.86	3.11
MW-9S	423982.6	872055.0	Upper Surficial Aquifer	Shallow	8.42	8.42	6.00	20.5	13.2-20.5	-7.20	-14.50	5.21	3.21	5.96	2.46
MW-9D	423987.6	872053.1	Upper Surficial Aquifer	Deep	8.82	8.82	5.50	83.2	76.1-83.2	-70.60	-77.70	5.02	3.80	5.96	2.86
MW-10S	424312.9	872320.2	Upper Surficial Aquifer	Shallow	8.87	8.87	6.40	18.0	10.0-18.0	-3.40	-11.10	6.09	2.78	6.70	2.17
MW-10D	424316.0	872323.5	Upper Surficial Aquifer	Deep	9.31	9.31	6.00	95.5	87.8-95.4	-81.80	-89.40	6.14	3.17	7.15	2.16
MW-11S	424867.8	872437.5	Upper Surficial Aquifer	Shallow	7.82	7.82	5.40	20.5	13.8-20.5	-8.40	-15.10	5.50	2.32	6.37	1.45
MW-11D	424864.6	872440.5	Upper Surficial Aquifer	Intermediate	8.26	8.26	4.90	55.0	48.5-55	-43.60	-50.10	4.80	3.46	5.85	2.41
MW-11DD	424866.6	872461.5	Upper Surficial Aquifer	Deep	8.23	8.23	5.20	91.0	81-91	-75.80	-85.80	4.99	3.24	6.01	2.22
MW-12S	425600.7	872109.7	Upper Surficial Aquifer	Shallow	10.18	10.18	7.60	20.5	11.6-20.5	-4.00	-12.90	6.19	3.99	6.90	3.28
MW-12D	425596.4	872108.9	Upper Surficial Aquifer	Deep	10.72	10.72	7.50	104.5	95.4-104.5	-87.90	-97.00	7.38	3.34	8.36	2.36
MW-13	424302.4	872746.7	Lower Surficial Aquifer	--	10.64	10.64	7.70	132.0	122-132	-114.30	-124.30	7.24	3.40	8.20	2.44
MW-14S	423982.7	871201.5	Upper Surficial Aquifer	Shallow	7.85	7.85	7.60	15.0	5-15	2.60	-7.40	2.49	5.36	2.96	4.89
MW-14D	423979.9	871193.7	Upper Surficial Aquifer	Deep	7.64	7.64	7.30	87.0	77-87	-69.70	-79.70	2.96	4.68	3.79	3.85
MW-15S	424830.1	871272.9	Upper Surficial Aquifer	Shallow	10.18	10.18	7.80	15.0	5-15	2.80	-7.20	5.76	4.42	6.34	3.84
MW-15D	424927.8	871264.2	Upper Surficial Aquifer	Deep	9.98	9.98	7.40	90.0	80-90	-72.60	-82.60	5.50	4.48	6.37	3.61
MW-16S	423507.4	869672.3	Upper Surficial Aquifer	Shallow	13.80	13.80	10.80	15.0	5-15	5.80	-4.20	7.54	6.26	8.30	5.50
MW-16D [3]	423499.7	869670.8	Upper Surficial Aquifer	Deep	NG - Damaged	13.80	11.13	80.0	70-80	-58.87	-68.87	NG - Damaged	--	9.72	4.08
MW-17S [4]	424809.7	869189.6	Upper Surficial Aquifer	Shallow	14.38	14.13	11.12	15.0	5-15	6.12	-3.88	6.82	7.56	7.78	6.35
MW-17D	424803.6	869192.6	Upper Surficial Aquifer	Deep	14.49	14.49	11.80	85.0	75-85	-63.20	-73.20	8.57	5.92	9.41	5.08
MW-18	426528.7	868825.3	Lower Surficial Aquifer	--	21.76	21.76	17.87	132.0	122-132	-104.13	-114.13	17.33	4.43	18.63	3.13
MW-19S	426289.5	868932.3	Upper Surficial Aquifer	Shallow	20.66	20.66	18.60	15.0	5-15	13.60	3.60	10.57	10.09	11.40	9.26
MW-19I [4]	426287.3	868927.3	Upper Surficial Aquifer	Intermediate	20.95	20.61	17.52	45.0	35-45	-17.48	-27.48	11.23	9.72	12.05	8.56
MW-19D	426291.8	868940.2	Upper Surficial Aquifer	Deep	20.99	20.99	18.00	83.0	71-83	-53.00	-65.00	14.37	6.62	15.65	5.34
MW-20S [4]	424176.2	872825.8	Upper Surficial Aquifer	Shallow	10.57	10.25	7.08	15.3	5-15	2.08	-7.92	6.70	3.87	7.41	2.84
MW-20I [5]	424179.8	872823.8	Upper Surficial Aquifer	Intermediate	10.54	10.23	8.02	45.0	35-45	-26.98	-36.98	7.26	3.28	8.42	1.81
MW-20D [5]	424185.0	872819.9	Upper Surficial Aquifer	Deep	9.99	9.69	7.68	90.0	80-90	-72.32	-82.32	6.75	3.24	7.95	1.74
MW-21	424317.0	870454.1	Upper Surficial Aquifer	Shallow	9.83	9.83	10.00	15.0	5.0-15.0	5.00	-5.00	2.35	7.48	2.49	7.34
MW-22	424347.0	870491.1	Upper Surficial Aquifer	Shallow	9.70	9.70	9.90	14.7	4.67-14.67	5.30	-4.80	2.32	7.38	2.27	7.43
MW-23	424392.1	870474.3	Upper Surficial Aquifer	Shallow	9.64	9.64	9.90	14.0	4.0-14.0	5.90	-4.10	2.34	7.30	2.24	7.40
MW-24	424374.6	870415.9	Upper Surficial Aquifer	Shallow	9.72	9.72	10.00	15.0	4.8-14.8	5.20	-4.80	2.35	7.37	2.28	7.44
MW-25S	423393.4	870992.3	Upper Surficial Aquifer	Shallow	10.40	10.40	11.50	15.0	5-15	6.50	-3.50	5.96	4.44	6.91	3.49
MW-25D	423393.3	870982.2	Upper Surficial Aquifer	Deep	10.30	10.30	11.20	80.0	70-80	-58.80	-68.80	5.89	4.41	6.80	3.50
MW-26S	425332.2	872431.3	Upper Surficial Aquifer	Shallow	7.25	7.25	7.40	15.0	5-15	2.40	-7.60	4.00	3.25	4.76	2.49
MW-26D	425330.3	872441.3	Upper Surficial Aquifer	Deep	7.11	7.11	7.40	90.0	80-90	-72.60	-82.60	3.67	3.44	4.78	2.33
MW-27D	424775.7	868899.2	Upper Surficial Aquifer	Deep	14.78	14.78	12.60	90.5	80.5-90.5	-67.90	-77.90	10.72	4.06	11.87	2.91
MW-28D	424096.6	872456.4	Upper Surficial Aquifer	Deep	8.65	8.65	5.91	91.0	81-91	-75.10	-85.10	5.35	3.30	6.38	2.27

Table 3-2
Summary of Recent Groundwater Elevations
Hercules/Pinova Facility, Brunswick, Georgia

Well ID	Northing	Easting	Hydrogeologic Unit		Top of Casing (ft MSL)		Ground Surface (ft MSL)	Well Depth (ft bgs)	Screened Interval (ft bgs)	Top Screen Elevation (ft MSL)	Bottom Screen Elevation (ft MSL)	December 2020 (1)		June 2021 (2)	
			Aquifer Unit	Aquifer Zone	December 2020	June 2021						Depth to Water (ft bgs)	Groundwater Elevation (ft MSL)	Depth to Water (ft bgs)	Groundwater Elevation (ft MSL)
MW-29I	424954.4	872667.9	Upper Surficial Aquifer	Intermediate	8.74	8.74	6.10	50.5	40.5-50.5	-34.40	-44.40	5.27	3.47	6.44	2.30
MW-29D	424964.1	872668.0	Upper Surficial Aquifer	Deep	9.12	9.12	6.40	89.8	79.75-89.75	-73.40	-83.40	5.85	3.27	7.03	2.09
MW-30S	426102.4	870791.0	Upper Surficial Aquifer	Shallow	12.36	12.36	10.00	15.0	5-15	5.00	-5.00	5.32	7.04	6.50	5.86
MW-30D	426101.7	870800.9	Upper Surficial Aquifer	Deep	12.38	12.38	9.90	90.5	80.5-90.5	-70.60	-80.60	7.31	5.07	8.21	4.17
MW-31D	425661.3	869693.6	Upper Surficial Aquifer	Deep	16.30	16.30	13.80	90.5	80.2-90.2	-66.40	-76.40	10.41	5.89	11.27	5.03
MW-32D	425877.6	871596.9	Upper Surficial Aquifer	Deep	12.50	12.50	10.10	90.0	79.8-89.8	-69.70	-79.70	8.32	4.18	9.28	3.22
MW-33	424112.7	871782.1	Lower Surficial Aquifer	--	9.17	9.17	6.60	130.0	120-130	-113.40	-123.40	5.49	3.68	6.28	2.89
MW-34	425390.4	870377.0	Lower Surficial Aquifer	--	13.95	13.95	11.40	130.2	120.2-130.2	-108.90	-118.80	9.72	4.23	10.76	3.19
MW-35I	423541.7	871546.4	Upper Surficial Aquifer	Intermediate	10.52	10.52	7.42	52.4	42.15-52.15	-34.73	-44.73	6.52	4.00	7.32	3.20
MW-35D	423542.9	871554.9	Upper Surficial Aquifer	Deep	10.18	10.18	7.80	91.0	80.7-90.7	-72.90	-82.90	6.39	3.79	7.30	2.88
MW-36D	425660.7	868489.0	Upper Surficial Aquifer	Deep	15.74	15.74	13.20	91.0	81-91	-67.80	-77.80	10.56	5.18	11.61	4.13
MW-37S	427021.4	867926.2	Upper Surficial Aquifer	Shallow	17.15	17.15	14.30	25.0	15-25	-0.70	-10.70	7.16	9.99	8.15	9.00
MW-37I	427022.2	867920.7	Upper Surficial Aquifer	Intermediate	16.91	16.91	14.20	75.0	60-75	-45.80	-60.80	9.96	6.95	11.00	5.91
MW-37D	427022.6	867917.2	Lower Surficial Aquifer	--	17.79	17.79	14.37	110.0	100-110	-85.63	-95.63	13.05	4.74	14.33	3.46
MW-38S	424935.4	873054.8	Upper Surficial Aquifer	Shallow	8.64	8.64	5.80	25.0	10-25	-4.20	-19.20	5.46	3.18	7.02	1.62
MW-38I	424936.7	873051.9	Upper Surficial Aquifer	Intermediate	8.75	8.75	5.80	55.0	40-55	-34.20	-49.20	5.47	3.28	6.80	1.95
MW-38D	424939.0	873047.6	Upper Surficial Aquifer	Deep	8.69	8.69	5.80	85.0	75-85	-69.20	-79.20	5.46	3.23	6.79	1.90
MW-39S	424321.7	873717.4	Upper Surficial Aquifer	Shallow	9.38	9.38	6.90	21.0	6-21	0.90	-14.10	7.74	1.64	8.91	0.47
MW-39I	424316.0	873719.3	Upper Surficial Aquifer	Intermediate	9.51	9.51	6.90	55.0	45-55	-38.10	-48.10	6.55	2.96	8.50	1.01
MW-39D	424309.7	873721.5	Upper Surficial Aquifer	Deep	9.79	9.79	6.90	85.0	75-85	-68.10	-78.10	6.80	2.99	8.59	1.20
MW-40S	424370.1	869355.2	Upper Surficial Aquifer	Shallow	14.15	14.15	11.60	25.0	10-25	1.60	-13.40	7.90	6.25	8.41	5.74
MW-40I	424365.4	869354.6	Upper Surficial Aquifer	Intermediate	14.05	14.05	11.70	55.0	40-55	-28.30	-43.30	7.82	6.23	8.46	5.59
MW-40D	424362.7	869354.3	Lower Surficial Aquifer	--	14.11	14.11	11.83	110.0	100-110	-88.30	-98.17	10.03	4.08	11.20	2.91
MW-41I	425872.1	871633.3	Upper Surficial Aquifer	Intermediate	12.36	12.36	9.70	48.0	38-48	-28.30	-38.30	8.36	4.00	9.30	3.06
MW-42S	424651.6	870489.3	Upper Surficial Aquifer	Shallow	11.52	11.52	8.80	20.0	10-20	-1.20	-11.20	4.81	6.71	5.51	6.01
MW-42I	424643.9	870491.4	Upper Surficial Aquifer	Intermediate	11.43	11.43	8.80	50.0	40-50	-31.20	-41.20	5.35	6.08	6.29	5.14
MW-42D	424657.9	870487.0	Upper Surficial Aquifer	Deep	11.54	11.54	8.70	98.0	88-98	-79.30	-89.30	6.21	5.33	7.07	4.47
MW-43S	424639.3	871552.9	Upper Surficial Aquifer	Shallow	9.94	9.94	7.00	20.0	10-20	-3.00	-13.00	4.85	5.09	5.68	4.26
MW-43I	424637.4	871545.2	Upper Surficial Aquifer	Intermediate	9.93	9.93	7.10	50.0	40-50	-32.90	-42.90	5.64	4.29	6.47	3.46
MW-43D	424636.8	871537.0	Upper Surficial Aquifer	Deep	9.96	9.96	7.10	99.0	89-99	-81.90	-91.90	5.71	4.25	6.59	3.37
MW-44S	424874.7	871756.3	Upper Surficial Aquifer	Shallow	11.75	11.75	9.20	21.0	11-21	-1.80	-11.80	7.71	4.04	8.18	3.57
MW-44I	424877.6	871754.9	Upper Surficial Aquifer	Intermediate	11.77	11.77	9.30	55.0	40-55	-30.70	-45.70	7.72	4.05	8.66	3.11
MW-44ID	424880.1	871753.3	Upper Surficial Aquifer	Deep	11.77	11.77	8.90	100.0	90-100	-81.10	-91.10	7.70	4.07	8.65	3.12
MW-44D	424883.5	871751.7	Lower Surficial Aquifer	--	11.79	11.79	9.23	130.0	120-130	-111.10	-120.77	7.77	4.02	8.65	3.14
MW-45I	423892.0	870162.2	Upper Surficial Aquifer	Intermediate	13.74	13.74	11.00	55.0	40-55	-29.00	-44.00	7.16	6.58	8.01	5.73
MW-46I	423608.1	871022.7	Upper Surficial Aquifer	Intermediate	10.92	10.92	8.30	55.0	40-55	-31.70	-46.70	6.18	4.74	7.02	3.90
MW-48S	424383.3	870157.6	Upper Surficial Aquifer	Shallow	NG (6)	11.04	8.80	25.0	10-25	-1.20	-16.20	NG (6)	--	4.33	6.71
MW-48I	424390.9	870164.9	Upper Surficial Aquifer	Intermediate	10.94	10.94	8.70	55.0	40-55	-31.30	-46.30	4.57	6.37	4.35	6.59
MW-48D	424392.8	870154.6	Upper Surficial Aquifer	Deep	10.99	10.99	9.00	91.0	81-91	-72.00	-82.00	5.11	5.88	5.92	5.07
MW-49S	424230.9	870730.9	Upper Surficial Aquifer	Shallow	10	10.00	10.10	20.0	10-20	0.00	-9.90	3.01	6.99	3.33	6.67
MW-49I	424229.7	870726.5	Upper Surficial Aquifer	Intermediate	9.85	9.85	10.10	67.0	57-67	-46.90	-56.90	4.40	5.45	5.26	4.59
MW-49D	424232.1	870735.1	Upper Surficial Aquifer	Deep	9.79	9.79	10.10	96.0	86-96	-75.90	-85.90	4.55	5.24	5.36	4.43
MW-50S	422953.1	872360.3	Upper Surficial Aquifer	Shallow	7.82	7.82	7.80	20.0	10-20	-2.20	-12.20	4.68	3.14	4.95	2.87
MW-50I	422952.7	872366.4	Upper Surficial Aquifer	Intermediate	7.88	7.88	7.90	46.0	36-46	-28.10	-38.10	4.88	3.00	5.88	2.00
MW-50D	422952.2	872372.5	Upper Surficial Aquifer	Deep	8.01	8.01	8.10	88.0	78-88	-69.90	-79.90	4.75	3.26	8.71	-0.70
MW-51S	423424.6	872733.4	Upper Surficial Aquifer	Shallow	6.71	6.71	7.00	20.0	10-20	-3.00	-13.00	3.35	3.36	4.11	2.60
MW-51I	423430.1	872734.5	Upper Surficial Aquifer	Intermediate	6.75	6.75	7.10	50.0	40-50	-32.90	-42.90	3.68	3.07	4.72	2.03
MW-51D	423435.3	872735.5	Upper Surficial Aquifer	Deep	6.68	6.68	7.10	86.0	76-86	-68.90	-78.90	3.57	3.11	4.63	2.05

Table 3-2
Summary of Recent Groundwater Elevations
Hercules/Pinova Facility, Brunswick, Georgia

Well ID	Northing	Easting	Hydrogeologic Unit		Top of Casing (ft MSL)		Ground Surface (ft MSL)	Well Depth (ft bgs)	Screened Interval (ft bgs)	Top Screen Elevation (ft MSL)	Bottom Screen Elevation (ft MSL)	December 2020 (1)		June 2021 (2)	
			Aquifer Unit	Aquifer Zone	December 2020	June 2021						Depth to Water (ft bgs)	Groundwater Elevation (ft MSL)	Depth to Water (ft bgs)	Groundwater Elevation (ft MSL)
MW-52S	425611.9	872662.5	Upper Surficial Aquifer	Shallow	NG (7)	NG (7)	7.60	20.0	10-20	-2.40	-12.40	NG (7)	--	NG (7)	--
MW-52I	425604.1	872662.9	Upper Surficial Aquifer	Intermediate	NG (7)	NG (7)	7.50	50.0	40-50	-32.50	-42.50	NG (7)	--	NG (7)	--
MW-52D	425608.4	872668.8	Upper Surficial Aquifer	Deep	NG (7)	NG (7)	7.50	89.0	79-89	-71.50	-81.50	NG (7)	--	NG (7)	--
MW-53S	424165.6	871731.4	Upper Surficial Aquifer	Shallow	10.01	10.01	7.00	21.0	6-21	1.00	-14.00	6.04	3.97	6.13	3.88
MW-53D	424155.5	871740.3	Upper Surficial Aquifer	Deep	9.36	9.36	6.69	91.3	81-91	-74.31	-84.31	5.34	4.02	6.25	3.11
MW-54S	424965.8	870896.4	Upper Surficial Aquifer	Shallow	11.16	11.16	8.80	25.0	10-25	-1.20	-16.20	5.98	5.18	6.49	4.67
MW-54I	424962.3	870897.8	Upper Surficial Aquifer	Intermediate	11.09	11.09	8.80	55.0	40-55	-31.20	-46.20	6.01	5.08	6.86	4.23
MW-54D	424957.9	870899.8	Upper Surficial Aquifer	Deep	11.11	11.11	8.80	90.0	80-90	-71.20	-81.20	6.25	4.86	7.11	4.00
MW-55S	424924.4	873353.4	Upper Surficial Aquifer	Shallow	8.07	8.07	5.28	25.0	10-25	-4.70	-19.72	6.17	1.90	6.86	1.21
MW-55I	424922.8	873363.2	Upper Surficial Aquifer	Intermediate	7.92	7.92	5.07	55.0	40-55	-34.90	-49.93	4.86	3.06	6.18	1.74
MW-55D	424923.6	873358.3	Upper Surficial Aquifer	Deep	7.812	7.81	5.31	85.0	75-85	-69.70	-79.69	5.00	2.81	6.29	1.52
MW-56D	425400.1	873176.7	Upper Surficial Aquifer	Deep	NG (7)	NG (7)	5.90	103.0	93-103	-87.10	-97.10	NG (7)	--	NG (7)	--
MW-57D	425877.6	872717.1	Upper Surficial Aquifer	Deep	NG (7)	NG (7)	7.30	92.0	82-92	-74.70	-84.70	NG (7)	--	NG (7)	--
MW-58I	423939.7	872395.2	Upper Surficial Aquifer	Intermediate	7.3	7.30	7.74	49.7	39.7-49.7	-32.00	-41.96	3.76	3.54	4.74	2.56
MW-58D	423941.3	872389.5	Upper Surficial Aquifer	Deep	7.26	7.26	7.72	83.1	73.1-83.1	-65.40	-75.38	3.68	3.58	4.68	2.58
MW-59I	423799.3	872634.9	Upper Surficial Aquifer	Intermediate	6.02	6.02	6.47	48.2	38.2-48.2	-31.70	-41.73	2.70	3.32	3.52	2.50
MW-59D	423794.2	872633.2	Upper Surficial Aquifer	Deep	6.18	6.18	6.51	90.5	80.5-90.5	-74.00	-83.99	2.90	3.28	3.24	2.94
MW-60I	423984.4	872709.7	Upper Surficial Aquifer	Intermediate	6.1	6.10	6.44	49.8	39.8-49.8	-33.40	-43.36	2.77	3.33	3.85	2.25
MW-60D	423989.9	872710.4	Upper Surficial Aquifer	Deep	5.91	5.91	6.32	95.3	85.3-95.3	-79.00	-88.98	2.45	3.46	2.91	3.00
MW-61I	423958.1	873293.8	Upper Surficial Aquifer	Intermediate	8.76	8.76	6.13	49.3	39.0-49.0	-32.87	-42.87	5.99	2.77	7.50	1.26
MW-61D	423960.9	873282.0	Upper Surficial Aquifer	Deep	9.07	9.07	6.28	87.3	77.0-87.0	-70.72	-80.72	6.18	2.89	7.64	1.43
POC-1S	425678.7	871047.2	Upper Surficial Aquifer	Shallow	15.70	15.70	13.70	20.0	10.0-20.0	3.70	-6.30	8.87	6.83	9.97	5.73
POC-1D	425687.8	871049.2	Upper Surficial Aquifer	Deep	14.74	14.74	13.10	103.0	93-103	-79.90	-89.90	10.05	4.69	10.90	3.84
POC-2S	425519.6	871187.1	Upper Surficial Aquifer	Shallow	18.13	18.13	16.60	23.0	13-23	3.60	-6.40	11.87	6.26	12.88	5.25
POC-2D	425529.0	871189.3	Upper Surficial Aquifer	Deep	18.54	18.54	16.40	103.6	97-107	-77.30	-87.20	14.03	4.51	14.80	3.74
POC-3S	425382.1	871181.3	Upper Surficial Aquifer	Shallow	10.75	10.75	8.80	13.5	3-13	5.80	-4.70	4.95	5.80	5.80	4.95
POC-3D	425392.1	871180.7	Upper Surficial Aquifer	Deep	11.57	11.57	9.70	91.6	81.8-91.6	-72.20	-81.90	7.10	4.47	7.96	3.61
UP-1S	426133.2	869994.0	Upper Surficial Aquifer	Shallow	15.23	15.23	12.90	14.0	2.5-12.5	10.40	-1.10	6.45	8.78	7.40	7.83
UP-1D-R	426123.3	869993.2	Upper Surficial Aquifer	Deep	15.00	15.00	12.90	92.0	82-92	-69.10	-79.10	9.45	5.55	10.32	4.68

Notes:

ID - Identification
ft - feet
ft MSL - feet above mean sea level
ft bgs - feet below ground surface
NG - Not gauged
-- - Not applicable
MW - Monitoring Well
POC - Point of Compliance
UP - Upgradient location representative of background conditions

(1) December 2020 water levels measured on December 7, 2020.
(2) June 2021 water levels measured on June 7, 2021.
(3) Top of casing and ground surface elevations at monitoring wells MW-16D were re-surveyed on April 19, 2021 following well repairs.
(4) Top of casing and ground surface elevations at monitoring wells MW-17S, MW-19I, and MW-20S were re-surveyed on April 9, 2021.
(5) Top of casing elevation at MW-20I and MW-20D were re-surveyed on June 24, 2021.
(6) Depth to groundwater at MW-48S was not gauged in December 2020 due a pumped installed in the well.
(7) Depth to groundwater not gauged due to refusal of property owner to provide access to monitoring wells.

Table 3-3
Horizontal Groundwater Gradient and Flow Velocity Calculations
Hercules/Pinova Facility, Brunswick, Georgia

Horizontal Hydraulic Gradient (Surficial Aquifer) (1)	December 2020							
	h_1 (ft)	h_2 (ft)	Δl (ft)	Δh/Δl (ft/ft)	K (ft/day)	n	V (ft/day)(2)	V (ft/year)(2)
Shallow Zone: Monitoring Well MW-49S to Monitoring Well MW-39S	6.99	1.64	2,988	0.0018	9.8	0.25	0.07	25.6
Intermediate Zone: Monitoring Well MW-42I to Monitoring Well MW-39I	6.08	2.96	3,245	0.0010	27.0	0.25	0.10	37.9
Deep Zone: Monitoring Well MW-42D to Monitoring Well MW-39D	5.33	2.99	3,247	0.0007	32.0	0.25	0.09	33.7
Lower Unit: Monitoring Well MW-44D to Monitoring Well MW-13	4.02	3.40	1,135	0.0005	No data	--	--	--
	June 2021							
Shallow Zone: Monitoring Well MW-49S to Monitoring Well MW-39S	6.67	0.47	2,988	0.0021	9.8	0.25	0.08	29.7
Intermediate Zone: Monitoring Well MW-42I to Monitoring Well MW-39I	5.14	1.01	3,245	0.0013	27.0	0.25	0.14	50.2
Deep Zone: Monitoring Well MW-42D to Monitoring Well MW-39D	4.47	1.20	3,247	0.0010	32.0	0.25	0.13	47.1
Lower Unit: Monitoring Well MW-44D to Monitoring Well MW-13	3.14	2.44	1,135	0.0006	No data	--	--	--

Groundwater Velocity (Surficial Aquifer)	K (ft/day)	n	Average		
			Δh/Δl (ft/ft)	V (ft/day)(2)	V (ft/year)(2)
Shallow Zone	9.8	0.25	0.0019	0.08	27.7
Intermediate Zone	27.0	0.25	0.0011	0.12	44.0
Deep Zone	34.1	0.25	0.0009	0.12	43.0
Lower Unit	No data	--	--	--	--

verage K

A

Notes:
ft = feet
ft/day = feet per day
ft/ft = feet per foot
ft/year = feet per year
h_1, h_2 = point of interpreted groundwater elevation
Δh/Δl = hydraulic gradient
K = horizontal hydraulic conductivity; values derived from Table 3-1
Δl = distance between location 1 and 2
n = effective porosity
V = groundwater flow velocity
-- = not calculated
(1) Flow paths illustrated on Figures 3-7 to 3-10 of this Corrective Action Plan
(2) Groundwater flow velocity equation: V = [K * (Δh/Δl)] / n

Table 3-4a
Vertical Groundwater Gradient Calculations - December 2020
Hercules/Pinova Facility, Brunswick, Georgia

Well ID	Upper Surficial Aquifer Zone	Date	TOC Elevation (ft MSL)	Depth to Water (ft)	December 2020 Groundwater Elevation (ft MSL)	Change in Head between Monitoring Wells (ft)	Top of Screen Elevation (ft MSL)	Bottom of Screen Elevation (ft MSL)	Screen Midpoint Elevation (ft MSL)	Vertical Distance between Monitoring Wells (ft)	Vertical Gradient (ft/ft)	Groundwater Flow Direction
MW-5S	Shallow	12/7/2020	9.31	5.82	3.49	-0.26	-8.77	-18.77	-13.77	9.53	-2.73E-02	Upward
MW-5I	Intermediate	12/7/2020	9.10	5.35	3.75		-18.3	-28.3	-23.3			
MW-10S	Shallow	12/7/2020	8.87	6.09	2.78	-0.39	-3.43	-11.13	-7.28	78.36	-4.98E-03	Upward
MW-10D	Deep	12/7/2020	9.31	6.14	3.17		-81.84	-89.44	-85.64			
MW-11S	Shallow	12/7/2020	7.82	5.50	2.32	-1.14	-8.44	-15.14	-11.79	35.10	-3.25E-02	Upward
MW-11D	Intermediate	12/7/2020	8.26	4.80	3.46		-43.64	-50.14	-46.89			
						0.22	-43.64	-50.14	-46.89	33.91	6.49E-03	Downward
MW-11DD	Deep	12/7/2020	8.23	4.99	3.24		-75.80	-85.80	-80.80			
MW-12S	Shallow	12/7/2020	10.18	6.19	3.99	0.65	-4.00	-12.9	-8.45	84.03	7.74E-03	Downward
MW-12D	Deep	12/7/2020	10.72	7.38	3.34		-87.93	-97.03	-92.48			
MW-19S	Shallow	12/7/2020	20.66	10.57	10.09	0.37	13.56	3.56	8.56	31.04	1.19E-02	Downward
MW-19I	Intermediate	12/7/2020	20.95	11.23	9.72		-17.48	-27.48	-22.48			
						3.10	-17.48	-27.48	-22.48	36.49	8.50E-02	Downward
MW-19D	Deep	12/7/2020	20.99	14.37	6.62		-52.97	-64.97	-58.97			
MW-20S	Shallow	12/7/2020	10.57	6.70	3.87	0.59	2.08	-7.92	-2.92	29.06	2.03E-02	Downward
MW-20I	Intermediate	12/7/2020	10.54	7.26	3.28		-26.98	-36.98	-31.98			
						0.04	-26.98	-36.98	-31.98	45.33	8.82E-04	Downward
MW-20D	Deep	12/7/2020	9.99	6.75	3.24		-72.32	-82.32	-77.32			
MW-29I	Intermediate	12/7/2020	8.74	5.27	3.47	0.20	-34.36	-44.36	-39.36	39.02	5.13E-03	Downward
MW-29D	Deep	12/7/2020	9.12	5.85	3.27		-73.38	-83.38	-78.38			
MW-37S	Shallow	12/7/2020	17.15	7.16	9.99	3.04	-0.72	-10.72	-5.72	47.61	6.39E-02	Downward
MW-37I	Intermediate	12/7/2020	16.91	9.96	6.95		-45.83	-60.83	-53.33			
MW-38S	Shallow	12/7/2020	8.64	5.46	3.18	-0.10	-4.17	-19.17	-11.67	30.02	-3.33E-03	Upward
MW-38I	Intermediate	12/7/2020	8.75	5.47	3.28		-34.19	-49.19	-41.69			
						0.05	-34.19	-49.19	-41.69	32.54	1.54E-03	Downward
MW-38D	Deep	12/7/2020	8.69	5.46	3.23		-69.24	-79.24	-74.24			
MW-39S	Shallow	12/7/2020	9.38	7.74	1.64	-1.32	0.92	-14.08	-6.58	36.57	-3.61E-02	Upward
MW-39I	Intermediate	12/7/2020	9.51	6.55	2.96		-38.15	-48.15	-43.15			
						-0.03	-38.15	-48.15	-43.15	29.99	-1.00E-03	Upward
MW-39D	Deep	12/7/2020	9.79	6.80	2.99		-68.14	-78.14	-73.14			
MW-40S	Shallow	12/7/2020	14.15	7.90	6.25	0.02	1.65	-13.35	-5.85	29.95	6.68E-04	Downward
MW-40I	Intermediate	12/7/2020	14.05	7.82	6.23		-28.31	-43.31	-35.81			
MW-42S	Shallow	12/7/2020	11.52	4.81	6.71	0.63	-1.20	-11.20	-6.20	30.00	2.10E-02	Downward
MW-42I	Intermediate	12/7/2020	11.43	5.35	6.08		-31.20	-41.20	-36.20			
						0.75	-31.20	-41.20	-36.20	48.10	1.56E-02	Downward
MW-42D	Deep	12/7/2020	11.54	6.21	5.33		-79.30	-89.30	-84.30			
MW-43S	Shallow	12/7/2020	9.94	4.85	5.09	0.80	-3.00	-13.00	-8.00	29.90	2.68E-02	Downward
MW-43I	Intermediate	12/7/2020	9.93	5.64	4.29		-32.90	-42.90	-37.90			
						0.04	-32.90	-42.90	-37.90	49.00	8.16E-04	Downward
MW-43D	Deep	12/7/2020	9.96	5.71	4.25		-81.90	-91.90	-86.90			
MW-44S	Shallow	12/7/2020	11.75	7.71	4.04	-0.01	-1.82	-11.82	-6.82	31.42	-3.18E-04	Upward
MW-44I	Intermediate	12/7/2020	11.77	7.72	4.05		-30.74	-45.74	-38.24			
						-0.02	-30.74	-45.74	-38.24	47.82	-4.18E-04	Upward
MW-44ID	Deep	12/7/2020	11.77	7.70	4.07		-81.06	-91.06	-86.06			
MW-48I	Intermediate	12/7/2020	10.94	4.57	6.37	0.49	-31.26	-46.26	-38.758	38.23	1.28E-02	Downward
MW-48D	Deep	12/7/2020	10.99	5.11	5.88		-71.99	-81.99	-76.99			
MW-49S	Shallow	12/7/2020	10.00	3.01	6.99	1.54	0.10	-9.90	-4.90	47.00	3.28E-02	Downward
MW-49I	Intermediate	12/7/2020	9.85	4.40	5.45		-46.90	-56.90	-51.90			
						0.21	-46.90	-56.90	-51.90	29.00	7.24E-03	Downward
MW-49D	Deep	12/7/2020	9.79	4.55	5.24		-75.90	-85.90	-80.90			
MW-54S	Shallow	12/7/2020	11.16	5.98	5.18	0.10	-1.18	-16.18	-8.68	30.04	3.33E-03	Downward
MW-54I	Intermediate	12/7/2020	11.09	6.01	5.08		-31.22	-46.22	-38.72			
						0.22	-31.22	-46.22	-38.72	37.47	5.87E-03	Downward
MW-54D	Deep	12/7/2020	11.11	6.25	4.86		-71.19	-81.19	-76.19			
MW-55S	Shallow	12/7/2020	8.07	6.17	1.90	-1.17	-4.72	-19.72	-12.22	30.21	-3.87E-02	Upward
MW-55I	Intermediate	12/7/2020	7.92	4.86	3.06		-34.93	-49.93	-42.43			
						0.25	-34.93	-49.93	-42.43	32.26	7.78E-03	Downward
MW-55D	Deep	12/7/2020	7.81	5.00	2.81		-69.69	-79.69	-74.69			

Notes:
TOC: top of casing
ft: feet
ft MSL: feet above mean sea level
ft/ft = feet per foot

Table 3-4b
Vertical Groundwater Gradient Calculations - June 2021
Hercules/Pinova Facility, Brunswick, Georgia

Well ID	Upper Surficial Aquifer Zone	Date	TOC Elevation (ft MSL)	Depth to Water (ft)	June 2021 Groundwater Elevation (ft MSL)	Change in Head between Monitoring Wells (ft)	Top of Screen Elevation (ft MSL)	Bottom of Screen Elevation (ft MSL)	Screen Midpoint Elevation (ft MSL)	Vertical Distance between Monitoring Wells (ft)	Vertical Gradient (ft/ft)	Groundwater Flow Direction
MW-5S	Shallow	6/7/2021	9.31	6.43	2.88	-0.08	-8.77	-18.77	-13.77	9.53	-8.39E-03	Upward
MW-5I	Intermediate	6/7/2021	9.10	6.14	2.96		-18.3	-28.3	-23.3			
MW-10S	Shallow	6/7/2021	8.87	6.70	2.17	0.01	-3.43	-11.13	-7.28	78.36	1.28E-04	Downward
MW-10D	Deep	6/7/2021	9.31	7.15	2.16		-81.84	-89.44	-85.64			
MW-11S	Shallow	6/7/2021	7.82	6.37	1.45	-0.96	-8.44	-15.14	-11.79	35.10	-2.74E-02	Upward
MW-11D	Intermediate	6/7/2021	8.26	5.85	2.41		-43.64	-50.14	-46.89			
						0.19	-43.64	-50.14	-46.89	33.91	5.60E-03	Downward
MW-11DD	Deep	6/7/2021	8.23	6.01	2.22		-75.80	-85.80	-80.80			
MW-12S	Shallow	6/7/2021	10.18	6.90	3.28	0.92	-4.00	-12.9	-8.45	84.03	1.09E-02	Downward
MW-12D	Deep	6/7/2021	10.72	8.36	2.36		-87.93	-97.03	-92.48			
MW-19S	Shallow	6/7/2021	20.66	11.40	9.26	0.70	13.56	3.56	8.56	31.04	2.26E-02	Downward
MW-19I	Intermediate	6/7/2021	20.61	12.05	8.56		-17.48	-27.48	-22.48			
						3.22	-17.48	-27.48	-22.48	36.49	8.82E-02	Downward
MW-19D	Deep	6/7/2021	20.99	15.65	5.34		-52.97	-64.97	-58.97			
MW-20S	Shallow	6/7/2021	10.25	7.41	2.84	1.03	2.08	-7.92	-2.92	29.06	3.54E-02	Downward
MW-20I	Intermediate	6/7/2021	10.23	8.42	1.81		-26.98	-36.98	-31.98			
						0.07	-26.98	-36.98	-31.98	45.33	1.54E-03	Downward
MW-20D	Deep	6/7/2021	9.69	7.95	1.74		-72.32	-82.32	-77.32			
MW-29I	Intermediate	6/7/2021	8.74	6.44	2.30	0.21	-34.36	-44.36	-39.36	39.02	5.38E-03	Downward
MW-29D	Deep	6/7/2021	9.12	7.03	2.09		-73.38	-83.38	-78.38			
MW-37S	Shallow	6/7/2021	17.15	8.15	9.00	3.09	-0.72	-10.72	-5.72	47.61	6.49E-02	Downward
MW-37I	Intermediate	6/7/2021	16.91	11.00	5.91		-45.83	-60.83	-53.33			
MW-38S	Shallow	6/7/2021	8.64	7.02	1.62	-0.33	-4.17	-19.17	-11.67	30.02	-1.10E-02	Upward
MW-38I	Intermediate	6/7/2021	8.75	6.80	1.95		-34.19	-49.19	-41.69			
						0.05	-34.19	-49.19	-41.69	32.54	1.54E-03	Downward
MW-38D	Deep	6/7/2021	8.69	6.79	1.90		-69.24	-79.24	-74.24			
MW-39S	Shallow	6/7/2021	9.38	8.91	0.47	-0.54	0.92	-14.08	-6.58	36.57	-1.48E-02	Upward
MW-39I	Intermediate	6/7/2021	9.51	8.50	1.01		-38.15	-48.15	-43.15			
						-0.19	-38.15	-48.15	-43.15	29.99	-6.34E-03	Upward
MW-39D	Deep	6/7/2021	9.79	8.59	1.20		-68.14	-78.14	-73.14			
MW-40S	Shallow	6/7/2021	14.15	8.41	5.74	0.15	1.65	-13.35	-5.85	29.95	5.01E-03	Downward
MW-40I	Intermediate	6/7/2021	14.05	8.46	5.59		-28.31	-43.31	-35.81			
MW-42S	Shallow	6/7/2021	11.52	5.51	6.01	0.87	-1.20	-11.20	-6.20	30.00	2.90E-02	Downward
MW-42I	Intermediate	6/7/2021	11.43	6.29	5.14		-31.20	-41.20	-36.20			
						0.67	-31.20	-41.20	-36.20	48.10	1.39E-02	Downward
MW-42D	Deep	6/7/2021	11.54	7.07	4.47		-79.30	-89.30	-84.30			
MW-43S	Shallow	6/7/2021	9.94	5.68	4.26	0.80	-3.00	-13.00	-8.00	29.90	2.68E-02	Downward
MW-43I	Intermediate	6/7/2021	9.93	6.47	3.46		-32.90	-42.90	-37.90			
						0.09	-32.90	-42.90	-37.90	49.00	1.84E-03	Downward
MW-43D	Deep	6/7/2021	9.96	6.59	3.37		-81.90	-91.90	-86.90			
MW-44S	Shallow	6/7/2021	11.75	8.18	3.57	0.46	-1.82	-11.82	-6.82	31.42	1.46E-02	Downward
MW-44I	Intermediate	6/7/2021	11.77	8.66	3.11		-30.74	-45.74	-38.24			
						-0.01	-30.74	-45.74	-38.24	47.82	-2.09E-04	Upward
MW-44ID	Deep	6/7/2021	11.77	8.65	3.12		-81.06	-91.06	-86.06			
MW-48S	Shallow	6/7/2021	11.04	4.33	6.71	0.12	-1.20	-16.20	-8.7	30.06	3.99E-03	Downward
MW-48I	Intermediate	6/7/2021	10.94	4.35	6.59		-31.26	-46.26	-38.76			
						1.52	-31.26	-46.26	-38.76	38.23	3.98E-02	Downward
MW-48D	Deep	6/7/2021	10.99	5.92	5.07		-71.99	-81.99	-76.99			
MW-49S	Shallow	6/7/2021	10.00	3.33	6.67	2.08	0.10	-9.90	-4.90	47.00	4.43E-02	Downward
MW-49I	Intermediate	6/7/2021	9.85	5.26	4.59		-46.90	-56.90	-51.90			
						0.16	-46.90	-56.90	-51.90	29.00	5.52E-03	Downward
MW-49D	Deep	6/7/2021	9.79	5.36	4.43		-75.90	-85.90	-80.90			
MW-54S	Shallow	6/7/2021	11.16	6.49	4.67	0.44	-1.18	-16.18	-8.68	30.04	1.46E-02	Downward
MW-54I	Intermediate	6/7/2021	11.09	6.86	4.23		-31.22	-46.22	-38.72			
						0.23	-31.22	-46.22	-38.72	37.47	6.14E-03	Downward
MW-54D	Deep	6/7/2021	11.11	7.11	4.00		-71.19	-81.19	-76.19			
MW-55S	Shallow	6/7/2021	8.07	6.86	1.21	-0.54	-4.72	-19.72	-12.22	30.21	-1.78E-02	Upward
MW-55I	Intermediate	6/7/2021	7.92	6.18	1.74		-34.93	-49.93	-42.43			
						0.22	-34.93	-49.93	-42.43	32.26	6.76E-03	Downward
MW-55D	Deep	6/7/2021	7.81	6.29	1.52		-69.69	-79.69	-74.69			

Notes:
TOC: top of casing
ft: feet
ft MSL: feet above mean sea level
ft/ft = feet per foot

Table 3-5
Summary of Recent Groundwater Analytical Data
Hercules/Pinova Facility, Brunswick, Georgia

Analyte	Units	POC-1S	POC-2S	POC-2D	POC-3S	POC-3D	UP-1S	UP-1D-R	MW-1D	MW-2D	MW-3S		MW-5S	MW-5I
		6/10/2021	6/10/2021	6/9/2021	6/10/2021	6/9/2021	6/9/2021	6/8/2021	6/10/2021	6/10/2021	12/8/2020	6/8/2021	12/8/2020	12/8/2020
	Aquifer	Surficial	Surficial	Surficial	Surficial	Surficial	Surficial	Surficial	Surficial	Surficial	Surficial		Surficial	Surficial
	Aquifer Unit	Upper	Upper	Upper	Upper	Upper	Upper	Upper	Upper	Upper	Upper		Upper	Upper
	Aquifer Zone	Shallow	Shallow	Deep	Shallow	Deep	Shallow	Deep	Shallow	Intermediate	Shallow		Shallow	Intermediate
Field Parameters														
Conductivity	mS/cm	2.12	1.93	7.87	2.01	6.56	0.18	0.55	19.3	13.1	0.568	0.51	22.1	5.22
Oxygen, Dissolved	mg/L	1.78	2.78	1.83	1.96	1.94	2.08	1.98	2.03	2.16	0.45	0.43	1.15	0.39
Oxidation Reduction Potential	mV	-110	-26	-85	-87	-64	54	155	-72	-64	-38	-114	-68	-69
pH	SU	6.34	5.75	6.21	5.65	6.15	4.81	8.36	6.28	6.34	5.97	7.27	5.93	6.15
Temperature	° C	31.54	29.94	26.74	28.67	26.55	24.75	22.72	25.00	25.75	19.95	28.42	20.78	24.1
Turbidity	NTU	12.2	0.0	17.9	0.8	1.7	0.7	9.2	1.4	12.4	5.1	36.2	9.7	4.6
Volatile Organic Compounds														
1,1-Dichloroethane	µg/L	< 1.0	< 200	**2.2**	< 1.0	< 1.0	< 1.0	< 1.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0
1,1-Dichloroethene	µg/L	< 1.0	< 200	< 1.0	**8.7**	< 1.0	< 1.0	< 1.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2,3-Trichloropropane	µg/L	< 1.0	< 200	< 1.0	**4.1**	< 1.0	< 1.0	< 1.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2,4-Trichlorobenzene	µg/L	< 9.8	< 1,000	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 10	< 10	< 5.0	< 5.0	< 5.0	< 5.0
1,2-Dichlorobenzene	µg/L	< 9.8	< 200	< 1.0	**11**	< 1.0	< 1.0	< 1.0	**3.2**	**6.2**	< 1.0	< 1.0	< 1.0	< 1.0
1,2-Dichloropropane	µg/L	< 1.0	< 200	< 1.0	**2.4**	< 1.0	< 1.0	< 1.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0
1,4-Dichlorobenzene	µg/L	< 9.8	< 200	< 1.0	**15**	< 1.0	< 1.0	< 1.0	**4.5**	**6.0**	< 1.0	< 1.0	< 1.0	< 1.0
2-Butanone (MEK)	µg/L	< 10	< 2,000	< 10	< 10	< 10	< 10	< 10	< 20	< 20	< 10	< 10	< 10	< 10
4-Methyl-2-pentanone (MIBK)	µg/L	< 10	< 2,000	< 10	< 10	< 10	< 10	< 10	< 20	< 20	< 10*	< 10	< 10*	< 10*
Acetone	µg/L	< 10	< 2,000	< 10	**35**	< 10	< 10	< 10	< 20	< 20	< 10	< 10	< 10	< 10
Benzene	µg/L	**20**	< 200	< 1.0	**72**	**21**	< 1.0	< 1.0	**120**	**49**	< 1.0	< 1.0	**3.9**	< 1.0
Carbon disulfide	µg/L	< 2.0	< 400	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 4.0	< 4.0	< 2.0	< 2.0	< 2.0	< 2.0
Carbon tetrachloride	µg/L	< 1.0	< 200	< 1.0	**240**	< 1.0	< 1.0	< 1.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0
Chlorobenzene	µg/L	**46**	< 200	< 1.0	**330**	**24**	< 1.0	< 1.0	**210**	**170**	< 1.0	< 1.0	< 1.0	< 1.0
Chloroform	µg/L	< 1.0	**200**	< 1.0	**980**	< 1.0	< 1.0	< 1.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0
cis-1,2-Dichloroethene	µg/L	**1.1**	< 200	< 1.0	**3.1**	< 1.0	< 1.0	< 1.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0
Ethylbenzene	µg/L	**8.8**	**3,700**	< 1.0	**1,100**	< 1.0	< 1.0	< 1.0	**32**	**13**	< 1.0	< 1.0	< 1.0	< 1.0
Isopropylbenzene (Cumene)	µg/L	--	--	--	--	--	--	--	--	--	--	--	--	--
Methylene chloride (Chloromethane)	µg/L	< 5.0	< 1,000	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 10	< 10	< 5.0	< 5.0	< 5.0	< 5.0
p-Isopropyltoluene (Para-cymene)	µg/L	< 1.0	< 200	< 1.0	**34**	< 1.0	< 1.0	< 1.0	**5.7**	**3.8**	< 1.0	< 1.0	< 1.0	< 1.0
Tetrachloroethene	µg/L	< 1.0	< 200	< 1.0	**3.2**	< 1.0	< 1.0	< 1.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0
Toluene	µg/L	**9.3**	< 200	< 1.0	**100**	< 1.0	< 1.0	< 1.0	**3.7**	**2.1**	< 1.0	< 1.0	< 1.0	< 1.0
Trichloroethene	µg/L	< 1.0	< 200	< 1.0	**2.9**	< 1.0	< 1.0	< 1.0	< 2.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0
Vinyl chloride	µg/L	**8.4**	< 200	< 1.0	**5.7**	< 1.0	< 1.0	< 1.0	**2.3**	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0
Xylene, total	µg/L	**27**	**18,000**	< 1.0	**6,900**	**2.1**	< 1.0	< 1.0	**17**	**3.8**	< 1.0	< 1.0	< 1.0	< 1.0
Semi-Volatile Organic Compounds														
2,4,6-Trichlorophenol	µg/L	< 9.8	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	--	--	--	--
2,4-Dimethylphenol	µg/L	< 9.8	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	--	--	--	--
2-Chlorophenol	µg/L	< 9.8	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	--	--	--	--
Acetophenone	µg/L	< 9.8	**15**	< 10	**11**	< 10	< 10	< 10	< 10	< 10	--	--	--	--
Benzo(g,h,i)perylene	µg/L	< 9.8	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	--	--	--	--
bis(2-Ethylhexyl)phthalate	µg/L	< 9.8	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	--	--	--	--
Dibenzo(a,h)anthracene	µg/L	< 9.8	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	--	--	--	--
Indeno (1,2,3-cd) pyrene	µg/L	< 9.8	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	--	--	--	--
m-p-Cresol	µg/L	< 9.8	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	--	--	--	--
Naphthalene	µg/L	< 9.8	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	--	--	--	--
Phenol	µg/L	< 9.8	**16**	< 10	< 10	< 10	< 10	< 10	< 10	< 10	--	--	--	--
Pesticides														
alpha-BHC	µg/L	< 0.23	**6.4**	< 0.046	**8.2**	< 0.046	< 0.046	< 0.046	< 0.046	< 0.046	--	--	--	--
delta-BHC	µg/L	< 0.23	< 0.46	< 0.046	< 0.92	< 0.046	< 0.046	< 0.046	< 0.046	< 0.046	--	--	--	--
gamma-BHC (Lindane)	µg/L	< 0.23	**2**	< 0.046	**3**	< 0.046	< 0.046	< 0.046	< 0.046	< 0.046	--	--	--	--
Heptachlor	µg/L	< 0.23	--	--	--	--	--	--	--	--	--	--	--	--
Toxaphene, TAUC	µg/L	< 23	< 46	< 4.6	**640**	< 4.6	< 4.6	< 4.6	< 4.6	< 4.6	--	< 4.6	--	--
Toxaphene, Technical	µg/L	< 23	< 46	< 4.6	< 92	< 4.6	< 4.6	< 4.6	< 4.6	< 4.6	--	< 4.6	--	--
Metals														
Arsenic [50][1]	µg/L	**3.3**	--	--	--	--	--	--	--	--	--	--	--	--
Barium [1,000]	µg/L	**43**	--	**540**	**43**	**400**	**7.5**	**58**	**1,400**	**940**	--	--	--	--
Beryllium	µg/L	< 0.50	--	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	--	--	--	--
Chromium [50]	µg/L	**16**	--	**52**	**10**	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	--	--	--	--
Cobalt [7.7]	µg/L	**2.1**	--	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	--	--	--	--
Copper	µg/L	< 5.0	--	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	--	--	--	--
Nickel [9.1]	µg/L	< 5.0	--	**16**	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	--	--	--	--
Selenium [10]	µg/L	**5.2**	--	< 2.5	**4.7**	< 2.5	< 2.5	< 2.5	< 2.5	< 2.5	--	--	--	--
Vanadium [Detection Limit]	µg/L	**65**	--	< 10	**27**	< 10	< 10	< 10	< 10	< 10	--	--	--	--
Zinc [64.5]	µg/L	< 20	--	< 20	**24**	< 20	< 20	< 20	< 20	< 20	--	--	--	--
Dioxins/Furans														
Hexachlorodibenzofurans (HxDCF), total	pg/L	< 52	--	--	< 52	--	< 51	--	< 49	< 51	--	--	--	--
hexachlorodibenzo-p-dioxins (HxCDD), total	pg/L	< 52	--	--	< 52	--	< 51	--	< 49	< 51	--	--	--	--
pentachlorodibenzofurans (PeCDF), total	pg/L	< 52	--	--	< 52	--	< 51	--	< 49	< 51	--	--	--	--
pentachlorodibenzo-p-dioxan (PeCDD), total	pg/L	< 52	--	--	< 52	--	< 51	--	< 49	< 51	--	--	--	--
tetrachlorodibenzofuran (TCDF), total	pg/L	< 10	--	--	< 10	--	< 10	--	< 9.9	< 10	--	--	--	--
tetrachlorodibenzodioxin (TCDD), total	pg/L	< 10	--	--	< 10	--	< 10	--	< 9.9	< 10	--	--	--	--
2,3,7,8-TCDD	pg/L	< 10	--	--	< 10	--	< 10	--	< 9.9	< 10	--	--	--	--
Miscellaneous Compounds														
Formaldehyde	µg/L	--	--	--	**57**	--	< 50	--	< 50	< 50	--	--	--	--
Sulfide	mg/L	**3.7**	--	--	**6.4**	--	**1.5**	--	< 0.81	**0.88**	--	--	--	--

Table 3-5
Summary of Recent Groundwater Analytical Data
Hercules/Pinova Facility, Brunswick, Georgia

Analyte	Units	MW-9S	MW-9D	MW-10D	MW-11D	MW-11DD	MW-12S	MW-12D	MW-13	MW-14D	MW-15D	MW-20D	
		12/8/2020	12/8/2020	12/10/2020	6/8/2021	6/10/2021	6/8/2021	6/8/2021	12/8/2020	12/9/2020	12/10/2020	12/9/2020	6/10/2021
	Aquifer	Surficial	Surficial	Surficial	Surficial	Surficial	Surficial	Surficial	Surficial	Surficial	Surficial	Surficial	
	Aquifer Unit	Upper	Upper	Upper	Upper	Upper	Upper	Upper	Lower	Upper	Upper	Upper	
	Aquifer Zone	Shallow	Deep	Deep	Intermediate	Deep	Shallow	Deep	--	Deep	Deep	Deep	
Field Parameters													
Conductivity	mS/cm	1.34	2.48	16.6	2.52	22.3	0.38	20.1	0.479	1.16	3.49	9.86	9.48
Oxygen, Dissolved	mg/L	0.57	0.33	0.49	0.97	0.95	0.28	3.17	0.73	0.48	0.45	0.44	0.33
Oxidation Reduction Potential	mV	11	-12	15	-52	-34	40	-34	-106	-36	-48	-33	-18
pH	SU	5.42	6.36	5.45	7.02	6.10	6.47	6.73	7.63	7.06	6.23	5.47	5.18
Temperature	° C	17.75	20.95	20.36	30.62	24.90	26.06	29.75	21.77	23.26	22.52	21.44	26.99
Turbidity	NTU	2.7	0	4.5	0.8	0.0	18.3	0.0	1.3	0	1.2	21.5	0.0
Volatile Organic Compounds													
1,1-Dichloroethane	µg/L	< 1.0	< 10	< 500	< 1.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 10H4	< 50	< 10
1,1-Dichloroethene	µg/L	< 1.0	< 10	< 500	< 1.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 10H4	< 50	< 10
1,2,3-Trichloropropane	µg/L	< 1.0	< 10	< 500	< 1.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 10H4	< 50	< 10
1,2,4-Trichlorobenzene	µg/L	< 5.0	< 50	< 2500	< 5.0	< 10	< 5.0	< 5.0	< 5.0	< 5.0	< 50H4	< 250	< 50
1,2-Dichlorobenzene	µg/L	< 1.0	< 10	< 500	< 1.0	**2.8**	< 1.0	< 1.0	< 1.0	< 1.0	**24H4**	< 50	**10**
1,2-Dichloropropane	µg/L	< 1.0	< 10	< 500	< 1.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 10H4	< 50	< 10
1,4-Dichlorobenzene	µg/L	< 1.0	**10**	< 500	< 1.0	**4.3**	< 1.0	< 1.0	< 1.0	< 1.0	**39H4**	< 50	**16**
2-Butanone (MEK)	µg/L	< 10	< 100	< 5000*+*1	< 10	< 20	< 10	< 10	< 10	< 10	< 100H4	< 500	< 100
4-Methyl-2-pentanone (MIBK)	µg/L	< 10*	< 100*	< 5000*+	< 10	< 20	< 10	< 10	< 10*	< 10	< 100H4	< 500*	< 100
Acetone	µg/L	< 10	< 100	< 5000	< 10	< 20	< 10	< 10	< 10	< 10	< 100H4	< 500	< 100
Benzene	µg/L	< 1.0	**910**	**740**	**5.1**	**120**	< 1.0	**20**	< 1.0	**28**	**940H4**	**1100**	**1,200**
Carbon disulfide	µg/L	< 2.0	< 20	< 1000	< 2.0	< 4.0	< 2.0	< 2.0	< 2.0	< 2.0	< 20H4	< 100	< 20
Carbon tetrachloride	µg/L	< 1.0	< 10	< 500	< 1.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 10H4	< 50	< 10
Chlorobenzene	µg/L	< 1.0	**440**	**3,900**	**32**	**160**	< 1.0	**15**	< 1.0	< 1.0	**1100H4**	**1700**	**1,200**
Chloroform	µg/L	< 1.0	< 10	**87000*1**	< 1.0	**21**	< 1.0	< 1.0	< 1.0	< 1.0	**41H4**	< 50	< 10
cis-1,2-Dichloroethene	µg/L	< 1.0	< 10	< 500*1	< 1.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 10H4	< 50	< 10
Ethylbenzene	µg/L	< 1.0	< 10	< 500	< 1.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	**77H4**	< 50	**12**
Isopropylbenzene (Cumene)	µg/L	--	--	--	**13**	**16**	--	--	--	--	--	--	--
Methylene chloride (Chloromethane)	µg/L	< 5.0	< 50	**7,900**	< 5.0	**20**	< 5.0	< 5.0	< 5.0	< 5.0	**230H4**	< 250	< 50
p-Isopropyltoluene (Para-cymene)	µg/L	< 1.0	< 10	**890**	< 1.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	**33H4**	< 50	< 10
Tetrachloroethene	µg/L	< 1.0	< 10	< 500	< 1.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 10H4	< 50	< 10
Toluene	µg/L	< 1.0	< 10	< 500	< 1.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	**37H4**	< 50	< 10
Trichloroethene	µg/L	< 1.0	< 10	< 500	< 1.0	< 2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 10H4	< 50	< 10
Vinyl chloride	µg/L	< 1.0	< 10	< 500	< 1.0	**2.6**	< 1.0	< 1.0	< 1.0	< 1.0	< 10H4	< 50	< 10
Xylene, total	µg/L	< 1.0	< 10	< 500	< 1.0	**6.5**	< 1.0	< 1.0	< 1.0	< 1.0	**590H4**	**65**	**37**
Semi-Volatile Organic Compounds													
2,4,6-Trichlorophenol	µg/L	--	--	--	--	< 10	--	< 10	--	--	< 9.5H*-	--	--
2,4-Dimethylphenol	µg/L	--	--	--	--	< 10	--	< 10	--	--	< 9.5H	--	--
2-Chlorophenol	µg/L	--	--	--	--	< 10	--	< 10	--	--	< 9.5H	--	--
Acetophenone	µg/L	--	--	--	--	< 10	--	< 10	--	--	< 9.5H*-	--	--
Benzo(g,h,i)perylene	µg/L	--	--	--	--	< 10	--	< 10	--	--	< 9.5H	--	--
bis(2-Ethylhexyl)phthalate	µg/L	--	--	--	--	< 10	--	< 10	--	--	< 9.5H	--	--
Dibenzo(a,h)anthracene	µg/L	--	--	--	--	< 10	--	< 10	--	--	< 9.5H	--	--
Indeno (1,2,3-cd) pyrene	µg/L	--	--	--	--	< 10	--	< 10	--	--	< 9.5H	--	--
m-p-Cresol	µg/L	--	--	--	--	< 10	--	< 10	--	--	< 9.5H*-	--	--
Naphthalene	µg/L	--	--	--	--	< 10	--	< 10	--	--	< 9.5H*-	--	--
Phenol	µg/L	--	--	--	--	< 10	--	< 10	--	--	< 9.5H	--	--
Pesticides													
alpha-BHC	µg/L	--	--	--	--	< 0.046	--	< 0.046	--	--	< 0.04	--	--
delta-BHC	µg/L	--	--	--	--	< 0.046	--	< 0.046	--	--	< 0.04	--	--
gamma-BHC (Lindane)	µg/L	--	--	--	--	< 0.046	--	< 0.046	--	--	< 0.04	--	--
Heptachlor	µg/L	--	--	--	--	--	--	--	--	--	--	--	--
Toxaphene, TAUC	µg/L	< 4.6	< 4.6	--	--	< 4.6	< 4.6	< 4.6	< 4.6	--	< 4.6	--	--
Toxaphene, Technical	µg/L	< 4.6	< 4.6	--	--	< 4.6	< 4.6	< 4.6	< 4.6	--	< 4.6	--	--
Metals													
Arsenic [50][1]	µg/L	--	--	--	--	--	--	--	--	--	--	--	--
Barium [1,000]	µg/L	--	--	--	--	--	--	--	--	--	--	--	--
Beryllium	µg/L	--	--	--	--	--	--	--	--	--	--	--	--
Chromium [50]	µg/L	--	--	--	--	--	--	--	--	--	--	--	--
Cobalt [7.7]	µg/L	--	--	--	--	--	--	--	--	--	--	--	--
Copper	µg/L	--	--	--	--	--	--	--	--	--	--	--	--
Nickel [9.1]	µg/L	--	--	--	--	--	--	--	--	--	--	--	--
Selenium [10]	µg/L	--	--	--	--	--	--	--	--	--	--	--	--
Vanadium [Detection Limit]	µg/L	--	--	--	--	--	--	--	--	--	--	--	--
Zinc [64.5]	µg/L	--	--	--	--	--	--	--	--	--	--	--	--
Dioxins/Furans													
Hexachlorodibenzofurans (HxDCF), total	pg/L	--	--	--	--	--	--	--	--	--	--	--	--
hexachlorodibenzo-p-dioxins (HxCDD), total	pg/L	--	--	--	--	--	--	--	--	--	--	--	--
pentachlorodibenzofurans (PeCDF), total	pg/L	--	--	--	--	--	--	--	--	--	--	--	--
pentachlorodibenzo-p-dioxan (PeCDD), total	pg/L	--	--	--	--	--	--	--	--	--	--	--	--
tetrachlorodibenzofuran (TCDF), total	pg/L	--	--	--	--	--	--	--	--	--	--	--	--
tetrachlorodibenzodioxin (TCDD), total	pg/L	--	--	--	--	--	--	--	--	--	--	--	--
2,3,7,8-TCDD	pg/L	--	--	--	--	--	--	--	--	--	--	--	--
Miscellaneous Compounds													
Formaldehyde	µg/L	--	--	--	--	--	--	--	--	--	--	--	--
Sulfide	mg/L	--	--	--	--	--	--	--	--	--	--	--	--

Table 3-5
Summary of Recent Groundwater Analytical Data
Hercules/Pinova Facility, Brunswick, Georgia

Analyte	Units	MW-23		MW-25S	MW-26D	MW-28D		MW-29S	MW-29I	MW-29D		MW-35I		MW-35D
		12/10/2020	6/10/2021	12/8/2020	6/9/2021	12/9/2020	6/10/2021	6/8/2021	6/8/2021	12/10/2020	6/10/2021	12/9/2020	6/9/2021	12/9/2020
	Aquifer	Surficial		Surficial	Surficial	Surficial		Surficial	Surficial	Surficial		Surficial		Surficial
	Aquifer Unit	Upper		Upper	Upper	Upper		Upper	Upper	Upper		Upper		Upper
	Aquifer Zone	Shallow		Shallow	Deep	Deep		Shallow	Intermediate	Deep		Intermediate		Deep
Field Parameters														
Conductivity	mS/cm	1.16	1.20	0.862	19.0	12.8	25.3	4.23	1.02	9.12	13.6	0.584	1.44	0.626
Oxygen, Dissolved	mg/L	1.29	0.96	0.33	0.75	0.69	0.36	1.78	3.20	1.73	0.21	0.36	1.72	0.6
Oxidation Reduction Potential	mV	-225	-264	29	-90	-51	-41	-57	-80	-70	-63	-123	-285	-36
pH	SU	5.46	5.39	4.73	7.05	5.51	5.90	6.66	7.11	6.16	6.25	8.5	6.04	7.5
Temperature	° C	22.6	28.76	21.03	29.73	23.58	28.98	29.69	28.82	24.12	33.05	21.51	28.01	19.82
Turbidity	NTU	0.9	0.0	2.1	0.0	2.9	0.0	3.6	0.0	4.7	1.7	1.6	0.0	1.4
Volatile Organic Compounds														
1,1-Dichloroethane	µg/L	< 500*1	< 50	< 1.0	< 1.0	< 500	< 500	< 1.0	< 1.0	< 20*1	< 20	< 20	< 50	< 1.0
1,1-Dichloroethene	µg/L	< 500*1	< 50	< 1.0	< 1.0	< 500	< 500	< 1.0	< 1.0	< 20*1	< 20	< 20	< 50	< 1.0
1,2,3-Trichloropropane	µg/L	< 500	< 50	< 1.0	< 1.0	< 500	< 500	< 1.0	< 1.0	< 20	< 20	< 20	< 50	< 1.0
1,2,4-Trichlorobenzene	µg/L	< 2500	< 250	< 5.0	< 5.0	< 2500	< 2,500	< 5.0	< 5.0	< 100	< 100	< 100	< 250	< 5.0
1,2-Dichlorobenzene	µg/L	< 500	< 50	< 1.0	< 1.0	< 500	< 500	< 1.0	< 1.0	< 20	< 20	< 20	< 50	< 1.0
1,2-Dichloropropane	µg/L	< 500*1	< 50	< 1.0	< 1.0	< 500	< 500	< 1.0	< 1.0	< 20*1	< 20	< 20	< 50	< 1.0
1,4-Dichlorobenzene	µg/L	< 500	< 50	< 1.0	< 1.0	< 500	< 500	< 1.0	< 1.0	< 20	< 20	< 20	< 50	< 1.0
2-Butanone (MEK)	µg/L	< 5000*1	< 500	< 10	< 10	< 5000	< 5,000	< 10	< 10	< 200*1	< 200	< 200	< 500	< 10
4-Methyl-2-pentanone (MIBK)	µg/L	< 5000*+*-*1	< 500	< 10*	< 10	< 5000*	< 5,000	< 10	< 10	< 200*+*-*1	< 200	< 200*	< 500	< 10*
Acetone	µg/L	< 5000*1	< 500	< 10	< 10	< 5000	< 5,000	< 10	< 10	< 200*1	< 200	< 200	< 500	< 10
Benzene	µg/L	**3,400**	**5,100**	< 1.0	< 1.0	**1,000**	**990**	< 1.0	**3.0**	**620**	**1,300**	**1,700**	**2,400**	< 1.0
Carbon disulfide	µg/L	< 1000*-*1	< 100	< 2.0	< 2.0	< 1000	< 1,000	< 2.0	< 2.0	< 40*-*1	< 40	< 40	< 100	< 2.0
Carbon tetrachloride	µg/L	< 500	< 50	< 1.0	< 1.0	< 500	< 500	< 1.0	< 1.0	< 20	< 20	< 20	< 50	< 1.0
Chlorobenzene	µg/L	< 500	< 50	< 1.0	**1.5**	**3,100**	**3,100**	< 1.0	**2.0**	**530**	**690**	< 20	< 50	< 1.0
Chloroform	µg/L	< 500	< 50	< 1.0	< 1.0	**59,000**	**49,000**	< 1.0	< 1.0	< 20	< 20	< 20	< 50	< 1.0
cis-1,2-Dichloroethene	µg/L	< 500*1	< 50	< 1.0	< 1.0	< 500	< 500	< 1.0	< 1.0	< 20*1	< 20	< 20	< 50	< 1.0
Ethylbenzene	µg/L	< 500	< 50	< 1.0	< 1.0	< 500	< 500	< 1.0	< 1.0	**100**	**110**	< 20	< 50	< 1.0
Isopropylbenzene (Cumene)	µg/L	--	--	--	--	--	--	< 1.0	**1.9**	--	**270**	--	--	--
Methylene chloride (Chloromethane)	µg/L	< 2500*-	< 250	< 5.0	< 5.0	**10,000**	**10,000**	< 5.0	< 5.0	< 100*-	< 100	< 100	< 250	< 5.0
p-Isopropyltoluene (Para-cymene)	µg/L	**11,000**	**8,100**	< 1.0	< 1.0	**660**	**770**	< 1.0	< 1.0	< 20	< 20	< 20	< 50	< 1.0
Tetrachloroethene	µg/L	< 500*+*1	< 50	< 1.0	< 1.0	< 500	< 500	< 1.0	< 1.0	< 20*+*1	< 20	< 20	< 50	< 1.0
Toluene	µg/L	**890*1**	**1,100**	< 1.0	< 1.0	< 500	< 500	< 1.0	< 1.0	< 20*1	< 20	< 20	< 50	< 1.0
Trichloroethene	µg/L	< 500	< 50	< 1.0	< 1.0	< 500	< 500	< 1.0	< 1.0	< 20	< 20	< 20	< 50	< 1.0
Vinyl chloride	µg/L	< 500*1	< 50	< 1.0	< 1.0	< 500	< 500	< 1.0	< 1.0	< 20*1	< 20	< 20	< 50	< 1.0
Xylene, total	µg/L	< 500	< 50	**15**	**1.1**	< 500	< 500	< 1.0	**1.8**	**190**	**240**	< 20	< 50	< 1.0
Semi-Volatile Organic Compounds														
2,4,6-Trichlorophenol	µg/L	< 9.5H*-	< 10	--	--	--	--	--	--	--	--	< 9.5	--	--
2,4-Dimethylphenol	µg/L	< 9.5H	< 10	--	--	--	--	--	--	--	--	< 9.5	--	--
2-Chlorophenol	µg/L	< 9.5H	< 10	--	--	--	--	--	--	--	--	< 9.5	--	--
Acetophenone	µg/L	< 9.5H*-	< 10	--	--	--	--	--	--	--	--	< 9.5	--	--
Benzo(g,h,i)perylene	µg/L	< 9.5H	< 10	--	--	--	--	--	--	--	--	< 9.5	--	--
bis(2-Ethylhexyl)phthalate	µg/L	< 9.5H	< 10	--	--	--	--	--	--	--	--	< 9.5	--	--
Dibenzo(a,h)anthracene	µg/L	< 9.5H	< 10	--	--	--	--	--	--	--	--	< 9.5	--	--
Indeno (1,2,3-cd) pyrene	µg/L	< 9.5H	< 10	--	--	--	--	--	--	--	--	< 9.5	--	--
m-p-Cresol	µg/L	**81H**	**110**	--	--	--	--	--	--	--	--	< 9.5	--	--
Naphthalene	µg/L	< 9.5H*-	< 10	--	--	--	--	--	--	--	--	< 9.5	--	--
Phenol	µg/L	**110H**	**130**	--	--	--	--	--	--	--	--	**14**	--	--
Pesticides														
alpha-BHC	µg/L	< 0.46	< 0.046	--	--	--	--	--	--	--	--	< 0.04	--	--
delta-BHC	µg/L	< 0.46	< 0.046	--	--	--	--	--	--	--	--	< 0.04	--	--
gamma-BHC (Lindane)	µg/L	< 0.46	< 0.046	--	--	--	--	--	--	--	--	< 0.04	--	--
Heptachlor	µg/L	--	--	--	--	--	--	--	--	--	--	--	--	--
Toxaphene, TAUC	µg/L	< 46	< 4.6	< 4.6	--	< 4.6	< 46	--	--	--	--	< 4.6	--	< 4.6
Toxaphene, Technical	µg/L	< 46	< 4.6	< 4.6	--	< 4.6	< 46	--	--	--	--	< 4.6	--	< 4.6
Metals														
Arsenic [50][1]	µg/L	--	--	--	--	--	--	--	--	--	--	--	--	--
Barium [1,000]	µg/L	--	--	--	--	--	--	--	--	--	--	**77**	--	--
Beryllium	µg/L	--	--	--	--	--	--	--	--	--	--	< 0.5	--	--
Chromium [50]	µg/L	--	--	--	--	--	--	--	--	--	--	< 5.0	--	--
Cobalt [7.7]	µg/L	--	--	--	--	--	--	--	--	--	--	< 0.5	--	--
Copper	µg/L	--	--	--	--	--	--	--	--	--	--	< 5.0	--	--
Nickel [9.1]	µg/L	--	--	--	--	--	--	--	--	--	--	< 5.0	--	--
Selenium [10]	µg/L	--	--	--	--	--	--	--	--	--	--	< 2.5	--	--
Vanadium [Detection Limit]	µg/L	--	--	--	--	--	--	--	--	--	--	< 10	--	--
Zinc [64.5]	µg/L	--	--	--	--	--	--	--	--	--	--	< 20	--	--
Dioxins/Furans														
Hexachlorodibenzofurans (HxDCF), total	pg/L	--	--	--	--	--	--	--	--	--	--	--	--	--
hexachlorodibenzo-p-dioxins (HxCDD), total	pg/L	--	--	--	--	--	--	--	--	--	--	--	--	--
pentachlorodibenzofurans (PeCDF), total	pg/L	--	--	--	--	--	--	--	--	--	--	--	--	--
pentachlorodibenzo-p-dioxan (PeCDD), total	pg/L	--	--	--	--	--	--	--	--	--	--	--	--	--
tetrachlorodibenzofuran (TCDF), total	pg/L	--	--	--	--	--	--	--	--	--	--	--	--	--
tetrachlorodibenzodioxin (TCDD), total	pg/L	--	--	--	--	--	--	--	--	--	--	--	--	--
2,3,7,8-TCDD	pg/L	--	--	--	--	--	--	--	--	--	--	--	--	--
Miscellaneous Compounds														
Formaldehyde	µg/L	--	--	--	--	--	--	--	--	--	--	--	--	--
Sulfide	mg/L	--	--	--	--	--	--	--	--	--	--	--	--	--

Table 3-5
Summary of Recent Groundwater Analytical Data
Hercules/Pinova Facility, Brunswick, Georgia

Analyte	Units	MW-38S	MW-38I	MW-38D		MW-39I	MW-39D	MW-41I	MW-42I	MW-42D	MW-43D	MW-44ID	MW-44D	MW-46I
		6/8/2021	6/8/2021	12/9/2020	6/10/2021	12/8/2020	12/8/2020	6/9/2021	12/10/2020	12/9/2020	12/9/2020	12/10/2020	12/9/2020	6/8/2021
	Aquifer	Surficial	Surficial	Surficial		Surficial	Surficial	Surficial	Surficial	Surficial	Surficial	Surficial	Surficial	Surficial
	Aquifer Unit	Upper	Upper	Upper		Upper	Upper	Upper	Upper	Upper	Upper	Upper	Lower	Upper
	Aquifer Zone	Shallow	Intermediate	Deep		Intermediate	Deep	Intermediate	Intermediate	Deep	Deep	Deep	--	Intermediate
Field Parameters														
Conductivity	mS/cm	17.1	0.74	7.24	6.92	2.26	0.529	30.6	0.673	2.47	11	6.49	2.64	1.46
Oxygen, Dissolved	mg/L	1.86	2.23	0.7	0.31	0.92	0.64	1.80	1.01	3.64	0.4	0.85	0.77	1.32
Oxidation Reduction Potential	mV	-109	-228	-36	-62	-56	-77	-69	-212	--	-203	-4	-119	-269
pH	SU	6.06	7.55	5.78	6.33	6.81	7.21	5.96	5.65	6.5	5.83	6.1	6.85	7.16
Temperature	° C	29.72	28.75	21.68	31.17	20.6	21.23	26.42	22.72	16.35	19.3	24.25	22.81	27.71
Turbidity	NTU	5.4	2.23	39.3	1.7	9.9	6.9	0.0	21.6	0	17.8	1.7	0	6.5
Volatile Organic Compounds														
1,1-Dichloroethane	µg/L	< 1.0	< 1.0	< 10	< 10	< 1.0	< 1.0	< 1.0	< 100*1	< 1.0	< 500	< 5.0	< 5.0	< 1.0
1,1-Dichloroethene	µg/L	< 1.0	< 1.0	< 10	< 10	< 1.0	< 1.0	< 1.0	< 100*1	**1.1**	< 500	< 5.0	< 5.0	< 1.0
1,2,3-Trichloropropane	µg/L	< 1.0	< 1.0	< 10	< 10	< 1.0	< 1.0	< 1.0	< 100	< 1.0	< 500	< 5.0	< 5.0	< 1.0
1,2,4-Trichlorobenzene	µg/L	< 5.0	< 5.0	< 50	< 50	< 5.0	< 5.0	< 5.0	< 500	< 5.0	< 2500	< 25	< 25	< 5.0
1,2-Dichlorobenzene	µg/L	< 1.0	< 1.0	**11**	< 10	< 1.0	< 1.0	< 1.0	< 100	< 1.0	< 500	**7**	< 5.0	< 1.0
1,2-Dichloropropane	µg/L	< 1.0	< 1.0	< 10	< 10	< 1.0	< 1.0	**1.0**	< 100*1	< 1.0	< 500	< 5.0	< 5.0	< 1.0
1,4-Dichlorobenzene	µg/L	< 1.0	< 1.0	**20**	**17**	< 1.0	< 1.0	< 1.0	< 100	< 1.0	< 500	**10**	< 5.0	< 1.0
2-Butanone (MEK)	µg/L	< 10	< 10	< 100	< 100	< 10	< 10	< 10	< 1000*1	< 10	< 5000	< 50	< 50	< 10
4-Methyl-2-pentanone (MIBK)	µg/L	< 10	< 10	< 100*	< 100	< 10*	< 10*	< 10	< 1000*+*-*1	< 10*	< 5000*	< 50	< 50*	< 10
Acetone	µg/L	< 10	< 10	< 100	< 100	< 10	< 10	< 10	< 1000*1	< 50	< 5000	< 50	< 50	< 10
Benzene	µg/L	< 1.0	< 1.0	**870**	**1,000**	**35**	< 1.0	**43**	**210**	**61**	**780**	**170**	**71**	**110**
Carbon disulfide	µg/L	< 2.0	< 2.0	< 20	< 20	< 2.0	< 2.0	< 2.0	< 200*-*1	< 2.0	< 1000	< 10	< 10	< 2.0
Carbon tetrachloride	µg/L	< 1.0	< 1.0	< 10	< 10	< 1.0	< 1.0	< 1.0	**210**	< 1.0	< 500	< 5.0	< 5.0	< 1.0
Chlorobenzene	µg/L	< 1.0	**3.6**	**780**	**850**	**74**	< 1.0	**9.5**	< 100	**1.4**	**4600**	**270**	**110**	< 1.0
Chloroform	µg/L	< 1.0	< 1.0	**27**	< 10	< 1.0	< 1.0	< 1.0	**1100**	< 1.0	**99000**	**5.7**	**9**	< 1.0
cis-1,2-Dichloroethene	µg/L	< 1.0	< 1.0	< 10	< 10	< 1.0	< 1.0	**1.4**	< 100*1	< 1.0	< 500	< 5.0	< 5.0	< 1.0
Ethylbenzene	µg/L	< 1.0	< 1.0	**110**	**15**	< 1.0	< 1.0	< 1.0	< 100	**9.1**	< 500	**7.3**	< 5.0	< 1.0
Isopropylbenzene (Cumene)	µg/L	< 1.0	< 1.0	--	**590**	--	--	--	--	--	--	--	--	--
Methylene chloride (Chloromethane)	µg/L	< 5.0	< 5.0	< 50	< 50	< 5.0	< 5.0	< 5.0	< 500*-	< 5.0	**5600**	< 25	< 25	< 5.0
p-Isopropyltoluene (Para-cymene)	µg/L	< 1.0	< 1.0	< 10	< 10	< 1.0	< 1.0	**10**	**4200**	**7.6**	**620**	< 5.0	< 5.0	< 1.0
Tetrachloroethene	µg/L	< 1.0	< 1.0	< 10	< 10	< 1.0	< 1.0	< 1.0	< 100*+*1	< 1.0	**830**	< 5.0	< 5.0	< 1.0
Toluene	µg/L	< 1.0	< 1.0	< 10	< 10	< 1.0	< 1.0	**2.4**	< 100*1	**5.3**	< 500	< 5.0	< 5.0	< 1.0
Trichloroethene	µg/L	< 1.0	< 1.0	< 10	< 10	< 1.0	< 1.0	< 1.0	< 100	< 1.0	< 500	< 5.0	< 5.0	< 1.0
Vinyl chloride	µg/L	< 1.0	< 1.0	< 10	< 10	< 1.0	< 1.0	< 1.0	< 100*1	< 1.0	< 500	< 5.0	< 5.0	< 1.0
Xylene, total	µg/L	< 1.0	< 1.0	**47**	**73**	< 1.0	< 1.0	**4.4**	< 100	**8.3**	< 500	**430**	< 5.0	< 1.0
Semi-Volatile Organic Compounds														
2,4,6-Trichlorophenol	µg/L	--	--	--	--	--	--	< 10	--	--	< 9.7	--	--	--
2,4-Dimethylphenol	µg/L	--	--	--	--	--	--	< 10	--	--	< 9.7	--	--	--
2-Chlorophenol	µg/L	--	--	--	--	--	--	< 10	--	--	< 9.7	--	--	--
Acetophenone	µg/L	--	--	--	--	--	--	< 10	--	--	< 9.7	--	--	--
Benzo(g,h,i)perylene	µg/L	--	--	--	--	--	--	< 10	--	--	< 9.7	--	--	--
bis(2-Ethylhexyl)phthalate	µg/L	--	--	--	--	--	--	< 10	--	--	< 9.7	--	--	--
Dibenzo(a,h)anthracene	µg/L	--	--	--	--	--	--	< 10	--	--	< 9.7	--	--	--
Indeno (1,2,3-cd) pyrene	µg/L	--	--	--	--	--	--	< 10	--	--	< 9.7	--	--	--
m-p-Cresol	µg/L	--	--	--	--	--	--	< 10	--	--	**65**	--	--	--
Naphthalene	µg/L	--	--	--	--	--	--	< 10	--	--	< 9.7	--	--	--
Phenol	µg/L	--	--	--	--	--	--	< 10	--	--	< 9.7	--	--	--
Pesticides														
alpha-BHC	µg/L	--	--	--	--	--	--	< 0.045	--	--	**10**	--	--	--
delta-BHC	µg/L	--	--	--	--	--	--	< 0.045	--	--	< 0.46	--	--	--
gamma-BHC (Lindane)	µg/L	--	--	--	--	--	--	< 0.045	--	--	< 0.46	--	--	--
Heptachlor	µg/L	--	--	--	--	--	--	--	--	--	--	--	--	--
Toxaphene, TAUC	µg/L	--	--	--	--	< 4.6	< 4.6	< 4.5	< 4.6*+	--	< 46	--	< 4.6	--
Toxaphene, Technical	µg/L	--	--	--	--	< 4.6	< 4.6	< 4.5	< 4.6	--	< 46	--	< 4.6	--
Metals														
Arsenic [50][(1)]	µg/L	--	--	--	--	--	--	--	--	--	--	--	--	--
Barium [1,000]	µg/L	--	--	--	--	--	--	**1,900**	--	--	--	--	--	--
Beryllium	µg/L	--	--	--	--	--	--	< 0.50	--	--	--	--	--	--
Chromium [50]	µg/L	--	--	--	--	--	--	< 5.0	--	--	--	--	--	--
Cobalt [7.7]	µg/L	--	--	--	--	--	--	< 0.50	--	--	--	--	--	--
Copper	µg/L	--	--	--	--	--	--	< 5.0	--	--	--	--	--	--
Nickel [9.1]	µg/L	--	--	--	--	--	--	< 5.0	--	--	--	--	--	--
Selenium [10]	µg/L	--	--	--	--	--	--	< 2.5	--	--	--	--	--	--
Vanadium [Detection Limit]	µg/L	--	--	--	--	--	--	< 10	--	--	--	--	--	--
Zinc [64.5]	µg/L	--	--	--	--	--	--	< 20	--	--	--	--	--	--
Dioxins/Furans														
Hexachlorodibenzofurans (HxDCF), total	pg/L	--	--	--	--	--	--	< 48	--	--	--	--	--	--
hexachlorodibenzo-p-dioxins (HxCDD), total	pg/L	--	--	--	--	--	--	< 48	--	--	--	--	--	--
pentachlorodibenzofurans (PeCDF), total	pg/L	--	--	--	--	--	--	< 48	--	--	--	--	--	--
pentachlorodibenzo-p-dioxan (PeCDD), total	pg/L	--	--	--	--	--	--	< 48	--	--	--	--	--	--
tetrachlorodibenzofuran (TCDF), total	pg/L	--	--	--	--	--	--	< 9.7	--	--	--	--	--	--
tetrachlorodibenzodioxin (TCDD), total	pg/L	--	--	--	--	--	--	< 9.7	--	--	--	--	--	--
2,3,7,8-TCDD	pg/L	--	--	--	--	--	--	< 9.7	--	--	--	--	--	--
Miscellaneous Compounds														
Formaldehyde	µg/L	--	--	--	--	--	--	< 50	--	--	--	--	--	--
Sulfide	mg/L	--	--	--	--	--	--	< 0.81	--	--	--	--	--	--

Table 3-5
Summary of Recent Groundwater Analytical Data
Hercules/Pinova Facility, Brunswick, Georgia

Analyte	Units	MW-49D	MW-50I	MW-50D	MW-51D	MW-53D		MW-54D	MW-55S	MW-55I	MW-55D	MW-58I	MW-58D	
		12/9/2020	12/8/2020	12/8/2020	12/8/2020	12/9/2020	6/10/2021	12/9/2020	6/8/2021	6/8/2021	6/10/2021	12/11/2020	12/8/20020	6/9/2021
	Aquifer	Surficial	Surficial	Surficial	Surficial	Surficial		Surficial	Surficial	Surficial	Surficial	Surficial	Surficial	
	Aquifer Unit	Upper	Upper	Upper	Upper	Upper		Upper	Upper	Upper	Upper	Upper	Upper	
	Aquifer Zone	Deep	Intermediate	Deep	Deep	Deep		Deep	Shallow	Intermediate	Deep	Intermediate	Deep	
Field Parameters														
Conductivity	mS/cm	0.833	2.09	0.672	0.643	2.9	2.50	2.82	33.7	0.79	8.28	1.76	8.69	19.2
Oxygen, Dissolved	mg/L	0.76	0.38	0.41	0.71	1.35	0.60	0.85	2.35	2.34	1.26	0.28	0.59	0.35
Oxidation Reduction Potential	mV	9	-115	-79	-75	-148	-314	-46	-359	-97	-29	-57	-164	-60
pH	SU	6.49	7.13	7.1	7.18	6.94	9.10	6.09	7.30	7.33	5.51	6.39	5.84	6.18
Temperature	° C	18.09	24.4	23.66	21.48	22.85	30.50	22.8	27.60	26.61	28.03	21.83	23.61	33.55
Turbidity	NTU	0	9.9	4.5	13.5	4.7	0.7	0	0.0	72.7	0.0	6.4	30.8	6.6
Volatile Organic Compounds														
1,1-Dichloroethane	μg/L	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 2.0	< 1.0	< 1.0	< 10	< 1.0	< 500	< 1.0
1,1-Dichloroethene	μg/L	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 2.0	< 1.0	< 1.0	< 10	< 1.0	< 500	**7.0**
1,2,3-Trichloropropane	μg/L	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 2.0	< 1.0	< 1.0	< 10	< 1.0	< 500	< 1.0
1,2,4-Trichlorobenzene	μg/L	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 10	< 5.0	< 5.0	< 50	< 5.0	< 2500	< 5.0
1,2-Dichlorobenzene	μg/L	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 2.0	< 1.0	< 1.0	**11**	< 1.0	< 500	**72**
1,2-Dichloropropane	μg/L	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 2.0	< 1.0	< 1.0	< 10	< 1.0	< 500	< 1.0
1,4-Dichlorobenzene	μg/L	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 2.0	< 1.0	< 1.0	**16**	< 1.0	< 500	**130**
2-Butanone (MEK)	μg/L	< 10	< 10	< 10	< 10	< 10	< 10	< 20	< 10	< 10	< 100	< 10*+*1	< 5000	< 10
4-Methyl-2-pentanone (MIBK)	μg/L	< 10*	< 10*	< 10*	< 10*	< 10*	< 10	< 20*	< 10	< 10	< 100	< 10*+	< 5000	< 10
Acetone	μg/L	< 10	< 10	< 10	< 10	< 10	< 10	< 20	< 10	< 10	< 100	< 10	< 5000	< 10
Benzene	μg/L	**1.6**	< 1.0	< 1.0	< 1.0	**1.4**	**2.5**	**54**	< 1.0	**4.6**	**1,000**	**30**	**970**	**940**
Carbon disulfide	μg/L	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	**5.0**	< 4.0	< 2.0	< 2.0	< 20	< 2.0	< 1000	< 2.0
Carbon tetrachloride	μg/L	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 2.0	< 1.0	< 1.0	< 10	< 1.0	< 500	< 1.0
Chlorobenzene	μg/L	< 1.0	< 1.0	< 1.0	< 1.0	**27**	**16**	**13**	< 1.0	**3.4**	**710**	**3**	**2,800**	**3,200**
Chloroform	μg/L	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	**1.5**	< 2.0	< 1.0	< 1.0	< 10	< 1*1	**47,000**	**32,000**
cis-1,2-Dichloroethene	μg/L	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 2.0	< 1.0	< 1.0	< 10	< 1*1	< 500	**18**
Ethylbenzene	μg/L	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 2.0	< 1.0	< 1.0	< 10	< 1.0	< 500	**53**
Isopropylbenzene (Cumene)	μg/L	--	--	--	--	--	--	--	< 1.0	< 1.0	**400**	--	--	--
Methylene chloride (Chloromethane)	μg/L	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 10	< 5.0	< 5.0	< 50	< 5.0	**7,200**	**6,800**
p-Isopropyltoluene (Para-cymene)	μg/L	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 2.0	< 1.0	< 1.0	< 10	< 1.0	**930**	**780**
Tetrachloroethene	μg/L	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 2.0	< 1.0	< 1.0	< 10	< 1.0	< 500	**170**
Toluene	μg/L	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 2.0	< 1.0	< 1.0	< 10	< 1.0	< 500	**48**
Trichloroethene	μg/L	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 2.0	< 1.0	< 1.0	< 10	< 1.0	< 500	**6.0**
Vinyl chloride	μg/L	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	**5.0**	< 1.0	< 1.0	< 10	< 1.0	< 500	**6.3**
Xylene, total	μg/L	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	**2.8**	< 1.0	< 1.0	< 10	< 1.0	< 500	**44**
Semi-Volatile Organic Compounds														
2,4,6-Trichlorophenol	μg/L	--	--	--	--	< 9.5	--	--	--	--	--	--	--	--
2,4-Dimethylphenol	μg/L	--	--	--	--	< 9.5	--	--	--	--	--	--	--	--
2-Chlorophenol	μg/L	--	--	--	--	< 9.5	--	--	--	--	--	--	--	--
Acetophenone	μg/L	--	--	--	--	< 9.5	--	--	--	--	--	--	--	--
Benzo(g,h,i)perylene	μg/L	--	--	--	--	< 9.5	--	--	--	--	--	--	--	--
bis(2-Ethylhexyl)phthalate	μg/L	--	--	--	--	< 9.5	--	--	--	--	--	--	--	--
Dibenzo(a,h)anthracene	μg/L	--	--	--	--	< 9.5	--	--	--	--	--	--	--	--
Indeno (1,2,3-cd) pyrene	μg/L	--	--	--	--	< 9.5	--	--	--	--	--	--	--	--
m-p-Cresol	μg/L	--	--	--	--	< 9.5	--	--	--	--	--	--	--	--
Naphthalene	μg/L	--	--	--	--	< 9.5	--	--	--	--	--	--	--	--
Phenol	μg/L	--	--	--	--	< 9.5	--	--	--	--	--	--	--	--
Pesticides														
alpha-BHC	μg/L	--	--	--	--	< 0.04	--	--	--	--	--	--	--	--
delta-BHC	μg/L	--	--	--	--	< 0.04	--	--	--	--	--	--	--	--
gamma-BHC (Lindane)	μg/L	--	--	--	--	< 0.04	--	--	--	--	--	--	--	--
Heptachlor	μg/L	--	--	--	--	--	--	--	--	--	--	--	--	--
Toxaphene, TAUC	μg/L	--	--	--	< 4.6	< 4.6	--	--	--	< 4.6	< 23	--	--	--
Toxaphene, Technical	μg/L	--	--	--	< 4.6	< 4.6	--	--	--	< 4.6	< 23	--	--	--
Metals														
Arsenic [50][1]	μg/L	--	--	--	--	--	--	--	--	--	--	--	--	--
Barium [1,000]	μg/L	--	--	--	--	**210**	--	--	--	--	--	--	--	--
Beryllium	μg/L	--	--	--	--	< 0.5	--	--	--	--	--	--	--	--
Chromium [50]	μg/L	--	--	--	--	< 5.0	--	--	--	--	--	--	--	--
Cobalt [7.7]	μg/L	--	--	--	--	< 0.5	--	--	--	--	--	--	--	--
Copper	μg/L	--	--	--	--	< 5.0	--	--	--	--	--	--	--	--
Nickel [9.1]	μg/L	--	--	--	--	< 5.0	--	--	--	--	--	--	--	--
Selenium [10]	μg/L	--	--	--	--	< 2.5	--	--	--	--	--	--	--	--
Vanadium [Detection Limit]	μg/L	--	--	--	--	< 10	--	--	--	--	--	--	--	--
Zinc [64.5]	μg/L	--	--	--	--	< 20	--	--	--	--	--	--	--	--
Dioxins/Furans														
Hexachlorodibenzofurans (HxDCF), total	pg/L	--	--	--	--	--	--	--	--	--	--	--	--	--
hexachlorodibenzo-p-dioxins (HxCDD), total	pg/L	--	--	--	--	--	--	--	--	--	--	--	--	--
pentachlorodibenzofurans (PeCDF), total	pg/L	--	--	--	--	--	--	--	--	--	--	--	--	--
pentachlorodibenzo-p-dioxan (PeCDD), total	pg/L	--	--	--	--	--	--	--	--	--	--	--	--	--
tetrachlorodibenzofuran (TCDF), total	pg/L	--	--	--	--	--	--	--	--	--	--	--	--	--
tetrachlorodibenzodioxin (TCDD), total	pg/L	--	--	--	--	--	--	--	--	--	--	--	--	--
2,3,7,8-TCDD	pg/L	--	--	--	--	--	--	--	--	--	--	--	--	--
Miscellaneous Compounds														
Formaldehyde	μg/L	--	--	--	--	--	--	--	--	--	--	--	--	--
Sulfide	mg/L	--	--	--	--	--	--	--	--	--	--	--	--	--

Table 3-5
Summary of Recent Groundwater Analytical Data
Hercules/Pinova Facility, Brunswick, Georgia

Analyte	Units	MW-59I	MW-59D		MW-60I	MW-60D		MW-61I		MW-61D		MW-62S	MW-62I	MW-62D
		12/11/2020	12/9/2020	6/10/2021	12/8/2020	12/9/2020	6/9/2021	12/8/2020	6/8/2021	12/8/2020	6/9/2021	6/8/2021	6/8/2021	6/9/2021
	Aquifer	Surficial	Surficial		Surficial	Surficial		Surficial		Surficial		Surficial	Surficial	Surficial
	Aquifer Unit	Upper	Upper		Upper	Upper		Upper		Upper		Upper	Upper	Upper
	Aquifer Zone	Intermediate	Deep		Intermediate	Deep		Intermediate		Deep		Shallow	Intermediate	Deep
Field Parameters														
Conductivity	mS/cm	1.39	0.551	0.39	1.8	6.65	6.85	0.674	1.73	1.74	3.37	0.57	1.63	7.98
Oxygen, Dissolved	mg/L	0.61	1.71	0.41	0.73	0.65	0.51	0.86	1.75	1.82	0.69	1.21	0.56	1.10
Oxidation Reduction Potential	mV	-94	-150	-117	-95	-145	-85	-121	-126	-153	-136	-78	-105	-24
pH	SU	6.62	7.27	7.92	6.58	6.13	6.56	8.43	7.45	7.61	7.70	6.66	6.73	5.82
Temperature	° C	20.19	22.55	30.07	22.91	22.75	32.54	20.4	30.95	17.74	29.35	25.86	25.21	28.57
Turbidity	NTU	6.5	0	0.0	5.3	0	0.0	2.5	0.0	0.7	3.0	64.3	7.6	22.3
Volatile Organic Compounds														
1,1-Dichloroethane	µg/L	< 1.0	< 1.0	< 1.0	< 1.0	< 50	< 50	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,1-Dichloroethene	µg/L	< 1.0	< 1.0	< 1.0	< 1.0	< 50	< 50	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2,3-Trichloropropane	µg/L	< 1.0	< 1.0	< 1.0	< 1.0	< 50	< 50	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2,4-Trichlorobenzene	µg/L	< 5.0	< 5.0	< 5.0	< 5.0	< 250	< 250	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
1,2-Dichlorobenzene	µg/L	< 1.0	< 1.0	< 1.0	< 1.0	< 50	< 50	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	**4.2**
1,2-Dichloropropane	µg/L	< 1.0	< 1*+*1	< 1.0	< 1.0	< 50*+*1	< 50	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,4-Dichlorobenzene	µg/L	< 1.0	< 1.0	< 1.0	< 1.0	< 50	< 50	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	**6.9**
2-Butanone (MEK)	µg/L	< 10*+*1	< 10*+	< 10	< 10	< 500*+	< 500	< 10*+	< 10	< 10*+	< 10	< 10	< 10	< 10
4-Methyl-2-pentanone (MIBK)	µg/L	< 10*+	< 10*+*1	< 10	< 10*	< 500*+*1	< 500	< 10*+	< 10	< 10*+	< 10	< 10	< 10	< 10
Acetone	µg/L	< 10	< 10*+	< 10	< 10	< 500*+	< 500	< 10*+	< 10	< 10*+	< 10	< 10	< 10	< 10
Benzene	µg/L	< 1.0	< 1.0	< 1.0	< 1.0	**710**	**690**	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	**120**
Carbon disulfide	µg/L	< 2.0	< 2.0	< 2.0	< 2.0	< 100	< 100	**11**	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
Carbon tetrachloride	µg/L	< 1.0	< 1.0	< 1.0	< 1.0	< 50	< 50	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Chlorobenzene	µg/L	< 1.0	< 1.0	< 1.0	< 1.0	**1,700**	**1,400**	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	**250**
Chloroform	µg/L	< 1*1	**1.4**	< 1.0	< 1.0	**12,000**	**6,100**	< 1.0	< 1.0	**3**	**5.5**	< 1.0	< 1.0	< 1.0
cis-1,2-Dichloroethene	µg/L	< 1*1	< 1.0	< 1.0	< 1.0	< 50	< 50	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Ethylbenzene	µg/L	< 1.0	< 1.0	< 1.0	< 1.0	< 50	< 50	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	**4.0**
Isopropylbenzene (Cumene)	µg/L	--	--	--	--	--	--	--	< 1.0	--	--	< 1.0	< 1.0	**26**
Methylene chloride (Chloromethane)	µg/L	< 5.0	< 5.0	< 5.0	< 5.0	**13,000**	**11,000**	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
p-Isopropyltoluene (Para-cymene)	µg/L	< 1.0	< 1.0	< 1.0	< 1.0	**200**	**170**	**1.5**	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	**1.0**
Tetrachloroethene	µg/L	< 1.0	< 1*+	< 1.0	< 1.0	< 50*+	< 50	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Toluene	µg/L	< 1.0	< 1*+	< 1.0	< 1.0	**88*+**	**78**	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Trichloroethene	µg/L	< 1.0	< 1*+*1	< 1.0	< 1.0	< 50*+*1	< 50	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Vinyl chloride	µg/L	< 1.0	< 1.0	< 1.0	< 1.0	< 50	< 50	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	**4.3**
Xylene, total	µg/L	< 1.0	< 1.0	< 1.0	< 1.0	**53**	< 50	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	**6.4**
Semi-Volatile Organic Compounds														
2,4,6-Trichlorophenol	µg/L	--	--	--	--	--	--	--	--	--	--	--	--	--
2,4-Dimethylphenol	µg/L	--	--	--	--	--	--	--	--	--	--	--	--	--
2-Chlorophenol	µg/L	--	--	--	--	--	--	--	--	--	--	--	--	--
Acetophenone	µg/L	--	--	--	--	--	--	--	--	--	--	--	--	--
Benzo(g,h,i)perylene	µg/L	--	--	--	--	--	--	--	--	--	--	--	--	--
bis(2-Ethylhexyl)phthalate	µg/L	--	--	--	--	--	--	--	--	--	--	--	--	--
Dibenzo(a,h)anthracene	µg/L	--	--	--	--	--	--	--	--	--	--	--	--	--
Indeno (1,2,3-cd) pyrene	µg/L	--	--	--	--	--	--	--	--	--	--	--	--	--
m-p-Cresol	µg/L	--	--	--	--	--	--	--	--	--	--	--	--	--
Naphthalene	µg/L	--	--	--	--	--	--	--	--	--	--	--	--	--
Phenol	µg/L	--	--	--	--	--	--	--	--	--	--	--	--	--
Pesticides														
alpha-BHC	µg/L	--	--	--	--	--	--	--	--	--	--	--	--	--
delta-BHC	µg/L	--	--	--	--	--	--	--	--	--	--	--	--	--
gamma-BHC (Lindane)	µg/L	--	--	--	--	--	--	--	--	--	--	--	--	--
Heptachlor	µg/L	--	--	--	--	--	--	--	--	--	--	--	--	--
Toxaphene, TAUC	µg/L	--	--	--	--	--	--	--	--	--	--	--	--	--
Toxaphene, Technical	µg/L	--	--	--	--	--	--	--	--	--	--	--	--	--
Metals														
Arsenic [50](1)	µg/L	--	--	--	--	--	--	--	--	--	--	--	--	--
Barium [1,000]	µg/L	--	--	--	--	--	--	--	--	--	--	--	--	--
Beryllium	µg/L	--	--	--	--	--	--	--	--	--	--	--	--	--
Chromium [50]	µg/L	--	--	--	--	--	--	--	--	--	--	--	--	--
Cobalt [7.7]	µg/L	--	--	--	--	--	--	--	--	--	--	--	--	--
Copper	µg/L	--	--	--	--	--	--	--	--	--	--	--	--	--
Nickel [9.1]	µg/L	--	--	--	--	--	--	--	--	--	--	--	--	--
Selenium [10]	µg/L	--	--	--	--	--	--	--	--	--	--	--	--	--
Vanadium [Detection Limit]	µg/L	--	--	--	--	--	--	--	--	--	--	--	--	--
Zinc [64.5]	µg/L	--	--	--	--	--	--	--	--	--	--	--	--	--
Dioxins/Furans														
Hexachlorodibenzofurans (HxDCF), total	pg/L	--	--	--	--	--	--	--	--	--	--	--	--	--
hexachlorodibenzo-p-dioxins (HxCDD), total	pg/L	--	--	--	--	--	--	--	--	--	--	--	--	--
pentachlorodibenzofurans (PeCDF), total	pg/L	--	--	--	--	--	--	--	--	--	--	--	--	--
pentachlorodibenzo-p-dioxan (PeCDD), total	pg/L	--	--	--	--	--	--	--	--	--	--	--	--	--
tetrachlorodibenzofuran (TCDF), total	pg/L	--	--	--	--	--	--	--	--	--	--	--	--	--
tetrachlorodibenzodioxin (TCDD), total	pg/L	--	--	--	--	--	--	--	--	--	--	--	--	--
2,3,7,8-TCDD	pg/L	--	--	--	--	--	--	--	--	--	--	--	--	--
Miscellaneous Compounds														
Formaldehyde	µg/L	--	--	--	--	--	--	--	--	--	--	--	--	--
Sulfide	mg/L	--	--	--	--	--	--	--	--	--	--	--	--	--

Table 3-5
Summary of Recent Groundwater Analytical Data
Hercules/Pinova Facility, Brunswick, Georgia

Analyte	Units	PSOW-12	OW-Q1S	OW-Q1I	OW-Q1D	OW-Q2S	OW-Q2I	OW-Q2D	OW-Q3S	OW-Q3I	OW-Q4S	OW-Q4I	OW-Q4D
		6/10/2021	6/8/2021	6/8/2021	6/9/2021	6/8/2021	6/8/2021	6/9/2021	6/9/2021	6/9/2021	6/8/2021	6/8/2021	6/9/2021
	Aquifer	Surficial	Surficial	Surficial	Surficial	Surficial	Surficial	Surficial	Surficial	Surficial	Surficial	Surficial	Surficial
	Aquifer Unit	Upper	Upper	Upper	Upper	Upper	Upper	Upper	Upper	Upper	Upper	Upper	Upper
	Aquifer Zone	Deep	Shallow	Intermediate	Deep	Shallow	Intermediate	Deep	Shallow	Intermediate	Shallow	Intermediate	Deep
Field Parameters													
Conductivity	mS/cm	11.8	16.0	0.50	8.01	1.11	6.28	8.68	0.40	0.60	28.1	0.49	7.44
Oxygen, Dissolved	mg/L	0.4	2.27	4.59	1.12	0.75	1.88	0.42	1.59	0.45	0.58	0.26	0.85
Oxidation Reduction Potential	mV	-75	-134	-129	-15	-77	-109	-32	-115	-134	-57	-102	-68
pH	SU	5.59	6.13	7.07	5.78	6.57	7.01	5.75	6.89	7.16	5.94	6.88	5.95
Temperature	° C	27.09	24.08	23.94	30.17	27.59	30.19	25.66	26.57	24.76	25.66	24.45	27.74
Turbidity	NTU	0.0	33.9	0.0	0.0	8.9	55.4	0.0	0.0	0.0	0.0	0.8	27.0
Volatile Organic Compounds													
1,1-Dichloroethane	µg/L	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,1-Dichloroethene	µg/L	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2,3-Trichloropropane	µg/L	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2,4-Trichlorobenzene	µg/L	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
1,2-Dichlorobenzene	µg/L	**1.9**	< 1.0	< 1.0	**12**	< 1.0	< 1.0	**13**	< 1.0	< 1.0	< 1.0	< 1.0	**10**
1,2-Dichloropropane	µg/L	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,4-Dichlorobenzene	µg/L	**2.5**	< 1.0	< 1.0	**20**	< 1.0	< 1.0	**22**	< 1.0	< 1.0	< 1.0	< 1.0	**16**
2-Butanone (MEK)	µg/L	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10
4-Methyl-2-pentanone (MIBK)	µg/L	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10
Acetone	µg/L	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10
Benzene	µg/L	**150**	< 1.0	< 1.0	**860**	< 1.0	< 1.0	**790**	< 1.0	**60**	< 1.0	< 1.0	**1,000**
Carbon disulfide	µg/L	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	**3.0**	< 2.0	< 2.0	< 2.0
Carbon tetrachloride	µg/L	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Chlorobenzene	µg/L	**190**	< 1.0	< 1.0	**910**	< 1.0	< 1.0	**780**	< 1.0	**11**	< 1.0	< 1.0	**730**
Chloroform	µg/L	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
cis-1,2-Dichloroethene	µg/L	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Ethylbenzene	µg/L	**1.3**	< 1.0	< 1.0	**350**	< 1.0	< 1.0	**340**	< 1.0	< 1.0	< 1.0	< 1.0	**140**
Isopropylbenzene (Cumene)	µg/L	**48**	< 1.0	< 1.0	**270**	< 1.0	< 1.0	**220**	< 1.0	**8.5**	< 1.0	< 1.0	**350**
Methylene chloride (Chloromethane)	µg/L	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
p-Isopropyltoluene (Para-cymene)	µg/L	< 1.0	< 1.0	< 1.0	**7.1**	< 1.0	< 1.0	**4.3**	< 1.0	< 1.0	< 1.0	< 1.0	**1.5**
Tetrachloroethene	µg/L	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Toluene	µg/L	< 1.0	< 1.0	< 1.0	**3.5**	< 1.0	< 1.0	**3.6**	< 1.0	< 1.0	< 1.0	< 1.0	**3.5**
Trichloroethene	µg/L	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Vinyl chloride	µg/L	**3.6**	< 1.0	< 1.0	**6.4**	< 1.0	< 1.0	**7.8**	< 1.0	< 1.0	< 1.0	< 1.0	**7.2**
Xylene, total	µg/L	**3.6**	< 1.0	< 1.0	**306.5**	< 1.0	< 1.0	**374.8**	< 1.0	**4.2**	< 1.0	< 1.0	**187.5**
Semi-Volatile Organic Compounds													
2,4,6-Trichlorophenol	µg/L	--	--	--	--	--	--	--	--	--	--	--	--
2,4-Dimethylphenol	µg/L	--	--	--	--	--	--	--	--	--	--	--	--
2-Chlorophenol	µg/L	--	--	--	--	--	--	--	--	--	--	--	--
Acetophenone	µg/L	--	--	--	--	--	--	--	--	--	--	--	--
Benzo(g,h,i)perylene	µg/L	--	--	--	--	--	--	--	--	--	--	--	--
bis(2-Ethylhexyl)phthalate	µg/L	--	--	--	--	--	--	--	--	--	--	--	--
Dibenzo(a,h)anthracene	µg/L	--	--	--	--	--	--	--	--	--	--	--	--
Indeno (1,2,3-cd) pyrene	µg/L	--	--	--	--	--	--	--	--	--	--	--	--
m-p-Cresol	µg/L	--	--	--	--	--	--	--	--	--	--	--	--
Naphthalene	µg/L	--	--	--	--	--	--	--	--	--	--	--	--
Phenol	µg/L	--	--	--	--	--	--	--	--	--	--	--	--
Pesticides													
alpha-BHC	µg/L	--	--	--	--	--	--	--	--	--	--	--	--
delta-BHC	µg/L	--	--	--	--	--	--	--	--	--	--	--	--
gamma-BHC (Lindane)	µg/L	--	--	--	--	--	--	--	--	--	--	--	--
Heptachlor	µg/L	--	--	--	--	--	--	--	--	--	--	--	--
Toxaphene, TAUC	µg/L	--	--	--	--	--	--	--	--	--	--	--	--
Toxaphene, Technical	µg/L	--	--	--	--	--	--	--	--	--	--	--	--
Metals													
Arsenic [50](1)	µg/L	--	--	--	--	--	--	--	--	--	--	--	--
Barium [1,000]	µg/L	--	--	--	--	--	--	--	--	--	--	--	--
Beryllium	µg/L	--	--	--	--	--	--	--	--	--	--	--	--
Chromium [50]	µg/L	--	--	--	--	--	--	--	--	--	--	--	--
Cobalt [7.7]	µg/L	--	--	--	--	--	--	--	--	--	--	--	--
Copper	µg/L	--	--	--	--	--	--	--	--	--	--	--	--
Nickel [9.1]	µg/L	--	--	--	--	--	--	--	--	--	--	--	--
Selenium [10]	µg/L	--	--	--	--	--	--	--	--	--	--	--	--
Vanadium [Detection Limit]	µg/L	--	--	--	--	--	--	--	--	--	--	--	--
Zinc [64.5]	µg/L	--	--	--	--	--	--	--	--	--	--	--	--
Dioxins/Furans													
Hexachlorodibenzofurans (HxDCF), total	pg/L	--	--	--	--	--	--	--	--	--	--	--	--
hexachlorodibenzo-p-dioxins (HxCDD), total	pg/L	--	--	--	--	--	--	--	--	--	--	--	--
pentachlorodibenzofurans (PeCDF), total	pg/L	--	--	--	--	--	--	--	--	--	--	--	--
pentachlorodibenzo-p-dioxan (PeCDD), total	pg/L	--	--	--	--	--	--	--	--	--	--	--	--
tetrachlorodibenzofuran (TCDF), total	pg/L	--	--	--	--	--	--	--	--	--	--	--	--
tetrachlorodibenzodioxin (TCDD), total	pg/L	--	--	--	--	--	--	--	--	--	--	--	--
2,3,7,8-TCDD	pg/L	--	--	--	--	--	--	--	--	--	--	--	--
Miscellaneous Compounds													
Formaldehyde	µg/L	--	--	--	--	--	--	--	--	--	--	--	--
Sulfide	mg/L	--	--	--	--	--	--	--	--	--	--	--	--

NOTES:

-- = Sample not analyzed for this constituent.

< = Not detected at or above the reporting detection limit

[#] = Bracketed values next to analytes indicate the Groundwater Protection Standard (GWPS) based on established site-specific background levels, where applicable.

BOLD = Analyte detected above laboratory reporting limit

(1) Analyte from 40 C.F.R. Part 264, Appendix IX required to be evaluated annually pursuant to Hazardous Waste Permit No. HW 052(D&S)-2. As noted in previous semi-annual groundwater monitoring reports, the GWPS is based on site-specific background levels.

ug/L = micrograms per liter

pg/L = picogram per liter

mg/L = milligrams per liter

mS/cm = millisiemens per centimeter

mV = millivolt

SU = standard units

° C = degrees Celsius

NTU = Nephelometric Turbidity Units

DATA QUALIFIERS:

* = Laboratory control sample (LCS) and/or laboratory control sample duplicate (LCSD) are outside acceptance limits.

*+ = LCS and/or LCSD are outside acceptance limits, high biased.

*- = LCS and/or LCSD is outside acceptance limits, low biased.

*1 = LCS and/or LCSD relative percent difference exceeds control limits.

H = Sample was prepped or analyzed beyond the specified holding time.

4 = The analyte present in the original sample is greater than 4 times the matrix spike (MS) concentration; therefore, control limits are not acceptable.

Table 3-6
Vapor Intrusion Investigation – Shallow Groundwater Analytical Data
Hercules/Pinova Facility, Brunswick, Georgia

	Location	**MW-3S**	**SGW-1**	**SGW-2**	**SGW-3**	**SGW-4**	**SGW-5**	**SGW-6**	**SGW-7**	**SGW-8**	**SGW-9**	**SGW-10**	**SGW-11**
	Sample Date	8/16/2019	8/12/2019	8/12/2019	8/12/2019	8/12/2019	8/12/2019	8/13/2019	8/13/2019	8/13/2019	8/13/2019	8/13/2019	8/13/2019
Analyte	**CAS*** **												
1,1-Dichloroethane	75-34-3	< 1	< 1	< 1	< 1	< 5	< 100	< 1	< 1	< 50	< 1	< 1	< 1
1,1-Dichloroethene (1,1-Dichloroethylene)	75-35-4	< 1	< 1	< 1	< 1	< 5	< 100	< 1	< 1	< 50	< 1	< 1	< 1
1,2,3-Trichloropropane	96-18-4	< 0.005	< 0.005	< 0.005	< 0.005	< 0.05	**1.5**	< 0.005	< 0.05	**0.014**	< 0.005	< 0.005	< 0.005
1,2,4-Trichlorobenzene	120-82-1	< 5	< 5	< 5	< 5	< 25	< 500	< 5	< 5	< 250	< 5	< 5	< 5
1,2-Dichlorobenzene	95-50-1	< 1	< 1	< 1	< 1	< 5	< 100	< 1	< 1	< 50	< 1	< 1	< 1
1,2-Dichloropropane	78-87-5	< 1	< 1	< 1	< 1	< 5	< 100	< 1	< 1	< 50	< 1	< 1	< 1
1,4-Dichlorobenzene	106-46-7	< 1	< 1	< 1	< 1	< 5	< 100	< 1	< 1	< 50	< 1	< 1	< 1
Acetone	67-64-1	< 10	< 10	< 10	< 10	< 50	< 1,000	< 10	**18**	< 500	< 10	< 10	< 10
Aldrin	309-00-2	< 0.05	< 0.048 R	< 0.047 R	< 0.047	< 0.048 R	< 0.049 R	< 0.048 R	< 0.048	**0.28 J**	< 0.049	< 0.047	< 0.048
Benzene	71-43-2	< 1	< 1	< 1	< 1	**14**	< 100	< 1	< 1	< 50	< 1	< 1	< 1
Carbon disulfide	75-15-0	< 2	< 2	< 2	< 2	< 10	< 200	< 2	< 2	< 100	< 2	< 2	< 2
Carbon Tetrachloride	56-23-5	< 0.1	< 0.1	< 0.1	< 0.1	< 1	< 1	< 0.1	< 1	< 1	< 0.1	< 0.1	< 0.1
Chlorobenzene	108-90-7	< 1	< 1	< 1	< 1	< 5	< 100	< 1	< 1	< 50	< 1	< 1	< 1
Chloroform	67-66-3	< 1	< 1	< 1	< 1	< 5	< 100	< 1	< 1	< 50	< 1	< 1	< 1
Ethyl Benzene	100-41-4	< 1	< 1	< 1	< 1	**1,000 E**	< 100	< 1	< 1	< 50	< 1	< 1	< 1
Formaldehyde	50-00-0	< 50	< 250	< 50	< 50	< 250	< 250	< 250	**260**	**260 J**	< 250	< 250	**57**
Formic acid	64-18-6	< 5,000	< 1,000	< 5,000	< 10,000	< 100,000	< 100,000	< 20,000	< 20,000	< 100,000	< 20,000	< 20,000	< 5,000
Methyl Ethyl Ketone	78-93-3	< 10	< 10	< 10	< 10	< 50	< 1,000	< 10	< 10	< 500	< 10	< 10	< 10
Methyl Isobutyl Ketone	108-10-1	< 10	< 10	< 10	< 10	< 50	< 1,000	< 10	< 10	< 500	< 10	< 10	< 10
Methylene Chloride	75-09-2	< 5	< 5	< 5	< 5	< 25	< 500	< 5	< 5	< 250	< 5	< 5	< 5
Naphthalene	91-20-3	< 0.5	< 0.5	< 0.5	< 0.5	**23**	< 5	< 0.5	**5.8**	**6.1 J**	< 0.5	< 0.5	< 0.5
p-Isopropyltoluene (Para-cymene)	99-87-6	< 1	< 1	< 1	< 1	**5,200 E**	**32,000 E**	< 1	**3.2**	**36,000 E**	**3.6**	**7.7**	**1.2**
Styrene	100-42-5	< 1	< 1	< 1	< 1	< 5	< 100	< 1	< 1	< 50	< 1	< 1	< 1
Tetrachloroethene (Tetrachloroethylene)	127-18-4	< 1	< 1	< 1	< 1	< 5	< 100	< 1	< 1	< 50	< 1	< 1	< 1
Toluene	108-88-3	< 1	< 1	< 1	< 1	**130**	< 100	< 1	< 1	< 50	< 1	< 1	< 1
Total Xylenes	1330-20-7	< 1	< 1	< 1	< 1	**5,100**	< 100	< 1	**23**	< 50	< 1	< 1	< 1
Trichloroethene (Trichloroethylene)	79-01-6	< 1	< 1	< 1	< 1	< 5	< 100	< 1	< 1	< 50	< 1	< 1	< 1
Vinyl chloride	75-01-4	< 0.04	< 0.04	< 0.04	< 0.04	< 0.4	< 0.4	< 0.04	< 0.4	< 0.4	< 0.04	< 0.04	**0.045**

Notes:

1. Results shown are in micrograms per liter (µg/L)

Bold - Detection

< - Not detected (reported at detection limit)

E - Result exceeded instrument calibration range

J - Result is estimated

R - Result rejected during data validation

N/A - Not applicable

* - Non-aqueous phase liquid (NAPL) was observed at this location and no groundwater samples were collected for analysis

** - Non-aqueous phase liquid (NAPL) was observed at this location and no groundwater samples were collected for analysis for volatile organic compounds by USEPA method 8260B

*** - Chemical Abstracts Service Registry Number

Table 3-6
Vapor Intrusion Investigation – Shallow Groundwater Analytical Data
Hercules/Pinova Facility, Brunswick, Georgia

	Location	**SGW-12**	**SGW-13**	**SGW-14**	**SGW-15**	**SGW-16**	**SGW-17**	**SGW-18**	**SGW-19**	**SGW-20***	**SGW-21***	**SGW-22**	**SGW-23****
	Sample Date	8/13/2019	8/14/2019	8/13/2019	8/13/2019	8/13/2019	8/14/2019	8/14/2019	8/13/2019	N/A	N/A	8/15/2019	8/15/2019
Analyte	**CAS***												
1,1-Dichloroethane	75-34-3	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1			< 1	
1,1-Dichloroethene (1,1-Dichloroethylene)	75-35-4	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1			< 1	
1,2,3-Trichloropropane	96-18-4	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005			**0.055**	
1,2,4-Trichlorobenzene	120-82-1	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5			< 5	
1,2-Dichlorobenzene	95-50-1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1			< 1	
1,2-Dichloropropane	78-87-5	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1			< 1	
1,4-Dichlorobenzene	106-46-7	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1			< 1	
Acetone	67-64-1	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10			**13**	
Aldrin	309-00-2	< 0.05	< 0.049	< 0.048	< 0.049	< 0.048	< 0.047	< 0.048	< 0.05			< 0.05	< 0.048
Benzene	71-43-2	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1			**1.6**	
Carbon disulfide	75-15-0	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2			< 2	
Carbon Tetrachloride	56-23-5	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1			< 0.1	
Chlorobenzene	108-90-7	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1			**2.3**	
Chloroform	67-66-3	< 1	**3.3**	< 1	< 1	< 1	< 1	< 1	< 1			< 1	
Ethyl Benzene	100-41-4	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1			**3.1**	
Formaldehyde	50-00-0	< 50	< 50	< 50	< 50	< 50	< 50	< 250	< 250			< 250	< 250
Formic acid	64-18-6	< 20,000	< 5,000	< 5,000	< 1,000	< 20,000	< 50,000	< 20,000	< 20,000			< 10,000	< 50,000
Methyl Ethyl Ketone	78-93-3	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10			< 10	
Methyl Isobutyl Ketone	108-10-1	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10			< 10	
Methylene Chloride	75-09-2	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5			< 5	
Naphthalene	91-20-3	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5			**3.1**	
p-Isopropyltoluene (Para-cymene)	99-87-6	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1			< 1	
Styrene	100-42-5	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1			< 1	
Tetrachloroethene (Tetrachloroethylene)	127-18-4	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1			< 1	
Toluene	108-88-3	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1			< 1	
Total Xylenes	1330-20-7	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1			< 1	
Trichloroethene (Trichloroethylene)	79-01-6	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1			< 1	
Vinyl chloride	75-01-4	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04			< 0.04	

Notes:

1. Results shown are in micrograms per liter (µg/L)

Bold - Detection

< - Not detected (reported at detection limit)

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J - Result is estimated

R - Result rejected during data validation

N/A - Not applicable

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** - Non-aqueous phase liquid (NAPL) was observed at this location and no groundwater samples were collected for analysis for volatile organic compounds by USEPA method 8260B

*** - Chemical Abstracts Service Registry Number

Table 3-6
Vapor Intrusion Investigation – Shallow Groundwater Analytical Data
Hercules/Pinova Facility, Brunswick, Georgia

	Location	**SGW-24**	**SGW-25**	**SGW-26**	**SGW-27**	**SGW-28**	**SGW-29**	**SGW-30**	**SGW-31**	**SGW-32**	**SGW-33**	**SGW-34**	**SGW-35**
	Sample Date	8/15/2019	8/15/2019	8/15/2019	8/15/2019	8/15/2019	8/15/2019	8/14/2019	8/14/2019	8/14/2019	8/15/2019	8/15/2019	8/14/2019
Analyte	**CAS*** **												
1,1-Dichloroethane	75-34-3	< 1	< 1	< 10	< 1	< 50	< 100	< 5	< 50	< 1	< 1	< 1	< 1
1,1-Dichloroethene (1,1-Dichloroethylene)	75-35-4	< 1	< 1	< 10	< 1	< 50	< 100	< 5	< 50	< 1	< 1	< 1	< 1
1,2,3-Trichloropropane	96-18-4	**0.018**	< 0.005	< 0.05	< 0.005	< 0.05	**0.14**	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005
1,2,4-Trichlorobenzene	120-82-1	< 5	< 5	< 50	< 5	< 250	< 500	< 25	< 250	< 5	< 5	< 5	< 5
1,2-Dichlorobenzene	95-50-1	< 1	< 1	< 10	< 1	< 50	< 100	< 5	< 50	< 1	< 1	< 1	< 1
1,2-Dichloropropane	78-87-5	< 1	< 1	< 10	< 1	< 50	< 100	< 5	< 50	< 1	< 1	< 1	< 1
1,4-Dichlorobenzene	106-46-7	< 1	< 1	< 10	< 1	< 50	< 100	< 5	< 50	< 1	< 1	< 1	< 1
Acetone	67-64-1	**12**	< 10	< 100	**11**	< 500	< 1,000	< 50	< 500	**11**	< 10	< 10	< 10
Aldrin	309-00-2	< 0.05	< 0.051	< 0.05	< 0.05	< 0.05 R	< 0.048	< 0.049	< 0.051	< 0.049	< 0.048	< 0.048	< 0.047
Benzene	71-43-2	< 1	< 1	**970**	< 1	< 50	**12,000**	**8**	**330**	**8**	< 1	< 1	**19**
Carbon disulfide	75-15-0	< 2	< 2	< 20	< 2	< 100	< 200	< 10	< 100	< 2	< 2	< 2	< 2
Carbon Tetrachloride	56-23-5	< 0.1	< 0.1	< 1	< 0.1	< 1	< 1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Chlorobenzene	108-90-7	< 1	< 1	< 10	< 1	< 50	< 100	< 5	< 50	< 1	< 1	< 1	< 1
Chloroform	67-66-3	< 1	< 1	< 10	< 1	< 50	< 100	< 5	< 50	< 1	< 1	< 1	< 1
Ethyl Benzene	100-41-4	< 1	< 1	**11**	< 1	< 50	< 100	< 5	< 50	< 1	< 1	< 1	< 1
Formaldehyde	50-00-0	< 250	< 50	< 50	**67**	**65**	**84**	< 50	**280**	< 250	< 50	< 50	< 50
Formic acid	64-18-6	< 10,000	< 10,000	< 50,000	< 5,000	< 50,000	< 50,000	< 20,000	< 50,000	< 20,000	< 5,000	< 10,000	< 20,000
Methyl Ethyl Ketone	78-93-3	< 10	< 10	< 100	< 10	< 500	< 1,000	< 50	< 500	< 10	< 10	< 10	< 10
Methyl Isobutyl Ketone	108-10-1	< 10	< 10	< 100	< 10	**34,000**	< 1,000	< 50	< 500	< 10	< 10	< 10	< 10
Methylene Chloride	75-09-2	< 5	< 5	< 50	< 5	< 250	< 500	< 25	< 250	< 5	< 5	< 5	< 5
Naphthalene	91-20-3	< 0.5	< 0.5	**26**	< 0.5	**24**	**8.2**	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
p-Isopropyltoluene (Para-cymene)	99-87-6	< 1	< 1	**5,100 E**	< 1	**2,500**	**12,000**	**7.1**	**20,000 E**	< 1	< 1	< 1	< 1
Styrene	100-42-5	< 1	< 1	< 10	< 1	< 50	< 100	< 5	< 50	< 1	< 1	< 1	< 1
Tetrachloroethene (Tetrachloroethylene)	127-18-4	< 1	< 1	< 10	< 1	< 50	< 100	< 5	< 50	< 1	< 1	< 1	< 1
Toluene	108-88-3	< 1	< 1	**58**	< 1	**140**	**1,200**	< 5	**210**	< 1	< 1	< 1	< 1
Total Xylenes	1330-20-7	< 1	< 1	< 10	< 1	< 50	< 100	< 5	< 50	< 1	< 1	< 1	< 1
Trichloroethene (Trichloroethylene)	79-01-6	< 1	< 1	< 10	< 1	< 50	< 100	< 5	< 50	< 1	< 1	< 1	< 1
Vinyl chloride	75-01-4	< 0.04	< 0.04	< 0.4	< 0.04	< 0.4	**0.78**	**0.68**	**0.042**	< 0.04	< 0.04	< 0.04	< 0.04

Notes:

1. Results shown are in micrograms per liter (µg/L)

Bold - Detection

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E - Result exceeded instrument calibration range

J - Result is estimated

R - Result rejected during data validation

N/A - Not applicable

* - Non-aqueous phase liquid (NAPL) was observed at this location and no groundwater samples were collected for analysis

** - Non-aqueous phase liquid (NAPL) was observed at this location and no groundwater samples were collected for analysis for volatile organic compounds by USEPA method 8260B

*** - Chemical Abstracts Service Registry Number

Table 3-6
Vapor Intrusion Investigation – Shallow Groundwater Analytical Data
Hercules/Pinova Facility, Brunswick, Georgia

	Location	**SGW-36**	**SGW-37**	**SGW-38**	**SGW-39**	**SGW-40**	**SGW-41**	**SGW-42**	**SGW-43**	**SGW-44**	**SGW-45**
	Sample Date	8/14/2019	8/15/2019	8/14/2019	8/14/2019	8/13/2019	8/12/2019	8/13/2019	8/12/2019	8/12/2019	8/12/2019
Analyte	**CAS*** **										
1,1-Dichloroethane	75-34-3	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
1,1-Dichloroethene (1,1-Dichloroethylene)	75-35-4	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
1,2,3-Trichloropropane	96-18-4	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005
1,2,4-Trichlorobenzene	120-82-1	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5
1,2-Dichlorobenzene	95-50-1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
1,2-Dichloropropane	78-87-5	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
1,4-Dichlorobenzene	106-46-7	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Acetone	67-64-1	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10
Aldrin	309-00-2	< 0.049	< 0.048	< 0.048	< 0.048	< 0.05	< 0.049	< 0.048	< 0.048	< 0.049	< 0.049
Benzene	71-43-2	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Carbon disulfide	75-15-0	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2
Carbon Tetrachloride	56-23-5	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Chlorobenzene	108-90-7	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Chloroform	67-66-3	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Ethyl Benzene	100-41-4	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Formaldehyde	50-00-0	< 50	< 250	< 250	**51**	< 250	< 250	< 50	< 250	< 250	< 250
Formic acid	64-18-6	< 5,000	< 20,000	< 5,000	< 5,000	< 20,000	< 20,000	< 5,000	< 20,000	< 20,000	< 20,000
Methyl Ethyl Ketone	78-93-3	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10
Methyl Isobutyl Ketone	108-10-1	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10
Methylene Chloride	75-09-2	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5
Naphthalene	91-20-3	< 0.5	**0.52**	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
p-Isopropyltoluene (Para-cymene)	99-87-6	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Styrene	100-42-5	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Tetrachloroethene (Tetrachloroethylene)	127-18-4	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Toluene	108-88-3	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Total Xylenes	1330-20-7	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Trichloroethene (Trichloroethylene)	79-01-6	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Vinyl chloride	75-01-4	< 0.04	**2**	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04

Notes:

1. Results shown are in micrograms per liter (µg/L)

Bold - Detection

< - Not detected (reported at detection limit)

E - Result exceeded instrument calibration range

J - Result is estimated

R - Result rejected during data validation

N/A - Not applicable

* - Non-aqueous phase liquid (NAPL) was observed at this location and no groundwater samples were collected for analysis

** - Non-aqueous phase liquid (NAPL) was observed at this location and no groundwater samples were collected for analysis for volatile organic compounds by USEPA method 8260B

*** - Chemical Abstracts Service Registry Number

Table 3-6
Vapor Intrusion Investigation – Shallow Groundwater Analytical Data
Hercules/Pinova Facility, Brunswick, Georgia

	Location	**SGW-46**	**SGW-47**	**SGW-48**	**SGW-49**	**SGW-50**	**SGW-51**	**TW-1R**	**TW-1RR**	**TW-2R**	**TW-3R**
	Sample Date	8/14/2019	8/12/2019	8/14/2019	8/14/2019	8/12/2019	8/12/2019	8/15/2019	2/19/2020	8/15/2019	8/16/2019
Analyte	**CAS*****										
1,1-Dichloroethane	75-34-3	< 1	< 1	< 1	< 1 R	< 1	< 50	< 1	< 1	< 5	< 1
1,1-Dichloroethene (1,1-Dichloroethylene)	75-35-4	< 1	< 1	< 1	< 1 R	< 1	< 50	< 1	< 1	< 5	< 1
1,2,3-Trichloropropane	96-18-4	< 0.005	< 0.005	< 0.005	< 0.005 R	< 0.005	< 0.005	**0.12**	< 0.005	**0.16**	< 0.005
1,2,4-Trichlorobenzene	120-82-1	< 5	< 5	< 5	< 5 R	< 5	< 250	< 5	< 5	< 25	< 5
1,2-Dichlorobenzene	95-50-1	< 1	< 1	< 1	< 1 R	< 1	< 50	**2.7**	< 1	< 5	< 1
1,2-Dichloropropane	78-87-5	< 1	< 1	< 1	< 1 R	< 1	< 50	< 1	< 1	< 5	< 1
1,4-Dichlorobenzene	106-46-7	< 1	< 1	< 1	< 1 R	< 1	< 50	**2.6**	< 1	< 5	< 1
Acetone	67-64-1	< 10	< 10	< 10	**29 J**	< 10	< 500	< 10	< 10	< 50	< 10
Aldrin	309-00-2	< 0.049	< 0.049	< 0.048	< 0.048	< 0.048	< 0.05	< 0.049	< 0.049	**0.087 J**	< 0.048
Benzene	71-43-2	**1.3**	< 1	< 1	< 1 R	< 1	< 50	**1.6**	< 1	< 5	< 1
Carbon disulfide	75-15-0	< 2	< 2	< 2	< 2 R	< 2	< 100	< 2	< 2	< 10	< 2
Carbon Tetrachloride	56-23-5	< 0.1	< 0.1	< 0.1	< 0.1 R	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Chlorobenzene	108-90-7	**6.3**	< 1	< 1	< 1 R	< 1	< 50	**9.5**	< 1	**14**	< 1
Chloroform	67-66-3	< 1	< 1	< 1	< 1 R	< 1	< 50	< 1	< 1	< 5	< 1
Ethyl Benzene	100-41-4	< 1	< 1	< 1	< 1 R	< 1	< 50	< 1	< 1	< 5	< 1
Formaldehyde	50-00-0	< 50	< 50	**59**	**62**	< 50	< 1,000	< 250	< 500	< 50	< 250
Formic acid	64-18-6	< 5,000	< 5,000	< 20,000	< 50,000	< 50,000	< 50,000	< 50,000	< 100	< 50,000	< 10,000
Methyl Ethyl Ketone	78-93-3	< 10	< 10	< 10	< 10 R	< 10	< 500	< 10	< 10	< 50	< 10
Methyl Isobutyl Ketone	108-10-1	< 10	< 10	< 10	< 10 R	< 10	< 500	< 10	< 10	< 50	< 10
Methylene Chloride	75-09-2	< 5	< 5	< 5	< 5 R	< 5	< 250	< 5	< 5	< 25	< 5
Naphthalene	91-20-3	< 0.5	< 0.5	< 0.5	< 0.5 R	**10**	< 0.5	**0.85**	< 0.5	< 0.5	< 0.5
p-Isopropyltoluene (Para-cymene)	99-87-6	**3.3**	**4.1**	**1.2**	< 1 R	< 1	**190**	< 1	< 1	< 5	< 1
Styrene	100-42-5	< 1	< 1	< 1	< 1 R	< 1	< 50	< 1	< 1	< 5	< 1
Tetrachloroethene (Tetrachloroethylene)	127-18-4	< 1	< 1	< 1	< 1 R	< 1	< 50	< 1	< 1	< 5	< 1
Toluene	108-88-3	< 1	< 1	< 1	< 1 R	< 1	< 50	< 1	< 1	< 5	< 1
Total Xylenes	1330-20-7	< 1	< 1	< 1	< 1 R	< 1	< 50	**2.1**	< 1	**5.1**	< 1
Trichloroethene (Trichloroethylene)	79-01-6	< 1	< 1	< 1	< 1 R	< 1	< 50	< 1	< 1	< 5	< 1
Vinyl chloride	75-01-4	< 0.04	< 0.04	< 0.04	**0.12 J**	< 0.04	< 0.04	**0.46 J**	< 0.04	**1.1**	< 0.04

Notes:

1. Results shown are in micrograms per liter (µg/L)

Bold - Detection

< - Not detected (reported at detection limit)

E - Result exceeded instrument calibration range

J - Result is estimated

R - Result rejected during data validation

N/A - Not applicable

* - Non-aqueous phase liquid (NAPL) was observed at this location and no groundwater samples were collected for analysis

** - Non-aqueous phase liquid (NAPL) was observed at this location and no groundwater samples were collected for analysis for volatile organic compounds by USEPA method 8260B

*** - Chemical Abstracts Service Registry Number

Table 3-7
Chemicals of Potential Concern for the Vapor Intrusion Pathway
Hercules/Pinova Facility, Brunswick, Georgia

Parameter	Target Groundwater Screening Level Commercial (µg/L)	Target Groundwater Screening Level Residential (µg/L)	Total Number of Detections	Number of Analyses	Maximum Value (2010-2018) (µg/L)	Maximum Value Sample Date	Most Recent Maximum Value (µg/L)	Most Recent Sample Year
Chlorobenzene	1,720	410	473	790	5,600	6/13/2018	5,600	2018
Benzene	6.93	1.59	462	790	70,000	6/23/2011	40,000	2018
Xylenes	1,620	385	359	790	35,000	12/18/2014	25,000	2018
Ethylbenzene	15.2	3.49	295	790	8,600	12/13/2012	5,500	2018
Toluene	80,700	19,200	241	790	9,300	6/14/2018	9,300	2018
Para-cymene (p-Isopropyltoluene)	3,730	887	224	667	12,000	12/15/2016	9,600	2018
Dichlorobenzene, 1,4-	11.3	2.59	165	634	1,200	6/16/2016	260	2018
Dichlorobenzene, 1,2-	11,200	2,660	159	634	780 J	6/16/2016	180	2018
Formaldehyde*	68,500	15,700	157	357	590	12/13/2012	58	2018
Acetone	94,500,000	22,500,000	142	790	20,000	6/16/2016	5,900	2018
Chloroform	3.55	0.814	130	790	110,000	6/16/2016	99,000	2018
Vinyl Chloride	2.45	0.147	123	790	35	2/1/2011	16	2018
Methylene Chloride	9,230	763	104	790	28,000	6/13/2018	28,000	2018
Dichloropropane, 1,2-	28.7	6.58	73	777	3	6/3/2010	1.5	2018
Dichloroethylene, 1,1-	821	195	52	790	32 J	2/2/2011	2.4	2018
Tetrachloroethylene	65.2	14.9	38	790	390 J	12/16/2016	380	2018
Naphthalene	20.1	4.59	35	377	5.9	6/16/2016	5.9	2016
Dichloroethane, 1,1-	33.4	7.64	22	719	2.2	6/8/2010	1.1	2018
Methyl Isobutyl Ketone (4-methyl-2-pentanone)	2,330,000	555,000	21	790	2,100	12/16/2015	1,500	2018
Carbon Disulfide	5,210	1,240	20	790	1700 J	6/16/2016	2.6	2018
Carbon Tetrachloride	1.81	0.415	20	790	25,000	6/16/2016	410	2018
Trichlorobenzene, 1,2,4-	151	35.9	15	574	5.9	12/13/2012	3.5 J	2016
Methyl Ethyl Ketone (2-Butanone)	9,410,000	2,240,000	13	790	100 J	5/16/2012	11	2018
Trichloropropane, 1,2,3-	93.7	22.3	13	787	5.8	12/13/2012	4.2	2016
Trichloroethylene	7.43	1.19	4	112	1.4	6/13/2018	1.4	2018
Dichloroethane, 1,2-*	9.78	2.24	2	111	8.1	6/3/2010	8.1	2010
Styrene	39,000	9,280	2	111	1	6/3/2010	1	2010
Aldrin*	1.39	0.319	1	25	0.15	6/12/2014	0.15	2014
Cumene*	3,730	887	1	4	0.19 J	8/2/2012	0.19 J	2012
Formic Acid*	192,000	45,800	1	15	68 J	12/6/2018	68 J	2018
Heptachlor*	0.785	0.18	1	303	0.016 J	6/12/2013	0.016 J	2013

Notes:
1. Target concentrations in groundwater were derived from the USEPA VISL Calculator accessed on the USEPA Vapor Intrusion website in March 2019.
2. Para-cymene does not have a USEPA RSL and therefore does not have a value from the VISL calculator. Cumene was use as a surrogate for para-cymene.
3. All monitoring well data from 2010-2018 were used in this screening process when the VI investigations were initiated.
4. Most recent maximum value is the maximum concentration of the parameter from the most recently sampled year.
J - indicates analyte detected at concentration between method detection limit (MDL) and reporting limit (RL), and concentration was estimated.
VI - vapor intrusion
VISL - vapor intrusion screening level
RSL - regional screening level
USEPA - United States Environmental Protection Agency
* - Denotes compound removed from current scope of the ongoing VI investigation.

Table 5-1
Corrective Action Technology Screening - Soils
Hercules/Pinova Facility, Brunswick, Georgia

Corrective Action Technology	Treatment Potential for Chemical Groups				Screening Criteria				Total Score	Retained or Rejected?
	Pesticides[1]	PCBs[2]	VOCs[3]	Arsenic	Effectiveness	Implementability	Timeframe	Cost		
Excavation and Offsite Disposal	L	L	L	L	5	5	5	3	18	Retained
Solidification/Stabilization (*In Situ* or *Ex Situ*)	L	L	L	L	4	4	5	3	16	Retained
Thermal Treatment (*In Situ* or *Ex Situ*)	L	L	L	UL	5	2	5	1	13	Retained
Soil Vapor Extraction	UL	UL	L	UL	3	3	3	5	14	Retained
In Situ Chemical Oxidation via Soil Mixing	L	L	L	UL	3	3	4	3	13	Retained
Capping	L	L	L	L	2	4	5	5	16	Retained
In Situ Chemical Reduction via Soil Mixing	P	P	UL	P	1	2	4	4	11	*Rejected*
Ex Situ Bioremediation or Landfarming	P	P	L	UL	2	2	3	3	10	*Rejected*

Notes:

(1) Pesticides include primary chemicals of potential concern Alpha BHC, chlorobenzilate, toxaphene and dieldrin.

(2) Polychlorinated biphenyls (PCBs) include Aroclor 1254 and Aroclor 1260.

(3) Volatile organic compounds (VOCs) include primary chemicals of potential concern benzene, chlorobenzene, chloroform, methylene chloride, para-cymene and xylenes.

NA - not applicable

Key:

Key	Potential
L	Likely
P	Potential
UL	Unlikely

Score	Effectiveness	Implementability	Timeframe	Cost
5	Very high	Best	Very Fast	Low
4	High	Better	Fast	Moderate Low
3	Moderate High	Good	Moderate	Moderate High
2	Moderate Low	Fair	Long	High
1	Low	Poor	Very Long	Very High

Table 5-2
Corrective Action Alternatives Screening - Groundwater
Hercules/Pinova Facility, Brunswick, Georgia

Corrective Action Technology	Treatment Potential of Primary Chemicals of Potential Concern						Screening Criteria				Total Score	Retained or Rejected?
	Chlorobenzene	Benzene	Xylenes	Para-cymene	Methylene Chloride	Chloroform	Effectiveness	Implementability	Timeframe	Cost		
Groundwater Extraction and Treatment	L	L	L	L	L	L	4	4	1	1	10	Retained
In Situ Solidification/Stabilization	L	L	L	L	L	L	3	3	5	2	13	Retained
Monitored Natural Attenuation	L	L	L	L	L	L	1	5	1	5	12	Retained
In Situ Chemical Reduction	P	UL	UL	UL	L	L	3	3	3	3	12	Retained
Air Sparging/Soil Vapor Extraction	L	L	L	L	L	L	3	2	3	3	11	Retained
Non-Aqueous Phase Liquid Recovery	L	L	L	L	L	L	3	3	2	4	12	Retained
Multi-Phase Extraction	L	L	L	L	L	L	3	3	3	3	12	Retained
In Situ Carbon Injection	L	L	L	L	L	L	2	3	3	2	10	Retained
In Situ Chemical Oxidation	L	L	L	L	L	L	3	3	3	3	12	Retained
Enhanced *In Situ* Bioremediation (Anaerobic or Aerobic)	L	L	L	L	L	L	4	4	3	3	14	Retained
In Situ Thermal Treatment	L	L	L	L	L	L	5	3	5	2	15	Retained
In Situ Geochemical Stabilization	P	P	P	P	P	P	1	2	3	3	9	*Rejected*
Phytoremediation	L	L	L	L	L	L	3	1	1	3	8	*Rejected*

Key:

Key	Potential
L	Likely
P	Potential
UL	Unlikely

Rating	Effectiveness	Implementability	Timeframe	Cost
5	Very high	Best	Very Fast	Low
4	High	Better	Fast	Moderate Low
3	Moderate High	Good	Moderate	Moderate High
2	Moderate Low	Fair	Long	High
1	Low	Poor	Very Long	Very High

Table 6-1
Field Reconnaissance of Potential Target Locations for Interim Corrective Measures
Hercules/Pinova Facility, Brunswick, Georgia

Target Location Sample Identification	Historical Sample Identification	Historical Toxaphene Concentration (mg/kg)	2020 Accessibility	Notes
D1-01	SS-420_10/25/06_(0-1)GRAB_NM	2,400	Inaccessible	Obstructed by stump pile
D1-02	SS-202_5/4/00_(0-1)GRAB_NM	750	Accessible	Nearby overhead obstructions are present
D1-03	SS-270_11/14/00_(0-1)GRAB_NM	370	Accessible	Near a stump pile
D1-04	SS-273_11/7/00_(0-1)GRAB_NM	230	Accessible	Very close to the laboratory building and sidewalk
D2-01	SS-256_11/7/00_(0-1)GRAB_NM	2,000	Accessible	No obstructions or access issues
D2-02	SS-318_10/24/06_(0-1)GRAB_NM	560	Accessible	No obstructions or access issues
D2-03	SIA2B022A_12/5/12_(0-2)COMP_V_NM	480	Accessible	Relocated approximately 20 feet to the northwest due to the presence of a very hard layer (impenetrable by hand auger)
D2-04	SIA2C003A_1/10/13_(0-2)COMP_V_NM	480	Accessible	No obstructions or access issues
D2-05	SS-300_1/31/01_(0-1)GRAB_NM	270	Inaccessible	Obstructed by stump pile
D2-06	SS-281_11/13/00_(0-1)GRAB_NM	210	Accessible	Nearby overead powerlines.
D3-01	SS-216_5/2/00_(0-1)GRAB_NM	4,000	Accessible	Small muddy ditch to cross, otherwise minimal issues.
D4-01	SS005A05_12/8/94_(0-0.5)GRAB_NM	15,000	Accessible	Concrete pad ~10 feet from location and overhead utilities present
D4-02	SS004A05_12/8/94_(0-0.5)GRAB_NM	8,000	Accessible	Concrete pad ~10 feet from location and overhead utilities present
D4-03	SS005A09_12/13/94_(0-0.5)GRAB_NM	3,800	Inaccessible	Entire area is concrete and surrounded by chemical storage tanks
D4-04	SIA4AT4-09Y2_10/19/12_(0-2)COMP_V_NM	3,500	Accessible	Location in between tanks, limited room between them ~12 feet
D4-05	T-3200_1/19/10_(0-1)_NM	2,600	Inaccessible	Located beneath lined tank containment area with standing water 12-18 inches deep
D4-06	TF-026_1/26/10_(0-1)_NM	1,800	Accessible	Location in between tanks, limited room between them ~12 feet
D4-07	SS001A09_12/8/94_(0-0.5)GRAB_NM	2,600	Accessible	Metal loading dock and concrete pad near sample location
D4-08	TF-011_1/26/10_(1-2)_NM	1,700	Accessible	In gravel road between storage tanks
D4-09	TF-025_1/26/10_(0-1)_NM	1,300	Accessible	Location in between tanks, limited room between them ~12 feet
D4-10	SS-316_4/18/01_(0-1)GRAB_NM	980	Accessible	No obstructions or access issues
D4-11	TF-024_1/28/10_(0-1)_NM	390	Inaccessible	Located beneath lined tank containment area with standing water 12-18 inches deep
D4-12	HCS GR H-1 (W,1.5)_10/10/09_(1.5-1.5)_NM	850	Accessible	Cargo trailers close (but can likely be moved for excavation)
D4-13	SIA4AT4-03A_2/19/13_(0-2)COMP_V_NM	610	Accessible	Large tanks within 20 feet of location
D4-14	SS-311_4/16/01_(0-1)GRAB_NM	580	Accessible	Very hard packed parking lot/road
D4-15	SS003A05_12/8/94_(0-0.5)GRAB_NM	410	Accessible	Cargo trailers close (but can likely be moved for excavation)
D4-16	SS001A07_1/11/95_(0-0.5)GRAB_NM	400	Not Sampled	Located in Vinsol containment area where the ground surface is seasonally very soft (tar-like)
D4-17	SIA4AT2-04A_2/14/13_(0-2)COMP_V_NM	390	Not Sampled	Located in Vinsol containment area where the ground surface is seasonally very soft (tar-like)
D4-18	SIA4C007A_3/5/13_(0-2)COMP_V_NM	340	Inaccessible	Concrete paved, not able to sample with hand auger equipment
D4-19	14_1/23/02_(0-1)GRAB_NM	330	Accessible	Tight space in between two concrete containment dikes approximately 10 feet apart
D4-20	SIA4AVINS05_7/11/14_(0-2)COMP_V_NM	310	Not Sampled	Located in Vinsol containment area where the ground surface is seasonally very soft (tar-like)
D4-21*	SS005A06_12/16/94_(0-0.5)GRAB_NM	11	Inaccessible	Located beneath lined tank containment area with standing water 12-18 inches deep
D4-22*	SS006A06_12/16/94_(0-0.5)GRAB_NM	60	Inaccessible	Located beneath lined tank containment area with standing water 12-18 inches deep
D4-23	TF-016_1/20/10_(0-1)_NM	340	Accessible	Adjacent to gravel and concrete pad

* Sampling results exceeded the risk management level established by the United States Environmental Protection Agency for Aroclor 1254 with concentrations of 330 mg/kg and 55 mg/kg at sampling locations D4-21 and D4-22, respectively

Table 6-2
Spring 2020 Sampling Results from Field Reconnaissance of Accessible Target Locations
Hercules/Pinova Facility, Brunswick, Georgia

	alpha-BHC	Aroclor 1254	Aroclor 1260	Arsenic	Benzene	Chlorobenzene	Chlorobenzilate	Chloroform	Dieldrin	Methylene Chloride	para-Cymene	Toxaphene	Toxaphene, TAUC
	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
RML (c)	*36*	*97*	*99*	*300*	*510*	--	*2,100*	*140*	*14*	*100,000*	--	*210*	--
RML (nc)	*20,000*	*44*	*44 s*	*1,400*	*1,300*	*4,000*	*49,000*	*3100*	*120*	*9,500*	*30,000 s*	*220*	--
D1-02	11 U	200 U	200 U	**2.1**	**0.17**	0.0077 UJ	620 UJ	0.0077 U	11 U	0.0077 U	0.013 **J+**	**3,200 J**	**3,100 J**
D1-03	0.0056 U	0.11 U	0.11 U	2.4 U	1.5 U	1.5 U	0.33 UJ	1.5 U	0.0056 U	1.8 U	**76**	**1.6 J**	**1.9 J**
D1-04	0.010 U	0.20 U	0.20 U	2.1 U	0.011 U	0.011 UJ	0.60 UJ	0.011 U	**0.13 J**	0.011 U	0.011 R	**2.2 J**	**5.7 J**
D2-01	0.098 R	1.9 U	1.9 U	**3.7**	**0.028 J**	0.0075 R	5.8 R	0.0075 R	0.098 U	0.0075 R	0.0075 R	**80**	**110**
D2-02	0.093 R	1.8 U	1.8 U	2.2 U	0.0063 R	0.0063 R	5.5 R	0.0063 R	0.093 R	0.0063 R	0.0063 R	**100**	**96**
D2-03	0.049 U	0.96 U	0.96 U	2.0 U	0.0059 U	0.0059 UJ	2.9 UJ	0.0059 U	0.049 U	0.0059 U	0.0059 UJ	**11 J**	**14 J**
D2-04	1.2 U	23 U	23 U	**5.2**	**0.044**	0.015 U	69 UJ	0.015 U	1.2 U	0.015 U	0.015 UJ	**190 J**	**180 J**
D2-06	0.18 U	3.5 U	3.5 U	**2.0**	0.0066 U	0.0066 UJ	11 UJ	0.0066 U	0.18 U	0.0066 U	0.0066 UJ	**43 J**	**41 J**
D3-01	0.37 U	7.2 U	7.2 U	2.0 U	0.0057 U	0.0057 U	22 UJ	0.0057 U	0.37 U	0.0057 U	0.0057 UJ	**160 J**	**140 J**
D4-01	0.18 U	3.5 U	3.5 U	1.9 U	0.0057 U	0.0057 U	11 UJ	0.0057 U	0.18 U	0.0057 U	0.0057 U	**58 J**	**50 J**
D4-02	**0.0013**	0.019 U	0.019 U	**2.4**	0.0074 U	0.0074 U	0.056 UJ	0.0074 U	0.001 U	0.0074 U	0.0074 U	**18 J**	**17 J**
D4-04	8.5 U	170 U	170 U	1.8 U	0.010 U	0.010 U	500 UJ	0.010 U	8.5 U	0.010 U	0.065 U	**1,200 J**	**1,200 J**
D4-06	9.0 U	170 U	170 U	1.9 U	0.0070 U	0.0070 U	530 UJ	0.0070 U	9.0 U	0.0070 U	**0.0093 J+**	**7,800 J**	**6,700 J**
D4-07	0.20 U	3.9 U	3.9 U	**2.1**	**0.99**	0.62 U	12 UJ	**0.69**	**0.20**	**0.62**	12 U	**49 J**	**93 J**
D4-08	4.9 U	95 U	95 U	2.0 U	0.0063 U	0.0063 U	290 UJ	0.0063 U	4.9 U	0.0063 U	0.037 U	**1,300 J**	**1,300 J**
D4-09	9.6 U	190 U	190 U	1.9 U	0.0075 U	0.0075 UJ	560 UJ	**0.011**	**9.6**	**0.0075**	**0.040 J+**	**2,400 J**	**2,400 J**
D4-10	0.0019 U	0.036 U	0.036 U	1.9 U	0.0052 U	0.0052 U	0.11 UJ	0.0052 U	0.0019 U	0.0052 U	0.0052 U	**0.30 J**	**0.29 J**
D4-12	0.91 U	18 U	18 U	**2.8**	**0.025 J+**	**0.024 J+**	54 U	**0.10 J+**	0.91 U	0.0079 UJ	0.0079 R	**500 J**	**460 J**
D4-13	0.0010 U	0.020 U	0.020 U	2.1 U	0.012 U	0.012 UJ	0.059 UJ	0.012 U	0.0010 U	0.012 U	**0.020 J+**	0.10 UJ	0.10 UJ
D4-14	0.0017 U	0.034 U	0.034 U	**2.2**	0.0063 U	0.0063 U	0.10 UJ	0.0063 U	0.0017 U	0.0063 U	0.011 U	0.17 UJ	0.17 UJ
D4-15	0.0046 U	0.090 U	0.090 U	**2.6**	0.0065 U	0.0065 U	0.27 UJ	**0.0075**	**0.0046**	**0.0065**	0.0065 U	**1.6 J**	**1.3 J**
D4-19	0.57 U	11 U	11 U	2.3 U	0.0071 U	0.0071 UJ	33 UJ	0.0071 U	0.57 U	0.0071 U	0.0071 UJ	**200 J**	**210 J**
D4-23	0.0011 U	**0.39**	0.022 U	2.5 U	0.0023 U	0.0023 U	0.066 UJ	0.0023 U	0.0011 U	**0.0023** U	0.0023 U	0.11 U	0.11 U

Notes

All sampling results reported in milligrams per kilogram (mg/kg). Toxaphene reported as both toxaphene and TAUC (total area under the curve).

RML (c) Risk management level for carcinogenic target risk of 1 x 10^{-4}. No RML available indicated by "--".

RML (nc) Risk management level for noncancer hazard quotient of 3.

U - Indicates that the analyte was analyzed but not detected.

J - Indicates that the reported result is an estimate. The value is less than the minimum calibration level but greater than the method detection limit (MDL).

UJ - Indicates that the analyte was not detected above the reported sample quantitation limit. However, the reported quantitation limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte in the sample.

J+ - Indicates that the analyte was positively identified; however, the associated numerical value is likely to be higher than the concentration of the analyte in the sample due to positive bias of associated quality control or calibration data or attributable to matrix interference.

R - Indicates that the sample results are rejected due to serious deficiencies in the ability to analyze the sample and meet quality control criteria. The presence or absence of the analyte cannot be verified.

s - No RML available, surrogate compound used: Aroclor 1254 for Aroclor 1260; toxaphene for total toxaphene (TAUC); cumene for para-cymene.

Table 6-3
Analytical Results for Toxaphene in Delineation Soil Samples
Hercules/Pinova Facility, Brunswick, Georgia

Target Location Identification		Sample Name	SampleDate	Toxaphene (mg/kg)	Toxaphene, TAUC (mg/kg)
Domain 1					
D1-02	D1-02	SSD1-02(0-2)-SO-04282020	4/28/2020	3,200	3,100
	D1-02A	SSD1-02A(0-2)-SO-12042020	12/4/2020	41	110
	D1-02B	SSD1-02B(0-2)-SO-12042020	12/4/2020	21	40
	D1-02C	SSD1-02C(0-2)-SO-12042020	12/4/2020	1,900	2,600
	D1-02D	SSD1-02D(0-2)-SO-01272021	1/27/2021	980	1,200
	D1-02E	SSD1-02E(0-2)-SO-01272021	1/27/2021	5,600	6,100
	D1-02F	SSD1-02F(0-2)-SO-03162021	3/16/2021	56	91
	D1-02G	SSD1-02G(0-2)-SO-03162021	3/16/2021	6,400	7,500
	D1-02H	SSD1-02H(0-2)-SO-04232021	4/23/2021	2,800	2,900
	D1-02J	SSD1-02J(0-2)-SO-04232021	4/23/2021	830	960
	D1-02K	SSD1-02K(0-2)-SO-04232021	4/23/2021	8,900	9,400
	D1-02L	SSD1-02L(0-2)-SO-04232021	4/23/2021	76,000	79,000
	D1-02M	SSD1-02M(0-2)-SO-06102021	6/10/2021	22	48
	D1-02N	SSD1-02N(0-2)-SO-06102021	6/10/2021	2.2	5.2
	D1-02P	SSD1-02P(0-2)-SO-06102021*	6/10/2021	1.9	1.7
	D1-02Q	SSD1-02Q(0-2)-SO-06102021	6/10/2021	1.3	1.7
	D1-02R	SSD1-02R(0-2)-SO-06102021	6/10/2021	0.46 U	0.46 U
	D1-02S	SSD1-02S(0-2)-SO-06102021	6/10/2021	0.9	1.0
	D1-02T	SSD1-02T(0-2)-SO-06102021	6/10/2021	2.1	1.8
	D1-02U	SSD1-02U(0-2)-SO-06102021	6/10/2021	2.1	3.0
	D1-02V	SSD1-02V(0-2)-SO-07152021	7/15/2021	12	16
D1-03	D1-03	SSD1-03(0-2)-SO-04292020	4/29/2020	1.6	1.9
	D1-03A	SSD1-03A(0-2)-SO-12032020	12/3/2020	0.8	1.4
	D1-03B	SSD1-03B(0-2)-SO-12032020	12/3/2020	6.5	9.1
	D1-03C	SSD1-03C(0-2)-SO-12032020	12/3/2020	0.11	0.87
D1-04	D1-04	SSD1-04(0-2)-SO-04282020	4/28/2020	2.2	5.7
	D1-04A	SSD1-04A(0-2)-SO-12182020	12/18/2020	0.24	1.4
	D1-04B	SSD1-04B(0-2)-SO-12182020	12/18/2020	1.1	2.1
	D1-04C	SSD1-04C(0-2)-SO-12182020	12/18/2020	1.1	4.0

Table 6-3
Analytical Results for Toxaphene in Delineation Soil Samples
Hercules/Pinova Facility, Brunswick, Georgia

Target Location Identification		Sample Name	SampleDate	Toxaphene (mg/kg)	Toxaphene, TAUC (mg/kg)
Domain 2					
D2-01	D2-01	SSD2-01(0-2)SO05142020	5/14/2020	80	110
	D2-01A	SSD2-01A(0-2)-SO-12022020	12/2/2020	79	72
	D2-01B	SSD2-01B(0-2)-SO-12022020	12/2/2020	360	350
	D2-01C	SSD2-01C(0-2)-SO-12022020	12/2/2020	190	220
	D2-01D	SSD2-01D(0-2)-SO-03152021	3/15/2021	300	320
	D2-01E	SSD2-01E(0-2)-SO-03152021	3/15/2021	2,700	2,800
	D2-01F	SSD2-01F(0-2)-SO-03152021	3/15/2021	830	930
	D2-01G	SSD2-01G(0-2)-SO-04232021	4/23/2021	54	57
	D2-01H	SSD2-01H(0-2)-SO-04232021	4/23/2021	380	410
	D2-01J	SSD2-01J(0-2)-SO-04232021	4/23/2021	24	29
	D2-01K	SSD2-01K(0-2)-SO-04232021	4/23/2021	240	270
	D2-01L	SSD2-01L(0-2)-SO-04232021	4/23/2021	4,400	4,700
	D2-01M	SSD2-01M(0-2)-SO-04232021	4/23/2021	590	630
	D2-01N	SSD2-01N(0-2)-SO-04232021	4/23/2021	4,600	4,600
	D2-01P	SSD2-01P(0-2)-SO-04232021	4/23/2021	250	270
	D2-01Q	SSD2-01Q(0-2)-SO-06092021	6/9/2021	370	420
	D2-01Q1	SSD2-01Q1(0-2)-SO-06092021	6/9/2021	1,100	1,200
	D2-01R	SSD2-01R(0-2)-SO-06092021*	6/9/2021	290	320
	D2-01S	SSD2-01S(0-2)-SO-06092021	6/9/2021	270	310
	D2-01T	SSD2-01T(0-2)-SO-06092021	6/9/2021	1,500	2,000
	D2-01T1	SSD2-01T1(0-2)-SO-06092021	6/9/2021	410	460
	D2-01U	SSD2-01U(0-2)-SO-06092021	6/9/2021	1,500	1,600
	D2-01U1	SSD2-01U1(0-2)-SO-06092021	6/9/2021	300	370
	D2-01U2	SSD2-01U2(0-2)-SO-06092021	6/9/2021	98	170
	D2-01V	SSD2-01V(0-2)-SO-06092021	6/9/2021	14,000	15,000
	D2-01V1	SSD2-01V1(0-2)-SO-06092021	6/9/2021	400	490
	D2-01W	SSD2-01W(0-2)-SO-06092021	6/9/2021	55,000	57,000
	D2-01W1	SSD2-01W1(0-2)-SO-06092021	6/9/2021	3,000	3,200
	D2-01R1	SSD2-01R1(0-2)-SO-07152021	7/15/2021	570	500
	D2-01X	SSD2-01X(0-2)-SO-07152021	7/15/2021	1,300	1,400
	D2-01X1	SSD2-01X1(0-2)-SO-07152021	7/15/2021	72	73
	D2-01X2	SSD2-01X2(0-2)-SO-07152021	7/15/2021	62	110
	D2-01Y	SSD2-01Y(0-2)-SO-07152021	7/15/2021	47	85
	D2-01Z	SSD2-01Z(0-2)-SO-07152021*	7/15/2021	600	740
	D2-01AA	SSD2-01AA(0-2)-SO-07152021	7/15/2021	580	490
	D2-01AB	SSD2-01AB(0-2)-SO-07152021	7/15/2021	1,300	1,200
	D2-01AC	SSD2-01AC(0-2)-SO-07152021	7/15/2021	32	36
	D2-01AD	SSD2-01AD(0-2)-SO-07152021	7/15/2021	1,000	1,100
	D2-01AE	SSD2-01AE(0-2)-SO-07152021	7/15/2021	2,900	2,700
	D2-01AF	SSD2-01AF(0-2)-SO-07152021	7/15/2021	49	51
	D2-01AG	SSD2-01AG(0-2)-SO-07152021	7/15/2021	210	450
	D2-01AH	SSD2-01AH(0-2)-SO-07152021	7/15/2021	140	300
	D2-01AJ	SSD2-01AJ(0-2)-SO-07152021	7/15/2021	320	740
	D2-01AK	SSD2-01AK(0-2)-SO-07152021	7/15/2021	31	33
	D2-01AM	SSD2-01AM(0-2)-SO-08172021	8/17/2021	24	36
	D2-01AN	SSD2-01AN(0-2)-SO-08172021	8/17/2021	44	55
	D2-01AP	SSD2-01AP(0-2)-SO-08172021	8/17/2021	120	160
	D2-01AQ	SSD2-01AQ(0-2)-SO-08172021	8/17/2021	90	82

Table 6-3
Analytical Results for Toxaphene in Delineation Soil Samples
Hercules/Pinova Facility, Brunswick, Georgia

Target Location Identification		Sample Name	SampleDate	Toxaphene (mg/kg)	Toxaphene, TAUC (mg/kg)
Domain 2 continued					
D2-02	D2-02	SSD2-02(0-2)-SO-05142020	5/14/2020	100	96
	D2-02A	SSD2-02A(0-2)-SO-12022020	12/2/2020	23	29
	D2-02B	SSD2-02B(0-2)-SO-12022020	12/2/2020	49	110
	D2-02C	SSD2-02C(0-2)-SO-12022020	12/2/2020	0.09	0.09
D2-03	D2-03	SSD2-03 (0-2)-SO-04272020	4/27/2020	11	14
	D2-03A	SSD2-03A(0-2)-SO-12022020	12/2/2020	720	1,400
	D2-03B	SSD2-03B(0-2)-SO-12022020	12/2/2020	540	950
	D2-03C	SSD2-03C(0-2)-SO-12022020	12/2/2020	280	590
	D2-03D	SSD2-03D(0-2)-SO-03152021	3/15/2021	32	44
	D2-03E	SSD2-03E(0-2)-SO-03162021	3/16/2021	1,700	1,700
	D2-03F	SSD2-03F(0-2)-SO-03152021	3/15/2021	1,500	1,600
	D2-03G	SSD2-03G(0-2)-SO-04232021	4/23/2021	21	24
	D2-03H	SSD2-03H(0-2)-SO-04232021	4/23/2021	38	74
	D2-03J	SSD2-03J(0-2)-SO-04232021	4/23/2021	87	170
	D2-03K	SSD2-03K(0-2)-SO-04232021	4/23/2021	2,600	2,800
	D2-03L	SSD2-03L(0-2)-SO-04232021	4/23/2021	3,300	3,600
	D2-03M	SSD2-03M(0-2)-SO-04232021	4/23/2021	7.6	13
	D2-03N	SSD2-03N(0-2)-SO-06092021	6/9/2021	84	97
	D2-03P	SSD2-03P(0-2)-SO-06092021	6/9/2021	160	140
	D2-03Q	SSD2-03Q(0-2)-SO-06092021	6/9/2021	37	44
	D2-03R	SSD2-03R(0-2)-SO-06092021	6/9/2021	620	730
	D2-03S	SSD2-03S(0-2)-SO-06092021	6/9/2021	1,800	2,200
	D2-03T	SSD2-03T(0-2)-SO-07152021	7/15/2021	84	89
	D2-03T2	SSD2-03T2(0-2)-SO-07152021	7/15/2021	11	10
	D2-03U	SSD2-03U(0-2)-SO-07152021	7/15/2021	1,000	1,100
	D2-03U1	SSD2-03U1(0-2)-SO-07152021	7/15/2021	110	120
	D2-03V	SSD2-03V(0-2)-SO-07152021	7/15/2021	2,500	2,500
	D2-03V1	SSD2-03V1(0-2)-SO-07152021	7/15/2021	250	530
	D2-03W	SSD2-03W(0-2)-SO-07152021	7/15/2021	350	310
	D2-03W1	SSD2-03W1(0-2)-SO-07152021	7/15/2021	330	350
	D2-03W2	SSD2-03W2(0-2)-SO-07152021	7/15/2021	300	630
	D2-03W3	SSD2-03W3(0-2)-SO-08172021	8/17/2021	20	31
	D2-03X	SSD2-03X(0-2)-SO-08172021	8/17/2021	9.1	11
	D2-03X2	SSD2-03X2(0-2)-SO-08172021	8/17/2021	31	41
	D2-03Y	SSD2-03Y(0-2)-SO-08172021	8/17/2021	1,300	1,400
	D2-03Y1	SSD2-03Y1(0-2)-SO-08172021	8/17/2021	560	560
	D2-03Y2	SSD2-03Y2(0-2)-SO-08172021	8/17/2021	620	630
	D2-03Z	SSD2-03Z(0-2)-SO-08172021	8/17/2021	130	270
	D2-03Z1	SSD2-03Z1(0-2)-SO-08172021	8/17/2021	140	130
	D2-03Y3	SSD2-03Y3(0-2)-SO-08172021	9/14/2021	260	250
	D2-03Y4	SSD2-03Y4(0-2)-SO-09142021	9/14/2021	1,100	1,200
	D2-03Y5	SSD2-03Y5(0-2)-SO-09142021	9/14/2021	110	130
	D2-03Y6	SSD2-03Y6(0-2)-SO-09142021	9/14/2021	45	54
	D2-03Y7	SSD2-03Y7(0-2)-SO-09142021	9/14/2021	180	170
	D2-03Y8	SSD2-03Y8(0-2)-SO-09142021	9/14/2021	640	650
	D2-03X3	SSD2-03X3(0-2)-SO-10072021*	10/7/2021	43	44
	D2-03Y10	SSD2-03Y10(0-2)-SO-10072021	10/7/2021	130	140
	D2-03Y11	SSD2-03Y11(0-2)-SO-10072021	10/7/2021	130	140
	D2-03Y12	SSD2-03Y12(0-2)-SO-10072021	10/7/2021	570	590
	D2-03Y13	SSD2-03Y13(0-2)-SO-10072021	10/7/2021	220	230
	D2-03Y15	SSD2-03Y15(0-2)-SO-10072021	10/7/2021	100	110
	D2-03Y16	SSD2-03Y16(0-2)-SO-10072021	10/7/2021	82	85
	D2-03Y17	SSD2-03Y17(0-2)-SO-10072021	10/7/2021	120	130
	D2-03Z3	SSD2-03Z3(0-2)-SO-10072021	10/7/2021	170	180

Table 6-3
Analytical Results for Toxaphene in Delineation Soil Samples
Hercules/Pinova Facility, Brunswick, Georgia

Target Location Identification		Sample Name	SampleDate	Toxaphene (mg/kg)	Toxaphene, TAUC (mg/kg)	
Domain 2 continued and Domain 3						
D2-04	D2-04	SSD2-04(0-2)-SO-04272020	4/27/2020	190	180	
	D2-04A	SSD2-04A(0-2)-SO-12022020	12/2/2020	43	83	
	D2-04B	SSD2-04B(0-2)-SO-12022020	12/2/2020	99	160	
	D2-04C	SSD2-04C(0-2)-SO-12022020	12/2/2020	11	66	
D2-06	D2-06	SSD2-06(0-2)-SO-04272020	4/27/2020	43	41	
	D2-06A	SSD2-06A(0-2)-SO-12032020	12/3/2020	16	36	
	D2-06B	SSD2-06B(0-2)-SO-12032020	12/3/2020	440	550	
	D2-06C	SSD2-06C(0-2)-SO-12032020	12/3/2020	38	75	
	D2-06D	SSD2-06D(0-2)-SO-03152021	3/15/2021	16	23	
D3-01	D3-01	SSD3-01 (0-2)-SO-04272020	4/27/2020	160	140	
	D3-01A	SSD3-01A(0-2)-SO-12022020	12/2/2020	390	350	
	D3-01B	SSD3-01B(0-2)-SO-12022020	12/2/2020	1,200	1,100	
	D3-01C	SSD3-01C(0-2)-SO-12022020	12/2/2020	280	260	
	D3-01D	SSD3-01D(0-2)-SO-03152021	3/15/2021	38	42	
	D3-01E	SSD3-01E(0-2)-SO-03152021	3/15/2021	440	430	
	D3-01F	SSD3-01F(0-2)-SO-03152021	3/15/2021	170	160	
	D3-01G	SSD3-01G(0-2)-SO-05172021	5/17/2021	150	140	
	D3-01H	SSD3-01H(0-2)-SO-05172021	5/17/2021	30	29	
	D3-01J	SSD3-01J(0-2)-SO-05172021	5/17/2021	780	710	
	D3-01K	SSD3-01K(0-2)-SO-05172021	5/17/2021	130	120	
	D3-01M	SSD3-01M(0-2)-SO-06102021	6/10/2021	2.2	1.9	
	D3-01N	SSD3-01N(0-2)-SO-06102021	6/10/2021	230	220	
	D3-01P	SSD3-01P(0-2)-SO-06102021	6/10/2021	77	56	
	D3-01Q	SSD3-01Q(0-2)-SO-07152021*	7/15/2021	150	130	
Domain 4						
D4-01	D4-01	SSD4-01 (0-2)-SO-04292020	4/29/2020	58	50	
	D4-01A	SSD4-01A(0-2)-SO-12032020	12/3/2020	4.2	4.8	
	D4-01B	SSD4-01B(0-2)-SO-12032020	12/3/2020	5.3	6.4	
	D4-01C	SSD4-01C(0-2)-SO-12032020	12/3/2020	240	300	
D4-02	D4-02	SSD4-02 (0-2)-SO-04292020	4/29/2020	18	17	
	D4-02A	SSD4-02A(0-2)-SO-12032020	12/3/2020	40	52	
	D4-02B	SSD4-02B(0-2)-SO-12032020	12/3/2020	34	38	
	D4-02C	SSD4-02C(0-2)-SO-12032020	12/3/2020	14	17	
D4-07	D4-07	SSD4-07 (0-2)-SO-04292020	4/29/2020	49	93	
	D4-07A	SSD4-07A(0-2)-SO-12032020	12/3/2020	8.8	81	
	D4-07B	SSD4-07B(0-2)-SO-12032020	12/3/2020	10	67	
D4-04	D4-04	SSD4-04(0-2)-SO-04282020	4/28/2020	1,200	1,200	E
D4-06	D4-06	SSD4-06(0-2)-SO-04282020	4/28/2020	7,800	6,700	E
D4-08	D4-08	SSD4-08(0-2)-SO-04282020	4/28/2020	1,300	1,300	E
D4-09	D4-09	SSD4-09(0-2)-SO-04282020	4/28/2020	2,400	2,400	E
	D4-25	SS DUP-01-SO-01272021	1/27/2021	13	23	
	D4-25	SSD4-25(0-2)-SO-09082020	9/8/2020	0.91	1.0	
	D4-26	SSD4_26(0-2)-SO-09082020	9/8/2020	0.84	1.2	E
	D4-27	SSD4-27(0-2)-SO-12042020	12/4/2020	260	330	E
	D4-28	SSD4-28(0-2)-SO-12042020	12/4/2020	150	200	E
	D4-29	SSD4-29(0-2)-SO-12042020	12/4/2020	17	25	E
	D4-30	SSD4-30(0-2)-SO-01272021	1/27/2021	17	32	
	D4-31	SSD4-31(0-2)-SO-01272021	1/27/2021	660	620	E
	D4-32	SSD4-32(0-2)-SO-01272021	1/27/2021	45	57	
	D4-33	SSD4-33(0-2)-SO-03042021	3/4/2021	2,300	2,600	E
	D4-34	SSD4-34(0-2)-SO-03042021	3/4/2021	2,000	2,300	E
	D4-35	SSD4-35(0-2)-SO-03162021	3/16/2021	210	230	E
	D4-36	SSD4-36(0-2)-SO-03162021	3/16/2021	69	86	E
	D4-37	SSD4-37(0-2)-SO-03162021	3/16/2021	2,000	2,200	E
	D4-38	SSD4-38(0-2)-SO-03162021	3/16/2021	1,700	1,900	E
	D4-38A	SSD2-38A(0-2)-SO-08172021	8/17/2021	25	30	
	D4-39	SSD4-39(0-2)-SO-05172021	5/17/2021	1,100	1,200	E
	D4-40	SSD4-40(0-2)-SO-05172021	5/17/2021	44	98	

Table 6-3
Analytical Results for Toxaphene in Delineation Soil Samples
Hercules/Pinova Facility, Brunswick, Georgia

Target Location Identification		Sample Name	SampleDate	Toxaphene (mg/kg)	Toxaphene, TAUC (mg/kg)	
Domain 4 continued						
D4-10	D4-10	SSD4-10 (0-2)-SO-04292020	4/29/2020	0.30	0.29	
	D4-10A	SSD4-10A(0-2)-SO-12022020	12/2/2020	0.1 U	0.1 U	
	D4-10B	SSD4-10B(0-2)-SO-12022020	12/2/2020	0.1 U	0.1 U	
	D4-10C	SSD4-10C(0-2)-SO-12022020	12/2/2020	0.1 U	0.1 U	
D4-12	D4-12	SSD4-12(0-2)-SO-04282020	4/28/2020	500	460	
	D4-12A	SSD4-12A(0-2)-SO-12042020*	12/4/2020	200	230	
	D4-12B	SSD4-12B(0-2)-SO-12042020	12/4/2020	110	130	
	D4-12C	SSD4-12C(0-2)-SO-12042020	12/4/2020	5.3	7.6	
	D4-12D	SSD4-12D(0-2)-SO-03162021	3/16/2021	26	44	
	D4-12E	SSD4-12E(0-2)-SO-05172021	5/17/2021	10	14	
D4-13	D4-13	SSD4-13(0-2)-SO-04282020	4/28/2020	0.1 U	0.1 U	
	D4-13A	SSD4-13A(0-2)-SO-12022020	12/2/2020	0.51	6.1	
	D4-13B	SSD4-13B(0-2)-SO-12022020	12/2/2020	3.0	9.3	
	D4-13C	SSD4-13C(0-2)-SO-12022020	12/2/2020	0.43	4.8	
D4-14	D4-14	SSD4-13(0-2)-SO-04282020	4/28/2020	0.17 U	0.17 U	
	D4-14A	SSD4-14A(0-2)-SO-12022020	12/2/2020	0.25	0.20	
	D4-14B	SSD4-14B(0-2)-SO-12022020	12/2/2020	0.20	0.44	
D4-15	D4-15	SSD4-15 (0-2)-SO-04292020	4/29/2020	1.6	1.3	
	D4-15A	SSD4-15A(0-2)-SO-12032020	12/3/2020	2.1	2.3	
	D4-15B	SSD4-15B(0-2)-SO-12032020	12/3/2020	1.2	1.3	
D4-19	D4-19	SSD4-19(0-2)-SO-04282020*	4/28/2020	200	210	
	D4-19A	SSD4-19A(0-2)-SO-12022020	12/2/2020	160	230	
	D4-19B	SSD4-19B(0-2)-SO-12022020	12/2/2020	32	73	
	D4-19C	SSD4-19C(0-2)-SO-12022020	12/2/2020	45	58	
	D4-19D	SSD4-19D(0-2)-SO-03162021	3/16/2021	11	20	
	D4-19E	SSD4-19E(0-2)-SO-03162021	3/16/2021	69	150	
D4-23	D4-23	SSD4-23(0-2)-SO-06162020	6/16/2020	0.11 U	0.11 U	
	D4-23A	SSD4-23A(0-2)-SO-12022020	12/2/2020	25	24	
	D4-23B	SSD4-23B(0-2)-SO-12022020	12/2/2020	2.9	2.8	
	D4-23C	SSD4-23C(0-2)-SO-12022020	12/2/2020	500	410	E
	D4-23D	SSD4-23D(0-2)-SO-01272021	1/27/2021	100	140	
	D4-23E	SSD4-23E(0-2)-SO-01272021	1/27/2021	1.8	2.6	
	D4-23F	SSD4-23F(0-2)-SO-03162021	3/16/2021	64	77	

Notes

Blue shaded cells indicate target locations where delineation sampling performed.

Green shaded cells correspond to target locations where supplemental sampling did not identify toxaphene at concentrations greater than the RML for toxaphene at industrial sites; such locations are not subject to interim corrective measures at this time. Toxaphene was detected a concentration exceeding the relevant RML at sample location D4-01C; however, further delineation sampling could not be performed due to location inaccessibility and this location is not subject to interim corrective measures at this time.

RML - Removal management level developed by the United States Environmental Protection Agency.

E - Indicates that soils were excavated and solidified with soils in former toxaphene tank farm.

U - Indicates the analyte was analyzed for but not detected.

* - Results for duplicate sample shown due to higher value.

Table 7-1
Groundwater Monitoring Program
Hercules/Pinova Facility, Brunswick, Georgia

Well ID	Easting	Northing	Hydrogeologic Unit		Monitoring Frequency	Sampling Timeframe	Laboratory Analyses
			Aquifer Unit	Aquifer Zone			
MW-1D	871608.5	425321.9	Upper Surficial Aquifer	Shallow	Annual	Summer	VOCs, SVOCs, Pesticides, Metals, Dioxins/Furans, Formaldehyde, Sulfide
MW-2D	871588.6	425195.9	Upper Surficial Aquifer	Intermediate	Annual	Summer	VOCs, SVOCs, Pesticides, Metals, Dioxins/Furans, Formaldehyde, Sulfide
MW-3S	871407.6	425718.1	Upper Surficial Aquifer	Shallow	Annual	Summer	VOCs, Toxaphene
MW-9S	872055.0	423982.6	Upper Surficial Aquifer	Shallow	Annual	Winter	VOCs, Toxaphene
MW-11DD	872461.5	424866.6	Upper Surficial Aquifer	Deep	Annual	Summer	VOCs, SVOCs, Pesticides
MW-12S	872109.7	425600.7	Upper Surficial Aquifer	Shallow	Annual	Summer	VOCs, Toxaphene
MW-12D	872108.9	425596.4	Upper Surficial Aquifer	Deep	Annual	Summer	VOCs, SVOCs, Pesticides
MW-13	872746.7	424302.4	Lower Surficial Aquifer	--	Annual	Winter	VOCs, Toxaphene
MW-15D	871264.2	424927.8	Upper Surficial Aquifer	Deep	Annual	Winter	VOCs, SVOCs, Pesticides
MW-23	870474.3	424392.1	Upper Surficial Aquifer	Shallow	Semi-Annual	Summer/Winter	VOCs, SVOCs, Pesticides
MW-25S	870992.3	423393.4	Upper Surficial Aquifer	Shallow	Annual	Winter	VOCs, Toxaphene
MW-26D	872441.3	425330.3	Upper Surficial Aquifer	Deep	Annual	Summer	VOCs, Toxaphene
MW-28D	872456.4	424096.6	Upper Surficial Aquifer	Deep	Annual	Summer	VOCs, Toxaphene
MW-39I	873719.3	424316.0	Upper Surficial Aquifer	Intermediate	Annual	Winter	VOCs, Toxaphene
MW-39D	873721.5	424309.7	Upper Surficial Aquifer	Deep	Annual	Winter	VOCs, Toxaphene
MW-41I	871633.3	425872.1	Upper Surficial Aquifer	Intermediate	Annual	Summer	VOCs, SVOCs, Pesticides, Metals, Dioxins/Furans, Formaldehyde, Sulfide
MW-42I	870491.4	424643.9	Upper Surficial Aquifer	Intermediate	Annual	Winter	VOCs, Toxaphene
MW-43D	871537.0	424636.8	Upper Surficial Aquifer	Deep	Annual	Winter	VOCs, SVOCs, Pesticides
MW-44D	871751.7	424883.5	Lower Surficial Aquifer	--	Annual	Winter	VOCs, Toxaphene
MW-51D	872735.5	423435.3	Upper Surficial Aquifer	Deep	Annual	Winter	VOCs, Toxaphene
MW-52D	872668.8	425608.4	Upper Surficial Aquifer	Deep	Annual	Summer	VOCs, Toxaphene
MW-55I	873363.2	424922.8	Upper Surficial Aquifer	Intermediate	Annual	Summer	VOCs, Toxaphene
MW-55D	873358.3	424923.6	Upper Surficial Aquifer	Deep	Annual	Summer	VOCs, Toxaphene
MW-61I	873293.8	423958.1	Upper Surficial Aquifer	Intermediate	Annual	Summer	VOCs, Toxaphene
MW-61D	873282.0	423960.9	Upper Surficial Aquifer	Deep	Annual	Summer	VOCs, Toxaphene
POC-1S(1)	871047.2	425678.7	Upper Surficial Aquifer	Shallow	Annual	Summer	VOCs, SVOCs, Pesticides
POC-2S(1)	871187.1	425519.6	Upper Surficial Aquifer	Shallow	Annual	Summer	VOCs, SVOCs, Pesticides
POC-2D	871189.3	425529.0	Upper Surficial Aquifer	Deep	Annual	Summer	VOCs, SVOCs, Pesticides, Metals
POC-3S(1)	871181.3	425382.1	Upper Surficial Aquifer	Shallow	Annual	Summer	VOCs, SVOCs, Pesticides, Metals, Dioxins/Furans, Formaldehyde, Sulfide
POC-3D	871180.7	425392.1	Upper Surficial Aquifer	Deep	Annual	Summer	VOCs, SVOCs, Pesticide, Metals
UP-1S	869994.0	426133.2	Upper Surficial Aquifer	Shallow	Annual	Summer	VOCs, SVOCs, Pesticides, Metals, Dioxins/Furans, Formaldehyde, Sulfide
UP-1D-R	869993.2	426123.3	Upper Surficial Aquifer	Deep	Annual	Summer	VOCs, SVOCs, Pesticides, Metals

Notes:

VOCs - volatile organic compounds

SVOCs - semi-volatile organic compounds

(1) Section IV.B of Hazardous Waste Permit HW-052(D&S)-2 provides that “the Permittee shall analyze samples from one of the point of compliance wells (POC-1S, POC-2S, and POC-3S) plus any additional wells specified by the Director (or as approved by EPD) for all constituents in Appendix IX of 40 CFR Part 264 at least annually. The Appendix IX sampling will be rotated among the point of compliance wells so that each well is sampled every three years. Requirements for reporting Appendix IX results and potential resampling if Appendix IX constituents are detected are detailed in Section IV.B of the Permit."

Table 7-2
Groundwater Monitoring Analytical Requirements
Hercules/Pinova Facility, Brunswick, Georgia

Parameter
Volatile Organic Compounds
Acetone
Benzene
2-Butanone (MEK)
Chlorobenzene
Chloroform
Carbon Disulfide
Carbon Tetrachloride
1,2-Dichlorobenzene
1,4-Dichlorobenzene
1,1-Dichloroethane
1,1-Dichloroethene
cis-1,2-Dichloroethene
1,2-Dichloropropane
Ethyl benzene
Methyl isobutyl ketone (MIBK)
Methylene chloride
p-Isopropyltoluene (Para-cymene)
Tetrachloroethene
Toluene
1,2,4-Trichlorobenzene
Trichloroethylene
1,2,3-Trichloropropane
Vinyl chloride
Xylene (Total)
Semi-Volatile Organic Compounds
Acetophenone
Benzo(g,h,i)perylene
bis(2-ethylhexyl)phthalate
2-Chlorophenol
Dibenz(a,h)anthracene
2,4-dimethylphenol
Indeno(1,2,3-cd)pyrene
m & p cresol (3 & 4 methylphenol)
Naphthalene
Phenol
2,4,6-Trichlorophenol

Parameter
Pesticides
alpha-BHC
delta-BHC
gamma-BHC (lindane)
Toxaphene (technical)
Toxaphene (TAUC)
Metals
Barium
Beryllium
Chromium
Cobalt
Copper
Nickel
Selenium
Vanadium
Zinc
Dioxins/Furans
Hexachlorodibenzofurans (HxDCF), Total
Hexachlorodibenzo-p-dioxins (HxCDD), Total
Pentachlorodibenzofurans (PeCDF), Total
Pentachlorodibenzo-p-dioxin (PeCDD), Total
Tetrachlorodibenzofuran (TCDF), Total
Tetrachlorodibenzodioxin (TCDD), Total
2,3,7,8-TCDD
Miscellaneous
Formaldehyde
Sulfide

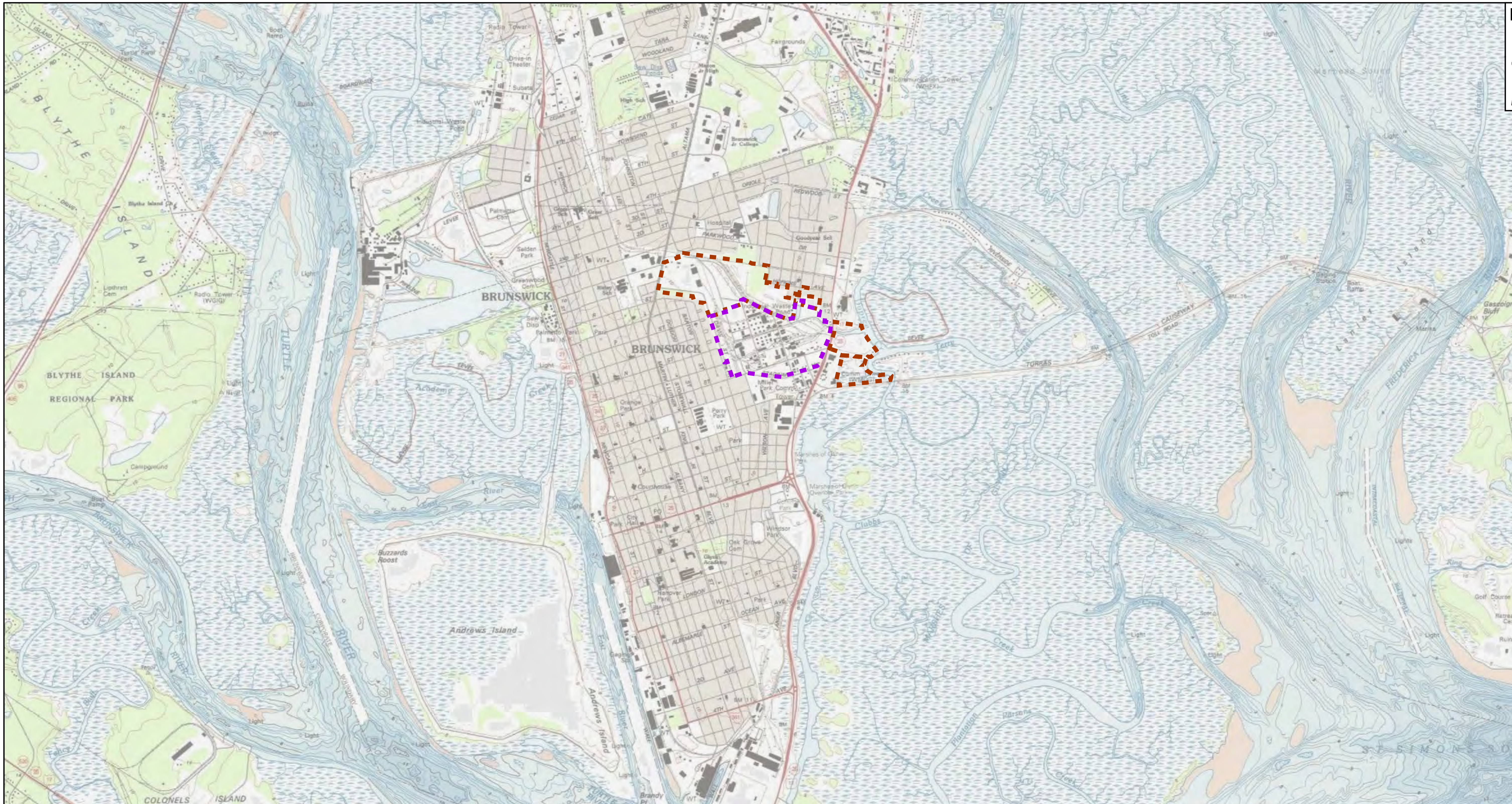
Notes:
1. From Table 1 of Hazardous Waste Permit HW-052(D&S)-2

Table 9-1
Cost Estimate Summary
Hercules/Pinova Facility, Brunswick, Georgia

Item	Estimated Scope	Estimated Costs ($)
Phase 1: Ongoing Corrective Measures		
Corrective Measures for Former Toxaphene Tank Farm	Prepare construction completion report and complete annual inspections of area where *in situ* solidification to address soils at the former toxaphene tank farm was performed, as described in Section 6.1.1 of this CAP.	$110,000
Corrective Measures for Sitewide Soils	Excavate soils in seven areas (cumulatively 20,000 square feet) to two feet below ground surface and backfill with clean soil, as described in Section 6.1.2.5 of this CAP. Soils that are excavated will be profiled and transported to an appropriate permitted offsite disposal facility under appropriate shipping documentation (manifests or bills of lading). Associated activities include design, procurement, sampling, construction management, excavation subcontractor services, waste transport and disposal, backfill placement, surface repairs, project management, and preparation of reports to document the interim corrective measure.	$540,000
Corrective Measures for Groundwater in the Shallow Zone of the Upper Surficial Aquifer	Perform *in situ* chemical oxidation to target shallow groundwater as described in Section 6.1.3.5 of this CAP. A network of 30 wells was recently installed to use for injecting chemical oxidants to shallow groundwater. Three injection events are planned, with each event including performance monitoring to evaluate progress toward achieving remedial objectives. Associated activities include baseline sampling, construction management, injection subcontractor services, multiple rounds of post-injection sampling and progress evaluation, project management, and preparation of reports to document the interim corrective measure. Perform recovery of non-aqueous phase liquid ("NAPL") as described in Section 6.1.3.6 of this CAP using a skimmer system. Recovered materials are sampled, profiled, and transported off site under appropriate shipping documenation for treatment/disposal at an appropriate permitted facility.	$1,160,000
Corrective Measures for Groundwater in the Deep Zone of the Upper Surficial Aquifer	Install an anaerobic biobarrier to perform enhanced *in situ* bioremediation by suppling beneficial amendments as described in Section 6.1.4.5.1 of this CAP. To accomplish this, a network of 49 wells will be installed to use for injecting and monitoring the impact of beneficial amendments (in this case, carbon to serve as electron donor and a commercially-available microbial consortium). Routine groundwater sampling (i.e., performance monitoring) will be performed to evaluate progress toward achieving remedial objectives. Associated activities include baseline sampling, construction management, injection subcontractor services, multiple rounds of post-injection sampling and progress evaluation, project management, and preparation of reports to document the interim corrective measure. Install an aerobic biobarrier to perform enhanced *in situ* bioremediation by suppling oxygen to the deep zone of the upper surficial aquifer as described in Section 6.1.4.5.2 of this CAP. To accomplish this, mechanical equipment and piping will be installed to supply air to a network of wells that will be installed to serve as the biobarrier. Routine maintenance visits will be performed to inspect and optimize operations. Routine groundwater sampling (i.e., performance monitoring) will be performed to evaluate progress toward achieving remedial objectives. Associated activities include design, procurement, construction management, system injection subcontractor services, multiple rounds of post-injection sampling and progress evaluation, project management, and preparation of reports to document the interim corrective measure.	$2,130,000
Vapor Intrusion Mitigation	Additional vapor intrusion mitigation activities as described in Section 6.1.5 of this CAP will be implemented, including construction and startup of one additional sub-slab depressurization system, and operation and maintenance of three sub-slab depressurization systems. Associated activities include construction management, progress evaluation, project management, and preparation of reports to document the interim corrective measures.	$270,000
	Subtotal Phase 1	**$4,210,000**
Phase 2: Activities to Inform Future Corrective Measures		
Source Area Investigations	Perform high-resolution characterization in 60 locations, install 30 monitoring wells, perform NAPL bail down and recovery testing, and perform NAPL characterization as described in Section 6.2.1 of this CAP. Associated activities include investigation design, procurement, sampling, high resolution characterization subcontractor services, well installation subcontractor services, waste transport and disposal, project management, and preparation of reports to document the source area investigations.	$570,000
Additional Investigations Involving the Upper and Lower Surficial Aquifer	Install new monitoring wells and collect groundwater samples as described in Sections 6.2.2 and 6.2.3 of this CAP for the purpose of continuing to refine the conceptual site model. Associated activities include well design, procurement, well installation subcontractor services, groundwater sampling, waste transport and disposal, project management, and reporting to EPD.	$190,000
Fate and Transport Groundwater Model	Perform groundwater fate and transport modeling as described in Section 6.2.4 of this CAP for the purpose of continuing to refine the conceptual site model.	$175,000
Vapor Intrusion Evaluation of Tier 2 Buildings	Perform vapor intrusion evaluation sampling and data analysis at Tier 2 buildings as described in Section 6.2.5 of this CAP for the purpose of continuing to refine the vapor intrusion conceptual site model.	$60,000
Refining the Risk Assessment and Corrective Action Objectives	Perform risk assessment activities as described in Section 6.2.4 of this CAP and prepare reports to EPD to document the risk assessment procedures and results.	$125,000
Soil Management Plan and Institutional Controls	Implement the revised Soil Management Plan included as Appendix D of this CAP.	$25,000
	Subtotal Phase 2	**$1,145,000**
Phase 3: Future Corrective Measures		
	Subtotal Phase 3	**To Be Determined**

Notes:
CAP = Corrective Action Plan
NAPL = non-aqueous phase liquid

FIGURES



Legend

- Pinova property
- Hercules property

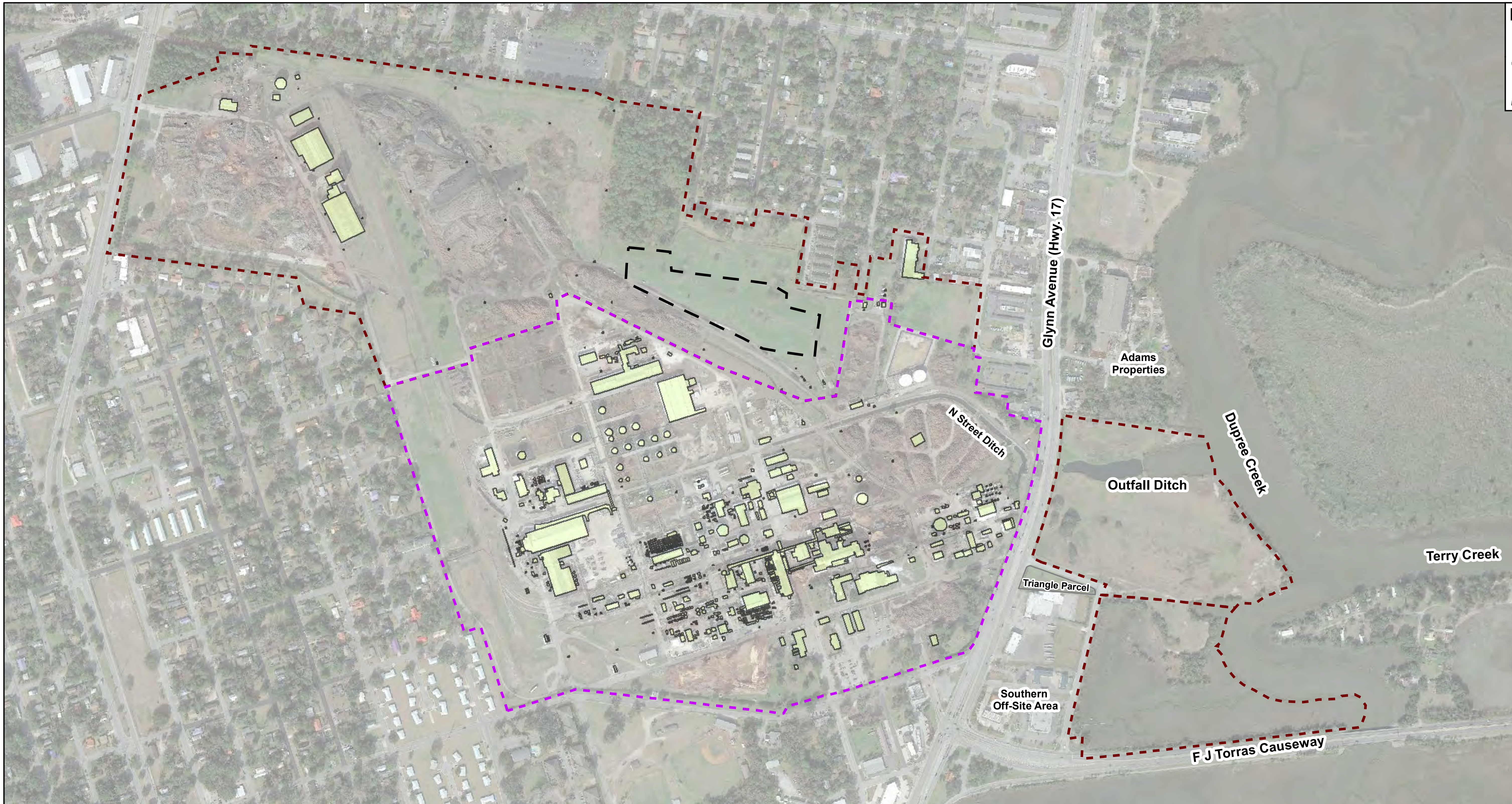
0 1,500 3,000 6,000 Feet

Site Vicinity and Topography
Hercules/Pinova Facility
Brunswick, Georgia

Geosyntec consultants

Kennesaw, GA | February 2021

Figure 2-1



Legend

- Pinova property
- Hercules property
- Approximate location of closed surface impoundments
- Structure

0 250 500 1,000 Feet

Notes:
1. Aerial photograph approximate date - January 2019. Source: Google Earth.

Site Location
Hercules/Pinova Facility
Brunswick, Georgia

Geosyntec consultants

Kennesaw, GA | January 2022

Figure 2-2

Path: N:\H\Hercules\Brunswick\GIS\MXD\CAP Figures\January 2022\Figure 2-2 Site Location.mxd; CKrachon; 1/25/2022

SWMU Legend

SWMU 1	Mill Room Pond	SWMU 21	Hard Resins Tank Farm Area
SWMU 2	Plant Clarifier	SWMU 22	Terpene Resins Area
SWMU 3	Former Truck Dumper Area	SWMU 23	Pexite Plant Blowdown Area
SWMU 4	Drum Crushing Unit	SWMU 24	Toxaphene Stormwater Collection Sump
SWMU 5	Former Toxaphene Plant Site	SWMU 25	Tank Car Cleaning Area
SWMU 6	Y Tank Farm	SWMU 26	Pexite Building Area
SWMU 7	Vinsol® Bins	SWMU 27	Resin Remelt & Drum Storage
SWMU 8	Y-1, Y-2, Y-3 Tank Area	SWMU 28	Intermediate Vinsol® Bin
SWMU 9	Chemical Plant	SWMU 29	N-Street Ditch, South Ditch, & Small Branch Ditches
SWMU 10	Former Toxaphene Surface Impoundments	SWMU 30	Non-Hazardous Waste Storage
SWMU 11	Former Equalization Basin	SWMU 31	Former Mercury Absorber Area
SWMU 12	Former Tank Car Percolation Pits	SWMU 32	Staybellite Area
SWMU 13	Residual Fuel Tank Area	SWMU 33	Tank Truck Liquid Loading Area
SWMU 14	Stillhouse Railcar Loading Area	SWMU 34	Product & Wastewater Piping
SWMU 15	Old Extractor Bldg & Tank Area	SWMU 35	Former Drum Storage Area
SWMU 16	Sawdust Pile	SWMU 36	Former Kymene Production Area and Tank Farm
SWMU 17	Former Sand Blasting Area	SWMU 37	Basin/Impoundments West of Lift Station 17
SWMU 18	Former Sludge Tank Area	SWMU 38	ICM Recovery Well Area
SWMU 19	Sand Filter Drying Beds and Pads	SWMU 39	Refinery Processing Building
SWMU 20	Former Amberlite Treatment System	SWMU 40	Central Accumulation Area (Former Hazardous Waste Storage Unit)

Legend

- Pinova Property
- Hercules Property
- Solid Waste Management Units

0 275 550 1,100 Feet

Notes:
1. SWMU - Solid Waste Management Unit
2. Aerial photograph approximate date - January 2019. Source: Google Earth.

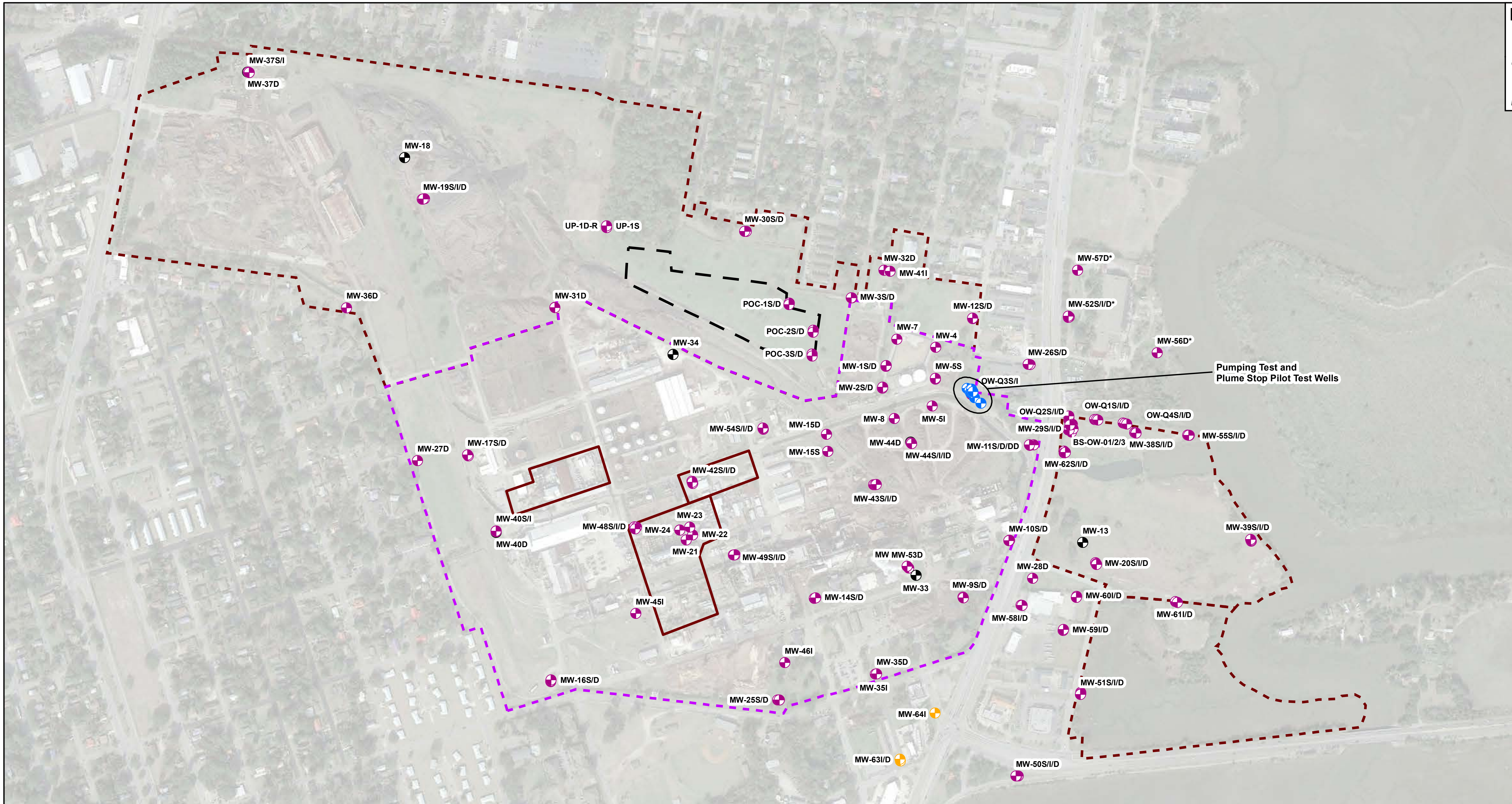
Solid Waste Management Units Location Map
Hercules/Pinova Facility
Brunswick, Georgia

Geosyntec consultants

Kennesaw, GA | January 2022

Figure 2-3

Path: \\aro-01\prj1$\H\Hercules\Brunswick\GIS\MXD\CAP Figures\January 2022\Figure 2-3 Solid Waste Management Units Location Map.mxd; NTilahun; 1/27/2022



Legend

- Surficial Aquifer, Upper Unit
- Surficial Aquifer, Lower Unit
- New Monitoring Well (November 2021)
- Pumping Test and Plume Stop Pilot Test Well
- Approximate Location of Closed Surface Impoundments
- Approximate Extent of Potential Source
- Pinova Property
- Hercules Property

0 275 550 1,100 Feet

Notes:

1. "S", "I", and "D" designate monitoring wells screened in shallow, intermediate, and deep zones, respectively, of the upper surficial aquifer. Monitoring wells MW-4, MW-6, MW-7, MW-8, MW-21, MW-22, MW-23, MW-24, and MW-1D are screened in the shallow zone of the upper surficial aquifer. Monitoring wells MW-11D, MW-2D, and MW-3D are screened in the intermediate zone of the upper surficial aquifer. Monitoring wells UP-1D-R, MW-44ID and MW-11DD are screened in the deep zone of the upper surficial aquifer. Monitoring wells MW-37D, MW-40D, and MW-44D are screened in the lower surficial aquifer.
2. Property owner has not allowed access for sampling since 2017.
3. Aerial photograph approximate date - January 2019. Source: Google Earth.

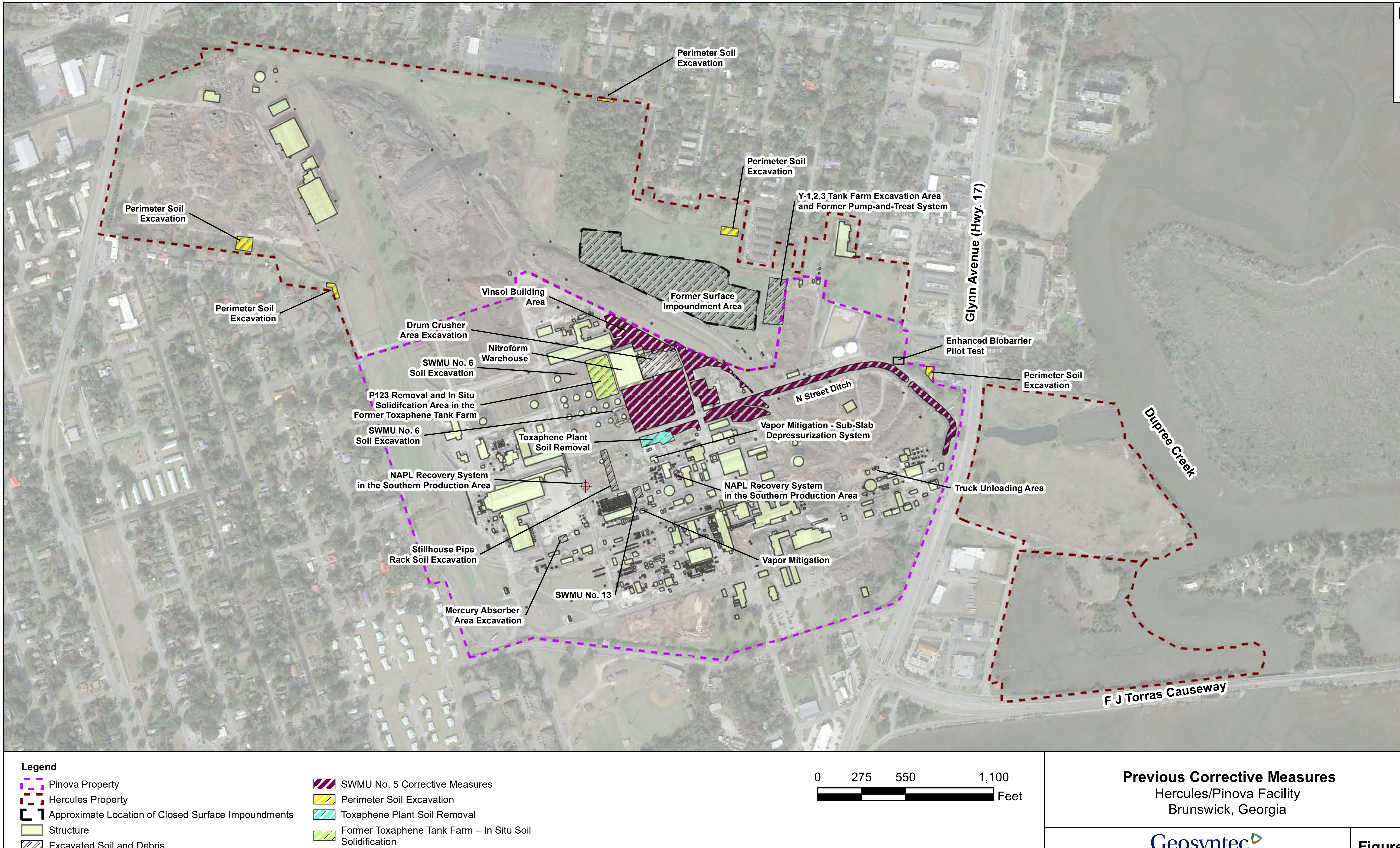
Groundwater Monitoring Well Network
Hercules/Pinova Facility
Brunswick, Georgia

Geosyntec consultants

Kennesaw, GA | January 2022

Figure 2-4

Path: \\aro-01\prj1$\H\Hercules\Brunswick\GIS\MXD\CAP Figures\January 2022\Figure 2-4 Groundwater Monitoring Well Network.mxd



Notes:
1. Aerial photograph approximate date - January 2019. Source: Google Earth.

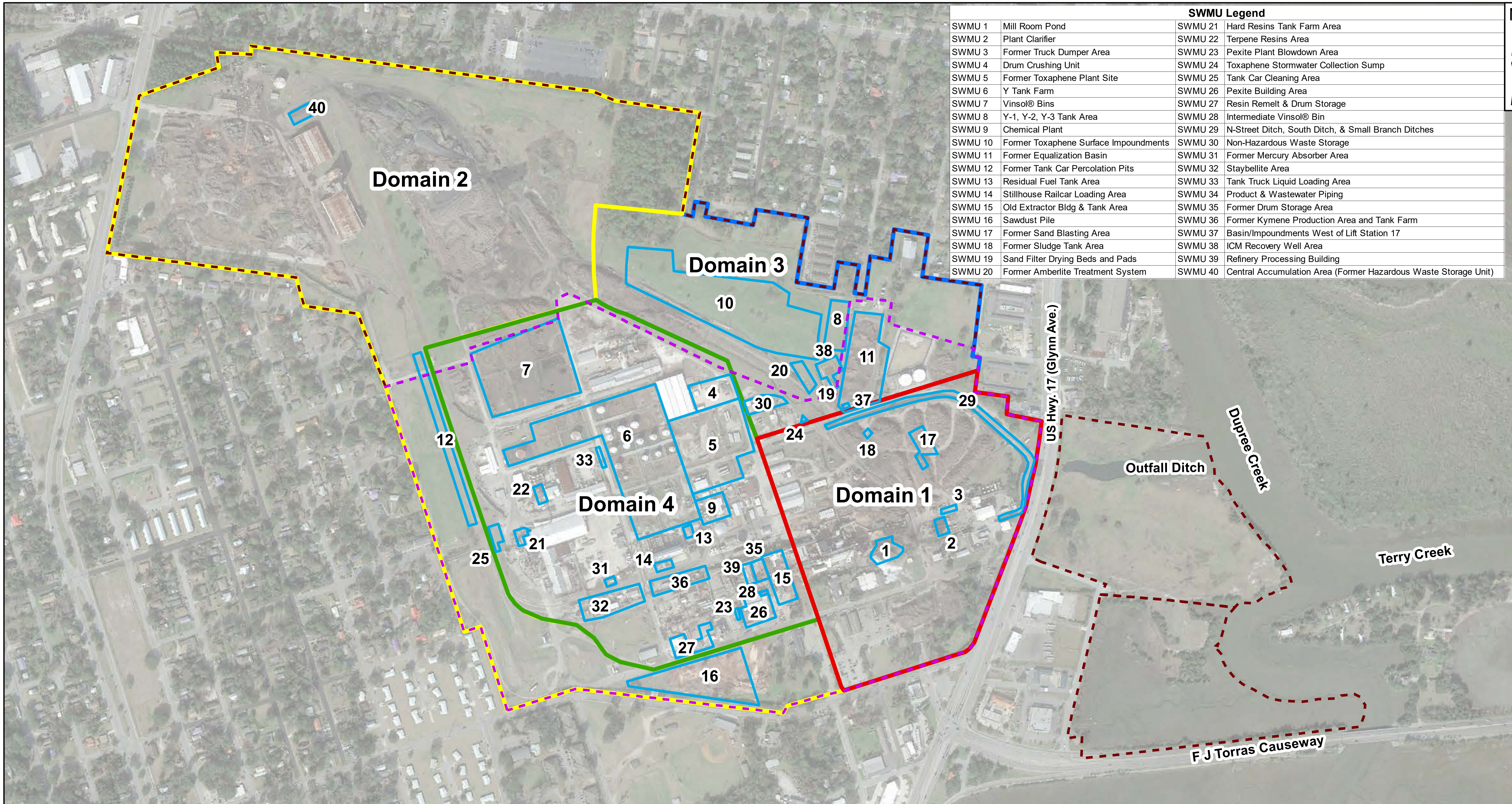
Previous Corrective Measures
Hercules/Pinova Facility
Brunswick, Georgia

Geosyntec consultants

Kennesaw, GA | January 2022

Figure 2-5

Path: \\aro-01\prj1$\H\Hercules\Brunswick\GIS\MXD\CAP Figures\January 2022\Figure 2-5 Previous Corrective Measures.mxd; NTillahun; 1/27/2022



SWMU Legend

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SWMU 13	Residual Fuel Tank Area	SWMU 33	Tank Truck Liquid Loading Area
SWMU 14	Stillhouse Railcar Loading Area	SWMU 34	Product & Wastewater Piping
SWMU 15	Old Extractor Bldg & Tank Area	SWMU 35	Former Drum Storage Area
SWMU 16	Sawdust Pile	SWMU 36	Former Kymene Production Area and Tank Farm
SWMU 17	Former Sand Blasting Area	SWMU 37	Basin/Impoundments West of Lift Station 17
SWMU 18	Former Sludge Tank Area	SWMU 38	ICM Recovery Well Area
SWMU 19	Sand Filter Drying Beds and Pads	SWMU 39	Refinery Processing Building
SWMU 20	Former Amberlite Treatment System	SWMU 40	Central Accumulation Area (Former Hazardous Waste Storage Unit)

Legend

- Pinova Property
- Hercules Property
- Solid Waste Management Units

Exposure Domains

- Domain 1
- Domain 2
- Domain 3
- Domain 4

0 275 550 1,100 Feet

Notes:
1. SWMU - Solid Waste Management Unit
2. Aerial photograph approximate date - January 2019. Source: Google Earth.

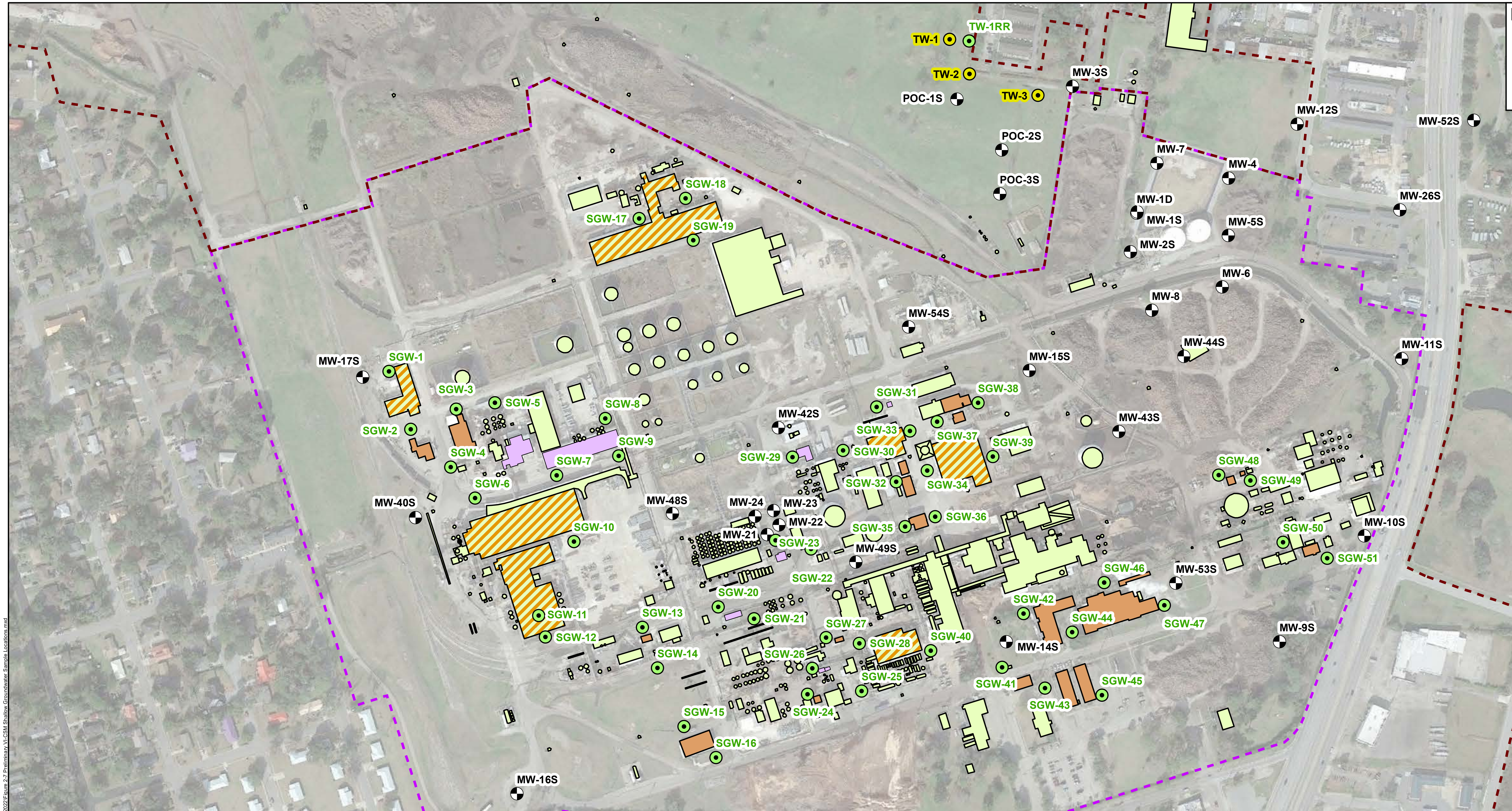
Solid Waste Management Units and Exposure Domains
Hercules/Pinova Facility
Brunswick, Georgia

Geosyntec consultants

Kennesaw, GA | January 2022

Figure 2-6

Path: \\aro-01\prj1$\H\Hercules\Brunswick\GIS\MXD\CAP Figures\January 2022\Figure 2-6 Solid Waste Management Units and Exposure Domains.mxd; NTilahun; 1/27/2022



Legend

- Shallow Groundwater (SGW) Sample Location
- Temporary Piezometer (TW)
- Existing Monitoring Well - Shallow Zone of Upper Surficial Aquifer
- Hercules Boundary
- Pinova Property
- Structure
- Building Containing Smaller Enclosed and Occupiable Space Susceptable to Vapor Intrusion
- Building Susceptable to Vapor Intrusion
- Building with Mitigation Measures Completed

0 150 300 600
Feet

Notes:
1. VI COPCs = Vapor Intrusion Constituents of Potential Concern.
2. VI-CSM = Vapor Intrusion-Conceptual Site Model.
3. Existing monitoring well MW-3S was sampled via low-flow methods for VI COPCs.
4. Temporary piezometers TW-1R, TW-2R, and TW-3R were sampled for VI COPCs.
5. Shallow groundwater sampling locations were sampled for VI COPCs via a hand auger boring.

Preliminary VI-CSM Shallow Groundwater Sample Locations
Hercules/Pinova Facility, Brunswick, Georgia

Geosyntec consultants

Kennesaw, GA | January 2022

Figure **2-7**

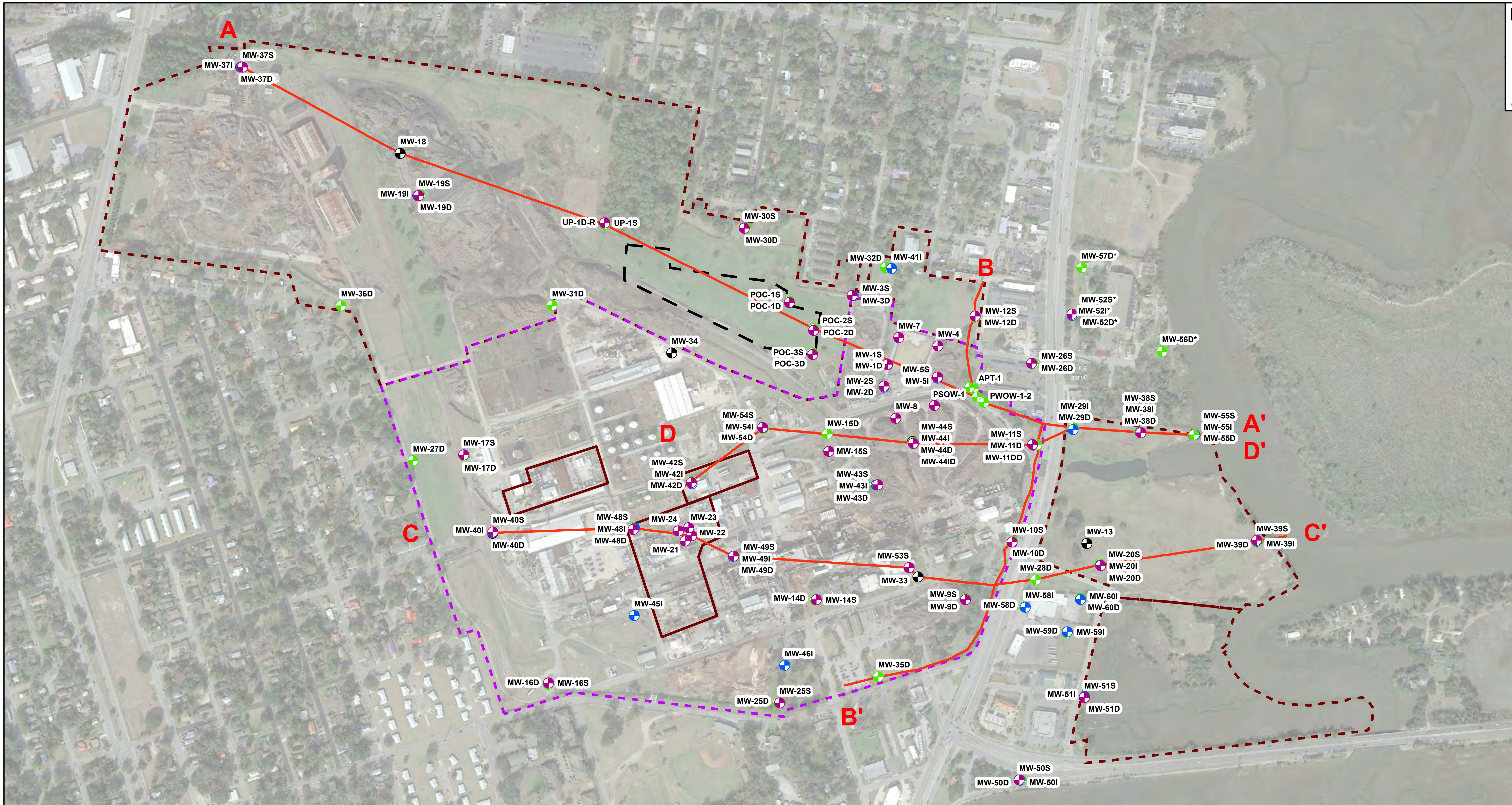
Geologic Epoch	Aquifer System	Aquifer and Confining Units	Approximate Aquifer or Confining Unit Depth (ft bgs)	Aquifer Zone	Approximate Zone Depth (ft bgs)
Post-Miocene	Surficial Aquifer System	Upper Surficial Aquifer	0 to 100	Shallow Zone	0 to 40
				Intermediate Zone	40 to 70
				Deep Zone	70 to 100
		Confining Unit (if present)	90 to 100 (if present)		
Miocene		Lower Surficial Aquifer	100 to 200		
	Brunswick Aquifer System	Confining Unit	200 to 280		
		Upper Brunswick Aquifer	280 to 355		
		Confining Unit	355 to 400		
		Lower Brunswick Aquifer	400 to 475		
Oligocene to Eocene	Floridan Aquifer System	Upper Floridan Confining Unit	475 to 500		
		Upper Floridan Aquifer	500 to 970		
		Lower Floridan Confining Unit	970 to 1000		
		Lower Floridan Aquifer	>1000+		

Notes:

1. Ft bgs = feet below ground surface.
2. Source: Clarke, J.S., Leeth, D.C., Taylor-Harris, D., Painter, J.A., Labowski, J.L., 2004. Summary of Hydraulic Properties of the Floridan Aquifer System in Coastal Georgia and Adjacent Parts of South Carolina and Florida: United States Geological Survey, Scientific Investigations Report 2004-5264, 54p.
3. Geologic epochs are approximate and estimated from Brunswick Pulp and Paper Co., Glynn County cross section, found on Plate 2 in *Geology and Ground-water Resources of the Coastal Area of Georgia. Bulletin 113.* (Clarke, et al., 1990).
4. In general, aquifer/confining unit (semi-confining unit) depths are generalizations and should be considered as approximate depth intervals for the Site.
5. The confining unit depth separating the upper surficial aquifer from the lower surficial aquifer is based on the boring log for monitoring well MW-52D.

Aquifers and Confining Units Hercules/Pinova Facility Brunswick, GA	Geosyntec consultants	Figure
Kennesaw, GA	January 2022	3-1

Source file: \Brunswick Plant\GIS\PDF\CAP Figures\January 2022\Figure 3-1 Aquifer and Confining Units.pptx



Legend

- Surficial Aquifer, Shallow Zone of Upper Unit Wells
- Surficial Aquifer, Intermediate Zone of Upper Unit Wells
- Surficial Aquifer, Deep Zone of Upper Unit Wells
- Surficial Aquifer, Lower Unit Wells
- Cross Section Line
- Approximate Location of Closed Surface Impoundments
- Approximate Extent of Primary Potential Source Areas
- Pinova Property
- Hercules Property

Notes:
1. Aerial photograph approximate date - January 2019. Source: Google Earth.
2. * = Property owner has not allowed access since 2017.

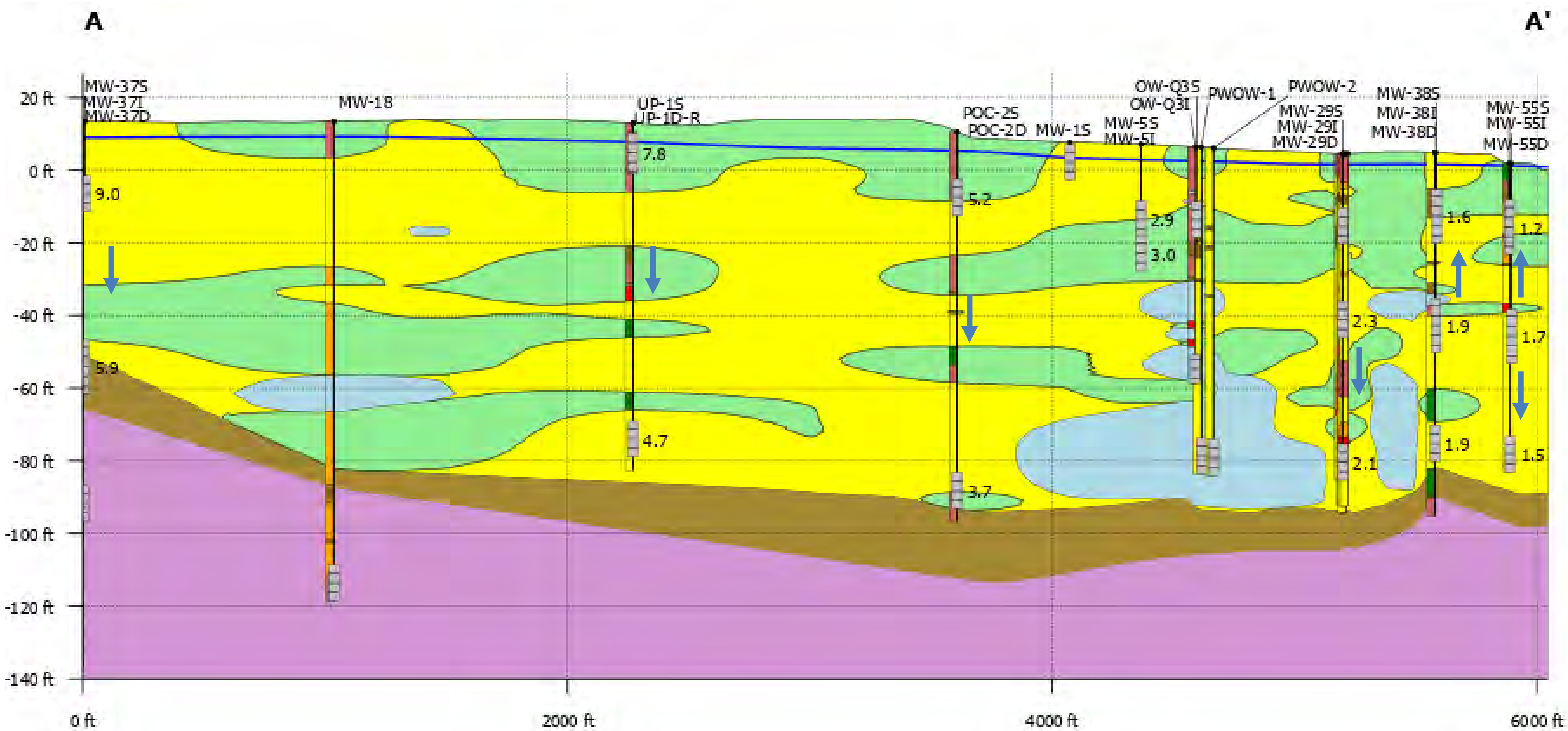
Cross Section Location Map
Hercules/Pinova Facility
Brunswick, Georgia

Geosyntec consultants

Kennesaw, GA | January 2022

Figure 3-2

Path: N:\H\Hercules\Brunswick\GIS\MXD\CAP Figures\Figure 3-X1 Cross Section Key Map.mxd



Geologic Model Lithology

Upper Surficial Aquifer Geology
- Lower Permeability Soils
- Sand
- Coarse Sand

Other Aquifer Units
- Semi-Confining Unit
- Lower Surficial Aquifer

Borehole Lithology

- CLAY
- CLAYEY SAND
- COARSE SAND
- GRAVEL
- ROCK
- SAND
- SILT
- SILTY SAND

Water Table

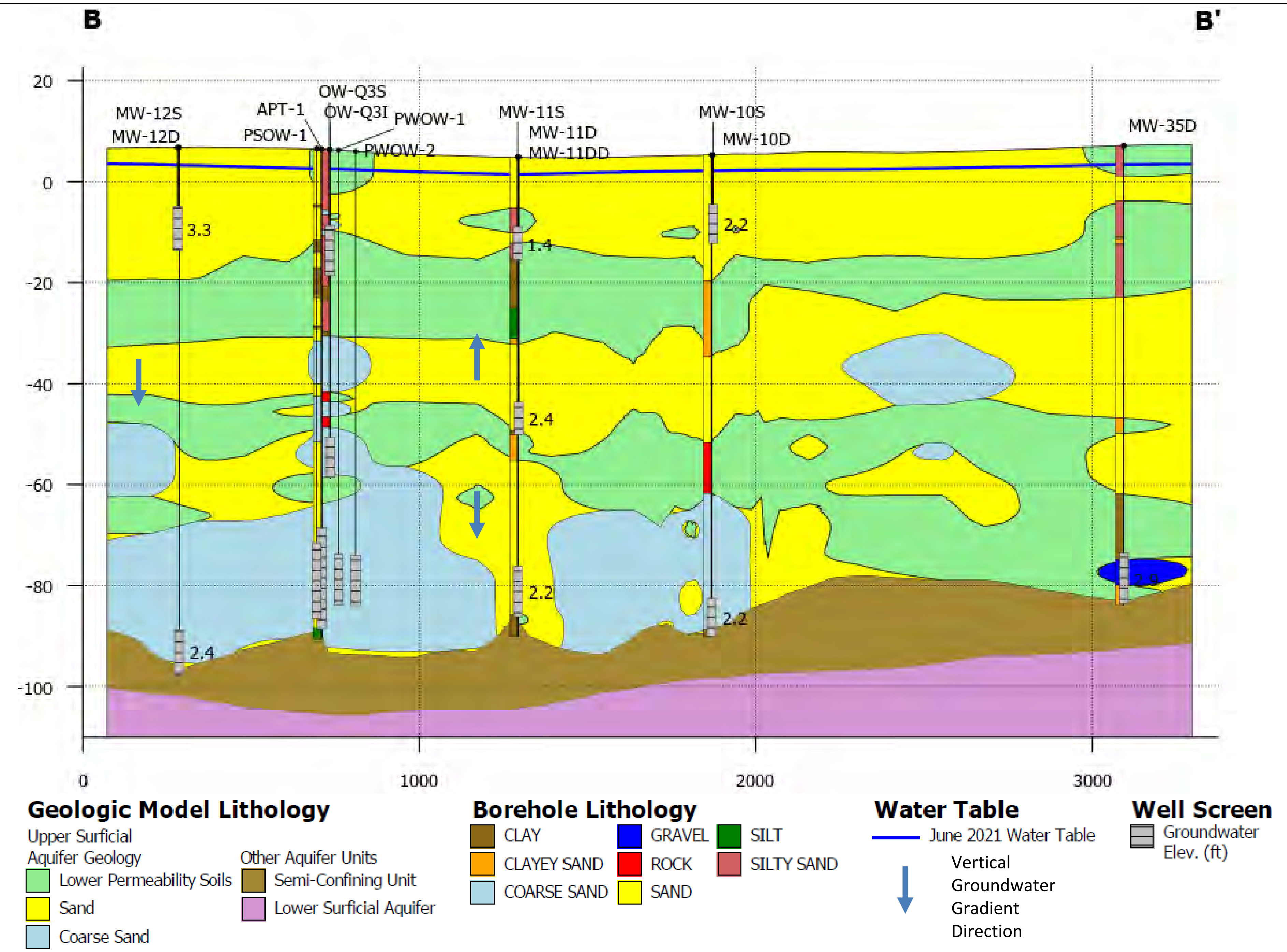
- June 2021 Water Table
- Vertical Groundwater Gradient Direction

Well Screen

- Groundwater Elev. (ft)

NOTES:
1. Lower permeability soils in the upper surficial aquifer include silty sands, clayey sands, silts, clays, and cemented sands.
2. Vertical exaggeration is 15x.

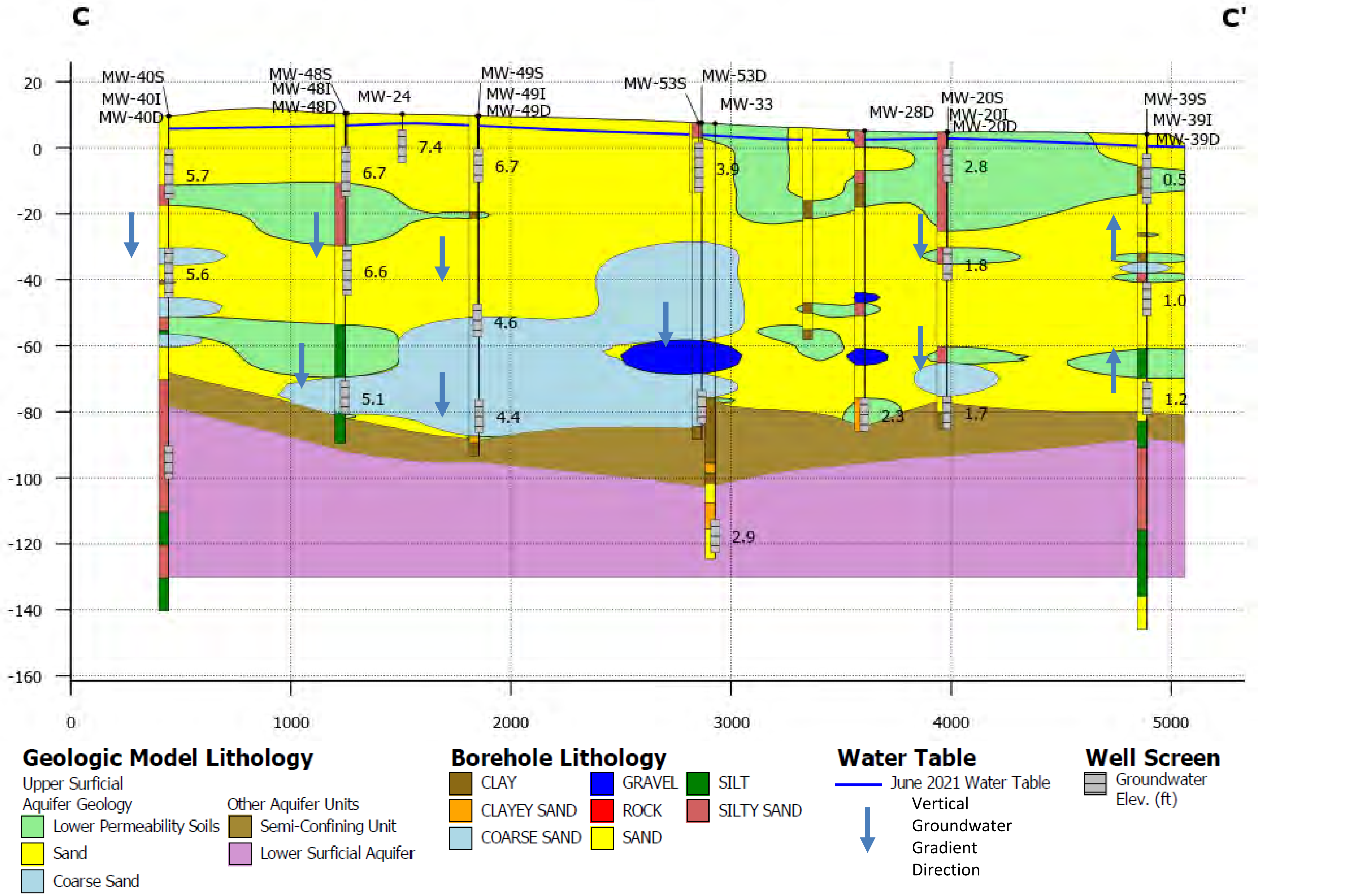
Cross Section A-A' Hercules/Pinova Facility Brunswick, Georgia	Geosyntec consultants	Figure **3-3**
Kennesaw, GA	January 2022	



NOTES:

1. Lower permeability soils in the upper surficial aquifer include silty sands, clayey sands, silts, clays, and cemented sands.
2. Vertical exaggeration is 15x.

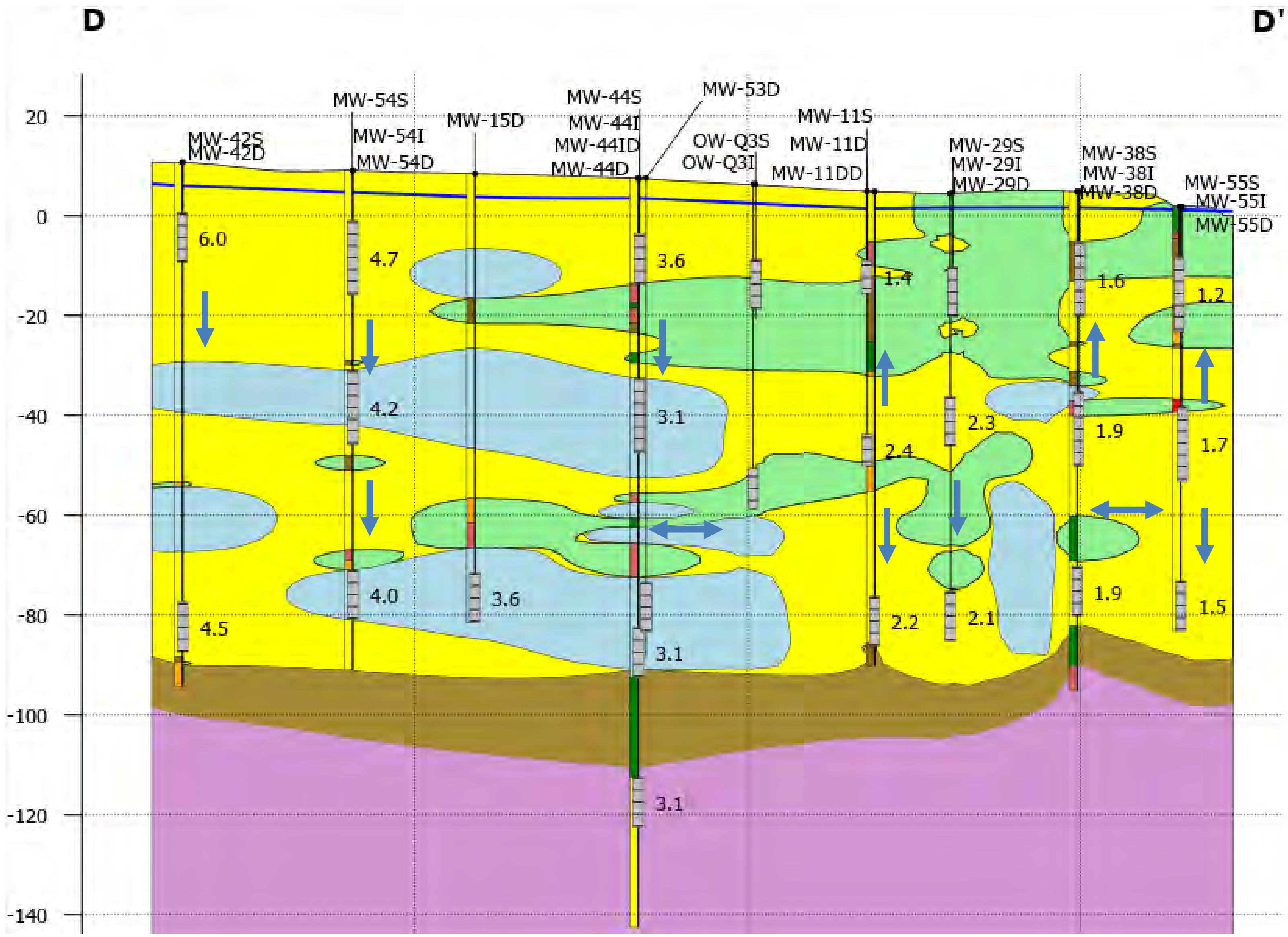
Cross Section B-B' Hercules/Pinova Facility Brunswick, Georgia	Geosyntec consultants	Figure
Kennesaw, GA	January 2022	3-4



NOTES:

1. Lower permeability soils in the upper surficial aquifer include silty sands, clayey sands, silts, clays, and cemented sands.
2. Vertical exaggeration is 15x.

Cross Section C-C' Hercules/Pinova Facility Brunswick, Georgia		Geosyntec consultants	Figure
Kennesaw, GA	January 2022		**3-5**



Geologic Model Lithology

Upper Surficial Aquifer Geology
- Lower Permeability Soils
- Sand
- Coarse Sand

Other Aquifer Units
- Semi-Confining Unit
- Lower Surficial Aquifer

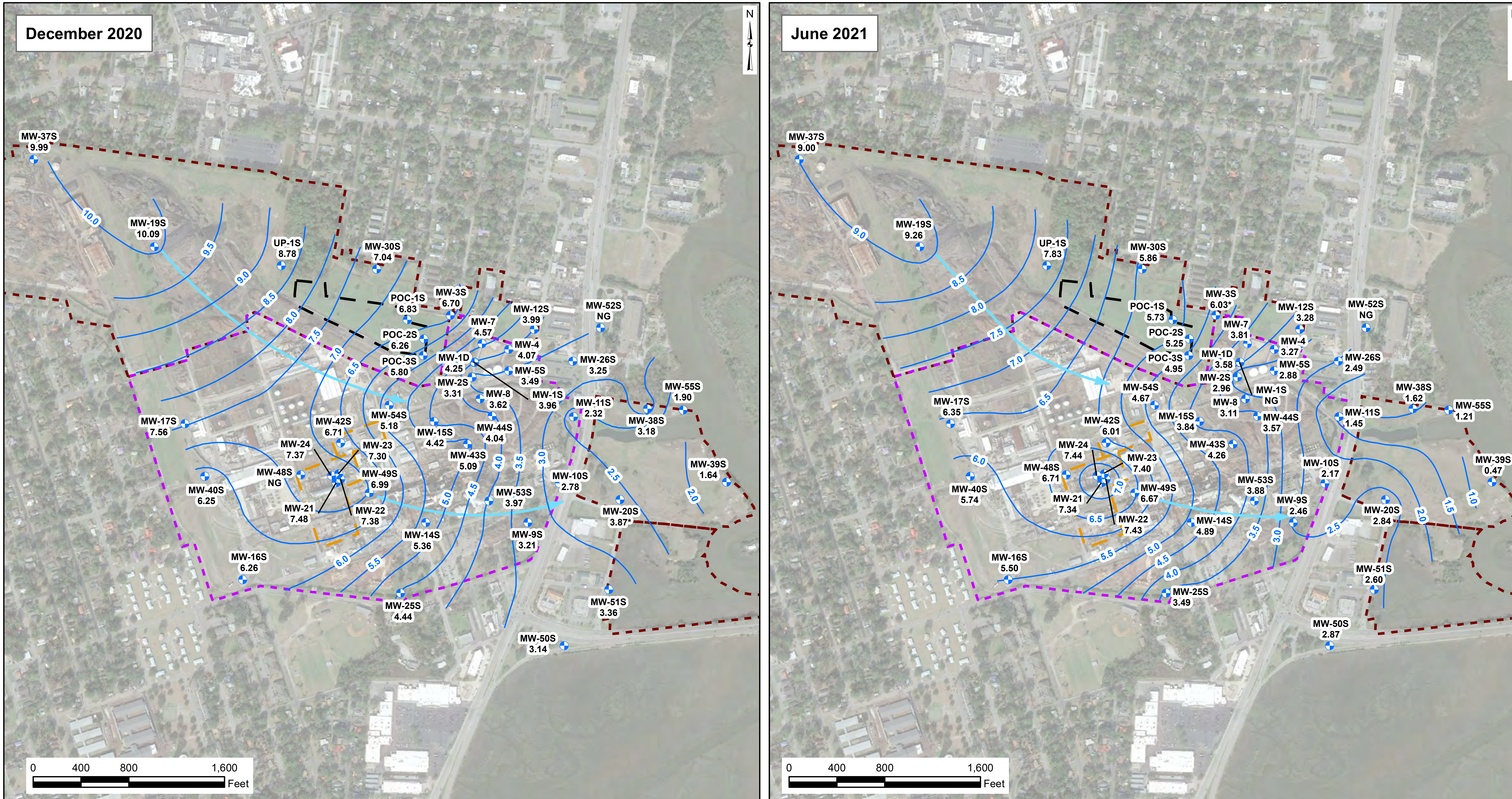
Borehole Lithology
- CLAY
- CLAYEY SAND
- COARSE SAND
- GRAVEL
- ROCK
- SAND
- SILT
- SILTY SAND

Water Table
- June 2021 Water Table
- Vertical Groundwater Gradient Direction

Well Screen
- Groundwater Elev. (ft)

NOTES:
1. Lower permeability soils in the upper surficial aquifer include silty sands, clayey sands, silts, clays, and cemented sands.
2. Vertical exaggeration is 15x.

Cross Section D-D' Hercules/Pinova Facility Brunswick, Georgia		Geosyntec consultants	Figure **3-6**
Kennesaw, GA	January 2022		



Legend

- Monitoring Well (Groundwater Elevation in ft MSL)
- Groundwater Elevation Iso-Contour (ft MSL)
- Approximate Groundwater Flow Direction
- Approximate Location of Closed Surface Impoundments
- Approximate Extent of Primary Potential Source
- Pinova Property
- Hercules Property

Notes:
1. Water level measurements recorded on December 7, 2020 and June 7, 2021. Elevations provided in feet above mean sea level (ft MSL).
2. * - Groundwater elevations from monitoring wells MW-20S and MW-3S were not used in contouring.
3. NG = Not gauged
4. Aerial photograph approximate date - January 2019. Source: Google Earth.

Potentiometric Map – Surficial Aquifer Shallow Zone of Upper Unit

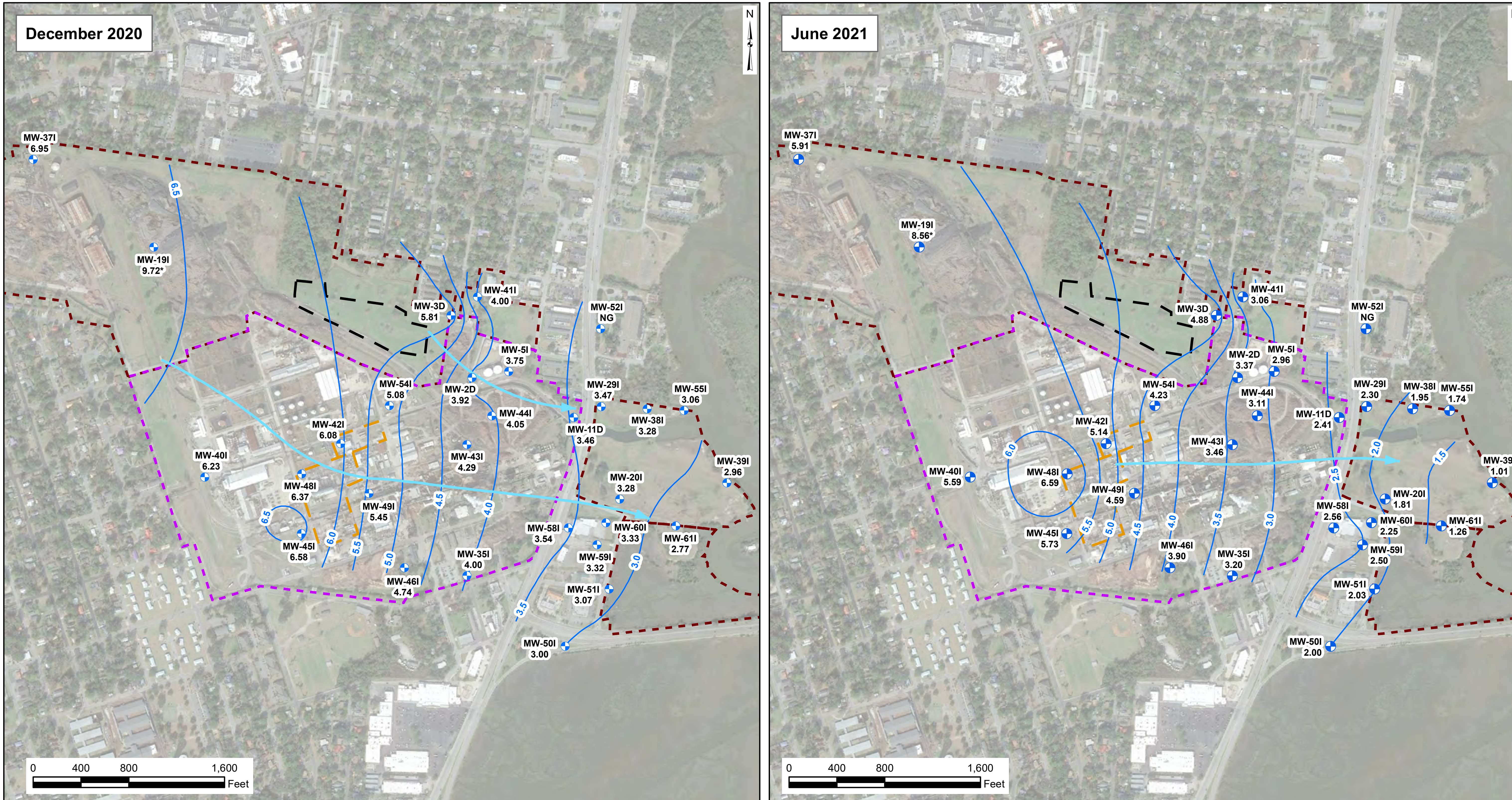
Hercules/Pinova Facility, Brunswick, Georgia

Geosyntec consultants

Kennesaw, GA | January 2022

Figure 3-7

Path: \\aro-01\prj1$\H\Hercules\Brunswick\GIS\MXD\CAP Figures\January 2022\Figure 3-7 Potentiometric Map – Surficial Aquifer Shallow Zone of Upper Unit.mxd; NTilahun; 1/25/2022



Legend

- Monitoring Well (Groundwater Elevation in ft MSL)
- Groundwater Elevation Iso-Contour (ft MSL)
- Approximate Groundwater Flow Direction
- Approximate Location of Closed Surface Impoundments
- Approximate Extent of Primary Potential Source Areas
- Pinova Property
- Hercules Property

Notes:
1. Water level measurements recorded on December 7, 2020 and June 7, 2021. Elevations provided in feet above mean sea level (ft MSL).
2. * - Groundwater elevation from monitoring well MW-19I was not used in contouring.
3. NG = Not gauged
4. Aerial photograph approximate date - January 2019. Source: Google Earth.

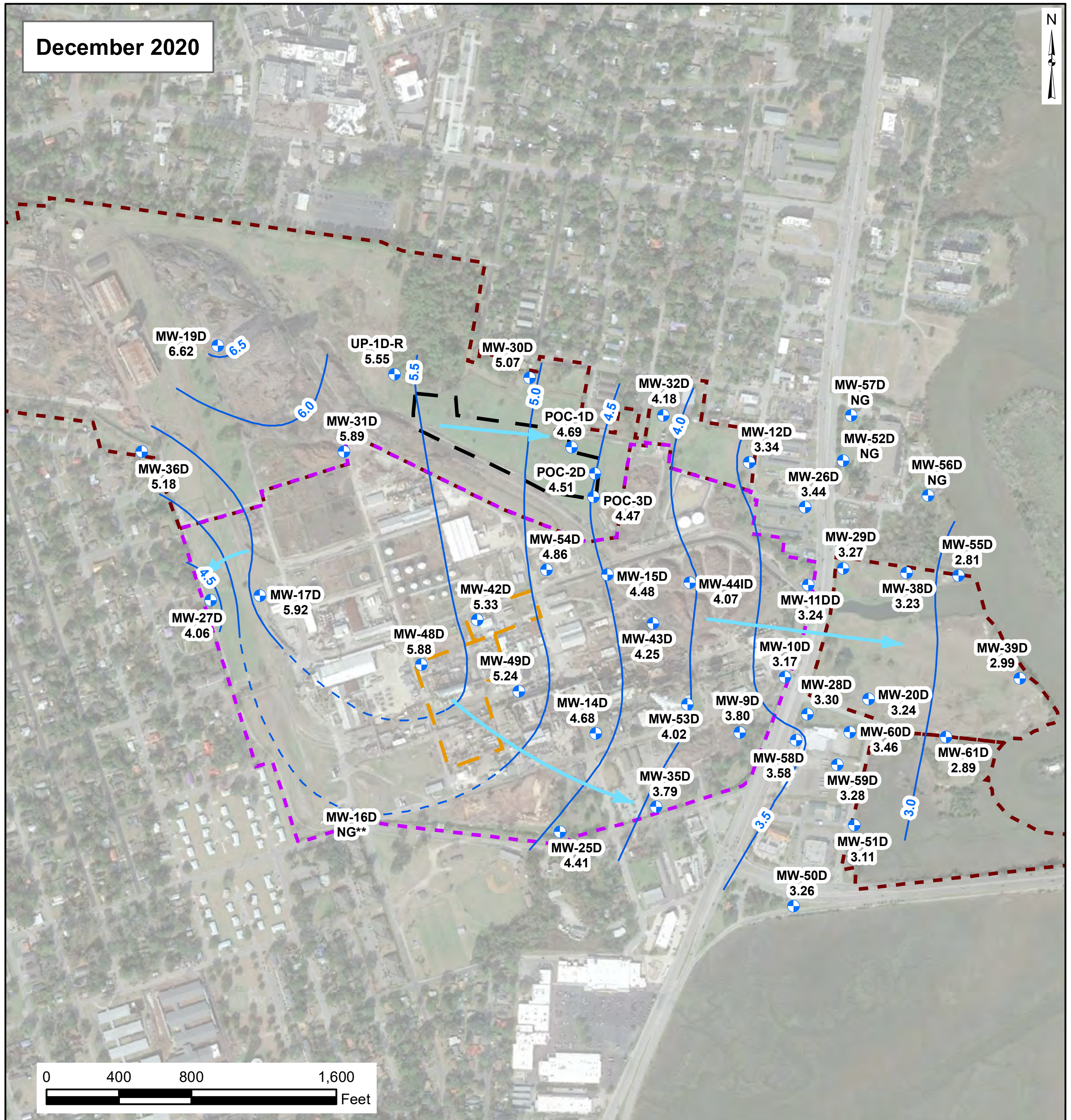
Potentiometric Map – Surficial Aquifer Intermediate Zone of Upper Unit
Hercules/Pinova Facility, Brunswick, Georgia

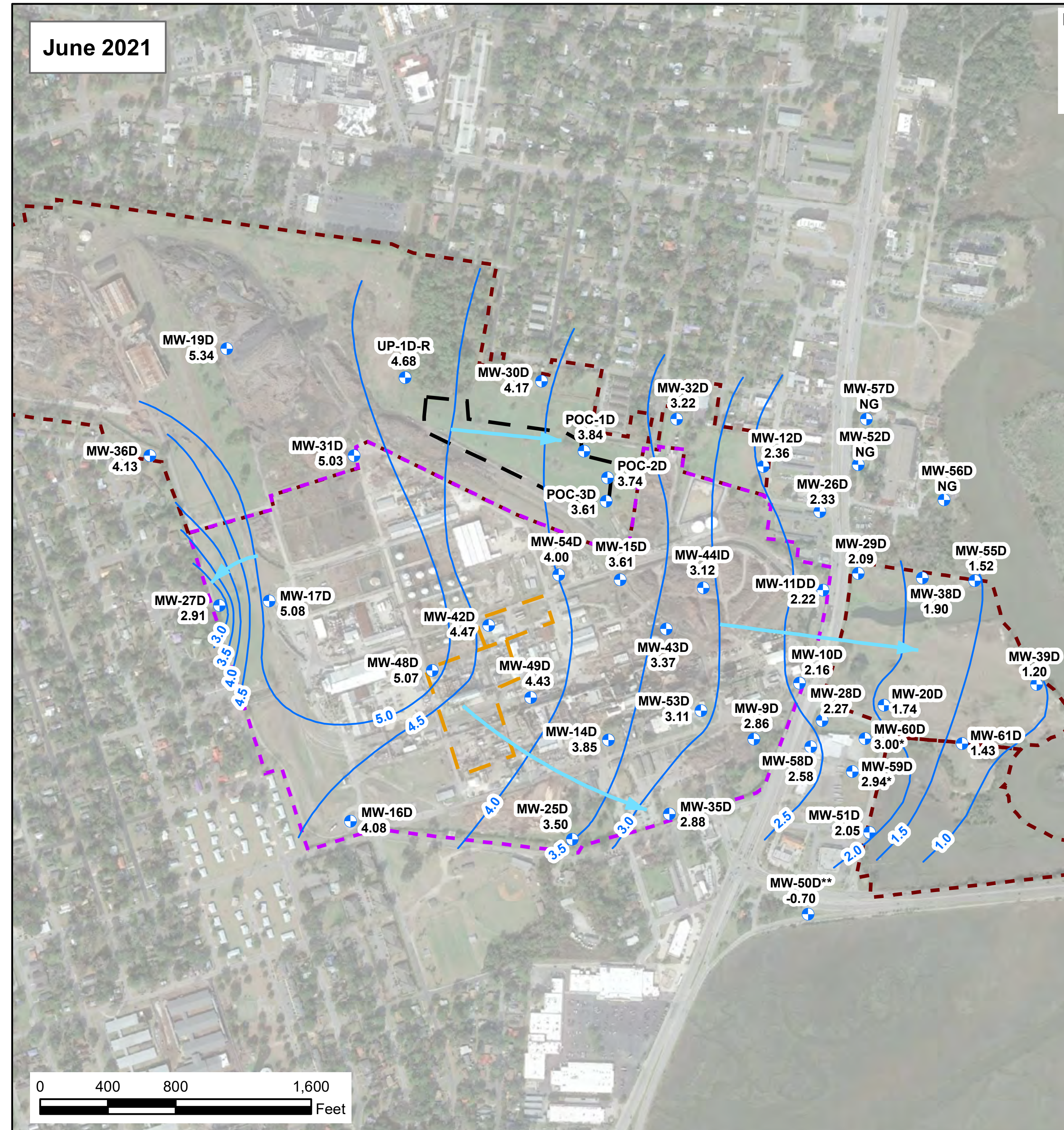
Geosyntec consultants

Kennesaw, GA | January 2022

Figure 3-8

Path: \\aro-01\prj1$\H\Hercules\Brunswick\GIS\MXD\CAP Figures\January 2022\Figure 3-8 Potentiometric Map – Surficial Aquifer Intermediate Zone of Upper Unit.mxd; NTilahun; 1/25/2022





Legend

- Monitoring Well (Groundwater Elevation in ft MSL)
- Groundwater Elevation Iso-Contour (ft MSL)
- Approximate Groundwater Flow Direction
- Approximate Location of Closed Surface Impoundments
- Approximate Extent of Primary Potential Source Areas
- Pinova Property
- Hercules Property

Notes:
1. Water level measurements recorded on December 7, 2020 and June 7, 2021. Elevations provided in feet above mean sea level (ft MSL).
2. * - Groundwater elevations from monitoring wells MW-59D and MW-60D were not used in contouring.
3. ** Indicates suspected field measurement error.
4. NG = Not gauged
5. Aerial photograph approximate date - January 2019. Source: Google Earth.

Potentiometric Map – Surficial Aquifer Deep Zone of Upper Unit

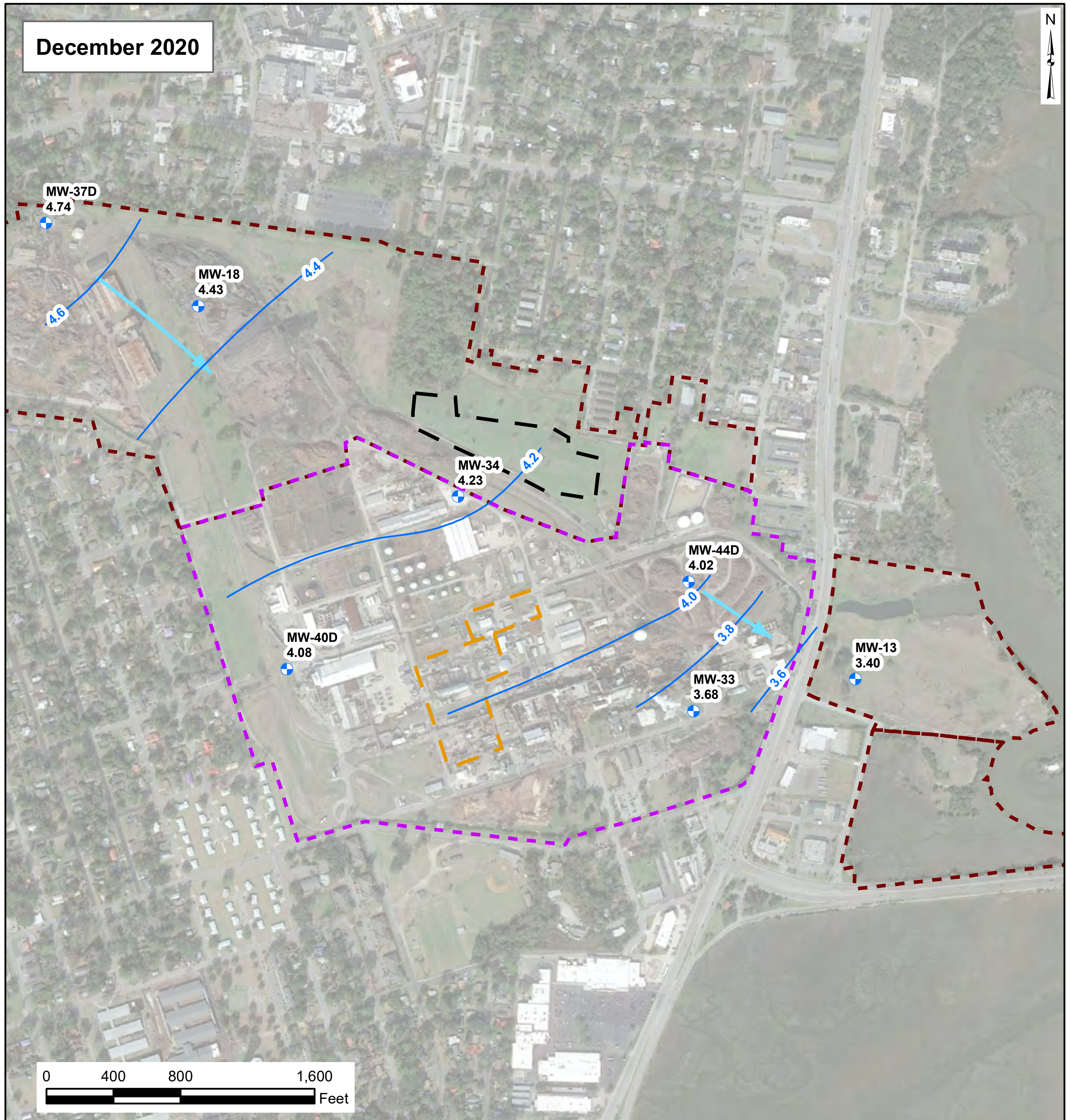
Hercules/Pinova Facility, Brunswick, Georgia

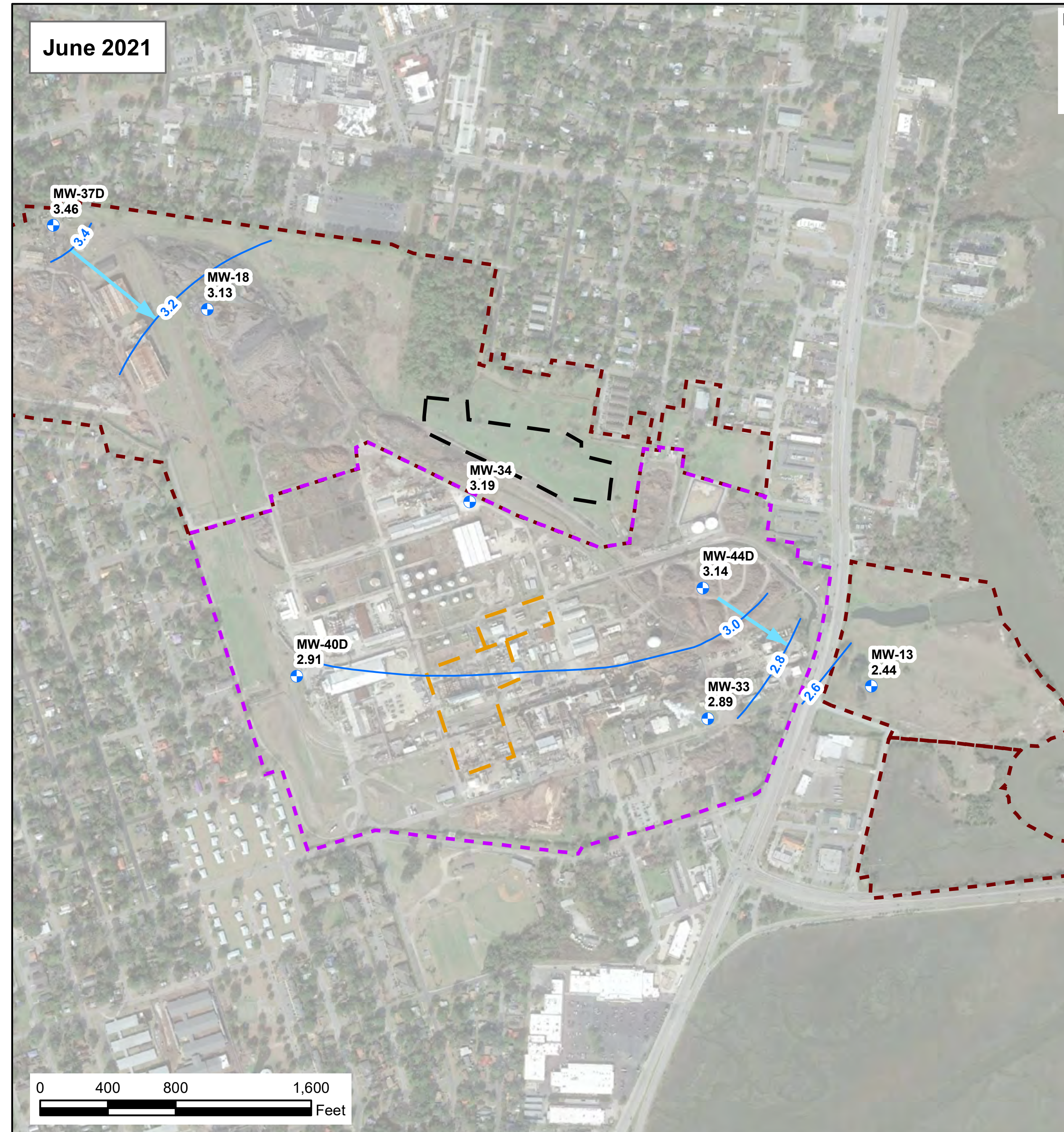
Geosyntec consultants

Kennesaw, GA | January 2022

Figure 3-9

Path: \\aro-01\prj1$\H\Hercules\Brunswick\GIS\MXD\CAP Figures\January 2022\Figure 3-9 Potentiometric Map – Surficial Aquifer Deep Zone of Upper Unit.mxd; NTilahun; 1/25/2022





Legend

- Monitoring Well (Groundwater Elevation in ft MSL)
- Groundwater Elevation Iso-Contour (ft MSL)
- Approximate Groundwater Flow Direction
- Approximate Location of Closed Surface Impoundments
- Approximate Extent of Primary Potential Source Areas
- Pinova Property
- Hercules Property

Notes:
1. Water level measurements recorded on December 7, 2020 and June 7, 2021. Elevations provided in feet above mean sea level (ft MSL).
2. Aerial photograph approximate date - January 2019. Source: Google Earth.

Potentiometric Map – Surficial Aquifer Lower Unit
Hercules/Pinova Facility, Brunswick, Georgia

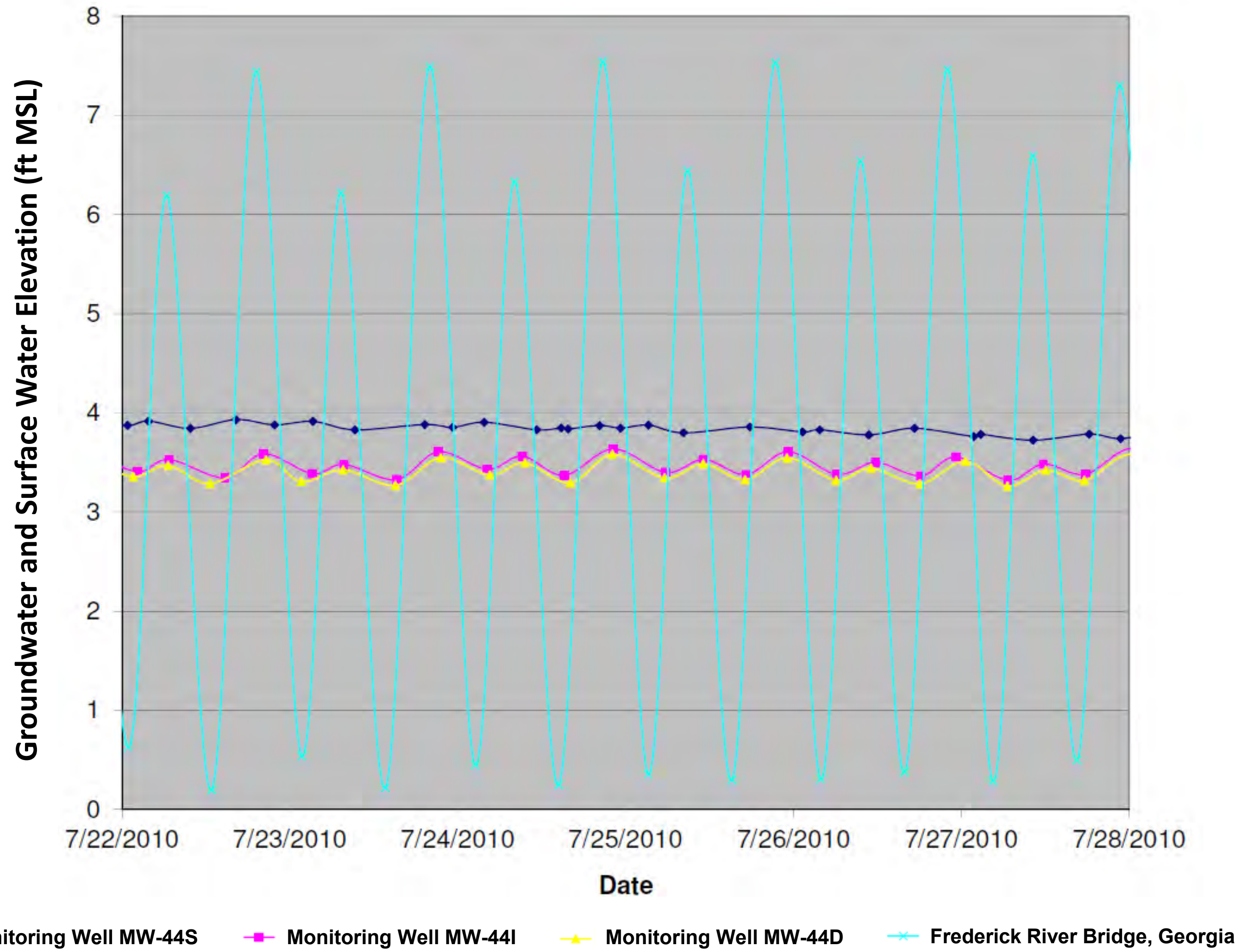
Geosyntec consultants

Kennesaw, GA | January 2022

Figure 3-10

Path: \\aro-01\prj1$\H\Hercules\Brunswick\GIS\MXD\CAP Figures\January 2022\Figure 3-10 Potentiometric Map – Surficial Aquifer Lower Unit.mxd; NTilahun; 1/25/2022

Monitoring Well MW-44 Cluster – Groundwater Elevations and Surface Water Tidal Ranges



NOTES:
1. ft MSL = ft above mean sea level
2. Water level measurements recorded in July 2010.
3. Figure adopted from the Brunswick Groundwater RFI Phase III Report (Antea 2015).

Tidal Influence at Monitoring Well MW-44 Cluster	Geosyntec consultants	Figure 3-11
Kennesaw, GA	January 2022	

Legend
- Approximate Location of Closed Surface Impoundments
- Potential Sources of COPCs
- Structure
- Pinova Property
- Hercules Property

0 275 550 1,100 Feet

Notes:
1. COPCs = Constituents of Potential Concern.
2. Aerial photograph approximate date - January 2019. Source: Google Earth.

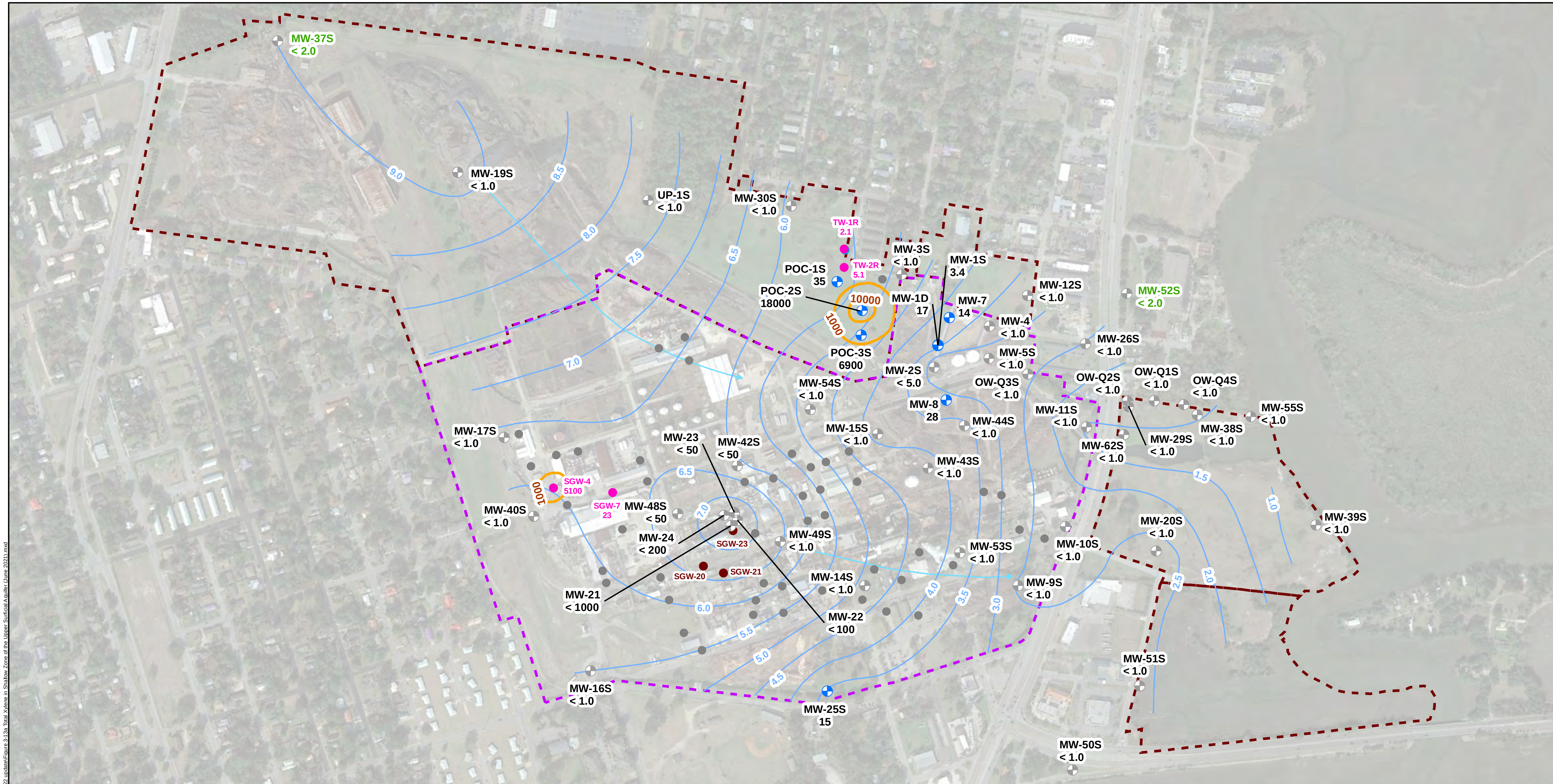
Locations of Potential Sources of COPCs in Groundwater
Hercules/Pinova Facility
Brunswick, Georgia

Geosyntec consultants

Kennesaw, GA | January 2022

Figure 3-12

Path: N:\H\Hercules\Brunswick\GIS\MXD\CAP Figures\January 2022\Figure 3-12 Locations of Potential Sources of COPCs.mxd; CKrachon; 12/21/2021



Total Xylene Concentration (ug/L)

- Detected Concentration
- Not Detected Reporting Limit > MCL
- Not Detected Reporting Limit <= MCL

MW-19S Black well label indicates sample was collected after January 2015

MW-37S Green well label indicates sample was collected prior to January 2015

August 2019 Shallow Groundwater Sample (Vapor Intrusion Investigation)

- Total Xylene Concentration (ug/L)
- Non-Aqueous Phase Liquid (NAPL) Observed
- Not Detected Reporting Limit > MCL
- Not Detected Reporting Limit <= MCL

- Total Xylene Concentration Iso-Contour (ug/L) (inferred where dashed)
- Groundwater Elevation Iso-Contour (ft MSL)
- Approximate Groundwater Flow Direction
- Pinova Property
- Hercules Property

0 275 550 1,100 Feet

N

Notes:
1. Water level measurements recorded on June 7, 2021. Elevations provided in feet above mean sea level (ft MSL).
2. Most recent sampling result is shown for each monitoring well.
3. The Maximum Contaminant Level (MCL) for total xylene is 10,000 ug/L.
4. Aerial photograph approximate date - January 2019. Source: Google Earth.

Total Xylene in Shallow Zone of the Upper Surficial Aquifer

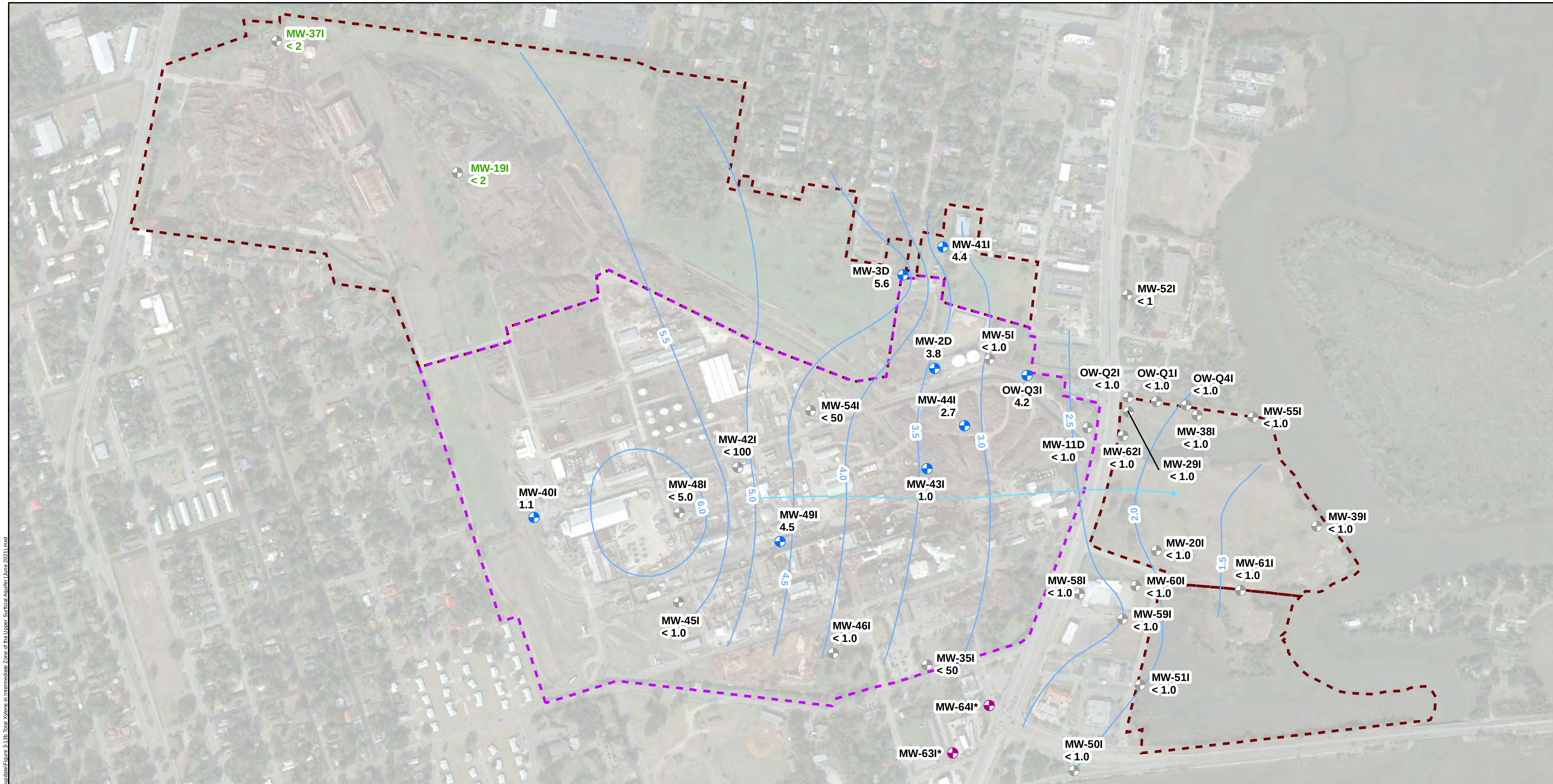
Hercules/Pinova Facility, Brunswick, Georgia

Geosyntec consultants

Kennesaw, GA | August 2022

Figure 3-13a

Path: N:\H\Hercules\Brunswick\GIS\MXD\CAP Figures\August 2022 update\Figure 3-13a Total Xylene in Shallow Zone of the Upper Surficial Aquifer (June 2021).mxd



Total Xylene Concentration (ug/L)

- Detected Concentration
- Not Detected Reporting Limit > MCL
- Not Detected Reporting Limit <= MCL
- New Monitoring Well

MW-40I Black well label indicates sample was collected after January 2015

MW-37I Green well label indicates sample was collected prior to January 2015

- Groundwater Elevation Iso-Contour (ft MSL)
- Approximate Groundwater Flow Direction
- Pinova Property
- Hercules Property

0 275 550 1,100 Feet

N

Notes:

1. Water level measurements recorded on June 7, 2021. Elevations provided in feet above mean sea level (ft MSL).
2. Most recent sampling result is shown for each monitoring well.
3. * - Monitoring wells MW-63I and MW-64I were installed in November 2021. Results for samples collected from these monitoring wells in December 2021 will be provided in the Groundwater Monitoring Report, Semi-Annual Groundwater Monitoring Event - December 2021.
4. The Maximum Contaminant Level (MCL) for total xylene is 10,000 ug/L.
5. All concentrations of total xylene are below the MCL, 10,000 ug/L.
6. Aerial photograph approximate date - January 2019. Source: Google Earth.

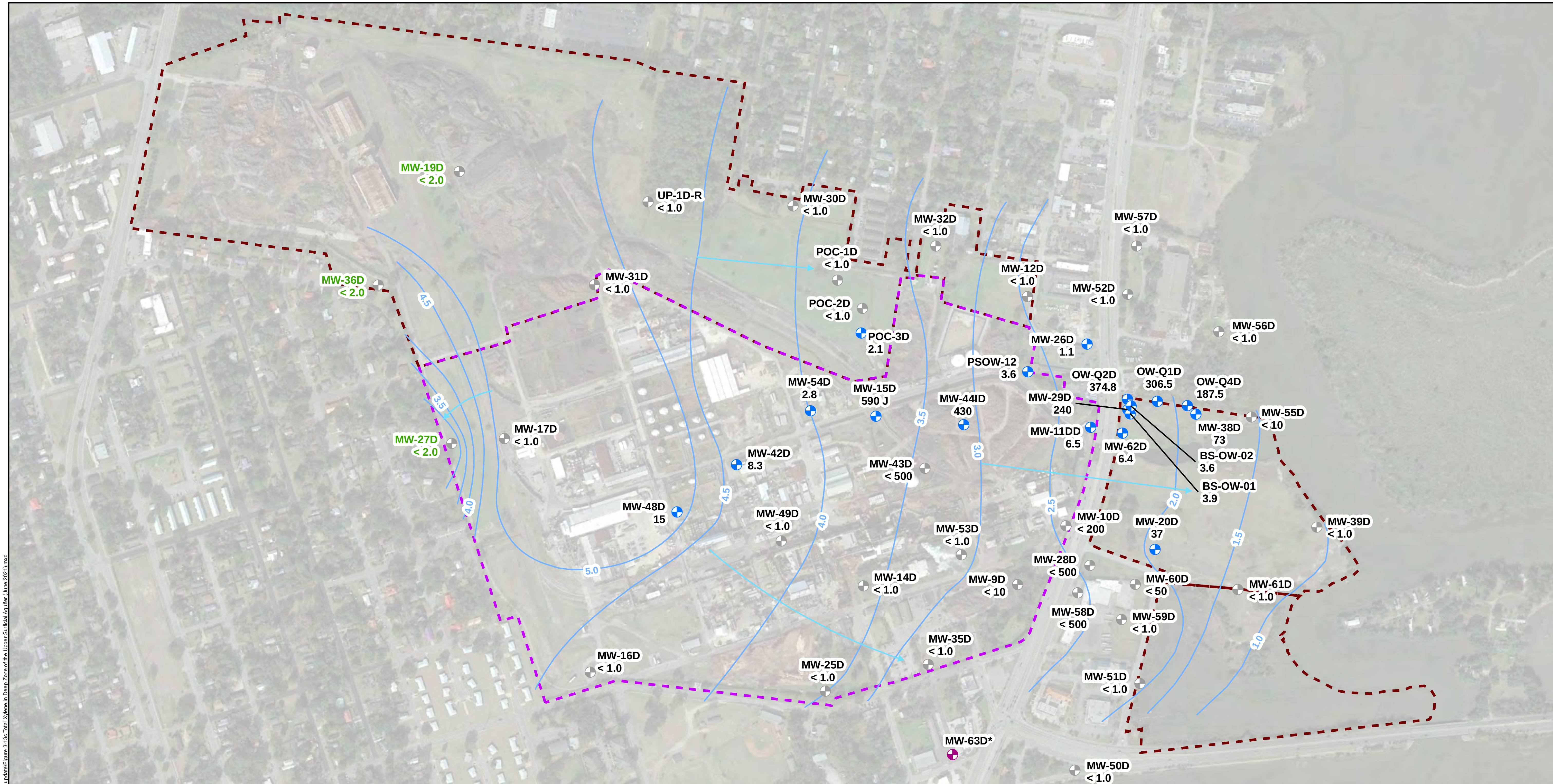
Total Xylene in Intermediate Zone of the Upper Surficial Aquifer

Hercules/Pinova Facility, Brunswick, Georgia

Geosyntec consultants

Kennesaw, GA | August 2022

Figure 3-13b



Total Xylene Concentration (ug/L)

- Detected Concentration
- Not Detected Reporting Limit > MCL
- Not Detected Reporting Limit <= MCL
- New Monitoring Well
- MW-17D Black well label indicates sample was collected after January 2015
- MW-19D Green well label indicates sample was collected prior to January 2015
- Approximate Groundwater Flow Direction
- Groundwater Elevation Iso-Contour (ft MSL)
- Pinova Property
- Hercules Property

0 275 550 1,100 Feet

N

Notes:

1. Water level measurements recorded on June 7, 2021. Elevations provided in feet above mean sea level (ft MSL).
2. Most recent sampling result is shown for each monitoring well.
3. * - Monitoring well MW-63D was installed in November 2021. Results for sample collected from this monitoring well in December 2021 will be provided in the Groundwater Monitoring Report, Semi-Annual Groundwater Monitoring Event - December 2021.
4. "J" - Result is estimated.
5. The Maximum Contaminant Level (MCL) for total xylene is 10,000 ug/L.
6. All concentrations of total xylene are below the MCL, 10,000 ug/L.
7. Aerial photograph approximate date - January 2019. Source: Google Earth.

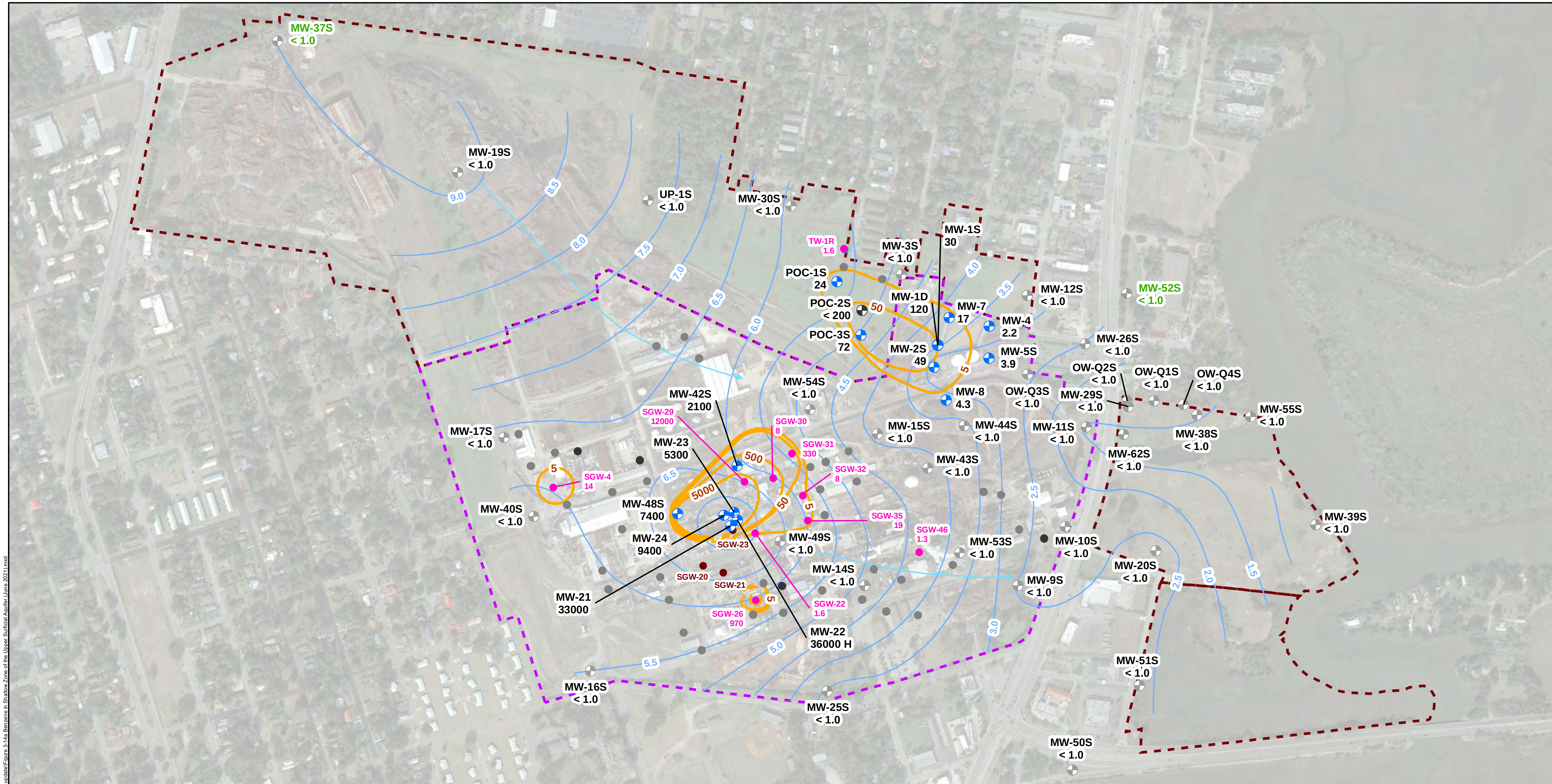
Total Xylene in Deep Zone of the Upper Surficial Aquifer

Hercules/Pinova Facility, Brunswick, Georgia

Geosyntec consultants

Kennesaw, GA | August 2022

Figure 3-13c



Benzene Concentration (ug/L)

- Detected Concentration
- Not Detected Reporting Limit > MCL
- Not Detected Reporting Limit <= MCL

MW-19S Black well label indicates sample was collected after January 2015

MW-37S Green well label indicates sample was collected prior to January 2015

August 2019 Shallow Groundwater Sample (Vapor Intrusion Investigation)

- Benzene Concentration (ug/L)
- Non-Aqueous Phase Liquid (NAPL) Observed
- Not Detected Reporting Limit > MCL
- Not Detected Reporting Limit <= MCL

- Benzene Concentration Iso-Contour (ug/L) (inferred where dashed)
- Groundwater Elevation Iso-Contour (ft MSL)
- Approximate Groundwater Flow Direction
- Pinova Property
- Hercules Property

0 275 550 1,100 Feet

N

Notes:

1. Water level measurements recorded on June 7, 2021. Elevations provided in feet above mean sea level (ft MSL).
2. Most recent sampling result is shown for each monitoring well.
3. "H" - Sample was analyzed beyond specific holding time.
4. The Maximum Contaminant Level (MCL) for benzene is 5 ug/L.
5. Aerial photograph approximate date - January 2019. Source: Google Earth.

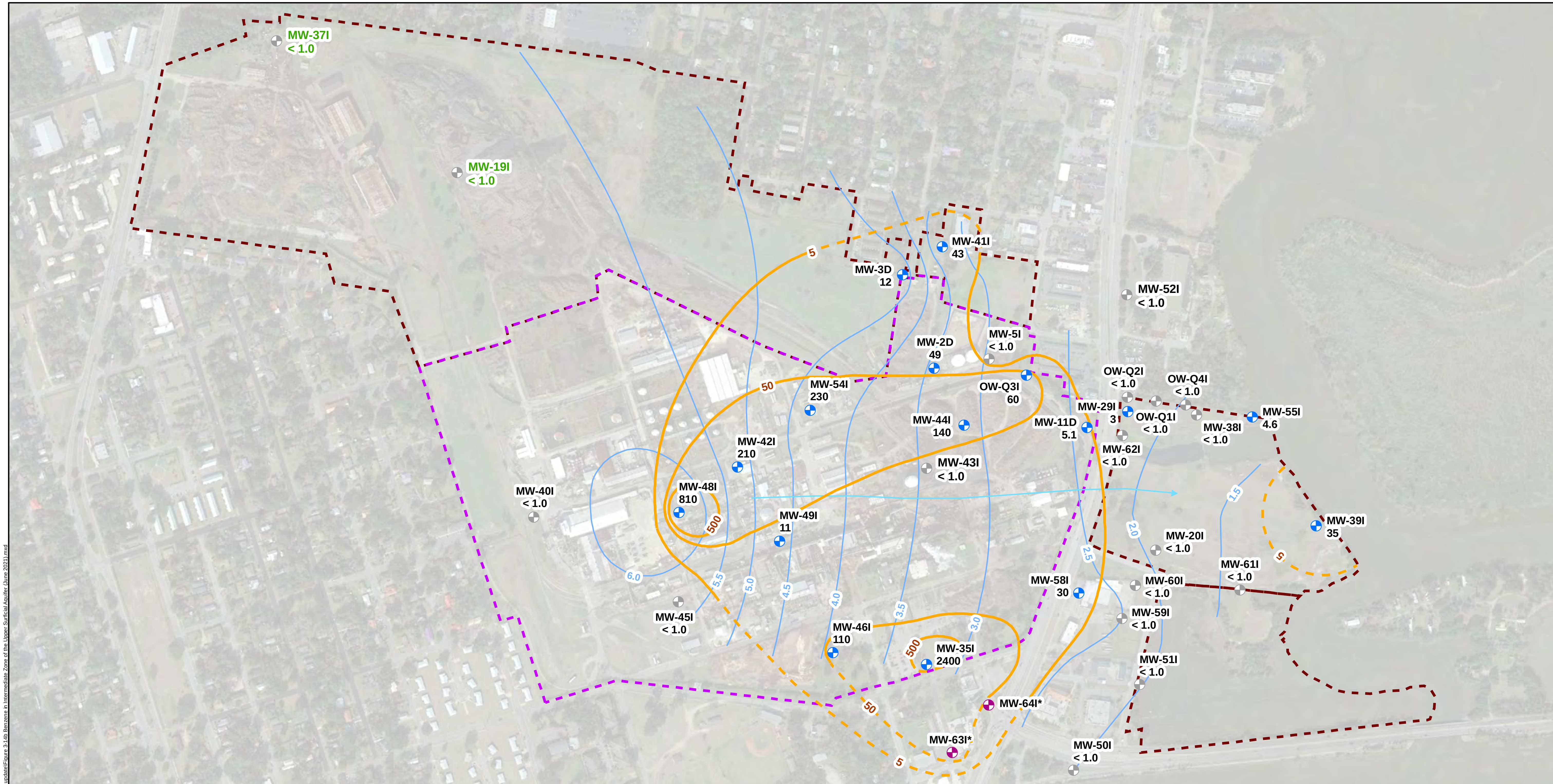
Benzene in Shallow Zone of the Upper Surficial Aquifer

Hercules/Pinova Facility, Brunswick, Georgia

Geosyntec consultants

Kennesaw, GA | August 2022

Figure 3-14a



Benzene Concentrations (ug/L)

- Detected Concentration
- Not Detected Reporting Limit > MCL
- Not Detected Reporting Limit <= MCL
- New Monitoring Well

MW-40I Black well label indicates sample was collected after January 2015

MW-37I Green well label indicates sample was collected prior to January 2015

- Benzene Concentration Iso-Contour (ug/L) (inferred where dashed)
- Groundwater Elevation Iso-Contour (ft MSL)
- Approximate Groundwater Flow Direction
- Pinova Property
- Hercules Property

0 275 550 1,100 Feet

N

Notes:

1. Water level measurements recorded on June 7, 2021. Elevations provided in feet above mean sea level (ft MSL).
2. Most recent sampling result is shown for each monitoring well.
3. * - Monitoring wells MW-63I and MW-64I were installed in November 2021. Results for samples collected from these monitoring wells in December 2021 will be provided in the Groundwater Monitoring Report, Semi-Annual Groundwater Monitoring Event - December 2021.
4. The Maximum Contaminant Level (MCL) for benzene is 5 ug/L.
5. Aerial photograph approximate date - January 2019. Source: Google Earth.

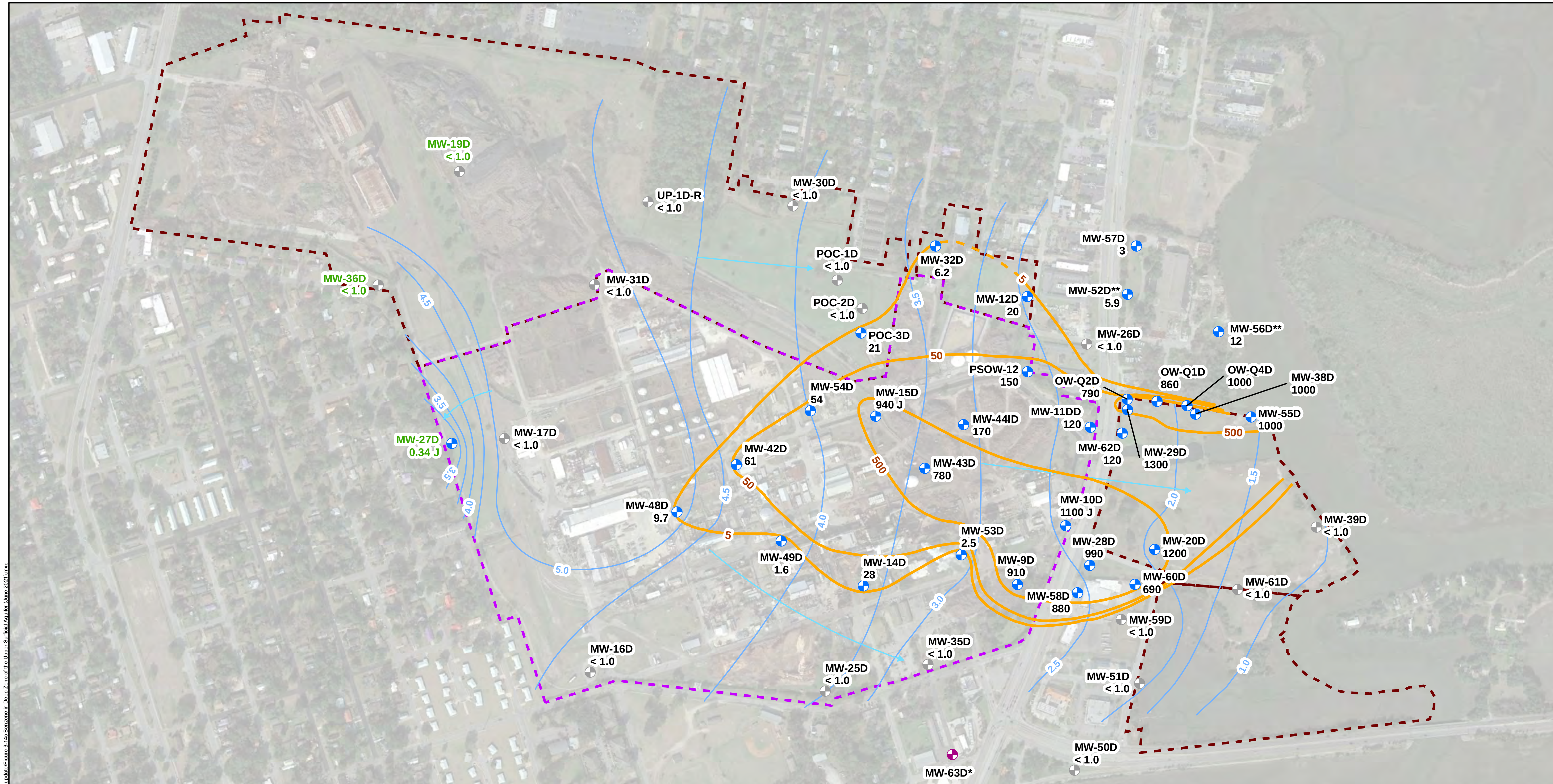
Benzene in Intermediate Zone of the Upper Surficial Aquifer

Hercules/Pinova Facility, Brunswick, Georgia

Geosyntec consultants

Kennesaw, GA | August 2022

Figure 3-14b



Benzene Concentrations (ug/L)

- Detected Concentration
- Not Detected Reporting Limit > MCL
- Not Detected Reporting Limit <= MCL
- New Monitoring Well

MW-17D Black well label indicates sample was collected after January 2015

MW-27D Green well label indicates sample was collected prior to January 2015

- Benzene Concentration Iso-Contour (ug/L) (inferred where dashed)
- Groundwater Elevation Iso-Contour (ft MSL)
- Approximate Groundwater Flow Direction
- Pinova Property
- Hercules Property

0 275 550 1,100 Feet

N

Notes:
1. Water level measurements recorded on June 7, 2021. Elevations provided in feet above mean sea level (ft MSL).
2. Most recent sampling result is shown for each monitoring well.
3. "J" - Result is estimated.
4. * - Monitoring well MW-63D was installed in November 2021. Results for sample collected from this monitoring well in December 2021 will be provided in the Groundwater Monitoring Report, Semi-Annual Groundwater Monitoring Event - December 2021.
5. ** - Monitoring wells MW-52D and MW-56D were not included in the contouring due to the samples not being collected contemporaneously with the other nearby monitoring well samples. Monitoring wells MW-52D and MW-56D were last sampled on 6/14/2018 and 9/25/2017, respectively.
6. The Maximum Contaminant Level (MCL) for benzene is 5 ug/L.
7. Aerial photograph approximate date - January 2019. Source: Google Earth.

Benzene in Deep Zone of the Upper Surficial Aquifer

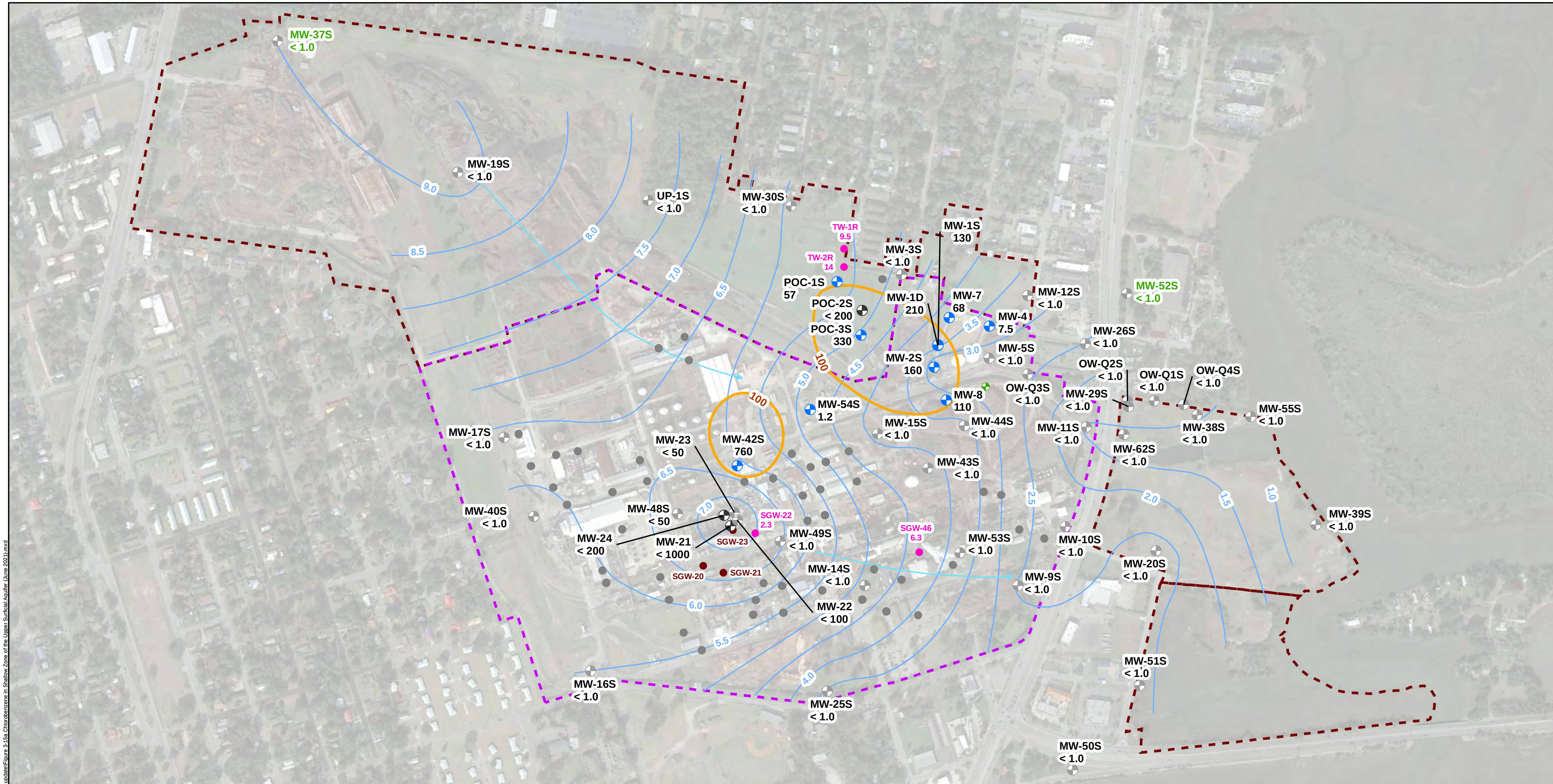
Hercules/Pinova Facility, Brunswick, Georgia

Geosyntec consultants

Kennesaw, GA | August 2022

Figure 3-14c

Path: N:\H\Hercules\Brunswick\GIS\MXD\CAP Figures\August 2022 update\Figure 3-14c Benzene in Deep Zone of the Upper Surficial Aquifer (June 2021).mxd



Chlorobenzene Concentration (ug/L)

- Detected Concentration
- Not Detected Reporting Limit > MCL
- Not Detected Reporting Limit <= MCL

MW-19S Black well label indicates sample was collected after January 2015

MW-37S Green well label indicates sample was collected prior to January 2015

August 2019 Shallow Groundwater Sample (Vapor Intrusion Investigation)

- Chlorobenzene Concentration (ug/L)
- Non-Aqueous Phase Liquid (NAPL) Observed
- Not Detected Reporting Limit > MCL
- Not Detected Reporting Limit <= MCL

- Chlorobenzene Concentration Iso-Contour (ug/L) (inferred where dashed)
- Groundwater Elevation Iso-Contour (ft MSL)
- Approximate Groundwater Flow Direction
- Pinova Property
- Hercules Property

0 275 550 1,100 Feet

N

Notes:

1. Water level measurements recorded on June 7, 2021. Elevations provided in feet above mean sea level (ft MSL).
2. Most recent sampling result is shown for each monitoring well.
3. The Maximum Contaminant Level (MCL) for chlorobenzene is 100 ug/L.
4. Aerial photograph approximate date - January 2019. Source: Google Earth.

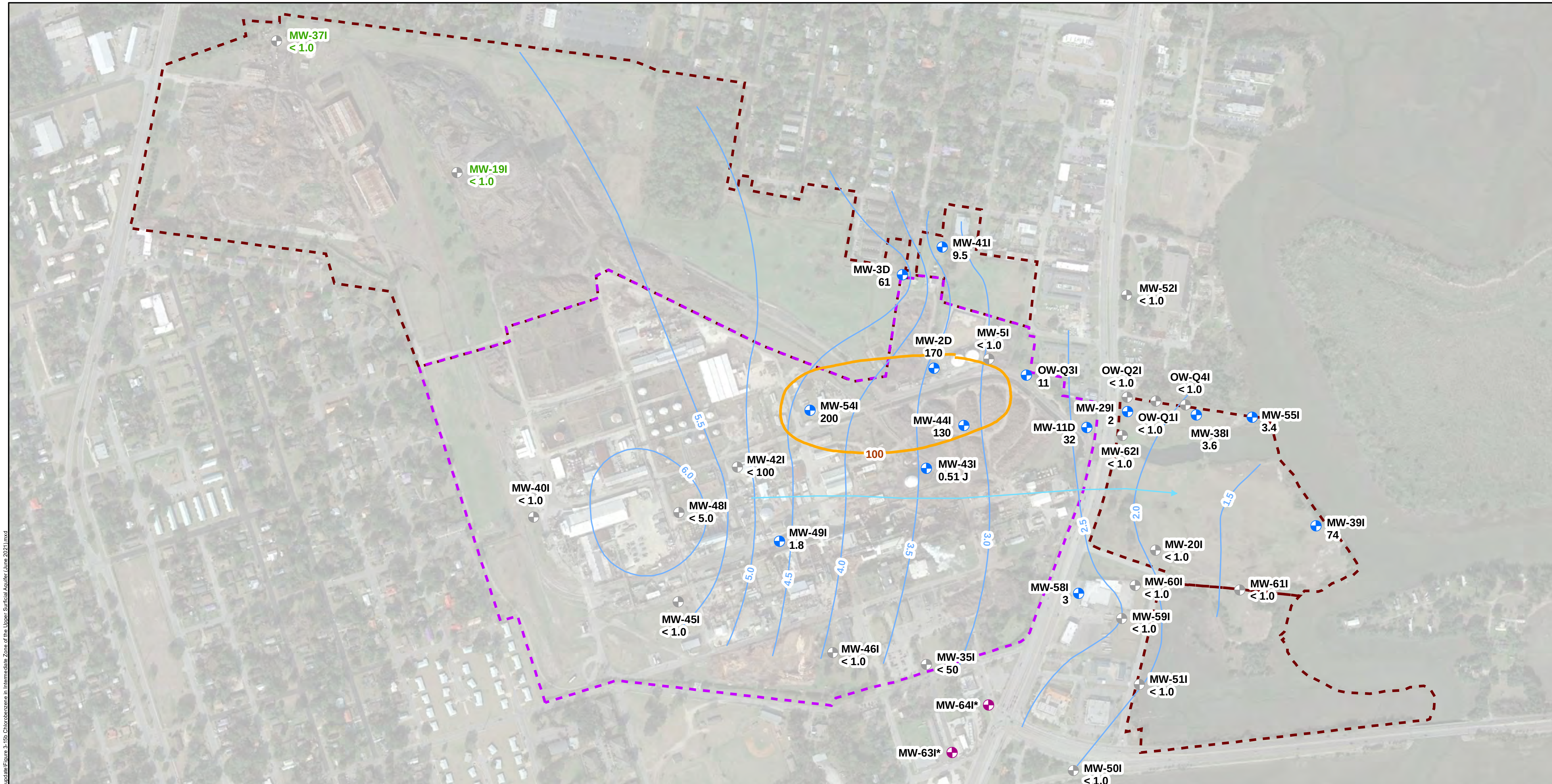
Chlorobenzene in Shallow Zone of the Upper Surficial Aquifer

Hercules/Pinova Facility, Brunswick, Georgia

Geosyntec consultants

Kennesaw, GA | August 2022

Figure 3-15a



Chlorobenzene Concentrations (ug/L)

- Sample Collected After January 2015
- Not Detected Reporting Limit > MCL
- Not Detected Reporting Limit <= MCL
- New Monitoring Well

MW-40I Black well label indicates sample was collected after January 2015

MW-37I Green well label indicates sample was collected prior to January 2015

- Chlorobenzene Concentration Iso-Contour (ug/L) (inferred where dashed)
- Groundwater Elevation Iso-Contour (ft MSL)
- Approximate Groundwater Flow Direction
- Pinova Property
- Hercules Property

0 275 550 1,100 Feet

N

Notes:

1. Water level measurements recorded on June 7, 2021. Elevations provided in feet above mean sea level (ft MSL).
2. Most recent sampling result is shown for each monitoring well.
3. "J" - Result is estimated.
4. * - Monitoring wells MW-63I and MW-64I were installed in November 2021. Results for samples collected from these monitoring wells in December 2021 will be provided in the Groundwater Monitoring Report, Semi-Annual Groundwater Monitoring Event - December 2021.
5. The Maximum Contaminant Level (MCL) for chlorobenzene is 100 ug/L.
6. Aerial photograph approximate date - January 2019. Source: Google Earth.

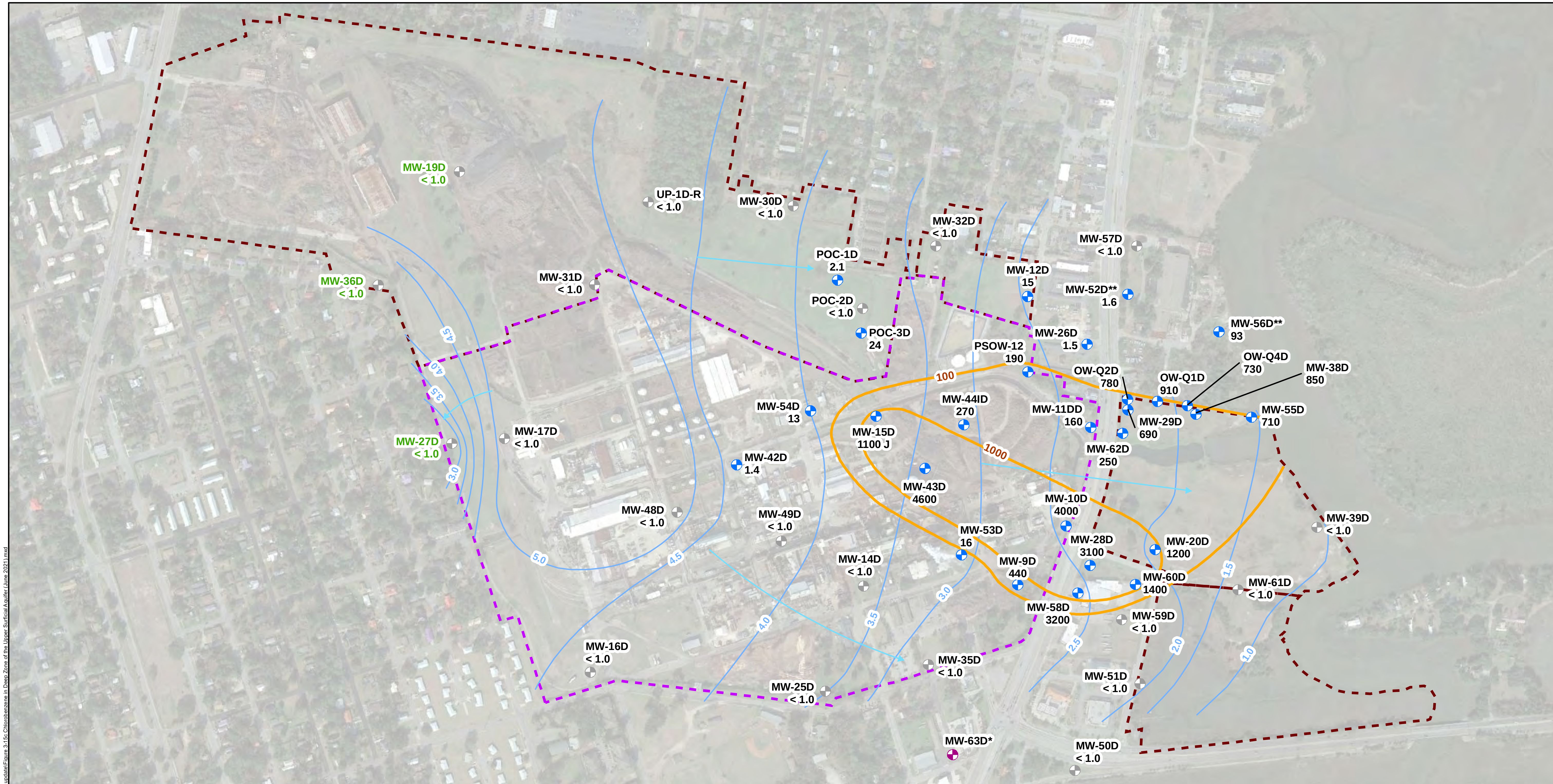
Chlorobenzene in Intermediate Zone of the Upper Surficial Aquifer

Hercules/Pinova Facility, Brunswick, Georgia

Geosyntec consultants

Kennesaw, GA | August 2022

Figure 3-15b



Chlorobenzene Concentrations (ug/L)

- Detected Concentration
- Not Detected Reporting Limit > MCL
- Not Detected Reporting Limit <= MCL
- New Monitoring Well

MW-17D Black well label indicates sample was collected after January 2015

MW-27D Green well label indicates sample was collected prior to January 2015

- Chlorobenzene Concentration Iso-Contour (ug/L) (inferred where dashed)
- Groundwater Elevation Iso-Contour (ft MSL)
- Approximate Groundwater Flow Direction
- Pinova Property
- Hercules Property

0 275 550 1,100 Feet

N

Notes:

1. Water level measurements recorded on June 7, 2021. Elevations provided in feet above mean sea level (ft MSL).
2. Most recent sampling result is shown for each monitoring well.
3. "J" - Result is estimated.
4. * - Monitoring well MW-63D was installed in November 2021. Results for sample collected from this monitoring well in December 2021 will be provided in the Groundwater Monitoring Report, Semi-Annual Groundwater Monitoring Event - December 2021.
5. ** - Monitoring wells MW-52D and MW-56D were not included in the contouring due to the samples not being collected contemporaneously with the other nearby monitoring well samples. Monitoring wells MW-52D and MW-56D were last sampled on 6/14/2018 and 9/25/2017, respectively.
6. The Maximum Contaminant Level (MCL) for chlorobenzene is 100 ug/L.
7. Aerial photograph approximate date - January 2019. Source: Google Earth.

Chlorobenzene in Deep Zone of the Upper Surficial Aquifer

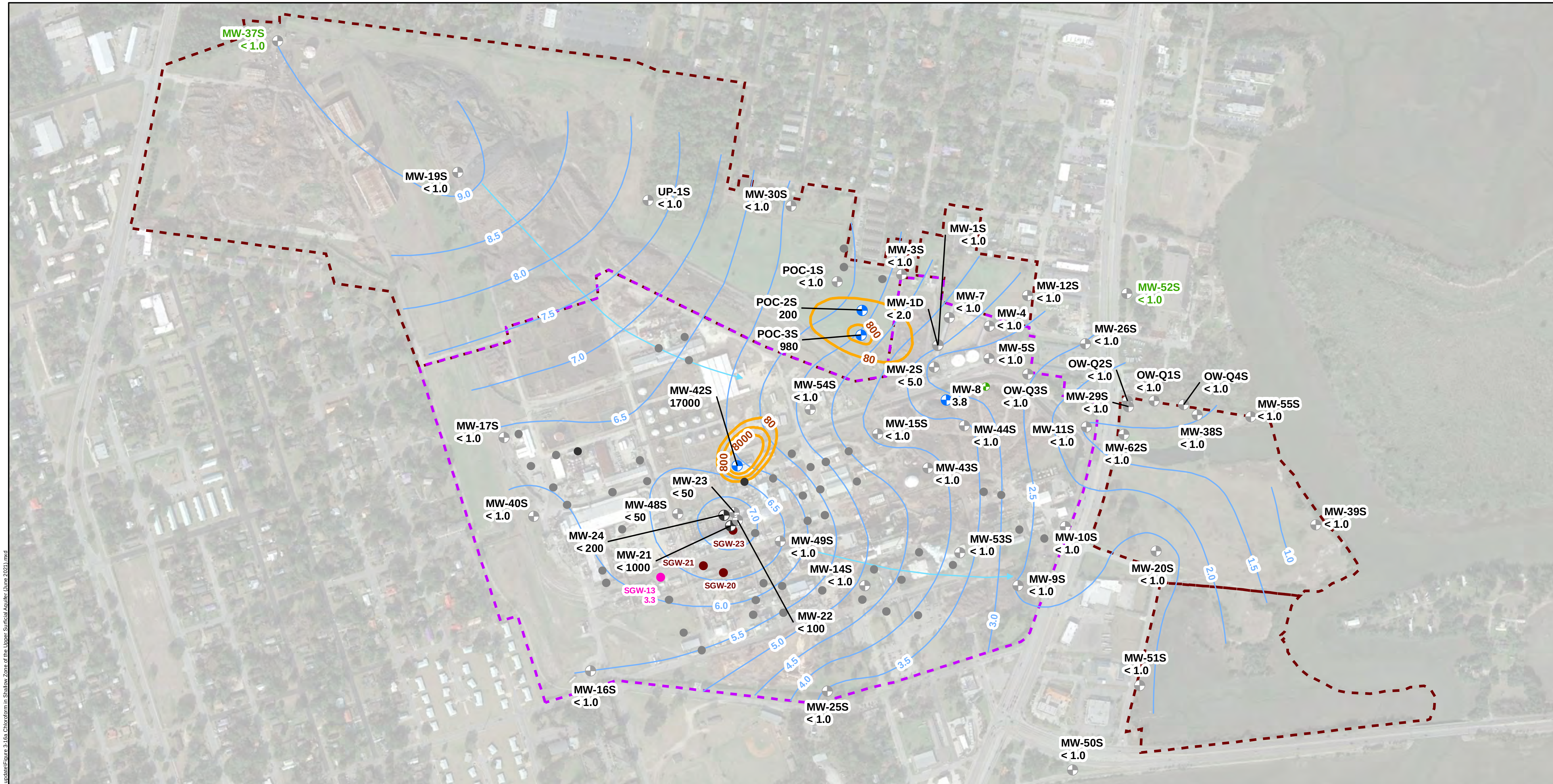
Hercules/Pinova Facility, Brunswick, Georgia

Geosyntec consultants

Kennesaw, GA | August 2022

Figure 3-15c

Path: N:\H\Hercules\Brunswick\GIS\MXD\CAP Figures\August 2022 update\Figure 3-15c Chlorobenzene in Deep Zone of the Upper Surficial Aquifer (June 2021).mxd



Chloroform Concentration (ug/L)

- Detected Concentration
- Not Detected Reporting Limit > MCL
- Not Detected Reporting Limit <= MCL

MW-19S Black well label indicates sample was collected after January 2015

MW-37S Green well label indicates sample was collected prior to January 2015

August 2019 Shallow Groundwater Sample (Vapor Intrusion Investigation)

- Chloroform Concentration (ug/L)
- Non-Aqueous Phase Liquid (NAPL) Observed
- Not Detected Reporting Limit > MCL
- Not Detected Reporting Limit <= MCL

- Chloroform Concentration Iso-Contour (ug/L) (inferred where dashed)
- Groundwater Elevation Iso-Contour (ft MSL)
- Approximate Groundwater Flow Direction
- Pinova Property
- Hercules Property

0 275 550 1,100 Feet

N

Notes:

1. Water level measurements recorded on June 7, 2021. Elevations provided in feet above mean sea level (ft MSL).
2. Most recent sampling result is shown for each monitoring well.
3. The Maximum Contaminant Level (MCL) for chloroform is 80 ug/L.
4. Aerial photograph approximate date - January 2019. Source: Google Earth.

Chloroform in Shallow Zone of the Upper Surficial Aquifer

Hercules/Pinova Facility, Brunswick, Georgia

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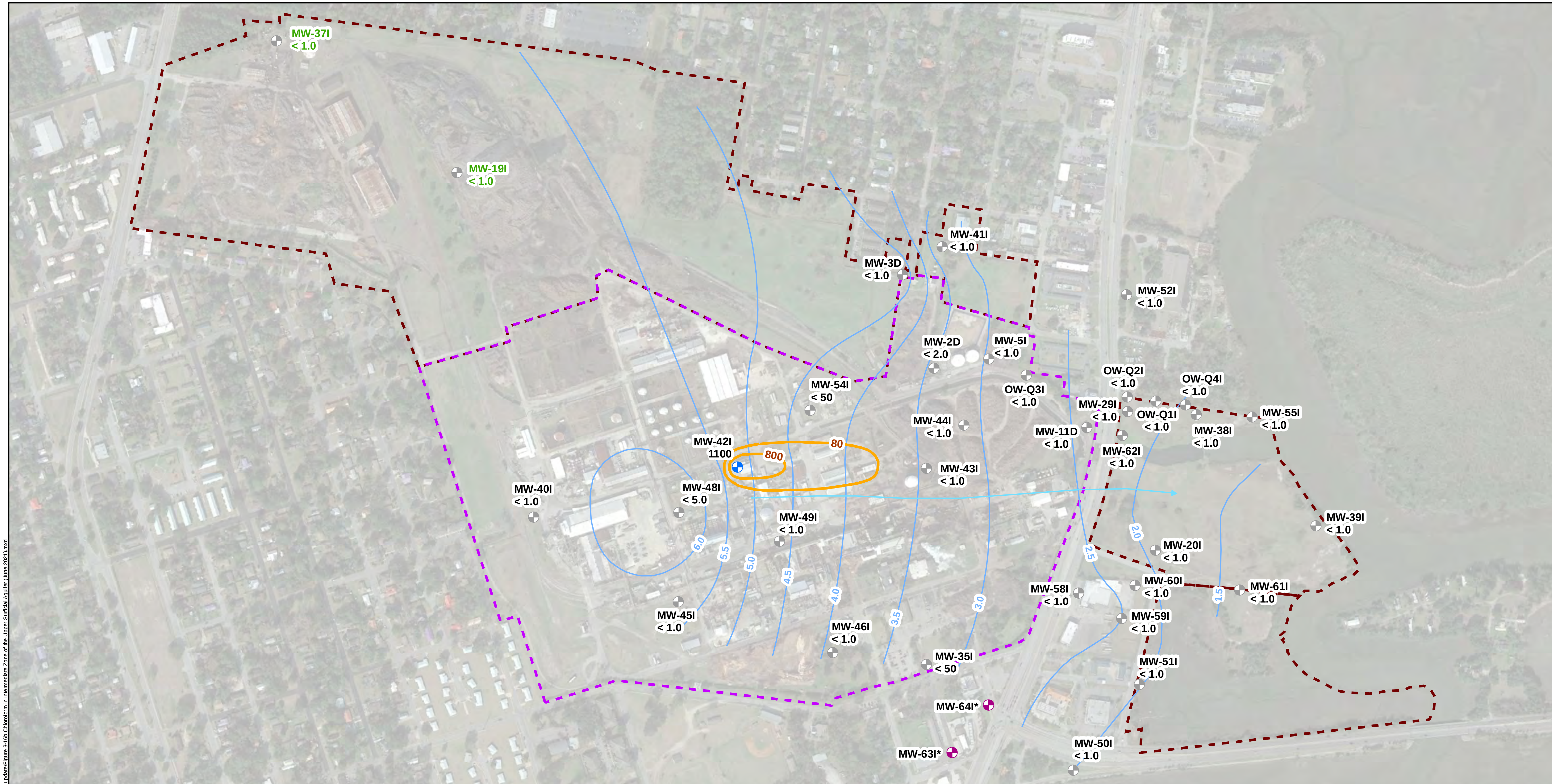
Kennesaw, GA | August 2022

Figure 3-16a

Path: N:\H\Hercules\Brunswick\GIS\MXD\CAP Figures\August 2022 update\Figure 3-16a Chloroform in Shallow Zone of the Upper Surficial Aquifer (June 2021).mxd



Chloroform Concentrations (ug/L)

- Detected Concentration
- Not Detected Reporting Limit > MCL
- Not Detected Reporting Limit <= MCL
- New Monitoring Well

MW-40I Black well label indicates sample was collected after January 2015

MW-37I Green well label indicates sample was collected prior to January 2015

- Chloroform Concentration Iso-Contour (ug/L) (inferred where dashed)
- Groundwater Elevation Iso-Contour (ft MSL)
- Approximate Groundwater Flow Direction
- Pinova Property
- Hercules Property

0 275 550 1,100 Feet

N

Notes:
1. Water level measurements recorded on June 7, 2021. Elevations provided in feet above mean sea level (ft MSL).
2. Most recent sampling result is shown for each monitoring well.
3. * - Monitoring wells MW-63I and MW-64I were installed in November 2021. Results for samples collected from these monitoring wells in December 2021 will be provided in the Groundwater Monitoring Report, Semi-Annual Groundwater Monitoring Event - December 2021.
4. The Maximum Contaminant Level (MCL) for chloroform is 80 ug/L.
5. Aerial photograph approximate date - January 2019. Source: Google Earth.

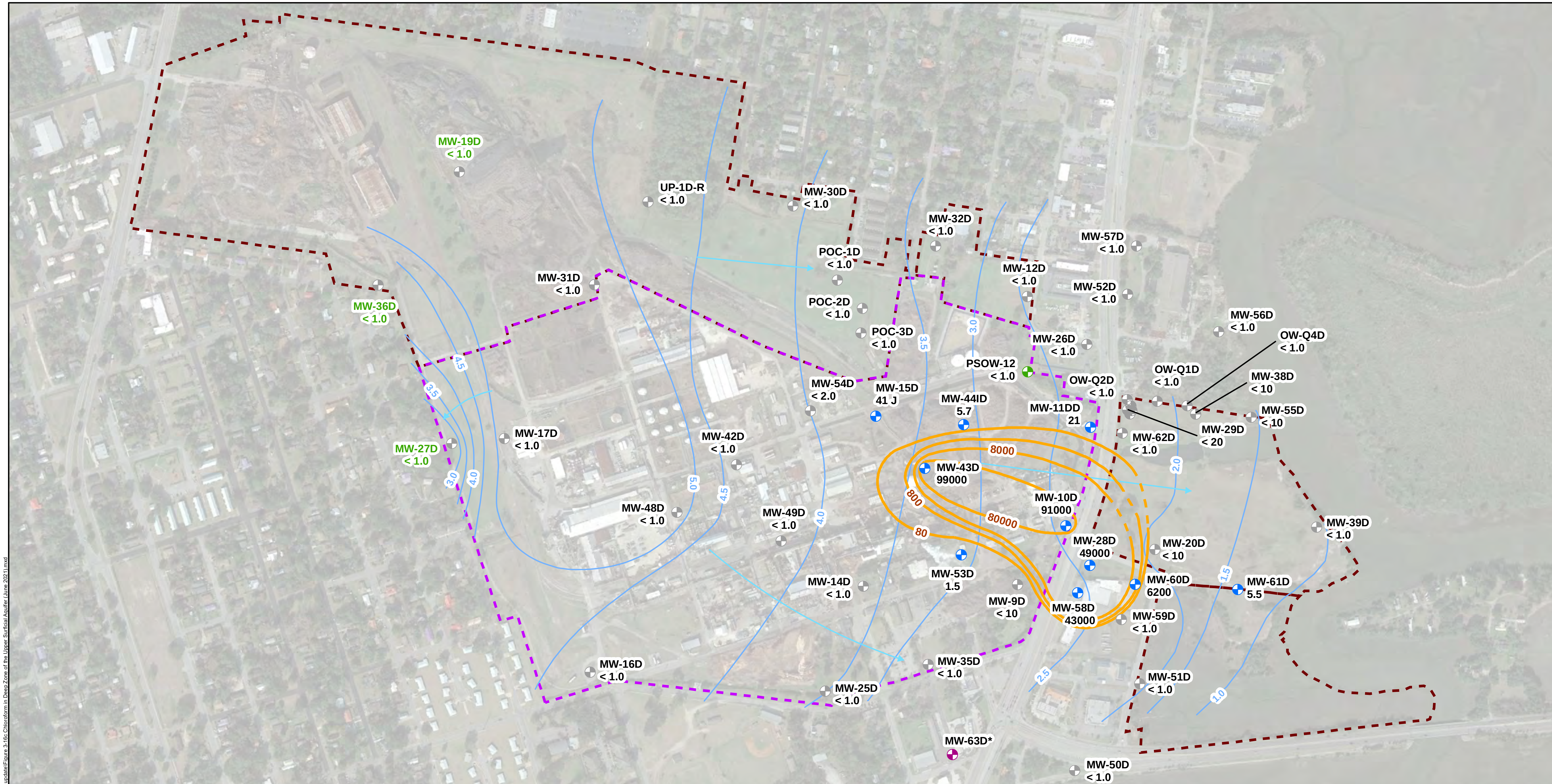
Chloroform in Intermediate Zone of the Upper Surficial Aquifer

Hercules/Pinova Facility, Brunswick, Georgia

Geosyntec consultants

Kennesaw, GA | August 2022

Figure 3-16b



Chloroform Concentrations (ug/L)

- Sample Collected After January 2015
- Not Detected Reporting Limit > MCL
- Not Detected Reporting Limit <= MCL
- New Monitoring Well

MW-17D Black well label indicates sample was collected after January 2015

MW-19D Green well label indicates sample was collected prior to January 2015

- Chloroform Concentration Iso-Contour (ug/L) (inferred where dashed)
- Groundwater Elevation Iso-Contour (ft MSL)
- Approximate Groundwater Flow Direction
- Pinova Property
- Hercules Property

0 275 550 1,100 Feet

N

Notes:

1. Water level measurements recorded on June 7, 2021. Elevations provided in feet above mean sea level (ft MSL).
2. Most recent sampling result is shown for each monitoring well.
3. "J" - Result is estimated.
4. * - Monitoring well MW-63D was installed in November 2021. Results for sample collected from this monitoring well in December 2021 will be provided in the Groundwater Monitoring Report, Semi-Annual Groundwater Monitoring Event - December 2021.
5. The Maximum Contaminant Level (MCL) for chloroform is 80 ug/L.
6. Aerial photograph approximate date - January 2019. Source: Google Earth.

Chloroform in Deep Zone of the Upper Surficial Aquifer

Hercules/Pinova Facility, Brunswick, Georgia

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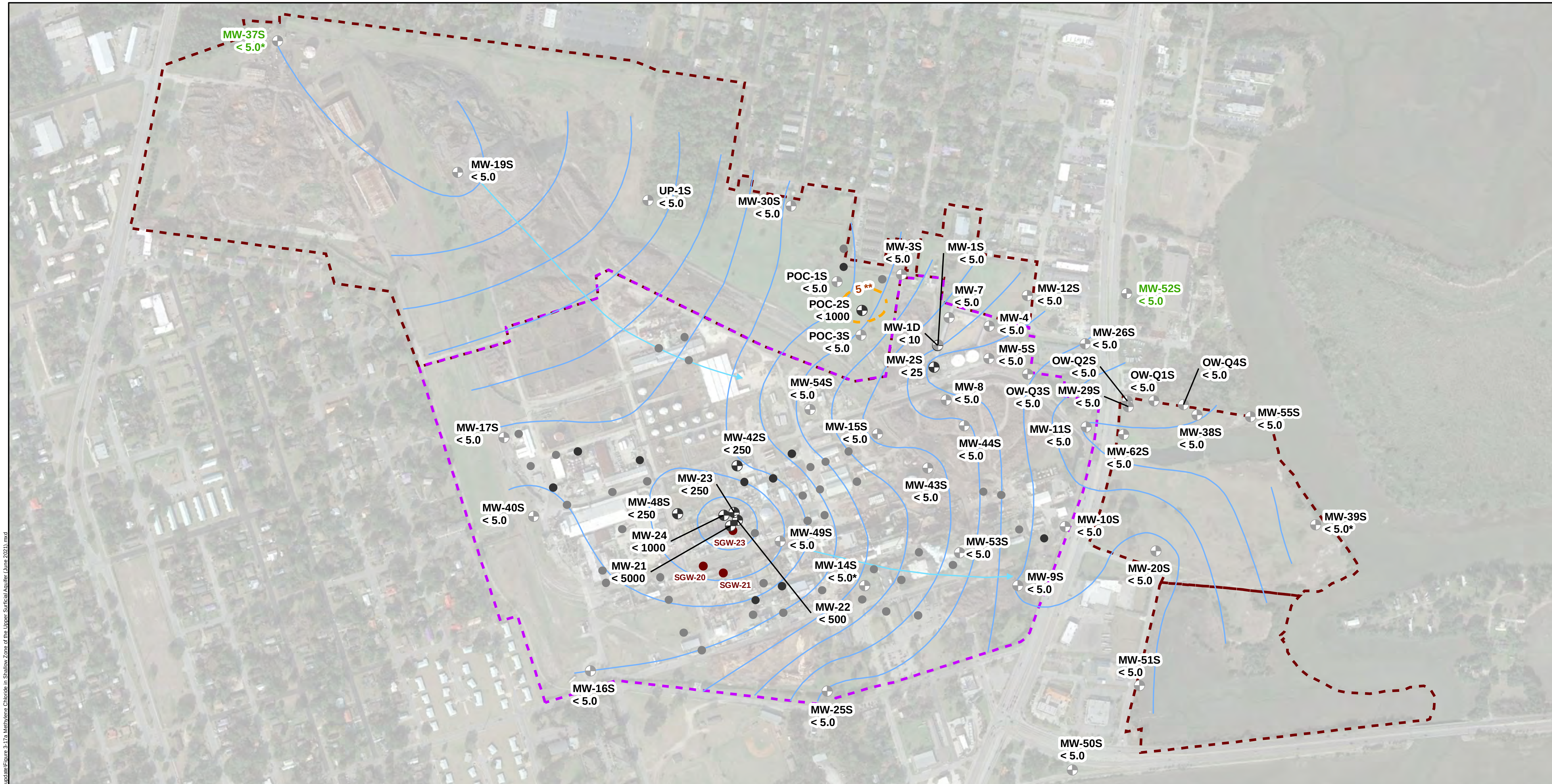
Kennesaw, GA | August 2022

Figure 3-16c



Methylene Chloride Non-Detect Concentration (ug/L)

- Not Detected Reporting Limit > MCL
- Not Detected Reporting Limit <= MCL

MW-19S Black well label indicates sample was collected after January 2015

MW-37S Green well label indicates sample was collected prior to January 2015

August 2019 Shallow Groundwater Sample (Vapor Intrusion Investigation)

- Non-Aqueous Phase Liquid (NAPL) Observed
- Not Detected Reporting Limit > MCL
- Not Detected Reporting Limit <= MCL
- Methylene Chloride Concentration Iso-Contour (ug/L) (inferred where dashed)
- Groundwater Elevation Iso-Contour (ft MSL)
- Approximate Groundwater Flow Direction

- Pinova Property
- Hercules Property

0 275 550 1,100 Feet

N

Notes:

1. Water level measurements recorded on June 7, 2021. Elevations provided in feet above mean sea level (ft MSL).
2. Most recent sampling result is shown for each monitoring well.
3. "*" - Laboratory Control Sample (LCS) and/or LCS Duplicate is outside acceptance limits, high biased.
4. "**" - Contour line is based on last detection of methylene chloride of 11 µg/L at monitoring well POC-2S, which was sampled in December 2019. Monitoring well POC-2S was sampled in June 2020 and methylene chloride was not detected at a detection limit of 25 µg/L.
5. The Maximum Contaminant Level (MCL) for methylene chloride is 5 ug/L.
6. Aerial photograph approximate date - January 2019. Source: Google Earth.

Methylene Chloride in Shallow Zone of the Upper Surficial Aquifer

Hercules/Pinova Facility, Brunswick, Georgia

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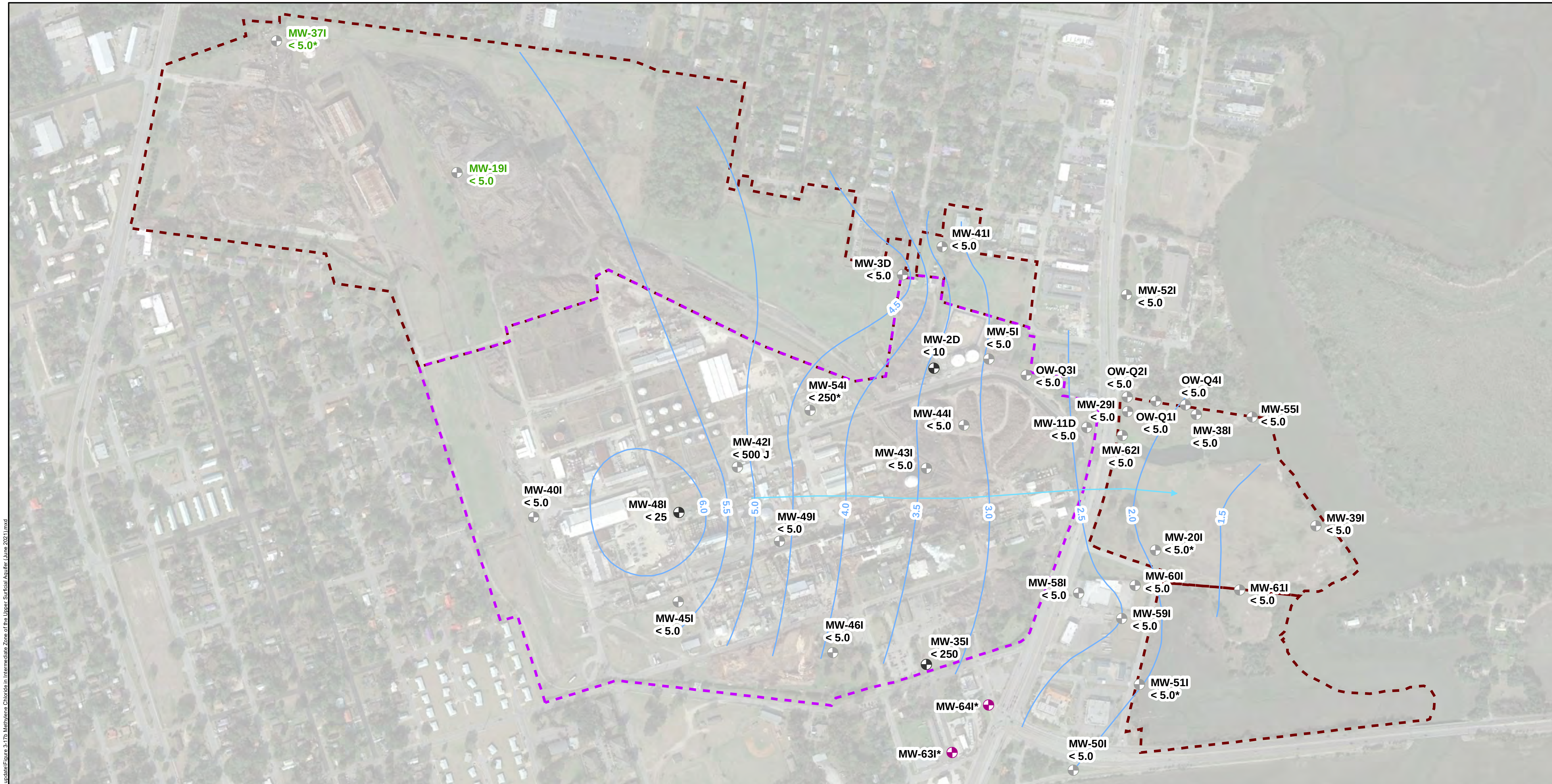
Kennesaw, GA | August 2022

Figure 3-17a



Methylene Chloride Concentration (ug/L)

- Not Detected Reporting Limit <= MCL
- Not Detected Reporting Limit > MCL
- New Monitoring Well

MW-40I Black well label indicates sample was collected after January 2015

MW-37I Green well label indicates sample was collected prior to January 2015

- Groundwater Elevation Iso-Contour (ft MSL)
- Approximate Groundwater Flow Direction
- Pinova Property
- Hercules Property

0 275 550 1,100 Feet

N

Notes:

1. Water level measurements recorded on June 7, 2021. Elevations provided in feet above mean sea level (ft MSL).
2. Most recent sampling result is shown for each monitoring well.
3. "J" - Result is estimated.
4. "*" - Laboratory Control Sample (LCS) and/or LCS Duplicate is outside acceptance limits, high biased.
5. * - Monitoring wells MW-63I and MW-64I were installed in November 2021. Results for samples collected from these monitoring wells in December 2021 will be provided in the Groundwater Monitoring Report, Semi-Annual Groundwater Monitoring Event - December 2021.
6. The Maximum Contaminant Level (MCL) for methylene chloride is 5 ug/L.
7. All concentrations of methylene chloride are below the MCL, 5 ug/L.
8. Aerial photograph approximate date - January 2019. Source: Google Earth.

Methylene Chloride in Intermediate Zone of the Upper Surficial Aquifer

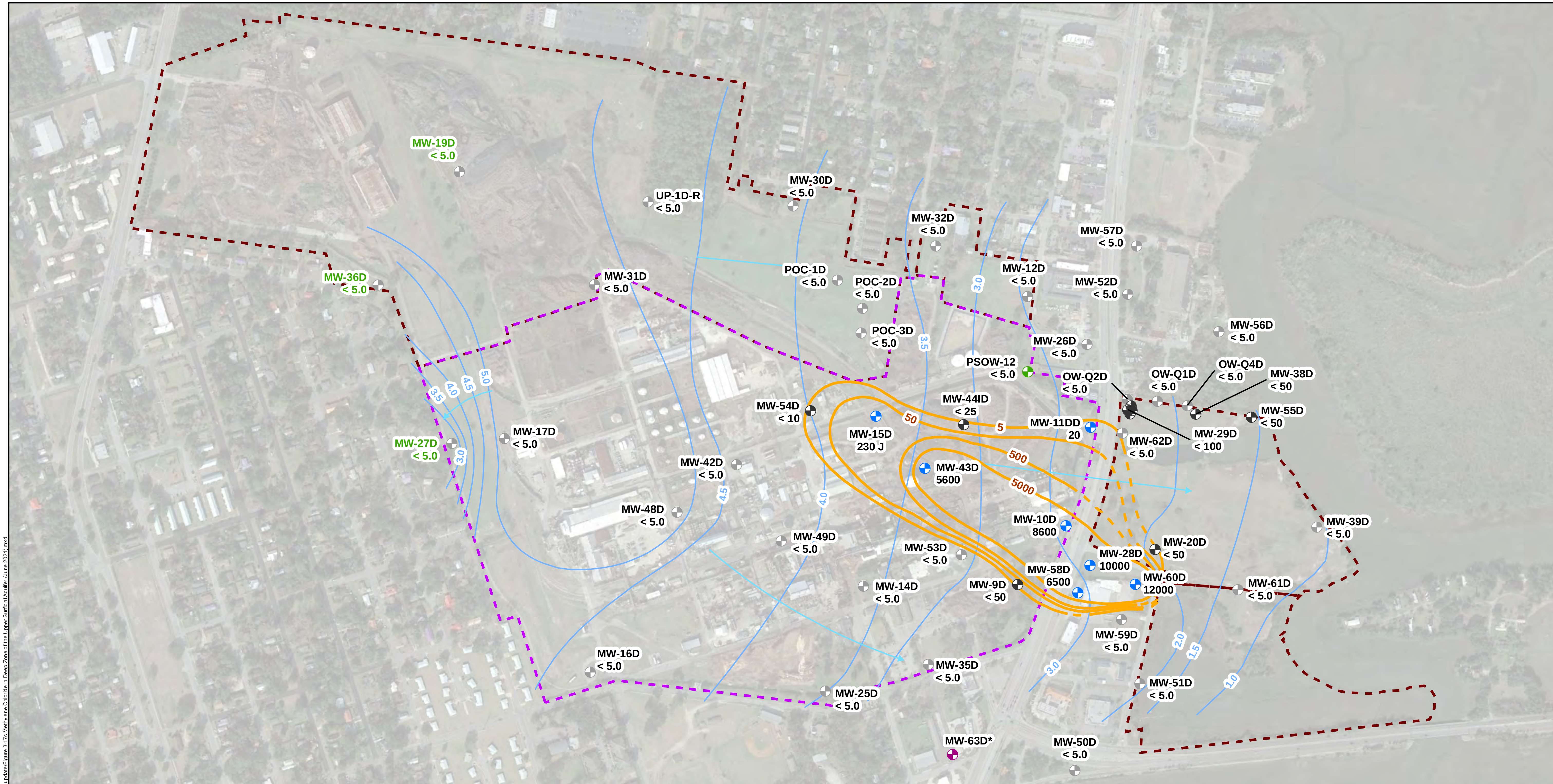
Hercules/Pinova Facility, Brunswick, Georgia

Geosyntec consultants

Kennesaw, GA | August 2022

Figure 3-17b

Path: N:\H\Hercules\Brunswick\GIS\MXD\CAP Figures\August 2022 update\Figure 3-17b Methylene Chloride in Intermediate Zone of the Upper Surficial Aquifer (June 2021).mxd



Methylene Chloride Concentration (ug/L)

- Detected Concentration
- Not Detected Reporting Limit > MCL
- Not Detected Reporting Limit <= MCL
- New Monitoring Well

MW-17D Black well label indicates sample was collected after January 2015

MW-19D Green well label indicates sample was collected prior to January 2015

- Methylene Chloride Concentration Iso-Contour (ug/L) (inferred where dashed)
- Groundwater Elevation Iso-Contour (ft MSL)
- Approximate Groundwater Flow Direction
- Pinova Property
- Hercules Property

0 275 550 1,100 Feet

N

Notes:

1. Water level measurements recorded on June 7, 2021. Elevations provided in feet above mean sea level (ft MSL).
2. Most recent sampling result is shown for each monitoring well.
3. "J" - Result is estimated.
4. * - Monitoring well MW-63D was installed in November 2021. Results for sample collected from this monitoring well in December 2021 will be provided in the Groundwater Monitoring Report, Semi-Annual Groundwater Monitoring Event - December 2021.
5. The Maximum Contaminant Level (MCL) for methylene chloride is 5 ug/L.
6. Aerial photograph approximate date - January 2019. Source: Google Earth.

Methylene Chloride in Deep Zone of the Upper Surficial Aquifer

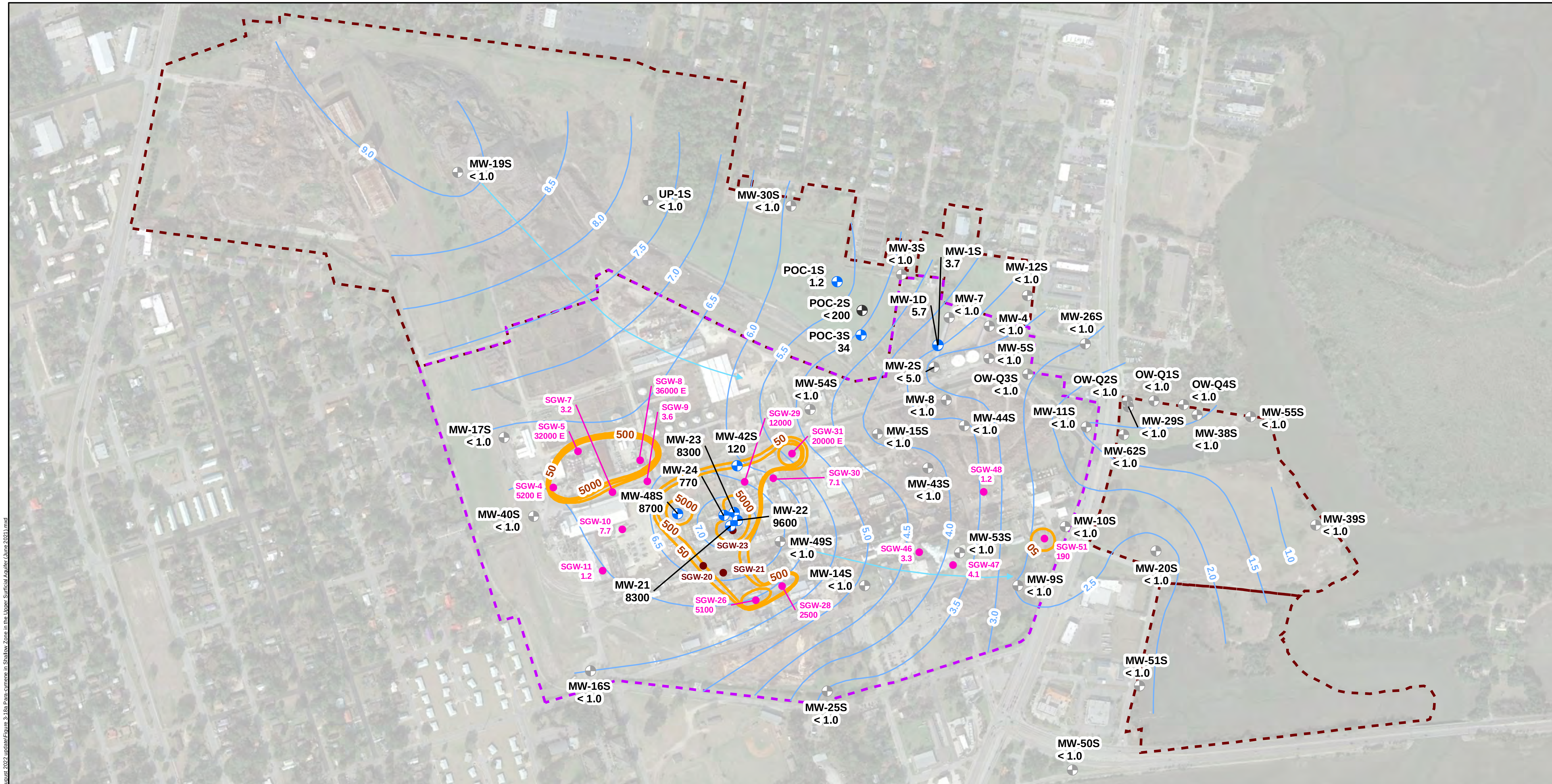
Hercules/Pinova Facility, Brunswick, Georgia

Geosyntec consultants

Kennesaw, GA | August 2022

Figure 3-17c

Path: N:\H\Hercules\Brunswick\GIS\MXD\CAP Figures\August 2022 update\Figure 3-17c Methylene Chloride in Deep Zone of the Upper Surficial Aquifer (June 2021).mxd



Para-cymene Concentration (ug/L)
- Detected Concentration
- Not Detected Reporting Limit > MCL
- Not Detected Reporting Limit <= MCL

MW-19S Black well label indicates sample was collected after January 2015

August 2019 Shallow Groundwater Sample (Vapor Intrusion Investigation)
- Para-cymene Concentration (ug/L)
- Non-Aqueous Phase Liquid (NAPL) Observed
- Not Detected Reporting Limit > MCL
- Not Detected Reporting Limit <= MCL

- Para-cymene Concentration Iso-Contour (ug/L) (inferred where dashed)
- Groundwater Elevation Iso-Contour (ft MSL)
- Approximate Groundwater Flow Direction
- Pinova Property
- Hercules Property

0 275 550 1,100 Feet

N

Notes:
1. Water level measurements recorded on June 7, 2021. Elevations provided in feet above mean sea level (ft MSL).
2. Most recent sampling result is shown for each monitoring well.
3. Aerial photograph approximate date - January 2019. Source: Google Earth.

Para-cymene in Shallow Zone of the Upper Surficial Aquifer
Hercules/Pinova Facility, Brunswick, Georgia

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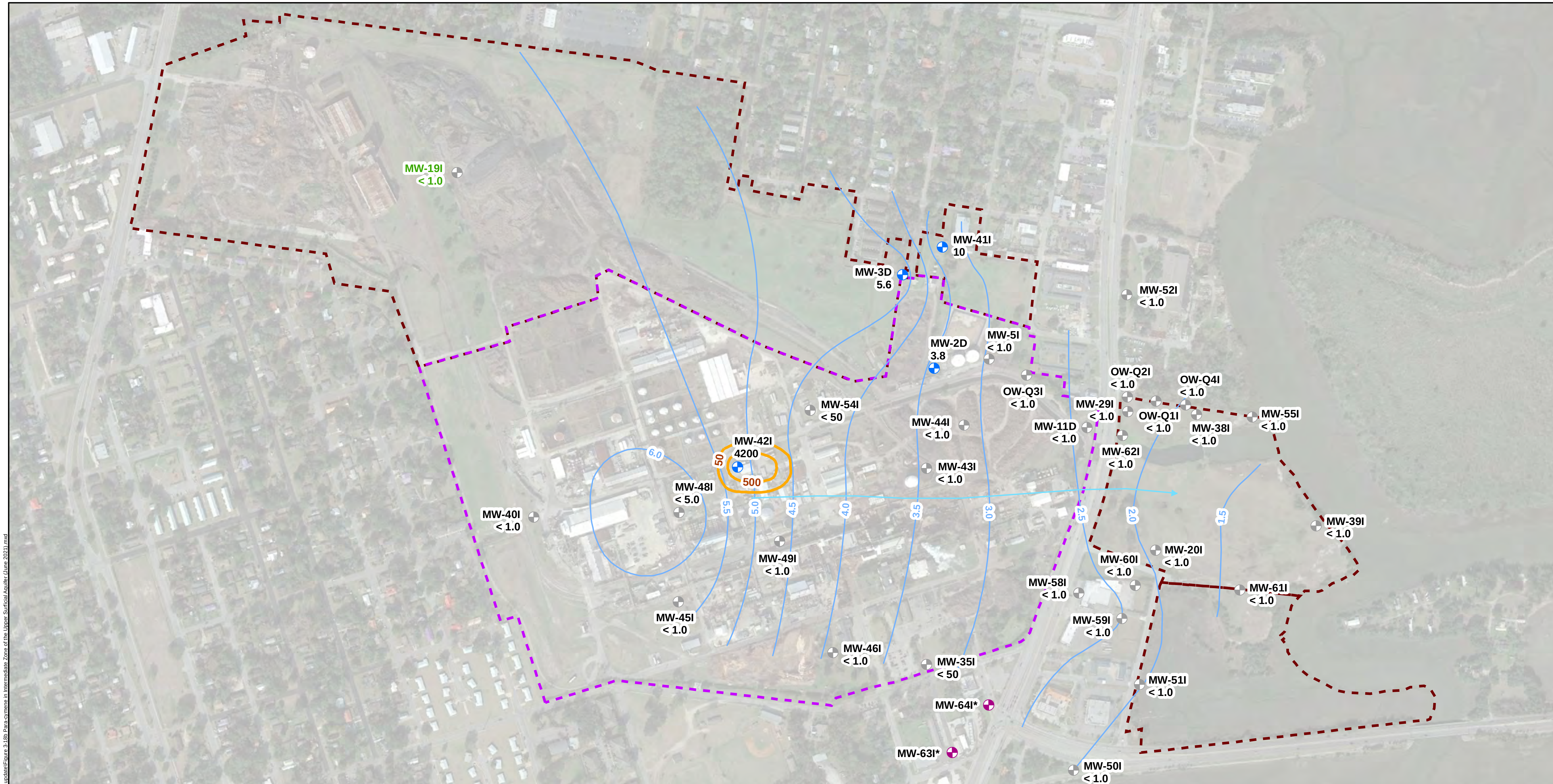
Kennesaw, GA | August 2022

Figure 3-18a

Path: \\A-01\\p\\GIS\\Hercules\\Brunswick\\GIS\\MXD\\CAP Figures\\August 2022 update\\Figure 3-18a Para-cymene in Shallow Zone in the Upper Surficial Aquifer (June 2021).mxd



Para-cymene Concentration (ug/L)

- Detected Concentration
- Not Detected Reporting Limit > MCL
- Not Detected Reporting Limit <= MCL
- New Monitoring Well

MW-40I Black well label indicates sample was collected after January 2015

MW-37I Green well label indicates sample was collected prior to January 2015

- Para-cymene Concentration Iso-Contour (ug/L) (inferred where dashed)
- Groundwater Elevation Iso-Contour (ft MSL)
- Approximate Groundwater Flow Direction
- Pinova Property
- Hercules Property

0 275 550 1,100 Feet

N

Notes:
1. Water level measurements recorded on June 7, 2021. Elevations provided in feet above mean sea level (ft MSL).
2. Most recent sampling result is shown for each monitoring well.
3. * - Monitoring wells MW-63I and MW-64I were installed in November 2021. Results for samples collected from these monitoring wells in December 2021 will be provided in the Groundwater Monitoring Report, Semi-Annual Groundwater Monitoring Event - December 2021.
4. Aerial photograph approximate date - January 2019. Source: Google Earth.

Para-cymene in Intermediate Zone of the Upper Surficial Aquifer

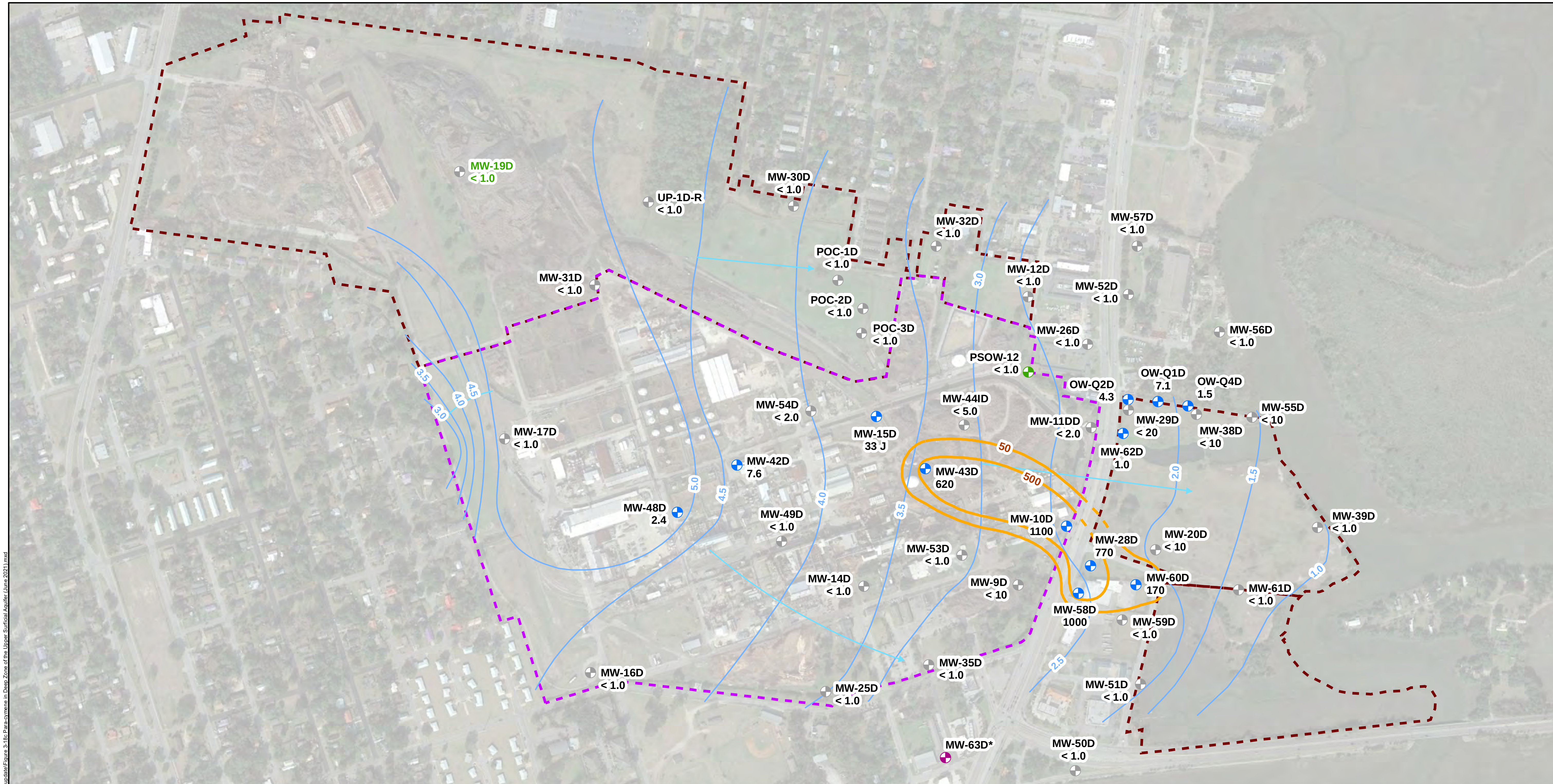
Hercules/Pinova Facility, Brunswick, Georgia

Geosyntec consultants

Kennesaw, GA | August 2022

Figure 3-18b

Path: N:\H\Hercules\Brunswick\GIS\MXD\CAP Figures\August 2022 update\Figure 3-18b Para-cymene in Intermediate Zone of the Upper Surficial Aquifer (June 2021).mxd



Para-cymene Concentration (ug/L)

- Detected Concentration
- Not Detected Reporting Limit > MCL
- Not Detected Reporting Limit <= MCL
- New Monitoring Well

MW-17D Black well label indicates sample was collected after January 2015

MW-19D Green well label indicates sample was collected prior to January 2015

- Para-cymene Concentration Iso-Contour (ug/L) (inferred where dashed)
- Groundwater Elevation Iso-Contour (ft MSL)
- Approximate Groundwater Flow Direction
- Pinova Property
- Hercules Property

0 275 550 1,100 Feet

N

Notes:

1. Water level measurements recorded on June 7, 2021. Elevations provided in feet above mean sea level (ft MSL).
2. Most recent sampling result is shown for each monitoring well.
3. "J" - Result is estimated.
4. * - Monitoring well MW-63D was installed in November 2021. Results for sample collected from this monitoring well in December 2021 will be provided in the Groundwater Monitoring Report, Semi-Annual Groundwater Monitoring Event - December 2021.
5. Aerial photograph approximate date - January 2019. Source: Google Earth.

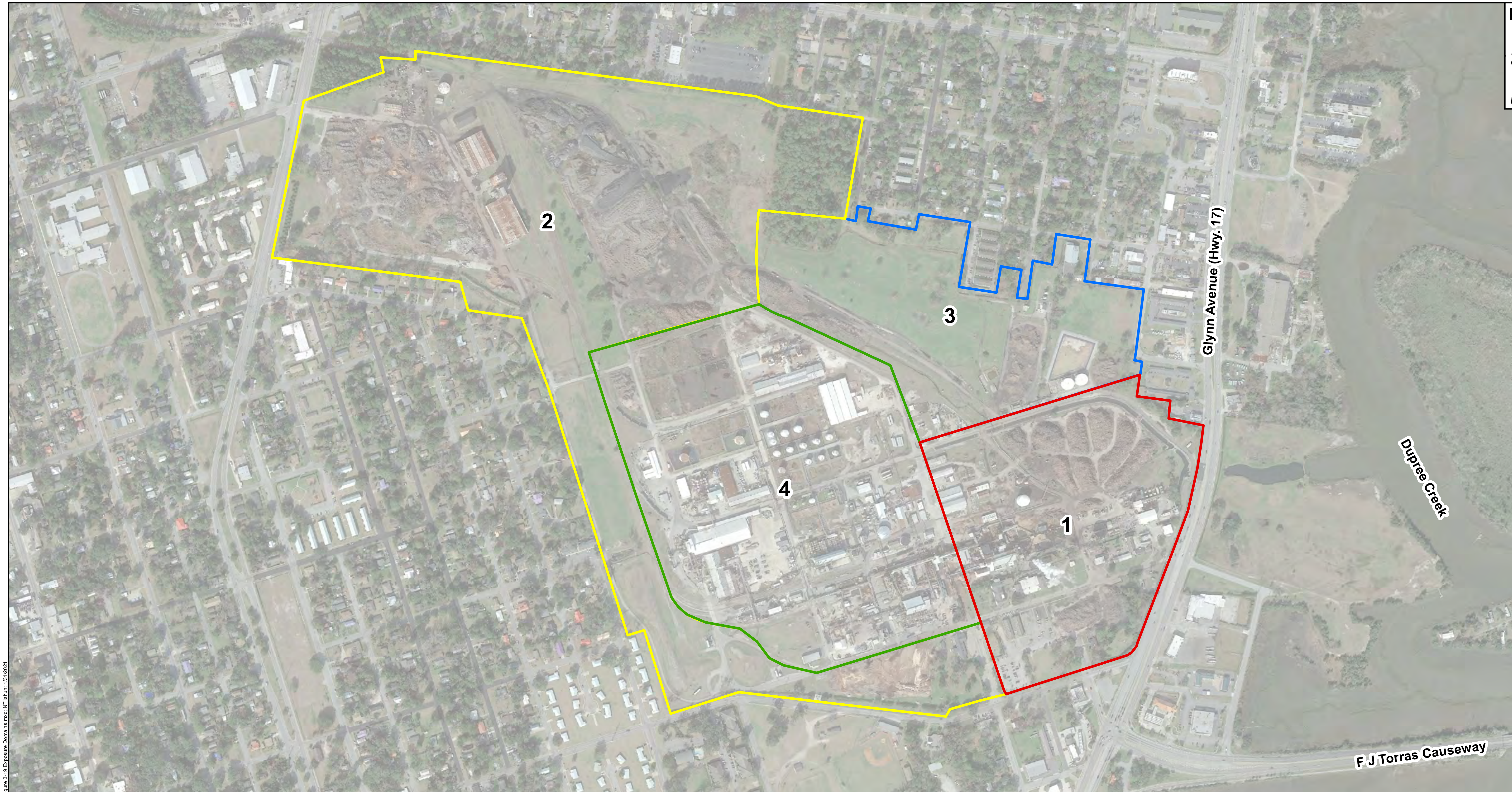
Para-cymene in Deep Zone of the Upper Surficial Aquifer

Hercules/Pinova Facility, Brunswick, Georgia

Geosyntec consultants

Kennesaw, GA | August 2022

Figure 3-18c



Legend

Exposure Domains

- Domain 1
- Domain 2
- Domain 3
- Domain 4

0 275 550 1,100 Feet

Notes:
1. Aerial photograph approximate date - January 2019. Source: Google Earth.

Exposure Domains
Hercules/Pinova Facility
Brunswick, Georgia

Geosyntec consultants

Kennesaw, GA | February 2021

Figure 3-19

Path: \\Aro-01\prj1$\H\Hercules\Brunswick\GIS\MXD\CAP Figures\Figure 3-19 Exposure Domains.mxd; NTilahun; 1/31/2021

Legend

- Pinova Property
- Hercules Property
- Excavated Areas
- Solidified Soil Monolith

Exposure Domains

- Domain 1
- Domain 2
- Domain 3
- Domain 4

Toxaphene Concentration (mg/kg)

Not Detected	Detected
DL < 2.1	< 21
DL > 2.1 and < 21	> 21 and < 210
DL > 21 and < 210	> 210

0 250 500 1,000 Feet

Notes:
1. ft bgs = feet below ground surface.
2, DL = detection limit
3. mg/kg = milligrams per kilogram
4. The concentration color coding categories are based on the Regional Screening Level (RSL) for toxaphene developed by the United States Environmental Protection Agency and indicate relative distributions of toxaphene in soils.
5. Aerial photograph approximate date - January 2019. Source: Google Earth.

Toxaphene in Surface Soil Samples (0-2 ft bgs)

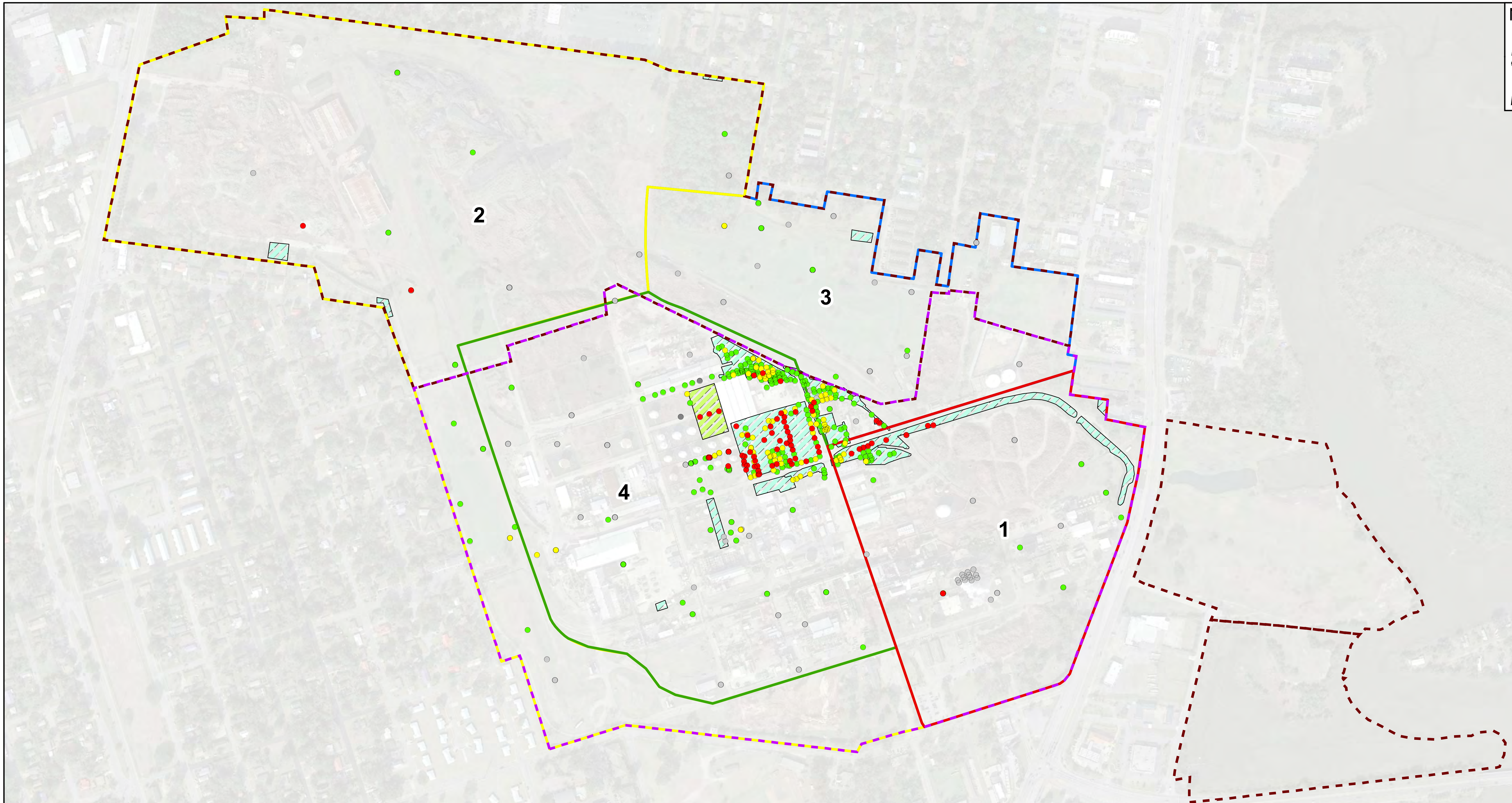
Hercules/Pinova Facility
Brunswick, Georgia

Geosyntec consultants

Kennesaw, GA | January 2022

Figure 3-20

Path: N:\H\Hercules\Brunswick\GIS\MXD\Sitewide Soils\SoilFig_SurfaceToxaphene_v3.mxd; NSekhon; 1/26/2022



Legend

- Pinova Property
- Hercules Property
- Excavated Areas
- Solidified Soil Monolith

Exposure Domains

- Domain 1
- Domain 2
- Domain 3
- Domain 4

Toxaphene Concentration (mg/kg)

Not Detected	Detected
DL < 2.1	< 21
DL > 2.1 and < 21	> 21 and < 210
DL > 21 and < 210	> 210

0 250 500 1,000 Feet

Notes:
1. ft bgs = feet below ground surface.
2, DL = detection limit
3. mg/kg = milligrams per kilogram
4. The concentration color coding categories are based on the Regional Screening Level (RSL) for toxaphene developed by the United States Environmental Protection Agency and indicate relative distributions of toxaphene in soils.
5. Aerial photograph approximate date - January 2019. Source: Google Earth.

Toxaphene in Subsurface Soil Samples (>2 ft bgs)

Hercules/Pinova Facility
Brunswick, Georgia

Geosyntec consultants

Kennesaw, GA | January 2022

Figure 3-21

Path: N:\H\Hercules\Brunswick\GIS\MXD\Sitewide Soils\SoilFig_SubsurfaceToxaphene_v3.mxd; NSekhon; 1/26/2022

Legend

- Pinova Property
- Hercules Property
- Excavated Areas
- Solidified Soil Monolith

Exposure Domains

- Domain 1
- Domain 2
- Domain 3
- Domain 4

Dieldrin Concentration (mg/kg)

Not Detected	Detected
DL < 0.14	< 1.4
DL > 0.14 and < 1.4	> 1.4 and < 14
DL > 1.4 and < 14	> 14
DL > 14	

0 250 500 1,000 Feet

Notes:
1. ft bgs = feet below ground surface.
2, DL = detection limit
3. mg/kg = milligrams per kilogram
4. The concentration color coding categories are based on the Regional Screening Level (RSL) for dieldrin developed by the United States Environmental Protection Agency and indicate relative distributions of dieldrin in soils.
5. Aerial photograph approximate date - January 2019. Source: Google Earth.

Dieldrin in Surface Soil Samples (0-2 ft bgs)

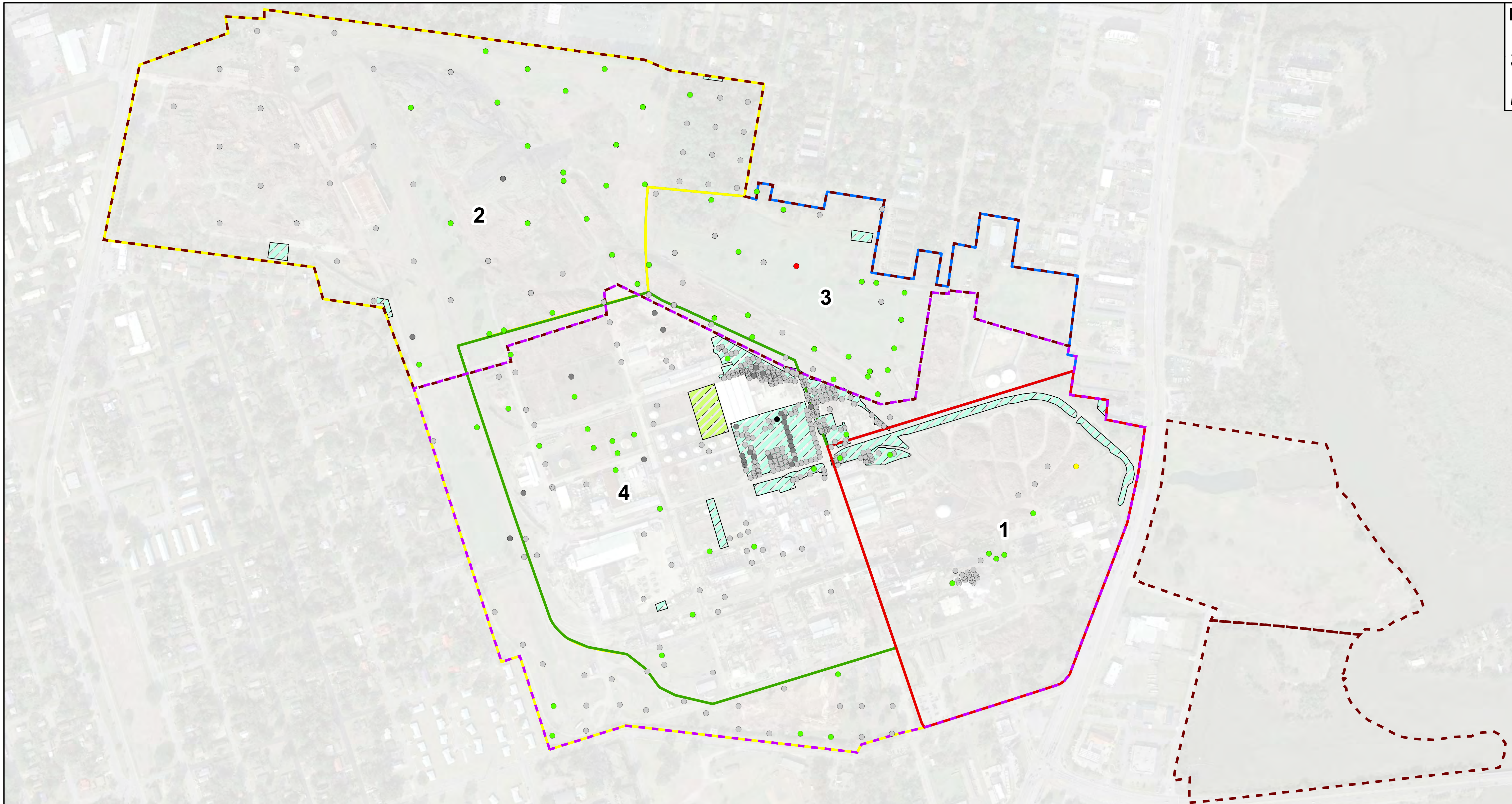
Hercules/Pinova Facility
Brunswick, Georgia

Geosyntec consultants

Kennesaw, GA | January 2022

Figure 3-22

Path: N:\H\Hercules\Brunswick\GIS\MXD\Sitewide Soils\SoilFig_SurfaceDieldrin_v3.mxd; NSekhon; 1/26/2022



Legend

- Pinova Property
- Hercules Property
- Excavated Areas
- Solidified Soil Monolith

Exposure Domains

- Domain 1
- Domain 2
- Domain 3
- Domain 4

Dieldrin Concentration (mg/kg)

Not Detected	Detected
DL < 0.14	< 1.4
DL > 0.14 and < 1.4	> 1.4 and < 14
DL > 1.4 and < 14	> 14
DL > 14	

0 250 500 1,000 Feet

Notes:
1. ft bgs = feet below ground surface.
2. DL = detection limit
3. mg/kg = milligrams per kilogram
4. The concentration color coding categories are based on the Regional Screening Level (RSL) for dieldrin developed by the United States Environmental Protection Agency and indicate relative distributions of dieldrin in soils.
5. Aerial photograph approximate date - January 2019. Source: Google Earth.

Dieldrin in Subsurface Soil Samples (>2 ft bgs)

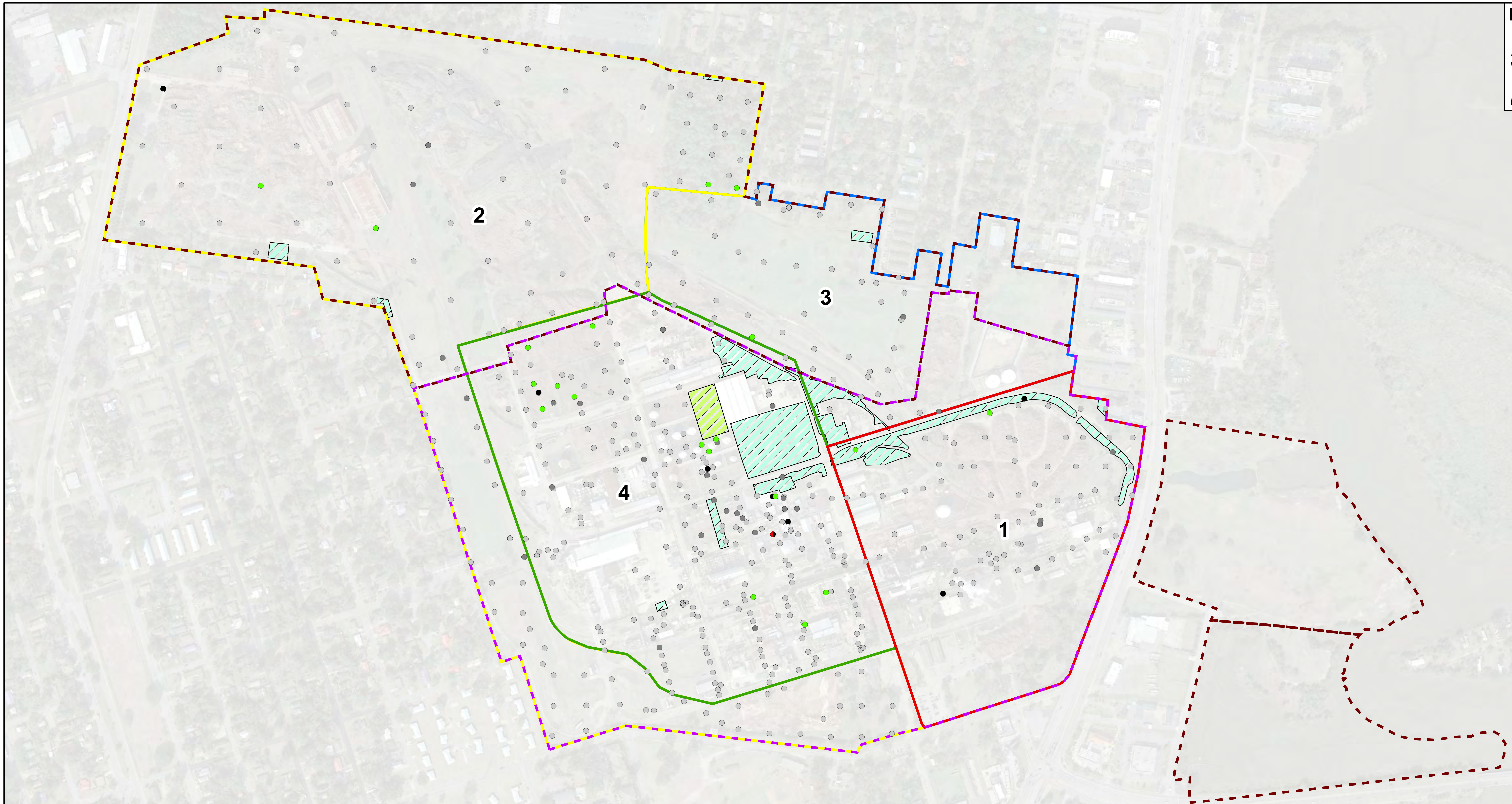
Hercules/Pinova Facility
Brunswick, Georgia

Geosyntec consultants

Kennesaw, GA | January 2022

Figure 3-23

Path: N:\H\Hercules\Brunswick\GIS\MXD\Sitewide Soils\SoilFig_SubsurfaceDieldrin_v3.mxd; NSekhon; 1/26/2022



Legend

- Pinova Property
- Hercules Property
- Excavated Areas
- Solidified Soil Monolith

Exposure Domains

- Domain 1
- Domain 2
- Domain 3
- Domain 4

alpha-BHC Concentration (mg/kg)

Not Detected	Detected
DL < 0.36	< 3.6
DL > 0.36 and < 3.6	
DL > 3.6 and < 36	
DL > 36	

0 250 500 1,000 Feet

Notes:
1. ft bgs = feet below ground surface.
2. DL = detection limit
3. mg/kg = milligrams per kilogram
4. The concentration color coding categories are based on the Regional Screening Level (RSL) for alpha-BHC developed by the United States Environmental Protection Agency and indicate relative distributions of alpha-BHC in soils.
5. Aerial photograph approximate date - January 2019. Source: Google Earth.

alpha-BHC in Surface Soil Samples (0-2 ft bgs)

Hercules/Pinova Facility
Brunswick, Georgia

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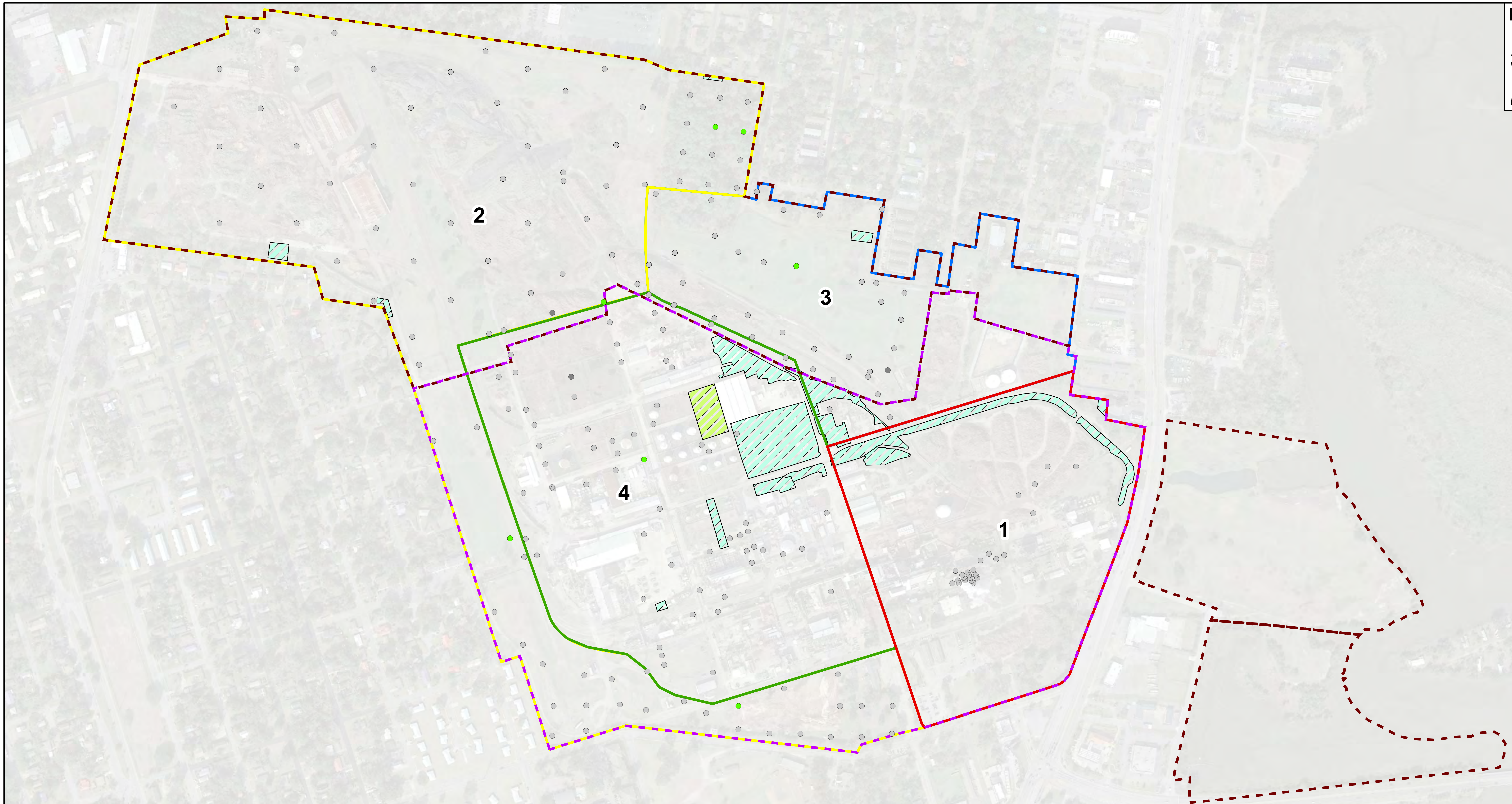
Kennesaw, GA | January 2022

Figure 3-24

Path: N:\H\Hercules\Brunswick\GIS\MXD\Sitewide Soils\SoilFig_Surfacealpha-BHC_v3.mxd; NSekhon; 1/26/2022



Legend

- Pinova Property
- Hercules Property
- Excavated Areas
- Solidified Soil Monolith

Exposure Domains

- Domain 1
- Domain 2
- Domain 3
- Domain 4

alpha-BHC Concentration (mg/kg)

Not Detected	Detected
DL < 0.36	< 3.6
DL > 0.36 and < 3.6	
DL > 3.6 and < 36	
DL > 36	

0 250 500 1,000 Feet

Notes:
1. ft bgs = feet below ground surface.
2. DL = detection limit
3. mg/kg = milligrams per kilogram
4. The concentration color coding categories are based on the Regional Screening Level (RSL) for alpha-BHC developed by the United States Environmental Protection Agency and indicate relative distributions of alpha-BHC in soils.
5. Aerial photograph approximate date - January 2019. Source: Google Earth.

alpha-BHC in Subsurface Soil Samples (>2 ft bgs)

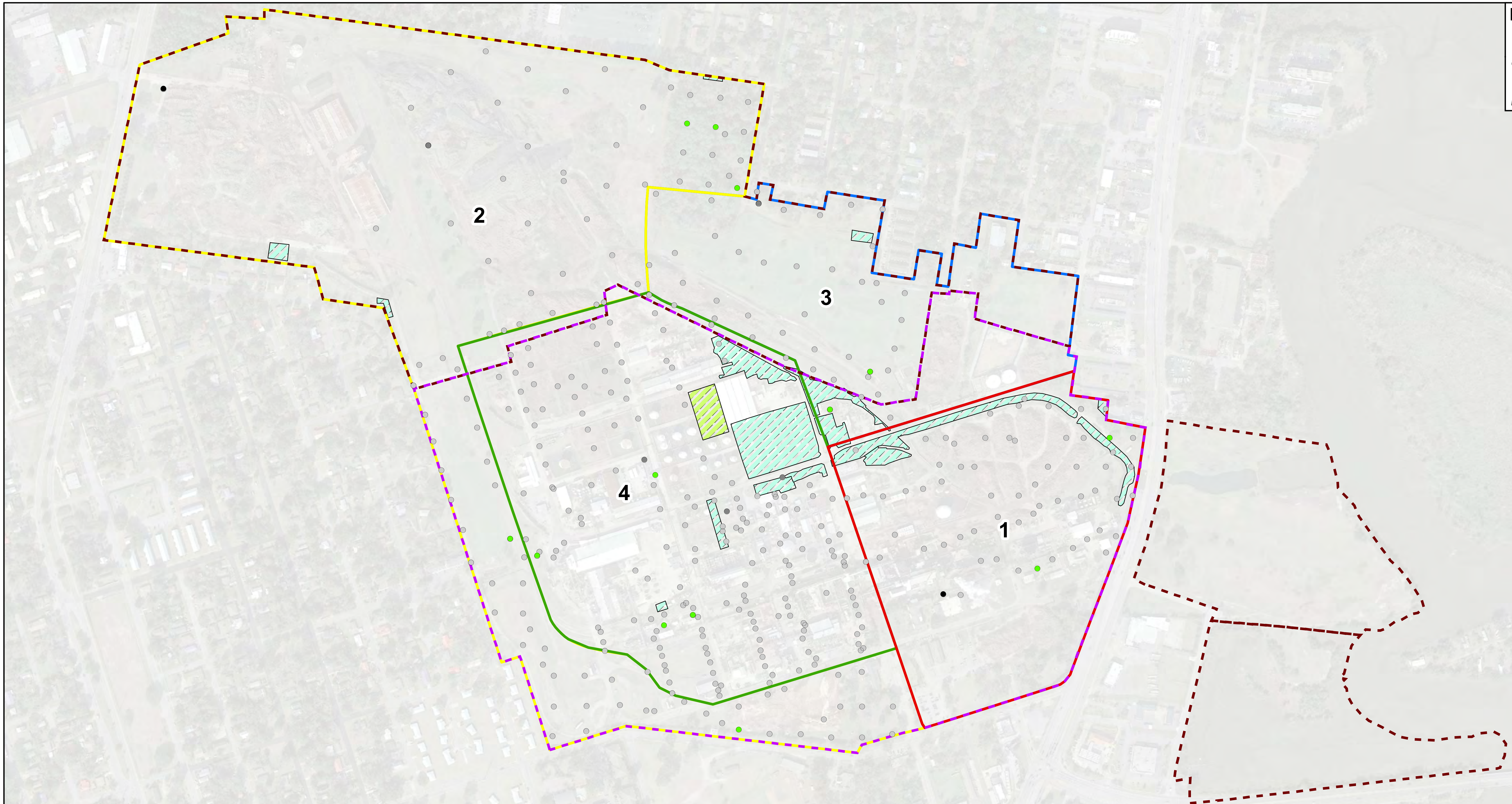
Hercules/Pinova Facility
Brunswick, Georgia

Geosyntec consultants

Kennesaw, GA | January 2022

Figure 3-25

Path: N:\H\Hercules\Brunswick\GIS\MXD\Sitewide Soils\SoilFig_Subsurfacealpha-BHC_v3.mxd; NSekhon; 1/26/2022



Legend

- Pinova Property
- Hercules Property
- Excavated Areas
- Solidified Soil Monolith

Exposure Domains

- Domain 1
- Domain 2
- Domain 3
- Domain 4

Chlorobenzilate Concentration (mg/kg)

Not Detected	Detected
DL < 21	< 210
DL > 21 and < 210	
DL > 210 and < 2,100	

0 250 500 1,000 Feet

Notes:
1. ft bgs = feet below ground surface.
2. DL = detection limit
3. mg/kg = milligrams per kilogram
4. The concentration color coding categories are based on the Regional Screening Level (RSL) for chlorobenzilate developed by the United States Environmental Protection Agency and indicate relative distributions of chlorobenzilate in soils.
5. Aerial photograph approximate date - January 2019. Source: Google Earth.

Chlorobenzilate in Surface Soil Samples (0-2 ft bgs)

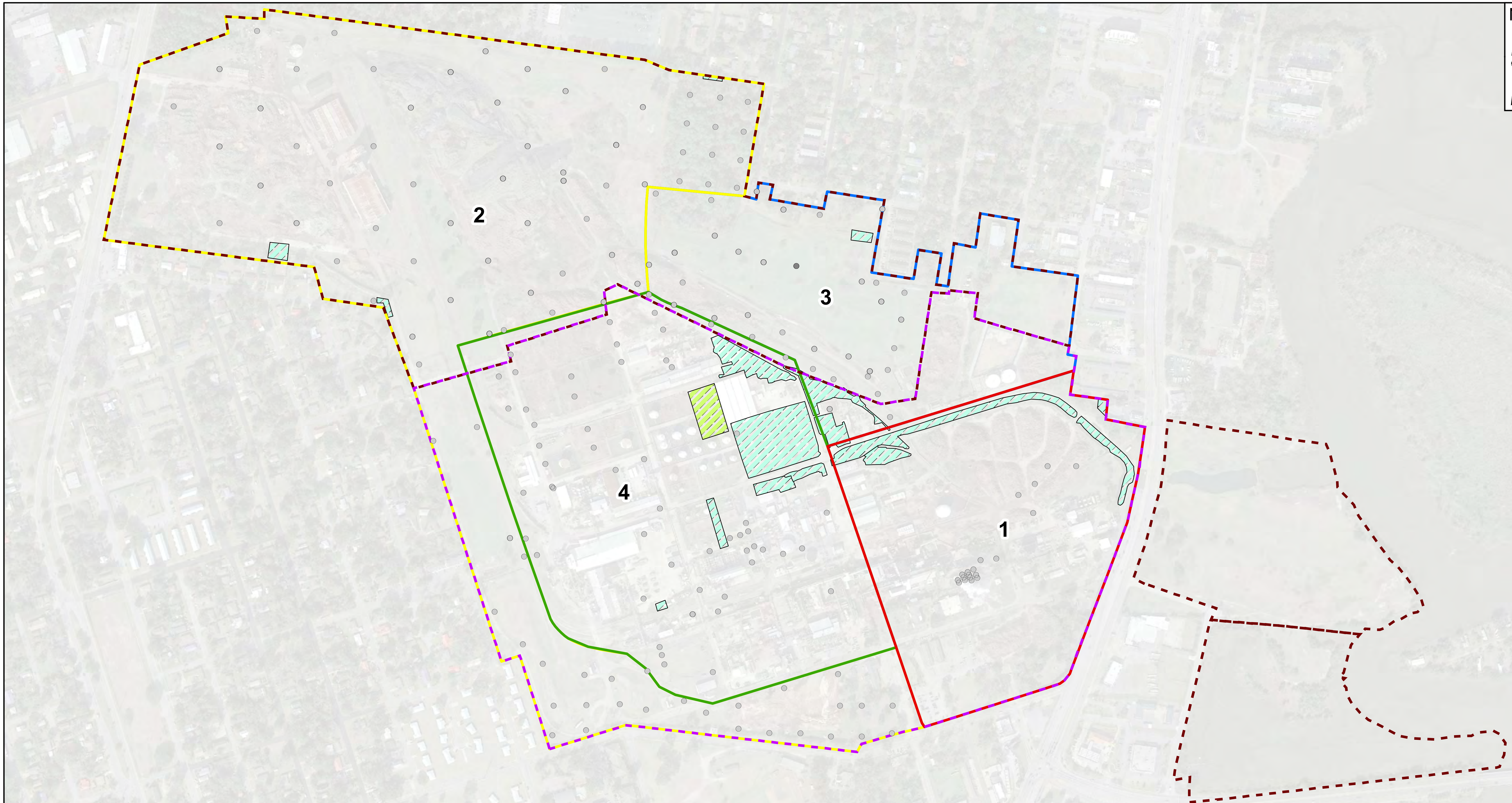
Hercules/Pinova Facility
Brunswick, Georgia

Geosyntec consultants

Kennesaw, GA | January 2022

Figure 3-26

Path: N:\H\Hercules\Brunswick\GIS\MXD\Sitewide Soils\SoilFig_SurfaceChlorobenzilate_v3.mxd; NSekhon; 1/26/2022



Legend

- Pinova Property
- Hercules Property
- Excavated Areas
- Solidified Soil Monolith

Exposure Domains

- Domain 1
- Domain 2
- Domain 3
- Domain 4

Chlorobenzilate Concentration (mg/kg)

Not Detected	Detected
DL < 21	< 210
DL > 21 and < 210	
DL > 210 and < 2,100	

0 250 500 1,000 Feet

Notes:
1. ft bgs = feet below ground surface.
2, DL = detection limit
3. mg/kg = milligrams per kilogram
4. The concentration color coding categories are based on the Regional Screening Level (RSL) for chlorobenzilate developed by the United States Environmental Protection Agency and indicate relative distributions of chlorobenzilate in soils.
5. Aerial photograph approximate date - January 2019. Source: Google Earth.

Chlorobenzilate in Subsurface Soil Samples (>2 ft bgs)

Hercules/Pinova Facility
Brunswick, Georgia

Geosyntec consultants

Kennesaw, GA | January 2022

Figure 3-27

Path: N:\H\Hercules\Brunswick\GIS\MXD\Sitewide Soils\SoilFig_SubsurfaceChlorobenzilate_v3.mxd; NSekhon; 1/26/2022

Legend

- Pinova Property
- Hercules Property
- Excavated Areas
- Solidified Soil Monolith

Exposure Domains

- Domain 1
- Domain 2
- Domain 3
- Domain 4

Aroclor 1254 Concentration (mg/kg)

Not Detected	Detected
DL < 0.97	< 9.7
DL > 0.97 and < 9.7	> 9.7 and < 97
DL > 9.7 and < 97	> 97
DL > 97	

0 250 500 1,000 Feet

Notes:
1. ft bgs = feet below ground surface.
2. DL = detection limit
3. mg/kg = milligrams per kilogram
4. The concentration color coding categories are based on the Regional Screening Level (RSL) for arcolor 1254 developed by the United States Environmental Protection Agency and indicate relative distributions of arcolor 1254 in soils.
5. Aerial photograph approximate date - January 2019. Source: Google Earth.

Aroclor 1254 in Surface Soil Samples (0-2 ft bgs)

Hercules/Pinova Facility
Brunswick, Georgia

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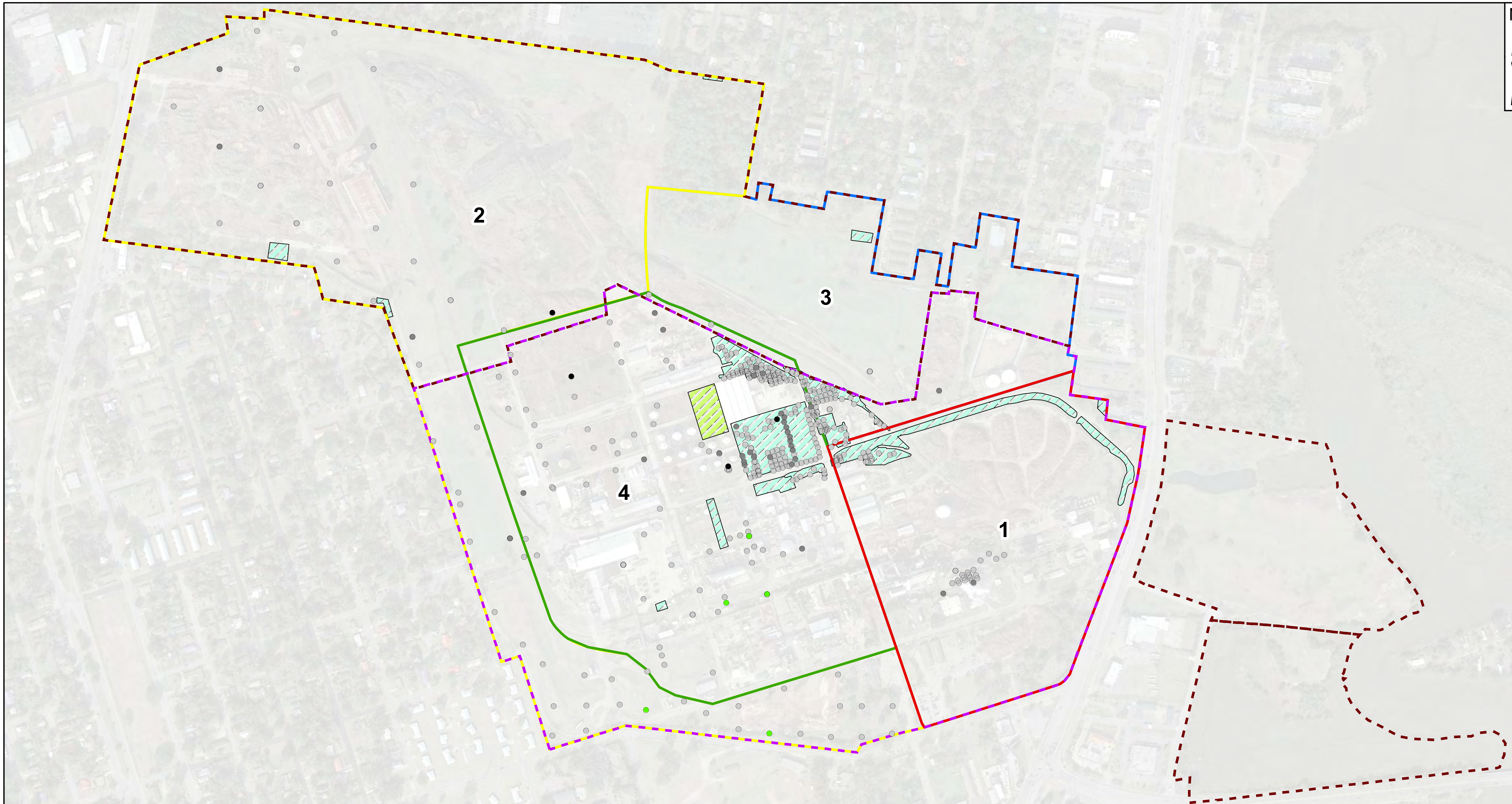
Kennesaw, GA | January 2022

Figure 3-28

Path: N:\H\Hercules\Brunswick\GIS\MXD\Sitewide Soils\SoilFig_SurfaceAroclor 1254_v3.mxd; NSekhon; 1/26/2022



Legend

- Pinova Property
- Hercules Property
- Excavated Areas
- Solidified Soil Monolith

Exposure Domains

- Domain 1
- Domain 2
- Domain 3
- Domain 4

Aroclor 1254 Concentration (mg/kg)

Not Detected	Detected
DL < 0.97	< 9.7
DL > 0.97 and < 9.7	> 9.7 and < 97
DL > 9.7 and < 97	> 97
DL > 97	

0 250 500 1,000 Feet

Notes:
1. ft bgs = feet below ground surface.
2, DL = detection limit
3. mg/kg = milligrams per kilogram
4. The concentration color coding categories are based on the Regional Screening Level (RSL) for aroclor 1254 developed by the United States Environmental Protection Agency and indicate relative distributions of aroclor 1254 in soils.
5. Aerial photograph approximate date - January 2019. Source: Google Earth.

Aroclor 1254 in Subsurface Soil Samples (>2 ft bgs)

Hercules/Pinova Facility
Brunswick, Georgia

Geosyntec consultants

Kennesaw, GA | January 2022

Figure 3-29

Path: N:\H\Hercules\Brunswick\GIS\MXD\Sitewide Soils\SoilFig_SubsurfaceAroclor 1254_v3.mxd; NSekhon; 1/26/2022

Legend

- Pinova Property
- Hercules Property
- Excavated Areas
- Solidified Soil Monolith

Exposure Domains

- Domain 1
- Domain 2
- Domain 3
- Domain 4

Aroclor 1260 Concentration (mg/kg)

Not Detected	Detected
DL < 0.99	< 9.9
DL > 0.99 and < 9.9	> 9.9 and < 99
DL > 9.9 and < 99	> 99
DL > 99	

0 250 500 1,000 Feet

Notes:
1. ft bgs = feet below ground surface.
2, DL = detection limit
3. mg/kg = milligrams per kilogram
4. The concentration color coding categories are based on the Regional Screening Level (RSL) for arcolor 1260 developed by the United States Environmental Protection Agency and indicate relative distributions of arcolor 1260 in soils.
5. Aerial photograph approximate date - January 2019. Source: Google Earth.

Aroclor 1260 in Surface Soil Samples (0-2 ft bgs)

Hercules/Pinova Facility
Brunswick, Georgia

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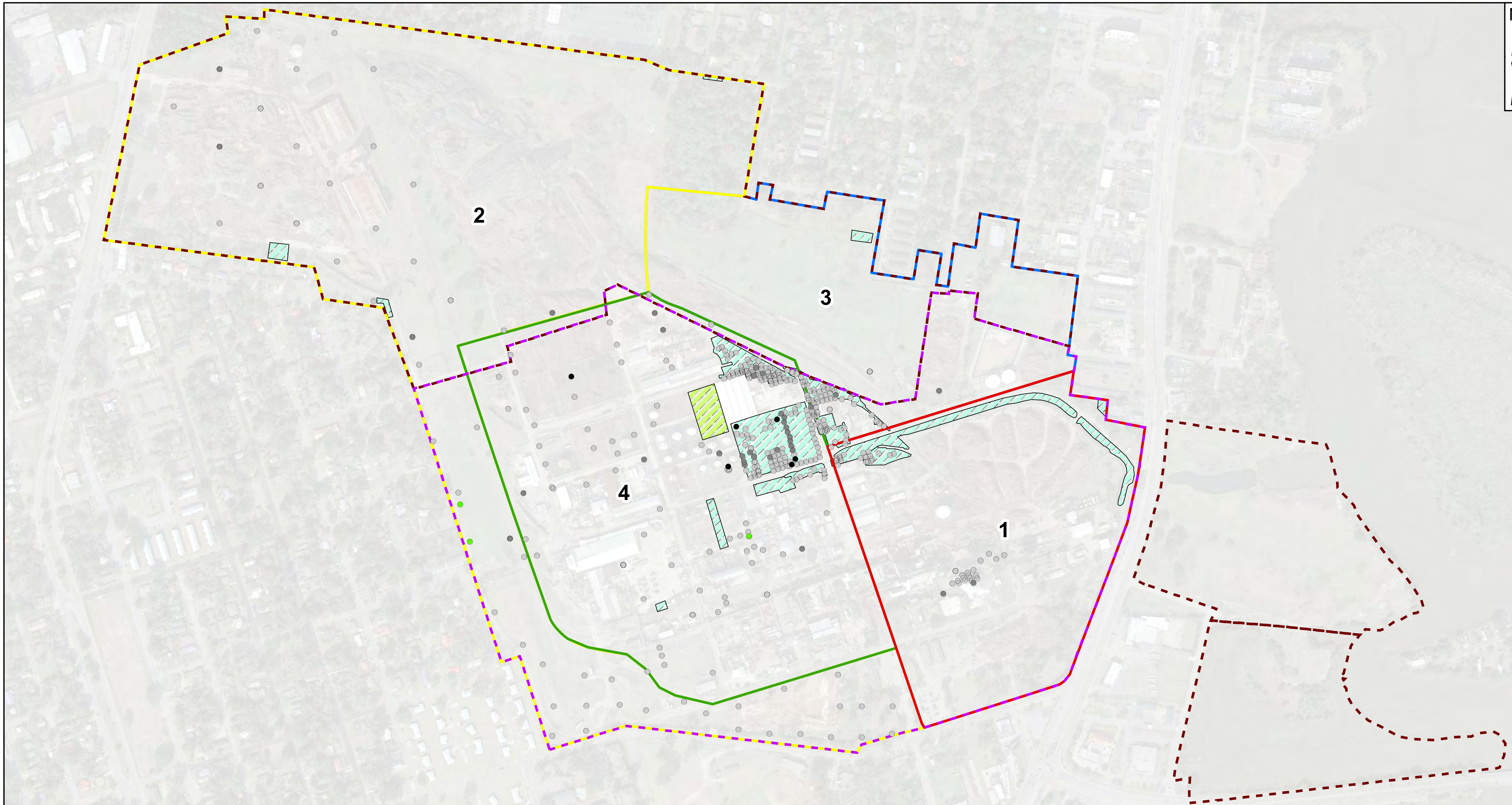
Figure 3-30

Path: N:\H\Hercules\Brunswick\GIS\MXD\Sitewide Soils\SoilFig_SurfaceAroclor 1260_v3.mxd; NSekhon; 1/26/2022



Legend

- Pinova Property
- Hercules Property
- Excavated Areas
- Solidified Soil Monolith

Exposure Domains

- Domain 1
- Domain 2
- Domain 3
- Domain 4

Aroclor 1260 Concentration (mg/kg)

Not Detected	Detected
DL < 0.99	< 9.9
DL > 0.99 and < 9.9	> 9.9 and < 99
DL > 9.9 and < 99	> 99
DL > 99	

0 250 500 1,000 Feet

Notes:
1. ft bgs = feet below ground surface.
2, DL = detection limit
3. mg/kg = milligrams per kilogram
4. The concentration color coding categories are based on the Regional Screening Level (RSL) for aroclor 1260 developed by the United States Environmental Protection Agency and indicate relative distributions of aroclor 1260 in soils.
5. Aerial photograph approximate date - January 2019. Source: Google Earth.

Aroclor 1260 in Subsurface Soil Samples (>2 ft bgs)

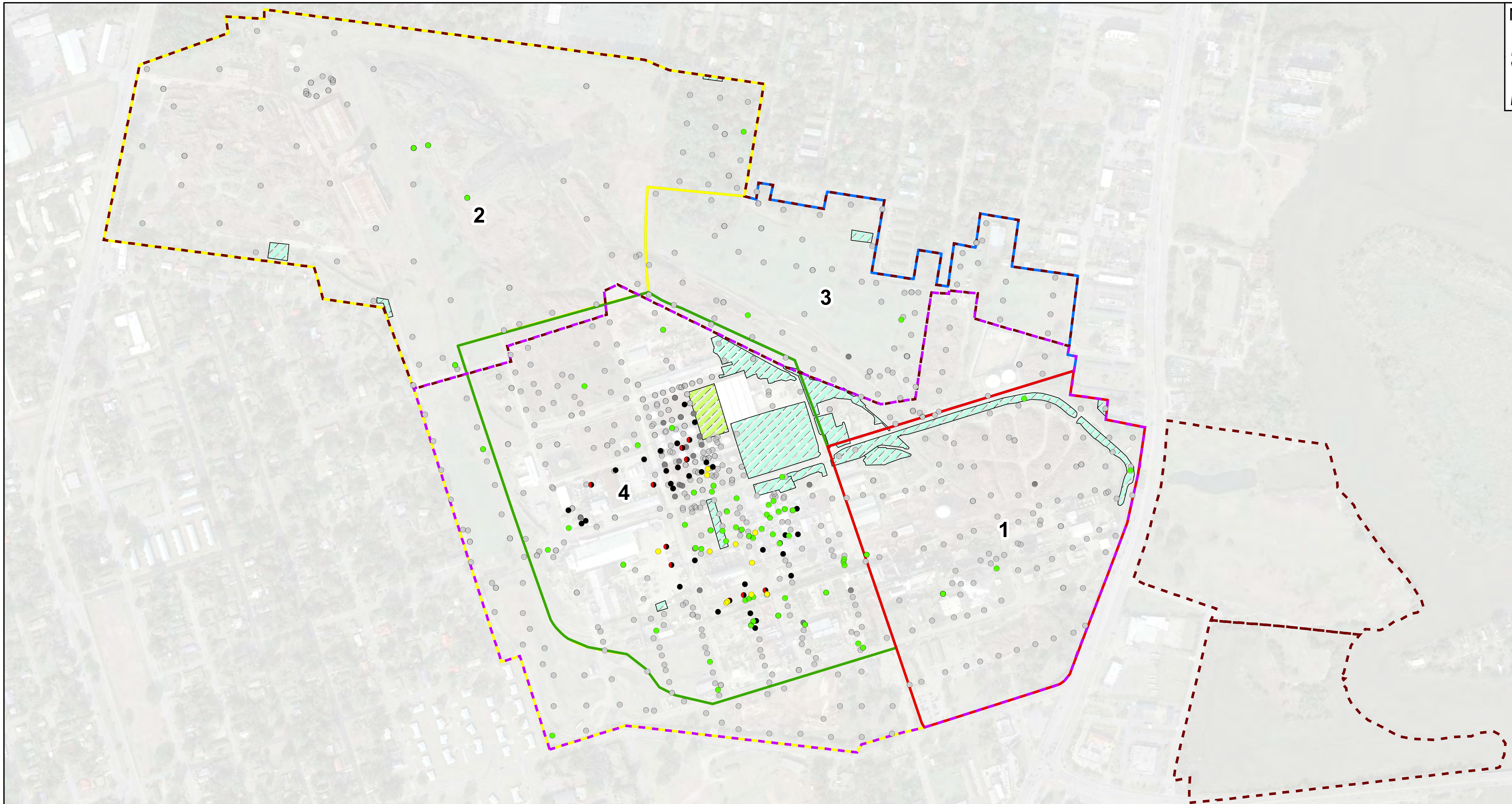
Hercules/Pinova Facility
Brunswick, Georgia

Geosyntec consultants

Kennesaw, GA | January 2022

Figure 3-31

Path: N:\H\Hercules\Brunswick\GIS\MXD\Sitewide Soils\SoilFig_SubsurfaceAroclor 1260_v3.mxd; NSekhon; 1/26/2022



Legend

- Pinova Property
- Hercules Property
- Excavated Areas
- Solidified Soil Monolith

Exposure Domains

- Domain 1
- Domain 2
- Domain 3
- Domain 4

Benzene Concentration (mg/kg)

Not Detected	Detected
DL < 5.1	< 51
DL > 5.1 and < 51	> 51 and < 510
DL > 51 and < 510	> 510
DL > 510	

0 250 500 1,000
Feet

Notes:
1. ft bgs = feet below ground surface.
2, DL = detection limit
3. mg/kg = milligrams per kilogram
4. The concentration color coding categories are based on the Regional Screening Level (RSL) for benzene developed by the United States Environmental Protection Agency and indicate relative distributions of benzene in soils.
5. Aerial photograph approximate date - January 2019. Source: Google Earth.

Benzene in Surface Soil Samples (0-2 ft bgs)

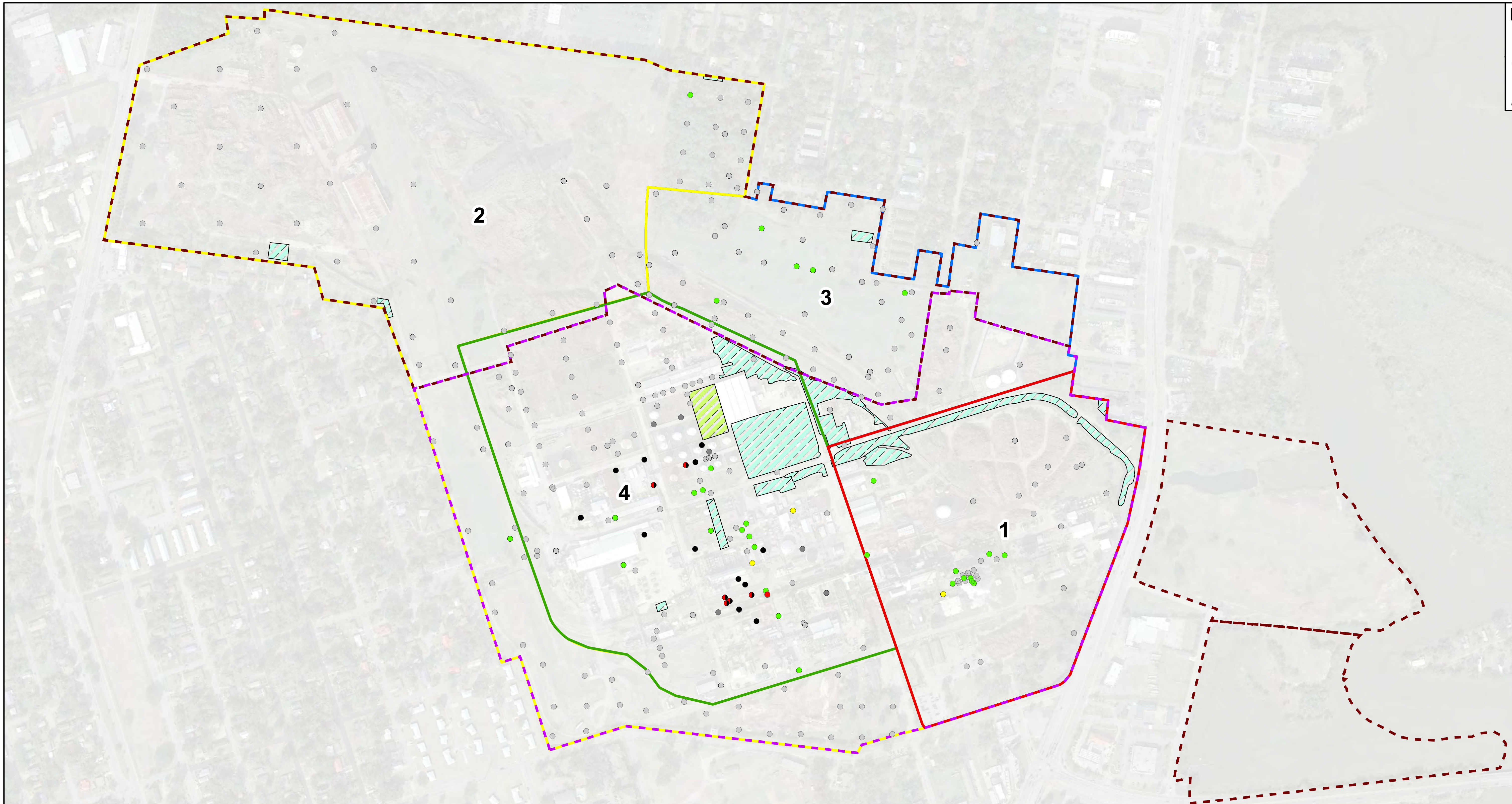
Hercules/Pinova Facility
Brunswick, Georgia

Geosyntec consultants

Kennesaw, GA | January 2022

Figure 3-32

Path: N:\H\Hercules\Brunswick\GIS\MXD\Sitewide Soils\SoilFig_SurfaceBenzene_v3.mxd; NSekhon; 1/26/2022



Legend

- Pinova Property
- Hercules Property
- Excavated Areas
- Solidified Soil Monolith

Exposure Domains

- Domain 1
- Domain 2
- Domain 3
- Domain 4

Benzene Concentration (mg/kg)

Not Detected	Detected
DL < 5.1	< 51
DL > 5.1 and < 51	> 51 and < 510
DL > 51 and < 510	> 510
DL > 510	

0 250 500 1,000 Feet

Notes:
1. ft bgs = feet below ground surface.
2, DL = detection limit
3. mg/kg = milligrams per kilogram
4. The concentration color coding categories are based on the Regional Screening Level (RSL) for benzene developed by the United States Environmental Protection Agency and indicate relative distributions of benzene in soils.
5. Aerial photograph approximate date - January 2019. Source: Google Earth.

Benzene in Subsurface Soil Samples (>2 ft bgs)

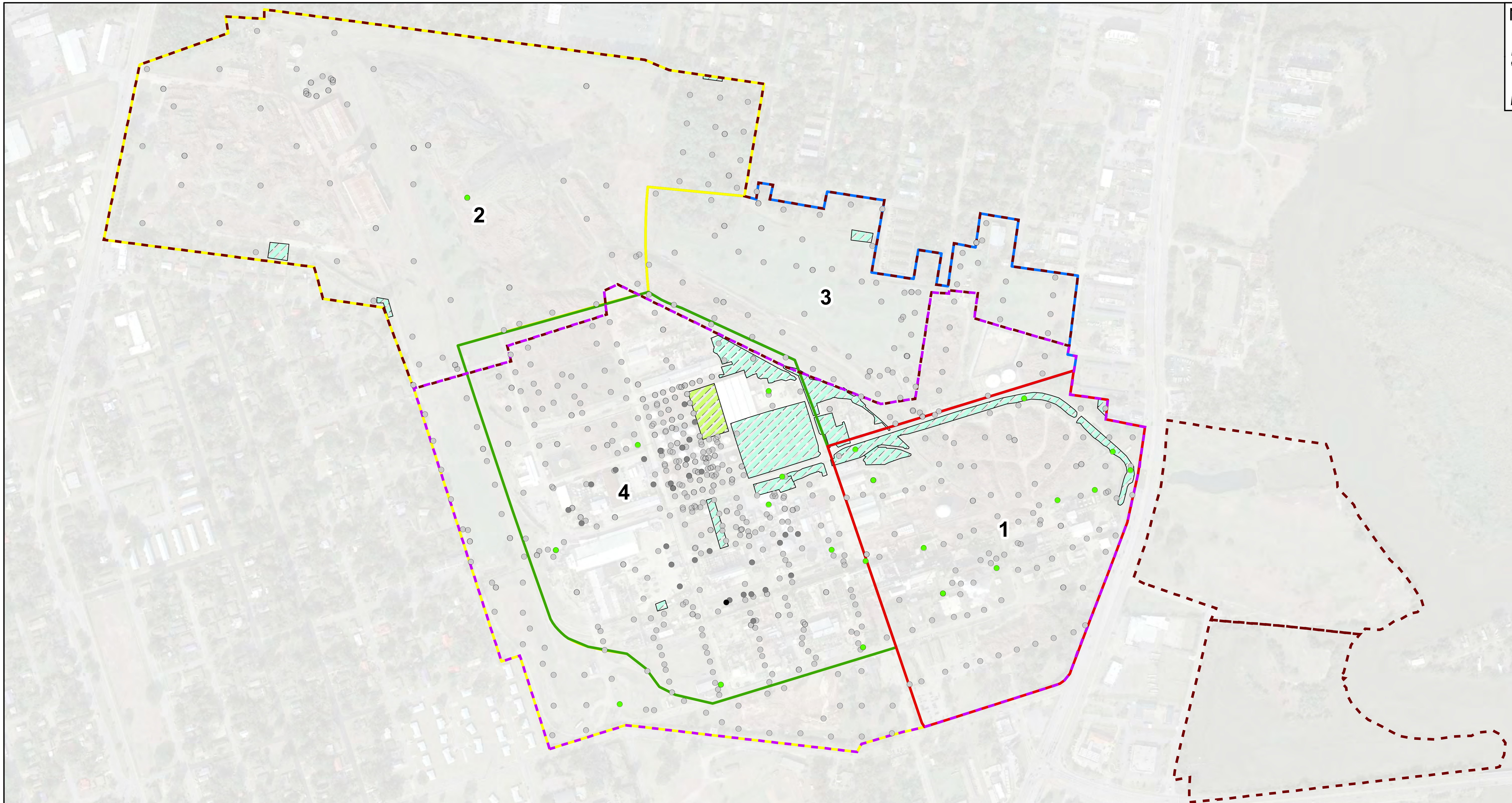
Hercules/Pinova Facility
Brunswick, Georgia

Geosyntec consultants

Kennesaw, GA | January 2022

Figure 3-33

Path: N:\H\Hercules\Brunswick\GIS\MXD\Sitewide Soils\SoilFig_SubsurfaceBenzene_v3.mxd; NSekhon; 1/26/2022



Legend

- Pinova Property
- Hercules Property
- Excavated Areas
- Solidified Soil Monolith

Exposure Domains

- Domain 1
- Domain 2
- Domain 3
- Domain 4

Chlorobenzene Concentration (mg/kg)

Not Detected	Detected
DL < 130	< 1,300
DL > 130 and < 1,300	
DL > 1,300 and < 3,900	
DL > 3,900	

0 250 500 1,000 Feet

Notes:
1. ft bgs = feet below ground surface.
2, DL = detection limit
3. mg/kg = milligrams per kilogram
4. The concentration color coding categories are based on the Regional Screening Level (RSL) for chlorobenzene developed by the United States Environmental Protection Agency and indicate relative distributions of chlorobenzene in soils.
5. Aerial photograph approximate date - January 2019. Source: Google Earth.

Chlorobenzene in Surface Soil Samples (0-2 ft bgs)

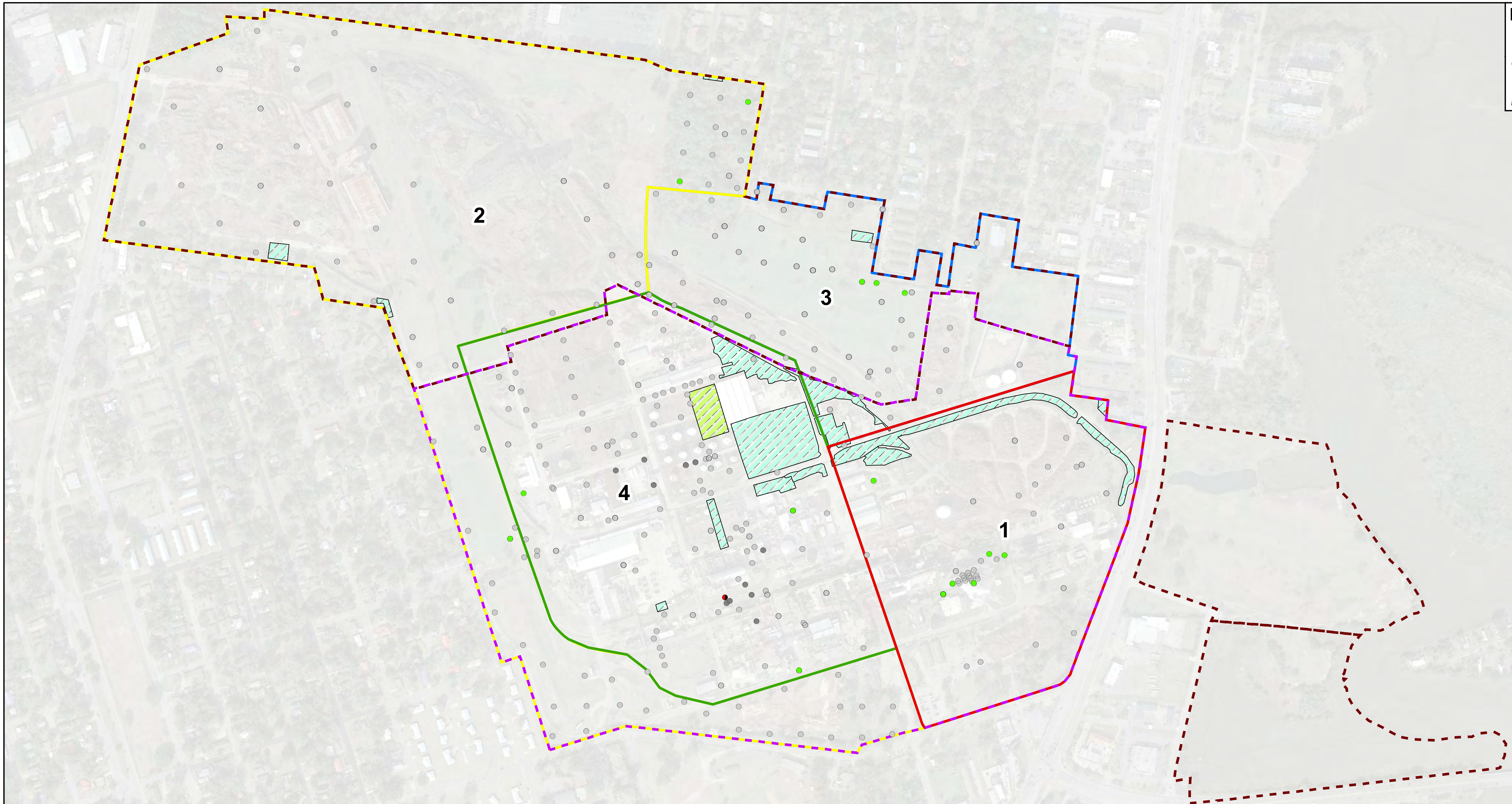
Hercules/Pinova Facility
Brunswick, Georgia

Geosyntec consultants

Kennesaw, GA | January 2022

Figure 3-34

Path: N:\H\Hercules\Brunswick\GIS\MXD\Sitewide Soils\SoilFig_SurfaceChlorobenzene_v3.mxd; NSekhon; 1/26/2022



Legend

- Pinova Property
- Hercules Property
- Excavated Areas
- Solidified Soil Monolith

Exposure Domains

- Domain 1
- Domain 2
- Domain 3
- Domain 4

Chlorobenzene Concentration (mg/kg)

Not Detected

- DL < 130
- DL > 130 and < 1,300
- DL > 1,300 and < 3,900
- DL > 3,900

Detected

- < 1,300

0 250 500 1,000 Feet

Notes:

1. ft bgs = feet below ground surface.
2. DL = detection limit
3. mg/kg = milligrams per kilogram
4. The concentration color coding categories are based on the Regional Screening Level (RSL) for chlorobenzene developed by the United States Environmental Protection Agency and indicate relative distributions of chlorobenzene in soils.
5. Aerial photograph approximate date - January 2019. Source: Google Earth.

Chlorobenzene in Subsurface Soil Samples (>2 ft bgs)

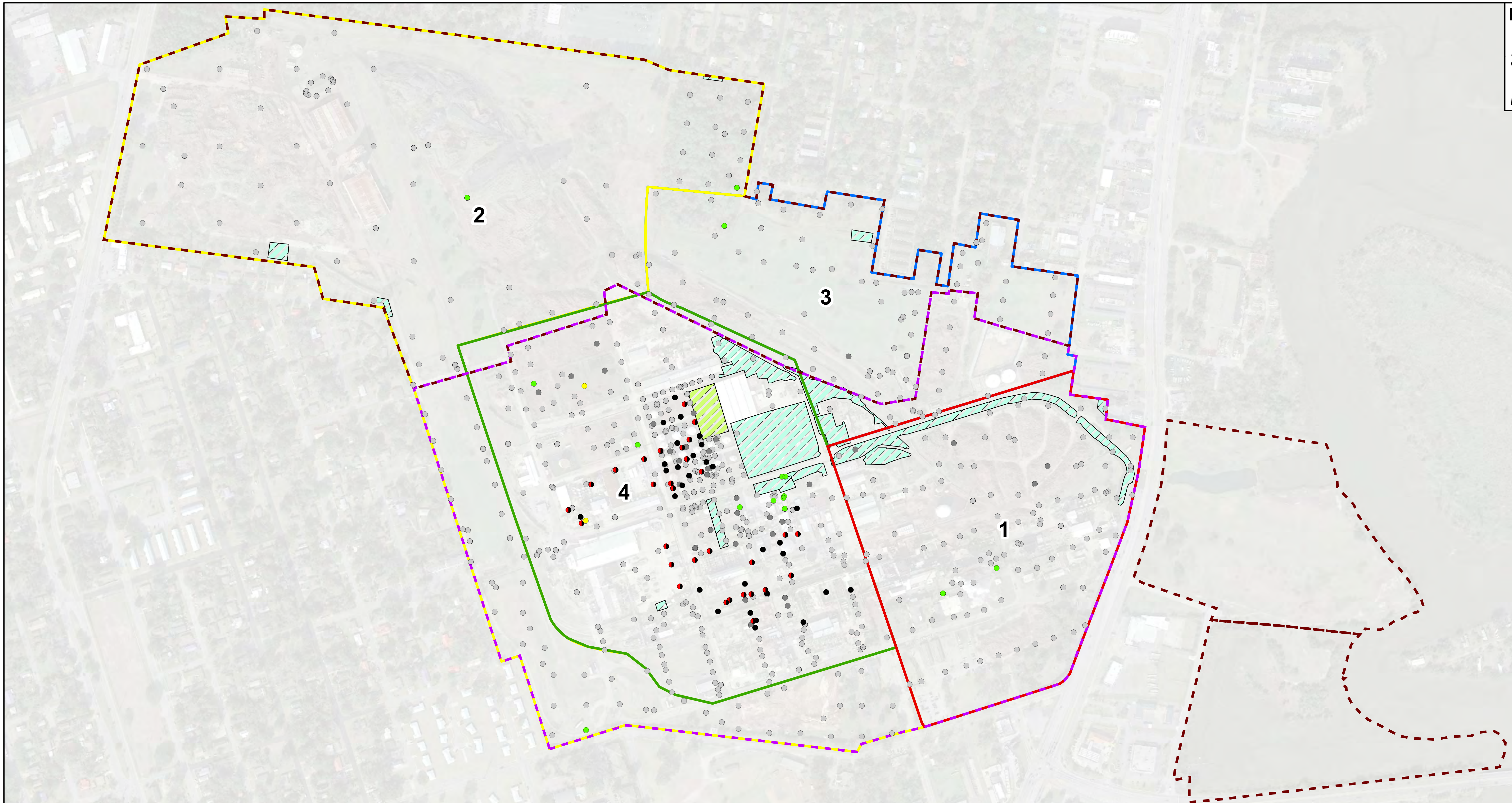
Hercules/Pinova Facility
Brunswick, Georgia

Geosyntec consultants

Kennesaw, GA | January 2022

Figure 3-35

Path: N:\H\Hercules\Brunswick\GIS\MXD\Sitewide Soils\SoilFig_SubsurfaceChlorobenzene_v3.mxd; NSekhon; 1/26/2022



Legend

- Pinova Property
- Hercules Property
- Excavated Areas
- Solidified Soil Monolith

Exposure Domains

- Domain 1
- Domain 2
- Domain 3
- Domain 4

Chloroform Concentration (mg/kg)

Not Detected	Detected
DL < 1.4	< 14
DL > 1.4 and < 14	> 14 and < 140
DL > 14 and < 140	
DL > 140	

0 250 500 1,000 Feet

Notes:
1. ft bgs = feet below ground surface.
2, DL = detection limit
3. mg/kg = milligrams per kilogram
4. The concentration color coding categories are based on the Regional Screening Level (RSL) for chloroform developed by the United States Environmental Protection Agency and indicate relative distributions of chloroform in soils.
5. Aerial photograph approximate date - January 2019. Source: Google Earth.

Chloroform in Surface Soil Samples (0-2 ft bgs)

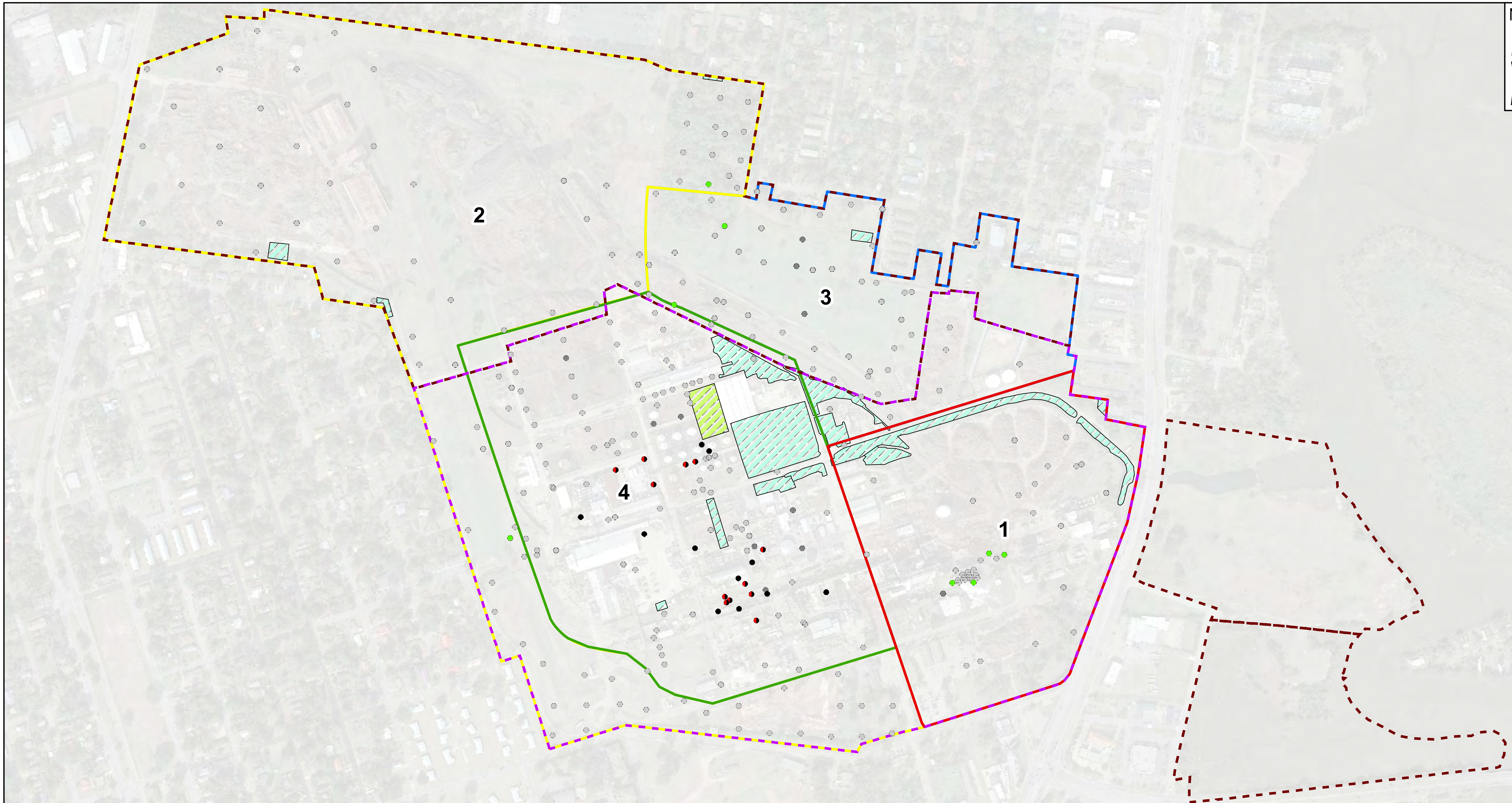
Hercules/Pinova Facility
Brunswick, Georgia

Geosyntec consultants

Kennesaw, GA | January 2022

Figure 3-36

Path: N:\H\Hercules\Brunswick\GIS\MXD\Sitewide Soils\SoilFig_SurfaceChloroform_v3.mxd; NSekhon; 1/26/2022



Legend
Pinova Property
Hercules Property
Excavated Area
In situ solidified soils

Exposure Domains
Domain 1
Domain 2
Domain 3
Domain 4

Chloroform Concentration (mg/kg)

Not Detected	Detected
DL < 1.4	< 14
DL > 1.4 and < 14	> 14 and < 140
DL > 14 and < 140	
DL > 140	

0 250 500 1,000 Feet

Notes:
1. ft bgs = feet below ground surface.
2, DL = detection limit
3. The concentration color coding categories are based on the US EPA Regional Screening Level (RSL) to provide relative contaminant distributions. The color coding does not imply excess risk.
4. Aerial photograph approximate date - January 2019. Source: Google Earth.

Chloroform in Subsurface Soil Samples (>2 ft bgs)

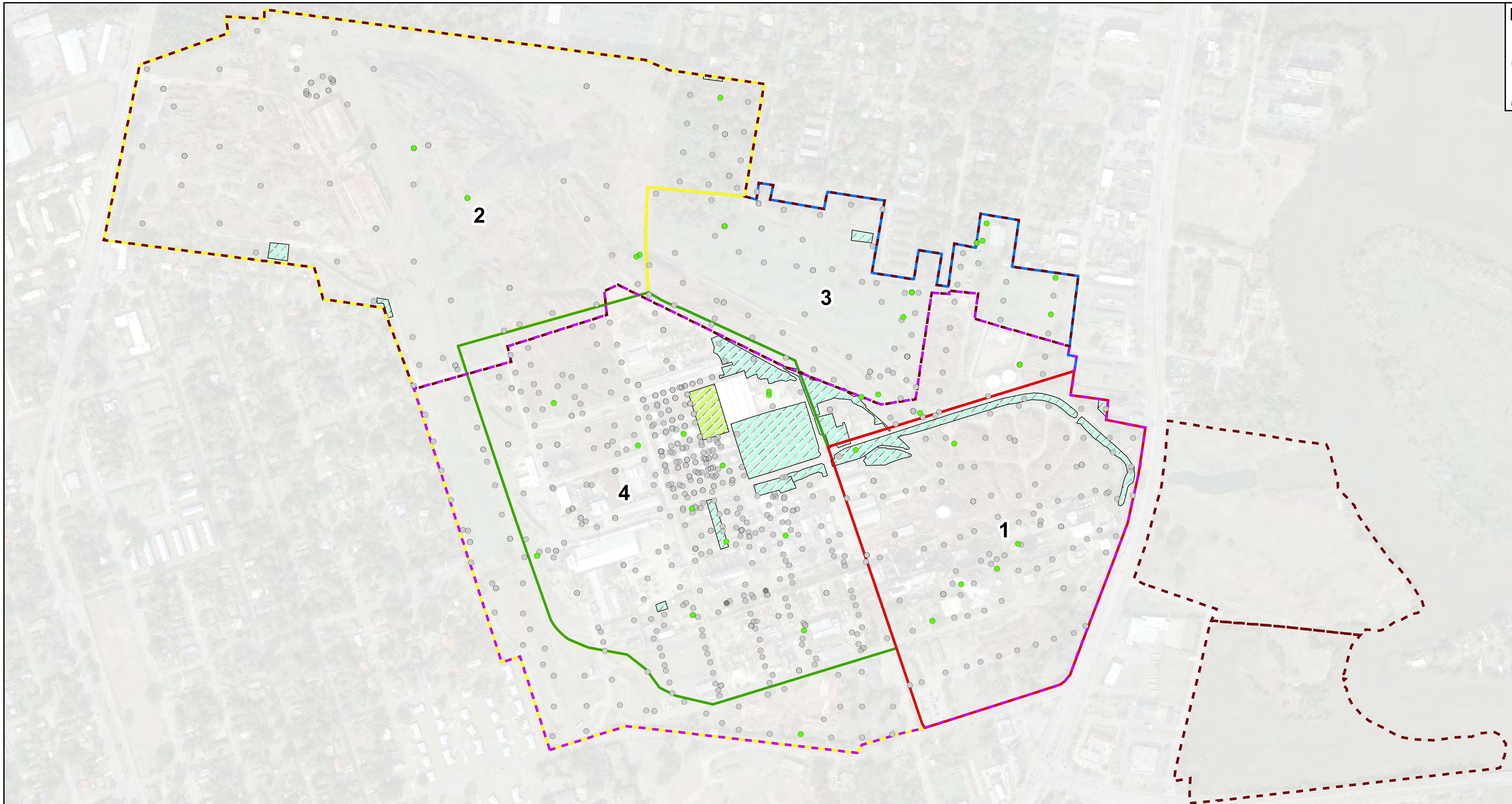
Hercules/Pinova Facility
Brunswick, Georgia

Geosyntec consultants

Kennesaw, GA | December 2021

Figure 3-37

Path: N:\H\Hercules\Brunswick\GIS\MXD\Sitewide Soils\SoilFig_SubsurfaceChloroform_v3.mxd; CKrachon; 12/19/2021



Legend

- Pinova Property
- Hercules Property
- Excavated Areas
- Solidified Soil Monolith

Exposure Domains

- Domain 1
- Domain 2
- Domain 3
- Domain 4

Methylene Chloride Concentration (mg/kg)

Not Detected
- DL < 1,000
- 1,000 - 10,000

Detected
- < 10,000

0 250 500 1,000 Feet

Notes:
1. ft bgs = feet below ground surface.
2, DL = detection limit
3. mg/kg = milligrams per kilogram
4. The concentration color coding categories are based on the Regional Screening Level (RSL) for methylene chloride developed by the United States Environmental Protection Agency and indicate relative distributions of methylene chloride in soils.
5. Aerial photograph approximate date - January 2019. Source: Google Earth.

Methylene Chloride in Surface Soil Samples (0-2 ft bgs)

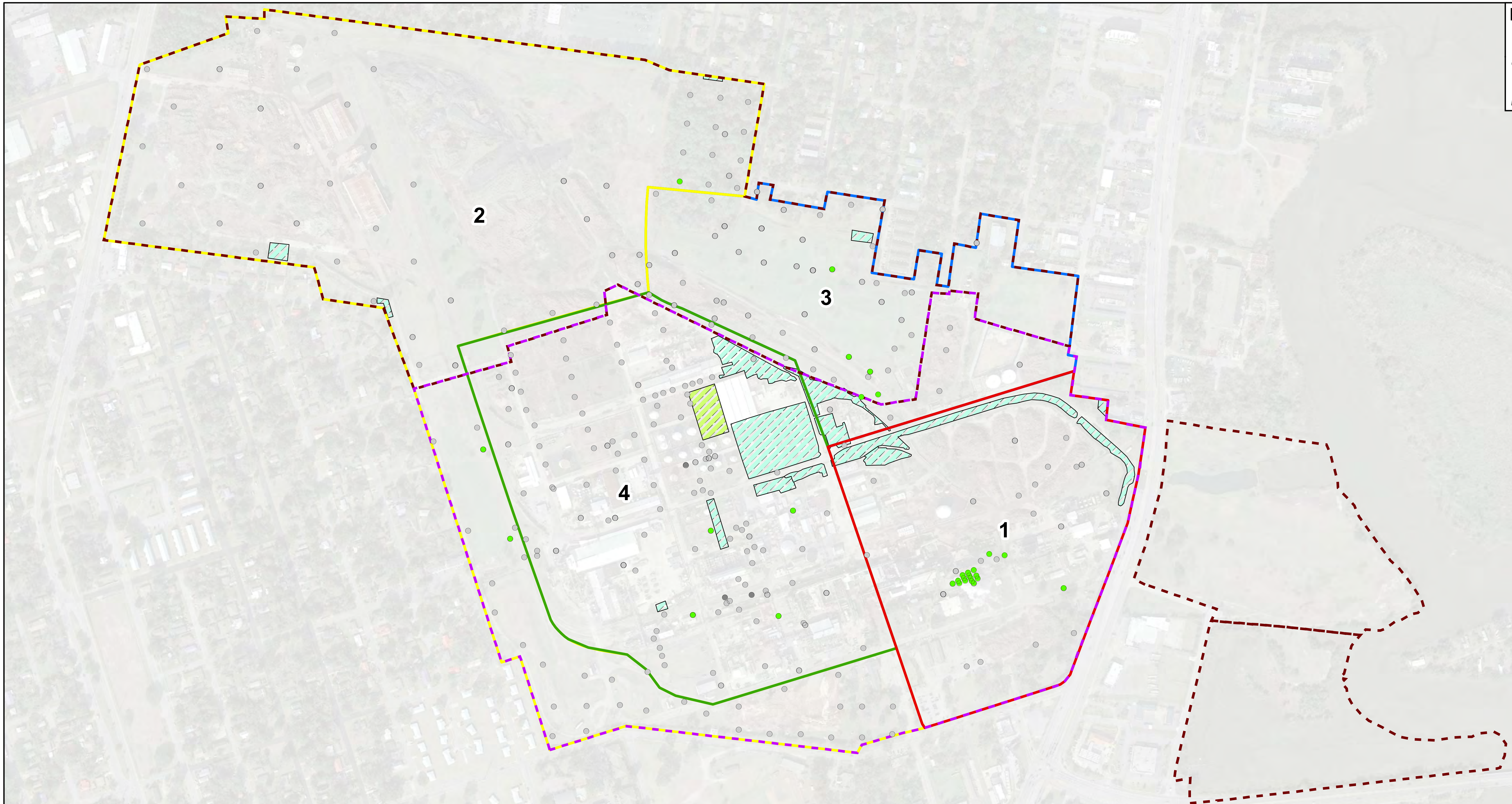
Hercules/Pinova Facility
Brunswick, Georgia

Geosyntec consultants

Kennesaw, GA | January 2022

Figure 3-38

Path: N:\H\Hercules\Brunswick\GIS\MXD\Sitewide Soils\SoilFig_SurfaceMethylene Chloride_v3.mxd; NSekhon; 1/26/2022



Legend

- Pinova Property
- Hercules Property
- Excavated Areas
- Solidified Soil Monolith

Exposure Domains

- Domain 1
- Domain 2
- Domain 3
- Domain 4

Methylene Chloride Concentration (mg/kg)

Not Detected

- DL < 1,000
- 1,000 - 10,000

Detected

- < 10,000

0 250 500 1,000 Feet

Notes:
1. ft bgs = feet below ground surface.
2. DL = detection limit
3. mg/kg = milligrams per kilogram
4. The concentration color coding categories are based on the Regional Screening Level (RSL) for methylene chloride developed by the United States Environmental Protection Agency and indicate relative distributions of methylene chloride in soils.
5. Aerial photograph approximate date - January 2019. Source: Google Earth.

Methylene Chloride in Subsurface Soil Samples (>2 ft bgs)

Hercules/Pinova Facility
Brunswick, Georgia

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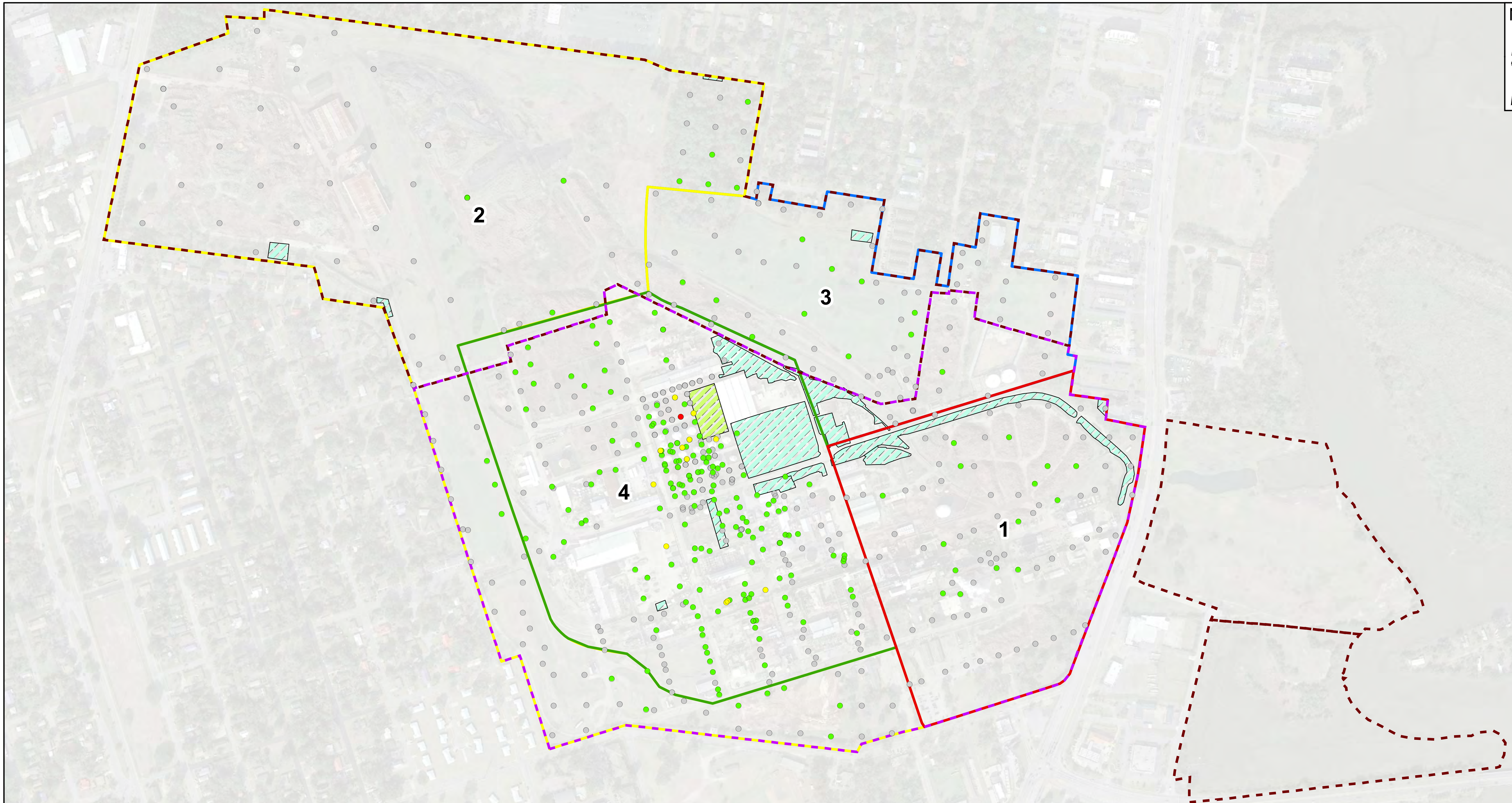
Kennesaw, GA | January 2022

Figure 3-39

Path: N:\H\Hercules\Brunswick\GIS\MXD\Sitewide Soils\SoilFig_SubsurfaceMethylene Chloride_v3.mxd; NSekhon; 1/26/2022



Legend

- Pinova Property
- Hercules Property
- Excavated
- Solidified Soil Monolith

Exposure Domains

- Domain 1
- Domain 2
- Domain 3
- Domain 4

Para-cymene Concentration (mg/kg)

Not Detected	Detected
DL < 990	< 9,900
	> 9,900 and < 29,700
	> 29,700

0 250 500 1,000 Feet

Notes:
1. ft bgs = feet below ground surface.
2, DL = detection limit
3. mg/kg = milligrams per kilogram
4. The concentration color coding categories are based on the Regional Screening Level (RSL) for para-cymene developed by the United States Environmental Protection Agency and indicate relative distributions of para-cymene in soils.
5. Aerial photograph approximate date - January 2019. Source: Google Earth.

Para-cymene in Surface Soil Samples (0-2 ft bgs)

Hercules/Pinova Facility
Brunswick, Georgia

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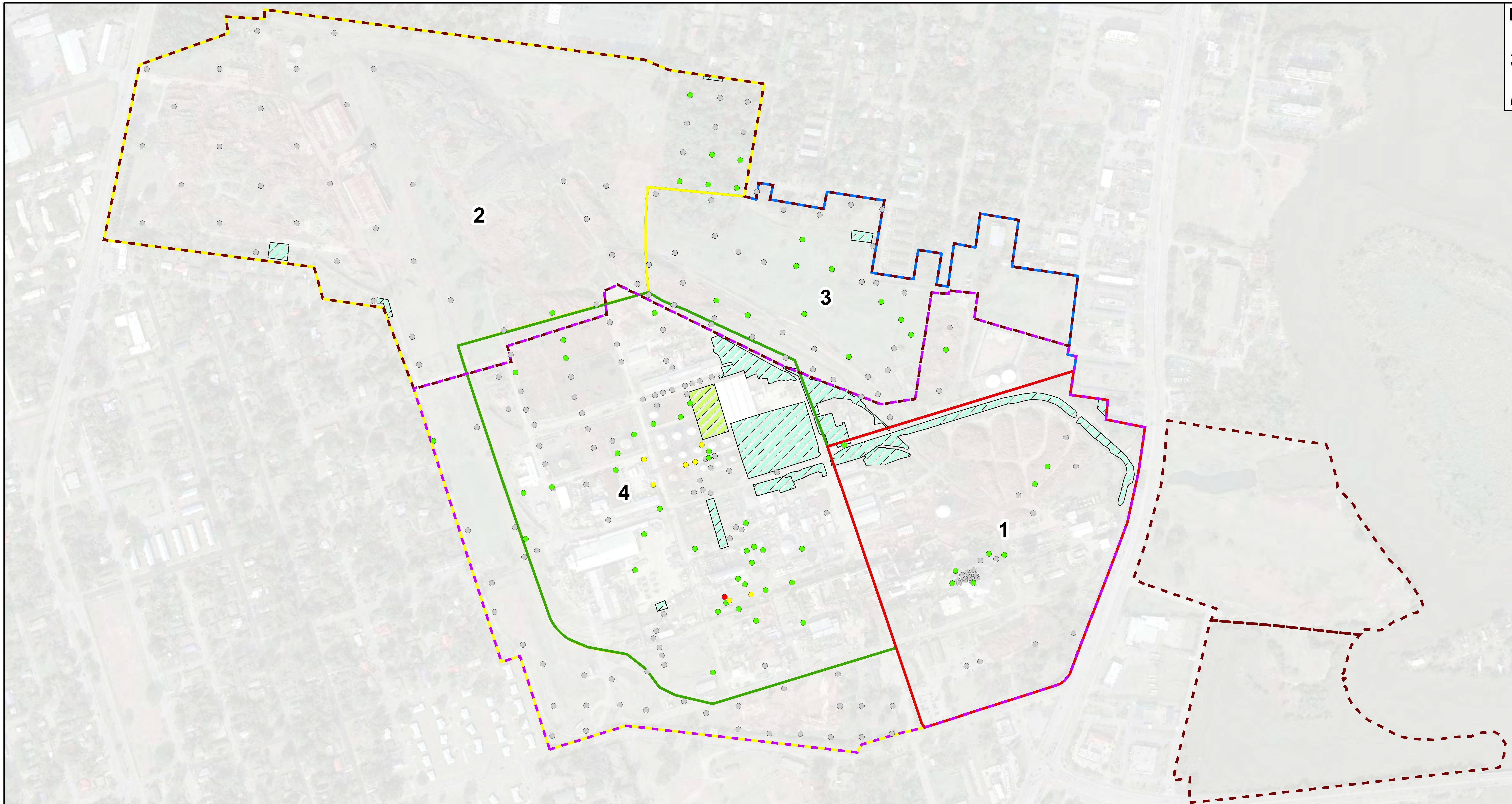
Kennesaw, GA | January 2022

Figure 3-40

Path: N:\H\Hercules\Brunswick\GIS\MXD\Sitewide Soils\SoilFig_Surfacep-Isopropyltoluene_v3.mxd; NSekhon; 1/26/2022



Legend

- Pinova Property
- Hercules Property
- Excavated Areas
- Solidified Soil Monolith

Exposure Domains

- Domain 1
- Domain 2
- Domain 3
- Domain 4

Para-cymene Concentration (mg/kg)

Not Detected

- DL < 990

Detected

- < 9,900
- > 9,900 and < 29,700
- > 29,700

0 250 500 1,000 Feet

Notes:
1. ft bgs = feet below ground surface.
2, DL = detection limit
3. mg/kg = milligrams per kilogram
4. The concentration color coding categories are based on the Regional Screening Level (RSL) for para-cymenee developed by the United States Environmental Protection Agency and indicate relative distributions of para-cymene in soils.
5. Aerial photograph approximate date - January 2019. Source: Google Earth.

Para-cymene in Subsurface Soil Samples (>2 ft bgs)

Hercules/Pinova Facility
Brunswick, Georgia

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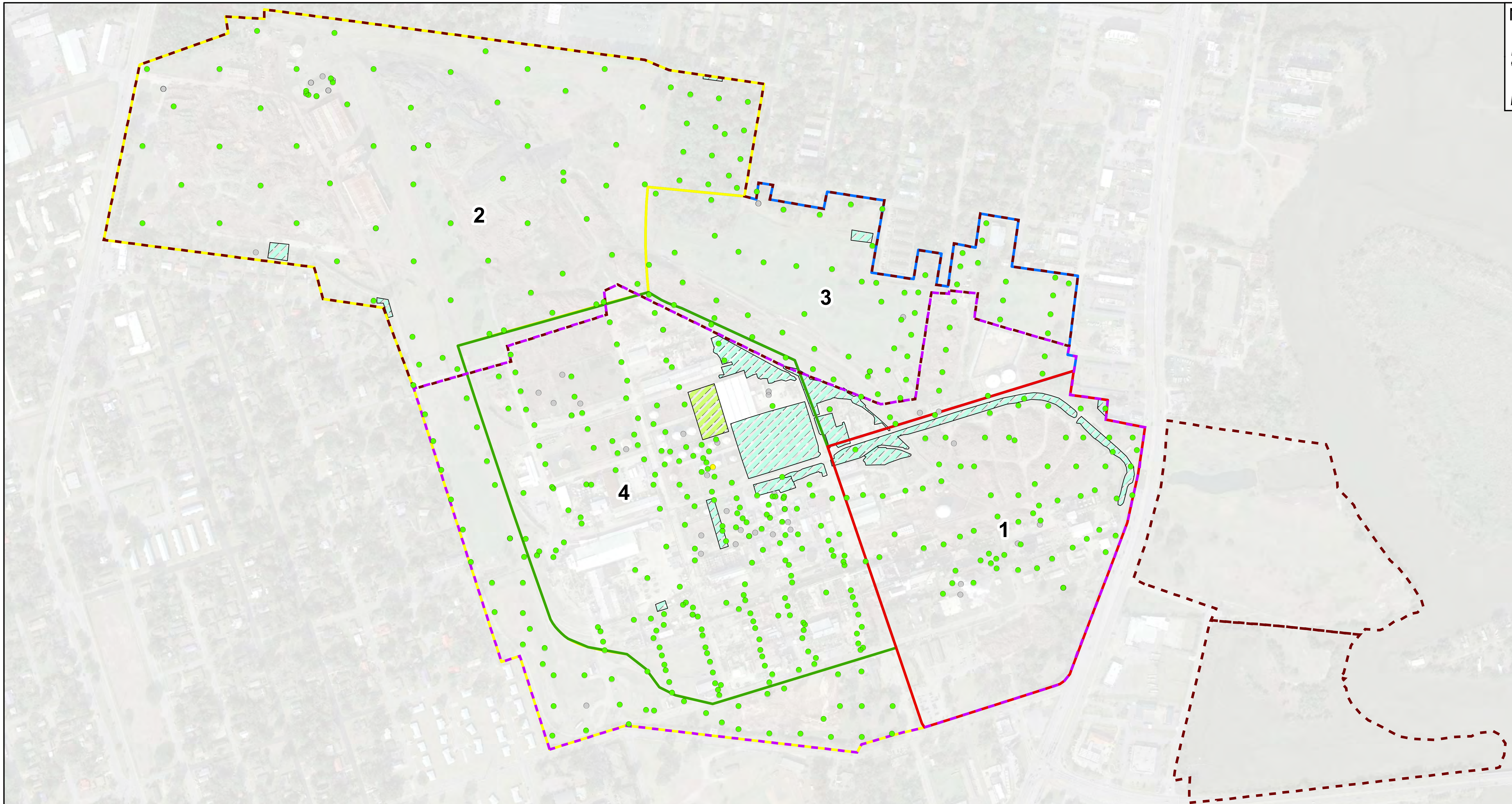
Kennesaw, GA | January 2022

Figure 3-41

Path: N:\H\Hercules\Brunswick\GIS\MXD\Sitewide Soils\SoilFig_Subsurfacep-Isopropyltoluene_v3.mxd; NSekhon; 1/26/2022



Legend

- Pinova Property
- Hercules Property
- Excavated Areas
- Solidified Soil Monolith

Exposure Domains

- Domain 1
- Domain 2
- Domain 3
- Domain 4

Arsenic Concentration (mg/kg)

Not Detected

- DL < 3

Detected

- < 30
- > 30 and < 300

0 250 500 1,000 Feet

Notes:
1. ft bgs = feet below ground surface.
2, DL = detection limit
3. mg/kg = milligrams per kilogram
4. The concentration color coding categories are based on the Regional Screening Level (RSL) for arsenic developed by the United States Environmental Protection Agency and indicate relative distributions of arsenic in soils.
5. Aerial photograph approximate date - January 2019. Source: Google Earth.

Arsenic in Surface Soil Samples (0-2 ft bgs)

Hercules/Pinova Facility
Brunswick, Georgia

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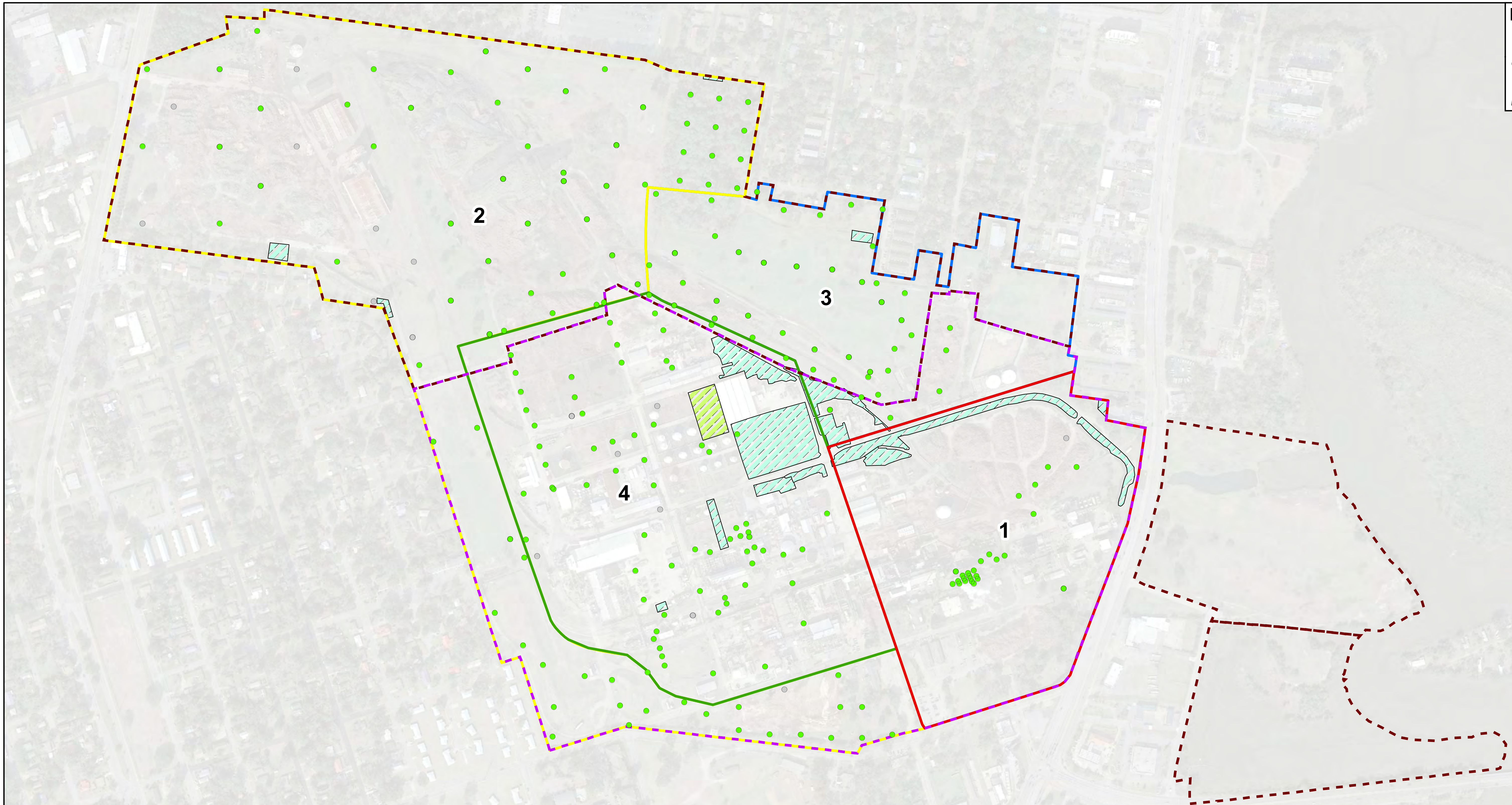
Kennesaw, GA | January 2022

Figure 3-42

Path: N:\H\Hercules\Brunswick\GIS\MXD\Sitewide Soils\SoilFig_SurfaceArsenic_v3.mxd; NSekhon; 1/26/2022



Legend

- Pinova Property
- Hercules Property
- Excavated Areas
- Solidified Soil Monolith

Exposure Domains

- Domain 1
- Domain 2
- Domain 3
- Domain 4

Arsenic Concentration (mg/kg)

Not Detected	Detected
DL < 3	< 30
	> 30 and < 300

0 250 500 1,000 Feet

Notes:
1. ft bgs = feet below ground surface.
2. DL = detection limit
3. mg/kg = milligrams per kilogram
4. The concentration color coding categories are based on the Regional Screening Level (RSL) for arsenic developed by the United States Environmental Protection Agency and indicate relative distributions of arsenic in soils.
5. Aerial photograph approximate date - January 2019. Source: Google Earth.

Arsenic in Subsurface Soil Samples (>2 ft bgs)

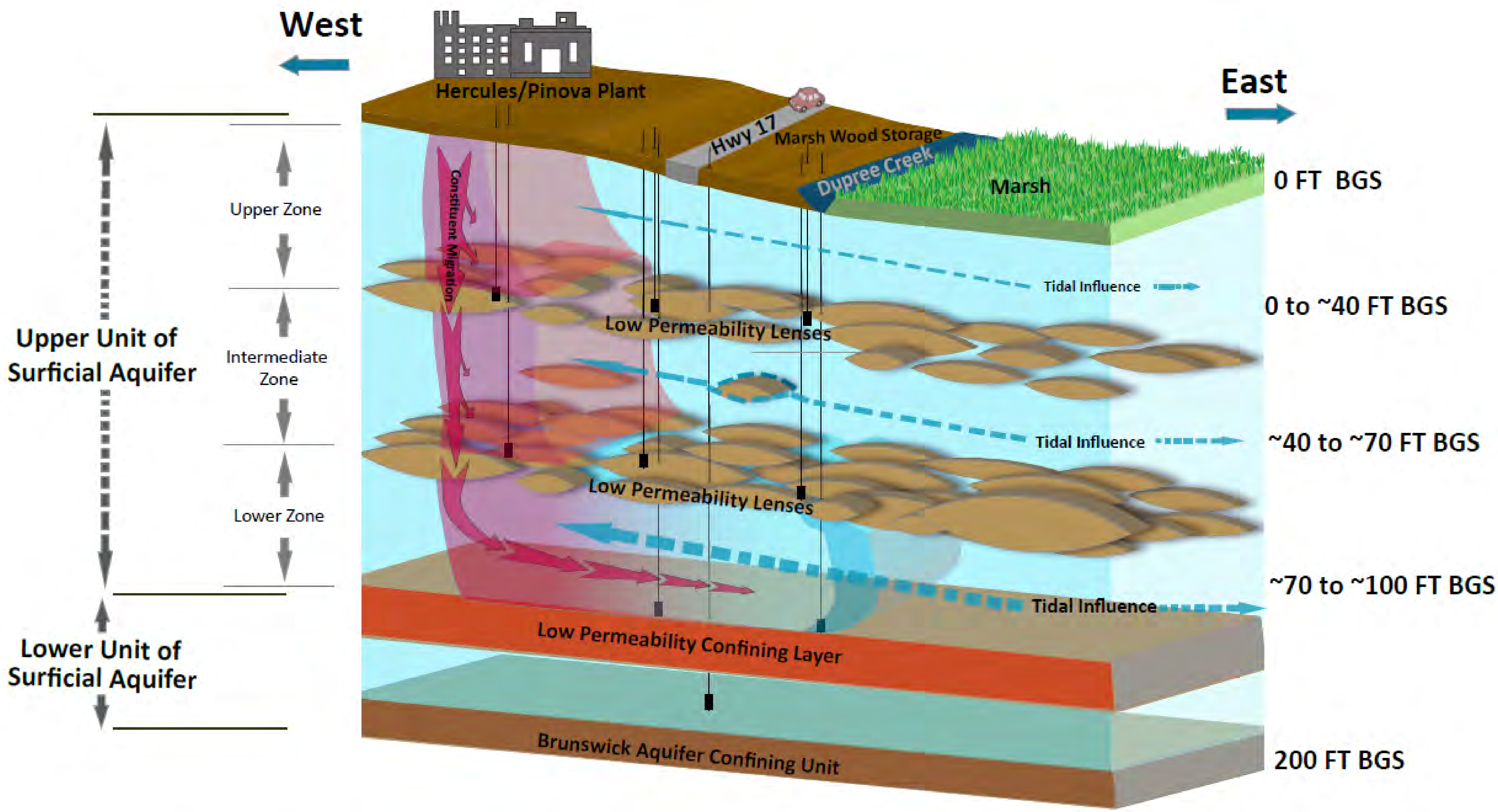
Hercules/Pinova Facility
Brunswick, Georgia

Geosyntec consultants

Kennesaw, GA | January 2022

Figure 3-43

Path: N:\H\Hercules\Brunswick\GIS\MXD\Sitewide Soils\SoilFig_SubsurfaceArsenic_v3.mxd; NSekhon; 1/26/2022



Notes:

Figure adopted from Antea, 2016

FT BGS = feet below ground surface

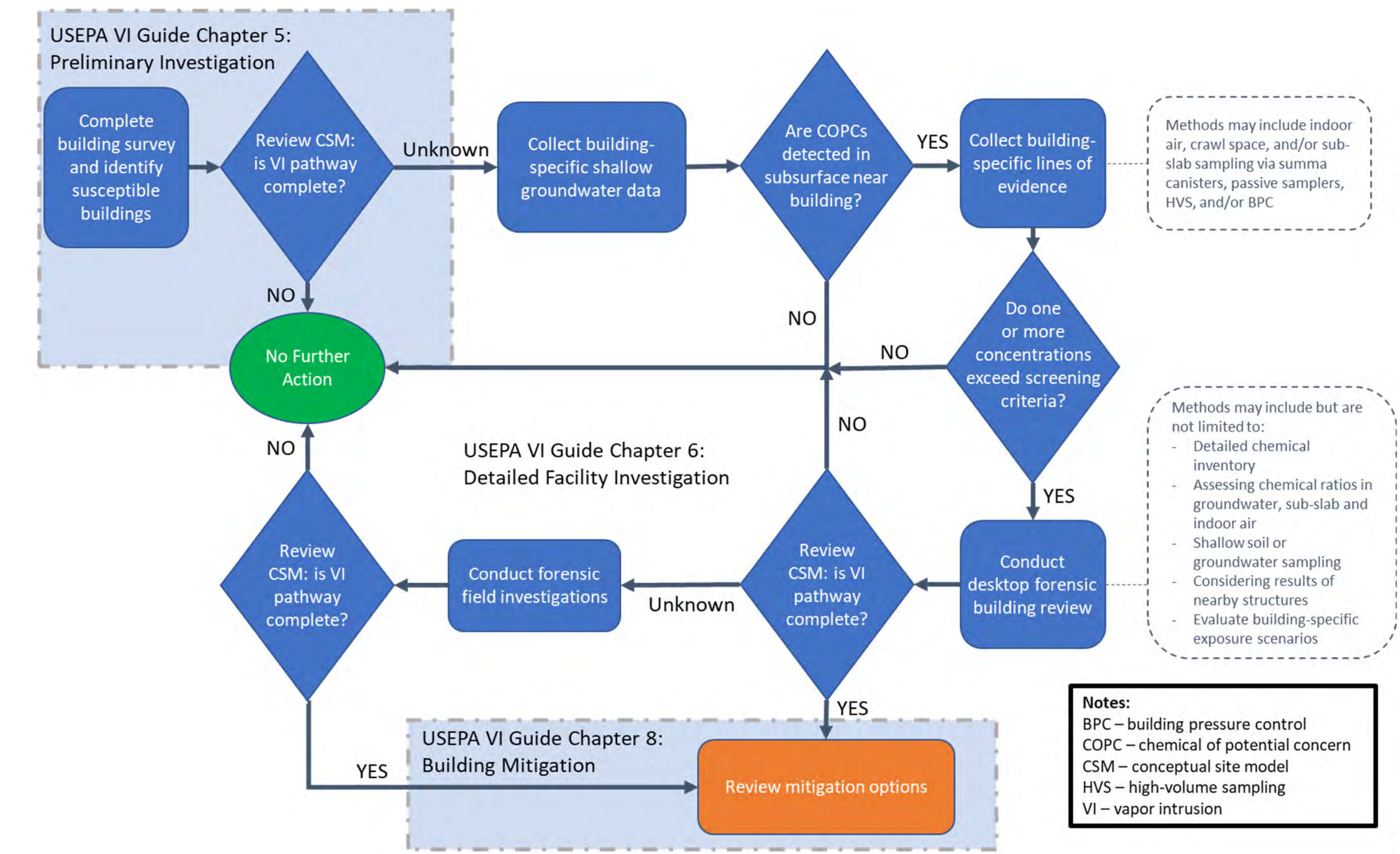
Conceptual Site Model Block Diagram

Hercules/Pinova Facility
Brunswick, Georgia

Geosyntec consultants

Kennesaw, GA | February 2021

Figure 3-44



Vapor Intrusion Investigation Flow Chart

Hercules/Pinova Facility, Brunswick, GA

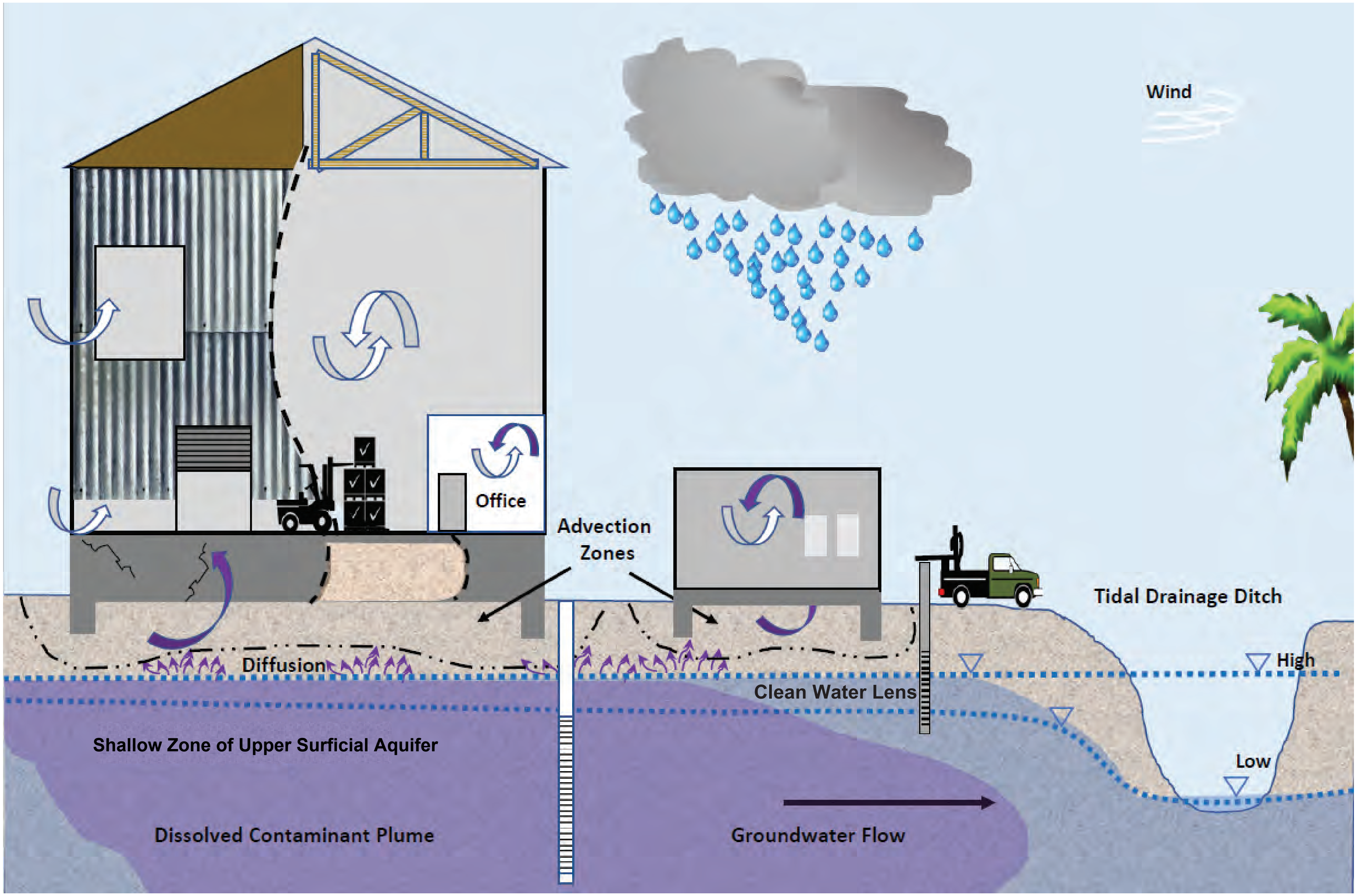
Geosyntec consultants

Kennesaw, Georgia | February 2021

Figure 3-45

USEPA. 2015. OSWER Technical Guide for Assessing and Mitigating the Vapor Intrusion Pathway from Subsurface Vapor Sources to Indoor Air, Office of Solid Waste and Emergency Management. 9200.2-154. June

N:\C\Chemtronics\Pilot Test - Back Valley\Sulfate Pilot\SIP Analysis\Sulfate SIP Study Memo\Fig2_SIP_conceptual.pptx

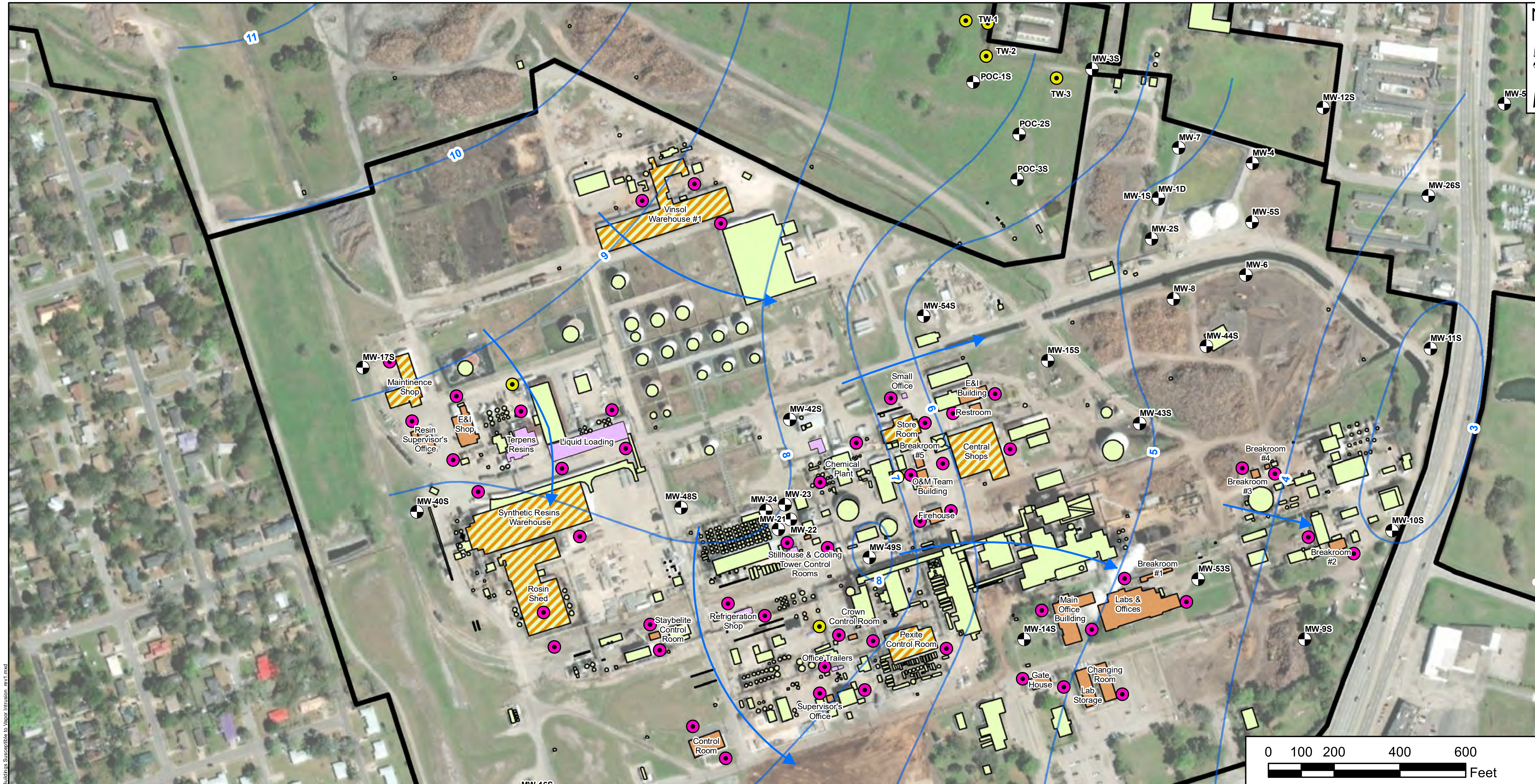


Vapor Intrusion

Conceptual Site Model

Hercules/Pinova Facility, Brunswick, Georgia

Geosyntec consultants		Figure 3-46
Kennesaw, GA	February 2021	



Shallow Groundwater Sample Location
Temporary Piezometer
Existing Monitoring Well - Shallow Zone of Upper Surficial Aquifer
Approximate Groundwater Flow Direction
June 2018 Groundwater Elevation Contour (ft. amsl.) - Shallow Zone of Upper Surficial Aquifer
Structure
Building Containing Smaller Enclosed and Occupiable Space Susceptible to Vapor Intrusion
Building Susceptible to Vapor Intrusion
Building with Mitigation Measures Completed
Site Boundary

Notes:
1. Groundwater elevation contours are from June 2018 and are provided by Antea. June 2018 contours were used to site shallow groundwater sample locations.
2. COPC - chemical of potential concern.
3. CSM - conceptual site model.
4. ND - not detected.
5. Ft. amsl. - feet above mean sea level.
6. ug/L - micrograms per liter
7. VI - vapor intrusion.
8. Existing monitoring well MW-3S were sampled for VI COPCs
9. Temporary piezometers TW-1, TW-2 and TW-3 were sampled for COPCs.

Buildings Susceptible to Vapor Intrusion
Hercules/Pinova Facility
Brunswick, Georgia

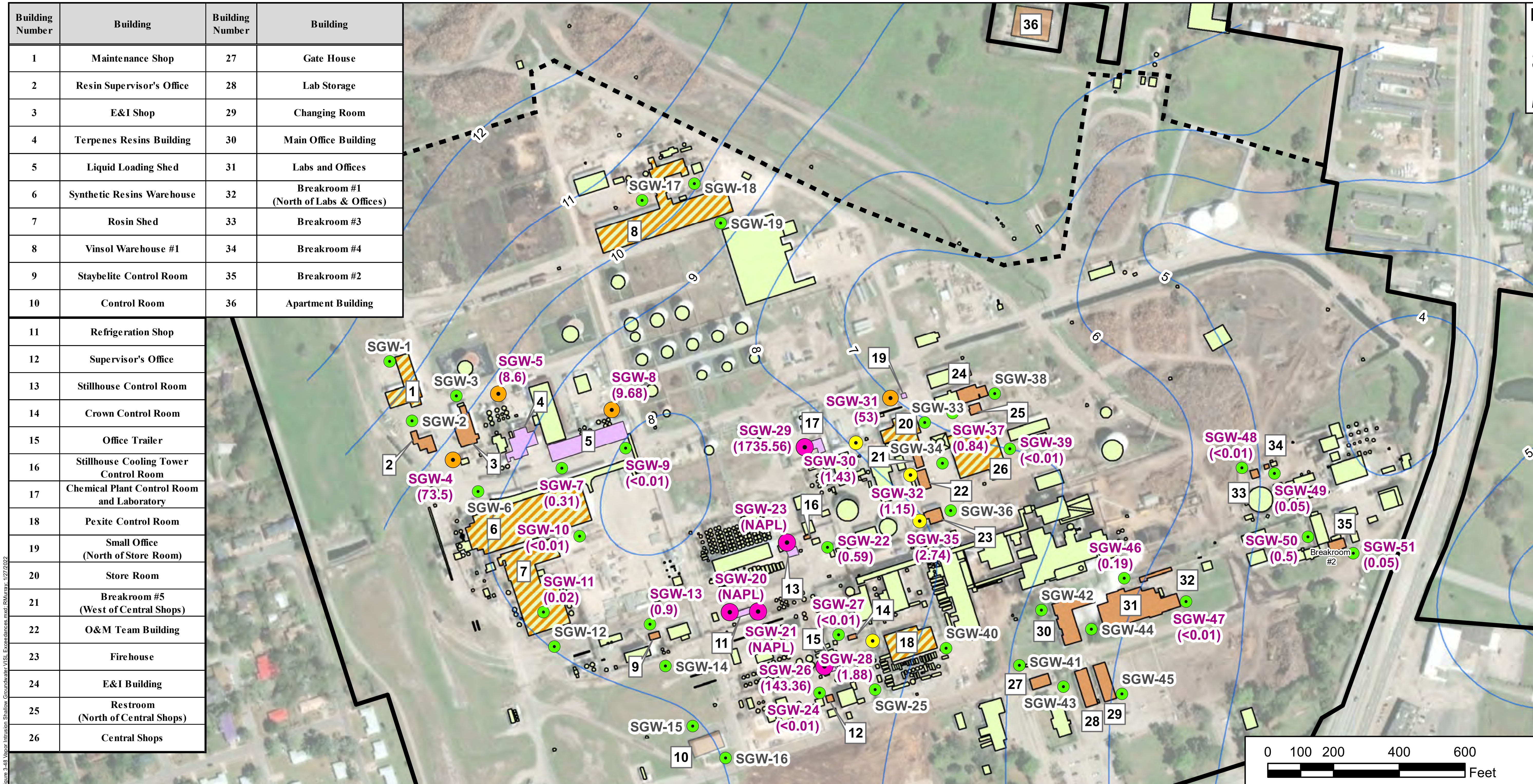
Geosyntec consultants

Kennesaw, GA | January 2022

Figure 3-47

Path: N:\H\Hercules\Brunswick\GIS\MXD\CAP Figures\Figure 3-47 Buildings Susceptible to Vapor Intrusion_rev1.mxd

Building Number	Building	Building Number	Building
1	Maintenance Shop	27	Gate House
2	Resin Supervisor's Office	28	Lab Storage
3	E&I Shop	29	Changing Room
4	Terpenes Resins Building	30	Main Office Building
5	Liquid Loading Shed	31	Labs and Offices
6	Synthetic Resins Warehouse	32	Breakroom #1 (North of Labs & Offices)
7	Rosin Shed	33	Breakroom #3
8	Vinsol Warehouse #1	34	Breakroom #4
9	Staybelite Control Room	35	Breakroom #2
10	Control Room	36	Apartment Building
11	Refrigeration Shop		
12	Supervisor's Office		
13	Stillhouse Control Room		
14	Crown Control Room		
15	Office Trailer		
16	Stillhouse Cooling Tower Control Room		
17	Chemical Plant Control Room and Laboratory		
18	Pexite Control Room		
19	Small Office (North of Store Room)		
20	Store Room		
21	Breakroom #5 (West of Central Shops)		
22	O&M Team Building		
23	Firehouse		
24	E&I Building		
25	Restroom (North of Central Shops)		
26	Central Shops		



Shallow Groundwater Sample Location Cumulative VISL Exceedance Factor

- <1
- >1 and <5
- >5 and <100
- >100

- December 2018 Groundwater Elevation Contours (feet above mean sea level)
- Site Boundary (dashed where separating Hercules and Pinova properties)
- Structure
- Building Containing Smaller Enclosed and Occupiable Space Susceptable to Vapor Intrusion
- Building Susceptable to Vapor Intrusion
- Building with Mitigation Measures Completed

Notes:
1. Locations of shallow groundwater samples shown are approximate based on field observations.
2. Non-aqueous phase liquid (NAPL) was observed at temporary well points SGW-20, SGW-21, and SGW-23. As a result, no groundwater samples were collected from temporary well points SGW-20 and SGW-21 for laboratory analysis. Groundwater samples for analysis of aldrin, formaldehyde, and formic acid only were collected from temporary well point SGW-23.
3. VI COPC - chemical of potential concern for the vapor intrusion pathway
4. VI - vapor intrusion.
5. VISL - vapor intrusion screening level.
6. Cumulative VISL exceedance factor calculated as sum of [detected VI COPC concentration]/[VISL].

Vapor Intrusion Shallow Groundwater Investigation Results – VISL Exceedances

Hercules/Pinova Facility
Brunswick, Georgia

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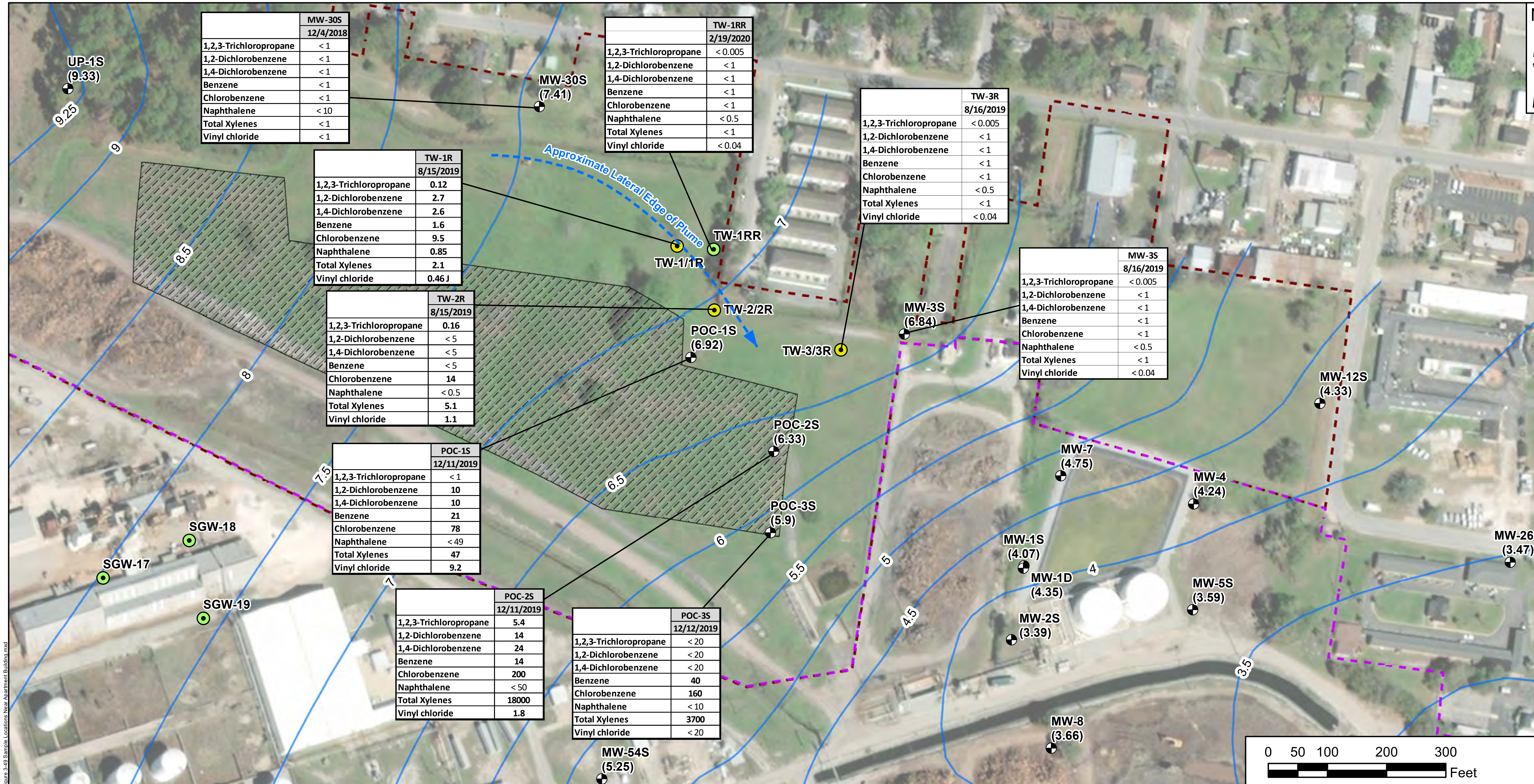
Figure 3-48

Path: \\Ken-01\gis1\$\H\Hercules\Brunswick\GIS\MXD\CAP Figures\Figure 3-48 Vapor Intrusion Shallow Groundwater VISL Exceedances.mxd; RMurray; 1/27/2022



	MW-30S 12/4/2018
1,2,3-Trichloropropane	< 1
1,2-Dichlorobenzene	< 1
1,4-Dichlorobenzene	< 1
Benzene	< 1
Chlorobenzene	< 1
Naphthalene	< 10
Total Xylenes	< 1
Vinyl chloride	< 1

	TW-1RR 2/19/2020
1,2,3-Trichloropropane	< 0.005
1,2-Dichlorobenzene	< 1
1,4-Dichlorobenzene	< 1
Benzene	< 1
Chlorobenzene	< 1
Naphthalene	< 0.5
Total Xylenes	< 1
Vinyl chloride	< 0.04

	TW-3R 8/16/2019
1,2,3-Trichloropropane	< 0.005
1,2-Dichlorobenzene	< 1
1,4-Dichlorobenzene	< 1
Benzene	< 1
Chlorobenzene	< 1
Naphthalene	< 0.5
Total Xylenes	< 1
Vinyl chloride	< 0.04

	TW-1R 8/15/2019
1,2,3-Trichloropropane	0.12
1,2-Dichlorobenzene	2.7
1,4-Dichlorobenzene	2.6
Benzene	1.6
Chlorobenzene	9.5
Naphthalene	0.85
Total Xylenes	2.1
Vinyl chloride	0.46 J

	MW-3S 8/16/2019
1,2,3-Trichloropropane	< 0.005
1,2-Dichlorobenzene	< 1
1,4-Dichlorobenzene	< 1
Benzene	< 1
Chlorobenzene	< 1
Naphthalene	< 0.5
Total Xylenes	< 1
Vinyl chloride	< 0.04

	TW-2R 8/15/2019
1,2,3-Trichloropropane	0.16
1,2-Dichlorobenzene	< 5
1,4-Dichlorobenzene	< 5
Benzene	< 5
Chlorobenzene	14
Naphthalene	< 0.5
Total Xylenes	5.1
Vinyl chloride	1.1

	POC-1S 12/11/2019
1,2,3-Trichloropropane	< 1
1,2-Dichlorobenzene	10
1,4-Dichlorobenzene	10
Benzene	21
Chlorobenzene	78
Naphthalene	< 49
Total Xylenes	47
Vinyl chloride	9.2

	POC-2S 12/11/2019
1,2,3-Trichloropropane	5.4
1,2-Dichlorobenzene	14
1,4-Dichlorobenzene	24
Benzene	14
Chlorobenzene	200
Naphthalene	< 50
Total Xylenes	18000
Vinyl chloride	1.8

	POC-3S 12/12/2019
1,2,3-Trichloropropane	< 20
1,2-Dichlorobenzene	< 20
1,4-Dichlorobenzene	< 20
Benzene	40
Chlorobenzene	160
Naphthalene	< 10
Total Xylenes	3700
Vinyl chloride	< 20

Legend

- Monitoring Well - Shallow Zone of Upper Surficial Aquifer (December 2019 groundwater elevation, ft. amsl.)
- Shallow Groundwater Sample Location
- Temporary Piezometer
- December 2019 Groundwater Elevation Contours - Shallow Zone of Upper Surficial Aquifer (ft. amsl.)
- Direction of Groundwater Flow
- Former Surface Impoundment Area
- Pinova Property
- Hercules Property

Notes:
1. Ft. amsl. - feet above mean sea level.
2. VI - vapor intrusion.
3. COPCs = Constituents of Potential Concern.
4. Existing monitoring well MW-3S was sampled via low-flow methods for VI COPCs in August 2019.
5. Temporary piezometers TW-1R, TW-1RR, TW-2R, and TW-3R were sampled for VI COPCs.

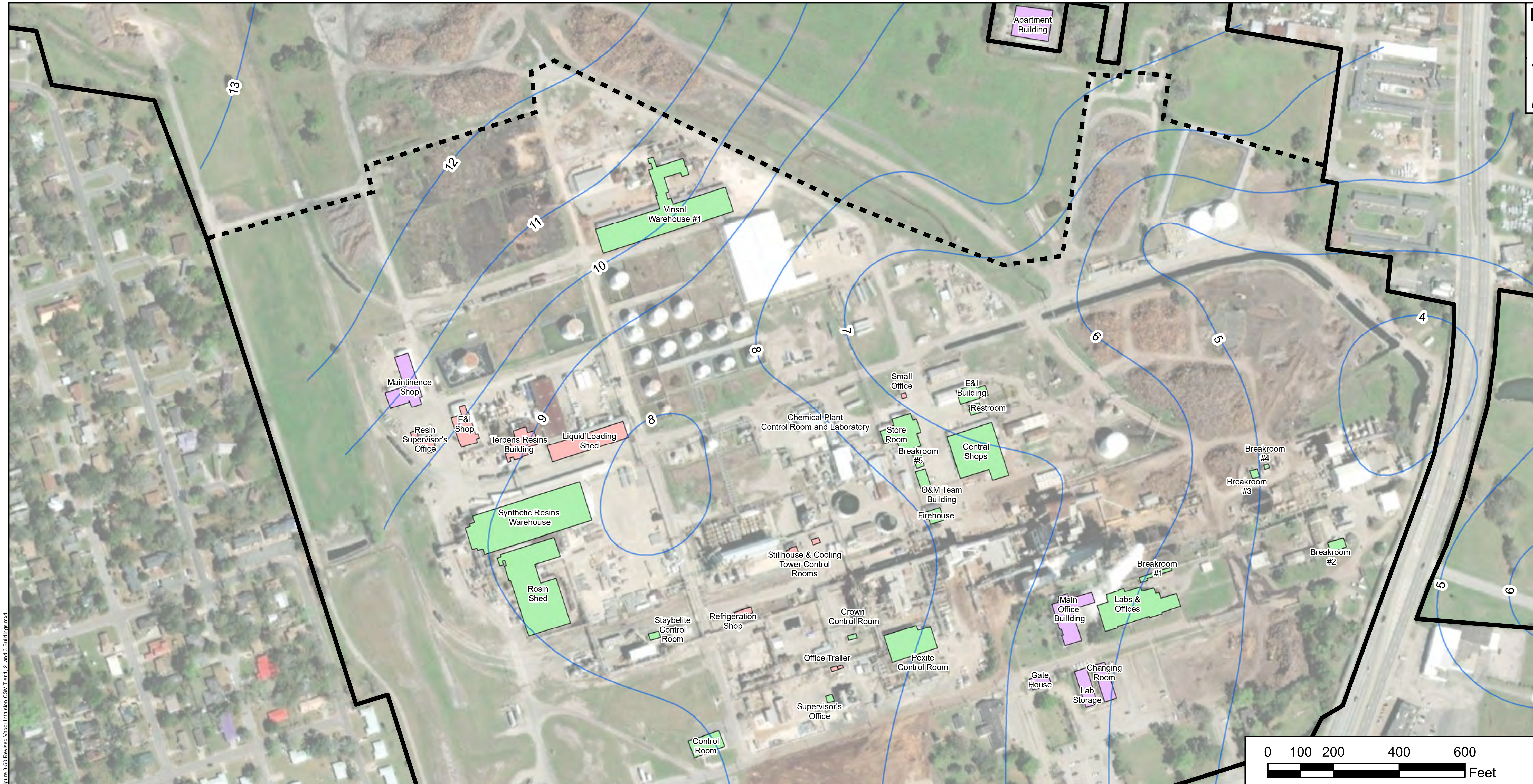
Groundwater Sample Locations Near Apartment Building
Hercules/Pinova Facility
Brunswick, Georgia

Geosyntec consultants

Kennesaw, GA | January 2022

Figure 3-49

Path: \\Ks-01\prj1$\H\Hercules\Brunswick\GIS\MXD\CAP Figures\Figure 3-49 Sample Locations Near Apartment Building.mxd



Buildings In VI Investigation

- Tier 1
- Tier 2
- Tier 3

December 2018 Groundwater Elevation Contours (ft. amsl)

Site Boundary (dashed where separating Hercules and Pinova properties)

Notes:
1. The 36 susceptible buildings shown were retained for further investigation of the vapor intrusion pathway in accordance with the *Vapor Intrusion Pathway Evaluation Work Plan, Hercules/Pinova Facility, Brunswick, GA* submitted March 22, 2019 (Geosyntec, 2019d)
2. The offsite Apartment Building was reclassified from Tier 1 to Tier 3 in *Vapor Intrusion Pathway Tier 1 Building Investigation Work Plan, Hercules/Pinova Facility, Brunswick, GA* approved by EPD in August 2020 (Geosyntec, 2020).
3. VI = vapor intrusion.
4. ft. amsl = feet above mean sea level.

Buildings in VI Investigation as of August 2020

Hercules/Pinova Facility
Brunswick, Georgia

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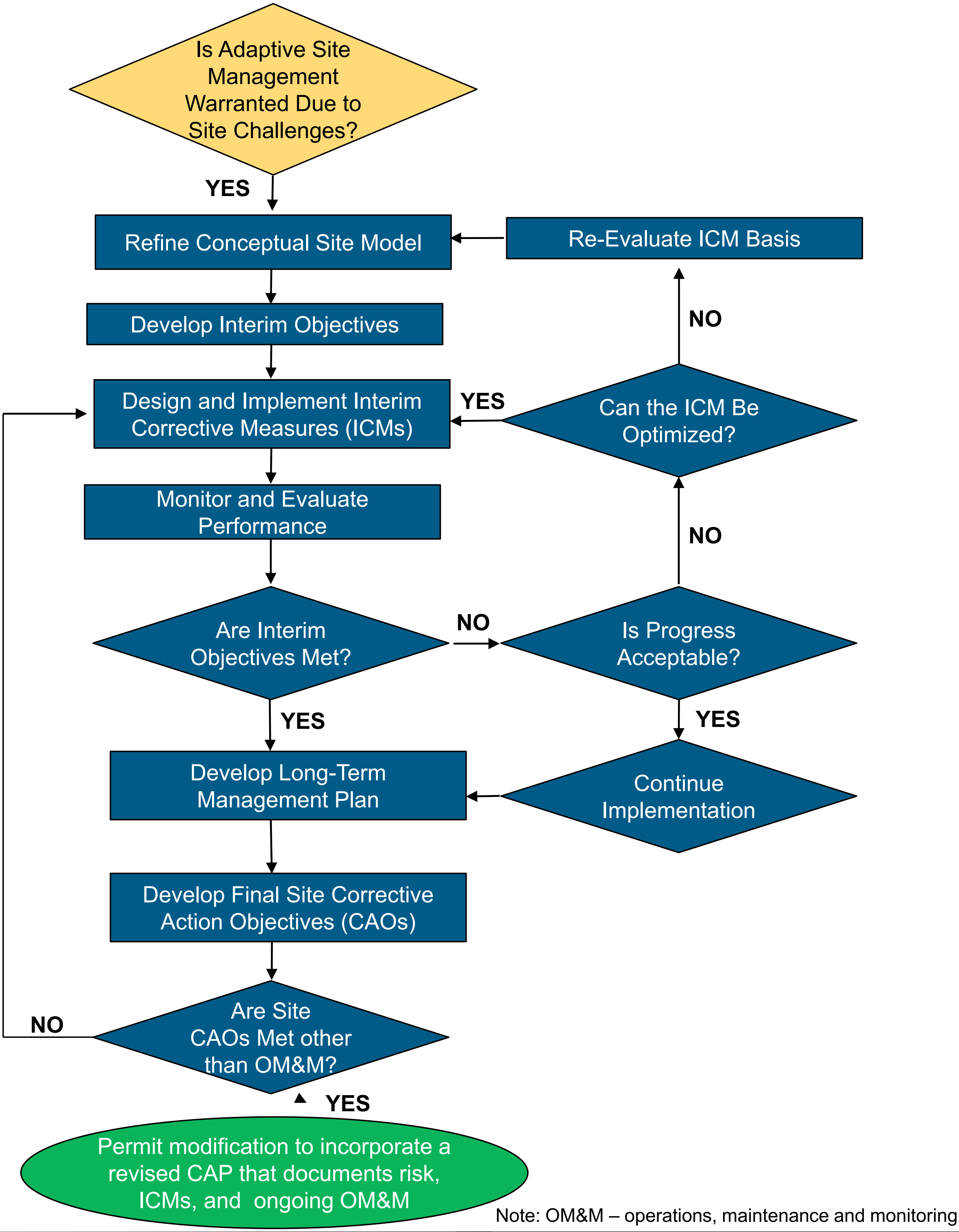
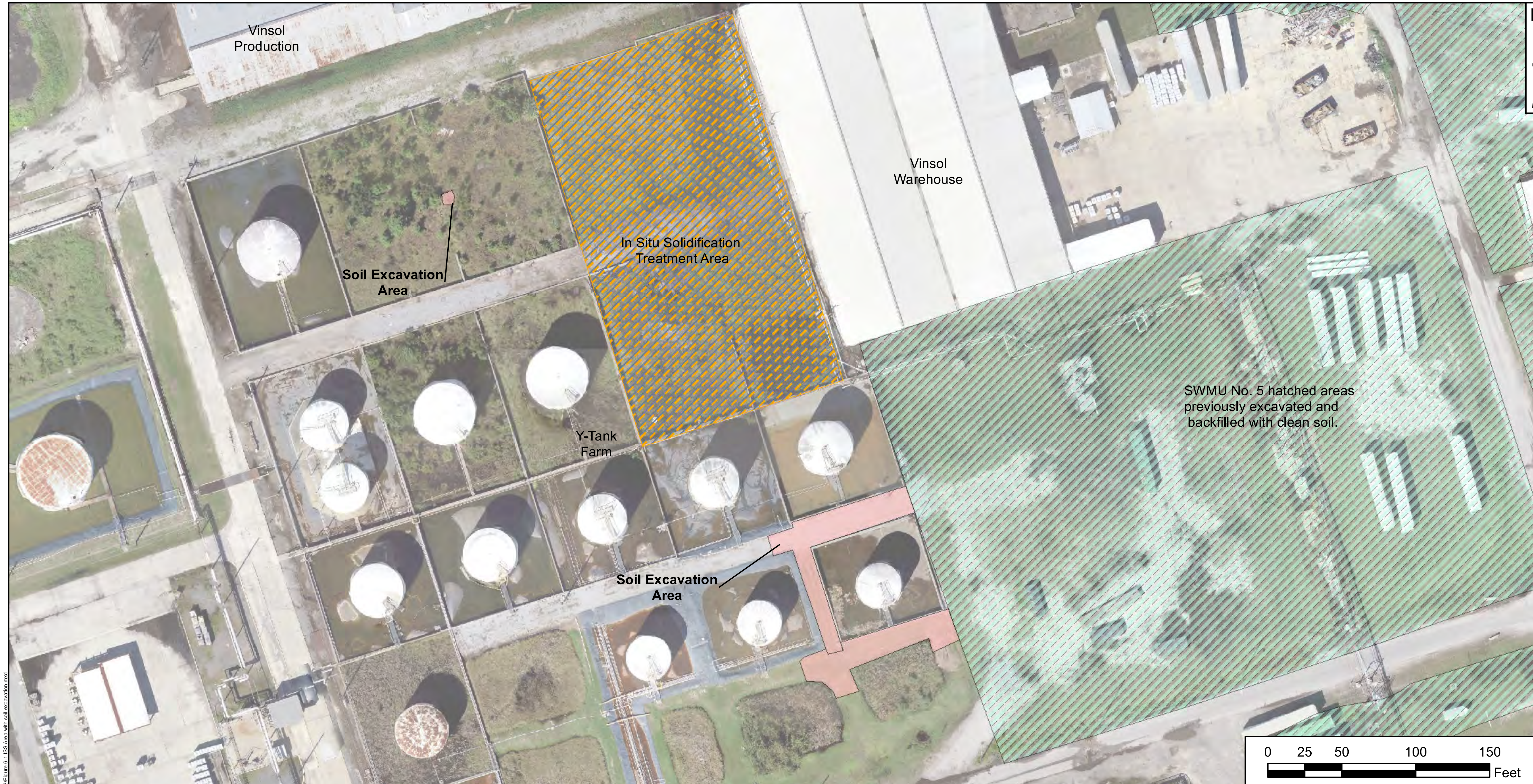
Figure 3-50



Note: OM&M – operations, maintenance and monitoring

Adaptive Management Framework for Brunswick Facility Corrective Measures Hercules/Pinova Facility, Brunswick, Georgia	Geosyntec consultants Atlanta, Georgia	Project No. GR6881 January 2022	**Figure** **4-1**



Legend

- Soil excavation areas in SWMU No. 6
- Former toxaphene tank farm – in situ solidification treatment area
- SWMU No. 5 – previously excavated areas

Notes:
SWMU - Solid waste management unit

Location of Former Toxaphene Tank Farm - Corrective Actions in SWMU No. 6
Hercules/Pinova Facility, Brunswick, Georgia

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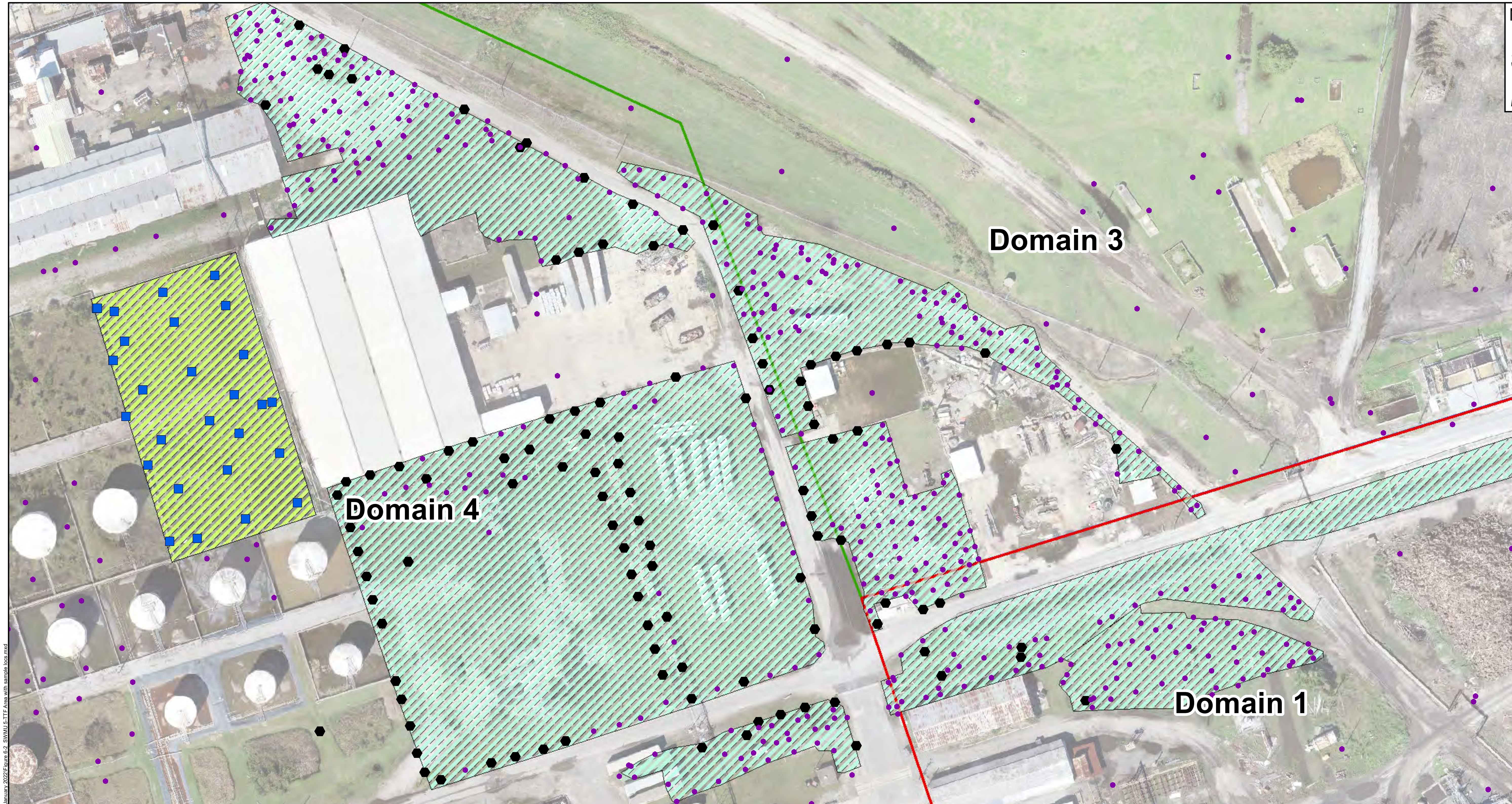
Figure 6-1



Domains

- 1 (red)
- 2 (yellow)
- 3 (blue)
- 4 (green)

SWMU No. 5 - previously excavated areas

Former toxaphene tank farm – in situ solidification treatment area

Inaccessible locations in SWMU No. 5 with soil sampling results for toxaphene greater than applicable RML

Surface soil sample location

Soil sample location in former toxaphene tank farm

0 75 150 300 Feet

Notes:
1. RML – Removal management level developed by the United States Environmental Protection Agency
2. RML for toxaphene in soils at industrial facilities = 210 mg/kg
3. Aerial photograph approximate date - December 2020.

Historical and Ongoing Corrective Actions
Hercules/Pinova Facility, Brunswick, Georgia

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Figure 6-2

Exposure Domains

- 1
- 2
- 3
- 4

● Target Locations

0 250 500 1,000 Feet

Target Soil Sampling Locations – Interim Corrective Measures for Sitewide Soils

Hercules/Pinova Facility, Brunswick, Georgia

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Figure 6-3

Legend

- Previously excavated areas
- Former toxaphene tank farm – in situ solidification treatment area
- Soils in SWMU No. 6 excavated and solidified in former toxaphene tank farm area

Toxaphene Concentration (mg/kg)

Not Detected	Detected
DL < 2.1	< 21
DL > 2.1 and < 21	> 21 and < 210
DL > 21 and < 210	> 210

0 40 80 160 Feet

Notes:
1. DL = detection limit
2. The concentration color coding categories are based on the Regional Screening Level (RSL) for toxaphene developed by the United States Environmental Protection Agency and indicate relative distributions of toxaphene in soils. The color coding does not imply excess risk.
3. Aerial photograph approximate date - December 2020.

Surface Soil Delineation Sampling and Excavation Areas near Former Toxaphene Tank Farm

Hercules/Pinova Facility
Brunswick, Georgia

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Figure 6-4

Path: N:\H\Hercules\Brunswick\GIS\MXD\CAP Figures\January 2022\Figure 6-4 Soil Delineation in Domain 4, D4-04-D4-23 TTF.mxd; CKrachon; 1/26/2022

Legend

Proposed excavation area

Toxaphene Concentration (mg/kg)

Not Detected	Detected
DL < 2.1	< 21
DL > 2.1 and < 21	> 21 and < 210
DL > 21 and < 210	> 210

0 12.5 25 50 Feet

Notes:
1. DL = detection limit
2. mg/kg = milligrams per kilogram
3. The concentration color coding categories are based on the Regional Screening Level (RSL) for toxaphene developed by the United States Environmental Protection Agency and indicate relative distributions of toxaphene in soils. The color coding does not imply excess risk.
4. Aerial photograph approximate date - December 2020.

Surface Soil Delineation Sampling in Domain 1, Location D1-02
Hercules/Pinova Facility
Brunswick, Georgia

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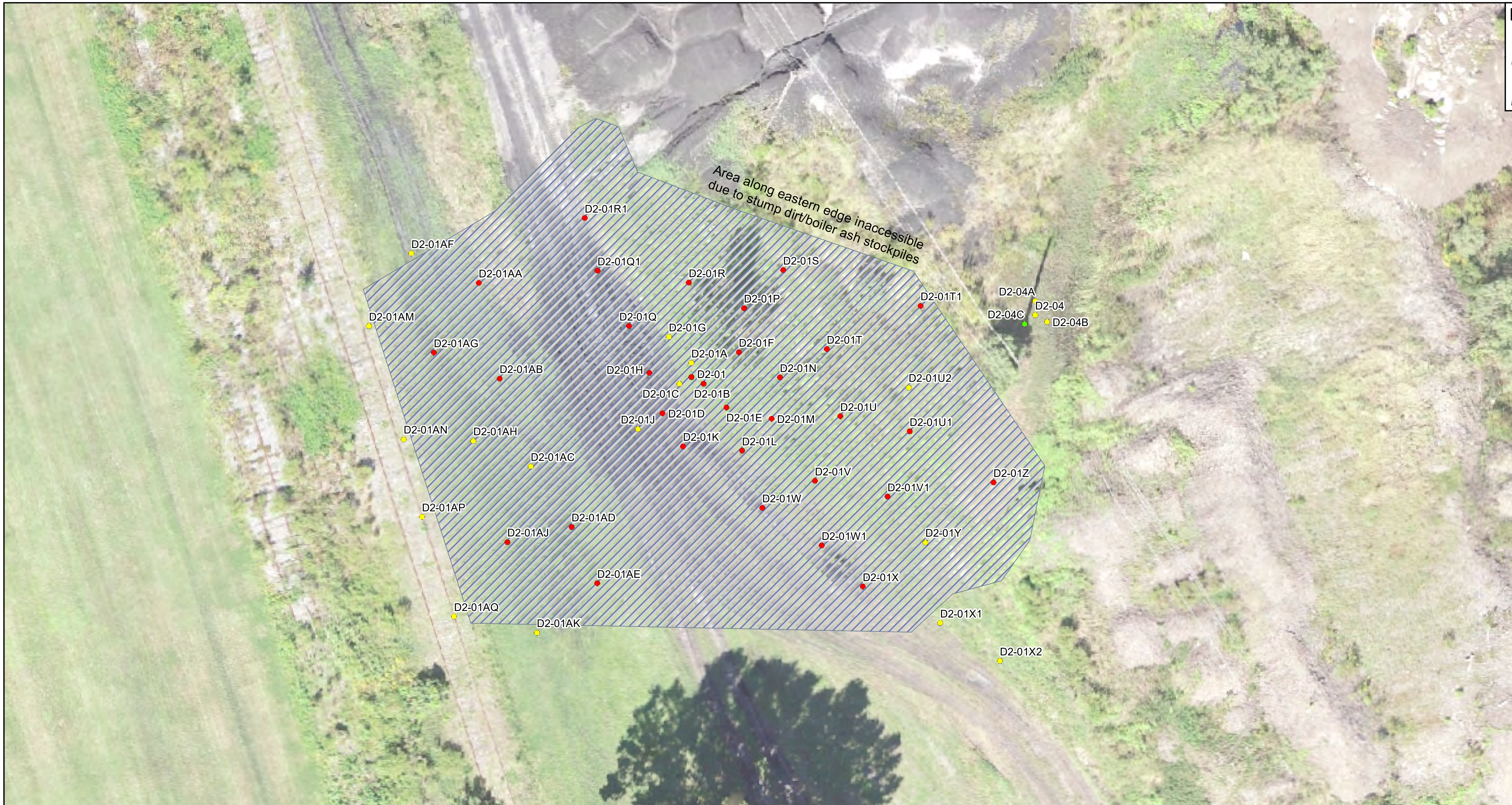
Kennesaw, GA | January 2022

Figure 6-5

Path: N:\H\Hercules\Brunswick\GIS\MXD\CAP Figures\January 2022\Figure 6-5 Soil Delineation-D1-02.mxd; CKrachon; 1/26/2022



Legend

Proposed excavation area

Toxaphene Concentration (mg/kg)

Not Detected	Detected
DL < 2.1	< 21
DL > 2.1 and < 21	> 21 and < 210
DL > 21 and < 210	> 210

0 12.5 25 50 Feet

1. DL = detection limit
2. mg/kg = milligrams per kilogram
3. The concentration color coding categories are based on the Regional Screening Level (RSL) for toxaphene developed by the United States Environmental Protection Agency and indicate relative distributions of toxaphene in soils. The color coding does not imply excess risk.
4. Aerial photograph approximate date - December 2020.

Surface Soil Delineation Sampling in Domain 2, Location D2-01

Hercules/Pinova Facility
Brunswick, Georgia

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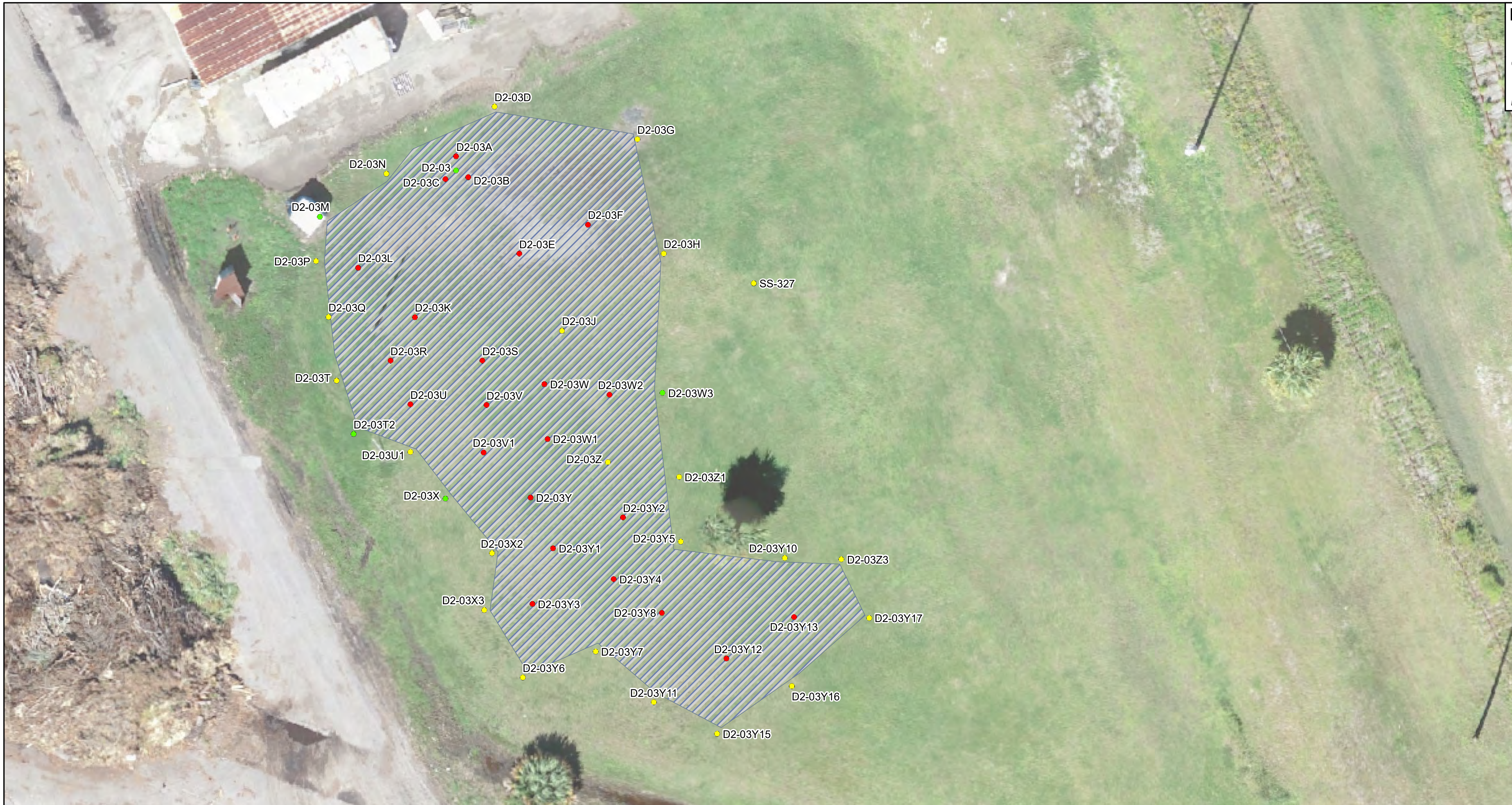
Figure 6-6

Path: N:\H\Hercules\Brunswick\GIS\MXD\CAP Figures\January 2022\Figure 6-6 Soil Delineation-D2-01.mxd; CKrachon; 1/26/2022



Legend

Proposed excavation area

Toxaphene Concentration (mg/kg)

Not Detected	Detected
DL < 2.1	< 21
DL > 2.1 and < 21	> 21 and < 210
DL > 21 and < 210	> 210

0 12.5 25 50 Feet

1. DL = detection limit
2. mg/kg = milligrams per kilogram
3. The concentration color coding categories are based on the Regional Screening Level (RSL) for toxaphene developed by the United States Environmental Protection Agency and indicate relative distributions of toxaphene in soils. The color coding does not imply excess risk.
4. Aerial photograph approximate date - December 2020.

Surface Soil Delineation Sampling in Domain 2, Location D2-03

Hercules/Pinova Facility
Brunswick, Georgia

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Figure 6-7

Path: N:\H\Hercules\Brunswick\GIS\MXD\CAP Figures\January 2022\Figure 6-7 Soil Delineation-D2-03.mxd; CKrachon; 1/26/2022

Legend

Proposed excavation area

Toxaphene Concentration (mg/kg)

Not Detected	Detected
DL < 2.1	< 21
DL > 2.1 and < 21	> 21 and < 210
DL > 21 and < 210	> 210

0 12.5 25 50 Feet

1. DL = detection limit
2. mg/kg = milligrams per kilogram
3. The concentration color coding categories are based on the Regional Screening Level (RSL) for toxaphene developed by the United States Environmental Protection Agency and indicate relative distributions of toxaphene in soils. The color coding does not imply excess risk.
4. Aerial photograph approximate date - December 2020.

Surface Soil Delineation Sampling in Domain 2, Location D2-06

Hercules/Pinova Facility
Brunswick, Georgia

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Kennesaw, GA | January 2022

Figure 6-8

Path: N:\H\Hercules\Brunswick\GIS\MXD\CAP Figures\January 2022\Figure 6-8 Soil Delineation-D2-06.mxd; CKrachon; 1/26/2022

Legend

Proposed excavation area

Toxaphene Concentration (mg/kg)

Not Detected	Detected
DL < 2.1	< 21
DL > 2.1 and < 21	> 21 and < 210
DL > 21 and < 210	> 210

0 12.5 25 50 Feet

1. DL = detection limit
2. mg/kg = milligrams per kilogram
3. The concentration color coding categories are based on the Regional Screening Level (RSL) for toxaphene developed by the United States Environmental Protection Agency and indicate relative distributions of toxaphene in soils. The color coding does not imply excess risk.
4. Aerial photograph approximate date - December 2020.

Surface Soil Delineation Sampling in Domain 3, Location D3-01

Hercules/Pinova Facility
Brunswick, Georgia

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Figure 6-9

Path: N:\H\Hercules\Brunswick\GIS\MXD\CAP Figures\January 2022\Figure 6-9 Soil Delineation-D3-01.mxd; CKrachon; 1/26/2022

Legend

Previously Excavated Areas

Proposed excavation area

Toxaphene Concentration (mg/kg)

Not Detected	Detected
DL < 2.1	< 21
DL > 2.1 and < 21	> 21 and < 210
DL > 21 and < 210	> 210

0 12.5 25 50 Feet

1. DL = detection limit
2. mg/kg = milligrams per kilogram
3. The concentration color coding categories are based on the Regional Screening Level (RSL) for toxaphene developed by the United States Environmental Protection Agency and indicate relative distributions of toxaphene in soils. The color coding does not imply excess risk.
4. Aerial photograph approximate date - December 2020.

Surface Soil Delineation Sampling in Domain 4, Locations D4-01 and D4-12

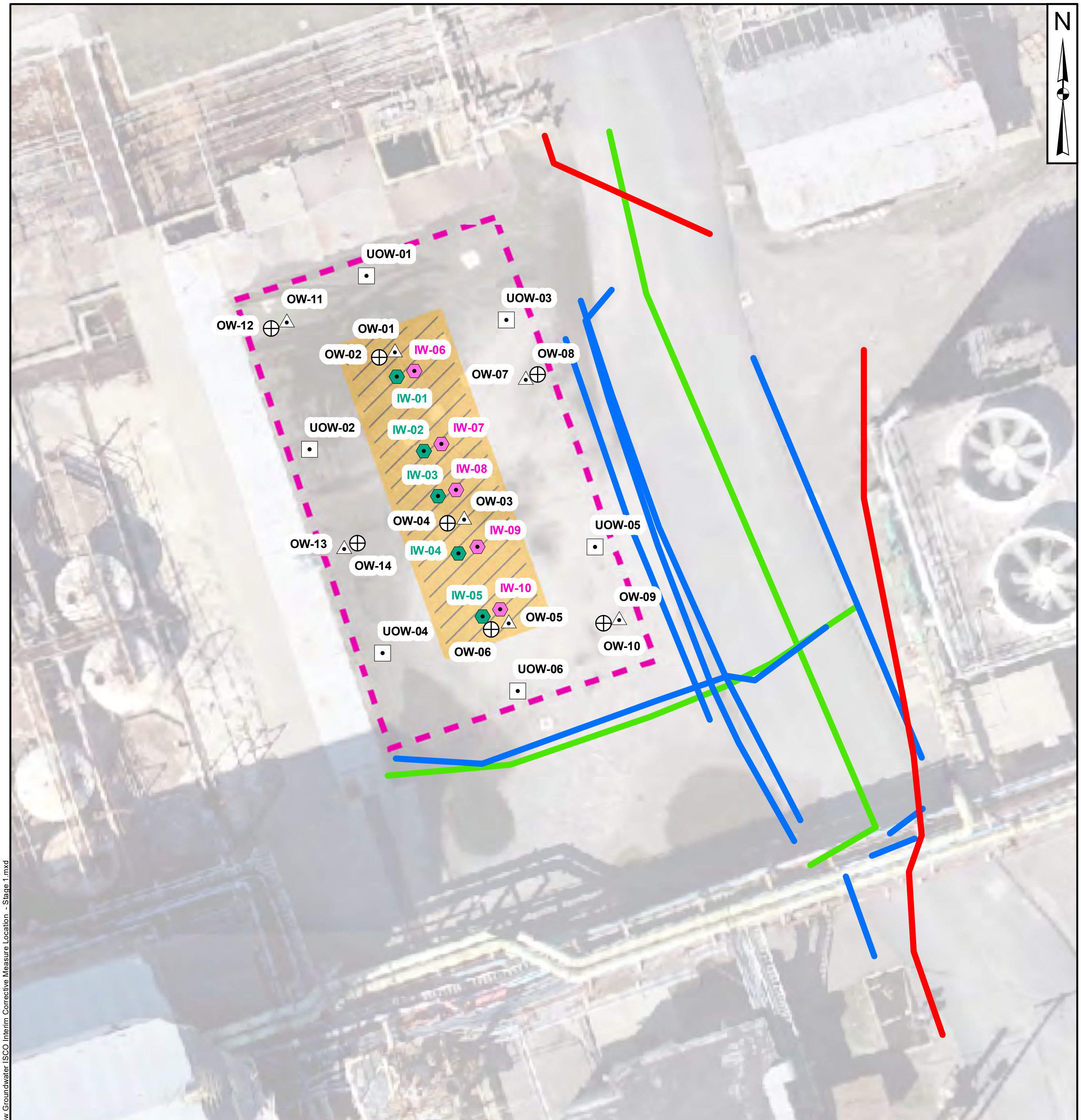
Hercules/Pinova Facility
Brunswick, Georgia

Geosyntec consultants

Kennesaw, GA | January 2022

Figure 6-10

Path: N:\H\Hercules\Brunswick\GIS\MXD\CAP Figures\January 2022\Figure 6-10 Soil Delineation-D4-12.mxd; CKrachon; 1/26/2022



Legend

- Step 1 Injection Well (IW) Screened at 15-20 ft bgs
- Step 2 Injection Well (IW) Screened at 5-15 ft bgs
- Observation Well (OW) Screened at 5-12 ft bgs
- Observation Well (OW) Screened at 13-20 ft bgs
- Utility Observation Well (UOW) Screened at 5-10 ft bgs
- Electrical Line (Approximate Underground Location)
- Fire Suppression Line (Approximate Underground Location)
- Water Line (Approximate Underground Location)
- Treatment Area (Stage 1)
- Target Treatment

Notes:

1. ft bgs - feet below ground surface; ISCO - *in situ* chemical oxidation.

0 10 20 40 Feet

Shallow Groundwater ISCO Interim Corrective Measure Location - Stage 1

Hercules/Pinova Facility

Brunswick, Georgia

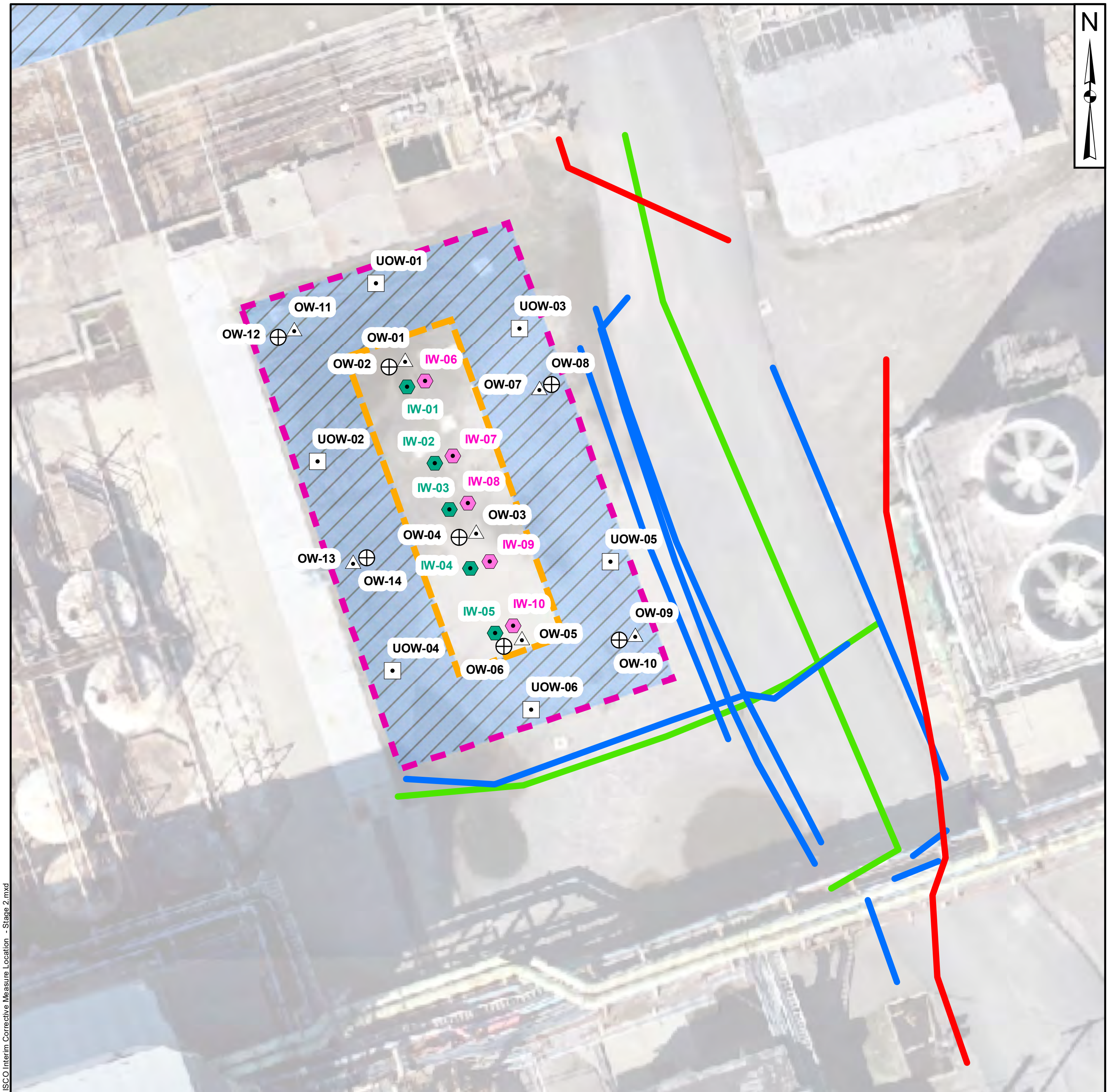
Geosyntec consultants

Kennesaw, GA

January 2022

Figure 6-11

Path: N:\H\Hercules\Brunswick\GIS\MXD\CAP Figures\January 2022\Figure 6-11 Shallow Groundwater ISCO Interim Corrective Measure Location - Stage 1.mxd



Legend

- Step 1 Injection Well (IW) Screened at 15-20 ft bgs
- Step 2 Injection Well (IW) Screened at 5-15 ft bgs
- Observation Well (OW) Screened at 5-12 ft bgs
- Observation Well (OW) Screened at 13-20 ft bgs
- Utility Observation Well (UOW) Screened at 5-10 ft bgs
- Electrical Line (Approximate Underground Location)
- Fire Suppression Line (Approximate Underground Location)
- Water Line (Approximate Underground Location)
- Treatment Area (Stage
- Treatment Area (Stage
- Target Treatment

0 10 20 40
Feet

Shallow Groundwater ISCO Interim Corrective Measure Location - Stage 2
Hercules/Pinova Facility
Brunswick, Georgia

Notes:
1. ft bgs - feet below ground surface; ISCO - *in situ* chemical oxidation.
2. Additional injection wells may be installed in the Stage 2 treatment area. Stage 2 will be performed if Stage 1 can be performed safely and effectively.

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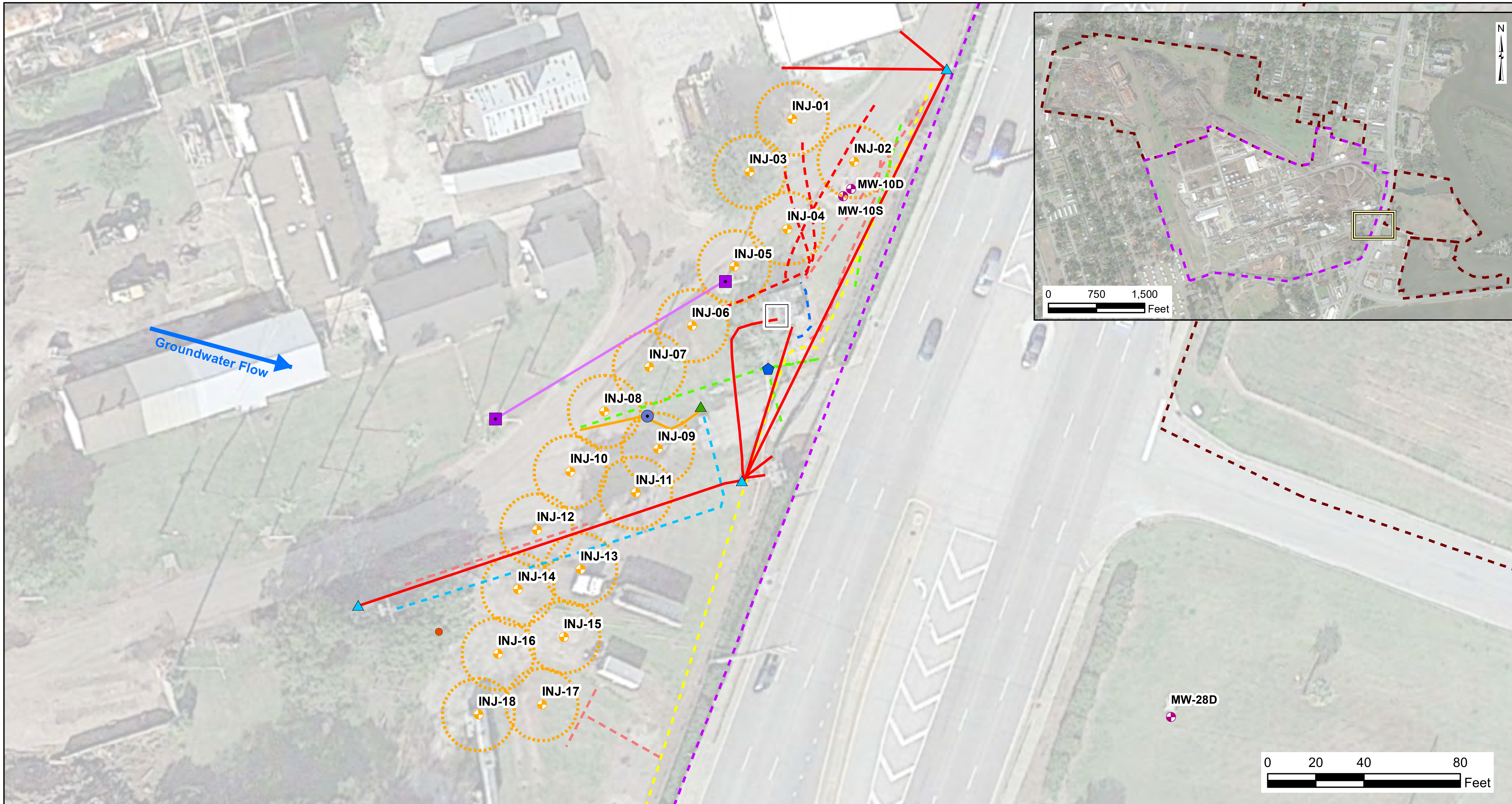
Kennesaw, GA | January 2022

Figure 6-12

Path: N:\H\Hercules\Brunswick\GIS\MXD\CAP Figures\January 2022\Figure 6-12 Shallow Groundwater ISCO Interim Corrective Measure Location - Stage 2.mxd



Legend

- Monitoring Well – Surficial Aquifer, Upper Unit
- Approximate Location of Proposed Injection Well Cluster
- 15 ft Radius of Influence (ROI)
- Unknown Utilities
- Water Riser
- Storm Water Catch Basin Square
- Electric Cabinet
- Electric Street Light
- Electric Powerpole
- Communication Pedestal
- Pinova, Inc. Property
- Hercules LLC Property
- Communication Line
- Electrical Ground Wire
- Electrical Line
- Electrical Street Light Line
- Storm Water Line
- Water Line
- Irrigation Line
- Unknown Line

Notes:

1. Aboveground utilites are designated by solid lines and underground utilities are designated by dashed lines.
2. Each injection well cluster will include two injection wells to cover a treatment zone of 70 to 95 feet below ground surface.
3. Proposed injection well locations may change in the field based on driller access, utility locations and Pinova operations.
4. Aerial photograph approximate date - January 2019. Source: Google Earth.

N

Conceptual Layout of Initial Segment of Anaerobic Biobarrier, Deep Zone of Upper Surficial Aquifer

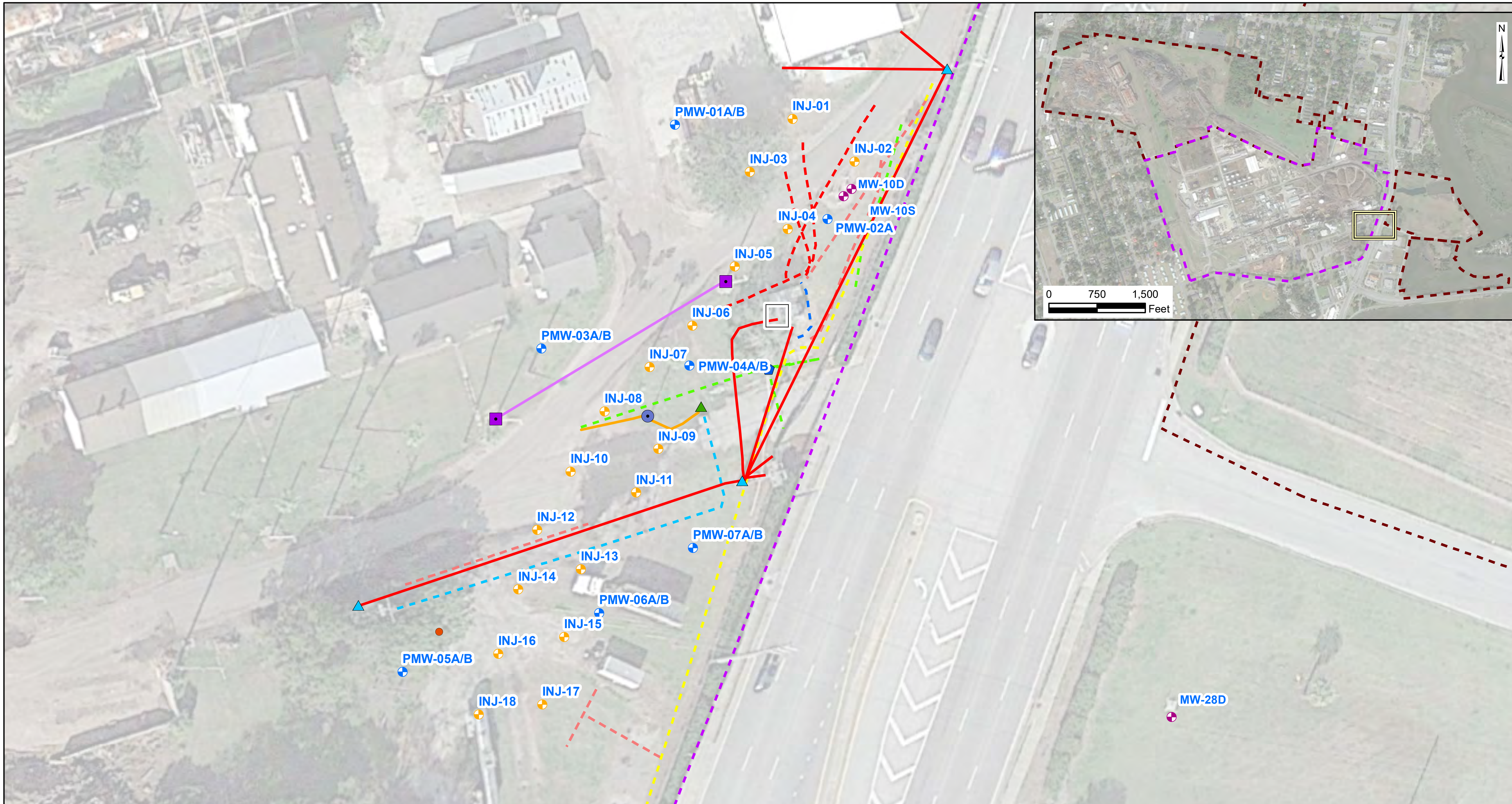
Hercules/Pinova Facility
Brunswick, Georgia

Geosyntec consultants

Kennesaw, GA | January 2022

Figure 6-13a

Path: N:\H\Hercules\Brunswick\GIS\MXD\CAP Figures\January 2022\Figure 6-13a Conceptual Layout of Initial Segment of Anaerobic Biobarrier - Deep Zone of Upper Surficial Aquifer.mxd



Legend

- Monitoring Well – Surficial Aquifer, Upper Unit
- Proposed Performance Monitoring Well Cluster
- Proposed Injection Well Clusters
- Unknown Utilities
- Water Riser
- Storm Water Catch Basin Square
- Electric Cabinet
- Electric Street Light
- Electric Powerpole
- Communication Pedestal
- Pinova, Inc. Property
- Hercules LLC Property
- Communication Line
- Electrical Ground Wire
- Electrical Line
- Electrical Street Light Line
- Storm Water Line
- Water Line
- Irrigation Line
- Unknown Line

0 20 40 80
Feet

N

Notes:
1. Aboveground utilites are designated by solid lines and underground utilities are designated by dashed lines.
2. "A" designates a proposed performance monitoring well screened approximately from 72 to 82 feet below ground surface. "B" designates a proposed performance monitoring well screened approximately from 84 to 94 feet below ground surface.
3. Proposed monitoring well locations may change in the field based on driller access, utility locations and Pinova operations.
4. Aerial photograph approximate date - January 2019. Source: Google Earth.

Layout of Anaerobic Biobarrier Performance Monitoring Wells - Deep Zone of Upper Surficial Aquifer

Hercules/Pinova Facility
Brunswick, Georgia

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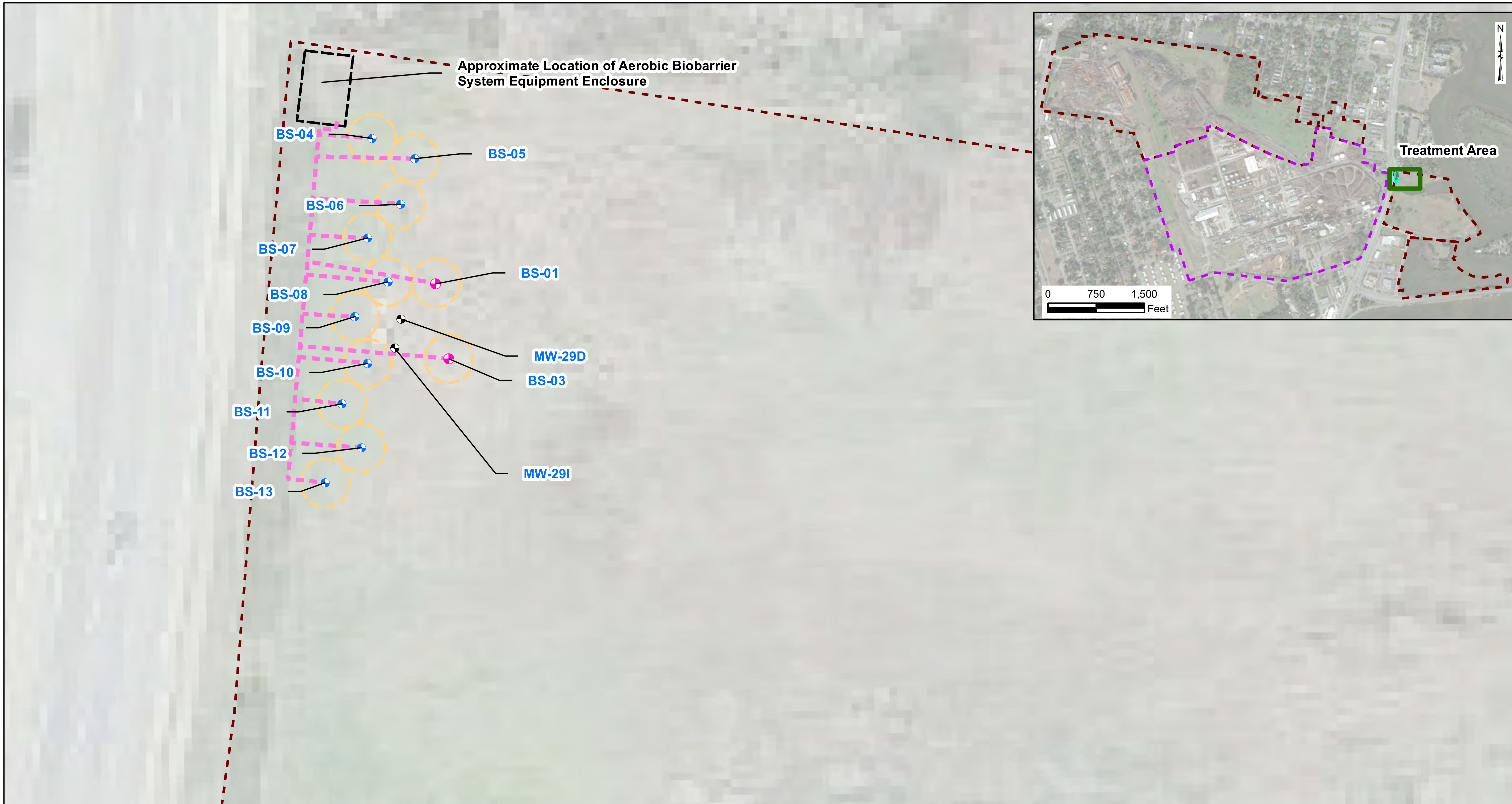
Kennesaw, GA | January 2022

Figure 6-13b

Path: N:\H\Hercules\Brunswick\GIS\MXD\CAP Figures\January 2022\Figure 6-13b Layout of Anaerobic Biobarrier Performance Monitoring Wells - Deep Zone of Upper Surficial Aquifer.mxd



Legend

- Supplemental Biosparging Well
- Monitoring Well – Surficial Aquifer, Upper Unit
- Proposed Biosparging Well
- Approximate Location of Trench for Underground Sparging Lines
- Anticipated radius of influence of biosparging well
- Pinova Property
- Hercules Property

0 15 30 60 Feet

N

Notes:

1. "S", "I", and "D" designate monitoring wells screened in the shallow, intermediate and deep zones of the upper surficial aquifer, respectively.
2. Proposed locations of biosparging wells are subject to change based on field conditions.
3. Aerial photograph approximate date - January 2019. Source: Google Earth.
4. Proposed location of aerobic biobarrier system equipment enclosure may be revised based on the final location of electrical service and the exact location and geometry of the aerobic biobarrier.

Layout of Initial Segment of Aerobic Biobarrier
Deep Zone of Upper Surficial Aquifer
Hercules/Pinova Facility
Brunswick, Georgia

Geosyntec consultants

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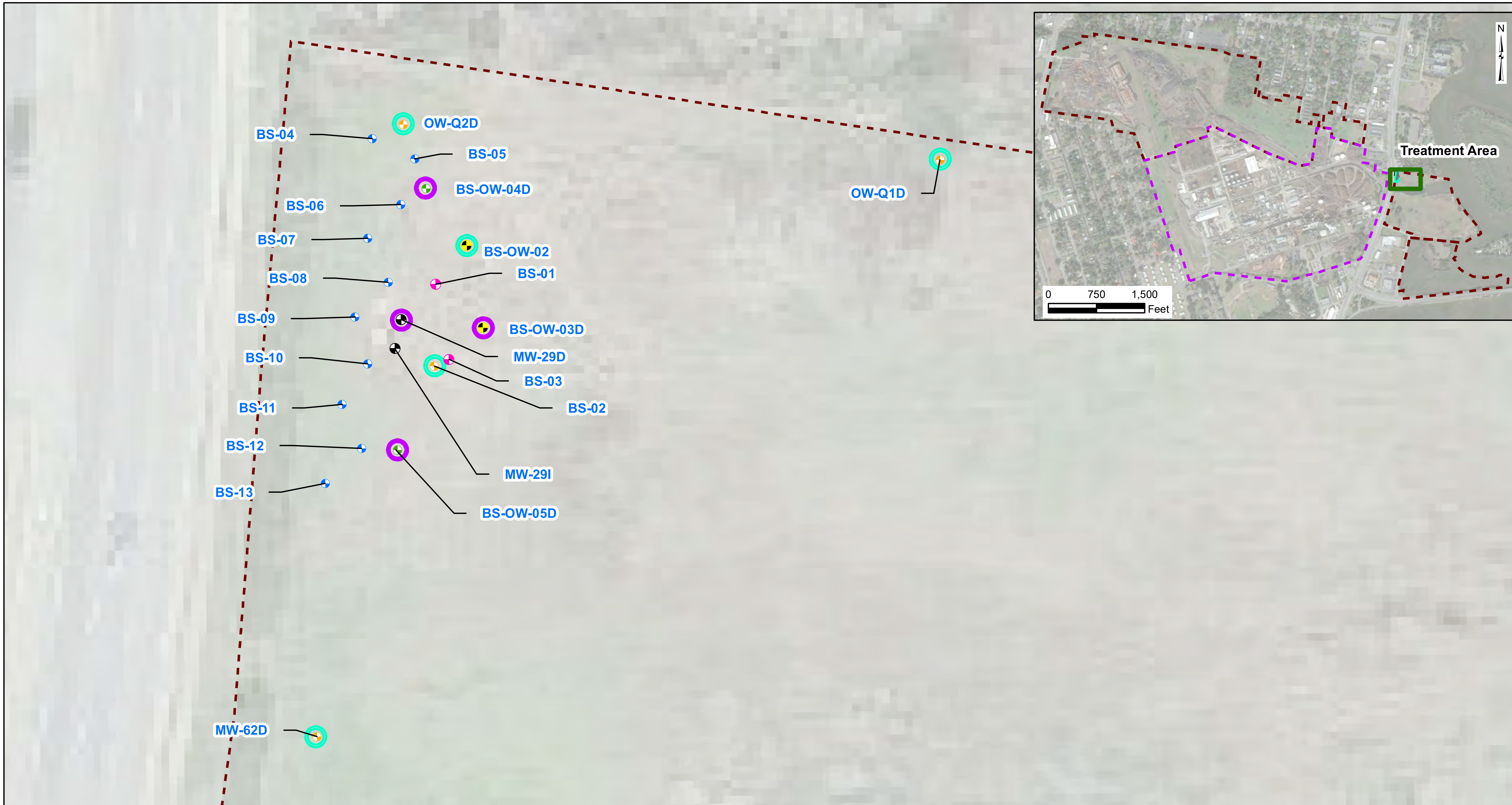
Figure 6-14a

Path: \\aro-01\prj1$\H\Hercules\Brunswick\GIS\MXD\CAP Figures\January 2022\Figure 6-14a Layout of Initial Segment of Aerobic Biobarrier - Deep Zone of Upper Surficial Aquifer.mxd



Legend

- Pilot Test Observation Well
- Tidal Study Observation Well
- Proposed Performance Monitoring Well
- Supplemental Biosparging Well
- Monitoring Well – Surficial Aquifer, Upper Unit
- Proposed Biosparging Well
- Pinova Property
- Hercules Property
- Monitoring Well – Field Parameters Only
- Performance Monitoring Well

0 15 30 60 Feet

N

Notes:
* - Observation well BS-OW-3I will be abandoned prior to installation of aerobic biobarrier.
1. "I", and "D" designate monitoring wells screened in the intermediate and deep zones of the upper surficial aquifer, respectively.
2. Proposed locations of biosparging performance monitoring wells are subject to change based on field conditions.
3. Aerial photograph approximate date - January 2019. Source: Google Earth.

Layout of Aerobic Biobarrier Performance Monitoring Wells - Deep Zone of Upper Surficial Aquifer
Hercules/Pinova Facility
Brunswick, Georgia

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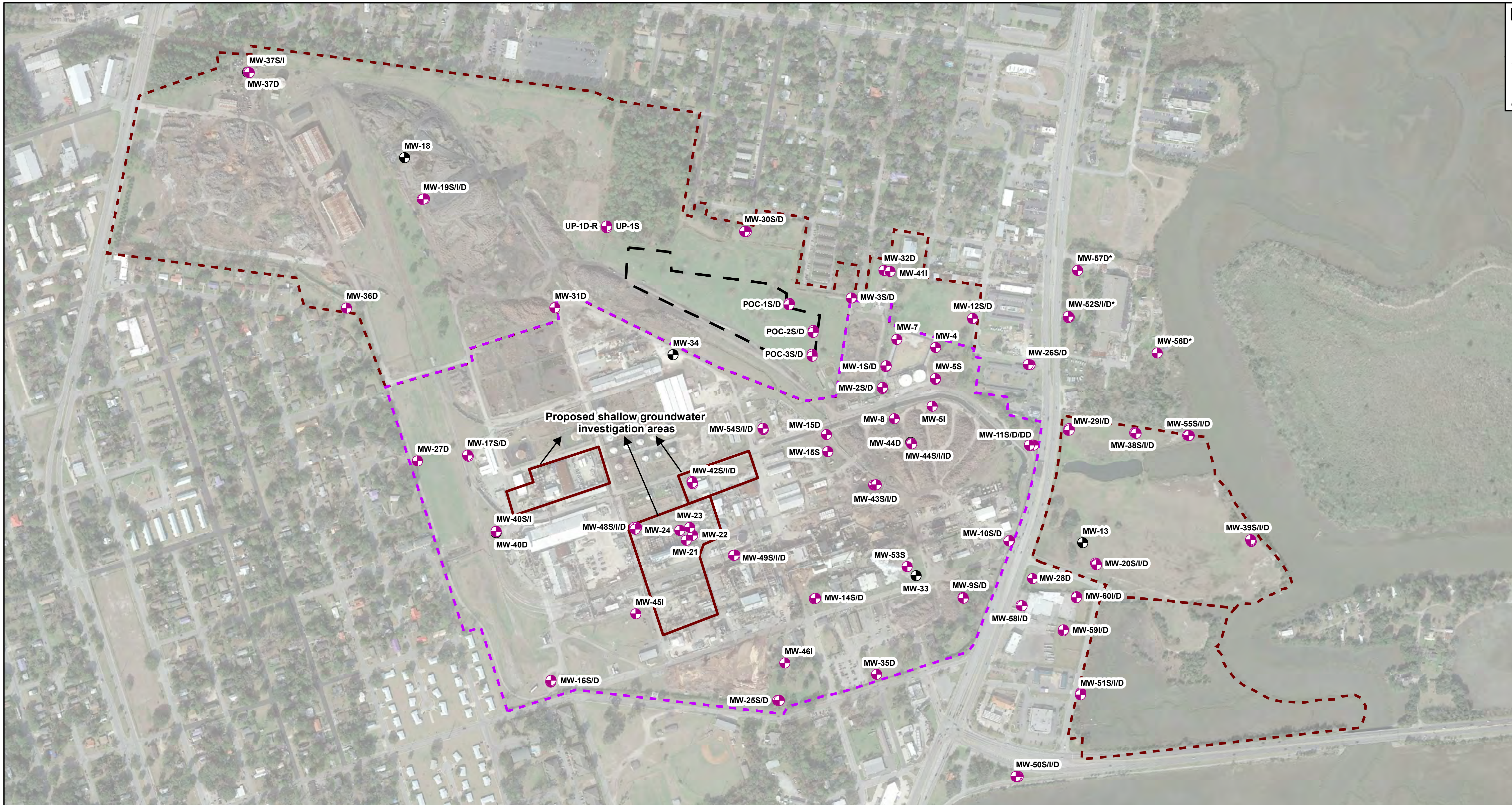
Figure 6-14b

Path: N:\H\Hercules\Brunswick\GIS\MXD\CAP Figures\January 2022\Figure 6-14b Layout of Aerobic Biobarrier Performance Monitoring Wells - Deep Zone of Upper Surficial Aquifer.mxd



Legend

- Surficial Aquifer, Upper Unit Well
- Surficial Aquifer, Lower Unit Well
- Approximate Location of Closed Surface Impoundments
- Proposed Shallow Groundwater Investigation Areas
- Pinova Property
- Hercules Property

0 275 550 1,100 Feet

Notes:

1. "S", "I", and "D" designate monitoring wells screened in shallow, intermediate, and deep zone, respectively, of the upper surficial aquifer. Monitoring wells MW-4, MW-6, MW-7, MW-8, MW-21, MW-22, MW-23, MW-24, and MW-1D are screened in the shallow zone of the upper surficial aquifer. Monitoring wells MW-11D, MW-2D, and MW-3D are screened in the intermediate zone of the upper surficial aquifer. Monitoring wells UP-1D-R, MW-44ID and MW-11DD are screened in the deep zone of the upper surficial aquifer. MW-37D, MW-40D, and MW-44D are screened in the lower surficial aquifer.
2. Property owner has not allowed access for sampling since 2017.
3. Aerial photograph approximate date - January 2019. Source: Google Earth.

Proposed Shallow Groundwater Investigation Areas

Hercules/Pinova Facility

Brunswick, Georgia

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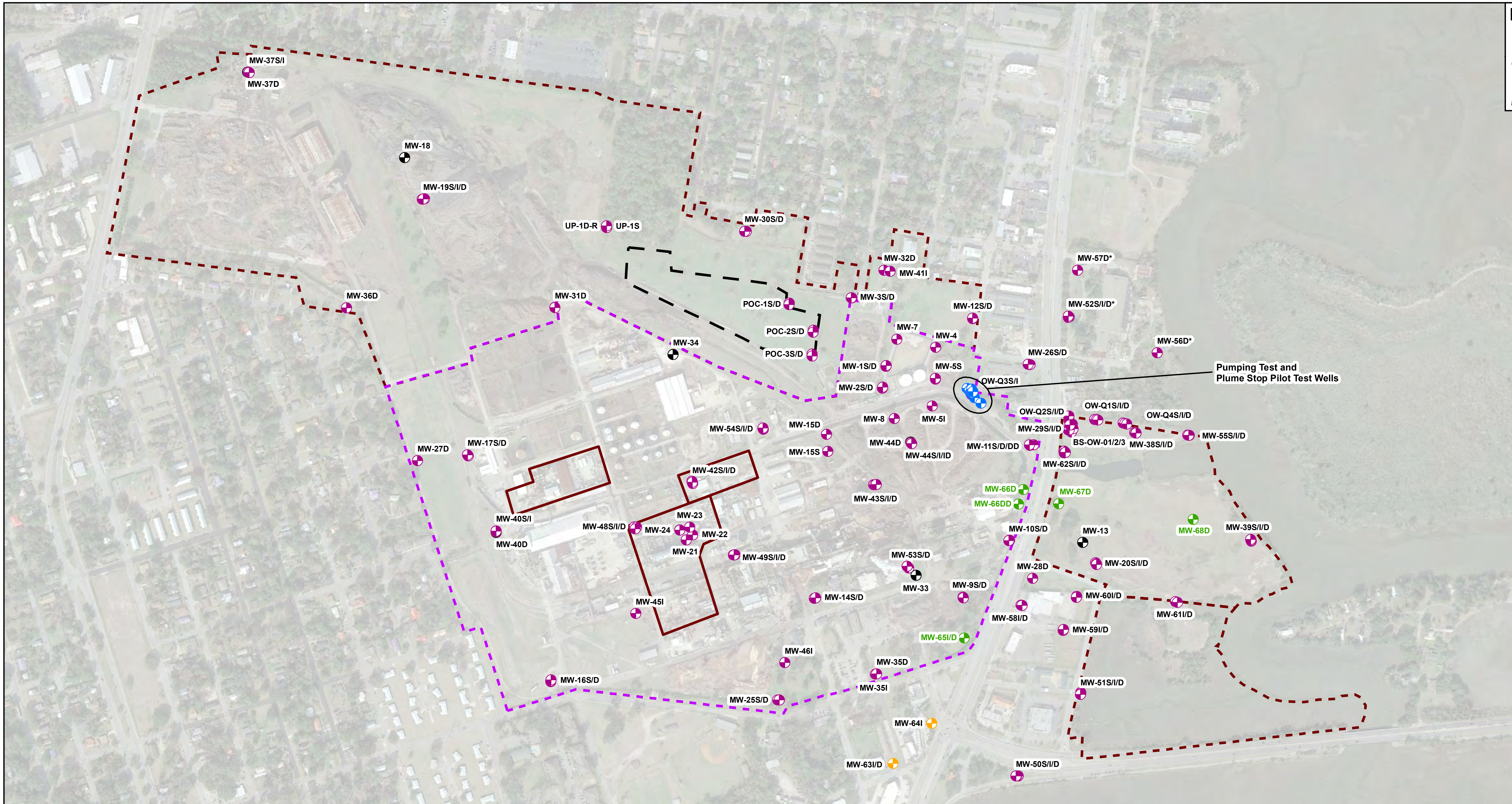
Figure 6-15

Path: N:\H\Hercules\Brunswick\GIS\MXD\CAP Figures\January 2022\Figure 6-15 Proposed Shallow Groundwater Investigation Areas - Copy.mxd



Legend

- Surficial Aquifer, Upper Unit Well
- Surficial Aquifer, Lower Unit Well
- Pumping Test and Plume Stop Pilot Test Well
- New Monitoring Well (November 2021)
- Proposed Monitoring Well
- Approximate Location of Closed Surface Impoundments
- Approximate Extent of Primary Potential Source Areas
- Pinova Property
- Hercules Property

0 275 550 1,100 Feet

Notes:

1. "S", "I", and "D" designate monitoring wells screened in shallow, intermediate, and deep zone, respectively, of the upper surficial aquifer. Monitoring wells MW-4, MW-6, MW-7, MW-8, MW-21, MW-22, MW-23, MW-24, and MW-1D are screened in the shallow zone of the upper surficial aquifert. Monitoring wells MW-11D, MW-2D, and MW-3D are screened in the intermediate zone of the upper surficial aquifert. Monitoring wells UP-1D-R, MW-44ID and MW-11DD are screened in the deep zone of the upper surficial aquifer. Monitoring wells MW-37D, MW-40D, and MW-44D are screened in the lower surficial aquifer unit. MW-63I/D and MW-64I locations are approximate and will be surveyed in December 2021.
2. Proposed monitoring well MW-66DD will be screened in the lower surficial aquifer.
3. Property owner has not allowed access for sampling since 2017.
4. Aerial photograph approximate date - January 2019. Source: Google Earth.

Proposed Surficial Aquifer Investigation Areas

Hercules/Pinova Facility
Brunswick, Georgia

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Kennesaw, GA | January 2022

Figure 6-16

Path: N:\H\Hercules\Brunswick\GIS\MXD\CAP Figures\January 2022\Figure 6-16 Proposed Surficial Aquifer Investigation Areas.mxd

Legend

- Surficial Aquifer, Upper Unit Well
- Surficial Aquifer, Lower Unit Well
- Pumping Test and Plume Stop Pilot Test Well
- New Monitoring Well (November 2020)
- Approximate Location of Closed Surface Impoundments
- Approximate Extent of Primary Potential Source Area
- Pinova Property
- Hercules Property
- Groundwater Flow Model Grid

Groundwater Flow Model Grid
Hercules/Pinova Facility
Brunswick, Georgia

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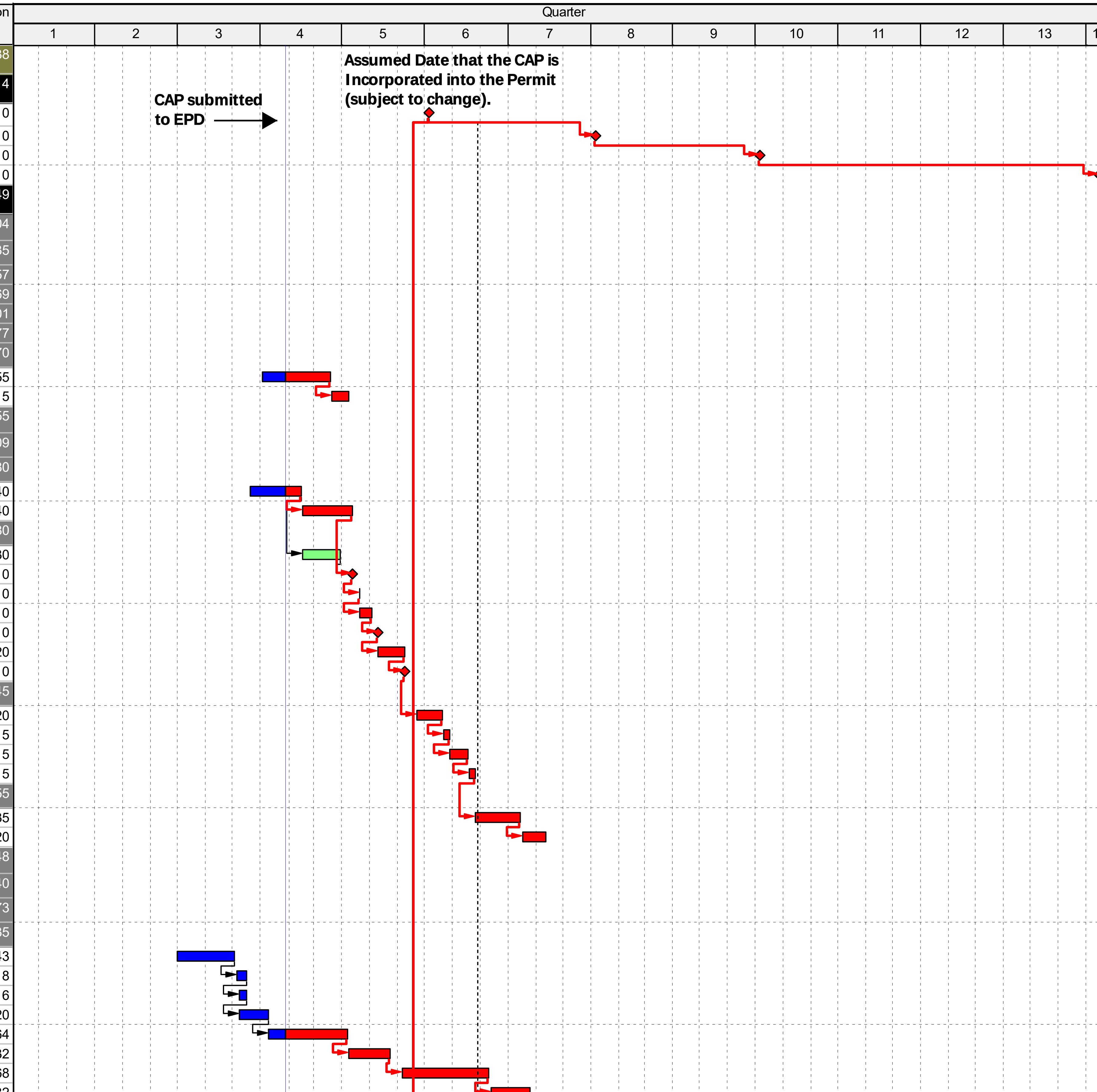
Figure 6-17

Path: N:\H\Hercules\Brunswick\GIS\MXD\CAP Figures\Figure 6-17 Groundwater Flow Model Grid.mxd

Figure 8-1 Brunswick Facility Corrective Measures Estimated Two Year Implementation Schedule 28-Jan-22

Activity ID	Activity Name	Duration
	Hercules - Brunswick Facility Corrective Action Plan	938
	1.0 Administrative Milestones	514
A1000	Corrective Action Plan - Incorporated into the Permit	0
A1010	Informational Meeting	0
A1020	Informational Meeting	0
A1030	Informational Meeting	0
	2.0 Phase 1 - Interim Correcive Measures (ICM)	849
	2.1 SWMU-6 Former Toxaphene Tank Farm ICM	304
	2.1.1 Implementation	235
	2.1.1.1 Pre-Project Planning	57
	2.1.1.2 Contractor Mobilization and Setup	69
	2.1.1.3 Initial Site Work/Pilot Test	101
	2.1.1.4 Site Remediation Activities	77
	2.1.2 Construction Completion Report	70
A1280	ICM Completion Report - Draft Report Preparation	55
A1290	ICM Completion Report - EPD Submission and Review	15
	2.2 Sitewide Soils ICM	455
	2.2.1 Pre-Design Assessment	209
	2.2.2 ICM Work Plan	80
A1450	ICM Work Plan - Draft Plan Preparation	40
A1460	ICM Work Plan - EPD Submission and Review	40
	2.2.3 Design and Procurement	80
A1470	Design Drawings and Technical Specifications	30
A1480	Contractor Bidding Submission to Contractors	0
A1490	Pre-Bid Site Walk	0
A1500	Issued Addendum to Contractor Bidding and Responses to Bidder Questions	10
A1510	Bids Due	0
A1520	Bid Review, Scoring, and Interviews	20
A1530	Notice to Award	0
	2.2.4 Implementation	45
A1540	Pre-Construction Activities	20
A1550	Site Staging	5
A1560	Excavation and Disposal	15
A1570	Demobilization	5
	2.2.5 Construction Completion Report	55
A1580	Completion Report Development - Draft Report Preparation	35
A1590	Completion Report - EPD Submission and Review	20
	2.3 Stillhouse Control Room Area Shallow Groundwater ICM (ISCO)	848
	2.3.1 ICM Work Plan	140
	2.3.2 Design and Procurement	173
	2.3.3 Implementation	335
A1700	Pre-Construction Activities	43
A1710	Well Installation	8
A1720	Well Development	6
A1730	Pre-Implementation Planning	20
A1740	Stage #1 - Step #1 Injections and Monitoring	64
A1750	Data Analysis and Evaluation from Stage #1 Step #1	32
A1760	Stage #1 - Step #2 Injections and Monitoring	68
A1770	Data Analysis and Evaluation from Stage #1 Step #2	32



Completed Work · Non-Critical Path Activity · Critical Path Activity

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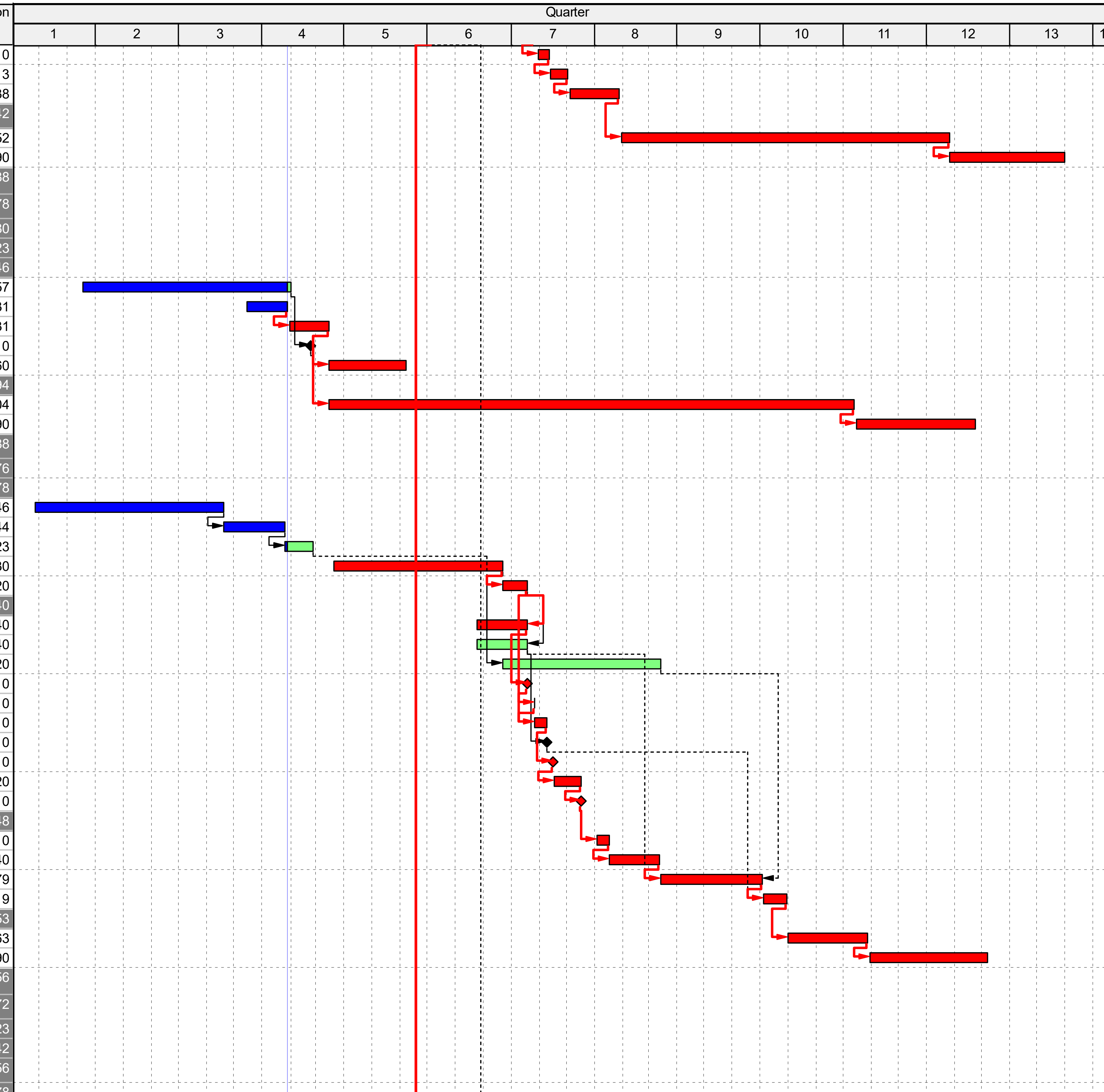
Figure 8-1 Brunswick Facility Corrective Measures Estimated Two Year Implementation Schedule 28-Jan-22

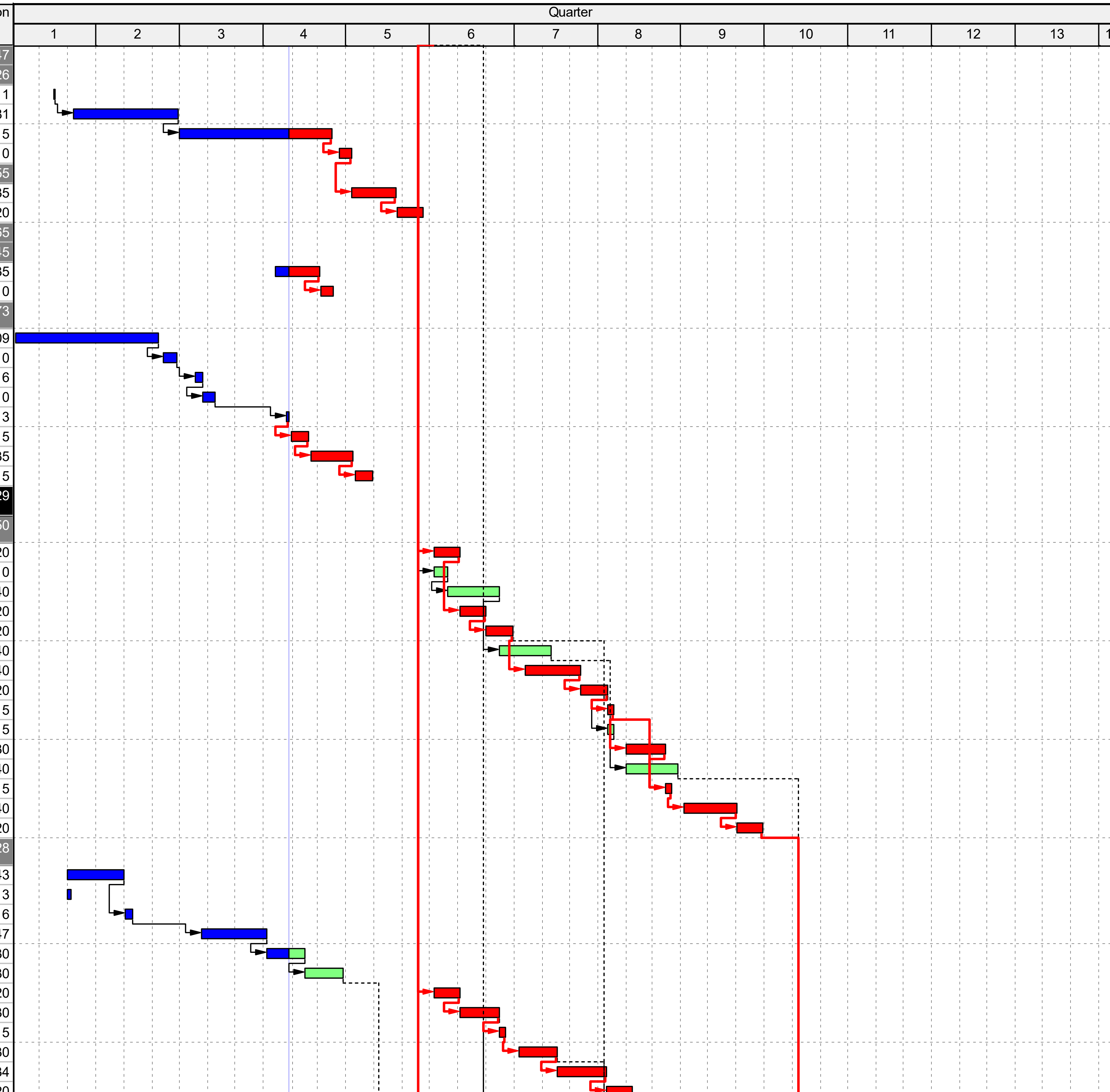
Activity ID	Activity Name	Duration
A1780	Stage #2 Well Installation and Development	10
A1790	Stage #2 Injections and Monitoring	13
A1800	Data Analysis and Evaluation from Stage #2	38
	2.3.4 Groundwater Monitoring and Effectiveness Reporting	342
A1810	Groundwater Monitoring and Effectiveness Reporting	252
A1820	Additional Groundwater Effectiveness Monitoring TBD	90
	2.4 Upper Surficial Aquifer Deep Zone ICM	788
	2.4.1 Anerobic Biobarrier for Chloroform and Methylene Chloride	778
	2.4.1.1 ICM Work Plan	180
	2.4.1.2 Design and Procurement	123
	2.4.1.3 Implementation	246
A1910	UIC Permit Drafted and Submitted	157
A1920	Pre-Construction Activities	31
A1930	Anerobic Biobarrier Well Installation and Development	31
A1940	UIC Permit Received	0
A1950	Anerobic Biobarrier Well Injections	60
	2.4.1.4 Groundwater Monitoring and Effectiveness Reporting	494
A1960	Groundwater Monitoring and Effectiveness Reporting	404
A1970	Additional Groundwater Effectiveness Monitoring TBD	90
	2.4.2 Aerobic Biobarrier Using Biosparging for Chlorobenzene and Benzene	788
	2.4.2.1 Pre-Design and Evaluation	76
	2.4.2.2 ICM Work Plan	378
A2020	ICM Work Plan - Draft Plan Preparation	146
A2030	ICM Work Plan - EPD Submission and Review	44
A2035	ICM Work Plan - Respond to EPD Comments	23
A2040	Offsite Property Investigation	130
A2050	ICM Work Plan - Revised Submission and EPD Review	20
	2.4.2.3 Design and Procurement Including Power Drop	140
A2060	Design Drawings and Technical Specifications	40
A2070	UIC Permit Drafted and Submitted	40
A2080	Power Drop Coordination	120
A2090	Contractor Bidding Submission to Contractors	0
A2100	Pre-Bid Site Walk	0
A2110	Issued Addendum to Contractor Bidding and Responses to Bidder Questions	10
A2120	UIC Permit Received	0
A2130	Bids Due	0
A2140	Bid Review, Scoring, and Interviews	20
A2150	Notice to Award	0
	2.4.2.4 Implementation	148
A2160	Pre-Construction Activities	10
A2170	Installation of Additional Wells and Preformance Monitoring	40
A2180	Aerobic Biobarrier System Construction	79
A2190	System Startup	19
	2.4.2.5 Groundwater Monitoring and Effectivess Reporting	153
A2200	Groundwater Monitoring and Effectiveness Reporting	63
A2210	Additional Groundwater Effectiveness Monitoring TBD	90
	2.5 Vapor Intrusion Tier I ICM	356
	2.5.1 Chemical Lab and Stillhouse Control Rooms Mitigation	172
	2.5.1.1 SSDS System Procurement and Installation	23
	2.5.2.2 SSDS System Construction Report	142
	2.5.2 Other Tier I Buildings Mitigation	356
	2.5.2.1 Finalize Tier 1 Building Investigation Report	78



Completed Work | Non-Critical Path Activity | Critical Path Activity

Figure 8-1 Brunswick Facility Corrective Measures Estimated Two Year Implementation Schedule 28-Jan-22

Activity ID	Activity Name	Duration
2.5.2.2 E&I Shop Mitigation Work Plan		147
2.5.2.3 E&I Shop SSDS Design, Procurement and Construction		226
A2400	Pre-Design Data Collection	1
A2410	SSDS Design Drawings and Technical Specifications - Draft Preparation	81
A2420	Equipment Procurement	115
A2430	SSDS System Installation and Commissioning	10
2.5.2.4 E&I Shop SSDS Construction Report		55
A2440	System Construction Report - Draft Report Preparation	35
A2450	System Construction Report - EPD Submission and Review	20
2.5.2.5 Other Buildings Modifications Design, Procurement and Construction		165
2.5.2.6 Other Buildings Modifications Construction Report		45
A2490	Building Modifications Report - Draft Report Preparation	35
A2500	Building Modifications Report - EPD Submission and Review	10
2.6 Vapor Intrusion Tier II Buildings		273
A2510	Tier 2 Building VI Investigation Work Plan - Draft Plan Preparation	109
A2520	Tier 2 Building VI Investigation Work Plan - EPD Submission and Review	10
A2530	Tier 2 Building VI Investigation	6
A2540	Tier 2 Building VI Data Evaluation	10
A2550	Tier 2 Building VI Investigation (Heating Season)	3
A2560	Tier 2 Building VI Data Evaluation (Heating Season)	15
A2570	Tier 2 Building VI Sampling Report - Draft Report Preparation	35
A2580	Tier 2 Building VI Sampling Report - EPD Submission and Review	15
3.0 Phase 2 - Activities to Inform Future Corrective Measures		529
3.1 Source Area Investigation		250
A2590	Field Planning for MiHPT	20
A2600	Field Planning for NAPL	10
A2610	NAPL Physical and Chemical Property Sampling (Existing Wells)	40
A2620	MiHPT Investigation	20
A2630	Temporary Well Installation and Sampling	20
A2640	NAPL Bail Down Testing (Existing Wells)	40
A2650	Data Analysis and Permanent Well Location Selection	40
A2660	Permanent Well Installation and Surveying	20
A2670	Groundwater Monitoring Event #1	5
A2680	NAPL Physical and Chemical Property Sampling (New Wells)	5
A2690	Laboratory Analysis and Data Evaluation	30
A2700	Data Evaluation Reporting and Recommendations	40
A2710	Groundwater Monitoring Event #2	5
A2720	Laboratory Analysis and Data Evaluation	40
A2730	Reporting and Recommendations	20
3.2 Upper Surfical Aquifer Investigation		428
A2740	MW-35I Investigation Work Plan - Draft Plan Preparation	43
A2750	City of Brunswick Access Agreements	3
A2760	MW-35I Investigation Work Plan - EPD Review and Approval	6
A2770	MW-35I Investigation	47
A2780	MW-35I Data Analysis and Validation	30
A2790	MW-35I Investigation Report (included in the semi-annual GW Report) - Draft Report Prepar	30
A2800	Field Planning for Additional Investigations	20
A2810	Well Installation, Development, and Survey	30
A2820	Groundwater Characterization Sampling	5
A2830	Data Analysis and Validation	30
A2840	Upper Surfical Aquifer Reporting - Draft Report Preparation	34
A2850	Upper Surfical Aquifer Reporting - EPD Submission and Review	20



Completed Work   Non-Critical Path Activity   Critical Path Activity

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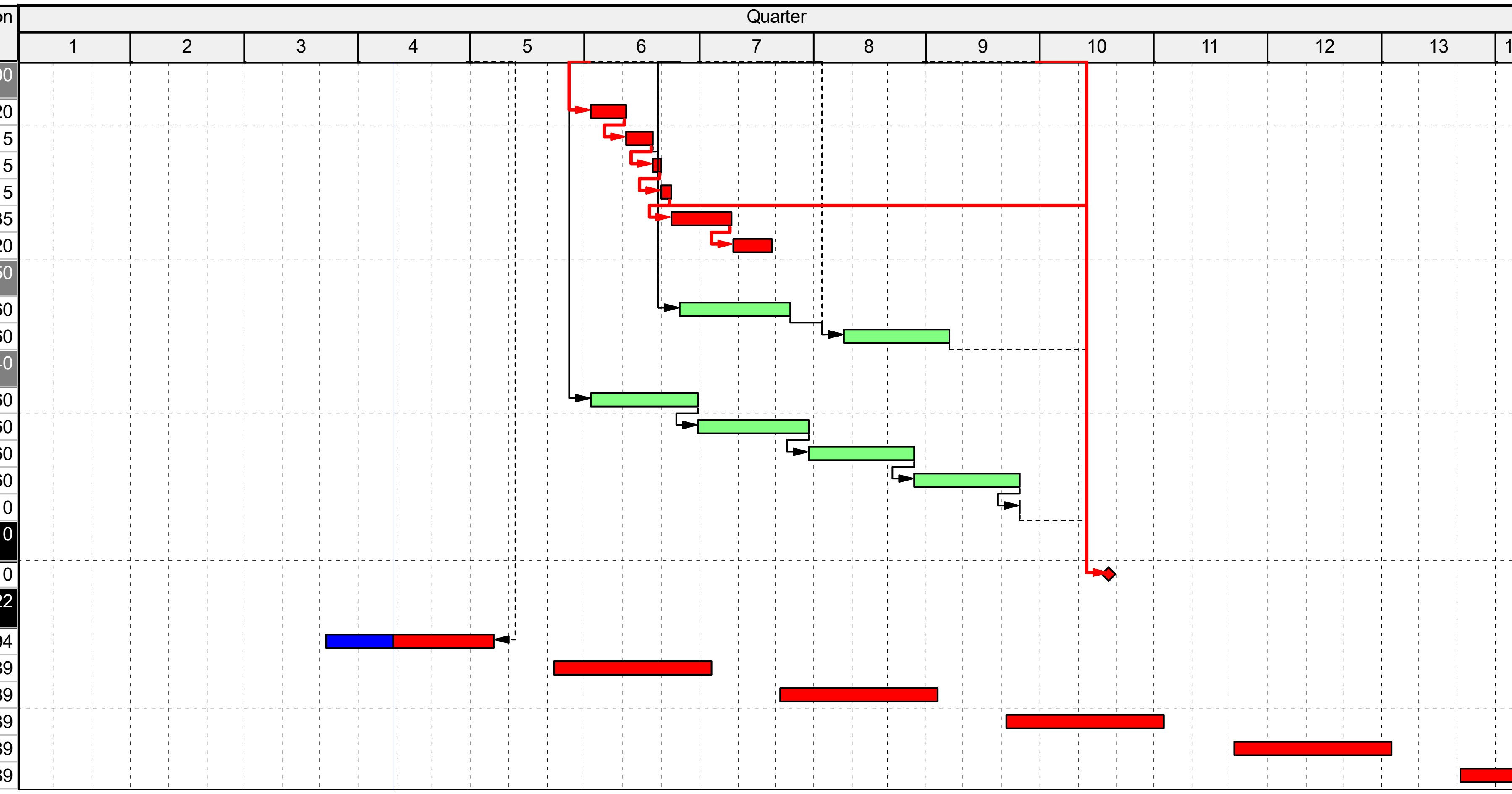
Figure 8-1 Brunswick Facility Corrective Measures Estimated Two Year Implementation Schedule 28-Jan-22

Activity ID	Activity Name	Duration
3.3 Lower Surfical Aquifer Investigation		100
A2860	Field Planning for Additional Investigations	20
A2870	Well Installation and Surveying	15
A2880	Groundwater Characterization Sampling	5
A2890	Data Analysis and Validation	5
A2900	Lower Surfical Aquifer Reporting - Draft Report Preparation	35
A2910	Lower Surfical Aquifer Reporting - EPD Submission and Review	20
3.4 Fate and Transport Groundwater Model		150
A2920	Groundwater Flow Model	60
A2930	Fate and Transport Model	60
3.5 Risk Assessment and Corrective Action Objectives		240
A2940	EPD Meeting - Data Usability and Chemicals of Potential Concern	60
A2950	EPD Meeting - Receptors and Exposure Pathways	60
A2960	EPD Meeting - Exposure Point Concentrations	60
A2970	EPD - Groundwater Usability	60
A2980	Revised Risk Assessment and Corrective Action Objectives Development	0
4.0 Phase 3 - Future Corrective Measures		0
A2990	PLACEHOLDER START MILESTONE FOR PHASE 3 CORRECTIVE MEASURES	0
5.0 Groundwater Monitoring		722
A3000	Semi-Annual Groundwater Monitoring and Reporting (December 2021)	94
A3010	Semi-Annual Groundwater Monitoring and Reporting (June 2022)	89
A3020	Semi-Annual Groundwater Monitoring and Reporting (December 2022)	89
A3030	Semi-Annual Groundwater Monitoring and Reporting (June 2023)	89
A3040	Semi-Annual Groundwater Monitoring and Reporting (December 2023)	89
A3050	Semi-Annual Groundwater Monitoring and Reporting (June 2024)	89



Notes:
1. Completed activities in the schedule are compressed to their work breakdown structure.
2. Duration is shown in working days, which excludes weekends and holidays.

Completed Work | Non-Critical Path Activity | Critical Path Activity

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APPENDIX A

New Monitoring Well Construction Logs

APPENDIX B

Well Installation and Aquifer Testing Report

APPENDIX C

Deep Zone of Upper Surficial Aquifer – Groundwater Interim Corrective Measure Work Plan – *In situ* Aerobic Biobarrier

APPENDIX D

Terry Creek Road – Private Water Supply Well Investigations

APPENDIX E

Soil Management Plan

APPENDIX F

Summary of Geochemical Parameters

APPENDIX G

Former Toxaphene Tank Farm Interim Corrective Measure Work Plan and Addendum

APPENDIX H

MPE/Injection Pilot Test Memorandum

APPENDIX I

Shallow Zone of Upper Surficial Aquifer – Groundwater Interim Corrective Measure Work Plan – *In situ* Chemical Oxidation

APPENDIX J

EISB Treatability Study Reports for Shallow Groundwater

APPENDIX K

EISB Treatability Study Reports for Deep Groundwater

APPENDIX L

Deep Zone of Upper Surficial Aquifer – Groundwater Interim Corrective Measure Work Plan – *In situ* Anaerobic Biobarrier

APPENDIX M

Construction Completion Report - Vapor Intrusion

APPENDIX N

Liquid Loading Shed Office Demolition Letter

APPENDIX O

Tier 1 Building Investigation Report