# Corrective Action Plan and Conceptual Site Model

IMTT Savannah North Terminal
Savannah, Chatham County, Georgia
VRP #1440101197

IMTT Epic LLC

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# 1. Introduction

On behalf of IMTT Epic LLC (formerly Epic Midstream LLC), GHD has prepared this corrective action plan (CAP) and updated conceptual site model (CSM) report pursuant to the approved Voluntary Remediation Program (VRP) application for the IMTT Savannah North Terminal located at 7 Foundation Drive, Savannah, Georgia (Site). A vicinity map for the Site is included as Figure 1. An aerial photograph of the Site obtained in 2016 is included as Figure 2. A layout of the Site in its current configuration is shown on Figure 3.

## 1.1 Background

The IMTT Savannah North Terminal has been utilized for petroleum refining and storage activities since the early 1900s. Mexican Petroleum first developed the property as a petroleum refinery in 1929. The property was acquired by American Oil Company (Amoco), which continued petroleum operations. In 1993, the property was acquired by CITGO Asphalt Refining (CITGO), and began asphalt refining operations until acquisition by NuStar Asphalt Refining, LLC in 2008. Asphalt refining operations were temporarily halted in 2012. The property was acquired by Axeon Specialty Products (Axeon) in 2014, which utilized the Site for bulk storage and distribution of petroleum related products. The property was obtained by Epic Midstream LLC (Epic) in December 2015, and Epic changed its company name to IMTT Epic LLC in Jan 2018. The Site is currently used as a bulk storage and distribution facility for petroleum products. The refinery portion of the Site was removed during the first quarter of 2016.

In 1989, light non-aqueous phase liquid (LNAPL) was discovered at the Site and a subsequent investigation by Amoco concluded that detected LNAPL was the result of the “gradual accumulation of residual oil over several decades.” Subsurface investigations and LNAPL control and recovery operations have been conducted in various capacities since the discovery of the LNAPL. Through subsurface investigations, the LNAPL present at the Site has been determined to be petroleum hydrocarbon-based material.

On August 8, 2015, a VRP application and Voluntary Investigation and Remediation Plan (VIRP) was submitted by Axeon to the Georgia Environmental Protection Division (EPD) for the Site. Following submittal of the VIRP, Terracon Consulting (Terracon), on behalf of Axeon, performed additional investigation at the Site and the results were summarized in a Site Investigation Summary Report (SISR) submitted to Georgia EPD on September 15, 2015. Additionally, Langan Engineering and Environmental Services (Langan) evaluated the LNAPL at the Site and identified potential LNAPL recovery approaches at the Site that were described in a Technical Memorandum submitted to Georgia EPD on October 29, 2015. The SISR and Langan Technical Memorandum were submitted to supplement the August 2015 VIRP.

In a correspondence dated November 24, 2015, Georgia EPD stated that the Site had been approved for participation in the VRP with comments and was assigned VRP #1440101197. Epic purchased the Site from Axeon on December 22, 2015 and on January 14, 2016 submitted a revised VRP application and checklist to reflect the ownership change. On December 13, 2017 IMTT Epic LLC submitted a revised VRP application and checklist to notify of a company name change to IMTT Epic LLC, effective January 1, 2018.

## 1.2 Report Overview

This report summarizes the following:

- Site conditions
- Updated conceptual site model
- Human health and environmental risk assessment
- LNAPL transmissivity and recoverability evaluations methodology and results
- Feasibility study of potential remedial alternatives
- Proposed corrective actions at the Site

# 2. Site Conditions

## 2.1 Geology and Hydrogeology

A summary of the regional geology and hydrogeology was provided in the Voluntary Remediation Program Application (Terracon, August 2015).

### 2.1.1 Site Geology

The United States Geological Survey (USGS) Natural Resources Conservation Service (NRCS) Web Soil Survey describes the soils throughout the developed portions of the Site as being Ocilla-urban land complex. Ocilla soils are described as being derived from marine deposits and are somewhat poorly drained, with moderately high to high hydraulic transmissivity and low water storage capacity. The typical soil profile is described as surficial loamy fine sand underlain by sandy clay loam.

The general shallow geology of the Site is comprised of alluvial deposits from the Savannah River that consist of well graded fine soil particles deposited in layers by the flow of water in the river over time. The shallow soil stratigraphy at the Site is depicted on several cross-sections which are based on available information obtained during historical monitoring well and borehole installations, and are available as Figures 7 through 9. Soil layers between wells and boring locations were interpolated based on available information.

Based on the available information, the upper 20 feet of soil generally consists of sand layers with varying percentages of clay and silt. Clay and silt lenses are observed at various locations and depths throughout the Site and a poorly graded sand layer underlies the upper 10 to 15 feet of well graded sandy soils. Soil stratigraphy at depths greater than approximately 20 feet is unknown.

### 2.1.2 Site Hydrogeology

Quarterly depth to water measurements have been recorded since March 2016 for all existing Site monitoring wells. A groundwater potentiometric elevation and contour map based on data collected in February 2018 is included as Figure 4. The depth to water is typically between 4 to 15 feet below grade and is tidally influenced by the Savannah River. Groundwater potentiometric maps developed for the Site have generally shown that groundwater in the northern and central portions of the Site flows to the east-northeast, toward the Savannah River. Groundwater mounding is observed in the

southern portion of the developed areas of the Site, near AW-5, and monitoring data indicates that shallow groundwater south of this mound flows to the southwest, toward a drainage area south of the Site.

The average horizontal hydraulic gradient for the Site is approximately 0.005 ft/ft, consistent with historical observations. The hydraulic conductivity at the Site has been reported previously as approximately 0.3 ft/day.

Due to the Site's location adjoining the Savannah River near the river's mouth, GHD conducted an assessment of tidal influence on Site groundwater. The assessment was performed by installing transducers in several of the Site wells to collect continuous water depth information over a 33-day period. Data was collected from AW-69 and AW-71, located along the riverfront, AW-20, located approximately 600 feet from the riverfront, and AW-30, located approximately 1,700 feet from the riverfront.

The data collected confirmed the findings from a similar tidal study completed in 2009 which indicated that the tidal influences at the Site do affect the groundwater table beneath the Site, but the natural variation in groundwater elevation diminishes with increasing distance from the Savannah River, as would be expected. The study also indicated that the presence of the polywall barrier appears to dampen the tidal effect.

## 2.2 Nature and Extent of Impact

### 2.2.1 Soil

Limited soil sampling has been completed at the Site to date; however, soil samples have been collected along the property boundary and at select locations within the Aboveground Storage Tank (AST) Farm as summarized in previous submittals. The analysis of the soil samples indicated no exceedances of the Type 3 Risk Reduction Standards (RRS). Given the large LNAPL plume present at the Site, it is likely that residual soil impacts are present as a result of historical operations. Potential soil impacts would most likely be present beneath or near the ASTs at the Site and near the truck loading rack.

### 2.2.2 Groundwater

Limited groundwater sampling has been performed at the Site to date and indicates that concentrations of arsenic, benzene, and naphthalene are present at concentrations above the Type 3 RRS in groundwater at select locations on the Site. Given the large LNAPL plume present at the Site, it is likely that residual dissolved groundwater impacts are present as a result of historical operations and the released LNAPL.

### 2.2.3 LNAPL

The presence of LNAPL resulting from historical releases of petroleum products is the primary concern at this Site. LNAPL impacts at the Site were reportedly first discovered in 1989 and the material consists of highly weathered petroleum products historically released from bulk ASTs which have been in use at the Site since the 1930s or other related activities. Due to the suspected age of the spill(s), the volatile constituents of the LNAPL mass appear to have decreased substantially at the Site, and the remaining mass is predominantly composed of semi-volatile compounds and long-chain hydrocarbons.

#### 2.2.3.1 LNAPL Behavior

LNAPL which has been released to the subsurface generally percolates vertically through the soil column following a release. As it travels through the soil, frictional and capillary forces resist the movement of LNAPL and a portion of the released LNAPL mass becomes contained within the interstitial space of the soil particles. This trapped LNAPL is unlikely to be dislodged from the interstitial space and is considered to be residual and not hydraulically recoverable. LNAPL not trapped between soil particles will spread laterally upon encountering the water table, though some of the LNAPL will displace water in the interstitial space below the water table and create additional residual LNAPL in the saturated zone. The mobile, or hydraulically recoverable, LNAPL will migrate laterally at the vadose and saturated zones, with fractions of LNAPL both above and below the groundwater table.

When the source of the LNAPL releases has been abated, the LNAPL plume will typically stabilize very quickly as the resistive forces of the soil and the LNAPL head at the source diminishes. Additional changes in the LNAPL plume are then effected through natural source zone depletion (NSZD) processes such as volatilization, dissolution, and biodegradation and the smearing of the LNAPL vertically due to fluctuation in the water table.

The NSZD processes result in the reduction in the mass of LNAPL over time whereas the LNAPL smearing process decreases the mobility and recoverability of the LNAPL by smearing it over a greater volume of soil.

While the LNAPL is contained within a large, non-homogenous mass throughout the vadose zone and upper saturated zone, introduction of a void space, such as that created by a screened monitoring well, within these zones will result in the accumulation of LNAPL within the void. The thickness of the LNAPL layer accumulated within the void or well can be used to estimate the amount of LNAPL within the area surrounding the well, but is typically not representative of the actual volume of total and/or mobile LNAPL in the formation.

#### 2.2.3.2 LNAPL Properties and Characteristics

In June 2009, LNAPL samples were collected from AW-12, AW-13, AW-51, AW-65, and AW-68 for laboratory analysis of viscosity (at 40ºC) and specific gravity (at 60ºF). The viscosity and specific gravity of product from AW-12, AW-51, AW-65, and AW-68 ranged from 2.04 to 4.05 centistokes (cSt) and 0.8275 to 0.8806, respectively. The four similar product samples displayed specific gravity and viscosity values consistent with a diesel-range LNAPL (kerosene and jet fuel would also be expected to have values in approximately the same range).

The general appearance and characteristics of the product in AW-13 is of a much more viscous consistency than in other wells at the Site. Product from AW-13 has a viscosity of 1,411 cSt and a density of 1.0826, which is consistent with a No. 6 fuel oil and some crude oils. Due to the disparate physical qualities of this product, recovery of this product using most conventional hydraulic recovery techniques would be extremely limited and problematic.

Field observations show that the LNAPL from the majority of the wells at the Site has similar characteristics to the LNAPL contained in the four similar wells. The average specific gravity of product at the site (with the exception of AW-13) is assumed to be 0.854, which is an average of the four similar product samples. This value is used to correct the groundwater elevation at the Site for all of the wells that did not have specific gravity determinations.

#### 2.2.3.3 LNAPL Extent

Available LNAPL monitoring data at the Site is limited to 1990 through 1995, 2003, 2008 through 2009, and 2015 through the present. Measureable LNAPL and the observed in-well LNAPL thicknesses have been highly variable over time, and many historically impacted monitoring wells no longer contain LNAPL. Figure 5 depicts a representation of the observed in-well LNAPL thicknesses during the February 2018 monitoring event and the inferred extent of LNAPL at the Site. Figure 10 depicts the same areal extent of LNAPL determined by the February 2018 data and the maximum extent of LNAPL based on all historical data available. Historically, LNAPL has been detected in monitoring wells across the majority of the Site with an inferred extent of over 35 acres. The measurements obtained in February 2018 indicated an extent of approximately 15.3 acres. Based on these observations, there has been and an overall reduction in the LNAPL areal extent of over 57%.

In-well LNAPL thicknesses have varied significantly since monitoring began, with the greatest thicknesses observed at or down gradient of presumed source areas near the existing/former AST locations and the truck loading rack. The following presents the reduction from the maximum observed in-well LNAPL thicknesses:

| Well ID | Historical Maximum In-Well LNAPL Thickness (feet) | Maximum In-Well LNAPL Thickness Since 2017 (feet) | % Reduction |
|---|---|---|---|
| AW-5 | 3.32 | 1.70 | 49% |
| AW-6 | 4.25 | 2.17 | 49% |
| AW-8 | 3.84 | 0.05 | 99% |
| AW-9 | 7.69 | 3.43 | 55% |
| AW-10 | 7.86 | 4.12 | 48% |
| AW-11 | 5.52 | 3.89 | 30% |
| AW-12 | 10.73 | 8.64 | 19% |
| AW-13 | 12.50 | 10.14 | 19% |
| AW-15 | 3.84 | 1.21 | 68% |
| AW-18 | 5.16 | 1.71 | 67% |
| AW-19 | 1.24 | -- | 100% |
| AW-22 | 13.05 | 3.76 | 71% |
| AW-30 | 0.59 | -- | 100% |
| AW-32 | 10.61 | 0.13 | 100% |
| AW-34 | 1.28 | -- | 100% |
| AW-38 | 11.68 | 0.15 | 99% |
| AW-42 | 0.01 | -- | 100% |
| AW-45 | 2.40 | -- | 100% |
| AW-49 | 4.28 | 2.33 | 46% |
| AW-51 | 10.21 | 1.52 | 85% |
| AW-52 | 4.99 | 3.12 | 37% |
| AW-53 | 0.62 | 0.57 | 8% |
| AW-54 | 14.02 | 13.75 | 2% |
| AW-55 | 3.68 | -- | 100% |
| AW-56 | 6.30 | 6.20 | 2% |

| Well ID | Historical Maximum In-Well LNAPL Thickness (feet) | Maximum In-Well LNAPL Thickness Since 2017 (feet) | % Reduction |
|---|---|---|---|
| AW-57 | 3.35 | 0.89 | 73% |
| AW-62 | 8.04 | 0.04 | 100% |
| AW-65 | 4.85 | 2.20 | 55% |
| AW-68 | 8.22 | 8.22 | 0% |
| AW-74 | 4.42 | 3.79 | 14% |
| AW-82 | 3.08 | 3.05 | 1% |

The average reduction is approximately 58% with 17 of the 31 wells exhibiting a reduction of greater than 50% and 10 of those wells exhibiting a greater than 95% reduction.

These observations suggest that the LNAPL plume is stable and in a declining condition that supports the conclusion that the LNAPL at the Site is immobile and not likely to migrate nor is it expected to be recoverable to a large extent.

#### 2.2.3.4 LNAPL Containment

Monitoring data for AW-62 dates back to 1991, and the data shows a consistent LNAPL thickness in this well of between 0.53 and 8.04 feet until 1995. In 1996, an underground polywall barrier was installed along the north side of the Site in an effort to prevent the LNAPL mass from migrating off-Site and into the Savannah River as shown on Figure 3. The polywall was constructed to a depth of approximately 20 feet below grade and consists of a continuous impermeable geotextile membrane. Following installation of the polywall, residual LNAPL was observed in AW-62 at thicknesses between 0.30 and 2.6 feet through 2015. Due to the presence of LNAPL in AW-62, POD-1 was installed in 2015 to further monitor residual LNAPL outside of the polywall in this area.
No measurable product was observed by GHD in either of these wells from March until September 2016, when 0.22 feet of product was observed in AW-62. Thereafter, GHD conducted weekly monitoring of both wells and installed absorbent socks in each well to recover any accumulated LNAPL.

Observations from periodic monitoring events support the assertion that the LNAPL in the vicinity of AW-62 and POD-1 is isolated from the up-gradient LNAPL plume and that mobile LNAPL has significantly diminished in this area since the installation of the polywall. No other LNAPL has been detected in monitoring wells located on the river side of the polywall nor has LNAPL been observed discharging into the Savannah River, indicating that the containment strategy for the Site has been successful.

# 3. Conceptual Site Model and Risk Assessment

## 3.1 Potential Exposure Pathways

Several potential exposure pathways were identified for the Site as described in the Voluntary Remediation Program Application (Terracon, August 2015) that was submitted on behalf of Axeon. These pathways included the potential exposure of receptors to contaminants in soil, groundwater, vapor, sediment, and/or surface water from impacts originating on the Site. As the Site and surrounding parcels are zoned as heavy industrial no residential receptors were identified. Potential receptors applicable for the Site are the current/future on-site industrial or construction workers, current/future off-site industrial or construction workers, current/future trespassers, and ecological receptors.

### 3.1.1 Soil Ingestion, Inhalation, or Direct Contact

The soil exposure pathway for current/future on-site industrial or construction workers, current/future off-site industrial or construction workers, and current/future trespassers is potentially complete. LNAPL is present beneath a large portion of the Site. Specific sources for the LNAPL impacts have not been identified but are likely associated with historical and current AST locations, piping systems, and the truck loading rack.

As described in the *2016 First Semi-Annual Progress Report,* shallow soil samples were collected from several locations at the Site along a suspected underground pipe and submitted for analysis of volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), and Resource Conservation and Recovery Act (RCRA) metals. The analytical results indicated that none of the analytes were present in soil at concentrations above the Type 3 RRS. Soil within the vadose and saturated stratigraphic layers within the current, and potentially within the historical footprint of the LNAPL mass likely contain residual petroleum products in the form of LNAPL. This LNAPL is trapped in the interstitial space of the soil particles, is not mobile, and is anticipated to break down over time through natural biodegradation.

No evidence of new or ongoing releases from the ASTs on the Site has been reported. All in-use ASTs at the Site have been systematically updated to conform to current tank construction and integrity regulations and Site personnel conduct appropriate monitoring and inspections to ensure that no releases are occurring. No large portions of underground petroleum product piping remain in-use at the Site which may result in an undetected release.

Residual LNAPL may be present in shallow soil in select areas of the Site, such as beneath existing ASTs. Therefore, the soil exposure pathway is potentially complete as the potential remains for exposure to LNAPL or Site contaminants via soil which may be disturbed by construction activities performed at the Site.

### 3.1.2 Groundwater/LNAPL Ingestion, Inhalation, or Direct Contact

No potable drinking water wells have been identified within the immediate vicinity of the Site. Drinking water at the Site and surrounding industrial properties is provided by the City of Savannah municipal supply. One non-potable process water well cased to the underlying Floridian aquifer is located on the Site; but has not been used since 2011.

The Site and surrounding industrial properties utilize groundwater extraction wells for non-potable consumptive use. The on-Site water well and off-Site water wells are cased to withdraw from the upper Floridian aquifer, which exists below a confining unit at a depth of greater than 200 feet below grade. As discussed in the *2016 First Semi-Annual VRP Progress Report*, GHD collected a water sample from the on-Site water well for analysis of RCRA metals, SVOCs, and VOCs. The laboratory results indicated no detectable impacts to groundwater within this aquifer layer. Based on the depth of the water wells on and off Site, presence of a confining unit, and the analytical data for the on-Site well, no exposure to Site contaminants is anticipated as a result of the use of the on and off-Site water wells.

Groundwater samples have been collected from several permanent and temporary monitoring wells at the Site and were analyzed for RCRA metals, SVOCs, and VOCs. Analyses of the groundwater sampling conducted previously at the Site indicates potential dissolved phase benzene and naphthalene at concentrations exceeding the Type 3 RRS developed for the Site. The dissolved impacts appear to be limited to the eastern edge of the Site, down gradient of the LNAPL mass; however, the groundwater quality data is limited, due to limitations of the sampling effort.

Due to the continued presence of LNAPL as a dissolved contaminant source in many of the Site wells, reliable groundwater quality information cannot be determined prior to the removal of LNAPL in and around these wells.

LNAPL is present in groundwater beneath a large portion of the Site, but is present greater than 5 feet below grade. However, the potential exists that for exposure to LNAPL or Site contaminants which may be encountered during construction activities performed at the Site. Therefore, the groundwater/LNAPL exposure pathway is potentially complete.

### 3.1.3 Vapor Intrusion Assessment

Structures at the Site that are routinely occupied include the administration building, laboratory, and operations building. There is also a guard house/locker building; however, it is not routinely occupied.

As discussed in the *2016 Second Semi-Annual VRP Progress Report*, groundwater samples were collected from wells AW-27, AW-33, and AW-34 surrounding the administration building in October 2016 to evaluate the potential for vapor intrusion of the administration building. There were no detected concentrations of Site-related constituents (i.e., benzene, toluene, ethylbenzene, xylenes, or naphthalene) in the groundwater collected from these three wells. Groundwater monitoring of AW-27, AW-33, and AW-34 since March 2016 has shown no evidence of LNAPL accumulation. Therefore, there are no source concentrations at this building that could result in vapor intrusion and the vapor intrusion pathway is incomplete.

LNAPL has been intermittently detected in AW-38 which is located between the laboratory and operations buildings at thicknesses between a sheen and 0.15 feet since March 2016. Because the depth to LNAPL is approximately 4 to 5 feet below grade, which is less than the vertical screening distance recommended by the Interstate Technology Regulatory Council (ITRC) *Petroleum Vapor Intrusion Guidance Document, PVI-1*, a potential vapor intrusion exposure from the LNAPL may exist at these structures. To further evaluate the potential for vapor intrusion from LNAPL into these buildings, soil vapor samples were collected.

The results of the soil vapor sampling activities were compared to conservative generic soil vapor criteria that are protective of indoor worker exposures. The soil vapor criteria were calculated using the United States Environmental Protection Agency (USEPA) Regional Screening Levels (RSL) for Composite Worker Ambient Air (at the lower of a Hazard Index [HI] of 1 and a cancer risk level of $10^{-5}$) and USEPA's conservative soil vapor attenuation factor of 0.002 for petroleum hydrocarbons into a residential building. Neither USEPA nor Georgia EPD provide generic attenuation factors for nonresidential buildings. The detected concentrations in soil vapor were compared to generic screening criteria and soil vapor criteria based on USEPA's conservative residential soil vapor attenuation factor of 0.03 for non-petroleum VOCs, as points of reference.

All detected concentrations of constituents in soil vapor were below the generic soil vapor criteria calculated using a conservative attenuation factor for petroleum hydrocarbons. Similarly, no detected concentrations in soil vapor exceeded the more conservative generic soil vapor criteria using the attenuation factor for non-petroleum VOCs.

Based on the screening evaluation completed above, the results do not indicate the presence of any unacceptable risk to workers via potential vapor intrusion into the laboratory or operations buildings at the Site.

### 3.1.4 Future Contaminant Migration

In 1996, Horizontal Subsurface Systems, Inc. installed a 20-foot (ft) deep and approximately 1,500 ft long high density polyethylene (HDPE) polywall at the Site along the Savannah River. The polywall was positioned at the downgradient edge of the Site to prevent the migration of LNAPL to the Savannah River. Portions of the polywall were exposed through excavation by Axeon in June and July of 2015. Upon inspection, the exposed sections of the polywall reportedly did not show any signs of delamination, degradation, or deterioration. The polywall provides a physical barrier preventing the potential migration of the LNAPL mass to the north and into the Savannah River.

Based upon available information, it appears that monitoring wells AW-62, POD-1, AW-70, AW-67, and AW-75 through AW-79 are all located on the river side of the polywall barrier. POD-1 and AW-75 through AW-79 were all installed in 2015 to monitor the polywall integrity. LNAPL has not been detected on the river side (down gradient side) of the polywall barrier since the polywall installation, with the exception of periodic detections in AW-62 and POD-1. Due to the diminishing amount of LNAPL in these wells and their intermittent detections, the LNAPL in the vicinity of these wells appears to be left over from prior to the polywall installation and not indicative of breakthrough of the polywall barrier.

Given the presence of residual LNAPL on the river side of the polywall near AW-62, the exposure pathway for contaminant migration to the Savannah River is potentially complete. However, no sheen or other evidence of a release of LNAPL to the Savannah River has been reported since the installation of the polywall barrier. Based on available information, it appears that the installed structure is effective at containing the bulk of the LNAPL mass and preventing potential off-Site migration of LNAPL as there is no effective LNAPL head on the river side of the polywall effecting the migration of trapped residual LNAPL. Monitoring will be continued to determine if conditions change and warrant further evaluation of this potential exposure pathway.

## 3.2 Human Receptors

Potential human receptors identified at the Site include current/future on-site industrial or construction workers, current/future off-site industrial or construction workers, current/future trespassers.

Based on the presence of LNAPL in the subsurface and that the former/existing ASTs, piping systems, and truck loading rack are the likely source of the LNAPL, there exists the potential for human exposure to contamination on-site. Construction undertaken at the Site could result in construction workers encountering impacted soil or groundwater.

Monitoring of LNAPL indicates that the LNAPL plume is contained within the limits of the Site. Historical monitoring has indicated LNAPL in wells located near the periphery of the property, which has since attenuated or become immobile within the soil matrix. Given that LNAPL was reportedly measured in AW-45 located along the eastern property boundary, the potential for off-site impacts in groundwater exists. Groundwater along the property boundary will be monitored and samples analyzed to confirm the presence of impacts; therefore, there exists the potential for exposure to current/future off-site industrial or construction workers.

Access to the Site is controlled via fencing and locked gates. Authorized visitors and employees are granted entry through the main gate along Foundation Drive and are required to sign in and out at the main administrative office or the operations building. Access to the Site by the public is restricted and all personnel on-Site are made aware of potential hazards at the Site. Because access to the Site is restricted, the likelihood of current or future trespassers is very low.

Additionally, as presented in Section 2.2.3.3, the areal extent of the LNAPL plume is decreasing over time due to LNAPL recovery efforts and natural processes. Therefore, the source of dissolved groundwater impacts is declining over time which suggests that the potential migration of dissolved groundwater impacts is low.

## 3.3 Ecological Receptors

The VRP Application submittal presented information on the potential ecological receptors at the Site and in the adjoining Savannah River. As noted in Section 3.1.4, potential impacts to the Savannah River have been mitigated through the installation of the polywall barrier. Because residual LNAPL has been observed on the river side of the polywall, there remains a potential risk for impacts to the Savannah River. However, because the Savannah River is dredged to maintain a suitable shipping channel, is a relatively low quality habitat, and has a high volume of maritime shipping traffic, appreciable exposures to ecological receptors in the Savannah River would be very low.

# 4. LNAPL Transmissivity and Recoverability Evaluation

Evaluation of the long-term practicability of LNAPL recovery at Site wells began in May 2016 and was completed in accordance with the methodologies discussed in the following Sections. The evaluation was completed to determine if high in-well LNAPL thickness was indicative of large volumes of recoverable LNAPL, to determine the recoverability of LNAPL across the Site, and to determine the most effective, science-based approach to completing LNAPL recovery to the extent practicable.

## 4.1 LNAPL Transmissivity and Recoverability

LNAPL skimming to evaluate the transmissivity and recoverability of LNAPL at the Site was conducted using skimmer systems that allow for the recovery of LNAPL from wells without the recovery of groundwater. Basic system operations involve the gravity-fed collection of LNAPL through an inlet at the top of a float at the LNAPL/water interface into coiled tubing. Pressurized air is then pumped at set intervals through the tubing which forces the LNAPL to a collection drum or tank at the surface. Timing of the pressurized air bursts can be adjusted to match the flow of LNAPL into the well from the surrounding formation. Due to the pump intake being maintained by a float at the oil/water interface, in-well thicknesses can only be reduced to approximately 0.2 feet with these systems.

The following Sections describe the field operations and maintenance (O&M) procedures for data collection and the data analytical methods used to determine LNAPL transmissivity and recoverability.

### 4.1.1 Field Data Collection Methodology

Collection of field data from the installed LNAPL skimmer systems was conducted in general accordance with the procedures described in American Society for Testing and Materials (ASTM) E2856-13 *Standard Guide for Estimation of LNAPL Transmissivity* and the manufacturer's system-specific recommendations.

GHD conducted short-term LNAPL skimming tests at all Site monitoring wells which displayed consistent in-well LNAPL thicknesses of greater than approximately 0.33 feet since March 2016. The two wells which are the exception to this are AW-15, for which an evaluation is pending, and AW-74, which only underwent a long-term evaluation due to logistical constraints. In general, the short-term tests were conducted over the course of three to four weeks. GHD determined that several wells at the Site that had been evaluated over a short duration required further evaluation to accurately estimate the long-term LNAPL recoverability and transmissivity. The longer duration evaluations were conducted and evaluated using the same methodology as the short-term tests.

Field data collected for each system during the routine O&M include the following: system uptime; number of discharge and refill cycles; LNAPL volume recovered; and depth to LNAPL and groundwater in the well. The data were used to calculate the following during the operating interval: system operational run time; LNAPL volume recovered; LNAPL recovery rate; LNAPL drawdown within the well; and an estimated LNAPL transmissivity.

For the duration of the initial well evaluations, data was collected on a weekly basis, as practicable. Drawdown data at the beginning of evaluations at certain wells was conducted on an hourly or daily interval before continuing on a weekly schedule. In general, each skimmer system was run continuously for the duration of the test. If a test was interrupted due to inclement weather, a full recovery tank, or system malfunction, the removal of LNAPL re-accumulated in the well during the system down-time was accounted for in the analysis.

### 4.1.2 Data Analysis Methodology

The data collected during the field events was used to develop trends in LNAPL transmissivity and recoverability. Calculations for these parameters are based on equations and methodologies given in ASTM E2856-13 (Standard). The values for each of these parameters are recorded for each well in the data tables included in Appendix A.

Recoverability is the volumetric recovery of LNAPL over a set time interval and is calculated with the following equation:

$$Q_n = \frac{V_n}{\Delta t}$$

Where:

$Q_n$ = LNAPL recovery rate or recoverability ($ft^3$/day)

$V_n$ = Incremental volumetric recovery ($ft^3$)

$\Delta t$ = Skimmer system uptime over the O&M interval (day)

Intervals were set between O&M events and values were calculated weekly to observe trends in recoverability. Initial recoverability at each of the wells evaluated was very high, as the LNAPL present within the well casing/screen, annular space, and area immediately surrounding the wells was extracted. The long-term transmissivity and recoverability was determined based on the data collected after this initial removal of in-well and nearby LNAPL and once the skimmer was recovering LNAPL at a rate in equilibrium with the volume of LNAPL entering the well. The LNAPL recovery at each well would be expected to display a decreasing trend as the hydraulically recoverable proportion of LNAPL within the radius of influence was removed.

Transmissivity is determined using the following equation[1]:

$$T_n = \frac{Q_n * \ln\left(\frac{R_{oi}}{r_w}\right)}{2\pi * s_n}$$

Where:

$T_n$ = LNAPL transmissivity ($ft^2$/day)

$R_{oi}$ = Radius of influence (ft)

$r_w$ = Radius of the well (ft)

$s_n$ = LNAPL drawdown (ft)

[1] ASTM E2856-13: Equation 16

Since the radius of influence is not known for each well and the well radii vary, the Standard indicates that an assumed value of $\ln\left(\frac{R_{oi}}{r_w}\right) = 4.6$ may be used with minimal error.

The LNAPL drawdown ($s_n$) is established based on the density of the LNAPL and the LNAPL thickness in the well prior to skimming operations. The maximum theoretical drawdown assumes complete removal of all in-well LNAPL and is calculated according to the following equation[2]:

$$s_n = b_n(1 - \rho_r)$$

Where:

$b_n$ = Initial in-well LNAPL thickness (ft)

$\rho_r$ = LNAPL specific gravity (unitless)

As discussed in Section 2.1.2, tidal and seasonal variability in the groundwater table is very high at the Site. In order to account for changes in LNAPL thicknesses over time as a result of the groundwater table changes, an average LNAPL thickness for each well was determined using data collected during the quarterly monitoring events since March 2016. Data from events during which skimming evaluations were being conducted were removed from the thickness data averaging. The averaged data was used to develop equilibrium LNAPL thicknesses for each well, which were then used to calculate the averaged maximum theoretical drawdown in each well. This value is given on the equilibrium row of each well's data table in Appendix A.

During the evaluations, variabilities in LNAPL and groundwater elevations were observed. Instantaneous measurements of LNAPL and groundwater interface levels in the wells collected during O&M events in comparison to the averaged equilibrium groundwater elevation resulted in fluctuating LNAPL drawdown values. ASTM E2856-13 recommends modeling tidal and seasonal groundwater fluctuations using transducer data and correcting interface depths using an algorithm. However, since LNAPL thickness was consistently observed to be less than approximately 0.3 feet during normal skimmer operations, the maximum theoretical LNAPL drawdown value was used in lieu of calculated instantaneous drawdown in all calculations.

The ITRC Technical/Regulatory Guidance document *Evaluating LNAPL Remedial Technologies for Achieving Project Goals*, dated December 2009, suggests that hydraulic recovery of LNAPL is technically practicable when transmissivity values exceed the de minimis criterion range of 0.1 to 0.8 $ft^2$/day. When the LNAPL transmissivity is within or below this range, LNAPL is not considered mobile enough for hydraulic recovery (i.e. skimming) to be technically practicable.

Wells which displayed the potential for significant long-term LNAPL recovery via skimming were determined based on the data analysis from the short and long-term evaluations. The most significant factors used in determining if a well was a candidate for on-going skimming operations under the CAP were the transmissivity and recoverability values observed after the initial removal of local LNAPL.

[2] ASTM E2856-13: Equation 17

Due to the significant reduction in LNAPL recoverability after removal of the initial in-well and local LNAPL mass, recoverability rate data was principally evaluated and considered for the long-term skimming tests. If a declining trend in the recoverability rate of LNAPL during consistent skimmer operation is observed, this trend can be extrapolated to determine an estimated volumetric remedial endpoint of LNAPL removal. A candidate well would generally display a potential endpoint volume exceeding the current total recovered volume, thus suggesting a potential for further technically practicable recovery at that well.

### 4.1.3 Graphical Depiction of Evaluation Results

Data from long-term skimming evaluations was used to develop several graphs to visually depict the skimming results and, if appropriate, depict long-term data trends. The data and applicable graphs for each well are included in Appendix A.

- The first graph for each well presents a depiction of the cumulative LNAPL recovery volume (gallons) and the weekly LNAPL recovery rate over time (gallons/day) during the long-term evaluation period. The cumulative volume of LNAPL recovery should become asymptotic with time. Typically, as the volume of LNAPL recovered from a well increases over time, the LNAPL recovery rate will decrease (i.e. LNAPL volumetric recovery decline). This is due to the removal of the recoverable/mobile portion of LNAPL from the subsurface in the vicinity of the well.
- The second graph for each well presents an analysis of the LNAPL volumetric recoverability ($Q_n$) over time. Once stabilization of LNAPL recovery is reached (i.e., the in-well LNAPL has been drawn down and the skimmer is operating continuously during the observation interval), plotting the LNAPL recoverability versus the cumulative LNAPL volume recovered can be used to determine an estimate of the total volume of recoverable LNAPL from the well. When a clear trend is identified based on the data collected, the value of the estimated recoverable volume is shown on the graph.
- The third graph for each well presents an analysis of the weekly LNAPL transmissivity ($T_n$) values compared to total volumetric recovery and, where appropriate, a $T_n$ decline curve. The plot presents the estimated LNAPL $T_n$ values following stabilization of LNAPL recovery rates as compared to the ITRC de minimis criteria of 0.1 and 0.8 $ft^2$/day.

## 4.2 Evaluation Results

All on-Site wells were grouped into one of the groups described in the following subsections based on current and historical LNAPL content, short-term skimming evaluations, and long-term skimming evaluations. Field data and calculated values from the evaluations are presented in Appendix A.

### 4.2.1 Monitoring Well AW-13

Monitoring well AW-13 contains LNAPL with physical properties that include a viscosity of 1,411 cSt and a specific gravity of 1.0826 which are significantly different from the LNAPL found throughout the rest of the Site. The AW-13 LNAPL is extremely thick and tar-like, but does not appear in any of the wells surrounding AW-13, including AW-51, which is located approximately 15 feet away. The source of this LNAPL is unknown and was likely the result of an isolated localized historical release. Due to its viscosity, the LNAPL in this well is not recoverable using skimmers or using conventional LNAPL removal methods.

Based on the viscosity of this LNAPL, its absence in surrounding wells, and the well's proximity to the polywall, the LNAPL in this well is unlikely to migrate or present an uncontrolled risk to human health or the environment. While removal of this product by other costly and unconventional means may be possible, its low mobility and low health hazard risk compared to the cost of removal suggest that no action is required.

### 4.2.2 Wells without LNAPL

The first group of wells are those which have not been observed to contain LNAPL in detectable amounts during quarterly groundwater monitoring events over the past two years. None of these wells are considered to be candidate wells for LNAPL removal. This group includes the following wells: AW-7, AW-14, AW-20, AW-24, AW-25, AW-26, AW-27, AW-28, AW-30, AW-31, AW-33, AW-34, AW-36, AW-37, AW-41, AW-44, AW-45, AW-48, AW-58, AW-67, AW-69, AW-70, AW-71, AW-72, AW-73, AW-75, AW-76, AW-77, AW-78, AW-79, RAIL LOADING-N, and RAIL LOADING-S. Monitoring well RAIL LOADING-M has been damaged since 2016, and has not been monitored; however, the well is located outside of the area of LNAPL impacts.

### 4.2.3 Wells with Intermittent or Low In-Well LNAPL Thicknesses

Wells within this group have been observed to contain LNAPL in detectable amounts during quarterly groundwater monitoring events during the past two years; however, the LNAPL detections have been intermittent or typical in-well LNAPL thicknesses have been below the minimum effective range of the skimming systems deployed at the Site (approximately 0.33 ft). None of these wells are considered to be candidates for on-going LNAPL removal operations:

| Well ID | Maximum Observed In-Well LNAPL Thickness since March 2016, feet – Date of Measurement | Typical Range of Observed In-Well LNAPL Thickness (feet) | Date of Most Recent LNAPL Detection in Well |
|---|---|---|---|
| AW-8 | 0.16 – May 2016 | 0.00 – 0.10 | November 1, 2017 |
| AW-19 | 0.05 – March 2016 | 0.00 – 0.05 | September 22, 2016 |
| AW-32 | 0.13 – May 2017 | 0.00 – 0.01 | May 2, 2017 |
| AW-38 | 0.15 – August 2017 | 0.00 – 0.10 | February 6, 2018 |
| AW-42 | 0.01 – May 2016 | 0.00 – 0.01 | May 1, 2016 |
| AW-53 | 0.57 – May 2017 | 0.20 – 0.40 | February 6, 2018 |

Wells AW-62 and POD-1 also fall under this well category; however, due to the location of these wells on the river side of the polywall containment structure, they are monitored weekly for the presence of LNAPL. Remedial actions for these wells are discussed separately in Section 6.3.3.

### 4.2.4 Wells with Low LNAPL Transmissivity or Recoverability

Wells within this group include those which consistently contain LNAPL at thicknesses above the minimum effective range of the skimmer systems deployed at the Site, but were determined not to be candidates for long-term skimming, based on test data. Monitoring well AW-15 has not undergone LNAPL skimmer evaluations due to logistical constraints; however, based on the location of the well near the periphery of the LNAPL plume and the typical in-well LNAPL thickness, it is likely that the well would fall into this group.

### *Wells Eliminated After Short-Term Evaluations*

In general, all wells containing LNAPL at recoverable in-well thicknesses initially underwent a short-term evaluation. The short-term evaluations were designed to eliminate wells with very low transmissivity and recoverability rates after the removal of the LNAPL mass accumulated in the monitoring well and surrounding area. The following table lists data from wells removed from consideration for long-term skimming as a result of the short-term evaluations:

| Well ID | LNAPL Recovered (gallons) | Test Duration (days) | Average Stabilized Recovery Rate (gal/day) | Stabilized Transmissivity ($ft^2$/day) | Current Estimated Unit Cost of LNAPL Removal ($/gal) |
|---|---|---|---|---|---|
| AW-51 | 21 | 22 | 0.60 | 0.70 | $67 |
| AW-52 | 11 | 28 | 0.22 | 0.07 | $182 |
| AW-57 | 7 | 27 | 0.04 | 0.03 | $1,000 |

While the calculated average transmissivity for AW-51 is within the 0.1 to 0.8 $ft^2$/day maximum ITRC de minimis guideline, the transmissivity is likely over estimated due to the very low theoretical maximum LNAPL drawdown value. Since the average LNAPL thickness in this well is only 0.71 ft, the theoretical maximum LNAPL drawdown is only 0.08 ft. The transmissivity equation is inversely proportional to LNAPL drawdown and is sensitive to low values; therefore, recovery rate was determined to be a more accurate indicator of skimming practicability. The short-term test only recovered approximately 18 gallons of product during a 3-week test (plus an initial 3-gallon LNAPL bail down), and that rate would be anticipated to decrease over time. Therefore, this well was removed from consideration after the short-term evaluation.

The estimated cost of operation of the systems was determined based on an assumed weekly O&M visit for the seven skimmer systems at the Site, project management time, an assumed equipment repair and upkeep cost, and LNAPL disposal costs. The average stabilized recovery rate and operational cost of the systems were used to determine the estimated long term cost of LNAPL recovery at each well on a per-gallon basis. It should be noted that this value is based on the stabilized recovery rate following initial extraction of LNAPL from the well and unit costs would be expected to increase as LNAPL removal continues and the recovery rate decreases.

The stabilized transmissivity was calculated using a geometric mean when numerous non-zero values were available, or a simple average when few non-zero values were available following the initial LNAPL removal from each well.

While the above wells contained appreciable in-well LNAPL thicknesses and the volume of LNAPL recovered from them is not necessarily small, the recoverability and transmissivities of the LNAPL are low. If skimming were implemented on a longer scale for each of these wells, the LNAPL recovery rate would continue to decrease and the unit cost of LNAPL removal would increase substantially. Therefore, long-term LNAPL recovery from these wells is technically impracticable.

### *Wells Eliminated or Considered for Intermittent Recovery After Long-Term Evaluations*

The following wells showed a potential for LNAPL transmissivity and recoverability at technically feasible rates during the short-term evaluations or did not undergo a short-term evaluation, as was the case for AW-74. The long-term evaluations were intended to better establish long-term skimming practicability and recovery potential at prospective candidate wells. The following wells displayed significantly diminished transmissivity and/or recoverability rates during the long-term evaluations and were, therefore, removed from consideration as candidate wells for long-term LNAPL removal operations:

| Well ID | LNAPL Recovered (gallons) | Test Duration (days) | Average Stabilized Recovery Rate (gal/day) | Stabilized Transmissivity ($ft^2$/day) | Current Estimated Unit Cost of LNAPL Removal ($/gal) |
|---|---|---|---|---|---|
| AW-5 | 128 | 38 | 0.40 | 0.20 | $100 |
| AW-6 | 4.3 | 35 | 0.00 | 0.00 | * |
| AW-10 | 324 | 165 | 0.45 | 0.13 | $89 |
| AW-12 | 112 | 62 | 0.38 | 0.08 | $105 |
| AW-18 | 11.4 | 65 | 0.00 | 0.00 | * |
| AW-22 | 275 | 154 | 0.27 | 0.07 | $148 |
| AW-54 | 333 | 124 | 0.00 | 0.00 | * |
| AW-65 | 27 | 22 | 1.1 | 0.42 | $36 |
| AW-68 | 224 | 114 | 0.68 | 0.12 | $59 |
| AW-74 | 7.0 | 77 | 0.00 | 0.00 | * |

* - No long-term recovery of LNAPL is possible as recovery ceased following removal of in-well LNAPL and LNAPL in the immediate vicinity of the well.

Several of the wells in this group displayed initial recovery rates and transmissivity values which indicated the potential for ongoing skimming activities, such as AW-5, AW-10, AW-12, AW-22, AW-54, AW-65, and AW-68. As long-term skimming was continued at each of these wells, volumetric LNAPL recovery declined significantly to the stabilized averages listed above. Unit costs for continued LNAPL removal were unable to be calculated for AW-6, AW-18, AW-54, and AW-74 since LNAPL recovery declined to zero after the first one to two weeks of operation; therefore long-term LNAPL recovery is not possible at these locations.

Due to the observed decrease in recovery and transmissivity at these wells after initial removal of local mobile LNAPL, these wells are not considered to be candidates for continuous long-term skimming operations. Further, LNAPL in these areas is not anticipated to be highly mobile or pose a significant risk of migration, based on the evaluations.

### 4.2.5 Potential Candidate Wells

The following wells showed a potential for practicable long-term LNAPL recovery, based on the evaluations completed:

| Well ID | LNAPL Recovered (gallons) | Test Duration (days) | Average Stabilized Recovery Rate (gal/day) | Stabilized Transmissivity ($ft^2$/day) | Current Estimated Unit Cost of LNAPL Removal ($/gal) |
|---|---|---|---|---|---|
| AW-9 | 1,503 | 489 | 2.8 | 0.46 | $14 |
| AW-11 | 1,061 | 399 | 1.0 | 0.35 | $41 |
| AW-49 | 2,243 | 495 | 2.6 | 0.47 | $15 |
| AW-56 | 1,331 | 400 | 2.8 | 0.36 | $14 |
| AW-82 | 1,224 | 411 | 2.0 | 0.55 | $20 |

The evaluations at the above monitoring wells displayed significantly higher long-term recoverability and transmissivity values than those conducted at other Site monitoring wells. As such, the incremental cost of LNAPL removal in these wells is significantly lower than other well groups. Based on the long-term evaluations at these wells, on-going skimming at each was determined to be technically practicable and economically feasible.

The above data was determined by using stabilized numbers following the initial LNAPL removal from the well casings and immediately surrounding areas and by removing select observations which were skewed due to equipment malfunction or system shut-down. The transmissivity and recoverability rates all show a declining trend which will, over time, increase the incremental cost of LNAPL removal.

It is anticipated that each of these candidate wells will maintain a technically practicable LNAPL removal rate in the immediate future, based on the long-term evaluations.

## 4.3 Additional Observations from LNAPL Transmissivity Evaluations

An assessment of the local geologic and hydrogeologic characteristics of the candidate and non-candidate wells did not reveal a distinct pattern, such as a more porous stratigraphic layer, which would explain the higher recovery rate and transmissivity of LNAPL in certain wells. Based on a review of the known soil stratigraphy and groundwater information, no geologic factors were identified which may have resulted in the more effective recovery of LNAPL in candidate wells. All candidate wells are located in an area of the Site which has a relatively small groundwater table gradient.

The most apparent commonality between the candidate wells which distinguishes them from the non-candidate wells containing LNAPL is location relative to the LNAPL mass. The candidate wells are all located in the central portion of the most down-gradient portion of the LNAPL plume. This provides a LNAPL head to the southwest and some LNAPL head to the north of the candidate wells, which is likely aiding in LNAPL recovery in these locations. Non-candidate wells located further north of the candidate well line are approaching the periphery of the LNAPL mass, and likely have a lower static LNAPL pressure, which may be the reason for lower transmissivity and recoverability results for wells in this area.

# 5. Feasibility Study

Extensive investigative work, including evaluation and pilot testing of several remedial approaches has been conducted previously at the Site. The information from the prior investigations and evaluations has been considered in the determination of the remedial approach at the Site.

## 5.1 Evaluation Criteria

The criteria used to assess the overall effectiveness of each remedial alternative are as follows:

1. Protection of human health and the environment
2. Compliance with applicable federal, state, and local regulations
3. Long-term effectiveness and permanence of the remedy to maintain protection of human health and the environment
4. Reduction of toxicity, mobility, and volume of LNAPL
5. Implementability: technical and logistical feasibility
6. Completion within the VRP 5-year timeframe
7. Cost

## 5.2 Remedial Alternatives

Based on available information and Site characteristics, the following remedial alternatives were considered: high vacuum extraction, multi-phase extraction (MPE), LNAPL skimming, excavation, and enhanced LNAPL recovery. This Section summarizes each of the proposed remedial approaches which have been considered or evaluated at the Site.

### 5.2.1 No Additional Action

The no additional action response is primarily used as a basis for comparison with other alternatives. Under the no additional action response, no measures are taken to alter environmental conditions at the Site, with the exception of those already implemented at the Site. Due to the prior installation of the polywall and the existing controls already present at the Site, these aspects are included in the no action alternative approach.

The implementability of this approach is high, consisting only of monitoring the polywall integrity and LNAPL containment, and the cost would be low. This response does not reduce the volume, mobility or toxicity of the LNAPL at the Site, except to the extent that the constituent concentrations are reduced through natural mechanisms. While implementation of this approach would be unlikely to adversely impact human health or the environment, mobile and hydraulically recoverable LNAPL would remain at the Site and VRP remedial goals would not be met.

### 5.2.2 High Vacuum Extraction Events

The high vacuum extraction remedial approach at the Site involves the periodic removal of LNAPL via vacuum at existing monitoring wells. The approach would require the mobilization of a vacuum extraction truck on an assumed weekly or monthly schedule to recover fluids from select monitoring wells which contain large in-well LNAPL thicknesses. Extracted water and LNAPL would have to be transported off-Site for treatment and disposal or recycling.

Long-term skimming tests conducted at the Site confirm assertions that the transmissivity of LNAPL through the subsurface is generally low and that at many wells, the bulk of LNAPL removal is accomplished quickly as the in-well and near-well LNAPL is removed. Based on this information, it is likely that the performance of periodic short-duration high vacuum extraction events would generate large quantities of groundwater, with little recovery of LNAPL beyond that which has accumulated in the well and the immediate vicinity.

Based on an assessment of the evaluation criteria, the beneficial volumetric reduction of LNAPL at the Site would be low using this approach, with a high cost of implementation and high water generation. It is not anticipated that removal of LNAPL would be accomplished in a timely or cost effective manner if using this proposed remedy.

### 5.2.3 Multi-Phase Extraction

The MPE remedial approach involves the installation of continuous pumping systems to extract LNAPL, groundwater, and soil vapor from Site wells. The extracted LNAPL and water would require separation, to isolate the LNAPL, followed by treatment of the recovered groundwater prior to discharge off-Site. Implementation at the Site would involve the installation of pumps, recovery piping, air blowers, air strippers, and associated storage tanks.

The LNAPL at the Site has been present since at least the 1980s, and likely much earlier. MPE is most effective when used for the recovery of volatile compounds, which readily partition into the vapor phase. Due to the age of the release, large fractions of volatile constituents in the LNAPL mass are unlikely to remain which would limit the efficacy of MPE at the Site.

Pilot testing of an MPE system at the Site was conducted by Langan in 2015 at wells AW-52, AW-56, and AW-82. The tests were run for approximately 24 hours each and showed a local vacuum influence extending approximately 35 feet radially from the wells. The pilot tests were successful at reducing in-well LNAPL thicknesses to approximately 0.2 feet during system operation and removed between 51 and 232 gallons of LNAPL and between 2.5 and 3.5 pounds of VOCs. Exhaust stack testing indicated a high concentration of VOCs being emitted from the systems to the atmosphere after filtering the soil vapor, which is a potential concern associated with this remedial option. A total of approximately 7,000 gallons of water were removed with 391 gallons of LNAPL (approximately 5% LNAPL-to-Water ratio) and soil vapor during the pilot tests.

These tests were conducted on a short time scale and did not account for a reduction in LNAPL recovery after the removal of LNAPL accumulated within and in the immediate vicinity of the well. Continued operation would have been expected to produce a progressively lower LNAPL-to-water recovery ratio. Longer duration LNAPL skimming tests conducted by GHD and discussed in Section 4 suggest that the recoverability of LNAPL would be significantly diminished after the initial removal of LNAPL in close proximity to the well. While the initial recovery by MPE is high, continued

operation of such systems would be expected to result in the production of large volumes of recovered water which would require treatment or disposal.

Equipment, energy input, operational, and maintenance costs and emission concerns for this remedial approach would be high, and would be anticipated to result in only marginally better LNAPL removal when compared to other remedial options. The anticipated completion time for the MPE approach would not be significantly less that other remedial options. As with the high vacuum extraction events approach, this approach would also generate large volumes of water that would and require treatment and disposal or recycling.

### 5.2.4 Transmissivity-Based LNAPL Skimming

LNAPL skimming is a process in which LNAPL accumulated within a monitoring well is removed at a rate matching the rate that LNAPL flows into the well from the surrounding formation. The information regarding the rate of recovery of LNAPL using these systems can be used to develop an estimated transmissivity value for the LNAPL through the surrounding formation. The methodology for determining this value is described in Section 4.1.2.

Pilot testing of this remedial approach was initially performed by Langan at monitoring wells AW-9, AW-10, and AW-11 in 2015. Each test system was set to cycle four times per minute and the pump intakes were set at the LNAPL-water interface within the wells. The pilot tests showed that skimmer systems were effective at reducing LNAPL thickness within a short time frame (between 16 and 26 hours) and resulted in an average recovery rate of 2.19 to 6.45 gallons per hour over the course of the tests. The pilot tests were effective at demonstrating the theory and practicability of this remedial approach, but did not assess the long-term viability of LNAPL skimming at the Site accounting for diminishing recovery with continuous long-term operation of these systems. GHD has conducted extensive LNAPL skimming at the Site since May 2016 and the results are discussed in Section 4.

The capital and operational costs for LNAPL skimming equipment is relatively low, and the systems can be easily deployed within existing monitoring wells at the Site. This approach is effective at reducing the volume of mobile LNAPL at the Site compared to other remedies, and does not produce large quantities of water requiring treatment.

### 5.2.5 Excavation and Removal

Excavation and removal of impacts involve the removal of LNAPL-saturated soil at the Site and replacement with clean materials. This option was considered as a baseline for complete removal of impacts at the Site. Implementation at the Site was deemed impracticable based on the high cost of implementation, numerous surface impediments, continued Site operations, tidal fluctuations in the water table, and the scale of the LNAPL plume. This approach would result in the production of large quantities of impacted and potentially hazardous waste and would only displace the contamination to the disposal or treatment facility. Due to these factors, this approach was removed from further consideration.

### 5.2.6 Thermal or Surfactant-Aided Recovery

Thermal or surfactant-aided recovery involves the introduction of heat or surfactants to the subsurface in an attempt to increase the mobility of the LNAPL, thereby enhancing recovery by either skimming or vacuum extraction. This option was considered for implementation at the Site; however, based on the continued Site operations, the high cost of implementation, numerous surface impediments, and the scale of the LNAPL plume, these potential approaches have been deemed to be impracticable and were removed from further consideration.

## 5.3 Proposed Remedy

Based on the evaluation criteria, the results of prior assessments of technologies at the Site, and the implementability and practicability of each proposed alternative, LNAPL transmissivity and recoverability based LNAPL skimming was determined to be the most advantageous, practicable approach to LNAPL removal at the Site. It was also determined to be the most cost effective remedial option and results in the least amount of waste material. Human health and the environment will remain protected under existing controls, and more aggressive actions, such as vacuum and multi-phase extraction, would not be anticipated to complete the remediation more effectively or in a significantly shorter time frame, being limited by the mobility of the LNAPL in the subsurface.

Data collected from long-term evaluations of on-Site wells can be used to determine transmissivity values for Site wells, which can be used to establish Site-specific remedial end-points for removal of hydraulically recoverable mobile LNAPL at the Site.

# 6. Proposed Corrective Actions

The overall LNAPL remediation objective is to remove LNAPL to a practicable limit at the Site given that the potential for LNAPL migration and exposure is very low.

Based on an evaluation of Site conditions, the results of the LNAPL skimming evaluations, and consideration of the ITRC LNAPL recovery concepts, GHD proposes to implement the following corrective actions at the Site to address LNAPL impacts:

- Continue long-term LNAPL recovery using skimmers at well locations AW-9, AW-11, AW-49, AW-56, and AW-82 until LNAPL transmissivities decrease to de minimis values.
- Perform 1 to 2-month duration intermittent LNAPL recovery from select wells using skimmers to remove LNAPL. The wells included are: AW-5, AW-10, AW-12, AW-22, AW-54, AW-65, and AW-68. Recovery duration will be limited as these wells typically have a large initial LNAPL recovery rate that quickly diminishes to the de minimis value or to zero.
- Continue monitoring of monitoring wells AW-62 and POD-1 on the river side of the polywall and use absorbent socks to remove residual LNAPL.
- Continue quarterly monitoring of all accessible Site monitoring wells to monitor the extent of the LNAPL plume, to verify LNAPL migration is not occurring, and to monitor the integrity of the polywall barrier.
- Implement land use restrictions to prevent exposure to Site contaminants.

## 6.1 Justification for Remedy Selection

### *Asymptotic LNAPL Recovery and Decline Curve Analysis*

The findings from the LNAPL skimming evaluations and efforts completed at the Site demonstrate that the skimmers are effective at removing LNAPL at a rate greater than or equal to the rate the LNAPL is able to accumulate within wells at the Site. Additionally, nearly all wells that have been evaluated using the skimmers have produced trends of diminishing LNAPL recovery over time. These observations are presented in the graphs included in Appendix A for select wells. As recovery efforts continue, the LNAPL recovery rates are expected to continue to diminish and become asymptotic consistent with observations to date.

As described in Section 6.3.5.1, the LNAPL recovery rates observed during the long-term skimming underway at the Site suggest that the remaining LNAPL volume is limited and the approximate timeframe for removal to a threshold that equates to a LNAPL transmissivity of 0.1 $ft^2$/day is between 1 and 2 years based on current conditions. As LNAPL recovery rates slow and the decline curve becomes asymptotic, the recovery of the remaining LNAPL is impracticable. LNAPL skimming is more appropriate than more aggressive methods as the observed LNAPL recovery rates at the Site are generally low.

### *Stable and Reducing LNAPL Plume*

As described in Section 2.1.5, the reduction of the inferred extent of the LNAPL plume and the observed reductions in the in-well LNAPL thicknesses from the maximum values reported at the Site historically demonstrate that the LNAPL plume is stable and reducing over time. Therefore, aggressive LNAPL recovery methods are not necessary to remove residual LNAPL, rather, focused LNAPL skimming is appropriate.

### *LNAPL Transmissivity Reduction Over Time*

The LNAPL skimming performed to date has yielded results that demonstrate that once the initial LNAPL volume is removed from within the well and the area near the well, the LNAPL recovery rate decreases as does the LNAPL transmissivity. In several cases, LNAPL recovered ceases after a short time or has decreased below the ITRC de minimis criteria of 0.1 $ft^2$/day within a short period, suggesting that LNAPL skimming is an appropriate remedy for the LNAPL at the Site.

### *Incremental Cost for LNAPL Mass Removal*

As presented in Section 4, wells with the highest observed LNAPL transmissivities and sustainable LNAPL recovery rates are the most cost effective locations to focus LNAPL recovery efforts. Given the effectiveness of the LNAPL skimming completed at these locations to date and the declining LNAPL recovery rates over time, more aggressive LNAPL recovery methodologies are not necessary. LNAPL skimming requires limited equipment and resources to implement and operate as compared to other more aggressive remedies. LNAPL skimming also results in the generation of LNAPL waste only, whereas other remedies would result in the generation of groundwater, vapors, or other wastes that would require expensive treatment and/or disposal. Therefore, given the observed declining LNAPL recoverability at the Site, LNAPL skimming is the most cost-effective approach to managing the limited volume of recoverable LNAPL.

## 6.2 Technical Impracticability

### 6.2.1 Low in-Well LNAPL Thickness

While in-well LNAPL thicknesses are often not indicative of the recoverability of LNAPL, several wells at the Site routinely contain less than 0.5 feet of LNAPL. These wells include AW-8, AW-19, AW-32, AW-38, AW-42, and AW-53 which are all located on the periphery of the LNAPL plume. As described in Section 2.2.3.3, observations from the Site indicate the LNAPL plume extent is shrinking over time; therefore, LNAPL at the periphery of the plume is likely the least mobile or recoverable LNAPL remaining at the Site. Based on this understanding of LNAPL characteristics and the observed low LNAPL transmissivities in other wells that are located closer to the recoverable LNAPL mass, it is technically impracticable to recover LNAPL at these locations.

### 6.2.2 Low LNAPL Recoverability

Several wells at the Site contain in-well LNAPL thicknesses that suggest recoverable LNAPL is present; however, evaluation of these wells has indicated that LNAPL recovery is not sustainable. These wells include AW-6, AW-18, AW-51, AW-52, AW-57, and AW-74 which appear to be near the periphery of the LNAPL plume. At these wells, recovery of a limited volume of LNAPL was observed during skimming with the majority of the recovery occurring in the first hours of skimmer operation when the in-well LNAPL was removed. Over the remainder of the skimming test, LNAPL recovery rates and the estimated LNAPL transmissivities were very low or zero suggesting that a large quantity of recoverable LNAPL is not present near these well locations. Therefore, it is technically impracticable to recover LNAPL from these locations due to low recovery, low LNAPL mobility, and higher incremental costs.

### 6.2.3 AW-13 LNAPL Characteristics

As discussed in Section 4.2.1, the LNAPL in monitoring well AW-13 is a thick fluid with a high viscosity that appears to be present in a small localized area. Given the high viscosity, the LNAPL is considered immobile and unrecoverable using readily available and effective technologies; therefore it is technically impracticable to recover this LNAPL due to the high cost, low implementablity, and the limited mobility of the material.

### 6.2.4 Cost to Implement

#### *Long-term Skimming Candidate Wells*

The following table presents a summary of unit costs for LNAPL recovery from the five wells at the Site proposed for continued long-term skimming. An estimated unit cost to date for each well is provided based on the days of operation and the volume of LNAPL recovered. A second cost is provided for each well that is the estimated unit cost to recover LNAPL when the well's LNAPL transmissivity reaches the ITRC de minimis criteria of 0.1 $ft^2$/day.

| Well ID | Estimated Unit Cost to Date ($/gallon) | Estimated Unit Cost at Transmissivity Endpoint ($/gallon) |
|---|---|---|
| AW-9 | $13 | $68 |
| AW-11 | $15 | $80 |
| AW-49 | $9 | $78 |

| Well ID | Estimated Unit Cost to Date ($/gallon) | Estimated Unit Cost at Transmissivity Endpoint ($/gallon) |
|---|---|---|
| AW-56 | $12 | $49 |
| AW-82 | $13 | $93 |

As shown above, the current unit cost ranges between $9 and $15 per gallon of LNAPL recovered. At the remedial endpoint for the long-term skimming (ITRC de minimis criteria of 0.1 $ft^2$/day), the estimated unit cost ranges between $49 and $93 per gallon of LNAPL recovered.

The unit costs assume that LNAPL removal at multiple wells is occurring simultaneously and operational costs would be divided evenly between each of the seven skimming systems currently in-use at the Site. Unit costs would be expected to increase with the operation of fewer systems.

### *Intermittent Skimming Wells*

The following table presents a summary of the estimated volumes of recoverable LNAPL and the associated unit cost for three iterations of intermittent skimming at select wells that have demonstrated reasonable LNAPL recovery for a very short duration before recovery decreases substantially or ceases all together. The estimated volume of LNAPL recovered during each iteration is anticipated to be less than the preceding.

| Well ID | 1st 2-Month Duration Event | | 2nd 2-Month Duration Event | | 3rd 2-Month Duration Event | |
|---|---|---|---|---|---|---|
| | Estimated LNAPL Recovery (gallons) | Unit Cost of Removal ($/gallon) | Estimated LNAPL Recovery (gallons) | Unit Cost of Removal ($/gallon) | Estimated LNAPL Recovery (gallons) | Unit Cost of Removal ($/gallon) |
| AW-5 | 60 | $40 | 40 | $60 | 20 | $120 |
| AW-10 | 80 | $30 | 50 | $48 | 25 | $96 |
| AW-12 | 80 | $30 | 50 | $48 | 25 | $96 |
| AW-22 | 40 | $60 | 20 | $120 | 10 | $240 |
| AW-54 | 50 | $48 | 30 | $80 | 15 | $160 |
| AW-65 | 50 | $48 | 30 | $80 | 15 | $160 |
| AW-68 | 150 | $16 | 100 | $24 | 50 | $48 |

As shown in the above, the unit cost for the short duration intermittent events ranges from $16 to $60 per gallon of LNAPL recovered initially but would be expected to increase substantially to $100 or more per gallon.

### *Wells Not Recommended for Additional Skimming*

The following table presents a summary of the estimated volumes of recoverable LNAPL and the associated unit cost to complete a single short duration recovery event at select wells that exhibit high in-well LNAPL thicknesses.

| Well ID | 1st 2-Month Duration Event | |
|---|---|---|
| | Estimated LNAPL Recovery (gallons) | Unit Cost of Removal ($/gallon) |
| AW-6 | 5 | $480 |
| AW-18 | 12 | $200 |
| AW-51 | 20 | $120 |
| AW-52 | 10 | $240 |
| AW-57 | 8 | $300 |
| AW-74 | 7 | $350 |

As shown in the above, the unit cost for the recovery of the very limited volume of recoverable LNAPL at these wells is $120 to $480 per gallon of recovered LNAPL. This estimated cost supports the assertion that it is not technically practicable to recover LNAPL from these wells, even though high in-well LNAPL thicknesses may be present. These costs are 2 to 5 times the estimated unit costs for the recovery of LNAPL from wells AW-9, AW-11, AW-49, AW-56, and AW-82 when they reach their respective remedial endpoints.

Overall, the unit costs to remove the recoverable LNAPL from the Site are generally less than $80 per gallon of LNAPL. Therefore, even though wells AW-6, AW-18, AW-51, AW-52, AW-57, and AW-74 have demonstrated high in-well LNAPL thicknesses historically, there does not appear to be a large recoverable volume of LNAPL at these wells and the costs to recover the limited volume are high and support the assertion that it is technically impracticable to remove LNAPL from these locations.

## 6.3 Corrective Action Program Description

### 6.3.1 Long-Term Skimming at Candidate Wells

Wells AW-9, AW-11, AW-49, AW-56, and AW-82 have been determined to be candidate wells that will undergo continuous LNAPL skimming until such a point that the volume of recoverable/mobile LNAPL in the candidate well has been extracted. This condition will be assumed to have been met when the average stabilized transmissivity of the monitoring wells decreases to at least 0.1 $ft^2$/day, which is the low end of the ITRC de minimis criteria. At this value for LNAPL transmissivity, LNAPL recovery rates would be between 0.4 to 0.8 gallons per day.

Weekly O&M for the well systems will continue to be conducted to ensure that the systems are operating property and to collect LNAPL recovery data which will continue to define LNAPL removal conditions at each well. O&M activities will be conducted as described in Section 4.1.1 and data analysis will be conducted as described in Section 4.1.2. As long-term skimming progresses, it is anticipated that LNAPL recovery and transmissivity values will diminish until a point when additional LNAPL recovery efforts are not practicably warranted.

Upon reaching the de minimis LNAPL recovery rate, intermittent skimming will be performed at these wells as necessary to remove any additional recoverable LNAPL from near the wells.

### 6.3.2 Intermittent Skimming at Select Wells

Several of the wells which underwent long-term skimming evaluations displayed initial recovery rates and transmissivity values which suggested that intermittent short-term skimming was practicable. These wells include AW-5, AW-10, AW-12, AW-22, AW-54, AW-65, and AW-68. Long-term skimming at these wells resulted in significantly reduced recovery after the initial removal of local LNAPL; however, the in-well LNAPL thicknesses in each of these wells recovers to near historical averages over time once skimming is halted thus allowing additional short duration LNAPL recovery of a relatively small volume of LNAPL.

Due to the observed decrease in recovery and transmissivity at these wells after initial removal of local mobile LNAPL, these wells are not considered to be candidates for long-term skimming operations, but will undergo short-term skimming with intermittent recovery periods to remove LNAPL with very limited mobility accumulated in and near the wells. The intermittent recovery events are expected to be for a duration of one and two months each, and up to three events may be performed.

### 6.3.3 Polywall Barrier Monitoring

No LNAPL has been detected in any of the wells installed on the river side of the polywall since at least 2009, with the exception of AW-62 and POD-1. AW-62 and POD-1 have been monitored weekly since October 2016, and have contained no more than 0.04 feet of LNAPL since that time. This suggests that the majority of the LNAPL mass has been adequately contained by the polywall barrier and that only residual LNAPL remains on the river side of the polywall barrier.

Based on the weekly observations, a large accumulation of LNAPL outside of the polywall is not anticipated to be present near AW-62 and POD-1. The occasional LNAPL in these wells is likely residual LNAPL which is slowly liberated from the soil matrix as a result of the significant tidal influence on groundwater in this area. There has been no evidence indicative of a rupture or leak of LNAPL through the polywall barrier, and no sheen resulting from the subsurface LNAPL has been observed in the Savannah River.

Absorbent socks have been installed in both wells and are replaced as needed to recover any residual LNAPL entering these wells. Based on the small volume and sporadic presence of LNAPL entering these wells, additional remedial actions do not appear warranted at this time.

All monitoring wells located on the river side of the polywall will continue to be monitored on a quarterly basis to ensure that the integrity of the polywall is maintained and off-Site LNAPL migration is not occurring. Weekly monitoring and LNAPL recovery via absorbent socks will also continue for monitoring wells AW-62 and POD-1.

### 6.3.4 Continued Quarterly Monitoring

Quarterly monitoring of all Site monitoring wells will continue to be conducted to ensure that no adverse changes in the LNAPL plume are occurring. The information from each monitoring event will be used to determine groundwater flow and approximate size and boundaries of the LNAPL mass, which will be used to track the reduction in the LNAPL footprint. This monitoring will also be conducted to ensure the following:

- No additional sources of LNAPL have been introduced
- No off-Site migration of LNAPL is occurring
- The integrity of the polywall barrier is maintained
- LNAPL migration has not presented an increased risk to human or environmental health

Should changing Site conditions indicate that any of the above may no longer be true, additional evaluation and/or remedial actions may be warranted.

### 6.3.5 Remedial Endpoints

The ITRC released *LNAPL-3: LNAPL Site Management: LCSM Evolution, Decision Process, and Remedial Technologies* in March 2018, which describes how to approach the development of a remedial strategy for a Site impacted with LNAPL. Within that document, ITRC describes established performance metrics and remedial end points which may be employed to track the progress of remediation efforts at a Site. Based on the Site characteristics and the proposed remedial actions, the following performance metrics and concepts, with associated descriptions, are applicable to Site:

- "Asymptotic performance of optimized recovery system: Analysis of unit volume of LNAPL recovery or recovery rate per unit of time, after considering optimization. Endpoint reached when asymptotic curve indicates the limit of recovery effectiveness (e.g., analysis indicates that further recovery of remaining LNAPL is impracticable).
- Decline curve analysis: Analysis of unit volume of LNAPL recovery or recovery rate per unit of time. Endpoint reached when decline curve analysis indicates that the remaining LNAPL volume is below threshold of concern, or the time and effort to recover the remaining volume is impracticable.
- LNAPL body footprint stabilized: Assesses whether technology effectively counters existing LNAPL driving gradient and/or captures migrating LNAPL. Comparison of LNAPL body footprint before and after treatment to demonstrate stable or shrinking footprint.
- LNAPL transmissivity: Use reduction of transmissivity over time to assess technology performance. Endpoint reached when LNAPL transmissivity indicates recovery has reached its practicable limit, or concern has been abated.
- No first LNAPL occurrence in down-gradient well: Performance metric to address/limit LNAPL migration. LNAPL never enters a monitoring well installed outside of LNAPL body.
- Unit cost of incremental mass removal: Increasing cost per unit LNAPL recovered indicates decreasing cost- effectiveness (cost may not always be in line with regulatory requirements; however, in certain circumstances this metric can be useful for assessing practicable limits)."

#### 6.3.5.1 Long-Term Skimming Locations

Long-term LNAPL skimming is proposed to be conducted at the candidate wells on a continuous basis until LNAPL transmissivity is determined to be consistently at or below the commonly accepted, science-based ITRC lower-bound of the de minimis criteria range of 0.1 $ft^2$/day. Based upon reviewed ITRC literature, a transmissivity value at or below this threshold indicates that the potential for LNAPL migration is minimal and the hydraulically recoverable proportion of the LNAPL mass has been removed from the area surrounding the well.

ITRC has published and presented significant information that arbitrary remedial endpoints such as 0.1 feet of LNAPL in a well are based on an outdated understanding of LNAPL behavior as in-well LNAPL thickness measurements are not representative of the recoverability/mobility of LNAPL. The decline in LNAPL recovery over several evaluations completed between 2015 and 2017 despite the presence of greater than several feet of LNAPL in select wells supports this determination.

Using the data obtained from the long-term skimming evaluations, an estimation of the completion date and remaining volume of LNAPL to be removed at each well can be made. Decreasing trends in the stabilized LNAPL recovery rate at each candidate well were used to determine an approximate operational time remaining and volume of mobile LNAPL to be removed in order for the transmissivity of the well to decrease to the 0.1 $ft^2$/day de minimis criteria.

Based on the above interpretation of the data, the estimated completion dates and remaining LNAPL volume to be removed for each of the candidate wells is given below:

| Well ID | Estimated Date for Long-Term Skimming Completion | LNAPL Removal as of April 27, 2018 (gallons) | Approximate Volume of Remaining LNAPL to be Removed (gallons) |
|---|---|---|---|
| AW-9 | July 2019 | 1,503 | 600 |
| AW-11 | June 2018 | 1,061 | 20 |
| AW-49 | March 2019 | 2,243 | 340 |
| AW-56 | September 2019 | 1,331 | 820 |
| AW-82 | January 2019 | 1,224 | 240 |

These completion dates are approximate, are based on the skimming data collected to date, and are likely to change with time as LNAPL recovery rates often fluctuate. As additional mobile LNAPL is removed, the recovery in the wells will likely become asymptotic, which would extend the estimated completion dates. Further, the end dates indicated assume consistent operation of the LNAPL skimmer systems at each of the wells. Delays due to system maintenance, malfunction, or other factors, such as weather, may increase the estimated time to completion.

Upon reaching the de minimis LNAPL transmissivity of 0.1 $ft^2$/day for one of these wells or reaching an asymptotic LNAPL recovery rate, skimming would be halted. In-well LNAPL thickness monitoring would then be performed on a routine basis and after approximately three months, the skimmer system would be reactivated on an intermittent basis to recover additional LNAPL. The LNAPL recovery rate and transmissivity will be evaluated to determine if additional long term skimming is necessary or if continued intermittent LNAPL skimming as described in Section 6.3.5.2 is appropriate.

#### 6.3.5.2 Intermittent LNAPL Skimming Locations

Short-duration intermittent skimming operations will be conducted at the wells identified for intermittent skimming (AW-5, AW-10, AW-12, AW-22, AW-54, AW-65, and AW-68). It is anticipated that the duration of these intermittent skimming events will be between one and two months. Skimmers will be rotated between wells as LNAPL thicknesses return to historical norms following the short-duration skimming events. It is anticipated that over time, the total recovered LNAPL volume and the LNAPL transmissivity for each intermittent event will decrease as the mobile LNAPL is removed. Short-term skimming will be continued periodically at each of these wells until the LNAPL recovery becomes impracticable due to reduced recovery during the skimming events or significantly diminished in-well LNAPL thickness after a recovery period is observed. It is anticipated that up to three intermittent events may be performed at these wells.

### 6.3.6 Cleanup Criteria

IMTT Epic intends to complete the removal of mobile/recoverable LNAPL to the extent practicable using the ITRC de minimis LNAPL transmissivity value of 0.1 $ft^2$/day as the criteria for completion. Concentrations of benzene and naphthalene exceeding the Type 3 RRS for groundwater in isolated areas of the Site have been identified. Delineation of dissolved phase constituents should be conducted at the conclusion of the LNAPL removal efforts. Based on available information, dissolved phase constituents do not pose an imminent threat to human health or the environment as there are no exposed receptors.

Once the mobile LNAPL is recovered to the extent practicable, the residual LNAPL plume, impacted soil and impacted groundwater will be managed using Type 5 RRS which allow for impact to remain in place provided suitable engineering and/or institutional controls are in place and maintained to prevent exposure. These controls will likely include the recording of a Uniform Environmental Covenant that restricts the land use to industrial, prohibits the installation of potable water wells, maintains containment of the plume, and restricts access to the Site. Other restrictions could include limiting worker exposure to impacted soil and groundwater during construction activities through the development and implementation of a Soil/Groundwater Management Plan that would define the potential hazards, measures to be implemented to limit or prevent exposure, and an appropriate methodology for the management of soil and groundwater.

## 6.4 Reporting

Observations and findings from the corrective action program described above will be summarized and evaluated on a frequent basis. Remedial progress updates will be provided in the semi-annual progress reports to be prepared and submitted by June 1st and December 1st each year. The remedial progress update will include an assessment of the LNAPL plume stability, a summary of LNAPL recovery efforts, the effectiveness of ongoing LNAPL recovery operations, any modifications to LNAPL recovery efforts, and progress to achieving remedial goals.

# 7. Preliminary Cost Estimate

A preliminary cost estimate has been developed for the continued remedial actions proposed for the Site. The cost is based on the assumption that continuous skimming will occur at the five identified long-term wells and intermittent skimming will occur at the seven identified wells until the remedial endpoints are met. The cost projection also accounts for anticipated groundwater sampling, project management, LNAPL disposal/recycling costs, and required reporting to EPD through the VRP program. The projection assumes that remedial action will be completed by 2021; however, this projection is subject to change if Site conditions, such as LNAPL recovery rates, change.

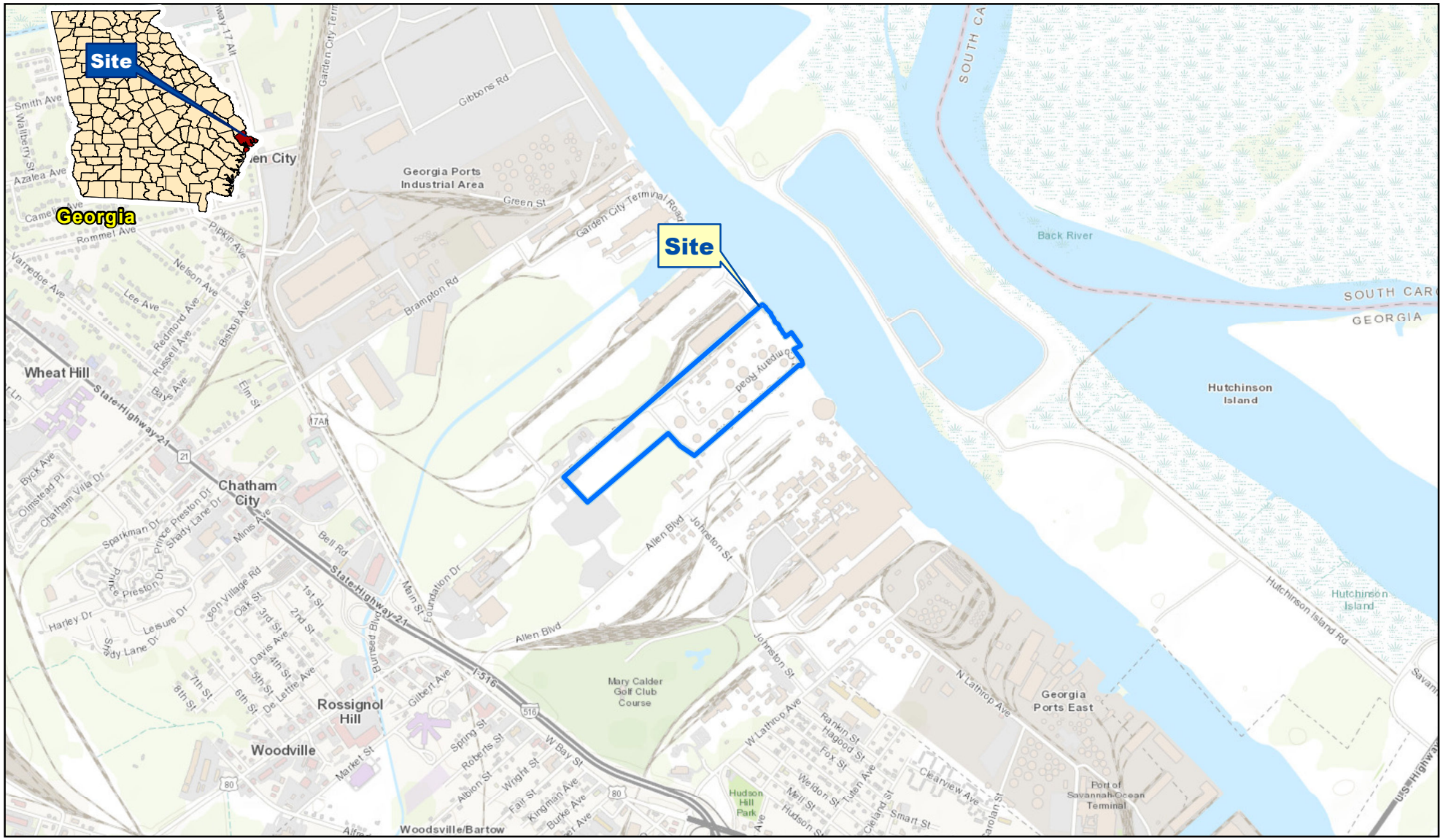
The total estimated cost of the remaining remedial efforts is approximately $740,000. A breakdown of the estimated costs is provided in Table 2.

# 8. References


- Technical/Regulatory Guidance: Evaluating LNAPL Remedial Technologies for Achieving Project Goals, ITRC, dated December 2009
- Standard Guide for Estimation of LNAPL Transmissivity, ASTM International E2856-13, dated 2013
- Guidance Document, PVI-1, Petroleum Vapor Intrusion, ITRC, dated October 2014
- LNAPL-3: LNAPL Site Management: LCSM Evolution, Decision Process, and Remedial Technologies, ITRC, dated March 2018
- Polywall Barrier System Installation and Specifications, Citgo Asphalt Refinery, Savannah, Georgia, dated 1996
- 2009 Fieldwork Summary, NuStar Asphalt Refinery, Savannah, Georgia, prepared by Conestoga Rovers Associates (CRA), dated November 2009
- Groundwater and LNAPL Gauging Event, First Quarter 2010, NuStar Asphalt Refining, LLC, Savannah, Georgia, prepared by Ash Creek Associates, dated September 2010
- Well Installation, SPH Gauging, and Remedial Options Evaluation Report, NuStar Asphalt Refining, LLC, Savannah, Georgia, prepared by Ash Creek Associates, dated August 2012
- Remediation Project Summary, Savannah Refinery, Savannah, Georgia, prepared by NuStar, dated August 2012
- Voluntary Remediation Program Application, Axeon Savannah Terminal, Savannah, Georgia, prepared by Terracon, dated August 2015
- Site Investigation Summary Report, Axeon Savannah Terminal, Savannah, Georgia, prepared by Terracon, dated September 2015
- Technical Memorandum, revised Phase II LNAPL Pre-Design Investigation, Recovery Design and Cost Summary, Axeon Asphalt Refinery, Axeon Specialty Products LLC, Savannah, Georgia, prepared by Langan Engineering and Environmental Services, Inc., dated October 2015

- VRP Approval Letter and Report Comments, Axeon Specialty Products, VRP #1440101197, prepared by Georgia EPD, dated November 2015
- Site Investigation Summary Report No. 2, Axeon Savannah Terminal, Savannah, Georgia, prepared by Terracon, dated December 2015
- 2016 First Semi-Annual VRP Progress Report, Epic Savannah North Terminal, Savannah, Georgia, prepared by GHD, dated June 2016
- 2016 Second Semi-Annual VRP Progress Report, Epic Savannah North Terminal, Savannah, Georgia, prepared by GHD, dated November 2016
- 2017 Third Semi-Annual VRP Progress Report, Epic Savannah North Terminal, Savannah, Georgia, prepared by GHD, dated May 2017
- 2017 Fourth-Semi Annual VRP Progress Report, Epic Savannah North Terminal, Savannah, Georgia, prepared by GHD, dated December 2017

# Figures




Source: ESRI World Topographic Map.

0 1,000 2,000
Feet

Coordinate System:
NAD 1983 UTM Zone 17N

N

GHD

IMTT SAVANNAH NORTH TERMINAL
7 FOUNDATION DRIVE, SAVANNAH, GEORGIA

089400-00
May 11, 2018

VICINITY MAP

FIGURE 1

GIS File: I:\GIS\GIS\Projects\89000s\89400\89400-00(004)PR\89400-00(004)PR-BR001.mxd

Source: Aerial Photograph provided by Epic Midstream, LLC on March 17, 2016.

0 1,000 2,000
Feet

Coordinate System:
NAD 1983 UTM Zone 15N

N

GHD

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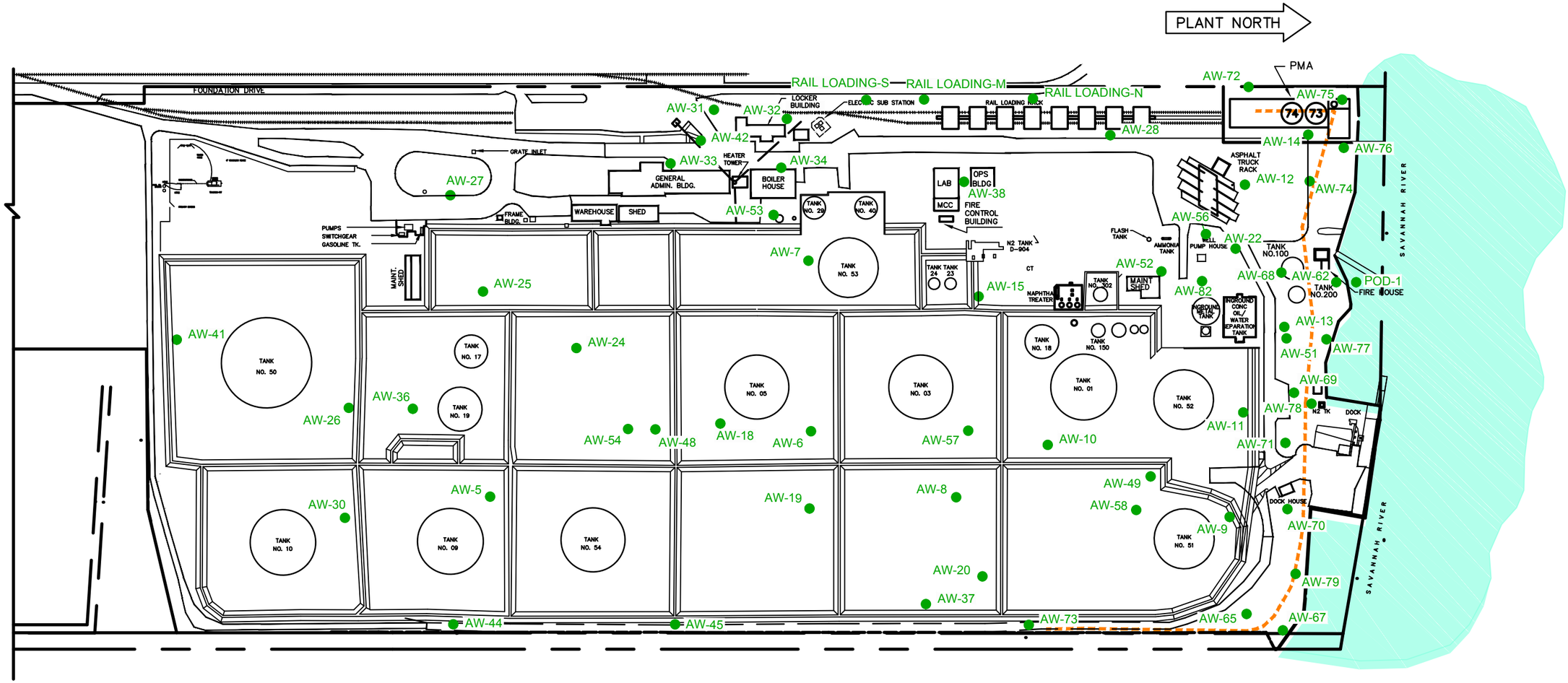
# 2016 AERIAL PHOTOGRAPH

FIGURE 2

GIS File: I:\GIS\GIS\Projects\89000s\89400\89400-00(004)PR\89400-00(004)PR-BR002.mxd




LEGEND

PROPERTY LINE AND BOUNDARY

POLYWALL BARRIER

AW-52 WELL LOCATION

0 100 200ft

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CORRECTIVE ACTION PLAN AND CONCEPTUAL SITE MODEL

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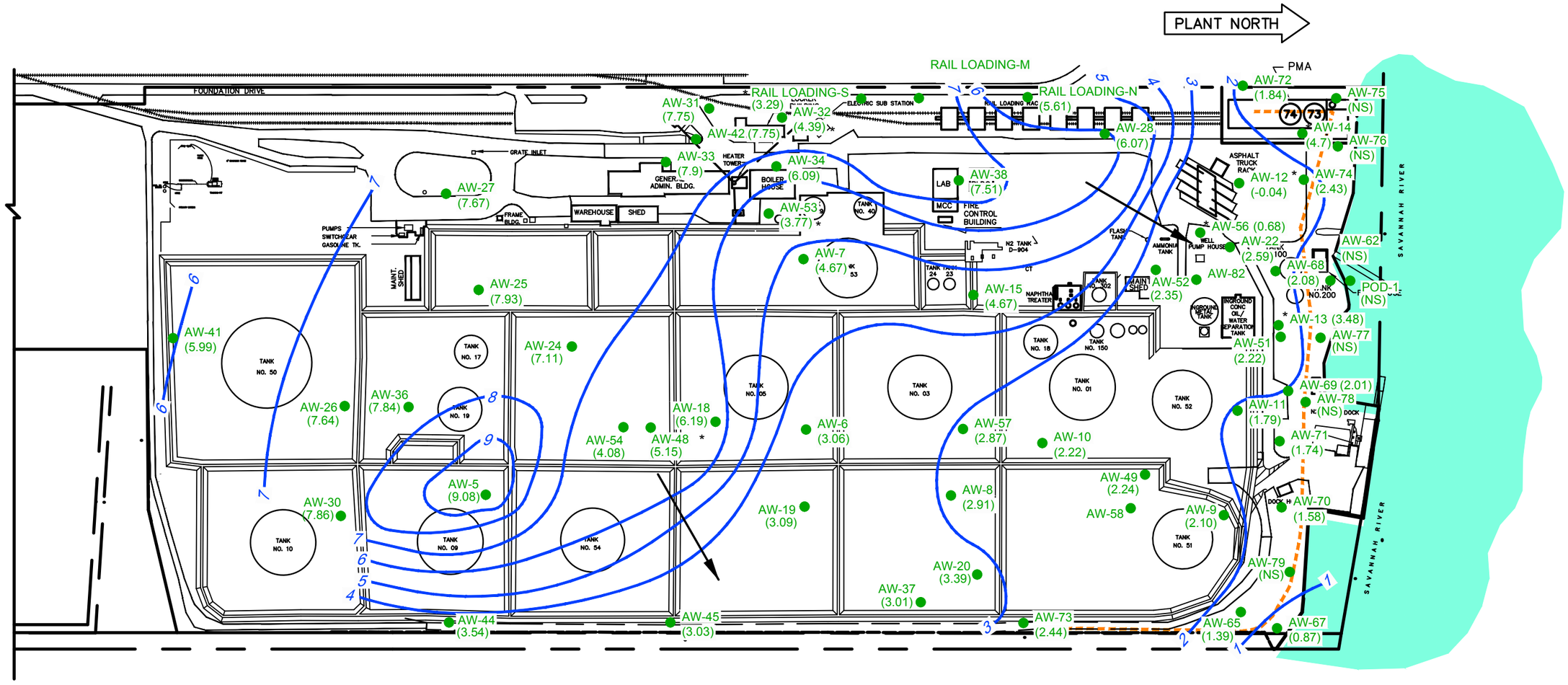
SITE PLAN

FIGURE 3

CAD File: P:\drawings\89000s\89400\89400-REPORT\89400-2018(006)\89400-2018(006)GN\89400-2018(006)GN-WA010.DWG




## LEGEND

- PROPERTY LINE AND BOUNDARY
- POLYWALL BARRIER
- AW-52 (8.01) — WELL LOCATION
- GROUNDWATER ELEVATION (FT AMSL)
- 8 — GROUNDWATER ELEVATION CONTOUR (FT AMSL)
- GROUNDWATER FLOW DIRECTION
- NS — NOT SURVEYED
- NM — NOT MEASURED
- * — MEASURED ELEVATION NOT USED TO DEVELOP CONTOURS

0 100 200ft

GHD

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CORRECTIVE ACTION PLAN AND CONCEPTUAL SITE MODEL

# FEBRUARY 2018 GROUNDWATER ELEVATION CONTOUR MAP

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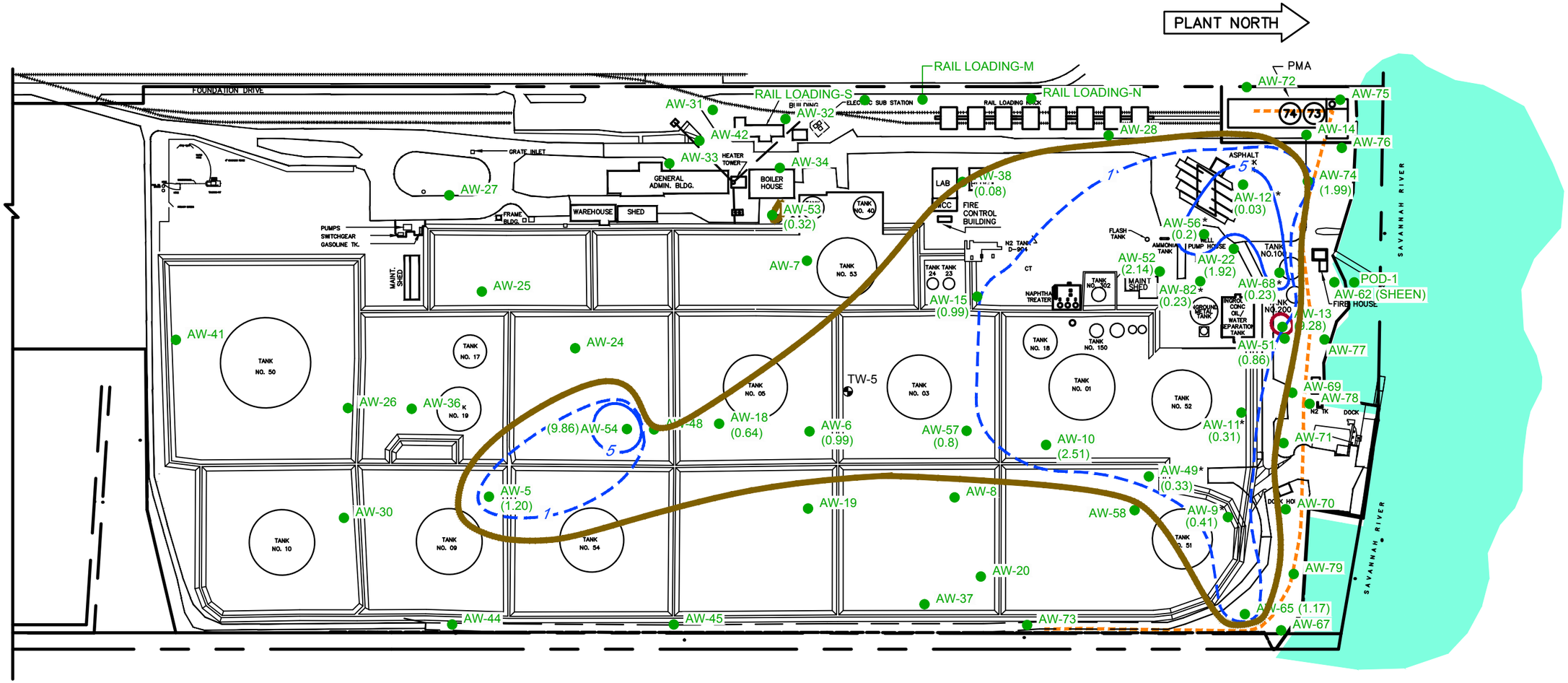
FIGURE 4

CAD File: P:\drawings\89000s\89400\89400-REPORT\89400-2018(006)\89400-2018(006)GN\89400-2018(006)GN-WA011.DWG




## LEGEND

- PROPERTY LINE AND BOUNDARY
- POLYWALL BARRIER
- AW-52 — WELL LOCATION
- TW-5 — DIRECT PUSH BORING LOCATION
- (2.55) — LNAPL THICKNESS (FEET)
- 1' — LNAPL THICKNESS ISOPLETH (FEET)
- HEAVIER LNAPL
- * — WELL UNDERGOING SKIMMING OPERATION
- FEBRUARY 2018 INFERRED EXTENT OF LNAPL

0 100 200ft

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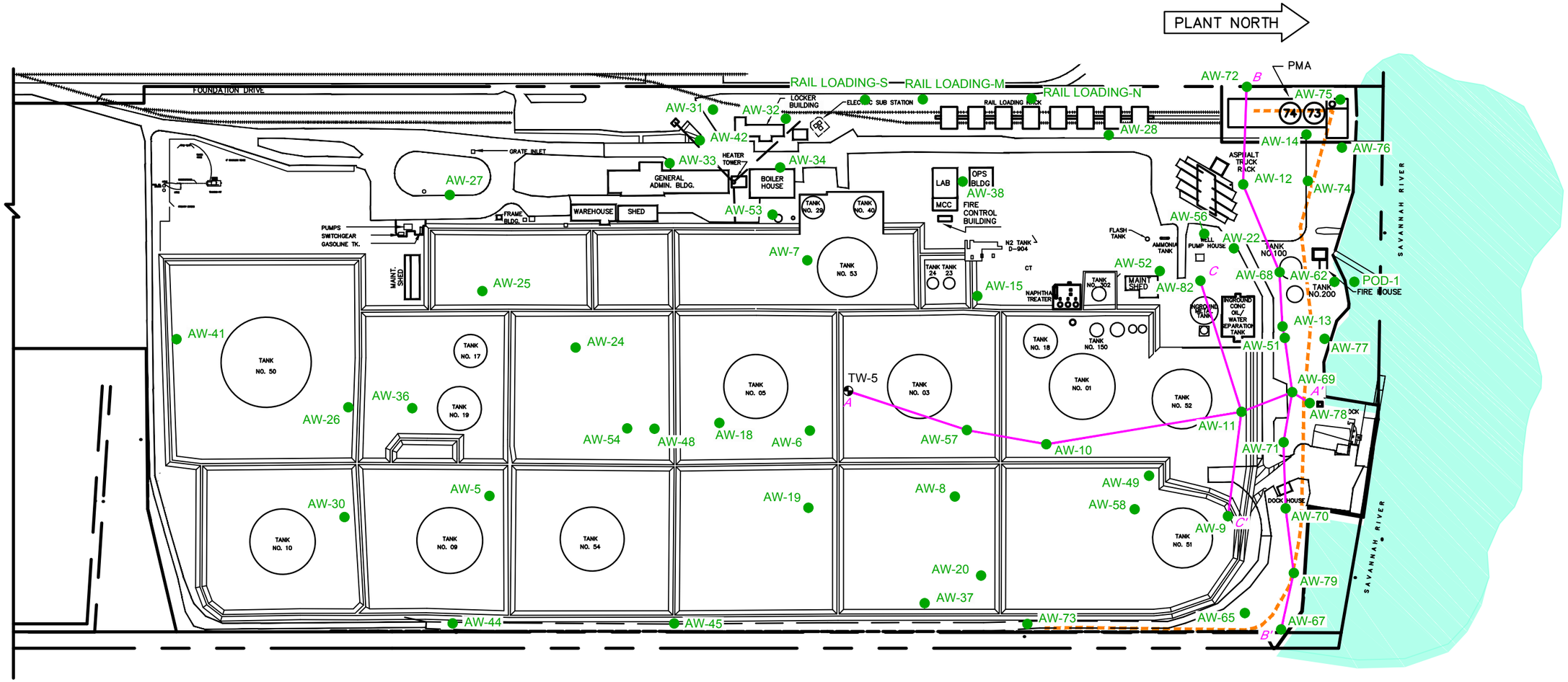
# FEBRUARY 2018 LNAPL ISOCONTOUR MAP

FIGURE 5

CAD File: P:\drawings\89000s\89400\89400-REPORT\89400-2018(006)\89400-2018(006)GN\89400-2018(006)GN-WA012.DWG




LEGEND

- PROPERTY LINE AND BOUNDARY
- POLYWALL BARRIER
- AW-52 WELL LOCATION
- TW-5 DIRECT PUSH BORING LOCATION
- A — A' CROSS-SECTION A - A' (SEE FIGURE 7)
- B — B' CROSS-SECTION B - B' (SEE FIGURE 8)
- C — C' CROSS-SECTION C - C' (SEE FIGURE 9)

0 100 200ft

GHD

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CORRECTIVE ACTION PLAN AND CONCEPTUAL SITE MODEL

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# CROSS SECTION LOCATIONS

FIGURE 6

CAD File: P:\drawings\89000s\89400\89400-REPORT\89400-2018(006)\89400-2018(006)GN\89400-2018(006)GN-WA013.DWG

A

A'

TANK NO. 03

TANK BERM

TANK NO. 01

TANK NO. 52

TANK BERM

TW-5

AW-57

AW-10

AW-11*

AW-69

POLYWALL

AW-78

APPROX. GROUND SURFACE ELEVATION

(3.35)

(0.80)

(7.71)

(2.51)

(5.50)

(0.31)

(0.47)

(0.00)

ELEVATION (FEET NAVD)

15
10
5
0
-5
-10
-15

0
70
140
210
280
350
420
490
560
630
700
770
840
910
980
1050

HORIZONTAL SCALE: 1"=70'

LEGEND

MONITORING WELL LOCATION W/SCREEN

DIRECT PUSH BORING LOCATION

SAND
SILT
CLAY
SILTY/CLAYEY SAND
SANDY CLAY
FILL

(#.##) FEBRUARY 2018 OBSERVED IN-WELL LNAPL THICKNESS

(#.##) HISTORICAL MAXIMUM IN-WELL LNAPL THICKNESS

FEBRUARY 2018 GROUNDWATER ELEVATION

* WELL UNDERGOING SKIMMING OPERATION

INFERRED

SCALE AS SHOWN

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May 22, 2018

# CROSS SECTION A - A'

FIGURE 7

CAD File: P:\drawings\89000s\89400\89400-REPORT\89400-2018(006)\89400-2018(006)GN\089400-2018(006)GN-TP007.dwg

B

B′

ELEVATION (FEET NAVD)

APPROX. GROUND SURFACE ELEVATION

TRUCK RACK

TANK NO. 100

TANK NO. 200

AW-72 AW-12* AW-68* AW-13 AW-51 AW-69 AW-71 AW-70 POLYWALL AW-79 AW-67

(10.73) (0.03) (8.22) (0.23) (12.50) (9.38) (0.86) (10.21) (0.47) (0.00) (0.47) (0.00) (4.40) (0.00)

HORIZONTAL SCALE: 1"=70'

LEGEND

MONITORING WELL LOCATION W/SCREEN

DIRECT PUSH BORING LOCATION

SAND
SILT
CLAY
SILTY/CLAYEY SAND
SANDY CLAY

(#.##) FEBRUARY 2018 OBSERVED IN-WELL LNAPL THICKNESS

(#.##) HISTORICAL MAXIMUM IN-WELL LNAPL THICKNESS

FEBRUARY 2018 GROUNDWATER ELEVATION

* WELL UNDERGOING SKIMMING OPERATION

----- INFERRED

SCALE AS SHOWN

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7 FOUNDATION DRIVE, SAVANNAH, CHATHAM COUNTY, GEORGIA
CORRECTIVE ACTION PLAN AND CONCEPTUAL SITE MODEL

089400-2018

May 11, 2018

CROSS SECTION B - B'

FIGURE 8

CAD File: P:\drawings\89000s\89400\89400-REPORT\89400-2018(006)\89400-2018(006)GN\089400-2018(006)GN-TP008.dwg

C

C′

AW-82*

AW-11*

AW-9*

TANK BERM

APPROX. GROUND SURFACE ELEVATION

ELEVATION (FEET NAVD)

15
10
5
0
-5
-10
-15

(3.08)

(0.23)

(5.52)

(0.31)

(5.34)

(0.41)

0
40
80
120
160
200
240
280
320
360
400
440
480
520
560
600

HORIZONTAL SCALE: 1"=40'

LEGEND

MONITORING WELL LOCATION W/SCREEN

DIRECT PUSH BORING LOCATION

SAND
SILT
CLAY
SILTY/CLAYEY SAND
SANDY CLAY
FILL

(#.##) FEBRUARY 2018 OBSERVED IN-WELL LNAPL THICKNESS

(#.##) HISTORICAL MAXIMUM IN-WELL LNAPL THICKNESS

FEBRUARY 2018 GROUNDWATER ELEVATION

* WELL UNDERGOING SKIMMING OPERATION

INFERRED

SCALE AS SHOWN

GHD

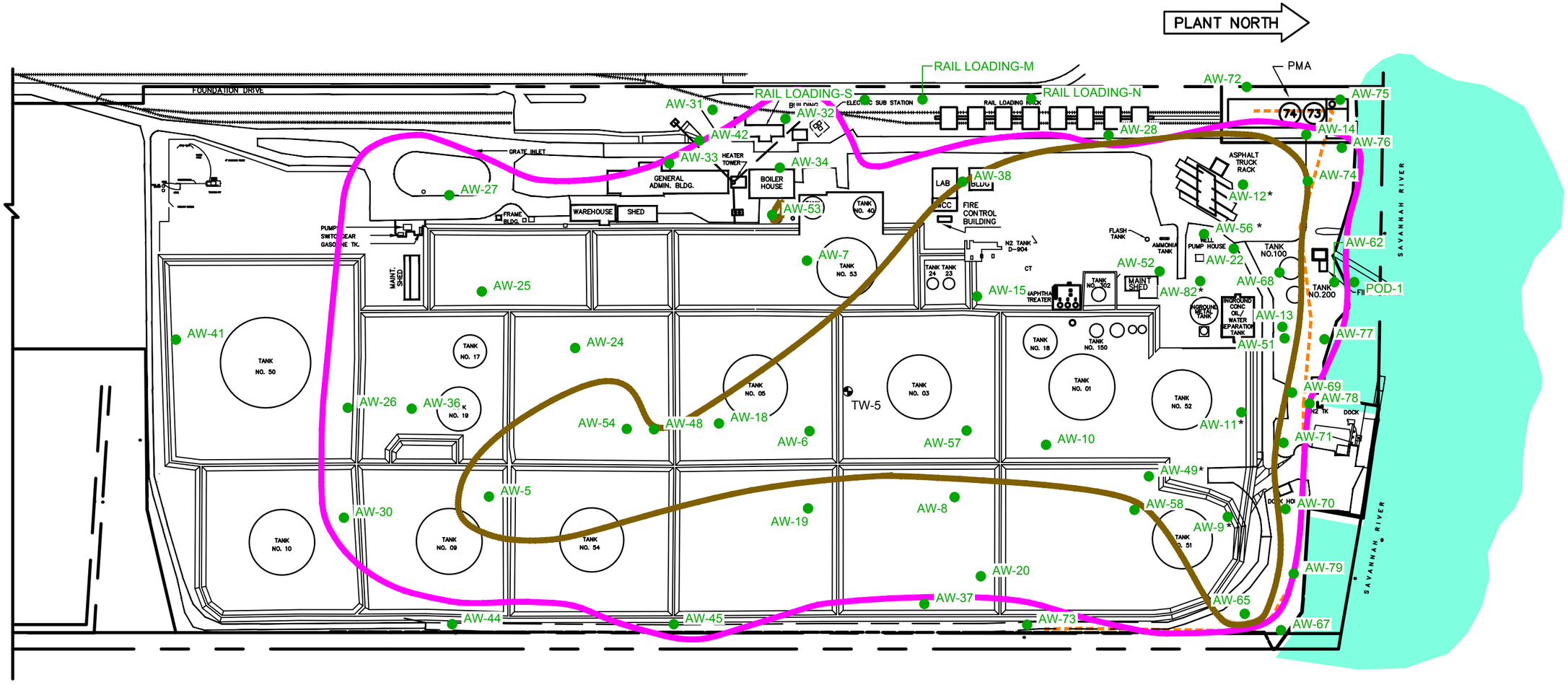
IMTT SAVANNAH NORTH TERMINAL
7 FOUNDATION DRIVE, SAVANNAH, CHATHAM COUNTY, GEORGIA
CORRECTIVE ACTION PLAN AND CONCEPTUAL SITE MODEL

089400-2018
May 11, 2018

CROSS SECTION C - C'

FIGURE 9

CAD File: P:\drawings\89000s\89400\89400-REPORT\89400-2018(006)\89400-2018(006)GN\089400-2018(006)GN-TP009.dwg




LEGEND

- PROPERTY LINE AND BOUNDARY
- POLYWALL BARRIER
- AW-52 WELL LOCATION
- TW-5 DIRECT PUSH BORING LOCATION
- MAXIMUM INFERRED EXTENT OF LNAPL
- FEBRUARY 2018 INFERRED EXTENT OF LNAPL

| AREAS | |
|---|---|
| MAXIMUM INFERRED EXTENT OF LNAPL | 1,554,313 SQ. FT. |
| FEBRUARY 2018 INFERRED EXTENT OF LNAPL | 666,661 SQ. FT. |

0 100 200ft

IMTT SAVANNAH NORTH TERMINAL
7 FOUNDATION DRIVE, SAVANNAH, CHATHAM COUNTY, GEORGIA
CORRECTIVE ACTION PLAN AND CONCEPTUAL SITE MODEL

# COMPARISON OF MAXIMUM INFERRED EXTENT OF LNAPL TO CURRENT INFERRED EXTENT OF LNAPL

89400-2018

May 11, 2018

FIGURE 10

CAD File: P:\drawings\89000s\89400\89400-REPORT\89400-2018(006)\89400-2018(006)GN\89400-2018(006)GN-WA014.DWG

# Tables

# Table 1

## Groundwater Elevation and LNAPL Thickness Data - March 2016 to Current
## IMTT Savannah North Terminal
## Savannah, Georgia
## VRP #1440101197

| Location ID | Measurement Date | Depth to LNAPL (ft btoc) | Depth to Water (ft btoc) | Groundwater Elevation (ft AMSL) | LNAPL Thickness (ft) |
|---|---|---|---|---|---|
| AW-5 | 3/1/2016 | 6.56 | 7.75 | 9.31 | 1.19 |
| | 5/1/2016 | 6.42 | 7.61 | 9.45 | 1.19 |
| | 9/21/2016 | 5.50 | 8.05 | 10.17 | 2.55 |
| | 11/15/2016 | 6.72 | 8.32 | 9.09 | 1.60 |
| | 2/14/2017 | 5.35 | 6.42 | 10.53 | 1.07 |
| | 5/2/2017 | 7.23 | 7.62 | 8.75 | 0.39 |
| | 8/8/2017 | 5.11 | 6.81 | 10.68 | 1.70 |
| | 11/1/2017 | 6.61 | 7.81 | 9.25 | 1.20 |
| | 2/6/2018 | 6.78 | 7.98 | 9.08 | 1.20 |
| | | | | | |
| AW-6 | 3/1/2016 | 8.20 | 9.43 | 3.19 | 1.23 |
| | 5/1/2016 | 8.06 | 9.58 | 3.29 | 1.52 |
| | 9/22/2016 | 7.46 | 9.37 | 3.83 | 1.91 |
| | 11/15/2016 | 7.25 | 9.54 | 3.99 | 2.29 |
| | 2/14/2017 | 7.91 | 9.53 | 3.42 | 1.62 |
| | 5/2/2017 | 8.36 | 9.64 | 3.02 | 1.28 |
| | 8/8/2017 | 7.70 | 7.81 | 3.85 | 0.11 |
| | 11/1/2017 | 7.90 | 9.31 | 3.46 | 1.41 |
| | 2/6/2018 | 8.37 | 9.36 | 3.06 | 0.99 |
| | | | | | |
| AW-7 | 3/1/2016 | -- | 7.93 | 4.61 | -- |
| | 5/1/2016 | -- | 7.78 | 4.76 | -- |
| | 9/22/2016 | -- | 7.22 | 5.32 | -- |
| | 11/15/2016 | -- | 6.38 | 6.16 | -- |
| | 2/14/2017 | Not Measured | | | |
| | 5/2/2017 | -- | 8.11 | 4.43 | -- |
| | 8/8/2017 | -- | 6.86 | 5.68 | -- |
| | 11/1/2017 | -- | 7.64 | 4.90 | -- |
| | 2/6/2018 | -- | 7.87 | 4.67 | -- |
| | | | | | |
| AW-8 | 3/1/2016 | -- | 12.70 | 2.98 | -- |
| | 5/1/2016 | 12.54 | 12.70 | 3.12 | 0.16 |
| | 9/22/2016 | 12.20 | 12.25 | 3.47 | 0.05 |
| | 11/15/2016 | 11.80 | 11.82 | 3.88 | 0.02 |
| | 2/14/2017 | 12.36 | 12.40 | 3.31 | 0.04 |
| | 5/2/2017 | 12.99 | 13.01 | 2.69 | 0.02 |
| | 8/8/2017 | 11.88 | 11.93 | 3.79 | 0.05 |
| | 11/1/2017 | 12.41 | 12.43 | 3.27 | 0.02 |
| | 2/6/2018 | -- | 12.77 | 2.91 | -- |
| | | | | | |
| AW-9 | 3/1/2016 | 10.89 | 14.82 | 2.04 | 3.93 |
| | 5/1/2016 | 10.77 | 14.62 | 2.17 | 3.85 |
| | 9/22/2016 | 11.15 | 11.40 | 2.31 | 0.25 |
| | 11/15/2016 | 10.31 | 13.20 | 2.77 | 2.89 |
| | 2/14/2017 | 10.92 | 11.24 | 2.53 | 0.32 |
| | 5/2/2017 | 11.74 | 11.85 | 1.74 | 0.11 |
| | 8/8/2017 | 10.35 | 10.45 | 3.14 | 0.10 |
| | 11/1/2017 | 11.18 | 11.30 | 2.30 | 0.12 |
| | 2/6/2018 | 11.34 | 11.75 | 2.10 | 0.41 |
| | | | | | |

# Table 1

## Groundwater Elevation and LNAPL Thickness Data - March 2016 to Current
## IMTT Savannah North Terminal
## Savannah, Georgia
## VRP #1440101197

| Location ID | Measurement Date | Depth to LNAPL (ft btoc) | Depth to Water (ft btoc) | Groundwater Elevation (ft AMSL) | LNAPL Thickness (ft) |
|---|---|---|---|---|---|
| AW-10 | 3/1/2016 | 11.10 | 14.72 | 2.27 | 3.62 |
| | 5/1/2016 | 10.73 | 14.82 | 2.57 | 4.09 |
| | 9/22/2016 | 10.44 | 15.33 | 2.75 | 4.89 |
| | 11/15/2016 | 9.40 | 14.12 | 3.82 | 4.73 |
| | 2/14/2017 | 11.31 | 11.56 | 2.55 | 0.25 |
| | 5/2/2017 | 11.73 | 13.08 | 1.97 | 1.35 |
| | 8/8/2017 | 9.90 | 13.79 | 3.43 | 3.89 |
| | 11/1/2017 | 10.84 | 14.75 | 2.49 | 3.91 |
| | 2/6/2018 | 11.31 | 13.82 | 2.22 | 2.51 |
| | | | | | |
| AW-11 | 3/1/2016 | 11.20 | 14.79 | 1.92 | 3.59 |
| | 5/1/2016 | 10.86 | 14.92 | 2.19 | 4.06 |
| | 9/22/2016 | 10.77 | 14.17 | 2.37 | 3.40 |
| | 11/15/2016 | 10.18 | 12.68 | 3.10 | 2.50 |
| | 2/14/2017 | 11.26 | 11.49 | 2.35 | 0.23 |
| | 5/2/2017 | 12.25 | 13.39 | 1.22 | 1.14 |
| | 8/8/2017 | 10.61 | 10.81 | 3.00 | 0.20 |
| | 11/1/2017 | 11.46 | 11.61 | 2.16 | 0.15 |
| | 2/6/2018 | 11.80 | 12.11 | 1.79 | 0.31 |
| | | | | | |
| AW-12 | 3/1/2016 | 9.25 | 12.65 | 2.30 | 3.40 |
| | 5/1/2016 | 8.96 | 15.77 | 2.01 | 6.81 |
| | 9/21/2016 | 5.47 | 16.20 | 4.82 | 10.73 |
| | 11/15/2016 | 8.70 | 10.99 | 3.04 | 2.29 |
| | 2/14/2017 | 9.46 | 14.09 | 1.88 | 4.63 |
| | 5/2/2017 | 9.50 | 15.15 | 1.67 | 5.65 |
| | 8/8/2017 | 8.40 | 17.04 | 2.25 | 8.64 |
| | 11/1/2017 | 9.06 | 16.61 | 1.78 | 7.55 |
| | 2/6/2018 | 12.17 | 12.20 | -0.04 | 0.03 |
| | | | | | |
| AW-13 | 3/1/2016 | 10.40 | 17.70 | 2.99 | 7.30 |
| | 5/1/2016 | 9.95 | 18.64 | 3.56 | 8.69 |
| | 9/22/2016 | 10.20 | 16.45 | 3.11 | 6.25 |
| | 11/15/2016 | 9.11 | 14.15 | 4.10 | 5.04 |
| | 2/14/2017 | 9.66 | 17.22 | 3.75 | 7.56 |
| | 5/2/2017 | 10.67 | 18.28 | 2.75 | 7.61 |
| | 8/8/2017 | 9.01 | 19.15 | 4.62 | 10.14 |
| | 11/1/2017 | 9.92 | 19.04 | 3.62 | 9.12 |
| | 2/6/2018 | 10.08 | 19.36 | 3.48 | 9.28 |
| | | | | | |
| AW-14 | 3/1/2016 | -- | 8.52 | 4.99 | -- |
| | 5/1/2016 | Not Measured | | | |
| | 9/22/2016 | -- | 8.05 | 5.46 | -- |
| | 11/15/2016 | -- | 7.46 | 6.05 | -- |
| | 2/14/2017 | -- | 8.66 | 4.85 | -- |
| | 5/2/2017 | -- | 8.19 | 5.32 | -- |
| | 8/8/2017 | -- | 8.09 | 5.42 | -- |
| | 11/1/2017 | -- | 8.45 | 5.06 | -- |
| | 2/6/2018 | -- | 8.81 | 4.70 | -- |
| | | | | | |

# Table 1

## Groundwater Elevation and LNAPL Thickness Data - March 2016 to Current
## IMTT Savannah North Terminal
## Savannah, Georgia
## VRP #1440101197

| Location ID | Measurement Date | Depth to LNAPL (ft btoc) | Depth to Water (ft btoc) | Groundwater Elevation (ft AMSL) | LNAPL Thickness (ft) |
|---|---|---|---|---|---|
| AW-15 | 3/1/2016 | 10.65 | 10.75 | 4.72 | 0.10 |
| | 5/1/2016 | 9.40 | 9.66 | 5.94 | 0.26 |
| | 9/22/2016 | 9.25 | 10.31 | 5.98 | 1.06 |
| | 11/15/2016 | 9.48 | 10.46 | 5.76 | 0.98 |
| | 2/14/2017 | 9.91 | 11.12 | 5.29 | 1.21 |
| | 5/2/2017 | 10.75 | 11.94 | 4.46 | 1.19 |
| | 8/8/2017 | 9.30 | 10.26 | 5.94 | 0.96 |
| | 11/1/2017 | 10.18 | 11.26 | 5.04 | 1.08 |
| | 2/6/2018 | 10.57 | 11.56 | 4.67 | 0.99 |
| | | | | | |
| AW-18 | 3/1/2016 | 7.06 | 8.60 | 5.64 | 1.54 |
| | 5/1/2016 | 7.00 | 8.75 | 5.66 | 1.75 |
| | 9/22/2016 | 6.70 | 9.45 | 5.82 | 2.75 |
| | 11/15/2016 | 6.29 | 7.74 | 6.42 | 1.45 |
| | 2/14/2017 | 6.09 | 7.31 | 6.65 | 1.22 |
| | 5/2/2017 | 6.95 | 7.80 | 5.85 | 0.85 |
| | 8/8/2017 | 6.16 | 6.40 | 6.72 | 0.24 |
| | 11/1/2017 | 6.87 | 8.52 | 5.81 | 1.65 |
| | 2/6/2018 | 6.64 | 7.28 | 6.19 | 0.64 |
| | | | | | |
| AW-19 | 3/1/2016 | 12.40 | 12.45 | 3.09 | 0.05 |
| | 5/1/2016 | -- | 12.26 | 3.24 | -- |
| | 9/22/2016 | 11.97 | 11.99 | 3.53 | 0.02 |
| | 11/15/2016 | -- | 11.60 | 3.90 | -- |
| | 2/14/2017 | -- | 12.11 | 3.39 | -- |
| | 5/2/2017 | -- | 12.50 | 3.00 | -- |
| | 8/8/2017 | -- | 11.51 | 3.99 | -- |
| | 11/1/2017 | -- | 12.13 | 3.37 | -- |
| | 2/6/2018 | -- | 12.41 | 3.09 | -- |
| | | | | | |
| AW-20 | 3/1/2016 | -- | 12.20 | 3.47 | -- |
| | 5/1/2016 | -- | 12.06 | 3.61 | -- |
| | 9/22/2016 | -- | 11.16 | 4.51 | -- |
| | 11/15/2016 | -- | 11.04 | 4.63 | -- |
| | 2/14/2017 | -- | 11.80 | 3.87 | -- |
| | 5/2/2017 | -- | 12.58 | 3.09 | -- |
| | 8/8/2017 | -- | 9.96 | 5.71 | -- |
| | 11/1/2017 | -- | 11.35 | 4.32 | -- |
| | 2/6/2018 | -- | 12.28 | 3.39 | -- |
| | | | | | |
| AW-22 | 3/1/2016 | 12.65 | 17.72 | 1.74 | 5.07 |
| | 5/1/2016 | 12.75 | 16.42 | 1.84 | 3.67 |
| | 9/21/2016 | 11.20 | 15.75 | 3.27 | 4.55 |
| | 11/15/2016 | 11.93 | 11.95 | 3.20 | 0.02 |
| | 2/14/2017 | 11.62 | 14.00 | 3.16 | 2.38 |
| | 5/2/2017 | 12.18 | 14.55 | 2.60 | 2.37 |
| | 8/8/2017 | 11.08 | 14.30 | 3.58 | 3.22 |
| | 11/1/2017 | 12.58 | 12.65 | 2.54 | 0.07 |
| | 2/6/2018 | 12.26 | 14.18 | 2.59 | 1.92 |
| | | | | | |

# Table 1

## Groundwater Elevation and LNAPL Thickness Data - March 2016 to Current
## IMTT Savannah North Terminal
## Savannah, Georgia
## VRP #1440101197

| Location ID | Measurement Date | Depth to LNAPL (ft btoc) | Depth to Water (ft btoc) | Groundwater Elevation (ft AMSL) | LNAPL Thickness (ft) |
|---|---|---|---|---|---|
| AW-24 | 3/1/2016 | -- | 5.10 | 6.26 | -- |
| | 5/1/2016 | -- | 5.04 | 6.32 | -- |
| | 9/22/2016 | -- | 4.67 | 6.69 | -- |
| | 11/15/2016 | -- | 5.16 | 6.20 | -- |
| | 2/14/2017 | -- | 4.56 | 6.80 | -- |
| | 5/2/2017 | -- | 5.34 | 6.02 | -- |
| | 8/8/2017 | -- | 3.34 | 8.02 | -- |
| | 11/1/2017 | -- | 4.94 | 6.42 | -- |
| | 2/6/2018 | -- | 4.25 | 7.11 | -- |
| | | | | | |
| AW-25 | 3/1/2016 | -- | 5.92 | 7.58 | -- |
| | 5/1/2016 | -- | 5.78 | 7.72 | -- |
| | 9/22/2016 | -- | 5.29 | 8.21 | -- |
| | 11/15/2016 | -- | 5.74 | 7.76 | -- |
| | 2/14/2017 | -- | 5.41 | 8.09 | -- |
| | 5/2/2017 | -- | 6.24 | 7.26 | -- |
| | 8/8/2017 | -- | 4.27 | 9.23 | -- |
| | 11/1/2017 | -- | 5.90 | 7.60 | -- |
| | 2/6/2018 | -- | 5.57 | 7.93 | -- |
| | | | | | |
| AW-26 | 3/1/2016 | -- | 4.52 | 7.95 | -- |
| | 5/1/2016 | -- | 4.54 | 7.93 | -- |
| | 9/22/2016 | -- | 4.64 | 7.83 | -- |
| | 11/15/2016 | -- | 4.91 | 7.56 | -- |
| | 2/14/2017 | -- | 4.46 | 8.01 | -- |
| | 5/2/2017 | -- | 5.23 | 7.24 | -- |
| | 8/8/2017 | -- | 3.66 | 8.81 | -- |
| | 11/1/2017 | -- | 5.00 | 7.47 | -- |
| | 2/6/2018 | -- | 4.83 | 7.64 | -- |
| | | | | | |
| AW-27 | 3/1/2016 | -- | 6.28 | 7.24 | -- |
| | 5/1/2016 | -- | 6.13 | 7.39 | -- |
| | 9/22/2016 | -- | 5.57 | 7.95 | -- |
| | 11/15/2016 | -- | 6.04 | 7.48 | -- |
| | 2/14/2017 | -- | 5.82 | 7.70 | -- |
| | 5/2/2017 | -- | 6.43 | 7.09 | -- |
| | 8/8/2017 | -- | 4.73 | 8.79 | -- |
| | 11/1/2017 | -- | 5.71 | 7.81 | -- |
| | 2/6/2018 | -- | 5.85 | 7.67 | -- |
| | | | | | |
| AW-28 | 3/1/2016 | -- | 5.15 | 6.03 | -- |
| | 5/1/2016 | -- | 5.19 | 5.99 | -- |
| | 9/22/2016 | -- | 4.60 | 6.58 | -- |
| | 11/15/2016 | -- | 5.13 | 6.05 | -- |
| | 2/14/2017 | -- | 5.40 | 5.78 | -- |
| | 5/2/2017 | -- | 5.80 | 5.38 | -- |
| | 8/8/2017 | -- | 3.19 | 7.99 | -- |
| | 11/1/2017 | -- | 4.87 | 6.31 | -- |
| | 2/6/2018 | -- | 5.11 | 6.07 | -- |
| | | | | | |

# Table 1

## Groundwater Elevation and LNAPL Thickness Data - March 2016 to Current
## IMTT Savannah North Terminal
## Savannah, Georgia
## VRP #1440101197

| Location ID | Measurement Date | Depth to LNAPL (ft btoc) | Depth to Water (ft btoc) | Groundwater Elevation (ft AMSL) | LNAPL Thickness (ft) |
|---|---|---|---|---|---|
| AW-30 | 3/1/2016 | -- | 5.35 | 8.05 | -- |
| | 5/1/2016 | -- | 5.31 | 8.09 | -- |
| | 9/22/2016 | -- | 5.39 | 8.01 | -- |
| | 11/15/2016 | -- | 5.59 | 7.81 | -- |
| | 2/14/2017 | -- | 5.29 | 8.11 | -- |
| | 5/2/2017 | -- | 5.95 | 7.45 | -- |
| | 8/8/2017 | -- | 4.47 | 8.93 | -- |
| | 11/1/2017 | -- | 5.73 | 7.67 | -- |
| | 2/6/2018 | -- | 5.54 | 7.86 | -- |
| | | | | | |
| AW-31 | 3/1/2016 | -- | 2.72 | 7.58 | -- |
| | 5/1/2016 | -- | 2.60 | 7.70 | -- |
| | 9/22/2016 | -- | 2.10 | 8.20 | -- |
| | 11/15/2016 | -- | 1.80 | 8.50 | -- |
| | 2/14/2017 | -- | 2.40 | 7.90 | -- |
| | 5/2/2017 | -- | 2.76 | 7.54 | -- |
| | 8/8/2017 | -- | 1.21 | 9.09 | -- |
| | 11/1/2017 | -- | 2.22 | 8.08 | -- |
| | 2/6/2018 | -- | 2.55 | 7.75 | -- |
| | | | | | |
| AW-32 | 3/1/2016 | -- | 10.40 | 3.99 | -- |
| | 5/1/2016 | -- | 9.60 | 4.79 | -- |
| | 9/22/2016 | -- | 9.37 | 5.02 | -- |
| | 11/15/2016 | -- | 9.70 | 4.69 | -- |
| | 2/14/2017 | 9.49 | 9.49 | 4.90 | Sheen |
| | 5/2/2017 | 9.91 | 10.04 | 4.46 | 0.13 |
| | 8/8/2017 | -- | 7.68 | 6.71 | -- |
| | 11/1/2017 | -- | 9.46 | 4.93 | -- |
| | 2/6/2018 | -- | 10.00 | 4.39 | -- |
| | | | | | |
| AW-33 | 3/1/2016 | -- | 5.43 | 7.65 | -- |
| | 5/1/2016 | -- | 5.35 | 7.73 | -- |
| | 9/22/2016 | -- | 4.92 | 8.16 | -- |
| | 11/15/2016 | -- | 5.39 | 7.69 | -- |
| | 2/14/2017 | -- | 5.32 | 7.76 | -- |
| | 5/2/2017 | -- | 6.79 | 6.29 | -- |
| | 8/8/2017 | -- | 4.00 | 9.08 | -- |
| | 11/1/2017 | -- | 5.26 | 7.82 | -- |
| | 2/6/2018 | -- | 5.18 | 7.90 | -- |
| | | | | | |
| AW-34 | 3/1/2016 | -- | 7.57 | 5.70 | -- |
| | 5/1/2016 | -- | 7.36 | 5.91 | -- |
| | 9/22/2016 | -- | 6.40 | 6.87 | -- |
| | 11/15/2016 | -- | 7.11 | 6.16 | -- |
| | 2/14/2017 | -- | 7.36 | 5.91 | -- |
| | 5/2/2017 | -- | 8.04 | 5.23 | -- |
| | 8/8/2017 | -- | 5.50 | 7.77 | -- |
| | 11/1/2017 | -- | 6.60 | 6.67 | -- |
| | 2/6/2018 | -- | 7.18 | 6.09 | -- |
| | | | | | |

# Table 1

## Groundwater Elevation and LNAPL Thickness Data - March 2016 to Current
## IMTT Savannah North Terminal
## Savannah, Georgia
## VRP #1440101197

| Location ID | Measurement Date | Depth to LNAPL (ft btoc) | Depth to Water (ft btoc) | Groundwater Elevation (ft AMSL) | LNAPL Thickness (ft) |
|---|---|---|---|---|---|
| AW-36 | 3/1/2016 | -- | 5.47 | 8.18 | -- |
| | 5/1/2016 | -- | 5.42 | 8.23 | -- |
| | 9/22/2016 | -- | 5.23 | 8.42 | -- |
| | 11/15/2016 | -- | 5.82 | 7.83 | -- |
| | 2/14/2017 | -- | 5.17 | 8.48 | -- |
| | 5/2/2017 | -- | 6.22 | 7.43 | -- |
| | 8/8/2017 | -- | 4.06 | 9.59 | -- |
| | 11/1/2017 | -- | 5.79 | 7.86 | -- |
| | 2/6/2018 | -- | 5.81 | 7.84 | -- |
| | | | | | |
| AW-37 | 3/1/2016 | -- | 11.37 | 2.96 | -- |
| | 5/1/2016 | -- | 11.24 | 3.09 | -- |
| | 9/22/2016 | -- | 10.95 | 3.38 | -- |
| | 11/15/2016 | -- | 10.49 | 3.84 | -- |
| | 2/14/2017 | -- | 10.98 | 3.35 | -- |
| | 5/2/2017 | -- | 11.53 | 2.80 | -- |
| | 8/8/2017 | -- | 10.40 | 3.93 | -- |
| | 11/1/2017 | -- | 11.06 | 3.27 | -- |
| | 2/6/2018 | -- | 11.32 | 3.01 | -- |
| | | | | | |
| AW-38 | 3/1/2016 | -- | 4.45 | 7.58 | -- |
| | 5/1/2016 | Not Measured | | | |
| | 9/22/2016 | 3.80 | 3.82 | 8.23 | 0.02 |
| | 11/15/2016 | 4.17 | 4.18 | 7.86 | 0.01 |
| | 2/14/2017 | 4.48 | 4.49 | 7.55 | 0.01 |
| | 5/2/2017 | 5.11 | 5.12 | 6.92 | 0.01 |
| | 8/8/2017 | 3.37 | 3.52 | 8.64 | 0.15 |
| | 11/1/2017 | -- | 4.06 | 7.97 | -- |
| | 2/6/2018 | 4.51 | 4.59 | 7.51 | 0.08 |
| | | | | | |
| AW-41 | 3/1/2016 | -- | 9.15 | 6.00 | -- |
| | 5/1/2016 | -- | 9.71 | 5.44 | -- |
| | 9/22/2016 | -- | 9.15 | 6.00 | -- |
| | 11/15/2016 | -- | 9.47 | 5.68 | -- |
| | 2/14/2017 | -- | 8.97 | 6.18 | -- |
| | 5/2/2017 | -- | 9.50 | 5.65 | -- |
| | 8/8/2017 | -- | 8.04 | 7.11 | -- |
| | 11/1/2017 | -- | 9.15 | 6.00 | -- |
| | 2/6/2018 | -- | 9.16 | 5.99 | -- |
| | | | | | |
| AW-42 | 3/1/2016 | Not Measured | | | |
| | 5/1/2016 | 1.69 | 1.70 | 7.74 | 0.01 |
| | 9/22/2016 | -- | 1.23 | 8.20 | -- |
| | 11/15/2016 | -- | 1.93 | 7.50 | -- |
| | 2/14/2017 | -- | 1.50 | 7.93 | -- |
| | 5/2/2017 | -- | 2.11 | 7.32 | -- |
| | 8/8/2017 | -- | 0.00 | 9.43 | -- |
| | 11/1/2017 | -- | 1.36 | 8.07 | -- |
| | 2/6/2018 | -- | 1.68 | 7.75 | -- |
| | | | | | |

# Table 1

## Groundwater Elevation and LNAPL Thickness Data - March 2016 to Current
## IMTT Savannah North Terminal
## Savannah, Georgia
## VRP #1440101197

| Location ID | Measurement Date | Depth to LNAPL (ft btoc) | Depth to Water (ft btoc) | Groundwater Elevation (ft AMSL) | LNAPL Thickness (ft) |
|---|---|---|---|---|---|
| AW-44 | 3/1/2016 | -- | 10.03 | 3.38 | -- |
| | 5/1/2016 | -- | 10.00 | 3.41 | -- |
| | 9/22/2016 | -- | 9.65 | 3.76 | -- |
| | 11/15/2016 | -- | 9.39 | 4.02 | -- |
| | 2/14/2017 | -- | 9.55 | 3.86 | -- |
| | 5/2/2017 | -- | 10.11 | 3.30 | -- |
| | 8/8/2017 | -- | 9.25 | 4.16 | -- |
| | 11/1/2017 | -- | 9.84 | 3.57 | -- |
| | 2/6/2018 | -- | 9.87 | 3.54 | -- |
| | | | | | |
| AW-45 | 3/1/2016 | -- | 12.14 | 2.99 | -- |
| | 5/1/2016 | -- | 12.12 | 3.01 | -- |
| | 9/22/2016 | -- | 11.78 | 3.35 | -- |
| | 11/15/2016 | -- | 11.51 | 3.62 | -- |
| | 2/14/2017 | -- | 11.88 | 3.25 | -- |
| | 5/2/2017 | -- | 12.22 | 2.91 | -- |
| | 8/8/2017 | -- | 11.22 | 3.91 | -- |
| | 11/1/2017 | -- | 11.79 | 3.34 | -- |
| | 2/6/2018 | -- | 12.10 | 3.03 | -- |
| | | | | | |
| AW-48 | 3/1/2016 | -- | 6.82 | 4.31 | -- |
| | 5/1/2016 | -- | 6.10 | 5.03 | -- |
| | 9/22/2016 | -- | 5.58 | 5.55 | -- |
| | 11/15/2016 | -- | 5.49 | 5.64 | -- |
| | 2/14/2017 | -- | 5.72 | 5.41 | -- |
| | 5/2/2017 | -- | 6.39 | 4.74 | -- |
| | 8/8/2017 | -- | 4.82 | 6.31 | -- |
| | 11/1/2017 | -- | 5.72 | 5.41 | -- |
| | 2/6/2018 | -- | 5.98 | 5.15 | -- |
| | | | | | |
| AW-49 | 3/1/2016 | 13.10 | 15.94 | 1.99 | 2.84 |
| | 5/1/2016 | 12.73 | 16.76 | 2.18 | 4.03 |
| | 9/22/2016 | 13.22 | 13.47 | 2.24 | 0.25 |
| | 11/15/2016 | 13.00 | 13.19 | 2.47 | 0.19 |
| | 2/14/2017 | 12.99 | 13.21 | 2.48 | 0.22 |
| | 5/2/2017 | 13.69 | 13.96 | 1.77 | 0.27 |
| | 8/8/2017 | 12.24 | 12.45 | 3.23 | 0.21 |
| | 11/1/2017 | 13.20 | 13.50 | 2.26 | 0.30 |
| | 2/6/2018 | 13.21 | 13.54 | 2.24 | 0.33 |
| | | | | | |
| AW-51 | 3/1/2016 | 10.48 | 11.41 | 2.16 | 0.93 |
| | 5/1/2016 | 9.90 | 10.62 | 2.76 | 0.72 |
| | 9/22/2016 | 10.35 | 11.67 | 2.24 | 1.32 |
| | 11/15/2016 | 9.41 | 9.62 | 3.31 | 0.21 |
| | 2/14/2017 | 9.84 | 10.17 | 2.87 | 0.33 |
| | 5/2/2017 | 10.85 | 11.34 | 1.84 | 0.49 |
| | 8/8/2017 | 9.21 | 9.98 | 3.45 | 0.77 |
| | 11/1/2017 | 10.31 | 11.12 | 2.34 | 0.81 |
| | 2/6/2018 | 10.43 | 11.29 | 2.22 | 0.86 |
| | | | | | |

## Table 1

## Groundwater Elevation and LNAPL Thickness Data - March 2016 to Current
## IMTT Savannah North Terminal
## Savannah, Georgia
## VRP #1440101197

| Location ID | Measurement Date | Depth to LNAPL (ft btoc) | Depth to Water (ft btoc) | Groundwater Elevation (ft AMSL) | LNAPL Thickness (ft) |
|---|---|---|---|---|---|
| AW-52 | 3/1/2016 | 12.80 | 15.69 | 2.52 | 2.89 |
| | 5/1/2016 | 12.47 | 15.56 | 2.82 | 3.09 |
| | 9/22/2016 | 12.40 | 15.52 | 2.88 | 3.12 |
| | 11/15/2016 | 11.68 | 15.00 | 3.58 | 3.32 |
| | 2/14/2017 | Not Measured | | | |
| | 5/2/2017 | 13.39 | 16.42 | 1.91 | 3.03 |
| | 8/8/2017 | 11.72 | 14.84 | 3.56 | 3.12 |
| | 11/1/2017 | 12.68 | 15.32 | 2.67 | 2.64 |
| | 2/6/2018 | 13.08 | 15.22 | 2.35 | 2.14 |
| | | | | | |
| AW-53 | 3/1/2016 | 6.62 | 6.92 | 3.67 | 0.30 |
| | 5/1/2016 | 6.51 | 6.76 | 3.78 | 0.25 |
| | 9/22/2016 | 6.06 | 6.28 | 4.24 | 0.22 |
| | 11/15/2016 | 5.88 | 6.36 | 4.38 | 0.48 |
| | 2/14/2017 | 6.39 | 6.60 | 3.91 | 0.21 |
| | 5/2/2017 | 6.77 | 7.34 | 3.48 | 0.57 |
| | 8/8/2017 | 5.50 | 5.72 | 4.80 | 0.22 |
| | 11/1/2017 | 6.25 | 6.44 | 4.05 | 0.19 |
| | 2/6/2018 | 6.51 | 6.83 | 3.77 | 0.32 |
| | | | | | |
| AW-54 | 3/1/2016 | 5.95 | 14.88 | 3.41 | 8.93 |
| | 5/1/2016 | 5.83 | 15.81 | 3.37 | 9.98 |
| | 9/22/2016 | 5.51 | 9.60 | 4.55 | 4.09 |
| | 11/15/2016 | 5.08 | 15.84 | 4.01 | 10.76 |
| | 2/14/2017 | 5.05 | 15.62 | 4.07 | 10.57 |
| | 5/2/2017 | 5.48 | 19.23 | 3.17 | 13.75 |
| | 8/8/2017 | 6.12 | 6.32 | 4.51 | 0.20 |
| | 11/1/2017 | 5.54 | 12.78 | 4.06 | 7.24 |
| | 2/6/2018 | 5.14 | 15.00 | 4.08 | 9.86 |
| | | | | | |
| AW-56 | 3/1/2016 | 9.32 | 14.05 | 2.64 | 4.73 |
| | 5/1/2016 | 8.48 | 14.55 | 3.28 | 6.07 |
| | 9/22/2016 | 9.39 | 15.09 | 2.43 | 5.70 |
| | 11/15/2016 | 7.88 | 13.39 | 3.97 | 5.51 |
| | 2/14/2017 | 8.63 | 13.85 | 3.26 | 5.22 |
| | 5/2/2017 | 11.15 | 11.45 | 1.46 | 0.30 |
| | 8/8/2017 | 11.04 | 11.25 | 1.58 | 0.21 |
| | 11/1/2017 | 12.31 | 14.05 | 0.09 | 1.74 |
| | 2/6/2018 | 11.94 | 12.14 | 0.68 | 0.20 |
| | | | | | |
| AW-57 | 3/1/2016 | Not Measured | | | |
| | 5/1/2016 | 8.64 | 10.23 | 3.27 | 1.59 |
| | 9/22/2016 | 8.45 | 9.27 | 3.57 | 0.82 |
| | 11/15/2016 | 7.96 | 9.77 | 3.92 | 1.81 |
| | 2/14/2017 | 8.89 | 9.09 | 3.22 | 0.20 |
| | 5/2/2017 | 9.33 | 9.74 | 2.75 | 0.41 |
| | 8/8/2017 | 8.12 | 8.22 | 4.01 | 0.10 |
| | 11/1/2017 | 8.68 | 9.34 | 3.37 | 0.66 |
| | 2/6/2018 | 9.16 | 9.96 | 2.87 | 0.80 |
| | | | | | |

## Table 1

## Groundwater Elevation and LNAPL Thickness Data - March 2016 to Current
## IMTT Savannah North Terminal
## Savannah, Georgia
## VRP #1440101197

| Location ID | Measurement Date | Depth to LNAPL (ft btoc) | Depth to Water (ft btoc) | Groundwater Elevation (ft AMSL) | LNAPL Thickness (ft) |
|---|---|---|---|---|---|
| AW-58 | 3/1/2016 | -- | 8.61 | NS | -- |
| | 5/1/2016 | -- | 8.51 | NS | -- |
| | 9/22/2016 | -- | 8.15 | NS | -- |
| | 11/15/2016 | -- | 7.44 | NS | -- |
| | 2/14/2017 | -- | 6.04 | NS | -- |
| | 5/2/2017 | -- | 8.91 | NS | -- |
| | 8/8/2017 | -- | 7.45 | NS | -- |
| | 11/1/2017 | -- | 8.39 | NS | -- |
| | 2/6/2018 | -- | 5.56 | NS | -- |
| | | | | | |
| AW-62 | 3/1/2016 | -- | 9.24 | NS | -- |
| | 5/1/2016 | -- | 10.60 | NS | -- |
| | 9/22/2016 | 9.60 | 9.60 | NS | Sheen |
| | 11/15/2016 | 9.42 | 9.42 | NS | Sheen |
| | 2/14/2017 | 4.92 | 4.92 | NS | Sheen |
| | 5/2/2017 | 10.92 | 10.92 | NS | Sheen |
| | 8/8/2017 | -- | 5.40 | NS | -- |
| | 11/1/2017 | -- | 9.24 | NS | Sheen |
| | 2/6/2018 | -- | 7.75 | NS | Sheen |
| | | | | | |
| AW-65 | 3/1/2016 | 11.45 | 13.20 | 1.56 | 1.75 |
| | 5/1/2016 | 11.53 | 13.51 | 1.45 | 1.98 |
| | 9/22/2016 | 10.75 | 12.41 | 2.27 | 1.66 |
| | 11/15/2016 | 10.41 | 12.62 | 2.53 | 2.21 |
| | 2/14/2017 | 11.01 | 12.13 | 2.09 | 1.12 |
| | 5/2/2017 | 11.78 | 13.82 | 1.19 | 2.04 |
| | 8/8/2017 | 9.30 | 11.50 | 3.64 | 2.20 |
| | 11/1/2017 | 10.57 | 12.12 | 2.47 | 1.55 |
| | 2/6/2018 | 11.70 | 12.87 | 1.39 | 1.17 |
| | | | | | |
| AW-67 | 3/1/2016 | -- | 12.33 | -1.01 | -- |
| | 5/1/2016 | -- | 13.37 | -2.05 | -- |
| | 9/22/2016 | -- | 8.85 | 2.47 | -- |
| | 11/15/2016 | -- | 12.33 | -1.01 | -- |
| | 2/14/2017 | -- | 6.10 | 5.22 | -- |
| | 5/2/2017 | -- | 11.09 | 0.23 | -- |
| | 8/8/2017 | -- | 7.89 | 3.43 | -- |
| | 11/1/2017 | -- | 10.55 | 0.77 | -- |
| | 2/6/2018 | -- | 10.45 | 0.87 | -- |
| | | | | | |
| AW-68 | 3/1/2016 | 11.75 | 15.11 | 1.56 | 3.36 |
| | 5/1/2016 | 10.48 | 13.90 | 2.82 | 3.42 |
| | 9/22/2016 | 11.66 | 16.90 | 1.37 | 5.24 |
| | 11/15/2016 | 10.88 | 18.10 | 1.87 | 7.22 |
| | 2/14/2017 | 9.89 | 17.90 | 2.74 | 8.01 |
| | 5/2/2017 | 11.19 | 18.46 | 1.55 | 7.27 |
| | 8/8/2017 | 9.56 | 16.91 | 3.17 | 7.35 |
| | 11/1/2017 | 11.02 | 19.24 | 1.58 | 8.22 |
| | 2/6/2018 | 11.69 | 11.92 | 2.08 | 0.23 |
| | | | | | |

# Table 1

## Groundwater Elevation and LNAPL Thickness Data - March 2016 to Current
## IMTT Savannah North Terminal
## Savannah, Georgia
## VRP #1440101197

| Location ID | Measurement Date | Depth to LNAPL (ft btoc) | Depth to Water (ft btoc) | Groundwater Elevation (ft AMSL) | LNAPL Thickness (ft) |
|---|---|---|---|---|---|
| AW-69 | 3/1/2016 | Not Measured | | | |
| | 5/1/2016 | -- | 6.90 | 2.54 | -- |
| | 9/22/2016 | -- | 4.50 | 4.94 | -- |
| | 11/15/2016 | -- | 7.36 | 2.08 | -- |
| | 2/14/2017 | -- | 6.39 | 3.05 | -- |
| | 5/2/2017 | -- | 7.40 | 2.04 | -- |
| | 8/8/2017 | -- | 5.45 | 3.99 | -- |
| | 11/1/2017 | -- | 6.62 | 2.82 | -- |
| | 2/6/2018 | -- | 7.43 | 2.01 | -- |
| | | | | | |
| AW-70 | 3/1/2016 | -- | 11.18 | 1.07 | -- |
| | 5/1/2016 | -- | 11.11 | 1.14 | -- |
| | 9/22/2016 | -- | 9.57 | 2.68 | -- |
| | 11/15/2016 | -- | 10.44 | 1.81 | -- |
| | 2/14/2017 | -- | 10.06 | 2.19 | -- |
| | 5/2/2017 | -- | 10.85 | 1.40 | -- |
| | 8/8/2017 | -- | 8.87 | 3.38 | -- |
| | 11/1/2017 | -- | 10.52 | 1.73 | -- |
| | 2/6/2018 | -- | 10.67 | 1.58 | -- |
| | | | | | |
| AW-71 | 3/1/2016 | -- | 11.05 | 2.24 | -- |
| | 5/1/2016 | -- | 10.79 | 2.50 | -- |
| | 9/22/2016 | -- | 10.53 | 2.76 | -- |
| | 11/15/2016 | -- | 10.22 | 3.07 | -- |
| | 2/14/2017 | -- | 10.91 | 2.38 | -- |
| | 5/2/2017 | -- | 11.46 | 1.83 | -- |
| | 8/8/2017 | -- | 9.75 | 3.54 | -- |
| | 11/1/2017 | -- | 10.64 | 2.65 | -- |
| | 2/6/2018 | -- | 11.55 | 1.74 | -- |
| | | | | | |
| AW-72 | 3/1/2016 | -- | 8.78 | 1.34 | -- |
| | 5/1/2016 | -- | 7.25 | 2.87 | -- |
| | 9/22/2016 | -- | 8.85 | 1.27 | -- |
| | 11/15/2016 | -- | 6.57 | 3.55 | -- |
| | 2/14/2017 | -- | 7.67 | 2.45 | -- |
| | 5/2/2017 | -- | 9.76 | 0.36 | -- |
| | 8/8/2017 | -- | 7.28 | 2.84 | -- |
| | 11/1/2017 | -- | 9.26 | 0.86 | -- |
| | 2/6/2018 | -- | 8.28 | 1.84 | -- |
| | | | | | |
| AW-73 | 3/1/2016 | Not Measured | | | |
| | 5/1/2016 | Not Measured | | | |
| | 9/22/2016 | Not Measured | | | |
| | 11/15/2016 | -- | 8.67 | 3.37 | -- |
| | 2/14/2017 | -- | 9.26 | 2.78 | -- |
| | 5/2/2017 | -- | 9.68 | 2.36 | -- |
| | 8/8/2017 | Not Measured | | | |
| | 11/1/2017 | -- | 9.02 | 3.02 | -- |
| | 2/6/2018 | -- | 9.60 | 2.44 | -- |
| | | | | | |

# Table 1

## Groundwater Elevation and LNAPL Thickness Data - March 2016 to Current
## IMTT Savannah North Terminal
## Savannah, Georgia
## VRP #1440101197

| Location ID | Measurement Date | Depth to LNAPL (ft btoc) | Depth to Water (ft btoc) | Groundwater Elevation (ft AMSL) | LNAPL Thickness (ft) |
|---|---|---|---|---|---|
| AW-74 | 3/1/2016 | 9.27 | 10.99 | 0.44 | 1.72 |
| | 5/1/2016 | 6.78 | 7.96 | 3.01 | 1.18 |
| | 9/22/2016 | 9.53 | 13.71 | -0.18 | 4.18 |
| | 11/15/2016 | 6.46 | 7.05 | 3.41 | 0.59 |
| | 2/14/2017 | 7.11 | 10.21 | 2.40 | 3.10 |
| | 5/2/2017 | 10.11 | 13.90 | -0.70 | 3.79 |
| | 8/8/2017 | 6.52 | 9.55 | 3.00 | 3.03 |
| | 11/1/2017 | 10.32 | 10.51 | -0.39 | 0.19 |
| | 2/6/2018 | 7.24 | 9.23 | 2.43 | 1.99 |
| | | | | | |
| AW-75 | 3/1/2016 | -- | 11.04 | NS | -- |
| | 5/1/2016 | -- | 6.57 | NS | -- |
| | 9/22/2016 | -- | 11.74 | NS | -- |
| | 11/15/2016 | -- | 6.40 | NS | -- |
| | 2/14/2017 | -- | 7.35 | NS | -- |
| | 5/2/2017 | -- | 12.36 | NS | -- |
| | 8/8/2017 | -- | 7.56 | NS | -- |
| | 11/1/2017 | -- | 11.59 | NS | -- |
| | 2/6/2018 | -- | 8.10 | NS | -- |
| | | | | | |
| AW-76 | 3/1/2016 | -- | 13.61 | NS | -- |
| | 5/1/2016 | -- | 14.07 | NS | -- |
| | 9/22/2016 | -- | 12.41 | NS | -- |
| | 11/15/2016 | -- | 13.86 | NS | -- |
| | 2/14/2017 | -- | 7.34 | NS | -- |
| | 5/2/2017 | -- | 13.00 | NS | -- |
| | 8/8/2017 | -- | 7.49 | NS | -- |
| | 11/1/2017 | -- | 12.81 | NS | -- |
| | 2/6/2018 | -- | 8.14 | NS | -- |
| | | | | | |
| AW-77 | 3/1/2016 | -- | 7.91 | NS | -- |
| | 5/1/2016 | -- | 9.59 | NS | -- |
| | 9/22/2016 | -- | 9.59 | NS | -- |
| | 11/15/2016 | -- | 9.18 | NS | -- |
| | 2/14/2017 | -- | 4.43 | NS | -- |
| | 5/2/2017 | -- | 9.71 | NS | -- |
| | 8/8/2017 | -- | 5.25 | NS | -- |
| | 11/1/2017 | -- | 9.22 | NS | -- |
| | 2/6/2018 | -- | 6.92 | NS | -- |
| | | | | | |
| AW-78 | 3/1/2016 | -- | 6.91 | NS | -- |
| | 5/1/2016 | -- | 6.77 | NS | -- |
| | 9/22/2016 | -- | 6.36 | NS | -- |
| | 11/15/2016 | -- | 6.42 | NS | -- |
| | 2/14/2017 | -- | 6.13 | NS | -- |
| | 5/2/2017 | -- | 7.42 | NS | -- |
| | 8/8/2017 | -- | 5.25 | NS | -- |
| | 11/1/2017 | -- | 6.37 | NS | -- |
| | 2/6/2018 | -- | 7.15 | NS | -- |
| | | | | | |

**Table 1**

**Groundwater Elevation and LNAPL Thickness Data - March 2016 to Current**
**IMTT Savannah North Terminal**
**Savannah, Georgia**
**VRP #1440101197**

| Location ID | Measurement Date | Depth to LNAPL (ft btoc) | Depth to Water (ft btoc) | Groundwater Elevation (ft AMSL) | LNAPL Thickness (ft) |
|---|---|---|---|---|---|
| AW-79 | 3/1/2016 | -- | 10.95 | NS | -- |
| | 5/1/2016 | -- | 11.03 | NS | -- |
| | 9/22/2016 | -- | 5.07 | NS | -- |
| | 11/15/2016 | -- | 10.73 | NS | -- |
| | 2/14/2017 | -- | 5.55 | NS | -- |
| | 5/2/2017 | -- | 7.29 | NS | -- |
| | 8/8/2017 | -- | 4.82 | NS | -- |
| | 11/1/2017 | -- | 9.55 | NS | -- |
| | 2/6/2018 | -- | 6.50 | NS | -- |
| | | | | | |
| AW-82 | 3/1/2016 | 9.95 | 12.84 | NS | 2.89 |
| | 5/1/2016 | 9.65 | 12.63 | NS | 2.98 |
| | 9/22/2016 | 9.54 | 12.62 | NS | 3.08 |
| | 11/15/2016 | 8.97 | 11.84 | NS | 2.87 |
| | 2/14/2017 | 9.77 | 12.35 | NS | 2.58 |
| | 5/2/2017 | 11.10 | 11.41 | NS | 0.31 |
| | 8/8/2017 | 9.60 | 9.72 | NS | 0.12 |
| | 11/1/2017 | 10.11 | 11.72 | NS | 1.61 |
| | 2/6/2018 | 10.85 | 11.08 | NS | 0.23 |
| | | | | | |
| RAIL LOADING - N | 3/1/2016 | -- | 7.31 | 5.30 | -- |
| | 5/1/2016 | -- | 7.25 | 5.36 | -- |
| | 9/22/2016 | -- | 6.42 | 6.19 | -- |
| | 11/15/2016 | -- | 7.29 | 5.32 | -- |
| | 2/14/2017 | -- | 7.22 | 5.39 | -- |
| | 5/2/2017 | -- | 8.02 | 4.59 | -- |
| | 8/8/2017 | -- | 4.58 | 8.03 | -- |
| | 11/1/2017 | -- | 6.53 | 6.08 | -- |
| | 2/6/2018 | -- | 7.00 | 5.61 | -- |
| | | | | | |
| RAIL LOADING - S | 3/1/2016 | -- | 6.22 | 6.08 | -- |
| | 5/1/2016 | -- | 6.10 | 6.20 | -- |
| | 9/22/2016 | -- | 5.28 | 7.02 | -- |
| | 11/15/2016 | -- | 6.10 | 6.20 | -- |
| | 2/14/2017 | -- | 5.91 | 6.39 | -- |
| | 5/2/2017 | -- | 6.63 | 5.67 | -- |
| | 8/8/2017 | -- | 3.42 | 8.88 | -- |
| | 11/1/2017 | -- | 5.48 | 6.82 | -- |
| | 2/6/2018 | -- | 9.01 | 3.29 | -- |
| | | | | | |
| RAIL LOADING - M | 3/1/2016 | Damaged Casing | | | |
| | 5/1/2016 | Damaged Casing | | | |
| | 9/22/2016 | Damaged Casing | | | |
| | 11/15/2016 | Damaged Casing | | | |
| | 2/14/2017 | Damaged Casing | | | |
| | 5/2/2017 | Damaged Casing | | | |
| | 8/8/2017 | Damaged Casing | | | |
| | 11/1/2017 | Damaged Casing | | | |
| | 2/6/2018 | Damaged Casing | | | |
| | | | | | |

## Table 1

### Groundwater Elevation and LNAPL Thickness Data - March 2016 to Current
### IMTT Savannah North Terminal
### Savannah, Georgia
### VRP #1440101197

| Location ID | Measurement Date | Depth to LNAPL (ft btoc) | Depth to Water (ft btoc) | Groundwater Elevation (ft AMSL) | LNAPL Thickness (ft) |
|---|---|---|---|---|---|
| POD - 1 | 3/1/2016 | -- | 11.60 | NS | -- |
| | 5/1/2016 | -- | 12.04 | NS | -- |
| | 9/22/2016 | -- | 10.35 | NS | -- |
| | 11/15/2016 | -- | 11.43 | NS | -- |
| | 2/14/2017 | -- | 4.65 | NS | -- |
| | 5/2/2017 | -- | 10.77 | NS | -- |
| | 8/8/2017 | -- | 4.45 | NS | -- |
| | 11/1/2017 | -- | 9.31 | NS | Sheen |
| | 2/6/2018 | -- | 9.31 | NS | Sheen |
| | | | | | |

Notes:

Dash (--) indicates not applicable

NS = Not Surveyed

ft btoc = feet below top of casing

ft AMSL = feet above mean sea level

**Table 2**

**Preliminary Cost Estimate**
**IMTT Savannah North Terminal**
**Savannah, Georgia**
**VRP #1440101197**

| Budget Item | 2018 | 2019 | 2020 | 2021 |
|---|---|---|---|---|
| Continued O & M of LNAPL Skimmer Systems and Polywall Monitoring | $100,000 | $100,000 | $100,000 | $75,000 |
| Quarterly Groundwater Monitoring and LNAPL Gauging | $10,000 | $10,000 | $10,000 | $10,000 |
| LNAPL Disposal/Recycling Costs | $3,000 | $3,000 | $2,000 | $2,000 |
| Project Management and Semi-Annual Progress Report Preparation | $60,000 | $60,000 | $60,000 | $40,000 |
| Groundwater Sampling for Wells at the Site Boundary | | | $25,000 | |
| Development of the Type 5 Risk Reduction Standards | | | $10,000 | |
| Implementation of a Uniform Environmental Covenant | | | $20,000 | |
| Preparation of the Compliance Status Report | | | | $40,000 |
| Annual Cost | $173,000 | $173,000 | $227,000 | $167,000 |
| Cumulative Cost | $740,000 | | | |

# Appendices

# Appendix A
# LNAPL Transmissivity Evaluation Summary Tables and Charts

# AW-05 Skimming Evaluation

**Appendix A**

**LNAPL Skimming Test Results - Short-Duration Skimming**
**IMTT Savannah North Terminal**
**Savannah, Georgia**

| Well ID | Measurement Date & Time | Time Between Measurement Events (days) | Actual Skimmer Run-Time Between Measurement Events (days) | Cumulative Run-Time (days) | Total Volume of LNAPL Recovered (gallons) | Volume of LNAPL Recovered During Measurement Interval (gallons) | RUNNING Total Volume of LNAPL Recovered (gallons) | Percentage of On-Time During Measurement Interval (%) | Depth to LNAPL (feet btoc) | Depth to Water (feet btoc) | In-Well LNAPL Thickness (feet) | LNAPL Drawdown (feet) | Maximum Theoretical Unconfined LNAPL Drawdown (feet) | LNAPL Drawdown Used in Transmissivity Estimate[a] (feet) | Average LNAPL Recovery Rate for Interval (gal/day) | Average LNAPL Recovery Rate for Interval ($ft^3$/day) | Estimated LNAPL Transmissivity for Interval ($ft^2$/day) | Overall Average LNAPL Transmissivity[b] ($ft^2$/day) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AW-5 | Equilibrium | -- | | -- | -- | -- | | -- | 6.25 | 7.60 | 1.35 | -- | 0.20 | -- | -- | -- | -- | |
| | 9/22/2016 11:45 | -- | | -- | -- | -- | | -- | 5.50 | 8.05 | 2.55 | -- | | -- | -- | -- | -- | |
| | 9/28/2016 10:00 | 5.93 | 5.93 | 5.93 | 29.00 | 29.00 | 29.00 | 101% | 6.21 | 8.15 | 1.94 | -0.04 | | 0.20 | 4.9 | 0.65 | 2.4 | |
| | 10/5/2016 12:31 | 7.10 | 7.10 | 13.03 | 46.25 | 17.25 | 46.25 | 97% | 6.55 | 7.41 | 0.86 | 0.30 | | 0.20 | 2.4 | 0.32 | 1.2 | |
| | *END OF TEST INTERVAL - SHUTDOWN DUE TO HURRICANE* | | | | | | | | | | | | | | | | | |
| | 11/16/2016 7:54 | -- | | -- | | -- | | -- | 6.79 | 8.37 | 1.58 | -- | | -- | -- | -- | -- | |
| | 11/22/2016 10:46 | 6.12 | 5.51 | 5.51 | 50.10 | 50.10 | 96.35 | 90% | 7.25 | 7.91 | 0.66 | 1.00 | | 0.20 | 9.1 | 1.22 | 4.5 | |
| | 11/29/2016 11:25 | 7.03 | 1.05 | 6.56 | 54.95 | 4.85 | 101.20 | 15% | 7.12 | 7.68 | 0.56 | 0.87 | | 0.20 | 4.6 | 0.62 | 2.3 | |
| | *END OF TEST INTERVAL - DUE TO SKIMMER MALFUNCTION* | | | | | | | | | | | | | | | | | |
| | 1/19/2017 13:26 | -- | | -- | | -- | | -- | 6.25 | 7.09 | 0.84 | -- | | -- | -- | -- | -- | |
| | 1/23/2017 14:28 | 4.04 | 4.04 | 4.04 | 11.68 | 11.68 | 112.88 | 99% | 5.76 | 6.00 | 0.24 | -0.49 | | 0.20 | 2.9 | 0.39 | 1.4 | |
| | 1/26/2017 14:09 | 2.99 | 2.99 | 2.99 | 21.68 | 10.00 | 122.88 | 100% | 5.82 | 5.90 | 0.08 | -0.43 | | 0.20 | 3.3 | 0.45 | 1.6 | |
| | 1/31/2017 12:02 | 4.91 | 3.48 | 3.48 | 26.18 | 4.50 | 127.38 | 71% | 6.15 | 6.18 | 0.03 | -0.10 | | 0.20 | 1.3 | 0.17 | 0.6 | |
| | 2/7/2017 12:13 | 7.01 | 1.61 | 1.61 | 26.68 | 0.50 | 127.88 | 23% | 6.28 | 6.95 | 0.67 | 0.03 | | 0.20 | 0.3 | 0.04 | 0.2 | |
| | 2/13/2017 15:12 | 6.12 | 6.12 | 6.12 | 26.68 | 0.00 | 127.88 | 311% | 6.09 | 6.22 | 0.13 | -0.16 | | 0.20 | 0.0 | 0.00 | 0.0 | |
| | 2/14/2017 13:50 | 0.94 | 0.21 | 0.21 | 26.68 | 0.00 | 127.88 | 22% | 5.35 | 6.42 | 1.07 | -0.90 | | 0.20 | 0.0 | 0.00 | 0.0 | |
| | 2/23/2017 9:00 | 8.80 | -- | -- | 26.68 | 0.00 | 127.88 | 0% | 6.34 | 6.99 | 0.65 | 0.09 | | 0.20 | 0.0 | 0.00 | 0.0 | 0.20 |
| | *END OF TEST INTERVAL* | | | | | | | | | | | | | | | | | |

Assumed LNAPL specific gravity : 0.854

All calculations performed pursuant to the methodology detailed in ASTM E2856-13

[a]The maximum theoretical drawdown is used for each interval calculation where the measured drawdown is negative or where it exceeds the theoretical maximum.

[b]Represents the average of the stabilized recovery rates/LNAPL transmissivity estimates (i.e., excludes initial elevated values that would not represent potential long-term recovery rates).

Equilibrium data is an average of quarterly groundwater data collected from March 2016 through Februrary 2018 and excludes data collected during skimming operations.

# AW-06 Skimming Evaluation

# Appendix A

## AW-6 LNAPL Skimming Test Results
## IMTT Savannah North Terminal
## Savannah, Georgia

| Well ID | Measurement Date & Time | Time Between Measurement Events (days) | Actual Skimmer Run-Time Between Measurement Events (days) | Cumulative Run Time (days) | Total Volume of LNAPL Recovered (gallons) | Volume of LNAPL Recovered During Measurement Interval (gallons) | RUNNING Total Volume of LNAPL Recovered (gallons) | Depth to LNAPL (feet btoc) | Depth to Water (feet btoc) | In-Well LNAPL Thickness (feet) | LNAPL Drawdown (feet) | Maximum Theoretical Unconfined LNAPL Drawdown (feet) | LNAPL Drawdown Used in Transmissivity Estimate[a] (feet) | Average LNAPL Recovery Rate for Interval (gal/day) | Average LNAPL Recovery Rate for Interval ($ft^3$/day) | Estimated LNAPL Transmissivity for Interval ($ft^2$/day) | Overall Average LNAPL Transmissivity[b] ($ft^2$/day) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Equilibrium | -- | | -- | -- | -- | | 7.87 | 9.52 | 1.65 | -- | 0.24 | -- | -- | -- | -- | |
| AW-6 Short term test | 8/2/2016 12:20 | -- | | -- | -- | -- | | 7.95 | 9.55 | 1.60 | -- | | -- | -- | -- | -- | |
| | 8/11/2016 9:25 | 8.88 | 5.50 | 5.50 | 2.05 | 2.05 | 2.05 | 8.15 | 9.30 | 1.15 | 0.28 | | 0.24 | 0.4 | 0.05 | 0.2 | |
| | 8/17/2016 10:25 | 6.04 | 6.04 | 11.55 | 2.76 | 0.71 | 2.76 | 7.75 | 9.01 | 1.26 | -0.12 | | 0.24 | 0.1 | 0.02 | 0.05 | |
| | 8/24/2016 17:00 | 7.27 | 7.27 | 18.82 | 3.28 | 0.52 | 3.28 | 7.77 | 9.39 | 1.62 | -0.10 | | 0.24 | 0.1 | 0.01 | 0.03 | 0.04 |
| AW-6 Long term test | 8/2/2017 13:00 | -- | -- | 0.00 | -- | -- | -- | 7.33 | 9.50 | 2.17 | -- | | | -- | -- | -- | |
| | 8/2/2017 14:45 | 0.07 | 0.07 | 0.07 | 1.00 | 1.0 | 4.3 | 7.73 | 8.01 | 0.28 | -0.14 | | 0.24 | 13.7 | 1.83 | 5.6 | |
| | 8/9/2017 9:17 | 6.77 | 6.77 | 6.85 | 1.00 | 0.0 | 4.3 | 7.70 | 7.81 | 0.11 | -0.17 | | 0.24 | 0.0 | 0.00 | 0.0 | |
| | 8/17/2017 8:12 | 7.95 | 7.95 | 14.80 | 1.00 | 0.0 | 4.3 | 7.44 | 7.54 | 0.10 | -0.43 | | 0.24 | 0.0 | 0.00 | 0.0 | |
| | 8/22/2017 12:55 | 5.20 | 5.20 | 20.00 | 1.00 | 0.0 | 4.3 | 7.46 | 7.62 | 0.16 | -0.41 | | 0.24 | 0.0 | 0.00 | 0.0 | |
| | 8/30/2017 17:00 | 8.17 | 8.17 | 28.17 | 1.00 | 0.0 | 4.3 | 7.71 | 7.80 | 0.09 | -0.16 | | 0.24 | 0.0 | 0.00 | 0.0 | |
| | 9/6/2017 11:12 | 6.76 | 6.76 | 34.93 | 1.00 | 0.0 | 4.3 | 7.52 | 7.73 | 0.21 | -0.35 | | 0.24 | 0.0 | 0.00 | 0.0 | |
| | ***END OF TEST*** | | | | | | | | | | | | | | | | |

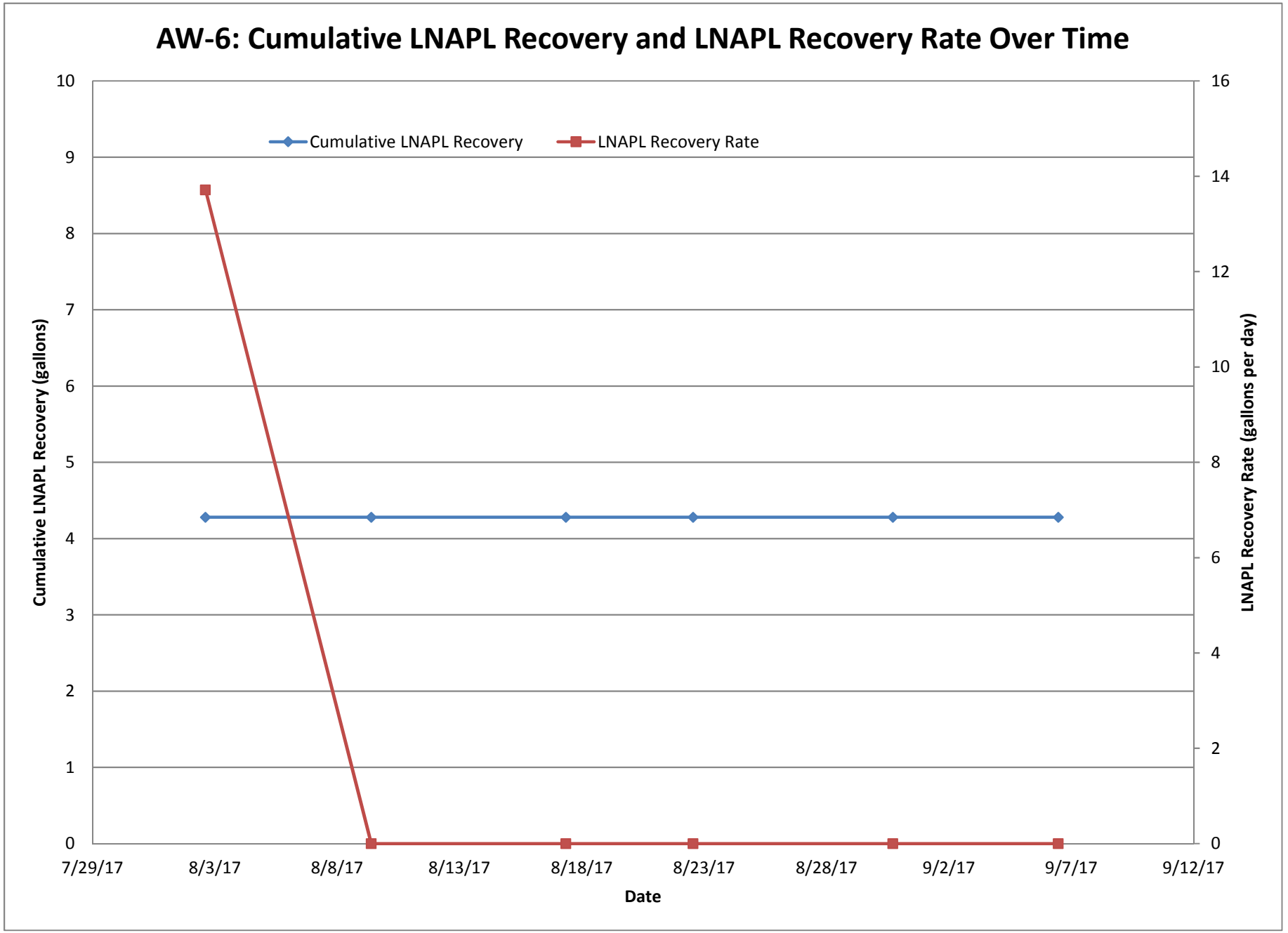
Assumed LNAPL specific gravity = 0.854

All calculations performed pursuant to the methodology detailed in ASTM E2856-13

[a]The maximum theoretical drawdown is used for each interval calculation where the measured drawdown is negative or where it exceeds the theoretical maximum.

[b]Represents the geometric mean of the stabilized recovery rates/LNAPL transmissivity estimates (i.e., excludes initial elevated values that would not represent potential long-term recovery rates).

Equilibrium data is an average of quarterly groundwater data collected from March 2016 through Februrary 2018 and excludes data collected during or following skimming operations.


AW-6: Cumulative LNAPL Recovery and LNAPL Recovery Rate Over Time
Cumulative LNAPL Recovery
LNAPL Recovery Rate
Cumulative LNAPL Recovery (gallons)
LNAPL Recovery Rate (gallons per day)
Date
0
1
2
3
4
5
6
7
8
9
10
0
2
4
6
8
10
12
14
16
7/29/17
8/3/17
8/8/17
8/13/17
8/18/17
8/23/17
8/28/17
9/2/17
9/7/17
9/12/17

# AW-09 Skimming Evaluation

**Appendix A**

**AW-9 LNAPL Skimming Test Results**
**IMTT Savannah North Terminal**
**Savannah, Georgia**

| Well ID | Measurement Date & Time | Time Between Measurement Events (days) | Actual Skimmer Run-Time Between Measurement Events (days) | Cumulative Run Time (days) | Total Volume of LNAPL Recovered (gallons) | Volume of LNAPL Recovered During Measurement Interval (gallons) | RUNNING Total Volume of LNAPL Recovered (gallons) | Depth to LNAPL (feet btoc) | Depth to Water (feet btoc) | In-Well LNAPL Thickness (feet) | LNAPL Drawdown (feet) | Maximum Theoretical Unconfined LNAPL Drawdown (feet) | LNAPL Drawdown Used in Transmissivity Estimate[a] (feet) | Average LNAPL Recovery Rate for Interval (gal/day) | Average LNAPL Recovery Rate for Interval ($ft^3$/day) | Estimated LNAPL Transmissivity for Interval ($ft^2$/day) | Overall Average LNAPL Transmissivity[b] ($ft^2$/day) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AW-9 Short term test | Equilibrium | -- | | -- | -- | -- | | 10.83 | 14.72 | 3.89 | -- | 0.57 | -- | -- | -- | -- | |
| | 6/8/2016 14:00 | -- | | -- | -- | -- | | 10.68 | 14.55 | 3.87 | -- | | -- | -- | -- | -- | |
| | 6/9/2016 17:35 | 1.15 | 1.15 | 1.15 | 8.55 | 8.55 | 8.55 | 9.60 | 12.00 | 2.40 | -1.23 | | 0.57 | 7.4 | 0.99 | 1.3 | |
| | 6/10/2016 7:00 | 0.56 | 0.56 | 1.71 | 9.60 | 1.05 | 9.60 | 9.60 | 12.50 | 2.90 | -1.23 | | 0.57 | 1.9 | 0.25 | 0.3 | |
| | 6/13/2016 11:00 | 2.96 | 2.96 | 4.88 | 21.34 | 11.74 | 21.34 | 10.27 | 12.60 | 2.33 | -0.56 | | 0.57 | 4.0 | 0.53 | 0.7 | |
| | 6/22/2016 16:30 | 9.23 | 9.23 | 14.10 | 49.25 | 27.91 | 49.25 | 10.40 | 12.20 | 1.80 | -0.43 | | 0.57 | 3.0 | 0.40 | 0.5 | |
| | 6/27/2016 14:27 | 4.91 | 4.91 | 19.02 | 49.25 | 0.00 | 49.25 | 10.06 | 14.51 | 4.45 | -0.77 | | 0.57 | 0.0 | 0 | 0 | 0.6 |
| | 9/14/2016 13:10 | -- | -- | | -- | -- | | 10.05 | 13.98 | 3.93 | -- | | | -- | -- | -- | |
| | 9/14/2016 16:50 | 0.15 | 0.15 | 0.15 | 9.00 | 9.0 | 58.3 | 10.65 | 12.35 | 1.70 | -0.18 | | 0.57 | 58.9 | 7.87 | 10.1 | |
| | 9/15/2016 8:05 | 0.64 | 0.64 | 0.64 | 14.70 | 5.7 | 64.0 | 10.35 | 10.51 | 0.16 | -0.48 | | 0.57 | 9.0 | 1.20 | 1.5 | |
| | 9/15/2016 8:55 | 0.03 | 0.03 | 0.67 | 14.90 | 0.2 | 64.2 | 10.31 | 10.51 | 0.20 | -0.52 | | 0.57 | 5.8 | 0.77 | 1.0 | |
| | 9/15/2016 11:50 | 0.12 | 0.12 | 0.79 | 15.30 | 0.4 | 64.6 | 10.26 | 10.50 | 0.24 | -0.57 | | 0.57 | 3.3 | 0.44 | 0.6 | |
| | 9/21/2016 11:52 | 6.00 | 6.69 | 7.48 | 31.80 | 16.5 | 81.1 | 10.75 | 11.10 | 0.35 | -0.08 | | 0.57 | 2.5 | 0.33 | 0.4 | |
| | 9/22/2016 9:45 | 0.91 | 0.90 | 8.39 | 33.10 | 1.3 | 82.4 | 11.15 | 11.40 | 0.25 | 0.32 | | 0.32 | 1.4 | 0.19 | 0.4 | |
| | 9/28/2016 8:15 | 5.94 | 5.94 | 14.33 | 52.10 | 19.0 | 101.4 | 10.46 | 10.72 | 0.26 | -0.37 | | 0.57 | 3.2 | 0.43 | 0.5 | |
| | 10/5/2016 14:15 | 7.25 | 6.32 | 20.65 | 71.10 | 19.0 | 120.4 | 10.19 | 10.42 | 0.23 | -0.64 | | 0.57 | 3.0 | 0.40 | 0.5 | |
| | *END OF TEST INTERVAL - SHUTDOWN DUE TO HURRICANE* | | | | | | | | | | | | | | | | |
| | 10/13/2016 13:50 | 7.98 | 0.00 | 20.65 | 0.00 | 0.0 | 120.4 | 8.83 | 12.89 | 4.06 | -- | | | -- | -- | -- | |
| | 10/20/2016 12:35 | 6.95 | 6.95 | 27.60 | 97.00 | 97.0 | 217.4 | 9.53 | 9.64 | 0.11 | -1.30 | | 0.57 | 6.5 | 0.87 | 1.1 | |
| | *END OF TEST INTERVAL - SHUTDOWN DUE TO FULL TANK* | | | | | | | | | | | | | | | | |
| | 10/28/2016 11:24 | -- | -- | -- | -- | -- | 217.4 | 9.33 | 12.73 | 3.40 | -- | | | -- | -- | -- | |
| | 11/4/2016 11:45 | 7.01 | 0.70 | 0.70 | 2.00 | 2.0 | 219.4 | 9.85 | 13.30 | 3.45 | -0.98 | | 0.57 | 2.9 | 0.38 | 0.5 | |
| | *END OF TEST INTERVAL - DUE TO EQUIPMENT MALFUNCTION* | | | | | | | | | | | | | | | | |
| | 11/15/2016 16:42 | -- | -- | -- | -- | -- | 219.4 | 10.31 | 13.20 | 2.89 | -- | | | -- | -- | -- | |
| | 11/22/2016 12:07 | 6.81 | 1.70 | 1.70 | 4.50 | 4.5 | 223.9 | 11.27 | 11.54 | 0.27 | 0.44 | | 0.57 | 2.6 | 0.35 | 0.5 | |
| | 11/29/2016 15:10 | 7.13 | 7.13 | 8.83 | 31.00 | 26.5 | 250.4 | 11.10 | 11.44 | 0.34 | 0.27 | | 0.57 | 3.7 | 0.50 | 0.6 | |
| | *END OF TEST INTERVAL - DUE TO EQUIPMENT MALFUNCTION* | | | | | | | | | | | | | | | | |
| | 12/5/2016 12:30 | 5.89 | -- | -- | -- | 2.0 | 252.4 | 10.38 | 13.21 | 2.83 | -- | | | -- | -- | -- | |
| | 12/7/2016 13:10 | 2.03 | 2.01 | 2.01 | 48.6 | 46.6 | 299.0 | 10.74 | 10.94 | 0.20 | -0.09 | | 0.57 | 14.0 | 1.87 | 2.4 | |
| | 12/14/2016 9:38 | 6.85 | 6.14 | 8.15 | 62.60 | 14.0 | 313.0 | 10.65 | 11.60 | 0.95 | -0.18 | | 0.57 | 2.3 | 0.30 | 0.4 | |
| | 12/21/2016 9:10 | 6.98 | 6.98 | 15.13 | 84.28 | 21.7 | 334.6 | 11.02 | 11.35 | 0.33 | 0.19 | | 0.57 | 3.1 | 0.42 | 0.5 | |
| | 12/27/2016 12:25 | 6.14 | 6.14 | 21.26 | 100.95 | 16.7 | 351.3 | 10.86 | 11.14 | 0.28 | 0.03 | | 0.57 | 2.7 | 0.36 | 0.5 | |
| | 1/4/2017 12:50 | 8.02 | 8.02 | 29.28 | 154.30 | 53.4 | 404.7 | 11.21 | 11.29 | 0.08 | 0.38 | | 0.57 | 6.7 | 0.89 | 1.1 | |
| | 1/9/2017 11:28 | 4.94 | 4.94 | 34.22 | 179.10 | 24.8 | 429.5 | 11.26 | 11.50 | 0.24 | 0.43 | | 0.57 | 5.0 | 0.67 | 0.9 | |
| | 1/19/2017 13:58 | 10.10 | 9.80 | 44.02 | 218.10 | 39.0 | 468.5 | 11.24 | 11.36 | 0.12 | 0.41 | | 0.57 | 4.0 | 0.53 | 0.7 | |
| | 1/26/2017 13:09 | 6.97 | 6.97 | 50.99 | 248.10 | 30.0 | 498.5 | 10.84 | 11.12 | 0.28 | 0.01 | | 0.57 | 4.3 | 0.58 | 0.7 | |
| | 1/31/2017 12:45 | 4.98 | 4.98 | 55.97 | 272.70 | 24.6 | 523.1 | 10.82 | 11.00 | 0.18 | -0.01 | | 0.57 | 4.9 | 0.66 | 0.8 | |
| | 2/7/2017 12:49 | 7.00 | 7.00 | 62.98 | 298.10 | 25.4 | 548.5 | 11.27 | 11.50 | 0.23 | 0.44 | | 0.57 | 3.6 | 0.48 | 0.6 | |
| | 2/13/2017 14:36 | 6.07 | 6.07 | 69.05 | 320.07 | 22.0 | 570.4 | 11.20 | 11.50 | 0.30 | 0.37 | | 0.57 | 3.6 | 0.48 | 0.6 | |
| | 2/14/2017 14:19 | 0.99 | 0.99 | 70.04 | 324.27 | 4.2 | 574.6 | 10.92 | 11.24 | 0.32 | 0.09 | | 0.57 | 4.3 | 0.57 | 0.7 | |
| | 2/23/2017 11:15 | 8.87 | 8.69 | 78.73 | 358.39 | 34.1 | 608.7 | 10.99 | 11.26 | 0.27 | 0.16 | | 0.57 | 3.9 | 0.52 | 0.7 | |
| | 3/3/2017 10:20 | 7.96 | 2.55 | 81.28 | 360.85 | 2.5 | 611.2 | 11.43 | 13.63 | 2.20 | 0.60 | | 0.57 | 1.0 | 0.13 | 0.2 | |
| | 3/7/2017 13:36 | 4.14 | 0.58 | 81.86 | 377.53 | 16.7 | 627.9 | 11.26 | 13.63 | 2.37 | 0.43 | | 0.57 | 4.0 | 0.54 | 0.7 | |
| | 3/10/2017 10:25 | 2.87 | 2.70 | 84.55 | 398.37 | 20.8 | 648.7 | 11.11 | 11.62 | 0.51 | 0.28 | | 0.57 | 7.7 | 1.03 | 1.3 | |
| | 3/16/2017 11:15 | 6.03 | 0.60 | 85.16 | 407.17 | 8.8 | 657.5 | 11.35 | 13.90 | 2.55 | 0.52 | | 0.57 | 1.5 | 0.19 | 0.3 | |
| | 3/23/2017 10:41 | 6.98 | 6.42 | 91.58 | 462.17 | 55.0 | 712.5 | 11.18 | 12.25 | 1.07 | 0.35 | | 0.57 | 8.6 | 1.15 | 1.5 | |
| | 3/31/2017 8:32 | 7.91 | 7.91 | 99.49 | 477.17 | 15.0 | 727.5 | 11.57 | 11.79 | 0.22 | 0.74 | | 0.57 | 1.9 | 0.25 | 0.3 | |

**Appendix A**

**AW-9 LNAPL Skimming Test Results**
**IMTT Savannah North Terminal**
**Savannah, Georgia**

| Well ID | Measurement Date & Time | Time Between Measurement Events (days) | Actual Skimmer Run-Time Between Measurement Events (days) | Cumulative Run Time (days) | Total Volume of LNAPL Recovered (gallons) | Volume of LNAPL Recovered During Measurement Interval (gallons) | RUNNING Total Volume of LNAPL Recovered (gallons) | Depth to LNAPL (feet btoc) | Depth to Water (feet btoc) | In-Well LNAPL Thickness (feet) | LNAPL Drawdown (feet) | Maximum Theoretical Unconfined LNAPL Drawdown (feet) | LNAPL Drawdown Used in Transmissivity Estimate[a] (feet) | Average LNAPL Recovery Rate for Interval (gal/day) | Average LNAPL Recovery Rate for Interval ($ft^3$/day) | Estimated LNAPL Transmissivity for Interval ($ft^2$/day) | Overall Average LNAPL Transmissivity[b] ($ft^2$/day) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AW-9 Long term test | 4/3/2017 10:00 | 3.06 | 3.06 | 102.55 | 488.37 | 11.2 | 738.7 | 11.55 | 11.79 | 0.24 | 0.72 | | 0.57 | 3.7 | 0.49 | 0.6 | |
| | 4/13/2017 11:46 | 10.07 | 9.77 | 112.32 | 518.77 | 30.4 | 769.1 | 11.14 | 11.32 | 0.18 | 0.31 | | 0.57 | 3.1 | 0.42 | 0.5 | |
| | 4/18/2017 11:41 | 5.00 | 5.00 | 117.32 | 532.67 | 13.9 | 783.0 | 11.65 | 11.81 | 0.16 | 0.82 | | 0.57 | 2.8 | 0.37 | 0.5 | |
| | 4/27/2017 10:55 | 8.97 | 8.97 | 126.28 | 557.77 | 25.1 | 808.1 | 11.09 | 11.20 | 0.11 | 0.26 | | 0.57 | 2.8 | 0.37 | 0.5 | |
| | 5/2/2017 12:39 | 5.07 | 5.07 | 131.36 | 567.27 | 9.5 | 817.6 | 11.74 | 11.85 | 0.11 | 0.91 | | 0.57 | 1.9 | 0.25 | 0.3 | |
| | 5/10/2017 10:40 | 7.92 | 7.60 | 138.96 | 594.27 | 27.0 | 844.6 | 11.49 | 11.60 | 0.11 | 0.66 | | 0.57 | 3.6 | 0.47 | 0.6 | |
| | 5/17/2017 7:39 | 6.87 | 6.87 | 145.83 | 609.27 | 15.0 | 859.6 | 11.80 | 11.90 | 0.10 | 0.97 | | 0.57 | 2.2 | 0.29 | 0.4 | |
| | 5/26/2017 10:49 | 9.13 | 9.13 | 154.96 | 637.77 | 28.5 | 888.1 | 11.42 | 11.50 | 0.08 | 0.59 | | 0.57 | 3.1 | 0.42 | 0.5 | |
| | 6/1/2017 7:55 | 5.88 | 5.88 | 160.84 | 652.27 | 14.5 | 902.6 | 11.33 | 11.58 | 0.25 | 0.50 | | 0.57 | 2.5 | 0.33 | 0.4 | |
| | 6/8/2017 11:50 | 7.16 | 7.16 | 168.01 | 662.77 | 10.5 | 913.1 | 10.86 | 11.06 | 0.20 | 0.03 | | 0.57 | 1.5 | 0.20 | 0.3 | |
| | 6/15/2017 11:03 | 6.97 | 6.69 | 174.69 | 672.87 | 10.1 | 923.2 | 11.60 | 11.76 | 0.16 | 0.77 | | 0.57 | 1.5 | 0.20 | 0.3 | |
| | 6/20/2017 9:48 | 4.95 | 4.95 | 179.64 | 680.27 | 7.4 | 930.6 | 11.34 | 11.51 | 0.17 | 0.51 | | 0.57 | 1.5 | 0.20 | 0.3 | |
| | 6/22/2017 10:10 | 2.02 | 2.04 | 181.68 | 687.27 | 7.0 | 937.6 | 11.09 | 11.27 | 0.18 | 0.26 | | 0.57 | 3.4 | 0.46 | 0.6 | |
| | 6/26/2017 11:51 | 4.07 | 4.03 | 185.71 | 693.27 | 6.0 | 943.6 | -- | -- | 0.15 | -- | | 0.57 | 1.5 | 0.20 | 0.3 | |
| | 6/30/2017 11:38 | 3.99 | 3.99 | 189.70 | 697.47 | 4.2 | 947.8 | 11.34 | 11.55 | 0.21 | 0.51 | | 0.57 | 1.1 | 0.14 | 0.2 | |
| | 7/7/2017 8:09 | 6.85 | 6.85 | 196.55 | 709.47 | 12.0 | 959.8 | 11.03 | 11.16 | 0.13 | 0.20 | | 0.57 | 1.8 | 0.23 | 0.3 | |
| | 7/12/2017 14:15 | 5.25 | 5.25 | 201.81 | 721.27 | 11.8 | 971.6 | 10.85 | 11.01 | 0.16 | 0.02 | | 0.57 | 2.2 | 0.30 | 0.4 | |
| | 7/19/2017 11:14 | 6.87 | 6.60 | 208.41 | 730.47 | 9.2 | 980.8 | 11.10 | 11.29 | 0.19 | 0.27 | | 0.57 | 1.4 | 0.19 | 0.2 | |
| | 7/26/2017 10:55 | 6.99 | 6.99 | 215.39 | 752.67 | 22.2 | 1003.0 | 10.90 | 10.94 | 0.04 | 0.07 | | 0.57 | 3.2 | 0.42 | 0.5 | |
| | 8/2/2017 11:48 | 7.04 | 7.04 | 222.43 | 759.47 | 6.8 | 1009.8 | 10.57 | 10.80 | 0.23 | -0.26 | | 0.57 | 1.0 | 0.13 | 0.2 | |
| | 8/9/2017 9:51 | 6.92 | 6.92 | 229.35 | 772.67 | 13.2 | 1023.0 | 10.65 | 10.72 | 0.07 | -0.18 | | 0.57 | 1.9 | 0.26 | 0.3 | |
| | 8/17/2017 8:33 | 7.95 | 7.95 | 237.29 | 790.67 | 18.0 | 1041.0 | 10.26 | 10.48 | 0.22 | -0.57 | | 0.57 | 2.3 | 0.30 | 0.4 | |
| | 8/22/2017 12:50 | 5.18 | 4.87 | 242.16 | 802.47 | 11.8 | 1052.8 | 10.20 | 10.38 | 0.18 | -0.63 | | 0.57 | 2.4 | 0.32 | 0.4 | |
| | 8/30/2017 17:13 | 8.18 | 8.18 | 250.34 | 854.17 | 51.7 | 1104.5 | 10.27 | 10.35 | 0.08 | -0.56 | | 0.57 | 6.3 | 0.84 | 1.1 | |
| | 9/6/2017 13:35 | 6.85 | 6.85 | 257.19 | 859.67 | 5.5 | 1110.0 | 10.36 | 10.46 | 0.10 | -0.47 | | 0.57 | 0.8 | 0.11 | 0.1 | 0.5 |
| | *END OF TEST INTERVAL - SHUTDOWN DUE TO HURRICANE* | | | | | | | | | | | | | | | | |
| | 9/21/2017 15:37 | -- | -- | -- | -- | -- | 1110.0 | 9.16 | 12.59 | 3.43 | -- | | | -- | -- | -- | |
| | 9/22/2017 7:57 | 0.68 | 0.68 | 257.87 | 5.00 | 5.0 | 1115.0 | 10.27 | 10.47 | 0.20 | -0.56 | | 0.57 | 7.3 | 0.98 | 1.3 | |
| | 9/29/2017 13:52 | 7.25 | 7.24 | 265.12 | 12.60 | 7.6 | 1122.6 | 10.31 | 10.55 | 0.24 | -0.52 | | 0.57 | 1.0 | 0.14 | 0.2 | |
| | 10/6/2017 13:49 | 7.00 | 6.99 | 272.11 | 16.50 | 3.9 | 1126.5 | 9.95 | 10.16 | 0.21 | -0.88 | | 0.57 | 0.6 | 0.07 | 0.1 | |
| | 10/12/2017 11:24 | 5.90 | 5.90 | 278.00 | 21.50 | 5.0 | 1131.5 | 10.36 | 10.97 | 0.61 | -0.47 | | 0.57 | 0.8 | 0.11 | 0.1 | |
| | 10/19/2017 12:10 | 7.03 | 7.03 | 285.03 | 27.50 | 6.0 | 1137.5 | 9.81 | 10.04 | 0.23 | -1.02 | | 0.57 | 0.9 | 0.11 | 0.1 | |
| | 11/2/2017 8:59 | 13.87 | 13.87 | 298.90 | 43.50 | 16.0 | 1153.5 | 10.81 | 11.04 | 0.23 | -0.02 | | 0.57 | 1.2 | 0.15 | 0.2 | |
| | 11/8/2017 12:15 | 6.14 | 6.18 | 305.08 | 48.00 | 4.5 | 1158.0 | 10.78 | 11.02 | 0.24 | -0.05 | | 0.57 | 0.7 | 0.10 | 0.1 | |
| | 11/15/2017 11:34 | 6.97 | 6.97 | 312.05 | 58.50 | 10.5 | 1168.5 | 10.65 | 10.87 | 0.22 | -0.18 | | 0.57 | 1.5 | 0.20 | 0.3 | |
| | 11/22/2017 10:23 | 6.95 | 6.95 | 319.00 | 67.50 | 9.0 | 1177.5 | 11.18 | 11.45 | 0.27 | 0.35 | | 0.57 | 1.3 | 0.17 | 0.2 | |
| | 11/30/2017 11:09 | 8.03 | 4.74 | 323.74 | 74.50 | 7.0 | 1184.5 | 10.85 | 13.00 | 2.15 | 0.02 | | 0.57 | 1.5 | 0.20 | 0.3 | |
| | 12/6/2017 12:01 | 6.04 | 6.03 | 329.77 | 94.50 | 20.0 | 1204.5 | 10.69 | 10.92 | 0.23 | -0.14 | | 0.57 | 3.3 | 0.44 | 0.6 | |
| | 12/13/2017 10:48 | 6.95 | 6.94 | 336.72 | 104.50 | 10.0 | 1214.5 | 11.41 | 11.60 | 0.19 | 0.58 | | 0.57 | 1.4 | 0.19 | 0.2 | |
| | 12/21/2017 13:14 | 8.10 | 8.10 | 344.82 | 129.50 | 25.0 | 1239.5 | 11.10 | 11.30 | 0.20 | 0.27 | | 0.57 | 3.1 | 0.41 | 0.5 | |
| | 12/28/2017 14:11 | 7.04 | 7.04 | 351.85 | 146.50 | 17.0 | 1256.5 | 11.41 | 11.65 | 0.24 | 0.58 | | 0.57 | 2.4 | 0.32 | 0.4 | |

**Appendix A**

**AW-9 LNAPL Skimming Test Results**
**IMTT Savannah North Terminal**
**Savannah, Georgia**

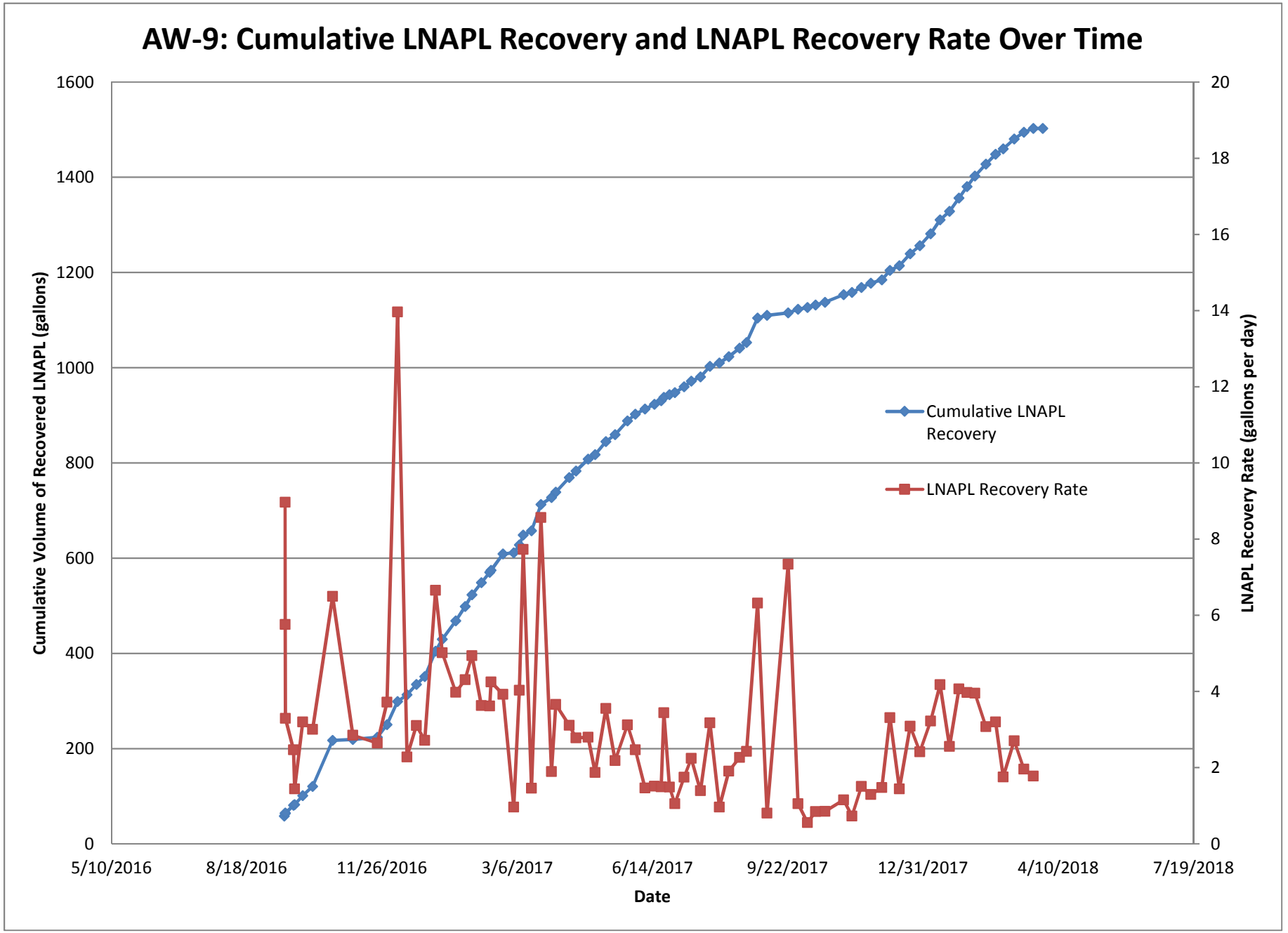
| Well ID | Measurement Date & Time | Time Between Measurement Events (days) | Actual Skimmer Run-Time Between Measurement Events (days) | Cumulative Run Time (days) | Total Volume of LNAPL Recovered (gallons) | Volume of LNAPL Recovered During Measurement Interval (gallons) | RUNNING Total Volume of LNAPL Recovered (gallons) | Depth to LNAPL (feet btoc) | Depth to Water (feet btoc) | In-Well LNAPL Thickness (feet) | LNAPL Drawdown (feet) | Maximum Theoretical Unconfined LNAPL Drawdown (feet) | LNAPL Drawdown Used in Transmissivity Estimate[a] (feet) | Average LNAPL Recovery Rate for Interval (gal/day) | Average LNAPL Recovery Rate for Interval ($ft^3$/day) | Estimated LNAPL Transmissivity for Interval ($ft^2$/day) | Overall Average LNAPL Transmissivity[b] ($ft^2$/day) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1/5/2018 14:23 | 8.01 | 7.73 | 359.58 | 171.40 | 24.9 | 1281.4 | 11.03 | 11.31 | 0.28 | 0.20 | | 0.57 | 3.2 | 0.43 | 0.6 | |
| | 1/12/2018 14:11 | 6.99 | 6.96 | 366.54 | 200.50 | 29.1 | 1310.5 | 11.52 | 11.81 | 0.29 | 0.69 | | 0.57 | 4.2 | 0.56 | 0.7 | |
| | 1/19/2018 14:15 | 7.00 | 7.04 | 373.58 | 218.50 | 18.0 | 1328.5 | 11.23 | 11.48 | 0.25 | 0.40 | | 0.57 | 2.6 | 0.34 | 0.4 | |
| | 1/26/2018 11:32 | 6.89 | 6.89 | 380.47 | 246.50 | 28.0 | 1356.5 | 11.94 | 12.25 | 0.31 | 1.11 | | 0.57 | 4.1 | 0.54 | 0.7 | |
| | 2/1/2018 12:41 | 6.05 | 6.04 | 386.51 | 270.50 | 24.0 | 1380.5 | 10.08 | 10.37 | 0.29 | -0.75 | | 0.57 | 4.0 | 0.53 | 0.7 | |
| | 2/7/2018 8:48 | 5.84 | 5.56 | 392.08 | 292.50 | 22.0 | 1402.5 | 11.67 | 12.04 | 0.37 | 0.84 | | 0.57 | 4.0 | 0.53 | 0.7 | |
| | 2/15/2018 12:08 | 8.14 | 8.13 | 400.21 | 317.50 | 25.0 | 1427.5 | 11.11 | 11.33 | 0.22 | 0.28 | | 0.57 | 3.1 | 0.41 | 0.5 | |
| | 2/22/2018 14:19 | 7.09 | 6.57 | 406.78 | 338.50 | 21.0 | 1448.5 | 11.18 | 11.44 | 0.26 | 0.35 | | 0.57 | 3.2 | 0.43 | 0.5 | |
| | 2/28/2018 8:10 | 5.74 | 6.26 | 413.04 | 349.50 | 11.0 | 1459.5 | 10.83 | 11.04 | 0.21 | 0.00 | | 0.57 | 1.8 | 0.23 | 0.3 | |
| | 3/8/2018 9:16 | 8.05 | 7.77 | 420.80 | 370.50 | 21.0 | 1480.5 | 11.41 | 11.77 | 0.36 | 0.58 | | 0.57 | 2.7 | 0.36 | 0.5 | |
| | 3/15/2018 13:45 | 7.19 | 7.14 | 427.95 | 384.50 | 14.0 | 1494.5 | 11.39 | 11.59 | 0.20 | 0.56 | | 0.57 | 2.0 | 0.26 | 0.3 | |
| | 3/22/2018 11:12 | 6.89 | 4.50 | 432.45 | 392.50 | 8.0 | 1502.5 | 11.60 | 13.10 | 1.50 | 0.77 | | 0.57 | 1.8 | 0.24 | 0.3 | |
| | 3/29/2018 11:05 | 7.00 | 0.00 | 432.45 | 392.50 | 0.0 | 1502.5 | 10.59 | 13.01 | 2.42 | -0.24 | | 0.57 | -- | -- | -- | 0.46 |
| | | | | | | | | | | | | | | | | | |

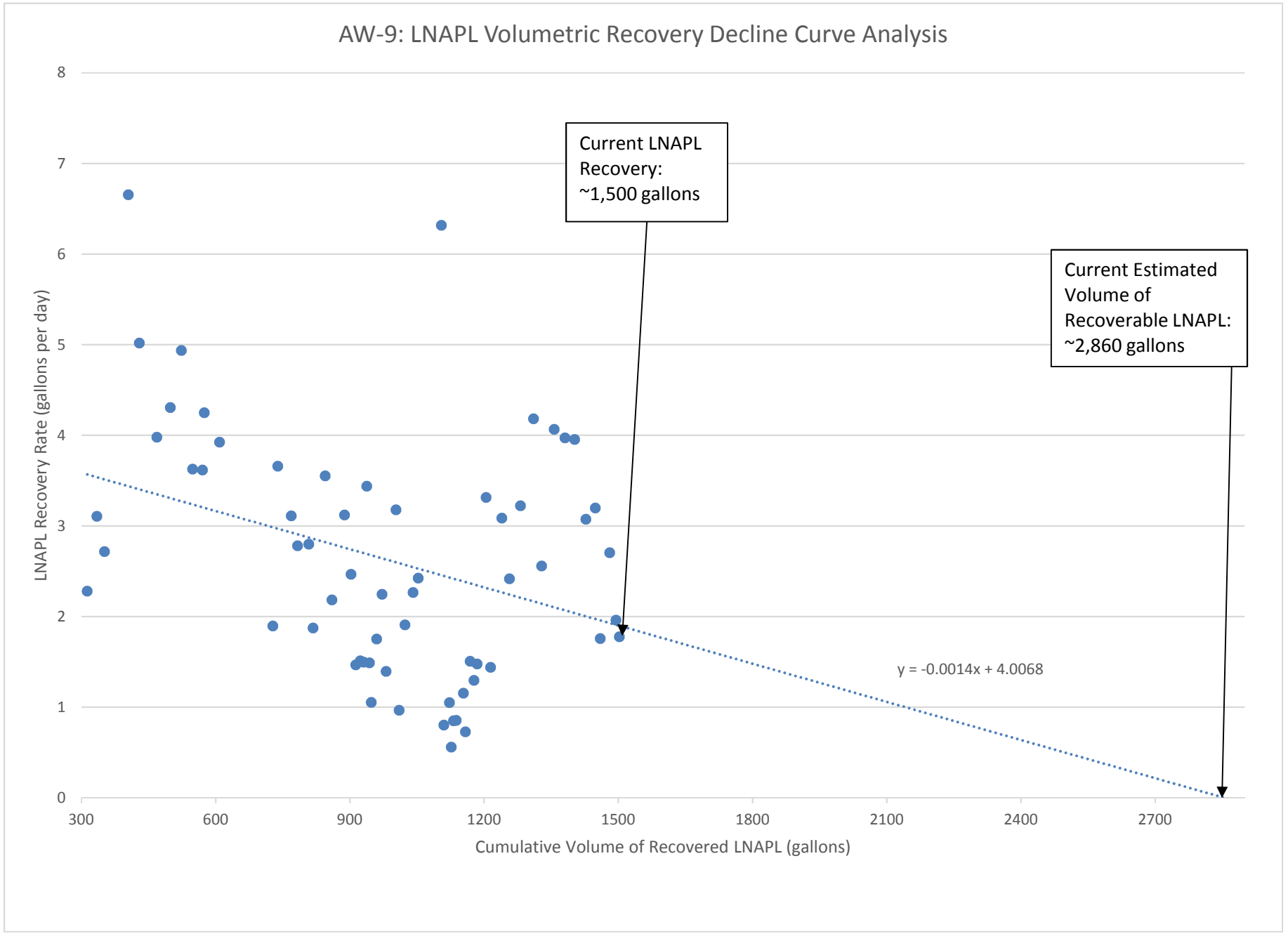
Assumed LNAPL specific gravity = 0.854

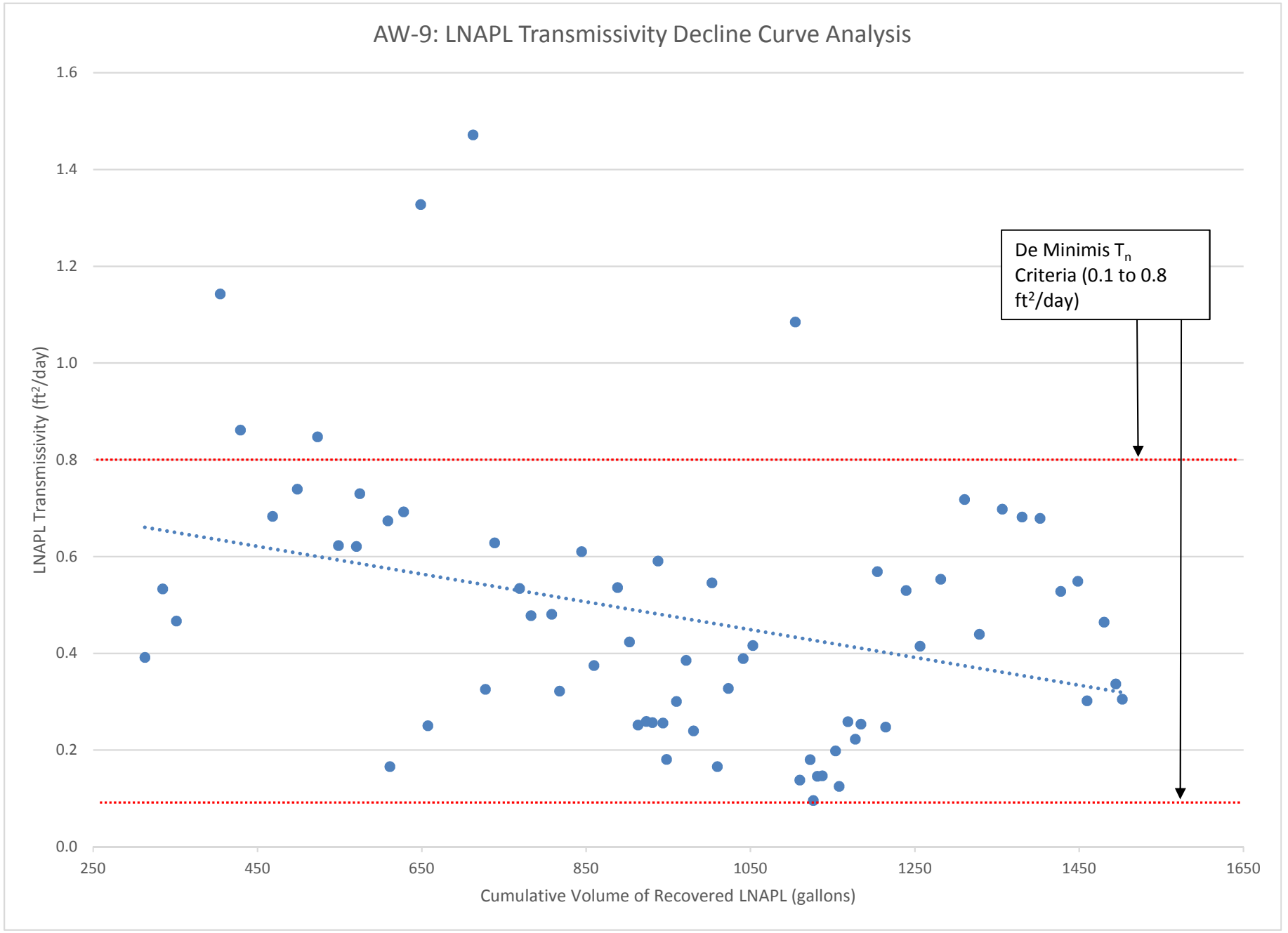
All calculations performed pursuant to the methodology detailed in ASTM E2856-13

[a]The maximum theoretical drawdown is used for each interval calculation where the measured drawdown is negative or where it exceeds the theoretical maximum.

[b]Represents the geometric mean of the stabilized recovery rates/LNAPL transmissivity estimates (i.e., excludes initial elevated values that would not represent potential long-term recovery rates).


AW-9: Cumulative LNAPL Recovery and LNAPL Recovery Rate Over Time
Cumulative Volume of Recovered LNAPL (gallons)
LNAPL Recovery Rate (gallons per day)
Date
Cumulative LNAPL Recovery
LNAPL Recovery Rate
0
200
400
600
800
1000
1200
1400
1600
0
2
4
6
8
10
12
14
16
18
20
5/10/2016
8/18/2016
11/26/2016
3/6/2017
6/14/2017
9/22/2017
12/31/2017
4/10/2018
7/19/2018


AW-9: LNAPL Volumetric Recovery Decline Curve Analysis
LNAPL Recovery Rate (gallons per day)
Cumulative Volume of Recovered LNAPL (gallons)
Current LNAPL Recovery: ~1,500 gallons
Current Estimated Volume of Recoverable LNAPL: ~2,860 gallons
y = -0.0014x + 4.0068
0
1
2
3
4
5
6
7
8
300
600
900
1200
1500
1800
2100
2400
2700


AW-9: LNAPL Transmissivity Decline Curve Analysis
LNAPL Transmissivity (ft²/day)
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
250
450
650
850
1050
1250
1450
1650
Cumulative Volume of Recovered LNAPL (gallons)
De Minimis $T_n$ Criteria (0.1 to 0.8 ft²/day)

# AW-10 Skimming Evaluation

# Appendix A

## AW-10 LNAPL Skimming Test Results
## IMTT Savannah North Terminal
## Savannah, Georgia

| Well ID | Measurement Date & Time | Time Between Measurement Events (days) | Actual Skimmer Run-Time Between Measurement Events (days) | Cumulative Run Time (days) | Total Volume of LNAPL Recovered (gallons) | Volume of LNAPL Recovered During Measurement Interval (gallons) | RUNNING Total Volume of LNAPL Recovered (gallons) | Depth to LNAPL (feet btoc) | Depth to Water (feet btoc) | In-Well LNAPL Thickness (feet) | LNAPL Drawdown (feet) | Maximum Theoretical Unconfined LNAPL Drawdown (feet) | LNAPL Drawdown Used in Transmissivity Estimate[a] (feet) | Average LNAPL Recovery Rate for Interval (gal/day) | Average LNAPL Recovery Rate for Interval ($ft^3$/day) | Estimated LNAPL Transmissivity for Interval ($ft^2$/day) | Overall Average LNAPL Transmissivity[b] ($ft^2$/day) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Equilibrium | -- | | -- | -- | -- | | 10.42 | 14.75 | 4.33 | -- | 0.63 | -- | -- | -- | -- | |
| AW-10 Short term test | 6/28/2016 8:39 | -- | | -- | -- | -- | | 9.72 | 14.80 | 5.08 | -- | | -- | -- | -- | -- | |
| | 6/28/2016 13:50 | 0.22 | 0.21 | 0.21 | 5.8 | 5.8 | 5.8 | -- | -- | -- | -- | | 0.63 | 27.7 | 3.70 | 4.3 | |
| | 7/1/2016 9:25 | 2.82 | 2.82 | 3.03 | 16.8 | 11.0 | 16.8 | 10.29 | 11.06 | 0.77 | -0.13 | | 0.63 | 3.9 | 0.52 | 0.6 | |
| | 7/7/2016 13:25 | 6.17 | 6.17 | 9.19 | 40.2 | 23.4 | 40.2 | 10.72 | 10.92 | 0.20 | 0.30 | | 0.63 | 3.8 | 0.51 | 0.6 | |
| | 7/11/2016 13:06 | 3.99 | 2.21 | 11.40 | 50.5 | 10.3 | 50.5 | 10.92 | 12.35 | 1.43 | 0.50 | | 0.63 | 4.6 | 0.62 | 0.7 | |
| | 7/12/2016 9:35 | 0.85 | 0.68 | 12.08 | 54.3 | 3.8 | 54.3 | 10.87 | 12.55 | 1.68 | 0.45 | | 0.63 | 5.6 | 0.74 | 0.9 | |
| | 7/12/2016 12:50 | 0.14 | 0.14 | 12.22 | 55.2 | 1.0 | 55.2 | 10.95 | 12.61 | 1.66 | 0.53 | | 0.63 | 7.2 | 0.97 | 1.1 | |
| | 7/19/2016 12:45 | 7.00 | 6.96 | 19.17 | 69.2 | 14.0 | 69.2 | 10.51 | 14.15 | 3.64 | 0.09 | | 0.63 | 2.0 | 0.27 | 0.3 | |
| | 7/21/2016 13:00 | 2.01 | 1.34 | 20.52 | 75.9 | 6.7 | 75.9 | 10.46 | 14.31 | 3.85 | 0.04 | | 0.63 | 5.0 | 0.67 | 0.8 | |
| | 7/27/2016 13:00 | 6.00 | 5.21 | 25.72 | 101.4 | 25.5 | 101.4 | 10.52 | 13.93 | 3.41 | 0.10 | | 0.63 | 4.9 | 0.65 | 0.8 | 0.8 |
| AW-10 Long term test | 1/19/2017 14:23 | -- | -- | | -- | -- | 101.4 | 11.07 | 15.19 | 4.12 | -- | | | -- | -- | -- | |
| | 1/20/2017 10:25 | 0.83 | 0.63 | 0.63 | 60.8 | 60.8 | 162.2 | 11.94 | 11.95 | 0.01 | 1.52 | | 0.63 | 97.0 | 12.97 | 15.1 | |
| | 1/23/2017 14:52 | 3.19 | 3.19 | 3.81 | 60.8 | 0.0 | 162.2 | 11.26 | 11.94 | 0.68 | 0.84 | | 0.63 | 0.0 | 0.00 | 0.0 | |
| | 1/26/2017 12:40 | 2.91 | 2.91 | 6.72 | 65.8 | 5.0 | 167.2 | 10.87 | 11.05 | 0.18 | 0.45 | | 0.63 | 1.7 | 0.23 | 0.3 | |
| | 1/31/2017 12:40 | 5.00 | 4.99 | 11.71 | 102.3 | 36.5 | 203.7 | 11.02 | 11.23 | 0.21 | 0.60 | | 0.63 | 7.3 | 0.98 | 1.1 | |
| | 2/7/2017 12:28 | 6.99 | 6.99 | 18.70 | 112.4 | 10.1 | 213.7 | 11.19 | 11.27 | 0.08 | 0.77 | | 0.63 | 1.4 | 0.19 | 0.2 | |
| | 2/13/2017 14:50 | 6.10 | 6.10 | 24.80 | 115.2 | 2.9 | 216.6 | 11.51 | 11.91 | 0.40 | 1.09 | | 0.63 | 0.5 | 0.06 | 0.1 | |
| | 2/14/2017 14:30 | 0.99 | 0.99 | 25.78 | 115.2 | 0.0 | 216.6 | 11.31 | 11.56 | 0.25 | 0.89 | | 0.63 | 0.0 | 0.00 | 0.0 | |
| | 2/23/2017 10:43 | 8.84 | 8.62 | 34.41 | 122.7 | 7.5 | 224.1 | 11.30 | 11.55 | 0.25 | 0.88 | | 0.63 | 0.9 | 0.12 | 0.1 | |
| | 3/3/2017 9:50 | 7.96 | 7.96 | 42.37 | 125.2 | 2.5 | 226.6 | 12.09 | 12.40 | 0.31 | 1.67 | | 0.63 | 0.3 | 0.04 | 0.0 | |
| | 3/7/2017 13:10 | 4.14 | 4.14 | 46.51 | 130.2 | 5.0 | 231.6 | 11.90 | 12.19 | 0.29 | 1.48 | | 0.63 | 1.2 | 0.16 | 0.2 | |
| | 3/10/2017 10:02 | 2.87 | 2.87 | 49.38 | 132.8 | 2.6 | 234.2 | 11.35 | 11.78 | 0.43 | 0.93 | | 0.63 | 0.9 | 0.12 | 0.1 | |
| | 3/16/2017 10:56 | 6.04 | 6.03 | 55.41 | 138.9 | 6.1 | 240.3 | 12.24 | 12.50 | 0.26 | 1.82 | | 0.63 | 1.0 | 0.14 | 0.2 | |
| | 3/23/2017 10:23 | 6.98 | 6.98 | 62.39 | 138.9 | 0.0 | 240.3 | 11.91 | 12.23 | 0.32 | 1.49 | | 0.63 | 0.0 | 0.00 | 0.0 | |
| | 3/31/2017 8:41 | 7.93 | 7.67 | 70.06 | 144.9 | 6.0 | 246.3 | 11.85 | 12.19 | 0.34 | 1.43 | | 0.63 | 0.8 | 0.10 | 0.1 | |
| | 4/3/2017 10:10 | 3.06 | 3.06 | 73.12 | 146.7 | 1.8 | 248.1 | 11.88 | 12.08 | 0.20 | 1.46 | | 0.63 | 0.6 | 0.08 | 0.1 | |
| | 4/13/2017 11:28 | 10.05 | 10.05 | 83.17 | 153.9 | 7.2 | 255.3 | 11.80 | 11.95 | 0.15 | 1.38 | | 0.63 | 0.7 | 0.10 | 0.1 | |
| | 4/18/2017 11:04 | 4.98 | 4.98 | 88.16 | 156.6 | 2.7 | 258.0 | 12.11 | 12.29 | 0.18 | 1.69 | | 0.63 | 0.5 | 0.07 | 0.1 | |
| | 4/27/2017 11:20 | 9.01 | 9.01 | 97.17 | 160.9 | 4.3 | 262.3 | 10.98 | 11.14 | 0.16 | 0.56 | | 0.63 | 0.5 | 0.06 | 0.1 | 0.2 |
| | ***END OF TEST*** | | | | | | | | | | | | | | | | |
| | 3/7/2018 14:30 | -- | -- | | -- | -- | 262.3 | 10.90 | 14.11 | 3.21 | -- | | | -- | -- | -- | |
| | 3/7/2018 15:45 | 0.05 | 0.05 | 0.05 | 60.8 | 5.5 | 267.8 | 11.52 | 12.35 | 0.83 | 1.10 | | 0.63 | 106.1 | 14.18 | 16.5 | |
| | 3/8/2018 9:03 | 0.72 | 0.62 | 0.67 | 60.8 | 1.5 | 269.3 | 11.59 | 11.95 | 0.36 | 1.17 | | 0.63 | 2.4 | 0.32 | 0.4 | |
| | 3/15/2018 13:00 | 7.16 | 0.74 | 1.41 | 62.8 | 2.0 | 271.3 | 11.43 | 13.03 | 1.60 | 1.01 | | 0.63 | 2.7 | 0.36 | 0.4 | |
| | 3/22/2018 12:00 | 6.96 | 5.08 | 6.49 | 99.8 | 37.0 | 308.3 | 12.04 | 12.67 | 0.63 | 1.62 | | 0.63 | 7.3 | 0.97 | 1.1 | |
| | 3/29/2018 11:53 | 7.00 | 7.00 | 13.48 | 105.8 | 6.0 | 314.3 | 11.44 | 11.68 | 0.24 | 1.02 | | 0.63 | 0.9 | 0.11 | 0.1 | |
| | 4/6/2018 11:10 | 7.97 | 7.97 | 21.45 | 106.8 | 1.0 | 315.3 | 11.93 | 12.24 | 0.31 | 1.51 | | 0.63 | 0.1 | 0.02 | 0.0 | |
| | 4/12/2018 12:35 | 6.06 | 5.93 | 27.38 | 108.1 | 1.3 | 316.6 | 11.84 | 12.08 | 0.24 | 1.42 | | 0.63 | 0.2 | 0.03 | 0.0 | |
| | 4/18/2018 13:22 | 6.03 | 6.03 | 33.41 | 112.8 | 4.7 | 321.3 | 11.86 | 12.08 | 0.22 | 1.44 | | 0.63 | 0.8 | 0.10 | 0.1 | |
| | 4/27/2018 13:30 | 9.01 | 8.80 | 42.21 | 115.3 | 2.5 | 323.8 | 11.44 | 11.74 | 0.30 | 1.02 | | 0.63 | 0.3 | 0.04 | 0.0 | 0.13 |

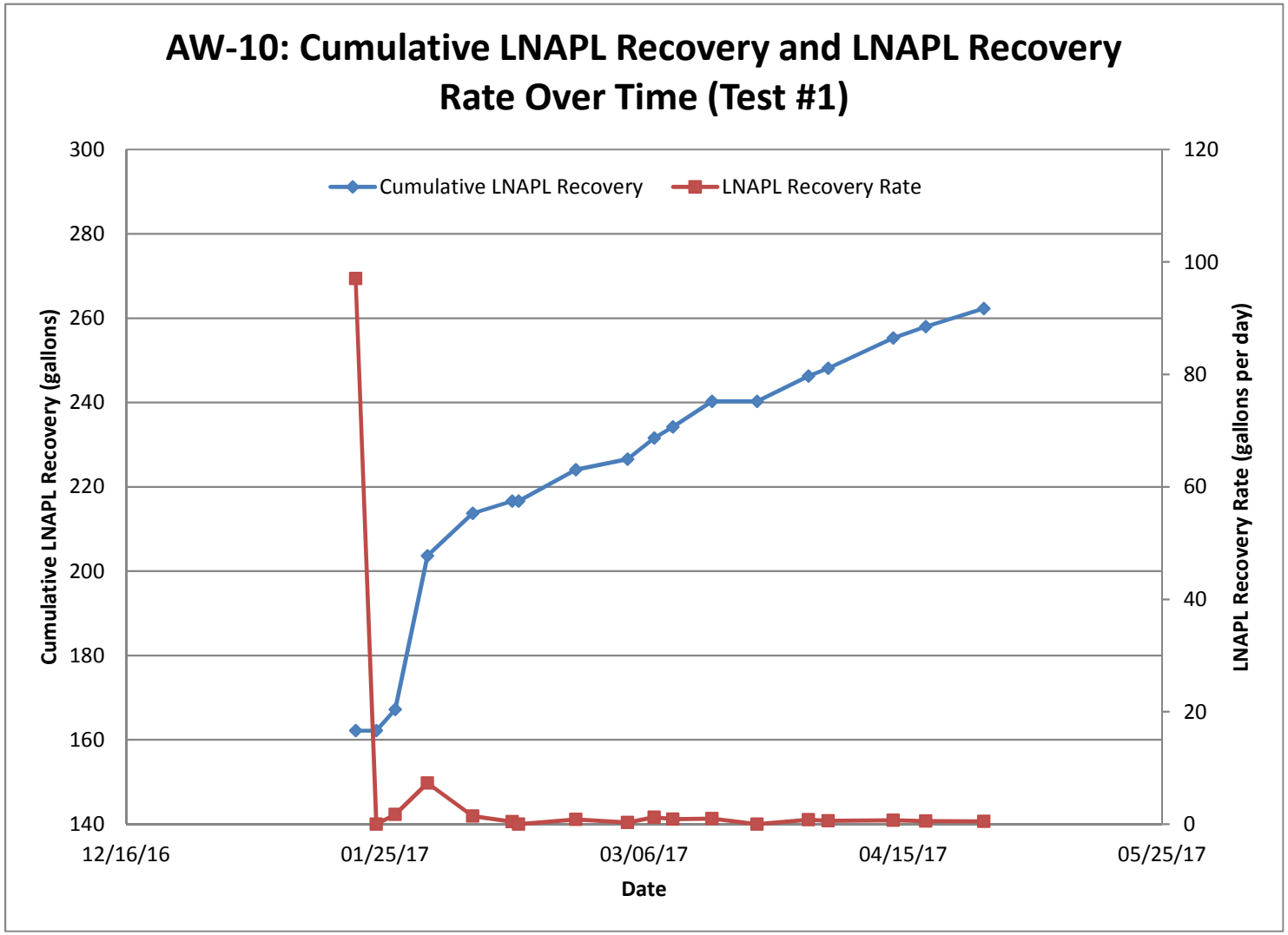
Assumed LNAPL specific gravity = 0.854

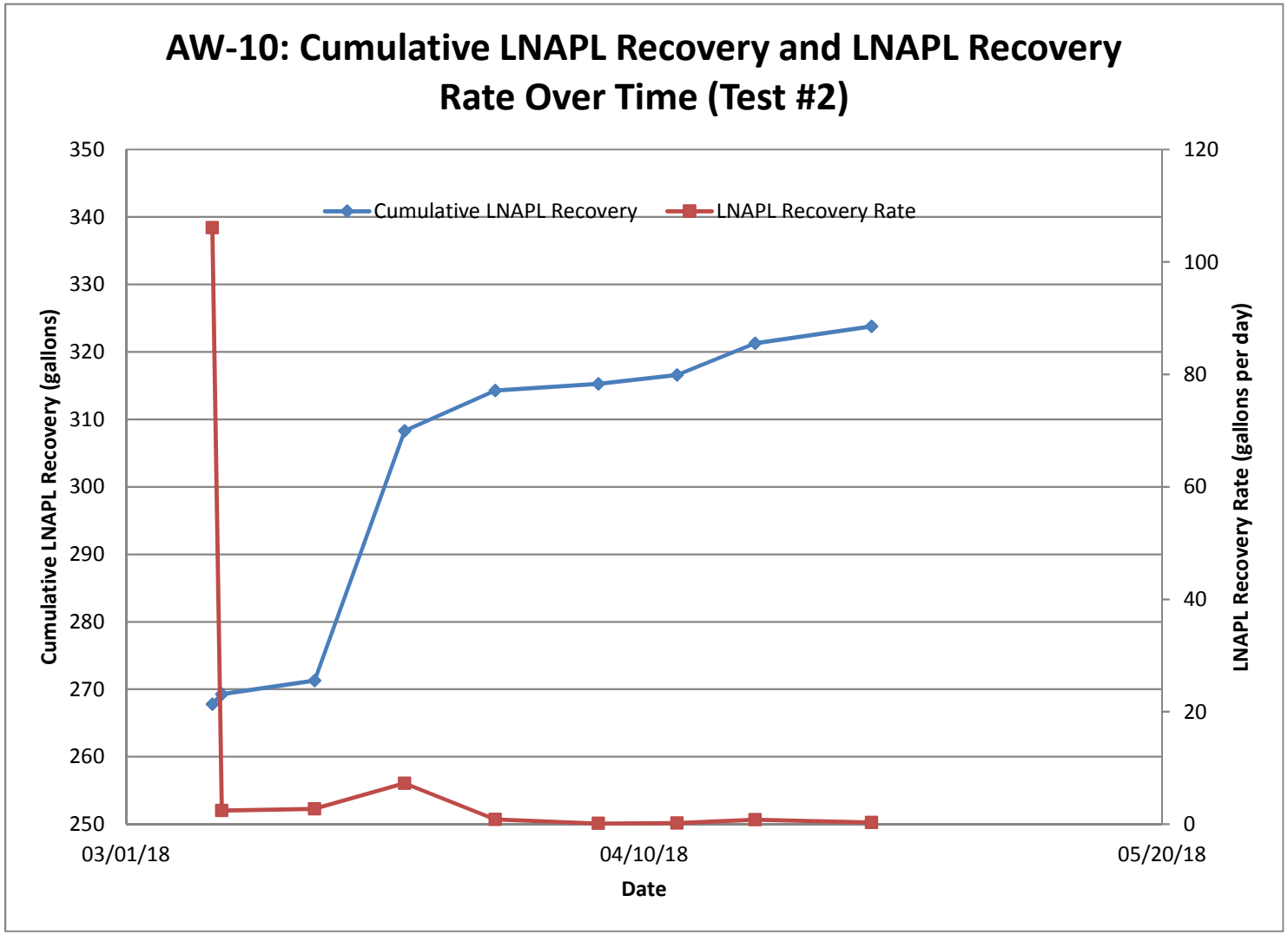
All calculations performed pursuant to the methodology detailed in ASTM E2856-13

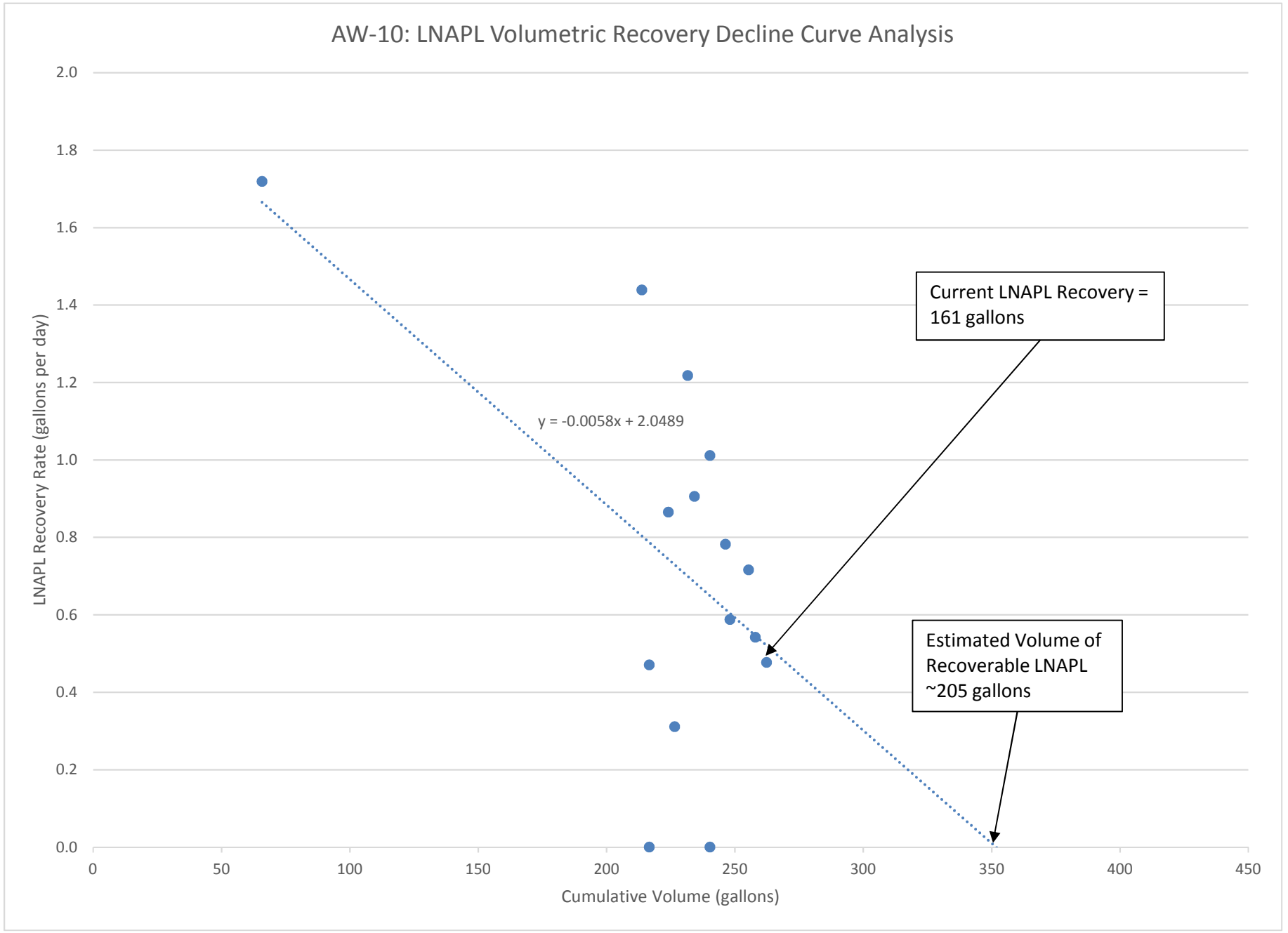
[a]The maximum theoretical drawdown is used for each interval calculation where the measured drawdown is negative or where it exceeds the theoretical maximum.

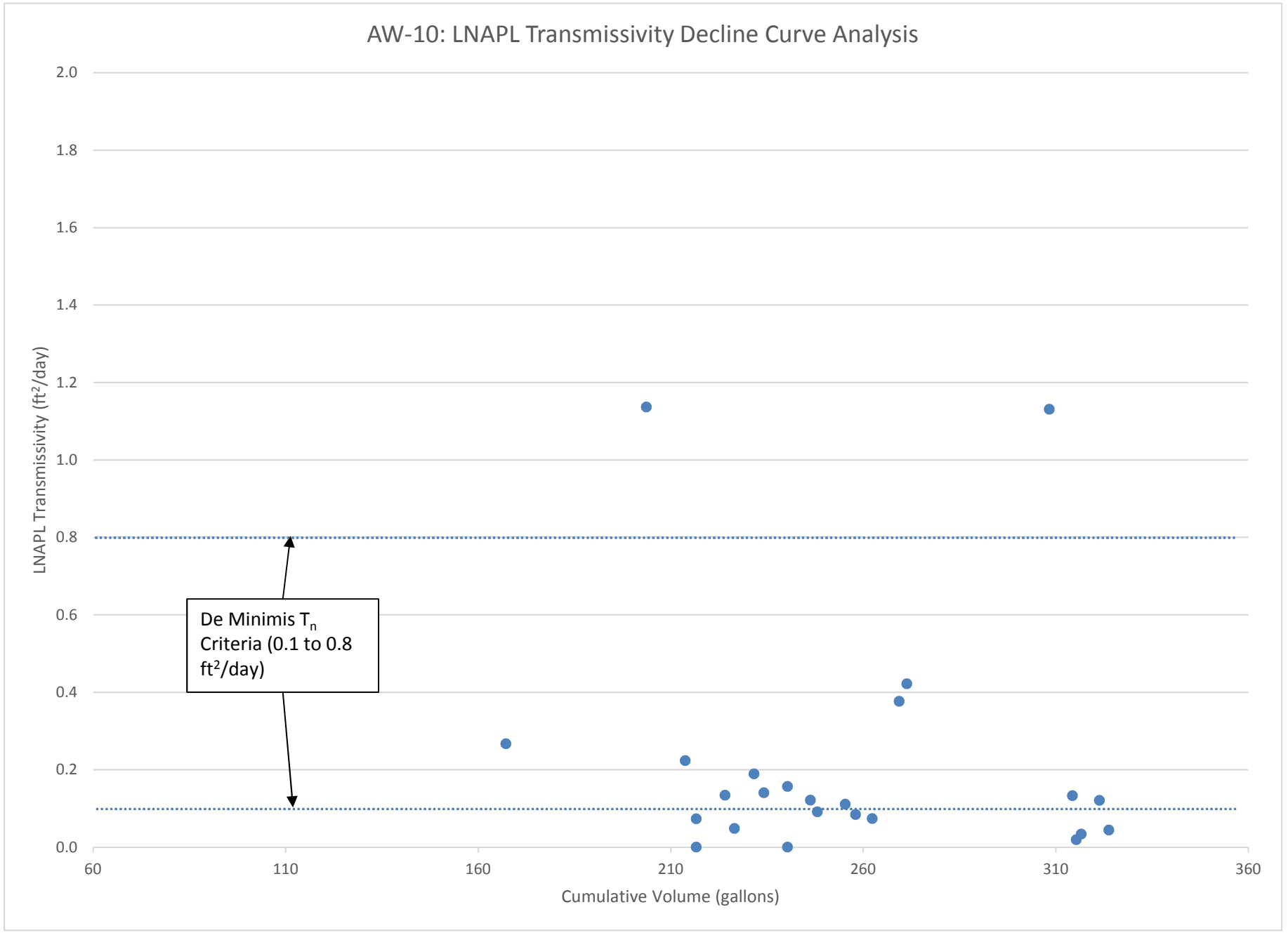
[b]Represents the geometric mean of the stabilized recovery rates/LNAPL transmissivity estimates (i.e., excludes initial elevated values that would not represent potential long-term recovery rates).

Equilibrium data is an average of quarterly groundwater data collected from March 2016 through Februrary 2018 and excludes data collected during or following skimming operations.


AW-10: Cumulative LNAPL Recovery and LNAPL Recovery Rate Over Time (Test #1)
Cumulative LNAPL Recovery
LNAPL Recovery Rate
Cumulative LNAPL Recovery (gallons)
LNAPL Recovery Rate (gallons per day)
300
280
260
240
220
200
180
160
140
120
100
80
60
40
20
0
12/16/16
01/25/17
03/06/17
04/15/17
05/25/17
Date


AW-10: Cumulative LNAPL Recovery and LNAPL Recovery Rate Over Time (Test #2)
Cumulative LNAPL Recovery
LNAPL Recovery Rate
Cumulative LNAPL Recovery (gallons)
LNAPL Recovery Rate (gallons per day)
350
340
330
320
310
300
290
280
270
260
250
120
100
80
60
40
20
0
03/01/18
04/10/18
05/20/18
Date


AW-10: LNAPL Volumetric Recovery Decline Curve Analysis
LNAPL Recovery Rate (gallons per day)
Cumulative Volume (gallons)
y = -0.0058x + 2.0489
Current LNAPL Recovery = 161 gallons
Estimated Volume of Recoverable LNAPL ~205 gallons
2.0
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
0
50
100
150
200
250
300
350
400
450


AW-10: LNAPL Transmissivity Decline Curve Analysis
LNAPL Transmissivity (ft²/day)
2.0
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
60
110
160
210
260
310
360
Cumulative Volume (gallons)
De Minimis Tn Criteria (0.1 to 0.8 ft²/day)

# AW-11 Skimming Evaluation

**Appendix A**

**AW-11 LNAPL Skimming Test Results**
**IMTT Savannah North Terminal**
**Savannah, Georgia**

| Well ID | Measurement Date & Time | Time Between Measurement Events (days) | Actual Skimmer Run-Time Between Measurement Events (days) | Cumulative Run Time (days) | Total Volume of LNAPL Recovered (gallons) | Volume of LNAPL Recovered During Measurement Interval (gallons) | RUNNING Total Volume of LNAPL Recovered (gallons) | Depth to LNAPL (feet btoc) | Depth to Water (feet btoc) | In-Well LNAPL Thickness (feet) | LNAPL Drawdown (feet) | Maximum Theoretical Unconfined LNAPL Drawdown (feet) | LNAPL Drawdown Used in Transmissivity Estimate[a] (feet) | Average LNAPL Recovery Rate for Interval (gal/day) | Average LNAPL Recovery Rate for Interval ($ft^3$/day) | Estimated LNAPL Transmissivity for Interval ($ft^2$/day) | Overall Average LNAPL Transmissivity[b] ($ft^2$/day) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AW-11 Short term test | Equilibrium | -- | | -- | -- | -- | | 10.75 | 14.14 | 3.39 | -- | 0.49 | -- | -- | -- | -- | |
| | 6/28/2016 9:45 | -- | | -- | -- | -- | | 10.21 | 13.32 | 3.11 | -- | | -- | -- | -- | -- | |
| | 6/28/2016 14:00 | 0.18 | 0.18 | 0.18 | 6.16 | 6.16 | 6.16 | -- | -- | -- | | | 0.49 | 34.8 | 4.65 | 6.9 | |
| | 7/1/2016 9:40 | 2.82 | 2.81 | 2.99 | 18.06 | 11.90 | 18.06 | 10.40 | 12.38 | 1.98 | -0.35 | | 0.49 | 4.2 | 0.57 | 0.8 | |
| | 7/7/2016 13:50 | 6.17 | 6.17 | 9.16 | 41.86 | 23.80 | 41.86 | 10.87 | 13.23 | 2.36 | 0.12 | | 0.49 | 3.9 | 0.52 | 0.8 | |
| | 7/11/2016 12:40 | 3.95 | 2.28 | 11.45 | 52.1 | 10.3 | 52.1 | 11.14 | 12.98 | 1.84 | 0.39 | | 0.49 | 4.5 | 0.60 | 0.9 | |
| | 7/12/2016 9:25 | 0.86 | 0.65 | 12.10 | 58.7 | 6.6 | 58.7 | 11.25 | 12.65 | 1.40 | 0.50 | | 0.49 | 10.1 | 1.35 | 2.0 | |
| | 7/12/2016 12:25 | 0.13 | 0.13 | 12.23 | 59.5 | 0.8 | 59.5 | 11.39 | 12.70 | 1.31 | 0.64 | | 0.49 | 6.6 | 0.88 | 1.3 | |
| | 7/19/2016 12:22 | 7.00 | 6.80 | 19.02 | 91.5 | 32.0 | 91.5 | 11.18 | 11.97 | 0.79 | 0.43 | | 0.49 | 4.7 | 0.63 | 0.9 | |
| | 7/27/2016 12:15 | 5.95 | 5.85 | 27.24 | 119.4 | 27.9 | 119.4 | 11.80 | 12.00 | 0.20 | 1.05 | | 0.49 | 4.8 | 0.64 | 1.0 | 1.1 |
| | 1/19/2017 14:16 | -- | -- | | -- | -- | 119.4 | 11.06 | 14.95 | 3.89 | -- | | | -- | -- | -- | |
| | 1/20/2017 11:15 | 0.87 | 0.62 | 0.62 | 11.3 | 11.3 | 130.8 | 11.82 | 12.14 | 0.32 | 1.07 | | 0.49 | 18.4 | 2.46 | 3.7 | |
| | 1/26/2017 12:52 | 6.07 | 6.07 | 6.68 | 31.3 | 20.0 | 150.8 | 11.19 | 11.51 | 0.32 | 0.44 | | 0.49 | 3.3 | 0.44 | 0.7 | |
| | 1/31/2017 12:36 | 4.99 | 4.97 | 11.65 | 47.6 | 16.3 | 167.0 | 11.41 | 11.70 | 0.29 | 0.66 | | 0.49 | 3.3 | 0.44 | 0.7 | |
| | 2/7/2017 12:39 | 7.00 | 7.00 | 18.65 | 143.5 | 95.9 | 262.9 | 11.72 | 11.90 | 0.18 | 0.97 | | 0.49 | 13.7 | 1.83 | 2.7 | |
| | 2/13/2017 14:02 | 6.06 | 6.06 | 24.71 | 159.1 | 15.6 | 278.5 | 11.44 | 11.90 | 0.46 | 0.69 | | 0.49 | 2.6 | 0.34 | 0.5 | |
| | 2/14/2017 14:41 | 1.03 | 1.03 | 25.74 | 161.6 | 2.5 | 281.0 | 11.26 | 11.49 | 0.23 | 0.51 | | 0.49 | 2.5 | 0.33 | 0.5 | |
| | 2/23/2017 10:58 | 8.85 | 8.85 | 34.58 | 174.1 | 12.5 | 293.5 | 11.25 | 11.60 | 0.35 | 0.50 | | 0.49 | 1.4 | 0.19 | 0.3 | |
| | 3/3/2017 10:00 | 7.96 | 7.86 | 42.44 | 184.6 | 10.5 | 304.0 | 12.12 | 12.25 | 0.13 | 1.37 | | 0.49 | 1.3 | 0.18 | 0.3 | |
| | 3/7/2017 13:18 | 4.14 | 4.14 | 46.57 | 188.9 | 4.3 | 308.3 | 11.85 | 12.15 | 0.30 | 1.10 | | 0.49 | 1.0 | 0.14 | 0.2 | |
| | 3/10/2017 10:13 | 2.87 | 2.87 | 49.45 | 199.4 | 10.6 | 318.8 | 11.70 | 12.02 | 0.32 | 0.95 | | 0.49 | 3.7 | 0.49 | 0.7 | |
| | 3/16/2017 11:08 | 6.04 | 6.00 | 55.44 | 205.6 | 6.2 | 325.0 | 12.26 | 12.49 | 0.23 | 1.51 | | 0.49 | 1.0 | 0.14 | 0.2 | |
| | 3/23/2017 10:30 | 6.97 | 6.97 | 62.42 | 277.6 | 72.0 | 397.0 | 12.22 | 12.45 | 0.23 | 1.47 | | 0.49 | 10.3 | 1.38 | 2.1 | |
| | 3/31/2017 8:10 | 7.90 | 0.33 | 62.75 | 287.8 | 10.2 | 407.2 | 11.78 | 13.10 | 1.32 | 1.03 | | 0.49 | 30.9 | 4.13 | 6.2 | |
| | 4/3/2017 9:51 | 3.07 | 3.07 | 65.82 | 445.3 | 157.5 | 564.7 | 12.71 | 12.75 | 0.04 | 1.96 | | 0.49 | 51.3 | 6.86 | 10.2 | |
| | 4/13/2017 11:35 | 10.07 | 9.81 | 75.63 | 458.6 | 13.3 | 578.0 | 11.84 | 12.09 | 0.25 | 1.09 | | 0.49 | 1.4 | 0.18 | 0.3 | |
| | 4/18/2017 11:13 | 4.98 | 4.98 | 80.61 | 467.7 | 9.1 | 587.1 | 11.90 | 12.16 | 0.26 | 1.15 | | 0.49 | 1.8 | 0.24 | 0.4 | |
| | 4/27/2017 11:11 | 9.00 | 9.00 | 89.61 | 478.6 | 10.9 | 598.0 | 11.74 | 12.08 | 0.34 | 0.99 | | 0.49 | 1.2 | 0.16 | 0.2 | |
| | 5/2/2017 12:51 | 5.07 | 5.07 | 94.68 | 486.9 | 8.3 | 606.3 | 12.25 | 13.39 | 1.14 | 1.50 | | 0.49 | 1.6 | 0.22 | 0.3 | |
| | 5/10/2017 10:54 | 7.92 | 7.65 | 102.34 | 500.6 | 13.7 | 620.0 | 12.09 | 12.38 | 0.29 | 1.34 | | 0.49 | 1.8 | 0.24 | 0.4 | |
| | 5/17/2017 7:54 | 6.88 | 6.88 | 109.21 | 512.6 | 12.0 | 632.0 | 12.11 | 12.34 | 0.23 | 1.36 | | 0.49 | 1.7 | 0.23 | 0.3 | |
| | 5/26/2017 11:06 | 9.13 | 9.13 | 118.35 | 527.3 | 14.7 | 646.7 | 12.02 | 12.21 | 0.19 | 1.27 | | 0.49 | 1.6 | 0.22 | 0.3 | |
| | 6/1/2017 8:10 | 5.88 | 5.83 | 124.18 | 532.6 | 5.3 | 652.0 | 11.89 | 12.19 | 0.30 | 1.14 | | 0.49 | 0.9 | 0.12 | 0.2 | |
| | 6/8/2017 11:30 | 7.14 | 7.14 | 131.32 | 540.7 | 8.1 | 660.1 | 11.31 | 11.48 | 0.17 | 0.56 | | 0.49 | 1.1 | 0.15 | 0.2 | |
| | 6/15/2017 10:45 | 6.97 | 6.70 | 138.02 | 550.0 | 9.3 | 669.4 | 11.85 | 11.98 | 0.13 | 1.10 | | 0.49 | 1.4 | 0.19 | 0.3 | |
| | 6/20/2017 10:04 | 4.97 | 4.97 | 142.99 | 554.6 | 4.6 | 674.0 | 11.99 | 12.24 | 0.25 | 1.24 | | 0.49 | 0.9 | 0.12 | 0.2 | |
| | 6/22/2017 10:50 | 2.03 | 2.03 | 145.03 | 581.8 | 27.2 | 701.2 | 11.86 | 12.02 | 0.16 | 1.11 | | 0.49 | 13.4 | 1.79 | 2.7 | |
| | 6/26/2017 11:23 | 4.02 | 4.02 | 149.05 | 595.7 | 13.9 | 715.1 | 12.09 | 12.12 | 0.03 | 1.34 | | 0.49 | 3.5 | 0.46 | 0.7 | |
| | 6/30/2017 11:52 | 4.02 | 4.02 | 153.07 | 605.7 | 10.0 | 725.1 | 11.66 | 11.88 | 0.22 | 0.91 | | 0.49 | 2.5 | 0.33 | 0.5 | |
| | 7/7/2017 8:24 | 6.86 | 6.86 | 159.92 | 618.7 | 13.0 | 738.1 | 11.28 | 11.49 | 0.21 | 0.53 | | 0.49 | 1.9 | 0.25 | 0.4 | |
| | 7/12/2017 14:29 | 5.25 | 5.25 | 165.17 | 628.7 | 10.0 | 748.1 | 11.19 | 11.40 | 0.21 | 0.44 | | 0.49 | 1.9 | 0.25 | 0.4 | |
| | 7/19/2017 11:28 | 6.87 | 6.60 | 171.78 | 640.7 | 12.0 | 760.1 | 11.28 | 11.55 | 0.27 | 0.53 | | 0.49 | 1.8 | 0.24 | 0.4 | |
| | 7/26/2017 11:08 | 6.99 | 6.99 | 178.77 | 650.4 | 9.7 | 769.8 | 11.16 | 11.34 | 0.18 | 0.41 | | 0.49 | 1.4 | 0.19 | 0.3 | |

**Appendix A**

**AW-11 LNAPL Skimming Test Results**
**IMTT Savannah North Terminal**
**Savannah, Georgia**

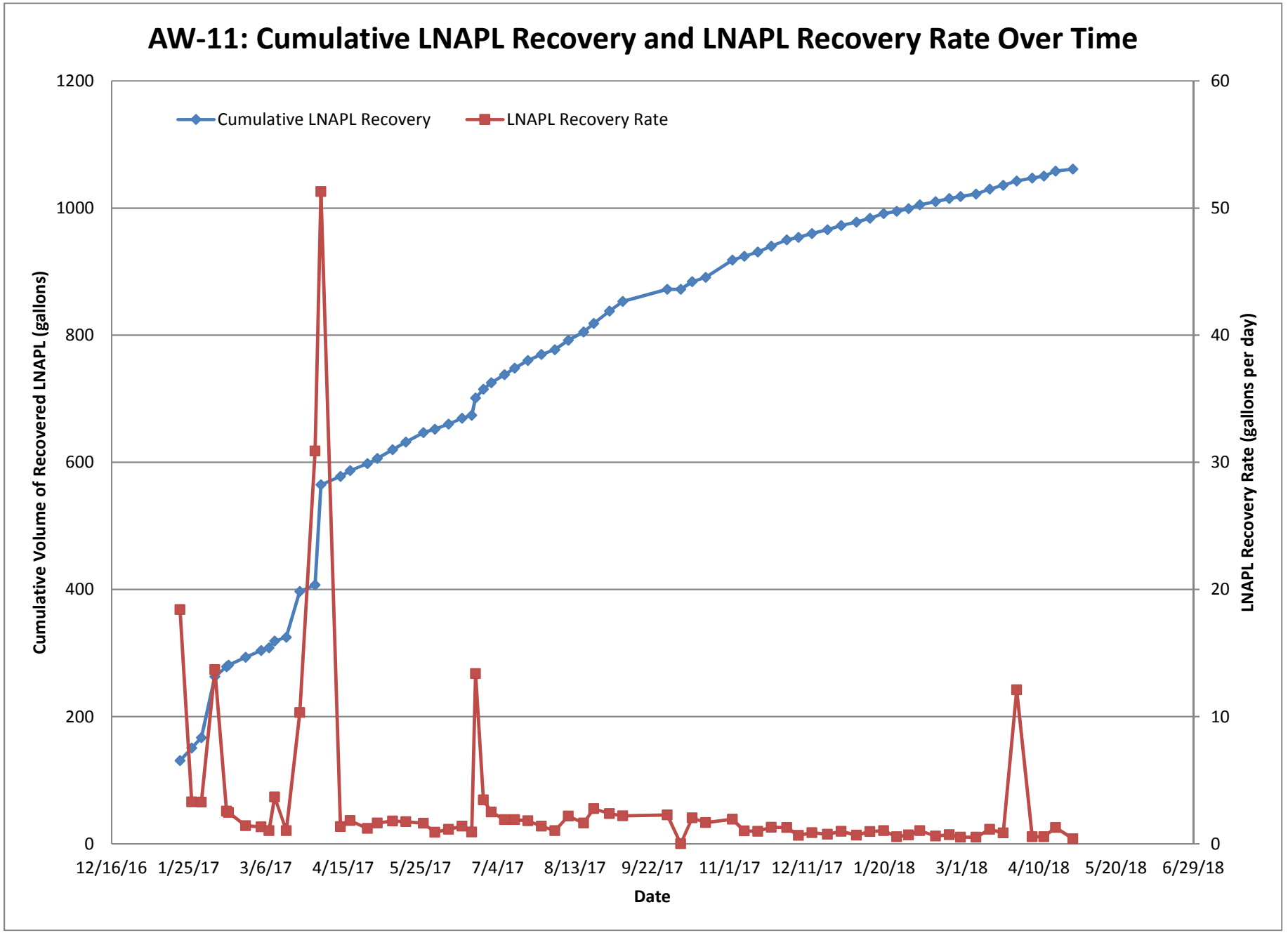
| Well ID | Measurement Date & Time | Time Between Measurement Events (days) | Actual Skimmer Run-Time Between Measurement Events (days) | Cumulative Run Time (days) | Total Volume of LNAPL Recovered (gallons) | Volume of LNAPL Recovered During Measurement Interval (gallons) | RUNNING Total Volume of LNAPL Recovered (gallons) | Depth to LNAPL (feet btoc) | Depth to Water (feet btoc) | In-Well LNAPL Thickness (feet) | LNAPL Drawdown (feet) | Maximum Theoretical Unconfined LNAPL Drawdown (feet) | LNAPL Drawdown Used in Transmissivity Estimate[a] (feet) | Average LNAPL Recovery Rate for Interval (gal/day) | Average LNAPL Recovery Rate for Interval ($ft^3$/day) | Estimated LNAPL Transmissivity for Interval ($ft^2$/day) | Overall Average LNAPL Transmissivity[b] ($ft^2$/day) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AW-11 Long term test | 8/2/2017 12:00 | 7.04 | 7.04 | 185.80 | 657.7 | 7.3 | 777.1 | 10.82 | 11.09 | 0.27 | 0.07 | | 0.49 | 1.0 | 0.14 | 0.2 | |
| | 8/9/2017 9:42 | 6.90 | 6.90 | 192.71 | 672.7 | 15.0 | 792.1 | 10.90 | 11.04 | 0.14 | 0.15 | | 0.49 | 2.2 | 0.29 | 0.4 | |
| | 8/17/2017 8:46 | 7.96 | 7.96 | 200.67 | 685.7 | 13.0 | 805.1 | 10.55 | 10.78 | 0.23 | -0.20 | | 0.49 | 1.6 | 0.22 | 0.3 | |
| | 8/22/2017 12:35 | 5.16 | 4.89 | 205.55 | 699.2 | 13.5 | 818.6 | 10.55 | 10.82 | 0.27 | -0.20 | | 0.49 | 2.8 | 0.37 | 0.6 | |
| | 8/30/2017 17:30 | 8.20 | 8.20 | 213.76 | 718.7 | 19.5 | 838.1 | 10.83 | 10.93 | 0.10 | 0.08 | | 0.08 | 2.4 | 0.32 | 2.9 | |
| | 9/6/2017 13:55 | 6.85 | 6.85 | 220.61 | 733.7 | 15.0 | 853.1 | 10.75 | 11.01 | 0.26 | 0.00 | | 0.49 | 2.2 | 0.29 | 0.4 | |
| | *END OF TEST INTERVAL - SHUTDOWN DUE TO HURRICANE* | | | | | | | | | | | | | | | | |
| | 9/22/2017 8:39 | -- | -- | -- | -- | -- | 853.1 | 10.08 | 12.32 | 2.24 | -- | | | -- | -- | -- | |
| | 9/22/2017 9:56 | 0.05 | 0.05 | 220.66 | 736.7 | 3.0 | 856.1 | 10.77 | 10.98 | 0.21 | 0.02 | | 0.49 | 56.7 | 7.57 | 11.3 | |
| | 9/29/2017 13:35 | 7.15 | 7.15 | 227.81 | 752.9 | 16.2 | 872.3 | 10.61 | 10.78 | 0.17 | -0.14 | | 0.49 | 2.3 | 0.30 | 0.5 | |
| | 10/6/2017 13:55 | 7.01 | 0.37 | 228.18 | 752.9 | 0.0 | 872.3 | 9.98 | 10.95 | 0.97 | -0.77 | | 0.49 | 0.0 | 0.00 | 0.0 | |
| | 10/12/2017 11:42 | 5.91 | 5.90 | 234.08 | 764.9 | 12.0 | 884.3 | 10.83 | 10.99 | 0.16 | 0.08 | | 0.49 | 2.0 | 0.27 | 0.4 | |
| | 10/19/2017 11:50 | 7.01 | 4.08 | 238.15 | 771.7 | 6.8 | 891.1 | 10.22 | 11.44 | 1.22 | -0.53 | | 0.49 | 1.7 | 0.22 | 0.3 | |
| | 11/2/2017 9:15 | 13.89 | 13.88 | 252.03 | 798.6 | 26.9 | 918.0 | 11.21 | 11.45 | 0.24 | 0.46 | | 0.49 | 1.9 | 0.26 | 0.4 | |
| | 11/8/2017 12:27 | 6.13 | 6.13 | 258.17 | 804.8 | 6.2 | 924.2 | 11.17 | 11.39 | 0.22 | 0.42 | | 0.49 | 1.0 | 0.14 | 0.2 | |
| | 11/15/2017 11:50 | 6.97 | 6.97 | 265.13 | 811.6 | 6.8 | 931.0 | 11.03 | 11.22 | 0.19 | 0.28 | | 0.49 | 1.0 | 0.13 | 0.2 | |
| | 11/22/2017 10:36 | 6.95 | 6.94 | 272.07 | 820.6 | 9.0 | 940.0 | 11.52 | 11.79 | 0.27 | 0.77 | | 0.49 | 1.3 | 0.17 | 0.3 | |
| | 11/30/2017 11:32 | 8.04 | 7.86 | 279.93 | 830.6 | 10.0 | 950.0 | 11.47 | 11.72 | 0.25 | 0.72 | | 0.49 | 1.3 | 0.17 | 0.3 | |
| | 12/6/2017 12:19 | 6.03 | 6.03 | 285.96 | 834.6 | 4.0 | 954.0 | 11.16 | 11.38 | 0.22 | 0.41 | | 0.49 | 0.7 | 0.09 | 0.1 | |
| | 12/13/2017 11:08 | 6.95 | 6.94 | 292.90 | 840.6 | 6.0 | 960.0 | 11.59 | 11.82 | 0.23 | 0.84 | | 0.49 | 0.9 | 0.12 | 0.2 | |
| | 12/21/2017 13:00 | 8.08 | 8.07 | 300.97 | 846.6 | 6.0 | 966.0 | 11.55 | 11.68 | 0.13 | 0.80 | | 0.49 | 0.7 | 0.10 | 0.1 | |
| | 12/28/2017 13:48 | 7.03 | 6.75 | 307.72 | 853.2 | 6.6 | 972.6 | 11.80 | 12.05 | 0.25 | 1.05 | | 0.49 | 1.0 | 0.13 | 0.2 | |
| | 1/5/2018 14:01 | 8.01 | 8.00 | 315.72 | 858.6 | 5.4 | 978.0 | 11.52 | 11.75 | 0.23 | 0.77 | | 0.49 | 0.7 | 0.09 | 0.1 | |
| | 1/12/2018 13:09 | 6.96 | 6.27 | 322.00 | 864.6 | 6.0 | 984.0 | 11.74 | 11.95 | 0.21 | 0.99 | | 0.49 | 1.0 | 0.13 | 0.2 | |
| | 1/19/2018 13:55 | 7.03 | 7.03 | 329.02 | 871.8 | 7.2 | 991.2 | 11.56 | 11.84 | 0.28 | 0.81 | | 0.49 | 1.0 | 0.14 | 0.2 | |
| | 1/26/2018 9:47 | 6.83 | 6.83 | 335.85 | 875.6 | 3.8 | 995.0 | 12.17 | 12.42 | 0.25 | 1.42 | | 0.49 | 0.6 | 0.07 | 0.1 | |
| | 2/1/2018 12:25 | 6.11 | 5.74 | 341.59 | 879.6 | 4.0 | 999.0 | 11.58 | 11.86 | 0.28 | 0.83 | | 0.49 | 0.7 | 0.09 | 0.1 | |
| | 2/7/2018 9:12 | 5.87 | 5.86 | 334.89 | 885.6 | 6.0 | 1005.0 | 11.96 | 12.28 | 0.32 | 1.21 | | 0.49 | 1.0 | 0.14 | 0.2 | |
| | 2/15/2018 12:21 | 8.13 | 8.12 | 343.97 | 890.6 | 5.0 | 1010.0 | 11.50 | 11.74 | 0.24 | 0.75 | | 0.49 | 0.6 | 0.08 | 0.1 | |
| | 2/22/2018 14:34 | 7.09 | 7.09 | 348.68 | 895.6 | 5.0 | 1015.0 | 11.67 | 11.89 | 0.22 | 0.92 | | 0.49 | 0.7 | 0.09 | 0.1 | |
| | 2/28/2018 8:27 | 5.75 | 5.74 | 340.63 | 898.6 | 3.0 | 1018.0 | 11.32 | 11.55 | 0.23 | 0.57 | | 0.49 | 0.5 | 0.07 | 0.1 | |
| | 3/8/2018 9:39 | 8.05 | 7.77 | 351.74 | 902.6 | 4.0 | 1022.0 | 11.67 | 11.99 | 0.32 | 0.92 | | 0.49 | 0.5 | 0.07 | 0.1 | |
| | 3/15/2018 12:50 | 7.13 | 7.06 | 355.74 | 910.6 | 8.0 | 1030.0 | 11.62 | 11.86 | 0.24 | 0.87 | | 0.49 | 1.1 | 0.15 | 0.2 | |
| | 3/22/2018 12:06 | 6.97 | 6.96 | 347.59 | 916.6 | 6.0 | 1036.0 | 12.13 | 12.31 | 0.18 | 1.38 | | 0.49 | 0.9 | 0.12 | 0.2 | |
| | 3/29/2018 11:21 | 6.97 | 0.55 | 352.28 | 923.2 | 6.6 | 1042.6 | 11.55 | 11.88 | 0.33 | 0.80 | | 0.49 | 12.1 | 1.62 | 2.4 | |
| | 4/6/2018 11:18 | 8.00 | 7.99 | 363.73 | 927.6 | 4.4 | 1047.0 | 11.95 | 12.26 | 0.31 | 1.20 | | 0.49 | 0.6 | 0.07 | 0.1 | |
| | 4/12/2018 12:25 | 6.05 | 6.04 | 353.63 | 930.9 | 3.3 | 1050.3 | 11.77 | 12.00 | 0.23 | 1.02 | | 0.49 | 0.5 | 0.07 | 0.1 | |
| | 4/18/2018 13:10 | 6.03 | 6.03 | 358.31 | 938.6 | 7.7 | 1058.0 | 10.95 | 11.19 | 0.24 | 0.20 | | 0.49 | 1.3 | 0.17 | 0.3 | |
| | 4/27/2018 13:09 | 9.00 | 7.99 | 371.72 | 941.8 | 3.2 | 1061.2 | 11.56 | 11.78 | 0.22 | 0.81 | | 0.49 | 0.4 | 0.05 | 0.1 | 0.35 |
| | | | | | | | | | | | | | | | | | |

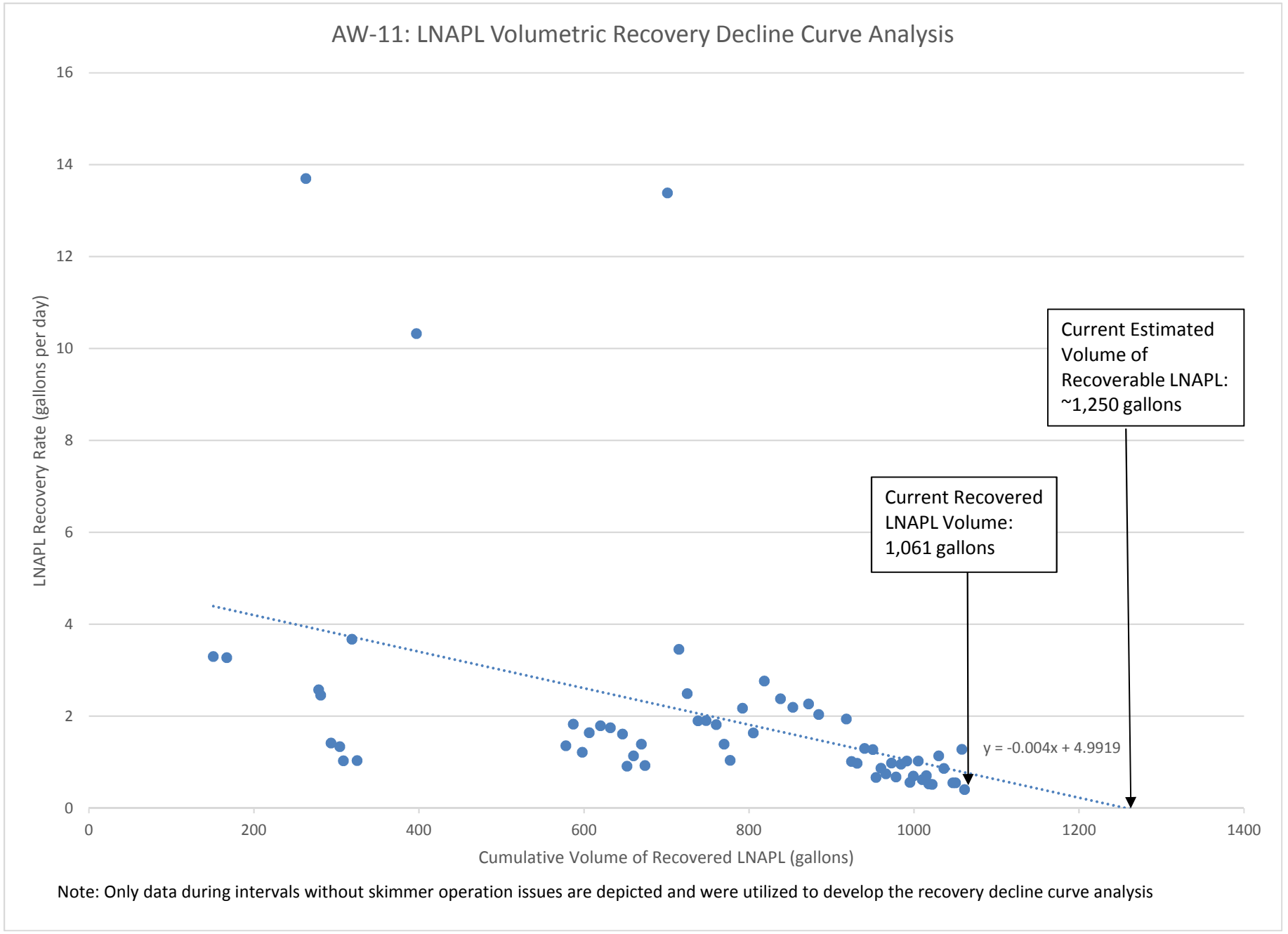
Assumed LNAPL specific gravity = 0.854

All calculations performed pursuant to the methodology detailed in ASTM E2856-13

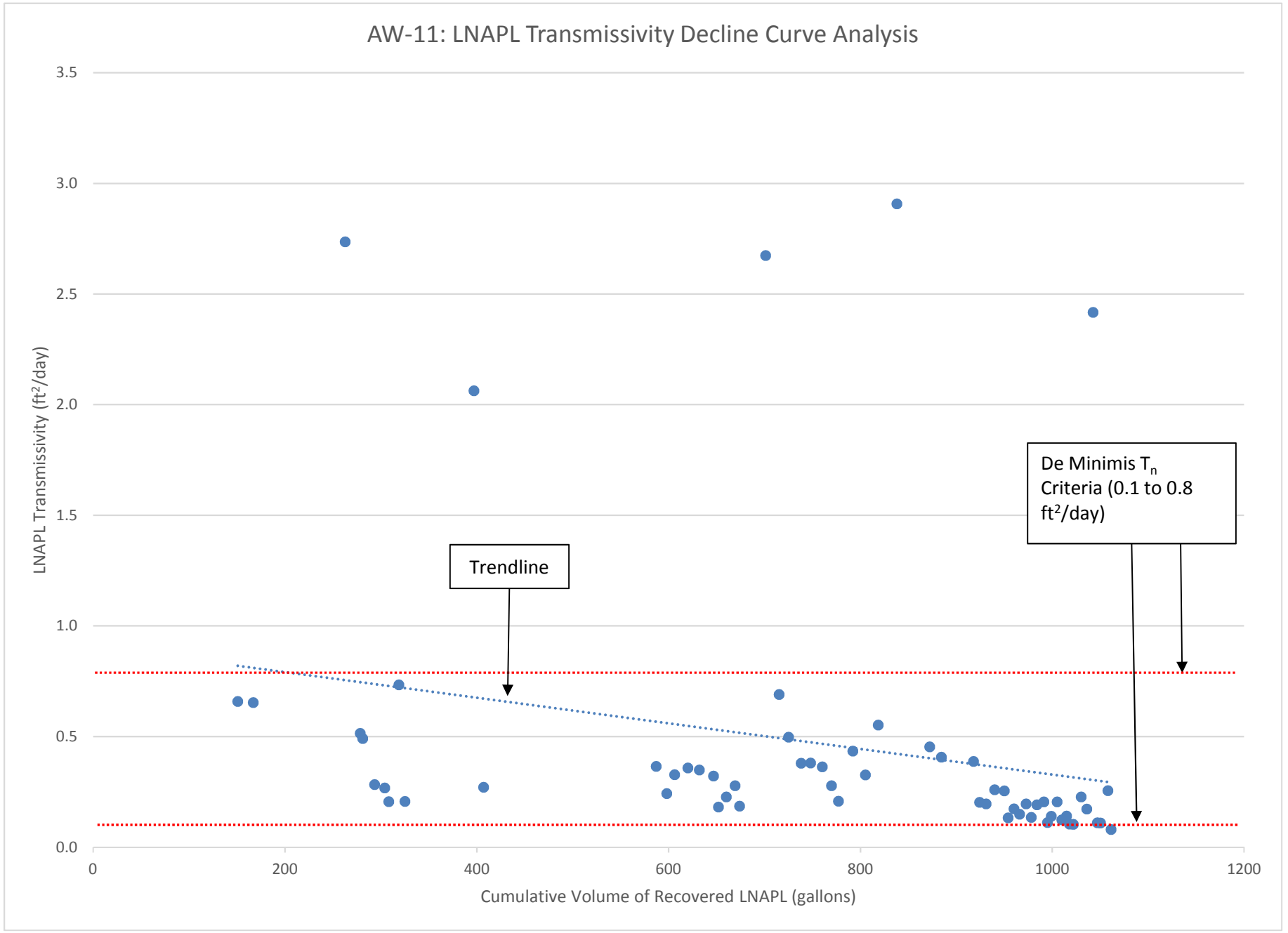
[a]The maximum theoretical drawdown is used for each interval calculation where the measured drawdown is negative or where it exceeds the theoretical maximum.

[b]Represents the geometric mean of the stabilized recovery rates/LNAPL transmissivity estimates (i.e., excludes initial elevated values that would not represent potential long-term recovery rates).


AW-11: Cumulative LNAPL Recovery and LNAPL Recovery Rate Over Time
Cumulative LNAPL Recovery
LNAPL Recovery Rate
Cumulative Volume of Recovered LNAPL (gallons)
LNAPL Recovery Rate (gallons per day)
0
200
400
600
800
1000
1200
0
10
20
30
40
50
60
12/16/16
1/25/17
3/6/17
4/15/17
5/25/17
7/4/17
8/13/17
9/22/17
11/1/17
12/11/17
1/20/18
3/1/18
4/10/18
5/20/18
6/29/18
Date




Note: Only data during intervals without skimmer operation issues are depicted and were utilized to develop the recovery decline curve analysis


AW-11: LNAPL Transmissivity Decline Curve Analysis
LNAPL Transmissivity (ft²/day)
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
0
200
400
600
800
1000
1200
Cumulative Volume of Recovered LNAPL (gallons)
Trendline
De Minimis Tn Criteria (0.1 to 0.8 ft²/day)

# AW-12 Skimming Evaluation

## Appendix A

## AW-12 LNAPL Skimming Test Results
## IMTT Savannah North Terminal
## Savannah, Georgia

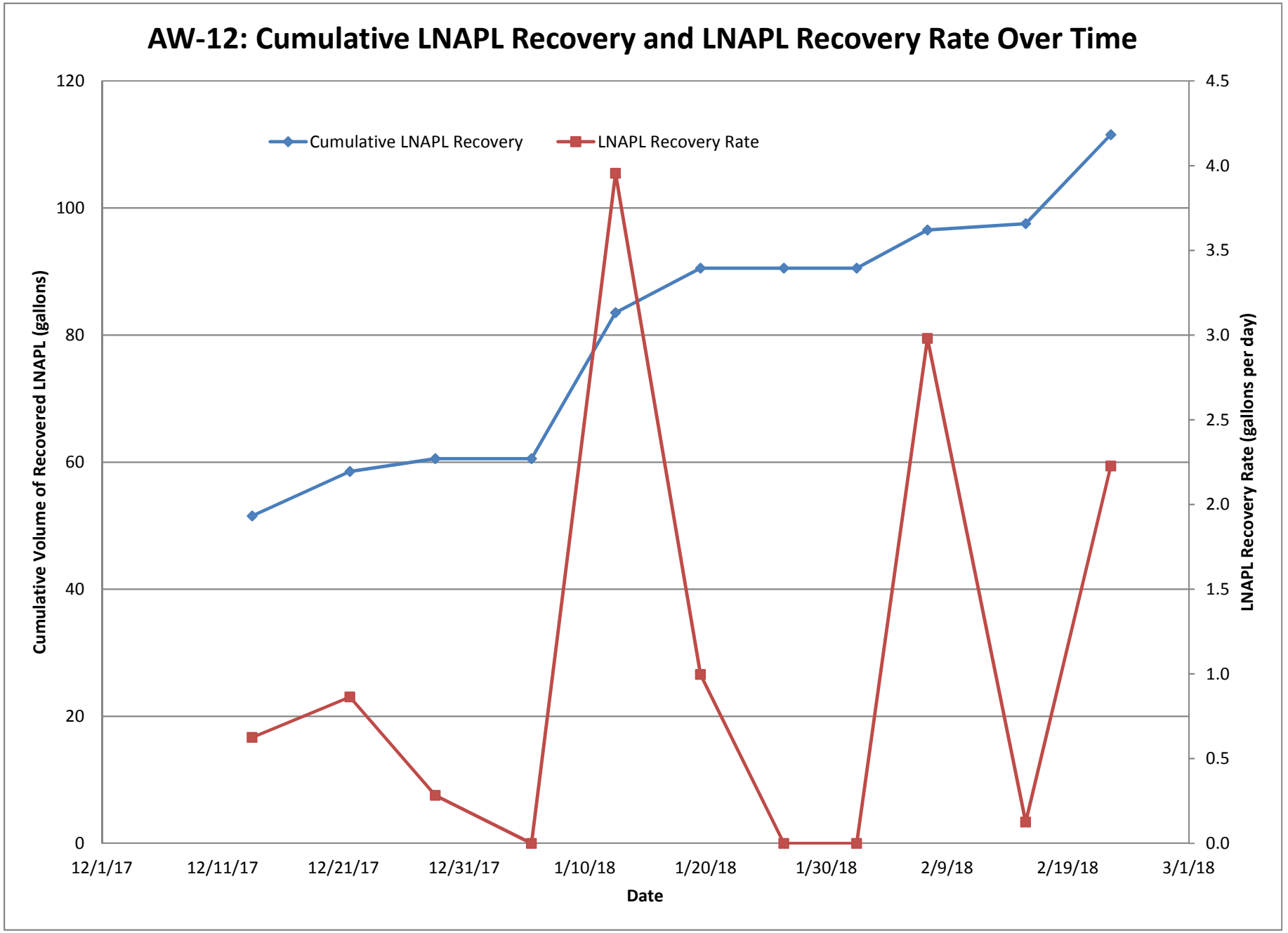
| Well ID | Measurement Date & Time | Time Between Measurement Events (days) | Actual Skimmer Run-Time Between Measurement Events (days) | Cumulative Run Time (days) | Total Volume of LNAPL Recovered (gallons) | Volume of LNAPL Recovered During Measurement Interval (gallons) | RUNNING Total Volume of LNAPL Recovered (gallons) | Depth to LNAPL (feet btoc) | Depth to Water (feet btoc) | In-Well LNAPL Thickness (feet) | LNAPL Drawdown (feet) | Maximum Theoretical Unconfined LNAPL Drawdown (feet) | LNAPL Drawdown Used in Transmissivity Estimate[a] (feet) | Average LNAPL Recovery Rate for Interval (gal/day) | Average LNAPL Recovery Rate for Interval ($ft^3$/day) | Estimated LNAPL Transmissivity for Interval ($ft^2$/day) | Overall Average LNAPL Transmissivity[b] ($ft^2$/day) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AW-12 Short term test | Equilibrium | | | | | | | 8.60 | 14.81 | 6.21 | -- | 1.07 | | -- | -- | -- | |
| | 9/22/2016 11:45 | -- | | -- | -- | -- | | 5.47 | 16.20 | 10.73 | -- | | -- | -- | -- | -- | |
| | 9/28/2016 8:55 | 5.88 | 5.88 | 5.88 | 24.6 | 24.6 | 24.6 | 11.31 | 11.41 | 0.10 | 2.71 | | 1.07 | 4.2 | 0.56 | 0.4 | |
| | 10/5/2016 13:03 | 7.17 | 7.17 | 13.05 | 30.5 | 5.9 | 30.5 | 11.18 | 12.26 | 1.08 | 2.58 | | 1.07 | 0.8 | 0.11 | 0.08 | 0.08 |
| AW-12 Long term test | 12/6/2017 11:17 | -- | -- | 0.00 | -- | -- | 30.5 | 11.24 | 17.11 | 5.87 | -- | | | -- | -- | -- | |
| | 12/6/2017 14:20 | 0.13 | 0.13 | 0.13 | 12.0 | 12.0 | 42.5 | 10.48 | 12.47 | 1.99 | 1.88 | | 1.07 | 94.4 | 12.62 | 8.6 | |
| | 12/6/2017 14:50 | 0.02 | 0.02 | 0.15 | 15.0 | 3.0 | 45.5 | 11.70 | 12.20 | 0.50 | 3.10 | | 1.07 | 144.0 | 19.25 | 13.2 | |
| | 12/6/2017 15:20 | 0.02 | 0.02 | 0.17 | 17.0 | 2.0 | 47.5 | 11.81 | 12.19 | 0.38 | 3.21 | | 1.07 | 96.0 | 12.83 | 8.8 | |
| | 12/6/2017 15:50 | 0.02 | 0.02 | 0.19 | 17.0 | 0.0 | 47.5 | 11.53 | 11.81 | 0.28 | 2.93 | | 1.07 | 0.0 | 0.00 | 0.0 | |
| | 12/13/2017 10:24 | 6.77 | 6.40 | 6.59 | 21.0 | 4.0 | 51.5 | 12.00 | 12.15 | 0.15 | 3.40 | | 1.07 | 0.6 | 0.08 | 0.1 | |
| | 12/21/2017 12:45 | 8.10 | 8.10 | 14.69 | 28.0 | 7.0 | 58.5 | 12.00 | 12.15 | 0.15 | 3.40 | | 1.07 | 0.9 | 0.12 | 0.1 | |
| | 12/28/2017 14:34 | 7.08 | 7.08 | 21.77 | 30.0 | 2.0 | 60.5 | 11.98 | 12.21 | 0.23 | 3.38 | | 1.07 | 0.3 | 0.04 | 0.0 | |
| | 1/5/2018 13:43 | 7.96 | 7.53 | 29.30 | 30.0 | 0.0 | 60.5 | 11.80 | 11.90 | 0.10 | 3.20 | | 1.07 | 0.0 | 0.00 | 0.0 | |
| | 1/12/2018 12:51 | 6.96 | 5.82 | 35.11 | 53.0 | 23.0 | 83.5 | 11.41 | 11.93 | 0.52 | 2.81 | | 1.07 | 4.0 | 0.53 | 0.4 | |
| | 1/19/2018 13:25 | 7.02 | 7.02 | 42.14 | 60.0 | 7.0 | 90.5 | 11.52 | 11.69 | 0.17 | 2.92 | | 1.07 | 1.0 | 0.13 | 0.1 | |
| | 1/26/2018 11:12 | 6.91 | 3.18 | 45.31 | 60.0 | 0.0 | 90.5 | 12.33 | 13.05 | 0.72 | 3.73 | | 1.07 | 0.0 | 0.00 | 0.0 | |
| | 2/1/2018 11:56 | 6.03 | 0.00 | 45.31 | 60.0 | 0.0 | 90.5 | 11.61 | 11.83 | 0.22 | 3.01 | | 1.07 | 0.0 | 0.00 | 0.0 | |
| | 2/7/2018 8:35 | 5.86 | 2.01 | 47.33 | 66.0 | 6.0 | 96.5 | 12.17 | 12.20 | 0.03 | 3.57 | | 1.07 | 3.0 | 0.40 | 0.3 | |
| | 2/15/2018 11:56 | 8.14 | 7.95 | 55.28 | 67.0 | 1.0 | 97.5 | 11.78 | 11.94 | 0.16 | 3.18 | | 1.07 | 0.1 | 0.02 | 0.0 | |
| | 2/22/2018 13:07 | 7.05 | 6.29 | 61.56 | 81.0 | 14.0 | 111.5 | 12.28 | 12.30 | 0.02 | 3.68 | | 1.07 | 2.2 | 0.30 | 0.2 | 0.08 |
| | 2/28/2018 9:55 | 5.87 | 0.00 | 61.56 | 81.0 | 0.0 | 111.5 | 11.51 | 11.70 | 0.19 | 2.91 | | -- | -- | -- | -- | |
| | ***END OF TEST INTERVAL*** | | | | | | | | | | | | | | | | |

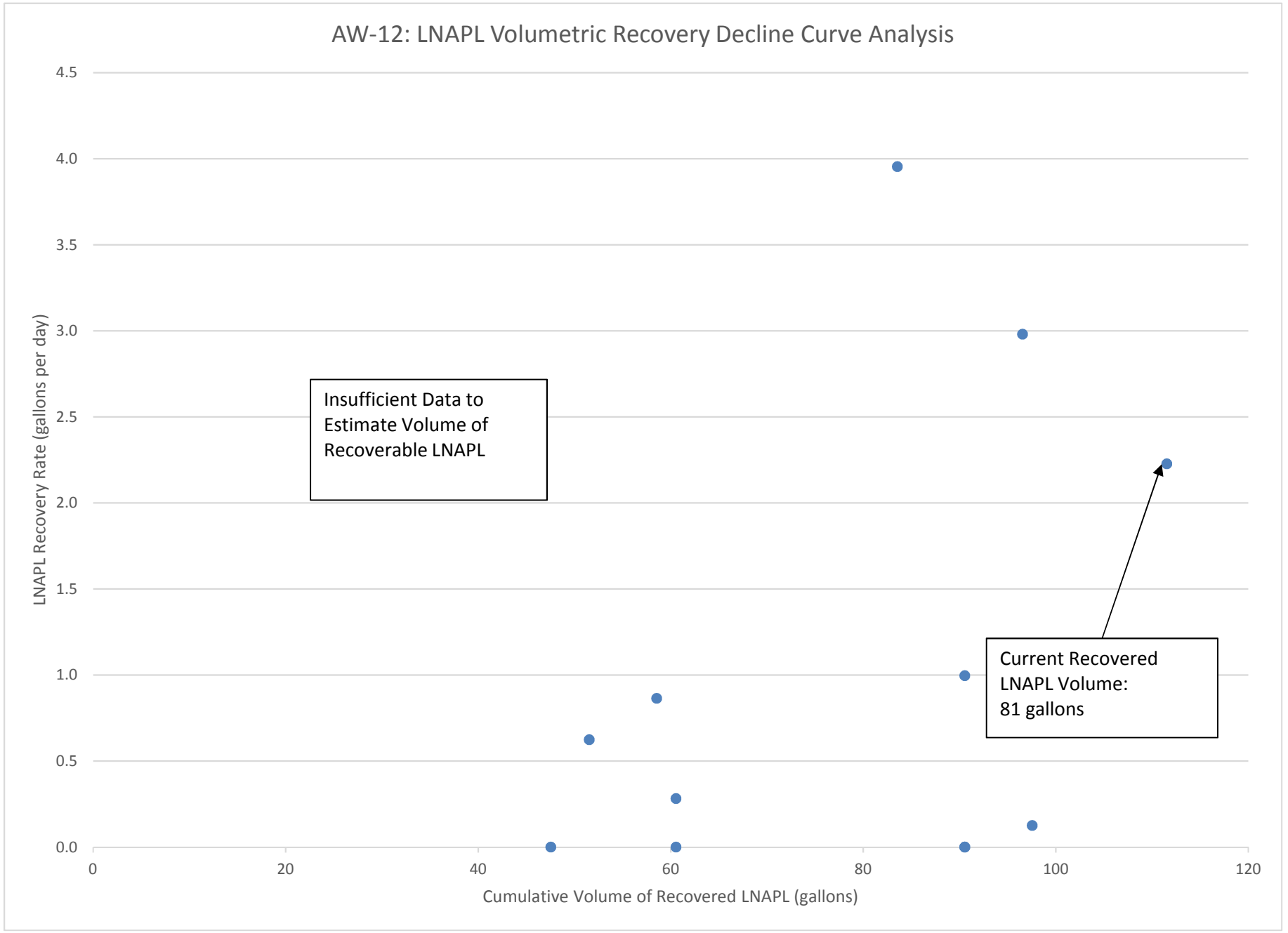
Assumed LNAPL specific gravity = 0.8275

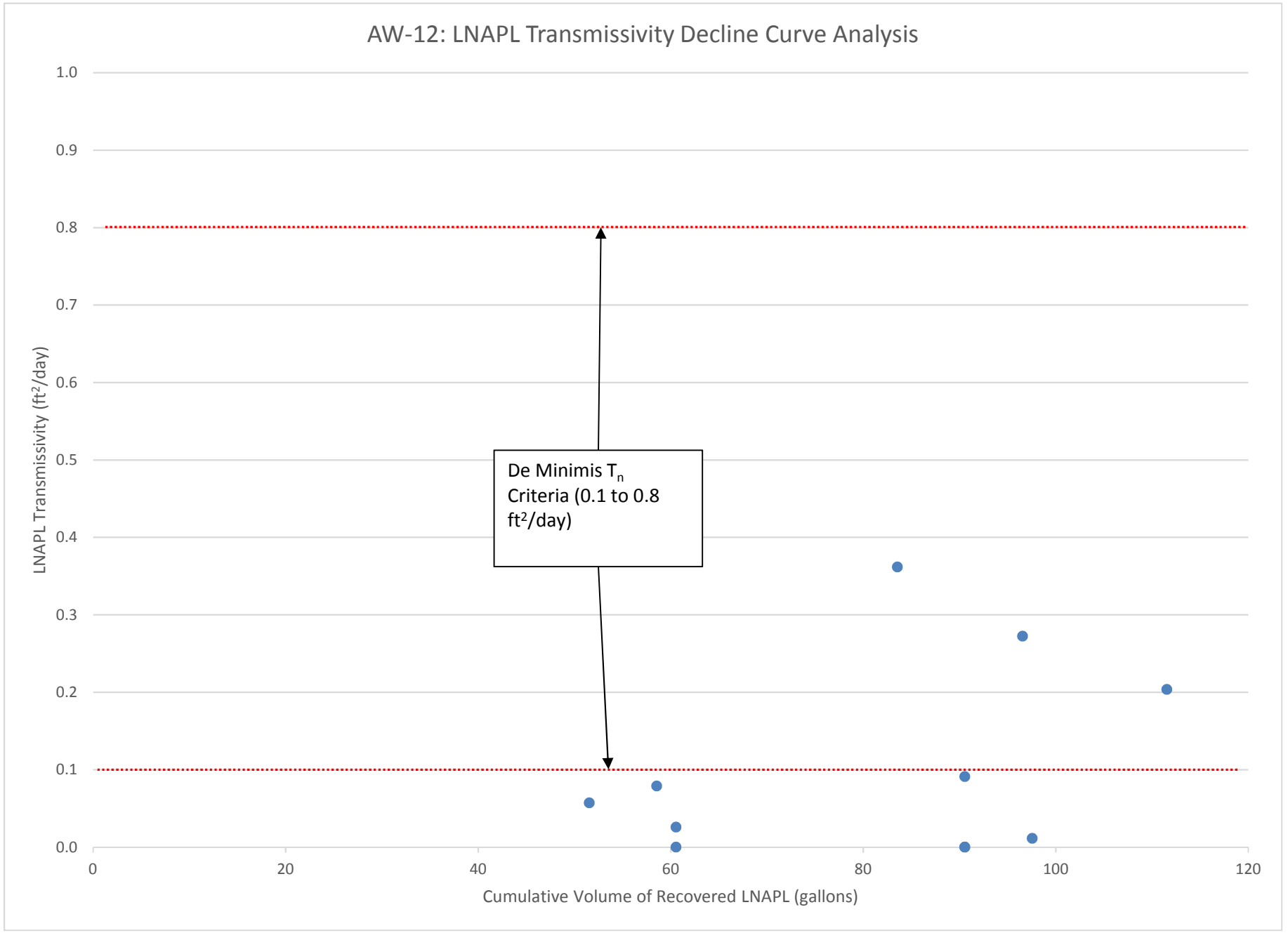
All calculations performed pursuant to the methodology detailed in ASTM E2856-13

[a]The maximum theoretical drawdown is used for each interval calculation where the measured drawdown is negative or where it exceeds the theoretical maximum.

[b]Represents the geometric mean of the stabilized recovery rates/LNAPL transmissivity estimates (i.e., excludes initial elevated values that would not represent potential long-term recovery rates).


AW-12: Cumulative LNAPL Recovery and LNAPL Recovery Rate Over Time
Cumulative LNAPL Recovery
LNAPL Recovery Rate
Cumulative Volume of Recovered LNAPL (gallons)
LNAPL Recovery Rate (gallons per day)
Date
0
20
40
60
80
100
120
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
12/1/17
12/11/17
12/21/17
12/31/17
1/10/18
1/20/18
1/30/18
2/9/18
2/19/18
3/1/18


AW-12: LNAPL Volumetric Recovery Decline Curve Analysis
LNAPL Recovery Rate (gallons per day)
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
0
20
40
60
80
100
120
Cumulative Volume of Recovered LNAPL (gallons)
Insufficient Data to Estimate Volume of Recoverable LNAPL
Current Recovered LNAPL Volume: 81 gallons


AW-12: LNAPL Transmissivity Decline Curve Analysis
LNAPL Transmissivity (ft²/day)
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
0
20
40
60
80
100
120
Cumulative Volume of Recovered LNAPL (gallons)
De Minimis $T_n$ Criteria (0.1 to 0.8 ft²/day)

# AW-18 Skimming Evaluation

## Appendix A

## AW-18 LNAPL Skimming Test Results
## IMTT Savannah North Terminal
## Savannah, Georgia

| Well ID | Measurement Date & Time | Time Between Measurement Events (days) | Actual Skimmer Run-Time Between Measurement Events (days) | Cumulative Run Time (days) | Total Volume of LNAPL Recovered (gallons) | Volume of LNAPL Recovered During Measurement Interval (gallons) | RUNNING Total Volume of LNAPL Recovered (gallons) | Depth to LNAPL (feet btoc) | Depth to Water (feet btoc) | In-Well LNAPL Thickness (feet) | LNAPL Drawdown (feet) | Maximum Theoretical Unconfined LNAPL Drawdown (feet) | LNAPL Drawdown Used in Transmissivity Estimate[a] (feet) | Average LNAPL Recovery Rate for Interval (gal/day) | Average LNAPL Recovery Rate for Interval ($ft^3$/day) | Estimated LNAPL Transmissivity for Interval ($ft^2$/day) | Overall Average LNAPL Transmissivity[b] ($ft^2$/day) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Equilibrium | -- | | -- | -- | -- | | 6.68 | 8.28 | 1.60 | -- | 0.23 | -- | -- | -- | -- | |
| AW-18 Short term test | 8/25/2016 11:15 | -- | | -- | -- | -- | | 7.00 | 11.70 | 4.70 | -- | | -- | -- | -- | -- | |
| | 8/31/2016 11:30 | 6.01 | 6.01 | 6.01 | 2.87 | 2.87 | 2.87 | 7.40 | 11.40 | 4.00 | 0.72 | | 0.20 | 0.5 | 0.06 | 0.2 | |
| | 9/7/2016 13:05 | 7.07 | 7.03 | 13.04 | 3.70 | 0.83 | 3.70 | 6.80 | 10.70 | 3.90 | 0.12 | | 0.16 | 0.1 | 0.02 | 0.07 | |
| | 9/15/2016 11:00 | 7.91 | 7.83 | 20.86 | 7.40 | 3.70 | 7.40 | 6.88 | 10.92 | 4.04 | 0.20 | | 0.20 | 0.5 | 0.06 | 0.23 | 0.15 |
| AW-18 Long term test | 6/19/2017 13:15 | -- | -- | 0.00 | -- | -- | -- | 6.48 | 8.19 | 1.71 | -- | | | -- | -- | -- | |
| | 6/20/2017 9:06 | 0.83 | 0.83 | 0.83 | 4.00 | 4.0 | 11.4 | 6.75 | 7.05 | 0.30 | 0.07 | | 0.07 | 4.8 | 0.65 | 6.8 | |
| | 6/22/2017 10:09 | 2.04 | 2.04 | 2.87 | 4.00 | 0.0 | 11.4 | 7.05 | 7.36 | 0.31 | 0.37 | | 0.23 | 0.0 | 0.00 | 0.0 | |
| | 6/26/2017 11:02 | 4.04 | 4.04 | 6.91 | 4.00 | 0.0 | 11.4 | 6.80 | 7.15 | 0.35 | 0.12 | | 0.12 | 0.0 | 0.00 | 0.0 | |
| | 6/30/2017 11:13 | 4.01 | 4.01 | 10.92 | 4.00 | 0.0 | 11.4 | 6.90 | 7.08 | 0.18 | 0.22 | | 0.22 | 0.0 | 0.00 | 0.0 | |
| | 7/7/2017 9:18 | 6.92 | 6.92 | 17.84 | 4.00 | 0.0 | 11.4 | 6.44 | 6.58 | 0.14 | -0.24 | | 0.23 | 0.0 | 0.00 | 0.0 | |
| | 7/12/2017 14:59 | 5.24 | 5.24 | 23.07 | 4.00 | 0.0 | 11.4 | 6.26 | 6.43 | 0.17 | -0.42 | | 0.23 | 0.0 | 0.00 | 0.0 | |
| | 7/19/2017 11:06 | 6.84 | 6.84 | 29.91 | 4.00 | 0.0 | 11.4 | 6.79 | 7.01 | 0.22 | 0.11 | | 0.11 | 0.0 | 0.00 | 0.0 | |
| | 7/26/2017 10:43 | 6.98 | 6.98 | 36.89 | 4.00 | 0.0 | 11.4 | 6.47 | 6.69 | 0.22 | -0.21 | | 0.23 | 0.0 | 0.00 | 0.0 | |
| | 8/2/2017 10:30 | 6.99 | 6.99 | 43.89 | 4.00 | 0.0 | 11.4 | 6.59 | 6.72 | 0.13 | -0.09 | | 0.23 | 0.0 | 0.00 | 0.0 | 0.0 |
| | End of Test | | | | | | | | | | | | | | | | |
| | 8/22/2017 13:00 | 20.10 | | | | | | 6.45 | 7.70 | 1.25 | | | | | | | |

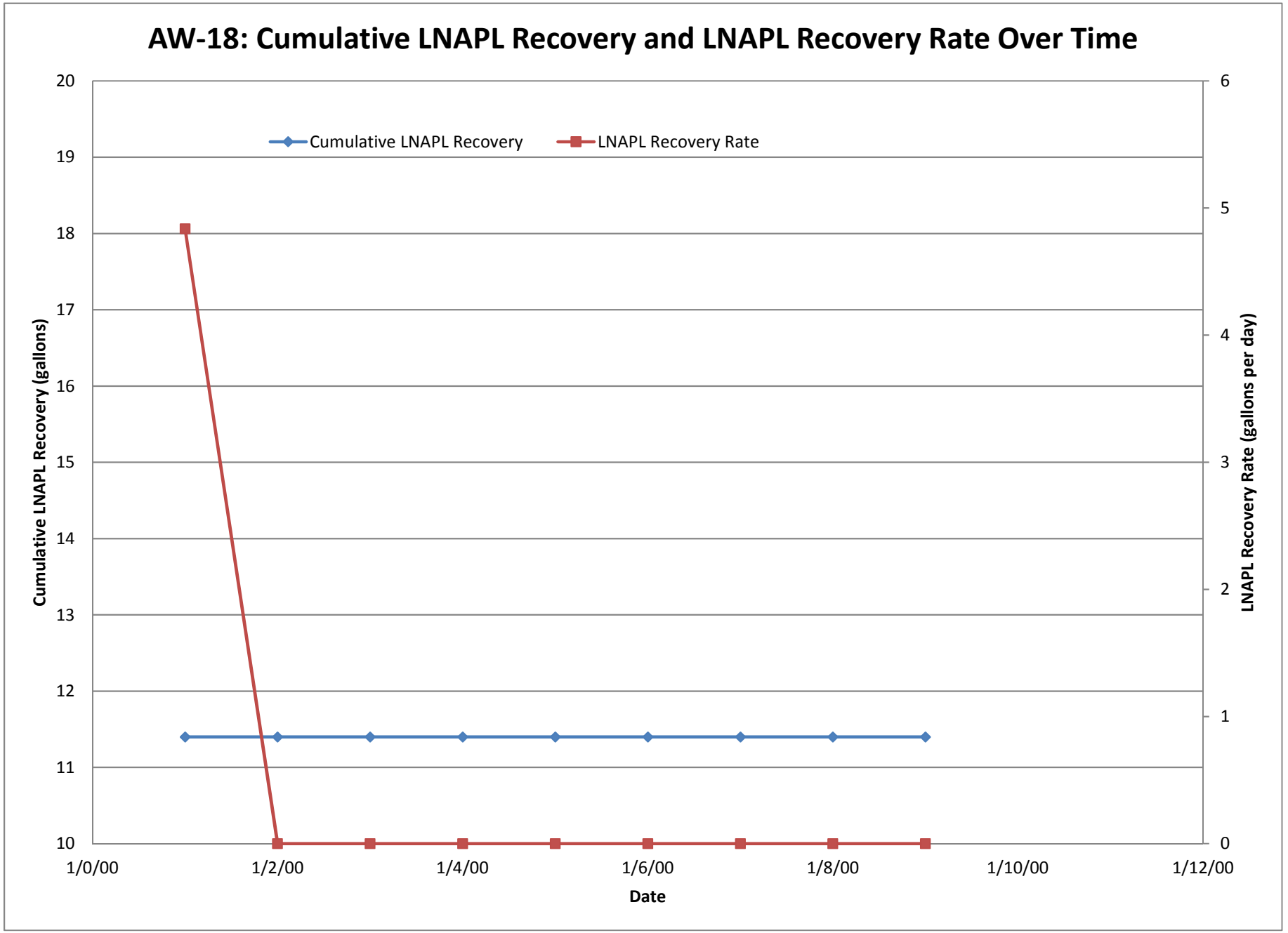
Assumed LNAPL specific gravity = 0.854

All calculations performed pursuant to the methodology detailed in ASTM E2856-13

[a]The maximum theoretical drawdown is used for each interval calculation where the measured drawdown is negative or where it exceeds the theoretical maximum.

[b]Represents the geometric mean of the stabilized recovery rates/LNAPL transmissivity estimates (i.e., excludes initial elevated values that would not represent potential long-term recovery rates).

Equilibrium data is an average of quarterly groundwater data collected from March 2016 through Februrary 2018 and excludes data collected during or following skimming operations.


AW-18: Cumulative LNAPL Recovery and LNAPL Recovery Rate Over Time
Cumulative LNAPL Recovery
LNAPL Recovery Rate
Cumulative LNAPL Recovery (gallons)
LNAPL Recovery Rate (gallons per day)
Date
20
19
18
17
16
15
14
13
12
11
10
6
5
4
3
2
1
0
1/0/00
1/2/00
1/4/00
1/6/00
1/8/00
1/10/00
1/12/00

# AW-22 Skimming Evaluation

**Appendix A**

**AW-22 LNAPL Skimming Test Results**
**IMTT Savannah North Terminal**
**Savannah, Georgia**

| Well ID | Measurement Date & Time | Time Between Measurement Events (days) | Actual Skimmer Run-Time Between Measurement Events (days) | Cumulative Run Time (days) | Total Volume of LNAPL Recovered (gallons) | Volume of LNAPL Recovered During Measurement Interval (gallons) | RUNNING Total Volume of LNAPL Recovered (gallons) | Depth to LNAPL (feet btoc) | Depth to Water (feet btoc) | In-Well LNAPL Thickness (feet) | LNAPL Drawdown (feet) | Maximum Theoretical Unconfined LNAPL Drawdown (feet) | LNAPL Drawdown Used in Transmissivity Estimate[a] (feet) | Average LNAPL Recovery Rate for Interval (gal/day) | Average LNAPL Recovery Rate for Interval ($ft^3$/day) | Estimated LNAPL Transmissivity for Interval ($ft^2$/day) | Overall Average LNAPL Transmissivity[b] ($ft^2$/day) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Equilibrium** | -- | | -- | -- | -- | | 11.91 | 15.46 | 3.55 | -- | 0.52 | -- | -- | -- | -- | |
| AW-22 Short term test | 9/22/2016 11:45 | -- | | -- | -- | -- | | 11.20 | 15.75 | 4.55 | -- | | -- | -- | -- | -- | |
| | 9/28/2016 8:40 | 5.87 | 5.87 | 5.87 | 51.00 | 51.00 | 51.00 | 11.82 | 13.45 | 1.63 | -0.09 | | 0.52 | 8.7 | 1.16 | 1.6 | |
| | 10/5/2016 13:40 | 7.21 | 5.98 | 11.85 | 103.53 | 52.53 | 103.53 | 11.89 | 13.48 | 1.59 | -0.02 | | 0.52 | 8.8 | 1.17 | 1.7 | |
| | *END OF TEST INTERVAL - SHUTDOWN DUE TO HURRICANE* | | | | | | | | | | | | | | | | |
| | 10/13/2016 12:50 | 7.97 | | 0.00 | 0.00 | 0.00 | 103.53 | 10.15 | 13.85 | 3.70 | | | -- | -- | -- | -- | |
| | 10/20/2016 10:50 | 6.92 | 6.92 | 6.92 | 51.00 | 51.00 | 154.53 | 11.07 | 13.47 | 2.40 | -0.84 | | 0.52 | 7.4 | 0.99 | 1.4 | |
| | *END OF TEST INTERVAL - DUE TO SKIMMER MALFUNCTION* | | | | | | | | | | | | | | | | |
| | 10/28/2016 10:50 | -- | | -- | | -- | | 10.78 | 13.17 | 2.39 | | | -- | -- | -- | -- | |
| | 11/4/2016 10:30 | 6.99 | 6.94 | 6.94 | 36.23 | 36.23 | 190.76 | 11.72 | 13.40 | 1.68 | -0.19 | | 0.52 | 5.2 | 0.70 | 1.0 | |
| | 11/16/2016 7:30 | 11.88 | 11.82 | 18.77 | 48.02 | 11.79 | 202.55 | 11.90 | 11.93 | 0.03 | -0.01 | | 0.52 | 1.0 | 0.13 | 0.2 | |
| | 11/22/2016 11:41 | 6.17 | 6.19 | 24.95 | 48.81 | 0.79 | 203.34 | 12.06 | 14.05 | 1.99 | 0.15 | | 0.10 | 0.1 | 0.02 | 0.1 | |
| | *END OF TEST INTERVAL - DUE TO SKIMMER MALFUNCTION* | | | | | | | | | | | | | | | | |
| | 11/29/2016 12:20 | -- | -- | -- | -- | -- | | 11.52 | 14.31 | 2.79 | | | -- | -- | -- | -- | |
| | 12/5/2016 12:15 | 6.00 | 5.99 | 0.00 | 37.32 | 37.32 | 240.66 | 12.71 | 13.65 | 0.94 | 0.80 | | 0.52 | 6.2 | 0.83 | 1.2 | |
| | 12/7/2016 12:30 | 2.01 | 1.77 | 0.00 | 37.32 | 0.00 | 240.66 | 11.95 | 13.46 | 1.51 | 0.04 | | 0.04 | 0.0 | 0.00 | 0.0 | |
| | 12/14/2016 9:24 | 6.87 | 6.38 | 8.15 | 37.32 | 0.00 | 240.66 | 12.26 | 12.35 | 0.09 | 0.35 | | 0.35 | 0.0 | 0.00 | 0.0 | |
| | 12/21/2016 9:00 | 6.98 | 6.93 | 15.07 | 37.32 | 0.00 | 240.66 | 12.35 | 12.37 | 0.02 | 0.44 | | 0.44 | 0.0 | 0.00 | 0.0 | |
| | 12/27/2016 12:00 | 6.13 | 6.08 | 21.15 | 37.32 | 0.00 | 240.66 | 11.90 | 12.12 | 0.22 | -0.01 | | 0.52 | 0.0 | 0.00 | 0.0 | |
| | 1/4/2017 11:06 | 7.96 | 7.91 | 29.06 | 37.32 | 0.00 | 240.66 | 12.69 | 12.80 | 0.11 | 0.78 | | 0.52 | 0.0 | 0.00 | 0.0 | |
| | 1/9/2017 11:17 | 5.01 | 4.90 | 33.95 | 50.12 | 12.80 | 253.46 | 12.54 | 12.61 | 0.07 | 0.63 | | 0.52 | 2.6 | 0.35 | 0.5 | |
| | 1/19/2017 8:20 | 9.88 | 9.81 | 43.76 | 52.51 | 2.39 | 255.85 | 12.67 | 12.73 | 0.06 | 0.76 | | 0.52 | 0.2 | 0.03 | 0.0 | 0.5 |
| | *END OF TEST INTERVAL* | | | | | | | | | | | | | | | | |
| AW-22 Long term test | 9/21/2017 16:00 | -- | -- | 0.00 | -- | -- | -- | 10.44 | 14.20 | 3.76 | -- | | | -- | -- | -- | |
| | 9/22/2017 8:44 | 0.70 | 0.70 | 0.70 | 2.30 | 2.3 | 258.2 | 11.59 | 11.65 | 0.06 | -0.32 | | 0.52 | 3.3 | 0.44 | 0.62 | |
| | 9/29/2017 12:43 | 7.17 | 7.17 | 7.86 | 5.80 | 3.5 | 261.7 | 11.65 | 11.68 | 0.03 | -0.26 | | 0.52 | 0.5 | 0.07 | 0.09 | |
| | 10/6/2017 12:42 | 7.00 | 7.00 | 14.86 | 7.30 | 1.5 | 263.2 | 11.41 | 11.50 | 0.09 | -0.50 | | 0.52 | 0.2 | 0.03 | 0.04 | |
| | 10/12/2017 10:55 | 5.93 | 5.93 | 20.79 | 9.30 | 2.0 | 265.2 | 12.22 | 12.40 | 0.18 | 0.31 | | 0.31 | 0.3 | 0.05 | 0.11 | |
| | 10/19/2017 11:05 | 7.01 | 7.01 | 27.80 | 9.80 | 0.5 | 265.7 | 11.60 | 11.72 | 0.12 | -0.31 | | 0.52 | 0.1 | 0.01 | 0.01 | |
| | 11/2/2017 8:32 | 13.89 | 13.89 | 41.69 | 14.30 | 4.5 | 270.2 | 12.76 | 12.86 | 0.10 | 0.85 | | 0.52 | 0.3 | 0.04 | 0.06 | |
| | 11/8/2017 11:57 | 6.14 | 6.14 | 47.83 | 14.30 | 0.0 | 270.2 | 12.60 | 12.82 | 0.22 | 0.69 | | 0.52 | 0.0 | 0.00 | 0.00 | |
| | 11/15/2017 11:09 | 6.97 | 6.97 | 54.80 | 14.30 | 0.0 | 270.2 | 12.30 | 12.81 | 0.51 | 0.39 | | 0.39 | 0.0 | 0.00 | 0.00 | |
| | 11/22/2017 10:06 | 6.96 | 6.96 | 61.75 | 17.30 | 3.0 | 273.2 | 12.87 | 13.07 | 0.20 | 0.96 | | 0.52 | 0.4 | 0.06 | 0.08 | |
| | 11/30/2017 9:42 | 7.98 | 7.98 | 69.74 | 19.30 | 2.0 | 275.2 | 12.65 | 12.84 | 0.19 | 0.74 | | 0.52 | 0.3 | 0.03 | 0.05 | 0.07 |
| | *TEST COMPLETED* | | | | | | | | | | | | | | | | |

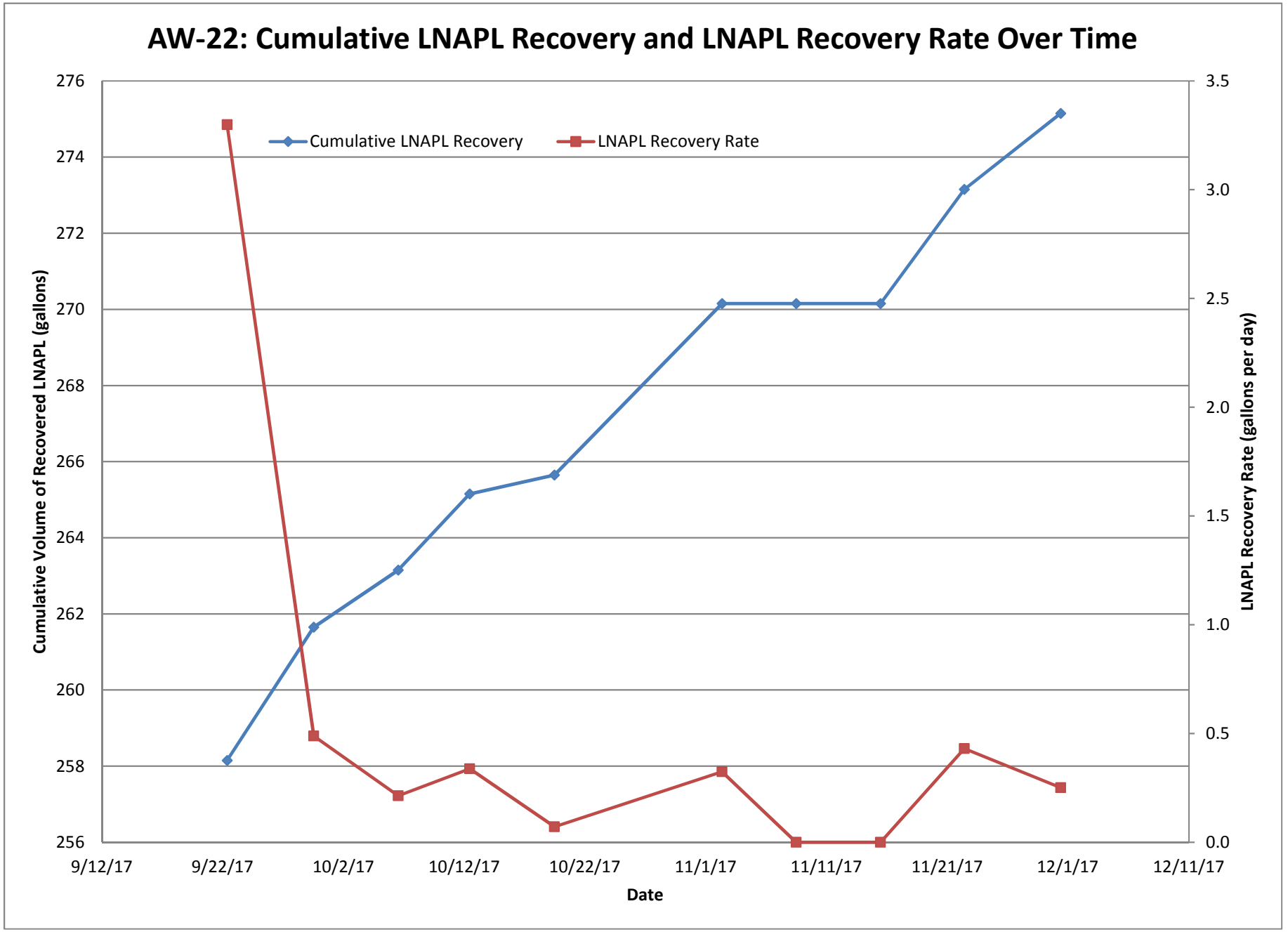
Assumed LNAPL specific gravity = 0.854

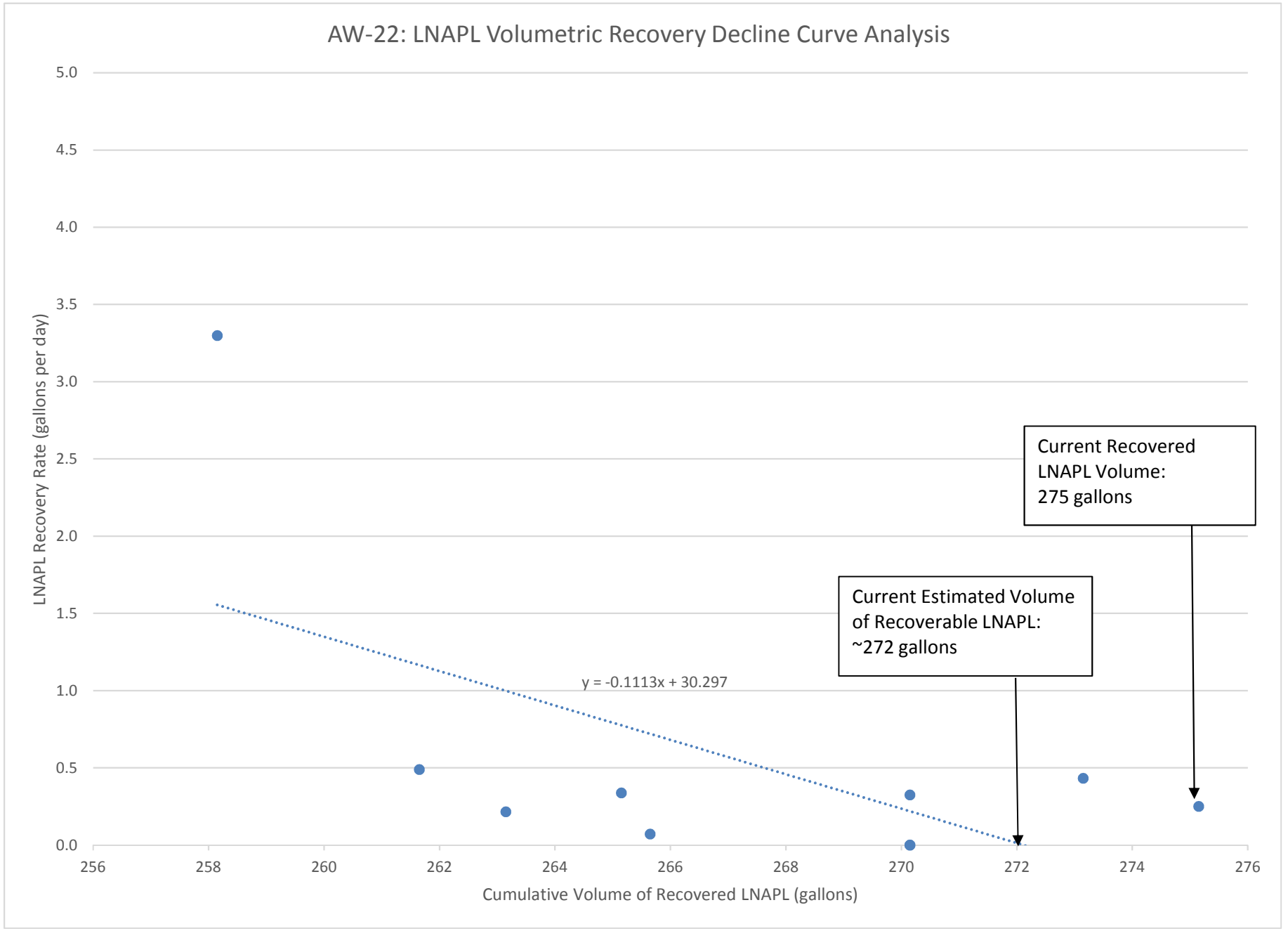
All calculations performed pursuant to the methodology detailed in ASTM E2856-13

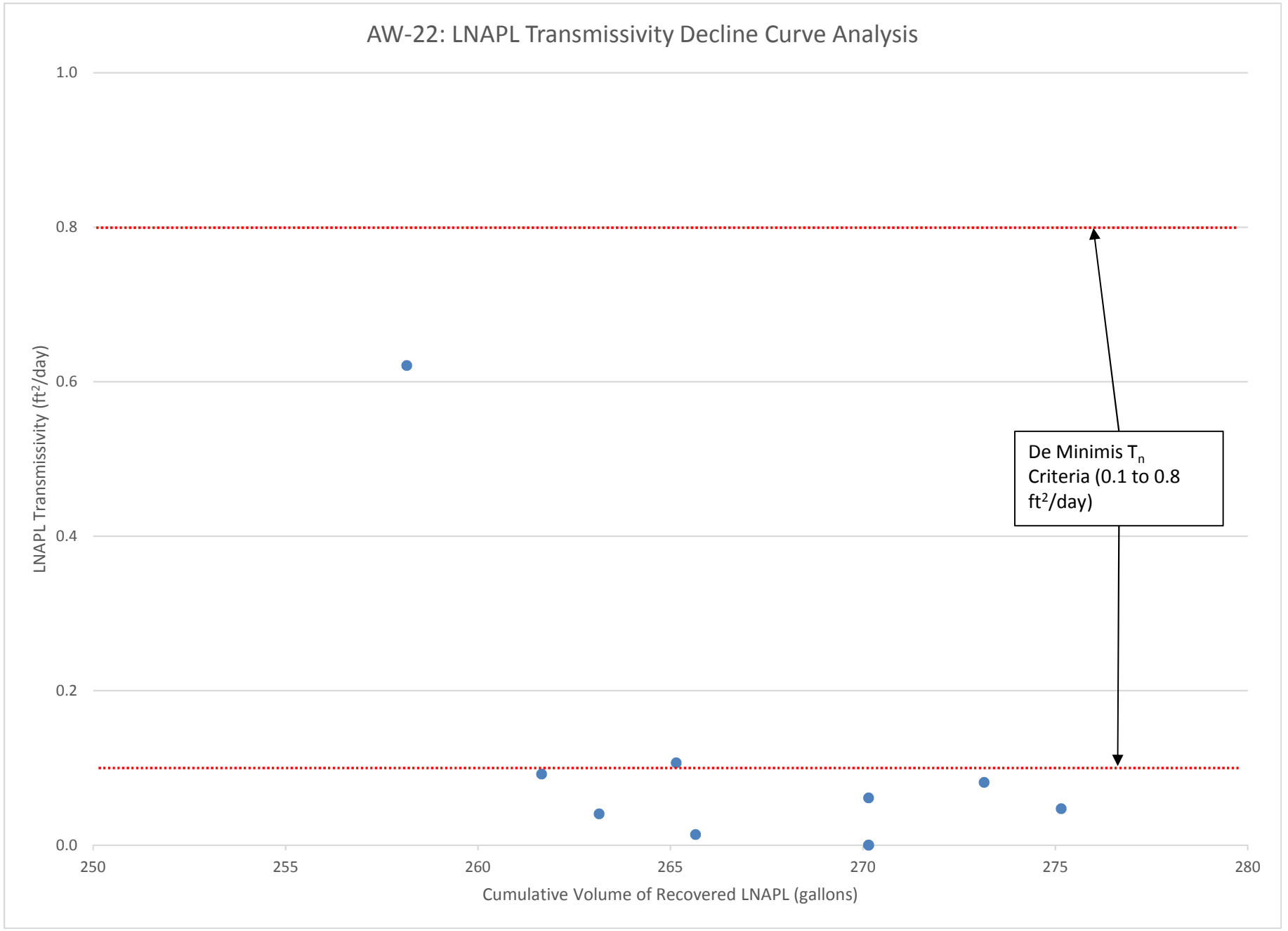
[a]The maximum theoretical drawdown is used for each interval calculation where the measured drawdown is negative or where it exceeds the theoretical maximum.

[b]Represents the geometric mean of the stabilized recovery rates/LNAPL transmissivity estimates (i.e., excludes initial elevated values that would not represent potential long-term recovery rates).

Equilibrium data is an average of quarterly groundwater data collected from March 2016 through Februrary 2018 and excludes data collected during or following skimming operations.


AW-22: Cumulative LNAPL Recovery and LNAPL Recovery Rate Over Time
Cumulative LNAPL Recovery
LNAPL Recovery Rate
Cumulative Volume of Recovered LNAPL (gallons)
LNAPL Recovery Rate (gallons per day)
Date
276
274
272
270
268
266
264
262
260
258
256
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
9/12/17
9/22/17
10/2/17
10/12/17
10/22/17
11/1/17
11/11/17
11/21/17
12/1/17
12/11/17


AW-22: LNAPL Volumetric Recovery Decline Curve Analysis
LNAPL Recovery Rate (gallons per day)
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
256
258
260
262
264
266
268
270
272
274
276
Cumulative Volume of Recovered LNAPL (gallons)
y = -0.1113x + 30.297
Current Recovered LNAPL Volume: 275 gallons
Current Estimated Volume of Recoverable LNAPL: ~272 gallons


AW-22: LNAPL Transmissivity Decline Curve Analysis
1.0
0.8
0.6
0.4
0.2
0.0
LNAPL Transmissivity (ft²/day)
250
255
260
265
270
275
280
Cumulative Volume of Recovered LNAPL (gallons)
De Minimis T_n Criteria (0.1 to 0.8 ft²/day)

# AW-49 Skimming Evaluation

**Appendix A**

**AW-49 LNAPL Skimming Test Results**
**IMTT Savannah North Terminal**
**Savannah, Georgia**

| Well ID | Measurement Date & Time | Time Between Measurement Events (days) | Actual Skimmer Run-Time Between Measurement Events (days) | Cumulative Run Time (days) | Total Volume of LNAPL Recovered (gallons) | Volume of LNAPL Recovered During Measurement Interval (gallons) | RUNNING Total Volume of LNAPL Recovered (gallons) | Depth to LNAPL (feet btoc) | Depth to Water (feet btoc) | In-Well LNAPL Thickness (feet) | LNAPL Drawdown (feet) | Maximum Theoretical Unconfined LNAPL Drawdown (feet) | LNAPL Drawdown Used in Transmissivity Estimate[a] (feet) | Average LNAPL Recovery Rate for Interval (gal/day) | Average LNAPL Recovery Rate for Interval ($ft^3$/day) | Estimated LNAPL Transmissivity for Interval ($ft^2$/day) | Overall Average LNAPL Transmissivity[b] ($ft^2$/day) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AW-49 Short term test | Equilibrium | -- | -- | | -- | -- | | 12.92 | 16.35 | 3.43 | -- | 0.50 | | -- | -- | -- | |
| | 6/8/2016 17:00 | -- | | -- | -- | -- | | 12.71 | 17.76 | 5.05 | -- | | -- | | | | |
| | 6/9/2016 9:00 | 0.67 | 0.67 | 0.67 | 7.8 | 7.8 | 7.8 | 11.36 | 16.24 | 4.88 | -1.56 | | 0.50 | 11.7 | 1.56 | 2.3 | |
| | 6/10/2016 7:17 | 0.93 | 0.92 | 1.58 | 8.6 | 0.8 | 8.6 | 11.16 | 16.20 | 5.04 | -1.76 | | 0.50 | 0.8 | 0.11 | 0.2 | |
| | 6/13/2016 10:35 | 2.92 | 2.88 | 4.67 | 20.1 | 11.5 | 20.1 | 11.50 | 16.89 | 5.39 | -1.42 | | 0.50 | 4.0 | 0.54 | 0.8 | |
| | 6/22/2016 17:10 | 9.27 | 9.15 | 13.82 | 45.3 | 25.2 | 45.3 | 11.72 | 16.91 | 5.19 | -1.20 | | 0.50 | 2.8 | 0.37 | 0.5 | |
| | 6/27/2016 15:50 | 4.94 | 0.00 | 13.82 | 45.3 | 0.0 | 45.3 | 11.70 | 17.02 | 5.32 | -1.22 | | 0.50 | 0.0 | 0 | 0 | 0.6 |
| | 9/14/2016 16:35 | -- | -- | | -- | -- | | 12.15 | 15.80 | 3.65 | -- | | | -- | -- | -- | |
| | 9/14/2016 17:20 | 0.03 | 0.03 | 0.03 | 2.3 | 2.3 | 47.6 | 12.25 | 14.55 | 2.30 | -0.67 | | 0.50 | 73.6 | 9.84 | 14.4 | |
| | 9/15/2016 8:15 | 0.62 | 0.62 | 0.65 | 21.1 | 18.8 | 66.4 | 12.25 | 12.41 | 0.16 | -0.67 | | 0.50 | 30.2 | 4.04 | 5.9 | |
| | 9/15/2016 8:45 | 0.02 | 0.02 | 0.67 | 21.6 | 0.5 | 66.9 | 12.21 | 12.41 | 0.20 | -0.71 | | 0.50 | 24.0 | 3.21 | 4.7 | |
| | 9/15/2016 11:45 | 0.13 | 0.13 | 0.80 | 23.4 | 1.8 | 68.7 | 12.33 | 12.50 | 0.17 | -0.59 | | 0.50 | 14.4 | 1.92 | 2.8 | |
| | 9/21/2016 12:07 | 6.02 | 5.93 | 6.73 | 134.4 | 111.0 | 179.7 | 12.57 | 12.86 | 0.29 | -0.35 | | 0.50 | 18.7 | 2.50 | 3.7 | |
| | 9/22/2016 9:50 | 0.90 | 0.90 | 7.63 | 146.9 | 12.5 | 192.2 | 13.22 | 13.47 | 0.25 | 0.30 | | 0.30 | 13.9 | 1.86 | 4.5 | |
| | 9/28/2016 8:35 | 5.95 | 5.94 | 13.57 | 205.2 | 58.3 | 250.5 | 12.37 | 12.60 | 0.23 | -0.55 | | 0.50 | 9.8 | 1.31 | 1.9 | |
| | 10/5/2016 14:32 | 7.25 | 6.26 | 19.83 | 260.7 | 55.5 | 306.0 | 12.16 | 12.29 | 0.13 | -0.76 | | 0.50 | 8.9 | 1.19 | 1.7 | 4.0 |
| | *END OF TEST INTERVAL - SHUTDOWN DUE TO HURRICANE* | | | | | | | | | | | | | | | | |
| | 10/13/2016 13:00 | 7.94 | 0.00 | 19.83 | 0.0 | -- | 306.0 | 10.60 | 15.33 | 4.73 | -2.32 | | | -- | -- | -- | |
| | 10/20/2016 12:20 | 6.97 | 3.63 | 23.45 | 267.0 | 267.0 | 573.0 | 10.88 | 14.04 | 3.16 | -2.04 | | 0.50 | 23.1 | 3.09 | 4.5 | |
| | *END OF TEST INTERVAL - SHUTDOWN DUE TO FULL TANK - PUMPED 11/21/2016* | | | | | | | | | | | | | | | | |
| | 10/28/2016 11:23 | -- | -- | -- | -- | -- | 573.0 | 11.55 | 13.80 | 2.25 | -- | | | -- | -- | -- | |
| | 11/4/2016 12:30 | 7.05 | 6.13 | 6.13 | 134.0 | 134.0 | 707.0 | 12.35 | 12.67 | 0.32 | -0.57 | | 0.50 | 21.9 | 2.92 | 4.3 | |
| | 11/15/2016 17:02 | 11.19 | 11.19 | 17.32 | 356.0 | 222.0 | 929.0 | 13.00 | 13.19 | 0.19 | 0.08 | | 0.50 | 19.8 | 2.65 | 3.9 | |
| | *END OF TEST INTERVAL - SHUTDOWN DUE TO FULL TANK* | | | | | | | | | | | | | | | | |
| | 11/22/2016 12:34 | -- | 6.81 | -- | 65.0 | 65.0 | 994.0 | 13.00 | 14.30 | 1.30 | 0.08 | | 0.50 | 9.5 | 1.28 | 1.9 | |
| | 11/29/2016 15:35 | -- | 7.13 | -- | 115.0 | 50.0 | 1044.0 | 13.06 | 14.44 | 1.38 | 0.14 | | 0.50 | 7.0 | 0.94 | 1.4 | |
| | 12/7/2016 13:20 | -- | -- | -- | -- | -- | 1044.0 | 12.87 | 13.40 | 0.53 | -- | | | -- | -- | -- | |
| | 12/14/2016 9:50 | -- | -- | -- | -- | -- | 1044.0 | 12.35 | 13.00 | 0.65 | -- | | | -- | -- | -- | |
| | *SHUTDOWN DUE TO FULL TANK* | | | | | | | | | | | | | | | | |
| | 12/21/2016 9:20 | -- | -- | -- | -- | -- | 1044.0 | 12.93 | 14.30 | 1.37 | -- | | | -- | -- | -- | |
| | 12/27/2016 12:40 | 6.14 | 6.13 | 6.14 | 29.7 | 29.7 | 1073.7 | 13.03 | 13.40 | 0.37 | 0.11 | | 0.50 | 4.8 | 0.65 | 0.9 | |
| | 1/4/2017 13:03 | 8.02 | 8.00 | 14.14 | 68.5 | 38.8 | 1112.5 | 13.05 | 13.26 | 0.21 | 0.13 | | 0.50 | 4.8 | 0.65 | 0.9 | |
| | 1/9/2017 11:36 | 4.94 | 4.93 | 19.07 | 84.4 | 15.9 | 1128.4 | 13.41 | 13.68 | 0.27 | 0.49 | | 0.50 | 3.2 | 0.43 | 0.6 | |
| | 1/19/2017 14:12 | 10.11 | 5.51 | 24.58 | 100.1 | 15.7 | 1144.1 | 12.45 | 14.48 | 2.03 | -0.47 | | 0.50 | 2.8 | 0.38 | 0.6 | |
| | 1/20/2017 10:49 | 0.86 | 0.12 | 24.71 | 100.1 | 0.0 | 1144.1 | 13.36 | 14.74 | 1.38 | 0.44 | | 0.50 | 0.0 | 0.00 | 0.0 | |
| | 1/23/2017 15:17 | 3.19 | 1.58 | 26.28 | 105.5 | 5.4 | 1149.6 | 12.82 | 13.83 | 1.01 | -0.10 | | 0.50 | 3.4 | 0.46 | 0.7 | |
| | 1/26/2017 13:01 | 2.91 | 2.90 | 29.18 | 125.5 | 20.0 | 1169.6 | 12.92 | 13.22 | 0.30 | 0.00 | | 0.50 | 6.9 | 0.92 | 1.3 | |
| | 1/31/2017 12:55 | 5.00 | 4.99 | 34.17 | 147.2 | 21.7 | 1191.3 | 12.65 | 12.90 | 0.25 | -0.27 | | 0.50 | 4.3 | 0.58 | 0.9 | |
| | 2/7/2017 12:56 | 7.00 | 6.99 | 41.17 | 168.8 | 21.5 | 1212.8 | 13.17 | 13.30 | 0.13 | 0.25 | | 0.50 | 3.1 | 0.41 | 0.6 | |
| | 2/13/2017 14:28 | 6.06 | 6.06 | 47.23 | 195.8 | 27.0 | 1239.8 | 13.30 | 13.61 | 0.31 | 0.38 | | 0.50 | 4.5 | 0.60 | 0.9 | |
| | 2/14/2017 14:24 | 1.00 | 1.00 | 48.22 | 197.5 | 1.7 | 1241.5 | 12.99 | 13.21 | 0.22 | 0.07 | | 0.50 | 1.7 | 0.23 | 0.3 | |
| | 2/23/2017 11:08 | 8.86 | 8.61 | 56.83 | 225.8 | 28.4 | 1269.8 | 12.99 | 13.20 | 0.21 | 0.07 | | 0.50 | 3.3 | 0.44 | 0.6 | |
| | 3/3/2017 10:10 | 7.96 | 5.83 | 62.66 | 237.4 | 11.6 | 1281.4 | 13.44 | 15.32 | 1.88 | 0.52 | | 0.50 | 2.0 | 0.27 | 0.4 | |
| | 3/7/2017 13:27 | 4.14 | 4.13 | 66.80 | 259.1 | 21.7 | 1303.1 | 13.66 | 13.92 | 0.26 | 0.74 | | 0.50 | 5.2 | 0.70 | 1.0 | |
| | 3/10/2017 10:34 | 2.88 | 2.88 | 69.68 | 268.6 | 9.4 | 1312.6 | 13.29 | 13.60 | 0.31 | 0.37 | | 0.50 | 3.3 | 0.44 | 0.6 | |
| | 3/16/2017 11:30 | 6.04 | 3.25 | 72.92 | 284.6 | 16.0 | 1328.6 | 13.26 | 14.40 | 1.14 | 0.34 | | 0.50 | 4.9 | 0.66 | 1.0 | |
| | 3/23/2017 10:53 | 6.97 | 0.76 | 73.68 | 286.8 | 2.2 | 1330.8 | 13.30 | 14.06 | 0.76 | 0.38 | | 0.50 | 2.9 | 0.39 | 0.6 | |
| | 3/31/2017 8:41 | 7.91 | 7.90 | 81.58 | 299.8 | 13.0 | 1343.8 | 13.62 | 13.93 | 0.31 | 0.70 | | 0.50 | 1.6 | 0.22 | 0.3 | |

**Appendix A**

**AW-49 LNAPL Skimming Test Results**
**IMTT Savannah North Terminal**
**Savannah, Georgia**

| Well ID | Measurement Date & Time | Time Between Measurement Events (days) | Actual Skimmer Run-Time Between Measurement Events (days) | Cumulative Run Time (days) | Total Volume of LNAPL Recovered (gallons) | Volume of LNAPL Recovered During Measurement Interval (gallons) | RUNNING Total Volume of LNAPL Recovered (gallons) | Depth to LNAPL (feet btoc) | Depth to Water (feet btoc) | In-Well LNAPL Thickness (feet) | LNAPL Drawdown (feet) | Maximum Theoretical Unconfined LNAPL Drawdown (feet) | LNAPL Drawdown Used in Transmissivity Estimate[a] (feet) | Average LNAPL Recovery Rate for Interval (gal/day) | Average LNAPL Recovery Rate for Interval ($ft^3$/day) | Estimated LNAPL Transmissivity for Interval ($ft^2$/day) | Overall Average LNAPL Transmissivity[b] ($ft^2$/day) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AW-49 Long term test | 4/3/2017 10:10 | 3.06 | 2.81 | 84.39 | 305.8 | 6.0 | 1349.8 | 13.74 | 14.02 | 0.28 | 0.82 | | 0.50 | 2.1 | 0.29 | 0.4 | |
| | 4/13/2017 11:53 | 10.07 | 10.07 | 94.46 | 328.3 | 22.5 | 1372.3 | 13.12 | 13.38 | 0.26 | 0.20 | | 0.50 | 2.2 | 0.30 | 0.4 | |
| | 4/18/2017 11:33 | 4.99 | 4.98 | 99.43 | 340.0 | 11.7 | 1384.0 | 13.70 | 14.10 | 0.40 | 0.78 | | 0.50 | 2.4 | 0.31 | 0.5 | |
| | 4/27/2017 11:03 | 8.98 | 8.97 | 108.41 | 356.3 | 16.3 | 1400.3 | 13.00 | 13.35 | 0.35 | 0.08 | | 0.50 | 1.8 | 0.24 | 0.4 | |
| | 5/2/2017 12:47 | 5.07 | 4.82 | 113.23 | 365.8 | 9.5 | 1409.8 | 13.69 | 13.96 | 0.27 | 0.77 | | 0.50 | 2.0 | 0.26 | 0.4 | |
| | 5/10/2017 10:47 | 7.92 | 7.91 | 121.14 | 385.5 | 19.7 | 1429.5 | 13.40 | 13.68 | 0.28 | 0.48 | | 0.50 | 2.5 | 0.33 | 0.5 | |
| | 5/17/2017 7:46 | 6.87 | 6.87 | 128.00 | 405.8 | 20.3 | 1449.8 | 13.85 | 14.08 | 0.23 | 0.93 | | 0.50 | 3.0 | 0.40 | 0.6 | |
| | 5/26/2017 10:51 | 9.13 | 9.12 | 137.13 | 427.8 | 22.0 | 1471.8 | 13.35 | 13.58 | 0.23 | 0.43 | | 0.50 | 2.4 | 0.32 | 0.5 | |
| | 6/1/2017 8:02 | 5.88 | 5.62 | 142.75 | 439.8 | 12.0 | 1483.8 | 13.55 | 13.79 | 0.24 | 0.63 | | 0.50 | 2.1 | 0.29 | 0.4 | |
| | 6/8/2017 11:40 | 7.15 | 7.14 | 149.89 | 445.1 | 5.3 | 1489.1 | 12.87 | 13.00 | 0.13 | -0.05 | | 0.50 | 0.7 | 0.10 | 0.1 | |
| | 6/15/2017 11:16 | 6.98 | 6.98 | 156.87 | 454.4 | 9.3 | 1498.4 | 13.51 | 13.79 | 0.28 | 0.59 | | 0.50 | 1.3 | 0.18 | 0.3 | |
| | 6/20/2017 9:56 | 4.94 | 4.94 | 161.81 | 463.8 | 9.4 | 1507.8 | 13.52 | 13.74 | 0.22 | 0.60 | | 0.50 | 1.9 | 0.25 | 0.4 | |
| | 6/22/2017 10:46 | 2.03 | 2.03 | 163.84 | 467.8 | 4.0 | 1511.8 | 13.13 | 13.41 | 0.28 | 0.21 | | 0.50 | 2.0 | 0.26 | 0.4 | |
| | 6/26/2017 11:42 | 4.04 | 4.04 | 167.88 | 472.8 | 5.0 | 1516.8 | 13.07 | 13.33 | 0.26 | 0.15 | | 0.50 | 1.2 | 0.17 | 0.2 | |
| | 6/30/2017 11:45 | 4.00 | 4.00 | 171.87 | 474.5 | 1.8 | 1518.5 | 13.36 | 13.64 | 0.28 | 0.44 | | 0.50 | 0.4 | 0.06 | 0.1 | |
| | 7/7/2017 8:17 | 6.86 | 6.60 | 178.47 | 481.8 | 7.3 | 1525.8 | 12.92 | 13.17 | 0.25 | 0.00 | | 0.50 | 1.1 | 0.15 | 0.2 | |
| | 7/12/2017 14:23 | 5.25 | 5.25 | 183.72 | 493.8 | 12.0 | 1537.8 | 12.86 | 13.12 | 0.26 | -0.06 | | 0.50 | 2.3 | 0.31 | 0.4 | |
| | 7/19/2017 11:22 | 6.87 | 6.87 | 190.59 | 504.8 | 11.0 | 1548.8 | 13.29 | 13.52 | 0.23 | 0.37 | | 0.50 | 1.6 | 0.21 | 0.3 | |
| | 7/26/2017 11:02 | 6.99 | 6.98 | 197.57 | 518.8 | 14.0 | 1562.8 | 12.72 | 12.90 | 0.18 | -0.20 | | 0.50 | 2.0 | 0.27 | 0.4 | |
| | 8/2/2017 11:54 | 7.04 | 6.78 | 204.35 | 559.8 | 41.0 | 1603.8 | 12.79 | 13.02 | 0.23 | -0.13 | | 0.50 | 6.0 | 0.81 | 1.2 | |
| | 8/9/2017 9:46 | 6.91 | 6.90 | 211.25 | 597.8 | 38.0 | 1641.8 | 12.46 | 12.70 | 0.24 | -0.46 | | 0.50 | 5.5 | 0.74 | 1.1 | |
| | 8/17/2017 8:40 | 7.95 | 7.95 | 219.20 | 631.7 | 33.9 | 1675.7 | 12.34 | 12.58 | 0.24 | -0.58 | | 0.50 | 4.3 | 0.57 | 0.8 | |
| | 8/22/2017 12:45 | 5.17 | 5.16 | 224.36 | 667.2 | 35.5 | 1711.2 | 12.18 | 12.38 | 0.20 | -0.74 | | 0.50 | 6.9 | 0.92 | 1.3 | |
| | 8/30/2017 17:22 | 8.19 | 8.15 | 232.51 | 716.1 | 48.9 | 1760.1 | 12.19 | 12.41 | 0.22 | -0.73 | | 0.50 | 6.0 | 0.80 | 1.2 | |
| | 9/6/2017 13:15 | 6.83 | 5.72 | 238.24 | 750.7 | 34.6 | 1794.7 | 12.43 | 12.68 | 0.25 | -0.49 | | 0.50 | 6.0 | 0.81 | 1.2 | |
| | *END OF TEST INTERVAL - SHUTDOWN DUE TO HURRICANE* | | | | | | | | | | | | | | | | |
| | 9/21/2017 15:22 | -- | -- | -- | -- | -- | 1794.7 | 11.28 | 13.61 | 2.33 | -- | | | -- | -- | -- | |
| | 9/22/2017 8:05 | 0.70 | 0.70 | 0.70 | 22.0 | 22.0 | 1816.7 | 12.30 | 12.55 | 0.25 | -0.62 | | 0.50 | 31.6 | 4.22 | 6.2 | |
| | 9/29/2017 13:45 | 7.24 | 7.24 | 7.93 | 105.3 | 83.3 | 1900.0 | 12.37 | 12.65 | 0.28 | -0.55 | | 0.50 | 11.5 | 1.54 | 2.3 | |
| | 10/6/2017 13:21 | 6.98 | 0.46 | 8.40 | 106.4 | 1.1 | 1901.1 | 11.75 | 13.35 | 1.60 | -1.17 | | 0.50 | 2.4 | 0.32 | 0.5 | |
| | 10/12/2017 11:32 | 5.92 | 5.92 | 14.32 | 126.4 | 20.0 | 1921.1 | 12.77 | 13.08 | 0.31 | -0.15 | | 0.50 | 3.4 | 0.45 | 0.7 | |
| | 10/19/2017 12:00 | 7.02 | 7.02 | 21.34 | 172.8 | 46.4 | 1967.5 | 11.82 | 12.02 | 0.20 | -1.10 | | 0.50 | 6.6 | 0.88 | 1.3 | |
| | 11/2/2017 9:05 | 13.88 | 13.88 | 35.21 | 218.1 | 45.3 | 2012.8 | 12.72 | 13.00 | 0.28 | -0.20 | | 0.50 | 3.3 | 0.44 | 0.6 | |
| | 11/8/2017 12:21 | 6.14 | 6.14 | 41.35 | 223.1 | 5.0 | 2017.8 | 12.67 | 12.80 | 0.13 | -0.25 | | 0.50 | 0.8 | 0.11 | 0.2 | |
| | 11/15/2017 11:42 | 6.97 | 6.97 | 48.32 | 223.1 | 0.0 | 2017.8 | 12.73 | 13.55 | 0.82 | -0.19 | | 0.50 | 0.0 | 0.00 | 0.0 | |
| | 11/22/2017 10:28 | 6.95 | 6.71 | 55.03 | 223.1 | 0.0 | 2017.8 | 12.90 | 14.27 | 1.37 | -0.02 | | 0.50 | 0.0 | 0.00 | 0.0 | |
| | 11/30/2017 11:24 | 8.04 | 8.04 | 63.07 | 238.1 | 15.0 | 2032.8 | 13.55 | 13.76 | 0.21 | 0.63 | | 0.50 | 1.9 | 0.25 | 0.4 | |
| | 12/6/2017 12:12 | 6.03 | 6.03 | 69.11 | 242.1 | 4.0 | 2036.8 | 12.64 | 12.80 | 0.16 | -0.28 | | 0.50 | 0.7 | 0.09 | 0.1 | |
| | 12/13/2017 10:56 | 6.95 | 6.95 | 76.05 | 247.1 | 5.0 | 2041.8 | 14.39 | 15.08 | 0.69 | 1.47 | | 0.50 | 0.7 | 0.10 | 0.1 | |
| | 12/21/2017 13:06 | 8.09 | 7.85 | 83.90 | 283.1 | 36.0 | 2077.8 | 13.09 | 13.25 | 0.16 | 0.17 | | 0.50 | 4.6 | 0.61 | 0.9 | |
| | 12/28/2017 14:00 | 7.04 | 7.04 | 90.94 | 298.1 | 15.0 | 2092.8 | 13.34 | 14.30 | 0.96 | 0.42 | | 0.50 | 2.1 | 0.28 | 0.4 | |
| | 1/5/2018 14:10 | 8.01 | 8.01 | 98.95 | 298.1 | 0.0 | 2092.8 | 13.00 | 13.60 | 0.60 | 0.08 | | 0.50 | 0.0 | 0.00 | 0.0 | |
| | 1/12/2018 13:19 | 6.96 | 6.96 | 105.91 | 315.1 | 17.0 | 2109.8 | 13.72 | 13.97 | 0.25 | 0.80 | | 0.50 | 2.4 | 0.33 | 0.5 | |
| | 1/19/2018 14:05 | 7.03 | 6.79 | 112.71 | 328.1 | 13.0 | 2122.8 | 13.31 | 13.52 | 0.21 | 0.39 | | 0.50 | 1.9 | 0.26 | 0.4 | |
| | 1/26/2018 11:39 | 6.90 | 6.90 | 119.61 | 339.1 | 11.0 | 2133.8 | 14.01 | 14.29 | 0.28 | 1.09 | | 0.50 | 1.6 | 0.21 | 0.3 | |

**Appendix A**

**AW-49 LNAPL Skimming Test Results**
**IMTT Savannah North Terminal**
**Savannah, Georgia**

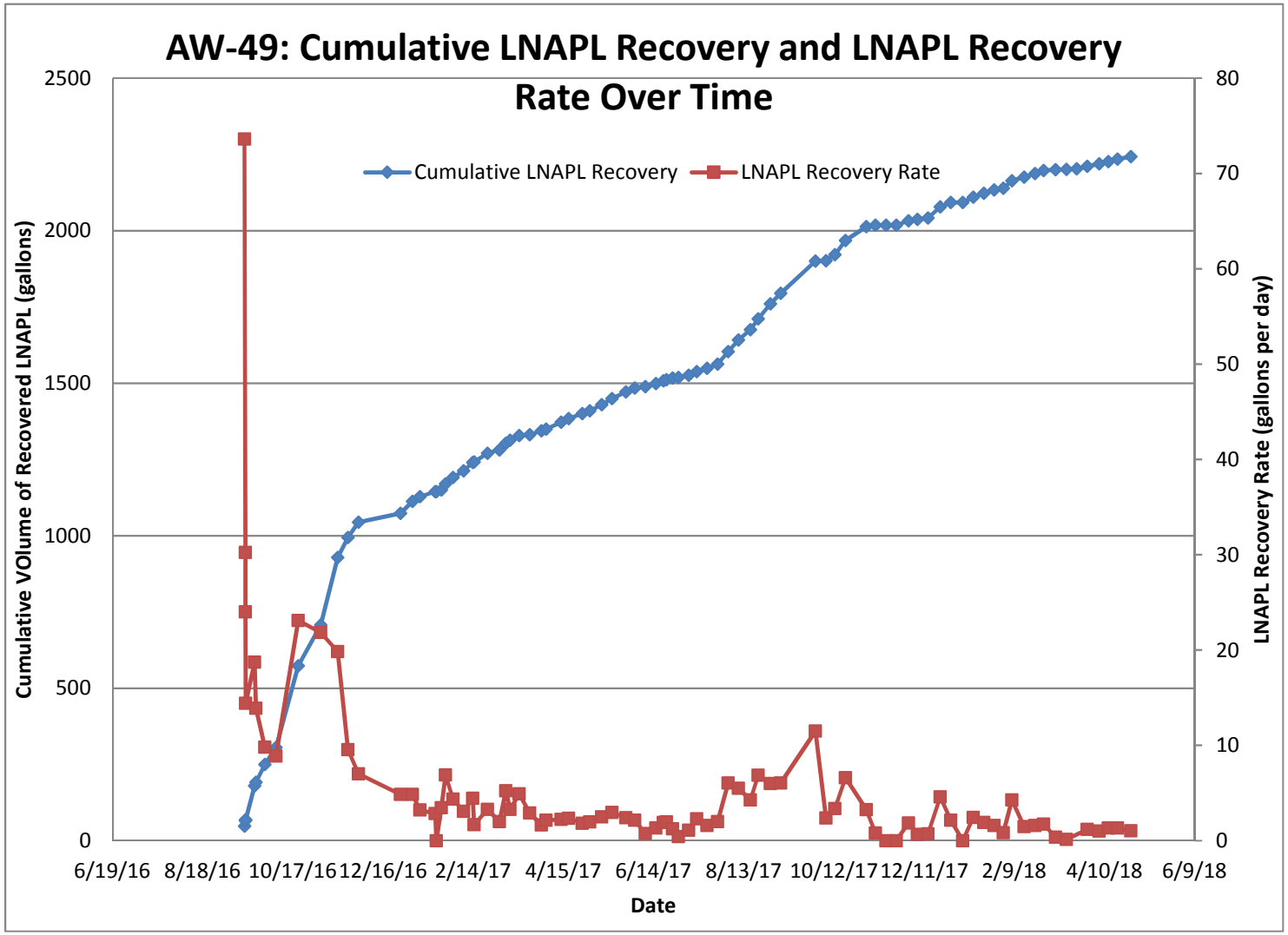
| Well ID | Measurement Date & Time | Time Between Measurement Events (days) | Actual Skimmer Run-Time Between Measurement Events (days) | Cumulative Run Time (days) | Total Volume of LNAPL Recovered (gallons) | Volume of LNAPL Recovered During Measurement Interval (gallons) | RUNNING Total Volume of LNAPL Recovered (gallons) | Depth to LNAPL (feet btoc) | Depth to Water (feet btoc) | In-Well LNAPL Thickness (feet) | LNAPL Drawdown (feet) | Maximum Theoretical Unconfined LNAPL Drawdown (feet) | LNAPL Drawdown Used in Transmissivity Estimate[a] (feet) | Average LNAPL Recovery Rate for Interval (gal/day) | Average LNAPL Recovery Rate for Interval ($ft^3$/day) | Estimated LNAPL Transmissivity for Interval ($ft^2$/day) | Overall Average LNAPL Transmissivity[b] ($ft^2$/day) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2/1/2018 12:32 | 6.04 | 6.04 | 125.64 | 344.1 | 5.0 | 2138.8 | 13.14 | 13.17 | 0.03 | 0.22 | | 0.50 | 0.8 | 0.11 | 0.2 | |
| | 2/7/2018 8:52 | 5.85 | 5.85 | 131.49 | 369.1 | 25.0 | 2163.8 | 13.88 | 14.20 | 0.32 | 0.96 | | 0.50 | 4.3 | 0.57 | 0.8 | |
| | 2/15/2018 12:15 | 8.14 | 8.14 | 139.63 | 381.1 | 12.0 | 2175.8 | 13.25 | 13.31 | 0.06 | 0.33 | | 0.50 | 1.5 | 0.20 | 0.3 | |
| | 2/22/2018 14:27 | 7.09 | 6.85 | 146.48 | 392.1 | 11.0 | 2186.8 | 13.14 | 13.35 | 0.21 | 0.22 | | 0.50 | 1.6 | 0.21 | 0.3 | |
| | 2/28/2018 8:17 | 5.74 | 5.74 | 152.22 | 402.1 | 10.0 | 2196.8 | 12.74 | 12.80 | 0.06 | -0.18 | | 0.50 | 1.7 | 0.23 | 0.3 | |
| | 3/8/2018 9:23 | 8.05 | 8.05 | 160.27 | 405.1 | 3.0 | 2199.8 | 13.54 | 13.84 | 0.30 | 0.62 | | 0.50 | 0.4 | 0.05 | 0.1 | |
| | 3/15/2018 13:35 | 7.17 | 7.14 | 167.41 | 406.1 | 1.0 | 2200.8 | 13.24 | 14.75 | 1.51 | 0.32 | | 0.50 | 0.1 | 0.02 | 0.0 | |
| | 3/22/2018 11:30 | 6.91 | 0.02 | 167.42 | 408.1 | 2.0 | 2202.8 | 13.47 | 15.02 | 1.55 | 0.55 | | 0.50 | 113.7 | 15.20 | 22.3 | |
| | 3/29/2018 11:13 | 6.99 | 6.74 | 174.16 | 416.1 | 8.0 | 2210.8 | 13.07 | 13.24 | 0.17 | 0.15 | | 0.50 | 1.2 | 0.16 | 0.2 | |
| | 4/6/2018 11:03 | 7.99 | 7.99 | 182.15 | 424.1 | 8.0 | 2218.8 | 13.74 | 13.96 | 0.22 | 0.82 | | 0.50 | 1.0 | 0.13 | 0.2 | |
| | 4/12/2018 13:00 | 6.08 | 6.08 | 188.24 | 432.1 | 8.0 | 2226.8 | 13.83 | 14.10 | 0.27 | 0.91 | | 0.50 | 1.3 | 0.18 | 0.3 | |
| | 4/18/2018 13:48 | 6.03 | 6.03 | 194.27 | 440.1 | 8.0 | 2234.8 | 13.43 | 13.70 | 0.27 | 0.51 | | 0.50 | 1.3 | 0.18 | 0.3 | |
| | 4/27/2018 13:20 | 8.98 | 7.74 | 202.01 | 448.1 | 8.0 | 2242.8 | 13.52 | 13.76 | 0.24 | 0.60 | | 0.50 | 1.0 | 0.14 | 0.2 | 0.47 |
| | | | | | | | | | | | | | | | | | |

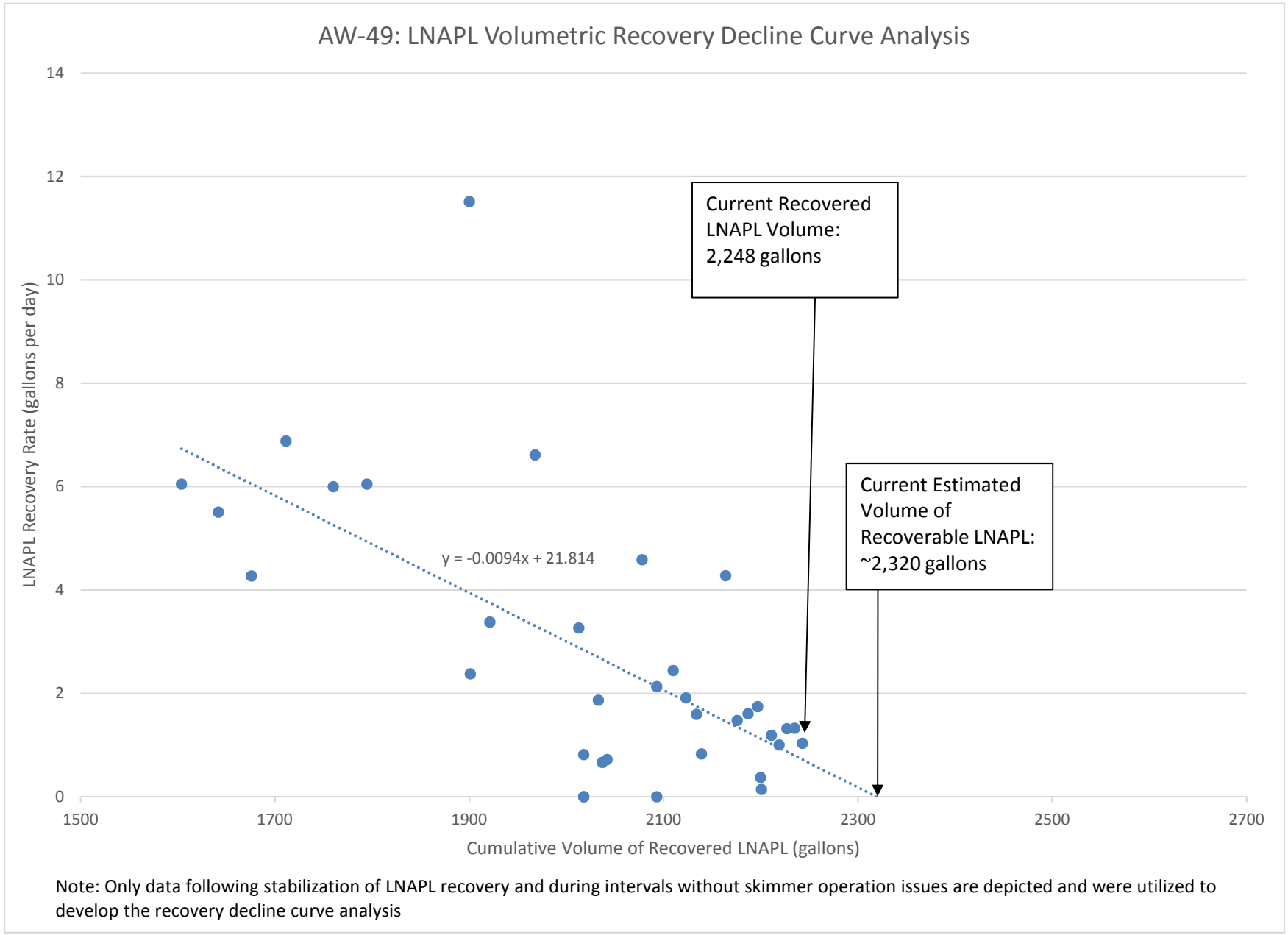
Assumed LNAPL specific gravity = 0.854

All calculations performed pursuant to the methodology detailed in ASTM E2856-13

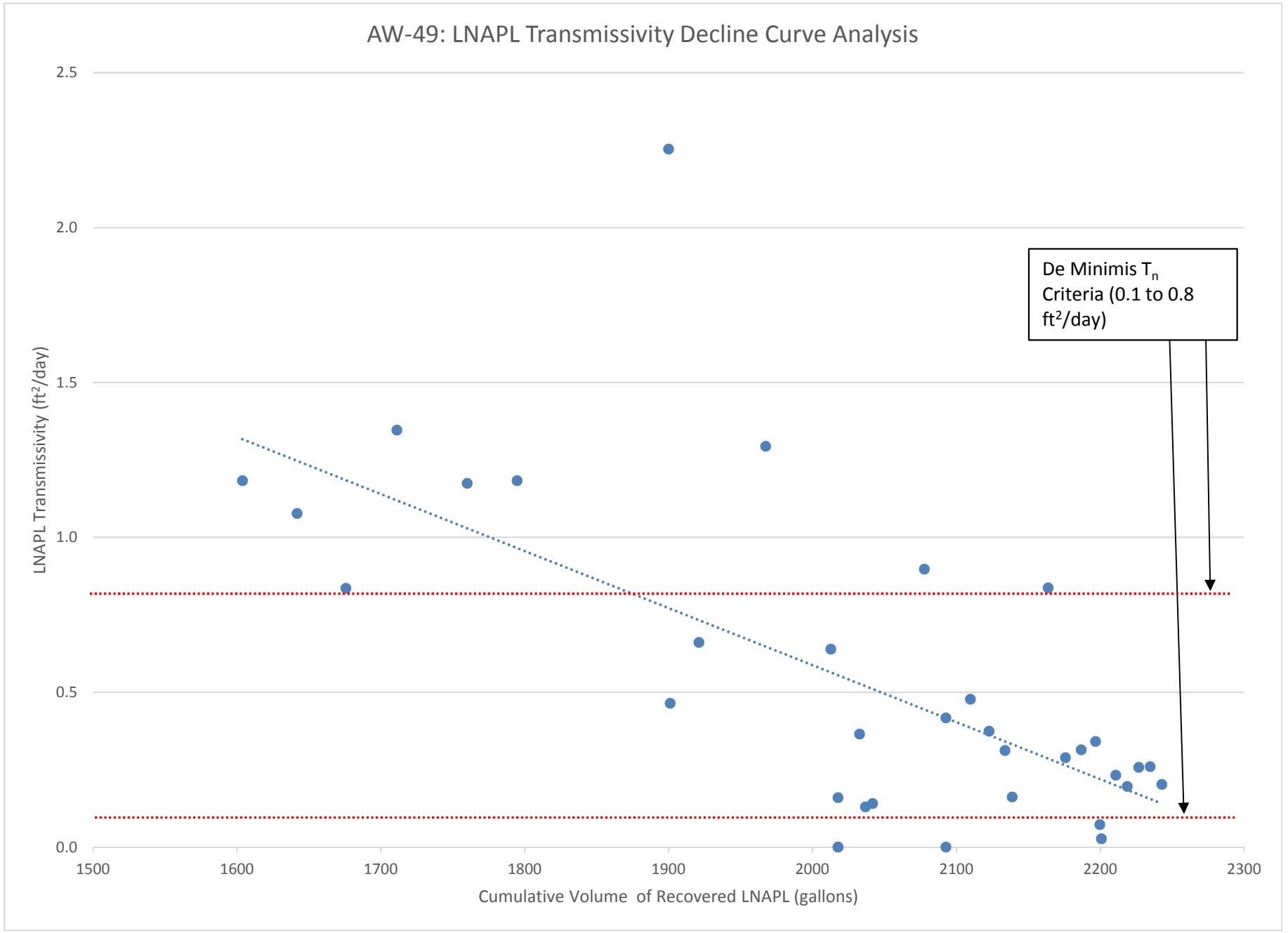
[a]The maximum theoretical drawdown is used for each interval calculation where the measured drawdown is negative or where it exceeds the theoretical maximum.

[b]Represents the geometric mean of the stabilized recovery rates/LNAPL transmissivity estimates (i.e., excludes initial elevated values that would not represent potential long-term recovery rates).


AW-49: Cumulative LNAPL Recovery and LNAPL Recovery Rate Over Time
Cumulative LNAPL Recovery
LNAPL Recovery Rate
Cumulative VOlume of Recovered LNAPL (gallons)
LNAPL Recovery Rate (gallons per day)
Date
0
500
1000
1500
2000
2500
0
10
20
30
40
50
60
70
80
6/19/16
8/18/16
10/17/16
12/16/16
2/14/17
4/15/17
6/14/17
8/13/17
10/12/17
12/11/17
2/9/18
4/10/18
6/9/18




Note: Only data following stabilization of LNAPL recovery and during intervals without skimmer operation issues are depicted and were utilized to develop the recovery decline curve analysis


AW-49: LNAPL Transmissivity Decline Curve Analysis
LNAPL Transmissivity (ft²/day)
2.5
2.0
1.5
1.0
0.5
0.0
1500
1600
1700
1800
1900
2000
2100
2200
2300
Cumulative Volume of Recovered LNAPL (gallons)
De Minimis $T_n$ Criteria (0.1 to 0.8 ft²/day)

# AW-51 Skimming Evaluation

## Appendix A

## LNAPL Skimming Test Results - Short-Duration Skimming
## IMTT Savannah North Terminal
## Savannah, Georgia

| Well ID | Measurement Date & Time | Time Between Measurement Events (days) | Actual Skimmer Run-Time Between Measurement Events (days) | Cumulative Run-Time (days) | Total Volume of LNAPL Recovered (gallons) | Volume of LNAPL Recovered During Measurement Interval (gallons) | RUNNING Total Volume of LNAPL Recovered (gallons) | Percentage of On-Time During Measurement Interval (%) | Depth to LNAPL (feet btoc) | Depth to Water (feet btoc) | In-Well LNAPL Thickness (feet) | LNAPL Drawdown (feet) | Maximum Theoretical Unconfined LNAPL Drawdown (feet) | LNAPL Drawdown Used in Transmissivity Estimate[a] (feet) | Average LNAPL Recovery Rate for Interval (gal/day) | Average LNAPL Recovery Rate for Interval ($ft^3$/day) | Estimated LNAPL Transmissivity for Interval ($ft^2$/day) | Overall Average LNAPL Transmissivity[b] ($ft^2$/day) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AW-51 | Equilibrium | -- | | -- | -- | -- | | -- | 10.09 | 10.80 | 0.71 | -- | 0.08 | -- | -- | -- | -- | |
| | 10/13/2016 11:30 | -- | | -- | -- | -- | | -- | 8.51 | 9.43 | 0.92 | -- | | -- | -- | -- | -- | |
| | 10/20/2016 11:12 | 6.99 | 6.99 | 6.99 | 9.85 | 9.85 | 9.85 | 99% | 8.85 | 9.05 | 0.20 | -1.24 | | 0.08 | 1.4 | 0.19 | 1.7 | |
| | 10/28/2016 11:06 | 8.00 | 8.00 | 14.98 | 9.85 | 0.00 | 9.85 | 99% | 9.54 | 9.57 | 0.03 | -0.55 | | 0.08 | 0.0 | 0 | 0 | |
| | 11/4/2016 11:00 | 7.00 | 7.00 | 21.98 | 17.80 | 7.95 | 17.80 | 99% | 9.65 | 9.90 | 0.25 | -0.44 | | 0.08 | 1.1 | 0.15 | 1.4 | 1.0 |

Assumed LNAPL specific gravity = 0.8806

All calculations performed pursuant to the methodology detailed in ASTM E2856-13

[a]The maximum theoretical drawdown is used for each interval calculation where the measured drawdown is negative or where it exceeds the theoretical maximum.

[b]Represents the average of the stabilized recovery rates/LNAPL transmissivity estimates (i.e., excludes initial elevated values that would not represent potential long-term recovery rates).

Equilibrium data is an average of quarterly groundwater data collected from March 2016 through Februrary 2018 and excludes data collected during skimming operations.

# AW-52 Skimming Evaluation

## Appendix A

## LNAPL Skimming Test Results - Short-Duration Skimming
## IMTT Savannah North Terminal
## Savannah, Georgia

| Well ID | Measurement Date & Time | Time Between Measurement Events (days) | Actual Skimmer Run-Time Between Measurement Events (days) | Cumulative Run-Time (days) | Total Volume of LNAPL Recovered (gallons) | Volume of LNAPL Recovered During Measurement Interval (gallons) | RUNNING Total Volume of LNAPL Recovered (gallons) | Percentage of On-Time During Measurement Interval (%) | Depth to LNAPL (feet btoc) | Depth to Water (feet btoc) | In-Well LNAPL Thickness (feet) | LNAPL Drawdown (feet) | Maximum Theoretical Unconfined LNAPL Drawdown (feet) | LNAPL Drawdown Used in Transmissivity Estimate[a] (feet) | Average LNAPL Recovery Rate for Interval (gal/day) | Average LNAPL Recovery Rate for Interval ($ft^3$/day) | Estimated LNAPL Transmissivity for Interval ($ft^2$/day) | Overall Average LNAPL Transmissivity[b] ($ft^2$/day) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AW-52 | Equilibrium | -- | | -- | -- | -- | | -- | 12.53 | 15.45 | 2.92 | -- | 0.43 | -- | -- | -- | -- | |
| | 7/28/2016 11:20 | -- | | -- | -- | -- | | -- | 12.78 | 16.08 | 3.30 | -- | | -- | -- | -- | -- | |
| | 8/2/2016 11:45 | 5.02 | 5.02 | 5.02 | 5.75 | 5.75 | 5.75 | 99% | 12.91 | 13.37 | 0.46 | 0.38 | | 0.43 | 1.1 | 0.15 | 0.3 | |
| | 8/11/2016 8:20 | 8.86 | 8.86 | 13.88 | 8.21 | 2.46 | 8.21 | 99% | 13.17 | 13.42 | 0.25 | 0.64 | | 0.43 | 0.3 | 0.04 | 0.1 | |
| | 8/17/2016 9:45 | 6.06 | 6.06 | 19.93 | 8.87 | 0.66 | 8.87 | 101% | 12.85 | 13.10 | 0.25 | 0.32 | | 0.43 | 0.1 | 0.015 | 0.0 | |
| | 8/25/2016 10:00 | 8.01 | 8.01 | 27.94 | 11.08 | 2.21 | 11.08 | 91% | 12.91 | 13.42 | 0.51 | 0.38 | | 0.43 | 0.3 | 0.04 | 0.1 | 0.07 |

Assumed LNAPL specific gravity 0.854

All calculations performed pursuant to the methodology detailed in ASTM E2856-13

[a]The maximum theoretical drawdown is used for each interval calculation where the measured drawdown is negative or where it exceeds the theoretical maximum.

[b]Represents the average of the stabilized recovery rates/LNAPL transmissivity estimates (i.e., excludes initial elevated values that would not represent potential long-term recovery rates).

Equilibrium data is an average of quarterly groundwater data collected from March 2016 through Februrary 2018 and excludes data collected during skimming operations.

# AW-54 Skimming Evaluation

# Appendix A

## AW-54 LNAPL Skimming Test Results
## IMTT Savannah North Terminal
## Savannah, Georgia

| Well ID | Measurement Date & Time | Time Between Measurement Events (days) | Actual Skimmer Run-Time Between Measurement Events (days) | Cumulative Run Time (days) | Total Volume of LNAPL Recovered (gallons) | Volume of LNAPL Recovered During Measurement Interval (gallons) | RUNNING Total Volume of LNAPL Recovered (gallons) | Depth to LNAPL (feet btoc) | Depth to Water (feet btoc) | In-Well LNAPL Thickness (feet) | LNAPL Drawdown (feet) | Maximum Theoretical Unconfined LNAPL Drawdown (feet) | LNAPL Drawdown Used in Transmissivity Estimate[a] (feet) | Average LNAPL Recovery Rate for Interval (gal/day) | Average LNAPL Recovery Rate for Interval ($ft^3$/day) | Estimated LNAPL Transmissivity for Interval ($ft^2$/day) | Overall Average LNAPL Transmissivity[b] ($ft^2$/day) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Equilibrium | -- | | -- | -- | -- | | 5.44 | 15.59 | 10.15 | -- | 1.48 | -- | -- | -- | -- | |
| AW-54 Short term test | 8/25/2016 10:45 | -- | | -- | -- | -- | | 5.45 | 15.48 | 10.03 | -- | | -- | -- | -- | -- | |
| | 8/31/2016 11:15 | 6.02 | 4.46 | 4.46 | 50.0 | 50.0 | 50.0 | 6.15 | 10.55 | 4.40 | 0.71 | | 1.48 | 11.2 | 1.50 | 0.7 | |
| | 9/7/2016 14:15 | 7.13 | 5.13 | 9.59 | 100.0 | 50.0 | 100.0 | -- | -- | -- | -- | | 1.48 | 9.7 | 1.30 | 0.6 | |
| | 9/14/2016 14:30 | 7.01 | 5.26 | 14.84 | 150.0 | 50.0 | 150.0 | 6.48 | 9.24 | 2.76 | 1.04 | | 1.48 | 9.5 | 1.27 | 0.6 | |
| | 9/21/2016 12:20 | 6.91 | 7.53 | 22.37 | 200.0 | 50.0 | 200.0 | 6.10 | 7.60 | 1.50 | 0.66 | | 1.48 | 6.6 | 0.89 | 0.4 | 0.6 |
| AW-54 Long term test | 6/20/2017 8:45 | -- | -- | 0.00 | -- | -- | -- | 5.40 | 15.82 | 10.42 | -- | | | -- | -- | -- | |
| | 6/20/2017 10:47 | 0.08 | 0.08 | 0.08 | 6.0 | 6.0 | 206.0 | 5.90 | 13.30 | 7.40 | 0.46 | | 1.48 | 70.8 | 9.47 | 4.7 | |
| | 6/22/2017 9:54 | 1.96 | 1.96 | 2.05 | 18.0 | 12.0 | 218.0 | 5.30 | 13.82 | 8.52 | -0.14 | | 1.48 | 6.1 | 0.82 | 0.4 | |
| | 6/26/2017 10:48 | 6.00 | 4.02 | 4.11 | 18.0 | 0.0 | 218.0 | 5.55 | 16.15 | 10.60 | 0.11 | | 1.48 | 0.0 | 0.00 | 0.0 | |
| | 6/30/2017 10:50 | 4.00 | 2.40 | 6.51 | 78.5 | 60.5 | 278.5 | 5.90 | 11.65 | 5.75 | 0.46 | | 1.48 | 25.2 | 3.37 | 1.7 | |
| | 7/7/2017 11:58 | 7.05 | 0.00 | 6.51 | 78.5 | 0.0 | 278.5 | -- | -- | -- | -- | | -- | -- | -- | -- | |
| | 7/12/2017 14:52 | 5.12 | 5.12 | 11.63 | 112.5 | 34.0 | 312.5 | 6.25 | 6.50 | 0.25 | 0.81 | | 1.48 | 6.6 | 0.89 | 0.4 | |
| | 7/19/2017 10:50 | 6.83 | 6.70 | 18.32 | 112.5 | 0.0 | 312.5 | 5.62 | 5.85 | 0.23 | 0.18 | | 1.48 | 0.0 | 0.00 | 0.0 | |
| | 7/26/2017 10:35 | 6.99 | 6.99 | 25.31 | 115.0 | 2.5 | 315.0 | 6.00 | 6.42 | 0.42 | 0.56 | | 1.48 | 0.4 | 0.05 | 0.0 | |
| | 8/2/2017 10:48 | 7.01 | 7.01 | 32.32 | 116.5 | 1.5 | 316.5 | 6.26 | 6.57 | 0.31 | 0.82 | | 1.48 | 0.2 | 0.03 | 0.0 | |
| | 8/9/2017 9:04 | 6.93 | 6.79 | 39.11 | 118.5 | 2.0 | 318.5 | 6.12 | 6.32 | 0.20 | 0.68 | | 1.48 | 0.3 | 0.04 | 0.0 | |
| | 8/17/2017 8:05 | 7.96 | 7.96 | 47.07 | 119.5 | 1.0 | 319.5 | 6.08 | 6.35 | 0.27 | 0.64 | | 1.48 | 0.1 | 0.02 | 0.0 | |
| | 8/22/2017 13:05 | 5.21 | 5.21 | 52.28 | 119.5 | 0.0 | 319.5 | 6.95 | 7.12 | 0.17 | 1.51 | | 1.48 | 0.0 | 0.00 | 0.0 | 0.1 |
| | End of Test | | | | | | | | | | | | | | | | |
| | 8/29/2017 16:00 | 12.33 | | | | | | 6.00 | 8.56 | 2.56 | | | | | | | |
| | 3/7/2018 13:42 | -- | -- | 0.00 | -- | -- | 319.5 | 5.25 | 15.40 | 10.15 | -- | | | -- | -- | -- | |
| | 3/7/2018 15:52 | 0.09 | 0.09 | 0.09 | 5.0 | 5.0 | 324.5 | 6.14 | 11.60 | 5.46 | 0.70 | | 1.48 | 55.4 | 7.40 | 3.7 | |
| | 3/8/2018 8:45 | 0.70 | 0.70 | 0.79 | 11.5 | 6.5 | 331.0 | 6.79 | 6.90 | 0.11 | 1.35 | | 1.48 | 9.2 | 1.24 | 0.6 | |
| | 3/15/2018 13:15 | 7.19 | 5.39 | 6.18 | 11.5 | 0.0 | 331.0 | 6.59 | 6.80 | 0.21 | 1.15 | | 1.48 | 0.0 | 0.00 | 0.0 | |
| | 3/22/2018 12:55 | 6.99 | 6.99 | 13.17 | 13.5 | 2.0 | 333.0 | 6.85 | 7.01 | 0.16 | 1.41 | | 1.48 | 0.3 | 0.04 | 0.0 | |
| | 3/29/2018 11:44 | 6.95 | 6.95 | 20.12 | 13.5 | 0.0 | 333.0 | 6.46 | 6.80 | 0.34 | 1.02 | | 1.48 | 0.0 | 0.00 | 0.0 | |
| | 4/6/2018 11:38 | 8.00 | 8.00 | 28.12 | 13.5 | 0.0 | 333.0 | 6.90 | 7.06 | 0.16 | 1.46 | | 1.48 | 0.0 | 0.00 | 0.0 | |
| | 4/12/2018 12:50 | 6.05 | 5.81 | 33.93 | 13.5 | 0.0 | 333.0 | 6.64 | 7.18 | 0.54 | 1.20 | | 1.48 | 0.0 | 0.00 | 0.0 | |
| | 4/18/2018 13:32 | 6.03 | 6.03 | 39.95 | 13.5 | 0.0 | 333.0 | 6.60 | 6.80 | 0.20 | 1.16 | | 1.48 | 0.0 | 0.00 | 0.0 | |
| | 4/27/2018 13:39 | 9.00 | 9.09 | 49.05 | 13.5 | 0.0 | 333.0 | 6.26 | 6.42 | 0.16 | 0.82 | | 1.48 | 0.0 | 0.00 | 0.0 | |
| | | | | | | | | | | | | | | | | | |

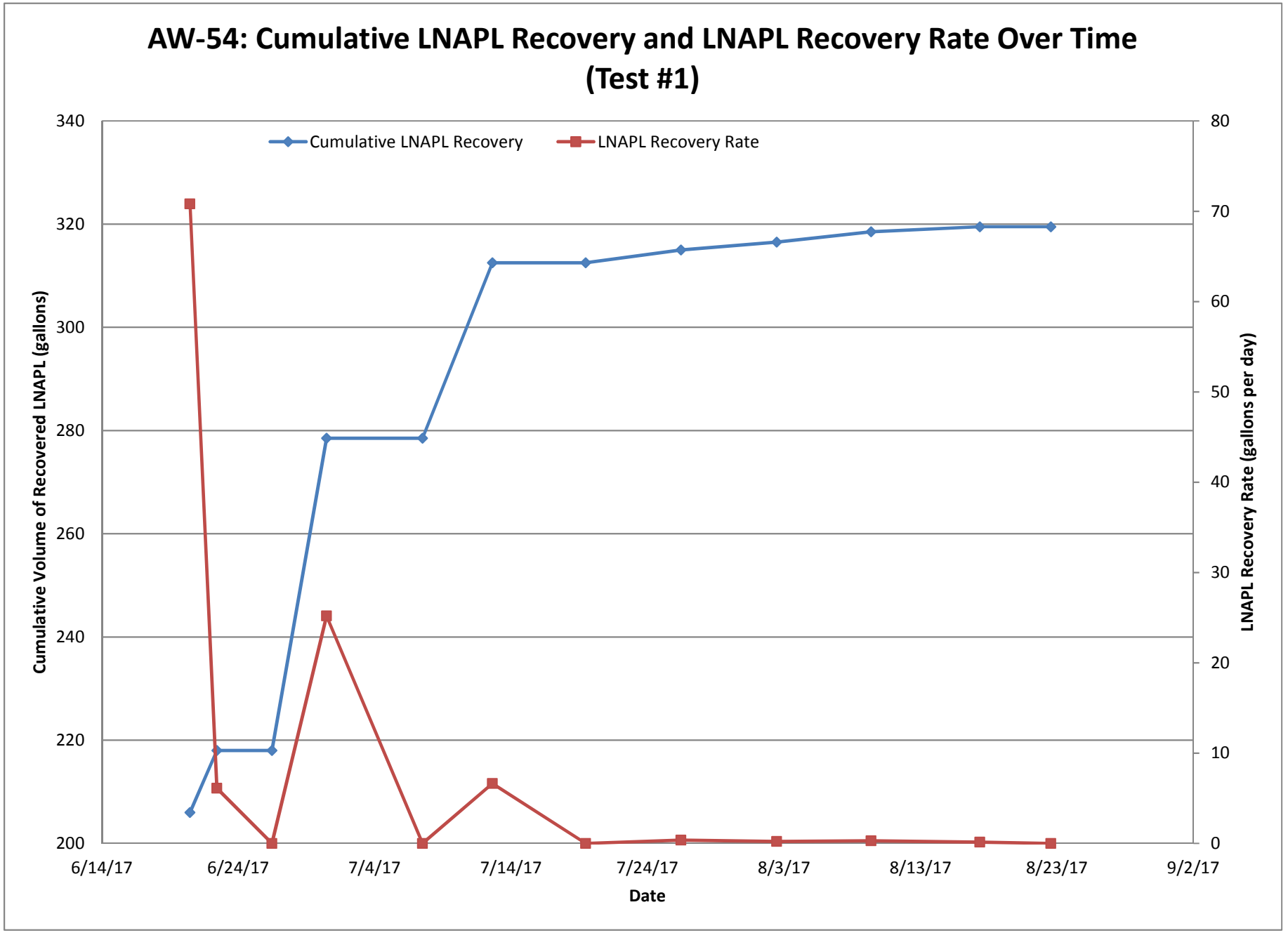
Assumed LNAPL specific gravity = 0.854

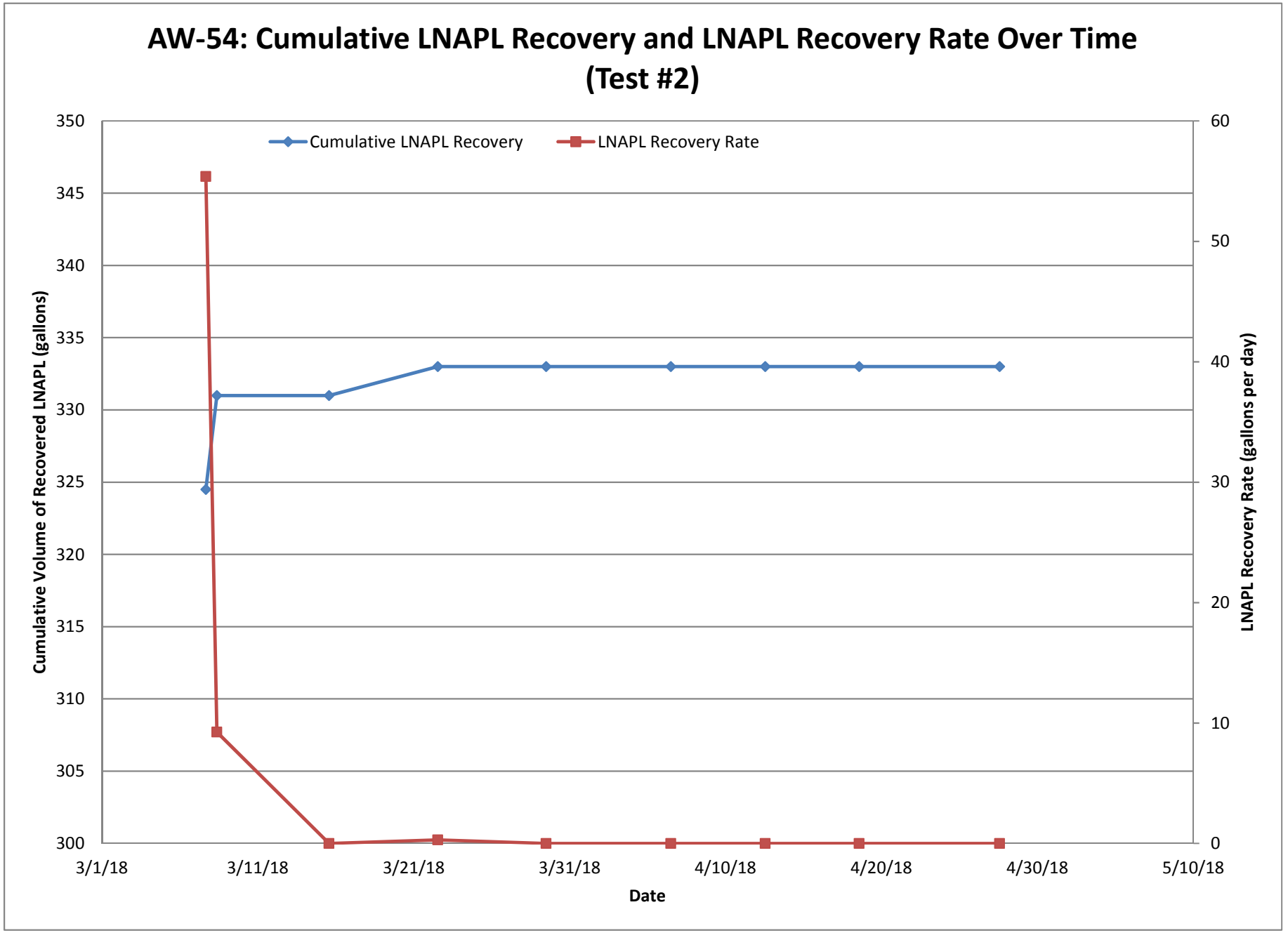
All calculations performed pursuant to the methodology detailed in ASTM E2856-13

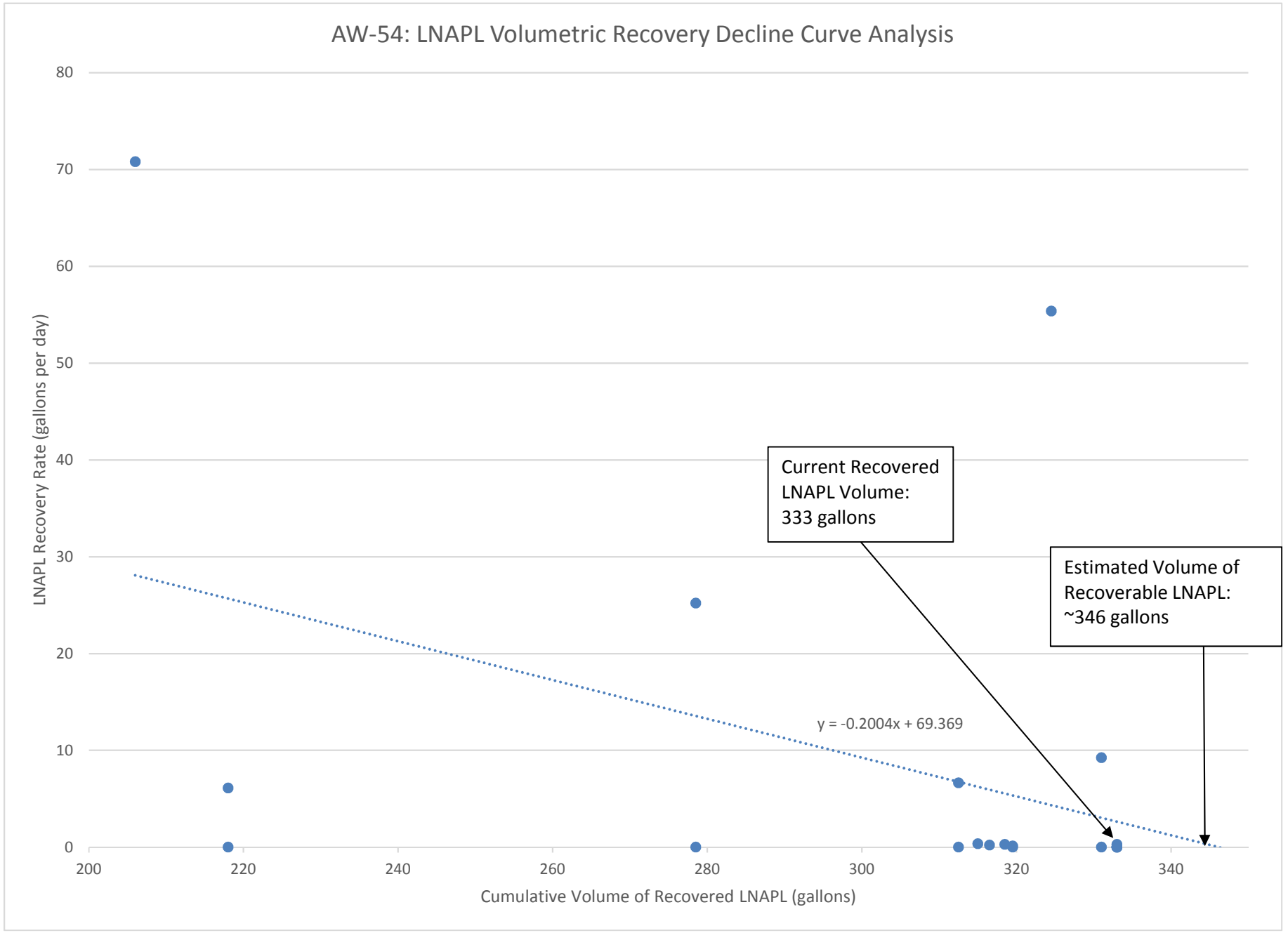
[a]The maximum theoretical drawdown is used for each interval calculation where the measured drawdown is negative or where it exceeds the theoretical maximum.

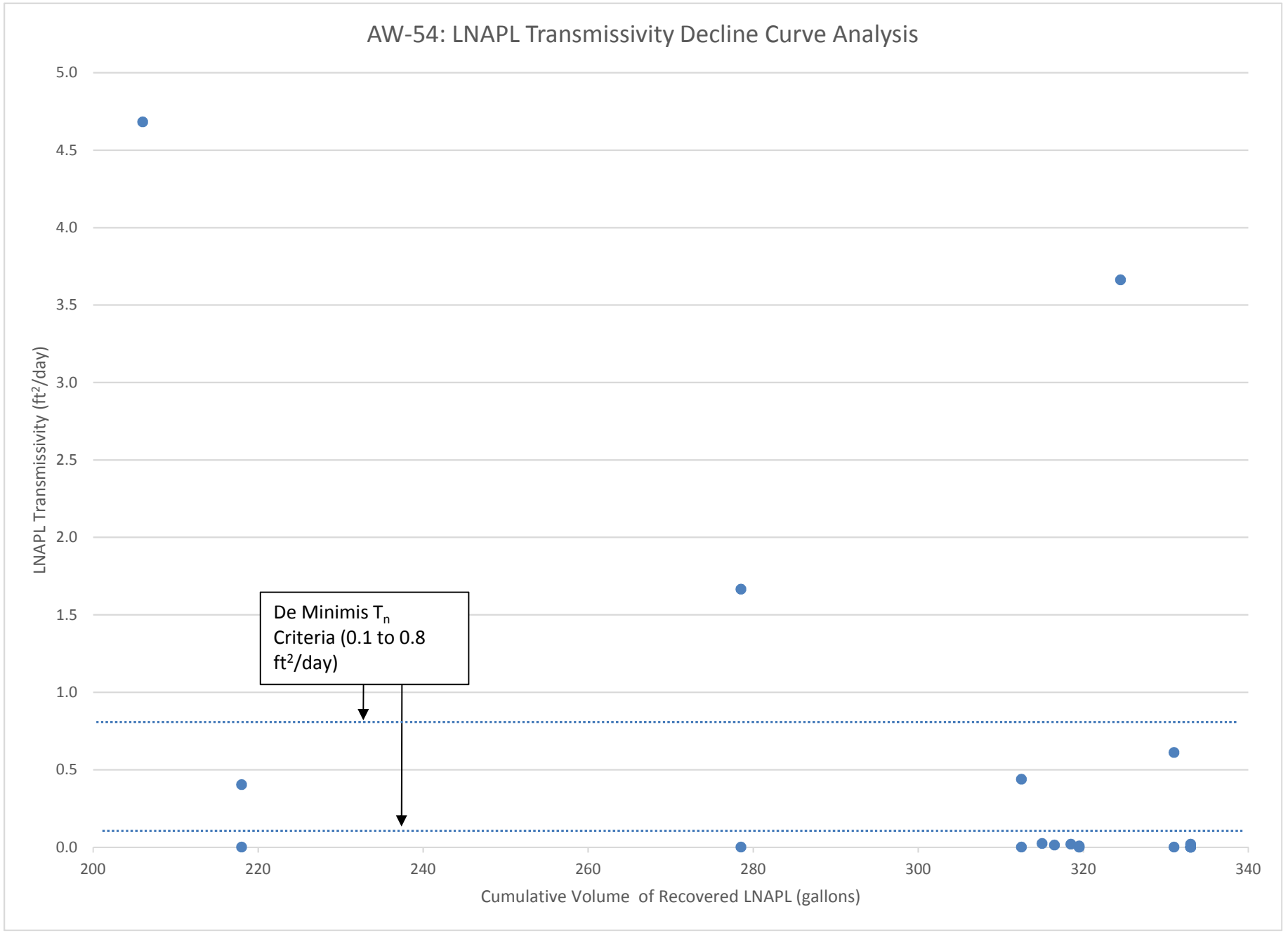
[b]Represents the geometric mean of the stabilized recovery rates/LNAPL transmissivity estimates (i.e., excludes initial elevated values that would not represent potential long-term recovery rates).

Equilibrium data is an average of quarterly groundwater data collected from March 2016 through Februrary 2018 and excludes data collected during or following skimming operations.


AW-54: Cumulative LNAPL Recovery and LNAPL Recovery Rate Over Time (Test #1)
Cumulative LNAPL Recovery
LNAPL Recovery Rate
Cumulative Volume of Recovered LNAPL (gallons)
LNAPL Recovery Rate (gallons per day)
Date
340
320
300
280
260
240
220
200
80
70
60
50
40
30
20
10
0
6/14/17
6/24/17
7/4/17
7/14/17
7/24/17
8/3/17
8/13/17
8/23/17
9/2/17


AW-54: Cumulative LNAPL Recovery and LNAPL Recovery Rate Over Time (Test #2)
Cumulative LNAPL Recovery
LNAPL Recovery Rate
Cumulative Volume of Recovered LNAPL (gallons)
LNAPL Recovery Rate (gallons per day)
Date
350
345
340
335
330
325
320
315
310
305
300
60
50
40
30
20
10
0
3/1/18
3/11/18
3/21/18
3/31/18
4/10/18
4/20/18
4/30/18
5/10/18


AW-54: LNAPL Volumetric Recovery Decline Curve Analysis
LNAPL Recovery Rate (gallons per day)
Cumulative Volume of Recovered LNAPL (gallons)
80
70
60
50
40
30
20
10
0
200
220
240
260
280
300
320
340
Current Recovered LNAPL Volume: 333 gallons
Estimated Volume of Recoverable LNAPL: ~346 gallons
y = -0.2004x + 69.369


AW-54: LNAPL Transmissivity Decline Curve Analysis
LNAPL Transmissivity (ft²/day)
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
200
220
240
260
280
300
320
340
Cumulative Volume of Recovered LNAPL (gallons)
De Minimis $T_n$ Criteria (0.1 to 0.8 ft²/day)

# AW-56 Skimming Evaluation

**Appendix A**

**AW-56 LNAPL Skimming Test Results**
**IMTT Savannah North Terminal**
**Savannah, Georgia**

| Well ID | Measurement Date & Time | Time Between Measurement Events (days) | Actual Skimmer Run-Time Between Measurement Events (days) | Cumulative Run Time (days) | Total Volume of LNAPL Recovered (gallons) | Volume of LNAPL Recovered During Measurement Interval (gallons) | RUNNING Total Volume of LNAPL Recovered (gallons) | Depth to LNAPL (feet btoc) | Depth to Water (feet btoc) | In-Well LNAPL Thickness (feet) | LNAPL Drawdown (feet) | Maximum Theoretical Unconfined LNAPL Drawdown (feet) | LNAPL Drawdown Used in Transmissivity Estimate[a] (feet) | Average LNAPL Recovery Rate for Interval (gal/day) | Average LNAPL Recovery Rate for Interval ($ft^3$/day) | Estimated LNAPL Transmissivity for Interval ($ft^2$/day) | Overall Average LNAPL Transmissivity[b] ($ft^2$/day) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AW-56 Short term test | Equilibrium | | | | | | | 8.74 | 14.19 | 5.45 | -- | 0.80 | | -- | -- | -- | |
| | 8/25/2016 11:45 | -- | | -- | -- | -- | | 9.12 | 15.13 | 6.01 | -- | | -- | -- | -- | -- | |
| | 8/31/2016 10:40 | 5.95 | 5.95 | 5.95 | 36.1 | 36.1 | 36.1 | 10.01 | 13.02 | 3.01 | 1.27 | | 0.80 | 6.1 | 0.81 | 0.7 | |
| | 9/7/2016 11:45 | 7.05 | 7.05 | 13.00 | 67.3 | 31.2 | 67.3 | 10.90 | 13.40 | 2.50 | 2.16 | | 0.80 | 4.4 | 0.59 | 0.5 | |
| | 9/14/2016 17:30 | 7.24 | 7.24 | 20.24 | 117.3 | 50.0 | 117.3 | 10.99 | 14.55 | 3.56 | 2.25 | | 0.80 | 6.9 | 0.92 | 0.8 | |
| | 9/15/2016 7:45 | 0.59 | 0.59 | 20.83 | 126.8 | 9.5 | 126.8 | 10.98 | 11.10 | 0.12 | 2.24 | | 0.80 | 16.0 | 2.14 | 2.0 | |
| | 9/21/2016 14:40 | 6.29 | 6.29 | 27.12 | -- | -- | | -- | -- | -- | -- | | | -- | -- | -- | 0.9 |
| AW-56 Long-term Test | 2/23/2017 9:45 | -- | -- | -- | -- | -- | | 10.80 | 15.85 | 5.05 | -- | | | -- | -- | -- | |
| | 2/23/2017 11:42 | 0.08 | 0.05 | 0.05 | 38.1 | 38.1 | 164.9 | 12.05 | 13.33 | 1.28 | 3.31 | | 0.80 | 744.3 | 99.50 | 91.5 | |
| | 2/23/2017 13:08 | 0.06 | 0.06 | 0.11 | 40.5 | 2.4 | 167.3 | 12.30 | 12.65 | 0.35 | 3.56 | | 0.80 | 40.2 | 5.37 | 4.9 | |
| | 3/3/2017 9:40 | 7.86 | 7.86 | 7.97 | 74.4 | 33.9 | 201.3 | 12.72 | 13.00 | 0.28 | 3.98 | | 0.80 | 4.3 | 0.58 | 0.5 | |
| | *SHUTDOWN DUE TO TANK FAILURE* | | | | | | | | | | | | | | | | |
| | 3/7/2017 14:00 | -- | -- | | -- | -- | 216.3 | 12.20 | 16.95 | 4.75 | -- | | | -- | -- | -- | |
| | 3/10/2017 9:40 | 2.82 | 2.82 | 2.82 | 11.5 | 11.5 | 227.8 | 11.34 | 14.90 | 3.56 | 2.60 | | 0.80 | 4.1 | 0.54 | 0.5 | |
| | 3/16/2017 10:35 | 6.04 | 6.04 | 8.86 | 17.7 | 6.2 | 233.9 | 11.86 | 16.90 | 5.04 | 3.12 | | 0.80 | 1.0 | 0.14 | 0.1 | |
| | 3/23/2017 9:58 | 6.97 | 6.07 | 14.93 | 51.2 | 33.5 | 267.5 | 11.77 | 13.61 | 1.84 | 3.03 | | 0.80 | 5.5 | 0.74 | 0.7 | |
| | 3/31/2017 7:50 | 7.91 | 7.65 | 22.58 | 59.4 | 8.2 | 275.7 | 12.75 | 13.00 | 0.25 | 4.01 | | 0.80 | 1.1 | 0.14 | 0.1 | |
| | 4/3/2017 9:38 | 3.07 | 3.09 | 25.67 | 72.4 | 13.0 | 288.7 | 12.72 | 12.90 | 0.18 | 3.98 | | 0.80 | 4.2 | 0.56 | 0.5 | |
| | 4/13/2017 11:20 | 10.07 | 10.11 | 35.78 | 106.2 | 33.8 | 322.5 | 11.76 | 11.91 | 0.15 | 3.02 | | 0.80 | 3.3 | 0.45 | 0.4 | |
| | 4/18/2017 10:47 | 4.98 | 5.00 | 40.78 | 119.9 | 13.7 | 336.2 | 12.25 | 15.25 | 3.00 | 3.51 | | 0.80 | 2.7 | 0.37 | 0.3 | |
| | 4/27/2017 10:41 | 9.00 | 9.03 | 49.80 | 130.9 | 11.0 | 347.2 | 11.10 | 14.35 | 3.25 | 2.36 | | 0.80 | 1.2 | 0.16 | 0.1 | |
| | 5/2/2017 12:58 | 5.10 | 5.11 | 54.92 | 155.2 | 24.3 | 371.5 | 12.44 | 12.66 | 0.22 | 3.70 | | 0.80 | 4.8 | 0.64 | 0.6 | |
| | 5/10/2017 10:30 | 7.90 | 7.65 | 62.56 | 179.2 | 24.0 | 395.5 | 12.00 | 12.46 | 0.46 | 3.26 | | 0.80 | 3.1 | 0.42 | 0.4 | |
| | 5/17/2017 7:32 | 6.88 | 6.90 | 69.47 | 208.2 | 29.0 | 424.5 | 12.83 | 13.28 | 0.45 | 4.09 | | 0.80 | 4.2 | 0.56 | 0.5 | |
| | 5/26/2017 10:42 | 9.13 | 9.16 | 78.63 | 244.2 | 36.0 | 460.5 | 11.95 | 11.98 | 0.03 | 3.21 | | 0.80 | 3.9 | 0.53 | 0.5 | |
| | 6/1/2017 7:45 | 5.88 | 5.90 | 84.53 | 263.2 | 19.0 | 479.5 | 12.31 | 12.59 | 0.28 | 3.57 | | 0.80 | 3.2 | 0.43 | 0.4 | |
| | 6/8/2017 11:15 | 7.15 | 6.89 | 91.42 | 271.7 | 8.5 | 488.0 | 11.13 | 12.86 | 1.73 | 2.39 | | 0.80 | 1.2 | 0.16 | 0.2 | |
| | 6/15/2017 10:29 | 6.97 | 6.98 | 98.39 | 305.2 | 33.5 | 521.5 | 12.51 | 12.72 | 0.21 | 3.77 | | 0.80 | 4.8 | 0.64 | 0.6 | |
| | 6/20/2017 9:36 | 4.96 | 4.88 | 103.28 | 320.2 | 15.0 | 536.5 | 12.27 | 12.51 | 0.24 | 3.53 | | 0.80 | 3.1 | 0.41 | 0.4 | |
| | 6/22/2017 10:57 | 2.06 | 2.04 | 105.31 | 327.2 | 7.0 | 543.5 | 11.86 | 12.00 | 0.14 | 3.12 | | 0.80 | 3.4 | 0.46 | 0.4 | |
| | 6/26/2017 12:30 | 4.06 | 4.08 | 109.39 | 341.2 | 14.0 | 557.5 | 11.55 | 11.60 | 0.05 | 2.81 | | 0.80 | 3.4 | 0.46 | 0.4 | |
| | 6/30/2017 12:28 | 4.00 | 3.92 | 113.31 | 360.2 | 19.0 | 576.5 | 12.02 | 12.11 | 0.09 | 3.28 | | 0.80 | 4.9 | 0.65 | 0.6 | |
| | 7/7/2017 8:03 | 6.82 | 6.84 | 120.14 | 383.2 | 23.0 | 599.5 | 11.65 | 11.84 | 0.19 | 2.91 | | 0.80 | 3.4 | 0.45 | 0.4 | |
| | 7/12/2017 14:36 | 5.27 | 5.19 | 125.34 | 407.8 | 24.6 | 624.1 | 11.65 | 11.74 | 0.09 | 2.91 | | 0.80 | 4.7 | 0.63 | 0.6 | |
| | 7/19/2017 11:45 | 6.88 | 6.90 | 132.24 | 449.2 | 41.4 | 665.5 | 12.51 | 12.68 | 0.17 | 3.77 | | 0.80 | 6.0 | 0.80 | 0.7 | |
| | 7/26/2017 11:24 | 6.99 | 6.91 | 139.15 | 466.5 | 17.3 | 682.8 | 11.30 | 11.43 | 0.13 | 2.56 | | 0.80 | 2.5 | 0.33 | 0.3 | |
| | 8/2/2017 12:06 | 7.03 | 0.01 | 139.16 | 469.5 | 3.0 | 685.8 | 10.91 | 17.11 | 6.20 | 2.17 | | 0.80 | 326.0 | 43.58 | 39.9 | |
| | 8/9/2017 10:00 | 6.91 | 6.83 | 145.99 | 501.5 | 32.0 | 717.8 | 11.11 | 11.22 | 0.11 | 2.37 | | 0.80 | 4.7 | 0.63 | 0.6 | |
| | 8/17/2017 8:26 | 7.93 | 7.87 | 153.85 | 531.5 | 30.0 | 747.8 | 11.13 | 11.25 | 0.12 | 2.39 | | 0.80 | 3.8 | 0.51 | 0.5 | |
| | 8/22/2017 12:25 | 5.17 | 5.09 | 158.94 | 552.0 | 20.5 | 768.3 | 10.80 | 10.98 | 0.18 | 2.06 | | 0.80 | 4.0 | 0.54 | 0.5 | |
| | 8/30/2017 17:38 | 8.22 | 8.24 | 167.18 | 576.5 | 24.5 | 792.8 | 10.74 | 10.91 | 0.17 | 2.00 | | 0.80 | 3.0 | 0.40 | 0.4 | |
| | 9/6/2017 12:47 | 6.80 | 3.44 | 170.62 | 587.5 | 11.0 | 803.8 | 10.24 | 15.51 | 5.27 | 1.50 | | 0.80 | 3.2 | 0.43 | 0.4 | 0.4 |
| | *END OF TEST INTERVAL - SHUTDOWN DUE TO HURRICANE* | | | | | | | | | | | | | | | | |

**Appendix A**

**AW-56 LNAPL Skimming Test Results**
**IMTT Savannah North Terminal**
**Savannah, Georgia**

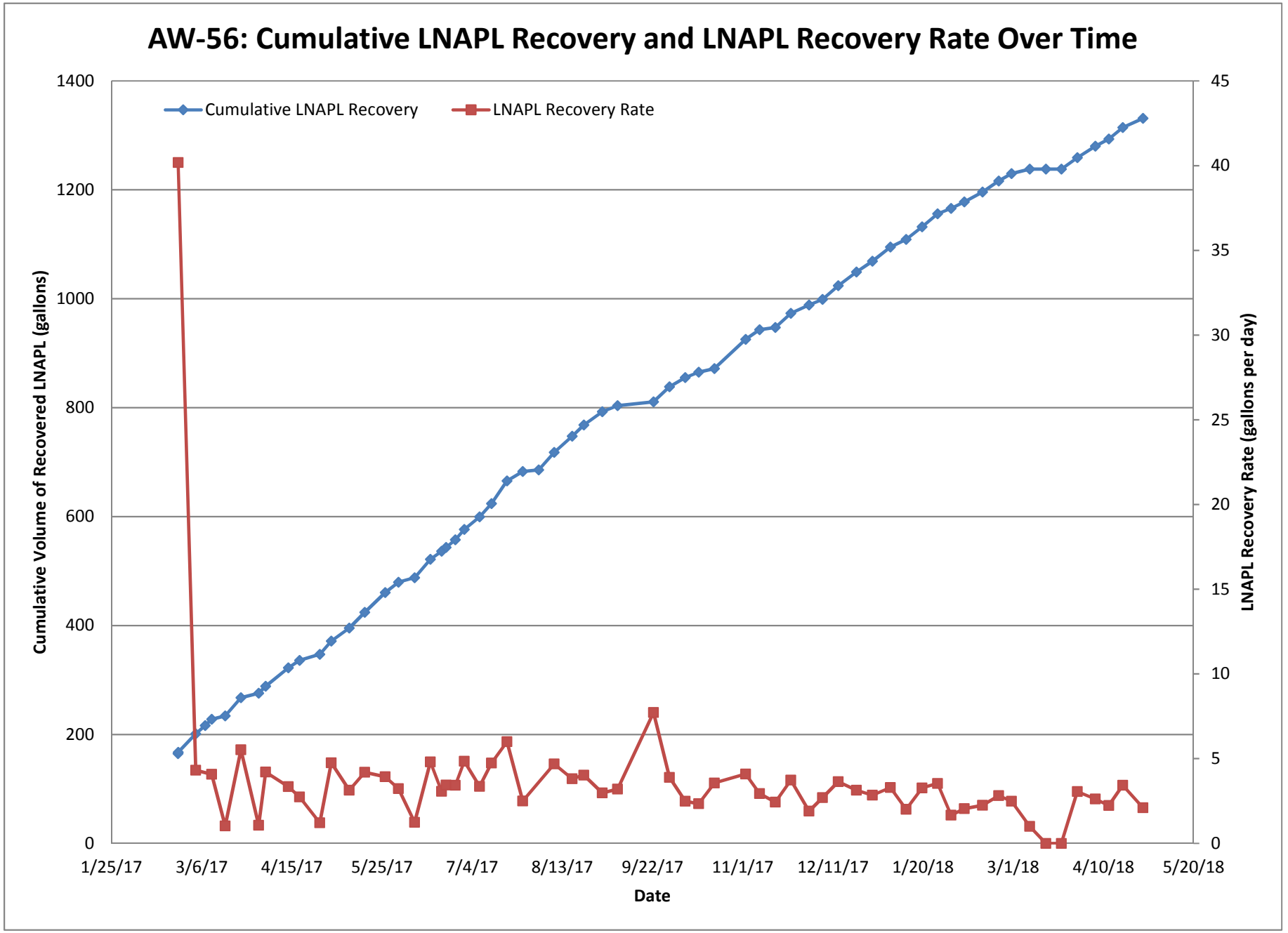
| Well ID | Measurement Date & Time | Time Between Measurement Events (days) | Actual Skimmer Run-Time Between Measurement Events (days) | Cumulative Run Time (days) | Total Volume of LNAPL Recovered (gallons) | Volume of LNAPL Recovered During Measurement Interval (gallons) | RUNNING Total Volume of LNAPL Recovered (gallons) | Depth to LNAPL (feet btoc) | Depth to Water (feet btoc) | In-Well LNAPL Thickness (feet) | LNAPL Drawdown (feet) | Maximum Theoretical Unconfined LNAPL Drawdown (feet) | LNAPL Drawdown Used in Transmissivity Estimate[a] (feet) | Average LNAPL Recovery Rate for Interval (gal/day) | Average LNAPL Recovery Rate for Interval ($ft^3$/day) | Estimated LNAPL Transmissivity for Interval ($ft^2$/day) | Overall Average LNAPL Transmissivity[b] ($ft^2$/day) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AW-56 Long term test | 9/21/2017 12:03 | -- | -- | -- | -- | -- | 803.8 | 9.42 | 15.12 | 5.70 | -- | | | -- | -- | -- | |
| | 9/22/2017 11:50 | 0.99 | 0.91 | 171.53 | 7.0 | 7.0 | 810.8 | 10.82 | 11.06 | 0.24 | 2.08 | | 0.80 | 7.7 | 1.03 | 0.9 | |
| | 9/29/2017 13:24 | 7.07 | 7.07 | 178.59 | 34.5 | 27.5 | 838.3 | 11.26 | 11.45 | 0.19 | 2.52 | | 0.80 | 3.9 | 0.52 | 0.5 | |
| | 10/6/2017 12:35 | 6.97 | 6.89 | 185.49 | 51.6 | 17.1 | 855.4 | 10.52 | 10.72 | 0.20 | 1.78 | | 0.80 | 2.5 | 0.33 | 0.3 | |
| | 10/12/2017 11:03 | 5.94 | 4.26 | 189.75 | 61.6 | 10.0 | 865.4 | 11.05 | 16.60 | 5.55 | 2.31 | | 0.80 | 2.3 | 0.31 | 0.3 | |
| | 10/19/2017 11:15 | 7.01 | 1.82 | 191.57 | 68.1 | 6.5 | 871.9 | 9.65 | 14.55 | 4.90 | 0.91 | | 0.80 | 3.6 | 0.48 | 0.4 | |
| | 11/2/2017 8:41 | 13.89 | 13.08 | 204.66 | 121.6 | 53.5 | 925.4 | 11.30 | 11.36 | 0.06 | 2.56 | | 0.80 | 4.1 | 0.55 | 0.5 | |
| | 11/8/2017 12:02 | 6.14 | 6.14 | 210.80 | 139.6 | 18.0 | 943.4 | 11.22 | 11.51 | 0.29 | 2.48 | | 0.80 | 2.9 | 0.39 | 0.4 | |
| | 11/15/2017 11:17 | 6.97 | 1.64 | 212.44 | 143.6 | 4.0 | 947.4 | 10.95 | 15.42 | 4.47 | 2.21 | | 0.80 | 2.4 | 0.33 | 0.3 | |
| | 11/22/2017 10:11 | 6.95 | 6.95 | 219.39 | 169.6 | 26.0 | 973.4 | 11.80 | 11.95 | 0.15 | 3.06 | | 0.80 | 3.7 | 0.50 | 0.5 | |
| | 11/30/2017 10:55 | 8.03 | 7.91 | 227.30 | 184.6 | 15.0 | 988.4 | 12.30 | 12.52 | 0.22 | 3.56 | | 0.80 | 1.9 | 0.25 | 0.2 | |
| | 12/6/2017 11:28 | 6.02 | 3.86 | 231.16 | 195.0 | 10.4 | 998.8 | 10.65 | 14.32 | 3.67 | 1.91 | | 0.80 | 2.7 | 0.36 | 0.3 | |
| | 12/13/2017 10:32 | 6.96 | 6.96 | 238.12 | 220.3 | 25.3 | 1024.1 | 12.54 | 12.76 | 0.22 | 3.80 | | 0.80 | 3.6 | 0.49 | 0.4 | |
| | 12/21/2017 12:38 | 8.09 | 7.96 | 246.08 | 245.3 | 25.0 | 1049.1 | 11.63 | 11.73 | 0.10 | 2.89 | | 0.80 | 3.1 | 0.42 | 0.4 | |
| | 12/28/2017 13:15 | 7.03 | 7.03 | 253.10 | 265.3 | 20.0 | 1069.1 | 12.40 | 12.65 | 0.25 | 3.66 | | 0.80 | 2.8 | 0.38 | 0.3 | |
| | 1/5/2018 13:37 | 8.02 | 7.89 | 260.99 | 291.3 | 26.0 | 1095.1 | 11.61 | 11.69 | 0.08 | 2.87 | | 0.80 | 3.3 | 0.44 | 0.4 | |
| | 1/12/2018 12:46 | 6.96 | 6.96 | 267.96 | 305.3 | 14.0 | 1109.1 | 12.71 | 12.94 | 0.23 | 3.97 | | 0.80 | 2.0 | 0.27 | 0.2 | |
| | 1/19/2018 14:15 | 7.06 | 7.05 | 275.01 | 328.3 | 23.0 | 1132.1 | 11.80 | 11.98 | 0.18 | 3.06 | | 0.80 | 3.3 | 0.44 | 0.4 | |
| | 1/26/2018 11:05 | 6.87 | 6.78 | 281.79 | 352.3 | 24.0 | 1156.1 | 12.97 | 13.65 | 0.68 | 4.23 | | 0.80 | 3.5 | 0.47 | 0.4 | |
| | 2/1/2018 11:48 | 6.03 | 6.03 | 287.82 | 362.3 | 10.0 | 1166.1 | 11.54 | 11.63 | 0.09 | 2.80 | | 0.80 | 1.7 | 0.22 | 0.2 | |
| | 2/7/2018 8:16 | 5.85 | 5.85 | 293.67 | 374.3 | 12.0 | 1178.1 | 12.82 | 13.14 | 0.32 | 4.08 | | 0.80 | 2.1 | 0.27 | 0.3 | |
| | 2/15/2018 10:45 | 8.10 | 8.02 | 301.69 | 392.3 | 18.0 | 1196.1 | 11.80 | 12.01 | 0.21 | 3.06 | | 0.80 | 2.2 | 0.30 | 0.3 | |
| | 2/22/2018 13:20 | 7.11 | 7.09 | 308.78 | 412.3 | 20.0 | 1216.1 | 11.92 | 12.10 | 0.18 | 3.18 | | 0.80 | 2.8 | 0.38 | 0.3 | |
| | 2/28/2018 8:02 | 5.78 | 5.64 | 314.42 | 426.3 | 14.0 | 1230.1 | 11.18 | 11.39 | 0.21 | 2.44 | | 0.80 | 2.5 | 0.33 | 0.3 | |
| | 3/8/2018 8:27 | 8.02 | 8.02 | 322.44 | 434.3 | 8.0 | 1238.1 | 11.89 | 16.41 | 4.52 | 3.15 | | 0.80 | 1.0 | 0.13 | 0.1 | |
| | 3/15/2018 12:30 | 7.17 | 7.15 | 329.58 | 434.3 | 0.0 | 1238.1 | 11.66 | 15.22 | 3.56 | 2.92 | | 0.80 | 0.0 | 0.00 | 0.0 | |
| | 3/22/2018 10:25 | 6.91 | 0.00 | 329.59 | 434.3 | 0.0 | 1238.1 | 12.12 | 16.27 | 4.15 | 3.38 | | 0.80 | 0.0 | 0.00 | 0.0 | |
| | 3/29/2018 10:50 | 7.02 | 6.87 | 336.46 | 455.3 | 21.0 | 1259.1 | 11.60 | 11.92 | 0.32 | 2.86 | | 0.80 | 3.1 | 0.41 | 0.4 | |
| | 4/6/2018 10:48 | 8.00 | 8.00 | 344.46 | 476.3 | 21.0 | 1280.1 | 12.61 | 12.85 | 0.24 | 3.87 | | 0.80 | 2.6 | 0.35 | 0.3 | |
| | 4/12/2018 11:55 | 6.05 | 6.05 | 350.50 | 489.8 | 13.5 | 1293.6 | 12.60 | 12.82 | 0.22 | 3.86 | | 0.80 | 2.2 | 0.30 | 0.3 | |
| | 4/18/2018 14:15 | 6.10 | 6.10 | 356.60 | 510.7 | 20.9 | 1314.5 | 12.11 | 12.23 | 0.12 | 3.37 | | 0.80 | 3.4 | 0.46 | 0.4 | |
| | 4/27/2018 14:15 | 9.00 | 7.97 | 364.57 | 527.4 | 16.7 | 1331.2 | 12.35 | 13.00 | 0.65 | 3.61 | | 0.80 | 2.1 | 0.28 | 0.3 | 0.36 |
| | | | | | | | | | | | | | | | | | |

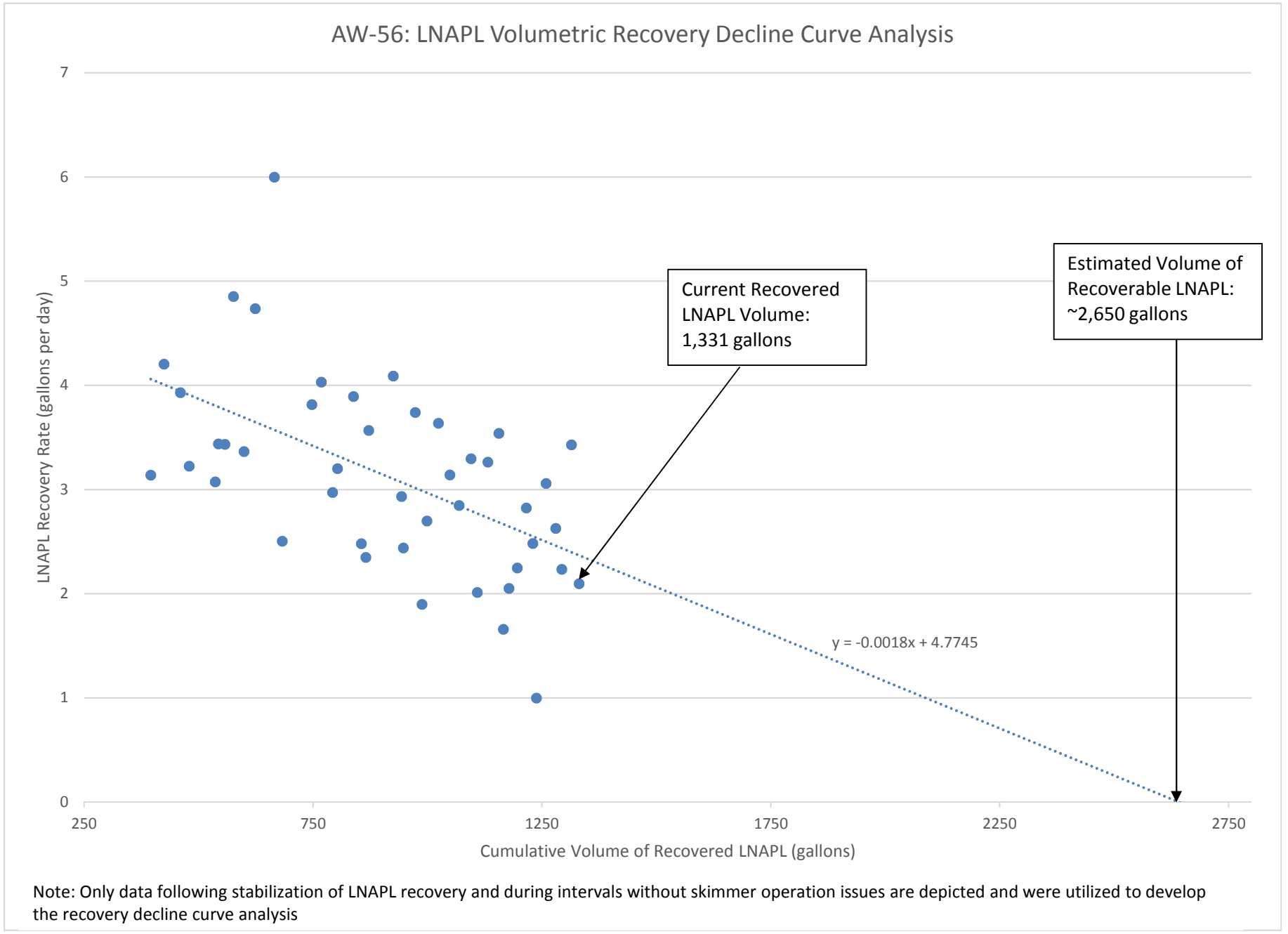
Assumed LNAPL specific gravity = 0.854

All calculations performed pursuant to the methodology detailed in ASTM E2856-13

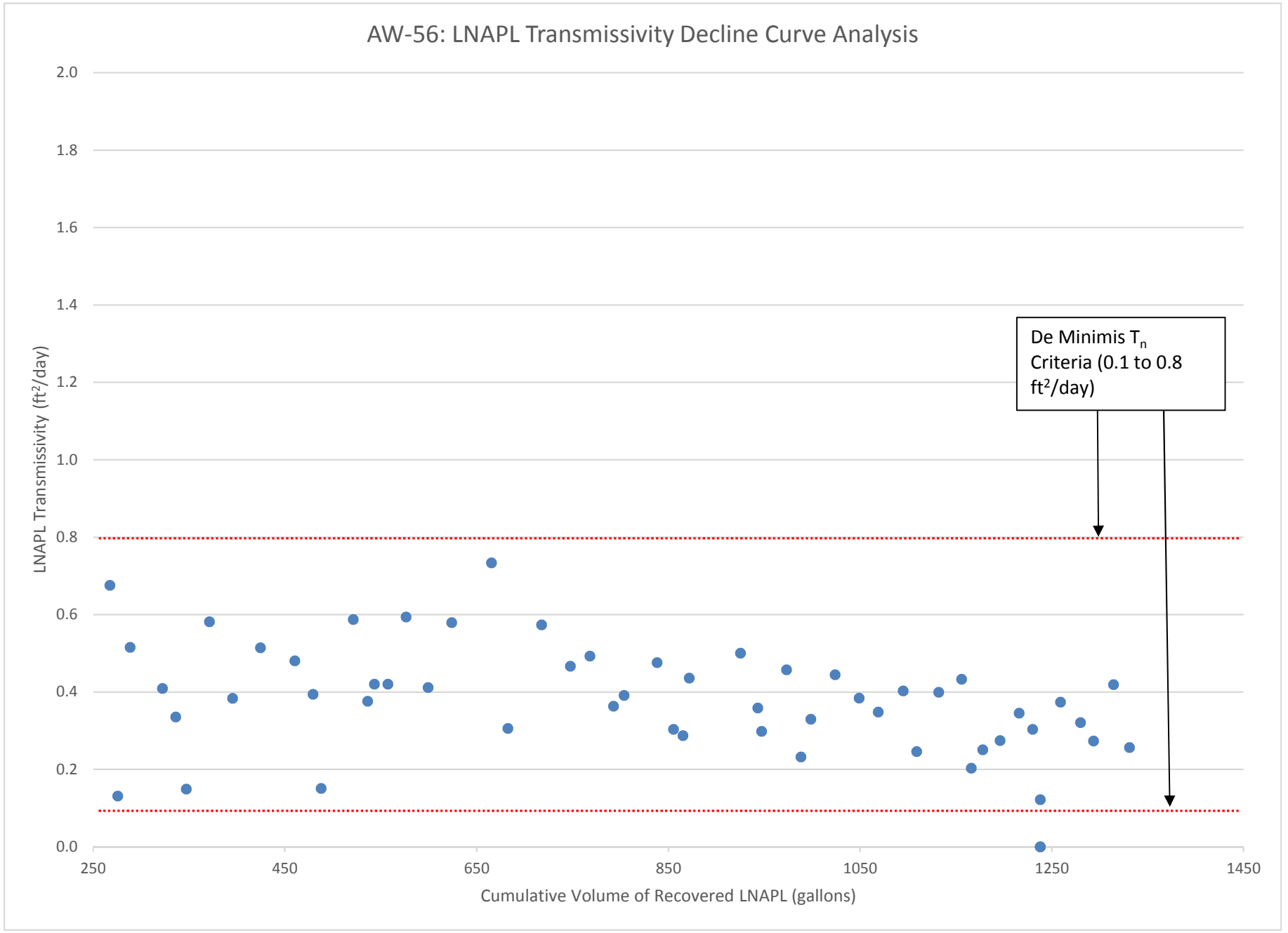
[a]The maximum theoretical drawdown is used for each interval calculation where the measured drawdown is negative or where it exceeds the theoretical maximum.

[b]Represents the geometric mean of the stabilized recovery rates/LNAPL transmissivity estimates (i.e., excludes initial elevated values that would not represent potential long-term recovery rates).


AW-56: Cumulative LNAPL Recovery and LNAPL Recovery Rate Over Time
Cumulative LNAPL Recovery
LNAPL Recovery Rate
Cumulative Volume of Recovered LNAPL (gallons)
LNAPL Recovery Rate (gallons per day)
Date
0
200
400
600
800
1000
1200
1400
0
5
10
15
20
25
30
35
40
45
1/25/17
3/6/17
4/15/17
5/25/17
7/4/17
8/13/17
9/22/17
11/1/17
12/11/17
1/20/18
3/1/18
4/10/18
5/20/18




Note: Only data following stabilization of LNAPL recovery and during intervals without skimmer operation issues are depicted and were utilized to develop the recovery decline curve analysis


AW-56: LNAPL Transmissivity Decline Curve Analysis
LNAPL Transmissivity (ft²/day)
2.0
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
250
450
650
850
1050
1250
1450
Cumulative Volume of Recovered LNAPL (gallons)
De Minimis $T_n$ Criteria (0.1 to 0.8 ft²/day)

# AW-57 Skimming Evaluation

## Appendix A

## LNAPL Skimming Test Results - Short-Duration Skimming
## IMTT Savannah North Terminal
## Savannah, Georgia

| Well ID | Measurement Date & Time | Time Between Measurement Events (days) | Actual Skimmer Run-Time Between Measurement Events (days) | Cumulative Run-Time (days) | Total Volume of LNAPL Recovered (gallons) | Volume of LNAPL Recovered During Measurement Interval (gallons) | RUNNING Total Volume of LNAPL Recovered (gallons) | Percentage of On-Time During Measurement Interval (%) | Depth to LNAPL (feet btoc) | Depth to Water (feet btoc) | In-Well LNAPL Thickness (feet) | LNAPL Drawdown (feet) | Maximum Theoretical Unconfined LNAPL Drawdown (feet) | LNAPL Drawdown Used in Transmissivity Estimate[a] (feet) | Average LNAPL Recovery Rate for Interval (gal/day) | Average LNAPL Recovery Rate for Interval ($ft^3$/day) | Estimated LNAPL Transmissivity for Interval ($ft^2$/day) | Overall Average LNAPL Transmissivity[b] ($ft^2$/day) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AW-57 | Equilibrium | -- | | -- | -- | -- | | -- | 8.65 | 9.45 | 0.80 | -- | 0.12 | -- | -- | -- | -- | |
| | 7/28/2016 10:17 | -- | | -- | -- | -- | | -- | 10.43 | 13.82 | 3.39 | -- | | -- | -- | -- | -- | |
| | 8/2/2016 12:50 | 5.11 | 5.11 | 5.11 | 6.57 | 6.57 | 6.57 | 99% | 11.21 | 11.47 | 0.26 | 2.56 | | 0.12 | 1.3 | 0.17 | 1.0 | |
| | 8/10/2016 16:25 | 8.15 | 8.15 | 13.26 | 6.60 | 0.03 | 6.60 | -- | 11.30 | 11.64 | 0.34 | 2.65 | | 0.12 | 0.00 | 0.00 | 0.00 | |
| | 8/17/2016 9:45 | 6.06 | 6.06 | 19.98 | 7.09 | 0.49 | 7.09 | 100% | 11.20 | 11.32 | 0.12 | 2.55 | | 0.12 | 0.1 | 0.01 | 0.07 | |
| | 8/24/2016 16:40 | 7.29 | 7.29 | 27.27 | 7.39 | 0.30 | 7.39 | 100% | 11.05 | 11.16 | 0.11 | 2.40 | | 0.12 | 0.04 | 0.01 | 0.03 | 0.03 |

Assumed LNAPL specific gravity = 0.854

All calculations performed pursuant to the methodology detailed in ASTM E2856-13

[a]The maximum theoretical drawdown is used for each interval calculation where the measured drawdown is negative or where it exceeds the theoretical maximum.

[b]Represents the average of the stabilized recovery rates/LNAPL transmissivity estimates (i.e., excludes initial elevated values that would not represent potential long-term recovery rates).

Equilibrium data is an average of quarterly groundwater data collected from March 2016 through Februrary 2018 and excludes data collected during skimming operations.

# AW-65 Skimming Evaluation

# Appendix A

## LNAPL Skimming Test Results - Short-Duration Skimming
## IMTT Savannah North Terminal
## Savannah, Georgia

| Well ID | Measurement Date & Time | Time Between Measurement Events (days) | Actual Skimmer Run-Time Between Measurement Events (days) | Cumulative Run-Time (days) | Total Volume of LNAPL Recovered (gallons) | Volume of LNAPL Recovered During Measurement Interval (gallons) | RUNNING Total Volume of LNAPL Recovered (gallons) | Percentage of On-Time During Measurement Interval (%) | Depth to LNAPL (feet btoc) | Depth to Water (feet btoc) | In-Well LNAPL Thickness (feet) | LNAPL Drawdown (feet) | Maximum Theoretical Unconfined LNAPL Drawdown (feet) | LNAPL Drawdown Used in Transmissivity Estimate[a] (feet) | Average LNAPL Recovery Rate for Interval (gal/day) | Average LNAPL Recovery Rate for Interval ($ft^3$/day) | Estimated LNAPL Transmissivity for Interval ($ft^2$/day) | Overall Average LNAPL Transmissivity[b] ($ft^2$/day) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AW-65 | Equilibrium | -- | | -- | -- | -- | | -- | 10.94 | 12.69 | 1.75 | -- | 0.25 | -- | -- | -- | -- | |
| | 5/17/2016 15:12 | -- | | -- | -- | -- | | -- | 10.85 | 12.65 | 1.80 | -- | | -- | -- | -- | -- | |
| | 5/20/2016 10:20 | 2.80 | 2.80 | 2.80 | 2.15 | 2.15 | 2.15 | 100% | 10.02 | 10.05 | 0.03 | -0.92 | | 0.26 | 0.8 | 0.10 | 0.3 | |
| | 5/25/2016 11:40 | 5.06 | 5.06 | 7.85 | 7.80 | 5.65 | 7.80 | 100% | 10.29 | 10.34 | 0.05 | -0.65 | | 0.26 | 1.1 | 0.15 | 0.4 | |
| | 6/1/2016 14:20 | 7.11 | 7.11 | 14.96 | 17.65 | 9.85 | 17.65 | 100% | 10.94 | 10.95 | 0.01 | 0.00 | | 0.26 | 1.4 | 0.19 | 0.5 | |
| | 6/8/2016 13:30 | 6.97 | 6.92 | 21.93 | 26.67 | 9.02 | 26.67 | 99% | 9.40 | 9.48 | 0.08 | -1.54 | | 0.26 | 1.3 | 0.17 | 0.5 | 0.42 |

Assumed LNAPL specific gravity = 0.8567

All calculations performed pursuant to the methodology detailed in ASTM E2856-13

[a]The maximum theoretical drawdown is used for each interval calculation where the measured drawdown is negative or where it exceeds the theoretical maximum.

[b]Represents the average of the stabilized recovery rates/LNAPL transmissivity estimates (i.e., excludes initial elevated values that would not represent potential long-term recovery rates).

Equilibrium data is an average of quarterly groundwater data collected from March 2016 through Februrary 2018 and excludes data collected during skimming operations.

# AW-68 Skimming Evaluation

# Appendix A

## AW-68 LNAPL Skimming Test Results
## IMTT Savannah North Terminal
## Savannah, Georgia

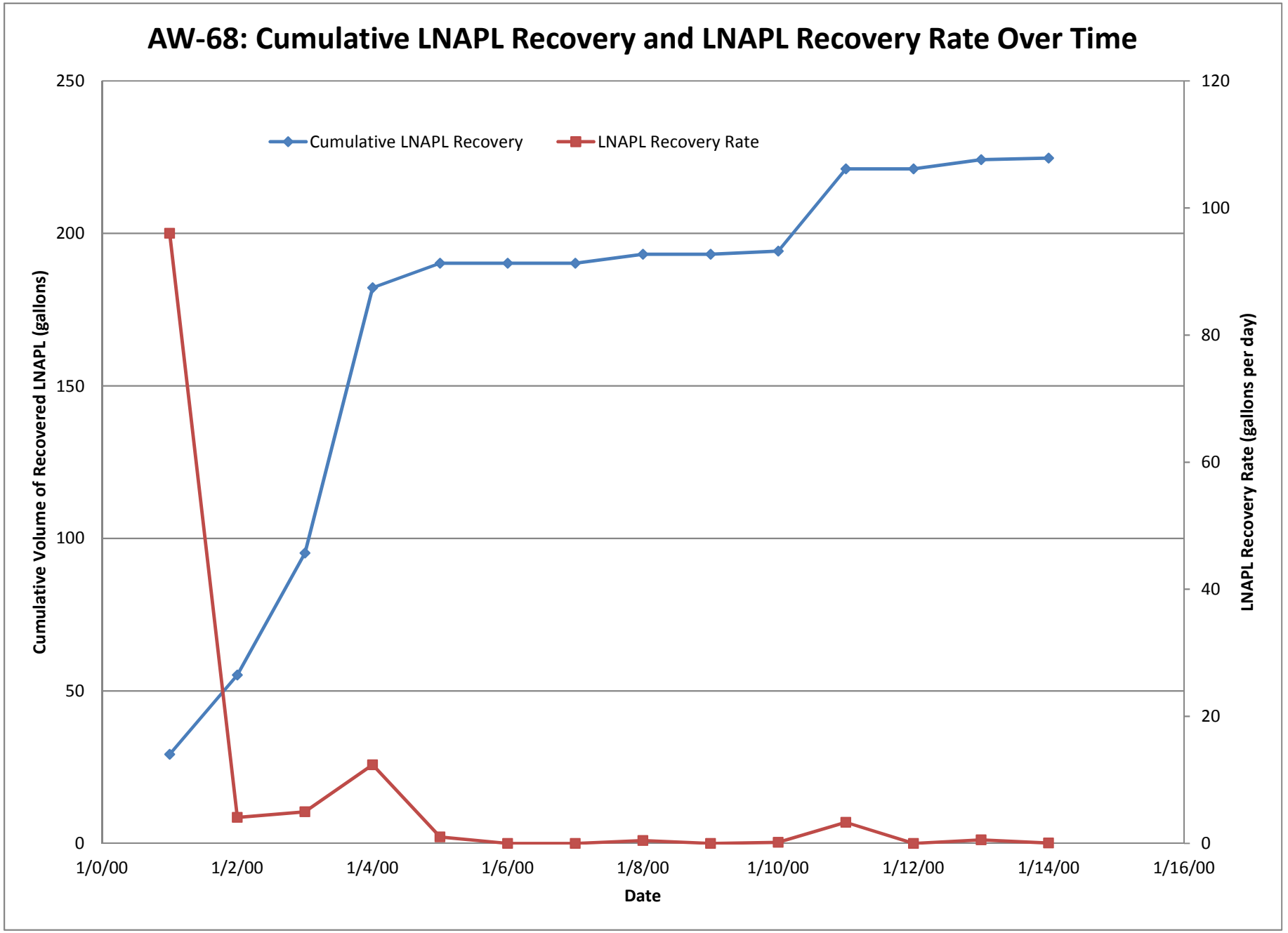
| Well ID | Measurement Date & Time | Time Between Measurement Events (days) | Actual Skimmer Run-Time Between Measurement Events (days) | Cumulative Run Time (days) | Total Volume of LNAPL Recovered (gallons) | Volume of LNAPL Recovered During Measurement Interval (gallons) | RUNNING Total Volume of LNAPL Recovered (gallons) | Depth to LNAPL (feet btoc) | Depth to Water (feet btoc) | In-Well LNAPL Thickness (feet) | LNAPL Drawdown (feet) | Maximum Theoretical Unconfined LNAPL Drawdown (feet) | LNAPL Drawdown Used in Transmissivity Estimate[a] (feet) | Average LNAPL Recovery Rate for Interval (gal/day) | Average LNAPL Recovery Rate for Interval ($ft^3$/day) | Estimated LNAPL Transmissivity for Interval ($ft^2$/day) | Overall Average LNAPL Transmissivity[b] ($ft^2$/day) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AW-68 Short term test | Equilibrium | | | | | | | 10.80 | 17.07 | 6.27 | -- | 0.92 | | -- | -- | -- | |
| | 5/17/2016 11:30 | -- | | -- | -- | -- | | 11.40 | 15.11 | 3.71 | -- | | -- | -- | -- | -- | |
| | 5/20/2016 9:15 | 2.91 | 2.91 | 2.91 | 5.2 | 5.2 | 5.2 | 10.74 | 10.91 | 0.17 | -0.06 | | 0.92 | 1.8 | 0.24 | 0.2 | |
| | 5/25/2016 11:00 | 5.07 | 3.60 | 6.51 | 6.6 | 1.4 | 6.6 | 10.43 | 10.76 | 0.33 | -0.37 | | 0.92 | 0.4 | 0.05 | 0.04 | |
| | 6/1/2016 13:00 | 7.08 | 4.04 | 10.55 | 6.9 | 0.3 | 6.9 | 11.46 | 11.84 | 0.38 | 0.66 | | 0.92 | 0.1 | 0.010 | 0.01 | |
| | 6/8/2016 12:15 | 6.97 | 6.97 | 17.51 | 13.2 | 6.3 | 13.2 | 9.90 | 10.85 | 0.95 | -0.90 | | 0.92 | 0.9 | 0.12 | 0.10 | 0.0 |
| AW-68 Long term test | 11/30/2017 9:50 | -- | -- | 0.00 | -- | -- | -- | 10.83 | 17.17 | 6.34 | -- | | | -- | -- | -- | |
| | 12/6/2017 11:08 | 6.05 | 6.05 | 6.05 | 0.0 | 0.0 | 13.2 | 10.12 | 15.15 | 5.03 | -0.68 | | 0.92 | 0.0 | 0.00 | 0.0 | |
| | 12/6/2017 14:20 | 0.13 | 0.13 | 6.18 | 12.0 | 12.0 | 25.2 | 11.11 | 13.05 | 1.94 | 0.31 | | 0.92 | 90.0 | 12.03 | 9.6 | |
| | 12/6/2017 14:50 | 0.02 | 0.02 | 6.20 | 13.0 | 1.0 | 26.2 | 11.36 | 12.45 | 1.09 | 0.56 | | 0.92 | 48.0 | 6.42 | 5.1 | |
| | 12/6/2017 15:20 | 0.02 | 0.02 | 6.22 | 14.0 | 1.0 | 27.2 | 11.60 | 12.35 | 0.75 | 0.80 | | 0.92 | 48.0 | 6.42 | 5.1 | |
| | 12/6/2017 15:50 | 0.02 | 0.02 | 6.25 | 16.0 | 2.0 | 29.2 | 11.89 | 12.27 | 0.38 | 1.09 | | 0.92 | 96.0 | 12.83 | 10.2 | |
| | 12/13/2017 10:40 | 6.78 | 6.34 | 12.59 | 42.0 | 26.0 | 55.2 | 12.36 | 12.61 | 0.25 | 1.56 | | 0.92 | 4.1 | 0.55 | 0.4 | |
| | 12/21/2017 12:31 | 8.08 | 8.08 | 20.67 | 82.0 | 40.0 | 95.2 | 11.35 | 11.37 | 0.02 | 0.55 | | 0.92 | 5.0 | 0.66 | 0.5 | |
| | 12/28/2017 13:23 | 7.04 | 7.04 | 27.70 | 169.0 | 87.0 | 182.2 | 12.10 | 12.17 | 0.07 | 1.30 | | 0.92 | 12.4 | 1.65 | 1.3 | |
| | 1/5/2018 13:23 | 8.00 | 7.80 | 35.50 | 177.0 | 8.0 | 190.2 | 11.33 | 11.35 | 0.02 | 0.53 | | 0.92 | 1.0 | 0.14 | 0.1 | |
| | 1/12/2018 12:39 | 6.97 | 6.97 | 42.47 | 177.0 | 0.0 | 190.2 | 12.59 | 12.65 | 0.06 | 1.79 | | 0.92 | 0.0 | 0.00 | 0.0 | |
| | 1/19/2018 13:04 | 7.02 | 7.02 | 49.49 | 177.0 | 0.0 | 190.2 | 11.51 | 11.86 | 0.35 | 0.71 | | 0.92 | 0.0 | 0.00 | 0.0 | |
| | 1/26/2018 11:25 | 6.93 | 6.93 | 56.42 | 180.0 | 3.0 | 193.2 | 12.78 | 13.95 | 1.17 | 1.98 | | 0.92 | 0.4 | 0.06 | 0.0 | |
| | 2/1/2018 11:36 | 6.01 | 5.81 | 62.23 | 180.0 | 0.0 | 193.2 | 11.23 | 11.43 | 0.20 | 0.43 | | 0.92 | 0.0 | 0.00 | 0.0 | |
| | 2/7/2018 8:25 | 5.87 | 5.87 | 68.10 | 181.0 | 1.0 | 194.2 | 12.65 | 13.05 | 0.40 | 1.85 | | 0.92 | 0.2 | 0.02 | 0.0 | |
| | 2/15/2018 12:02 | 8.15 | 8.15 | 76.25 | 208.0 | 27.0 | 221.2 | 11.64 | 11.71 | 0.07 | 0.84 | | 0.92 | 3.3 | 0.44 | 0.4 | |
| | 2/22/2018 12:57 | 7.04 | 7.04 | 83.28 | 208.0 | 0.0 | 221.2 | 11.41 | 11.72 | 0.31 | 0.61 | | 0.92 | 0.0 | 0.00 | 0.0 | |
| | 2/28/2018 7:52 | 5.79 | 5.58 | 88.87 | 211.0 | 3.0 | 224.2 | 10.86 | 11.05 | 0.19 | 0.06 | | 0.92 | 0.5 | 0.07 | 0.1 | |
| | 3/7/2018 11:30 | 7.15 | 7.15 | 96.02 | 211.5 | 0.5 | 224.7 | 11.49 | 11.78 | 0.29 | 0.69 | | 0.92 | 0.1 | 0.01 | 0.0 | 0.12 |
| | Test Completed | | | | | | | | | | | | | | | | |

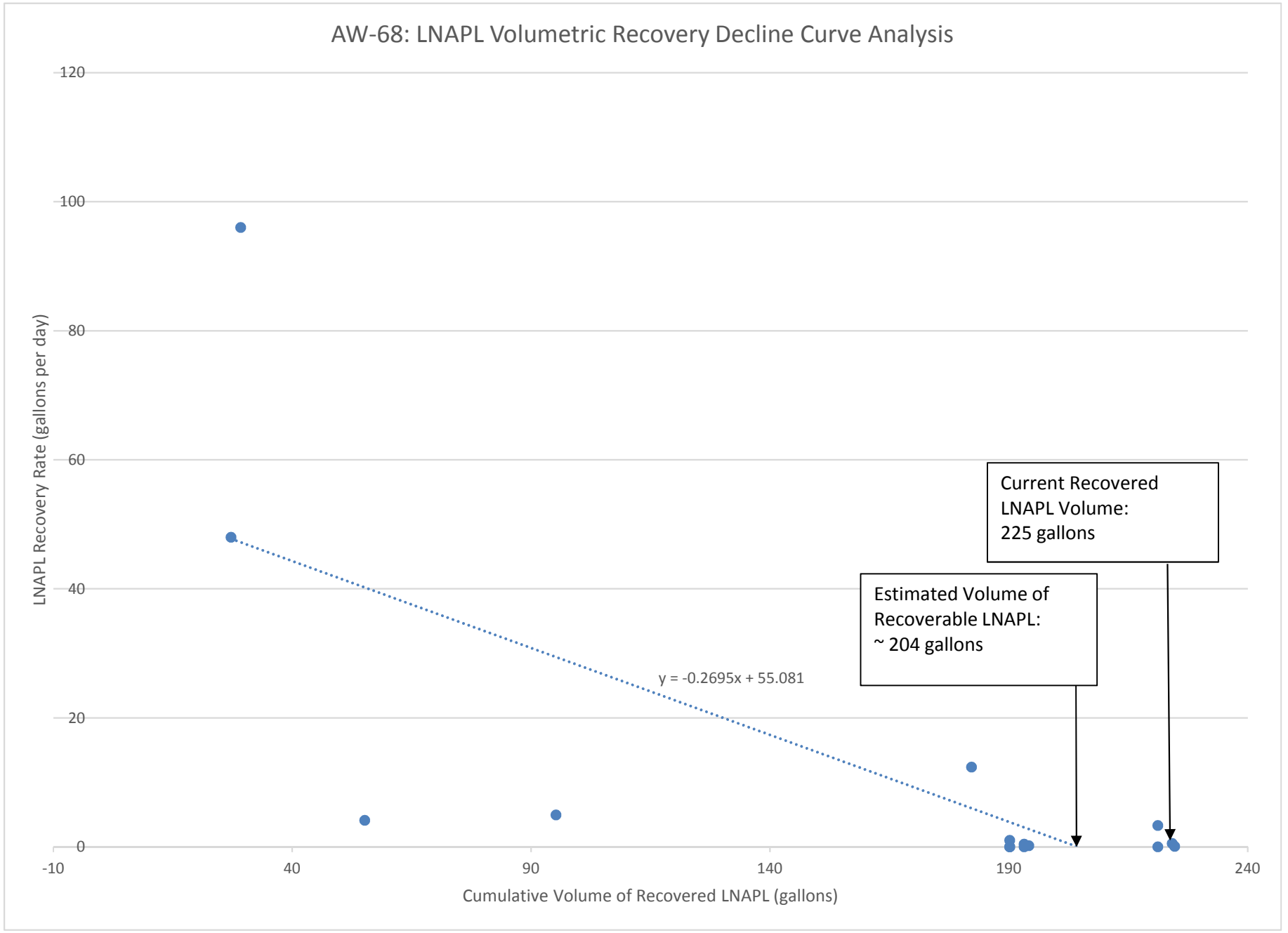
Assumed LNAPL specific gravity = 0.854

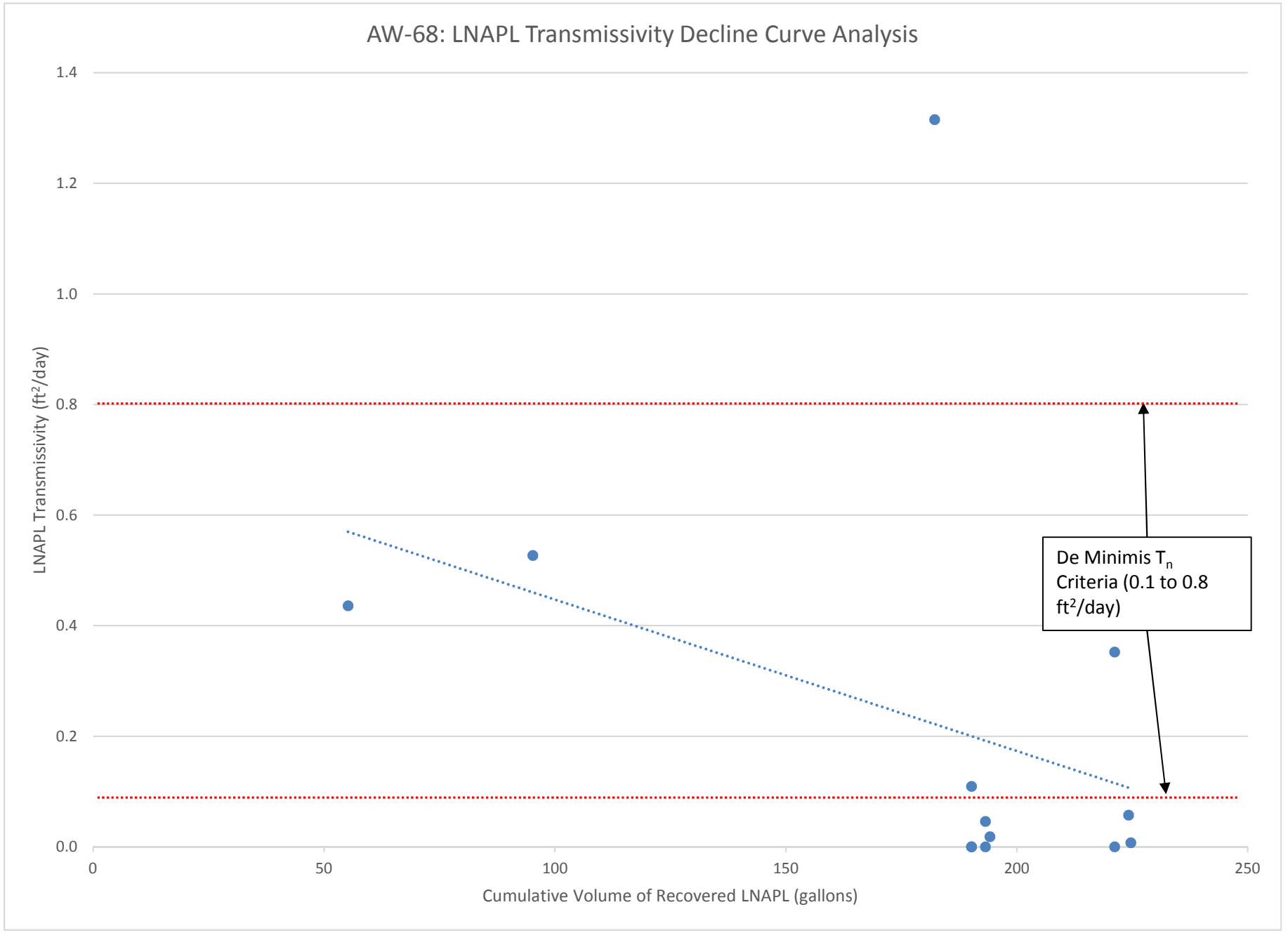
All calculations performed pursuant to the methodology detailed in ASTM E2856-13

[a]The maximum theoretical drawdown is used for each interval calculation where the measured drawdown is negative or where it exceeds the theoretical maximum.

[b]Represents the geometric mean of the stabilized recovery rates/LNAPL transmissivity estimates (i.e., excludes initial elevated values that would not represent potential long-term recovery rates).


AW-68: Cumulative LNAPL Recovery and LNAPL Recovery Rate Over Time
Cumulative LNAPL Recovery
LNAPL Recovery Rate
Cumulative Volume of Recovered LNAPL (gallons)
LNAPL Recovery Rate (gallons per day)
Date
250
200
150
100
50
0
120
100
80
60
40
20
0
1/0/00
1/2/00
1/4/00
1/6/00
1/8/00
1/10/00
1/12/00
1/14/00
1/16/00


AW-68: LNAPL Volumetric Recovery Decline Curve Analysis
LNAPL Recovery Rate (gallons per day)
120
100
80
60
40
20
0
-10
40
90
140
190
240
Cumulative Volume of Recovered LNAPL (gallons)
y = -0.2695x + 55.081
Current Recovered LNAPL Volume: 225 gallons
Estimated Volume of Recoverable LNAPL: ~ 204 gallons


AW-68: LNAPL Transmissivity Decline Curve Analysis
LNAPL Transmissivity (ft²/day)
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
0
50
100
150
200
250
Cumulative Volume of Recovered LNAPL (gallons)
De Minimis Tn Criteria (0.1 to 0.8 ft²/day)

# AW-74 Skimming Evaluation

## Appendix A

## AW-74 LNAPL Skimming Test Results
## IMTT Savannah North Terminal
## Savannah, Georgia

| Well ID | Measurement Date & Time | Time Between Measurement Events (days) | Actual Skimmer Run-Time Between Measurement Events (days) | Cumulative Run Time (days) | Total Volume of LNAPL Recovered (gallons) | Volume of LNAPL Recovered During Measurement Interval (gallons) | RUNNING Total Volume of LNAPL Recovered (gallons) | Depth to LNAPL (feet btoc) | Depth to Water (feet btoc) | In-Well LNAPL Thickness (feet) | LNAPL Drawdown (feet) | Maximum Theoretical Unconfined LNAPL Drawdown (feet) | LNAPL Drawdown Used in Transmissivity Estimate[a] (feet) | Average LNAPL Recovery Rate for Interval (gal/day) | Average LNAPL Recovery Rate for Interval ($ft^3$/day) | Estimated LNAPL Transmissivity for Interval ($ft^2$/day) | Overall Average LNAPL Transmissivity[b] ($ft^2$/day) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Equilibrium** | | | | | | | **7.97** | **10.48** | **2.51** | **--** | **0.37** | | **--** | **--** | **--** | |
| AW-74 | 8/30/2017 16:00 | -- | -- | | -- | -- | 0.0 | 6.25 | 8.08 | 1.83 | -- | | | -- | -- | -- | |
| | 8/30/2017 17:48 | 0.08 | 0.06 | 0.06 | 3.30 | 3.3 | 3.3 | 6.52 | 6.78 | 0.26 | -1.45 | | 0.37 | 59.6 | 7.97 | 15.8 | |
| | 9/6/2017 12:19 | 6.77 | 6.77 | 6.83 | 7.00 | 3.7 | 7.0 | 7.49 | 7.70 | 0.21 | -0.48 | | 0.37 | 0.5 | 0.07 | 0.1 | |
| | *END OF TEST INTERVAL - SHUTDOWN DUE TO HURRICANE* | | | | | | | | | | | | | | | | |
| | 9/21/2017 12:00 | -- | -- | | -- | | -- | 6.15 | 6.20 | 0.05 | -- | | | -- | -- | -- | |
| | 9/22/2017 8:12 | 0.84 | 0.84 | 0.84 | 7.00 | 0.0 | 7.0 | 7.58 | 7.65 | 0.07 | -0.39 | | 0.37 | 0.0 | 0.00 | 0.0 | |
| | 9/29/2017 12:55 | 7.20 | 7.20 | 8.04 | 7.00 | 0.0 | 7.0 | 7.95 | 7.99 | 0.04 | -0.02 | | 0.37 | 0.0 | 0.00 | 0.0 | |
| | 10/6/2017 12:55 | 7.00 | 7.00 | 15.04 | 7.00 | 0.0 | 7.0 | 6.74 | 6.75 | 0.01 | -1.23 | | 0.37 | 0.0 | 0.00 | 0.0 | |
| | 10/12/2017 11:12 | 5.93 | 5.93 | 20.97 | 7.00 | 0.0 | 7.0 | 8.88 | 8.95 | 0.07 | 0.91 | | 0.37 | 0.0 | 0.00 | 0.0 | |
| | 10/19/2017 10:50 | 6.98 | 6.98 | 27.95 | 7.00 | 0.0 | 7.0 | 5.94 | 5.97 | 0.03 | -2.03 | | 0.37 | 0.0 | 0.00 | 0.0 | |
| | 11/2/2017 8:43 | 13.91 | 13.91 | 41.86 | 7.00 | 0.0 | 7.0 | 6.77 | 6.93 | 0.16 | -1.20 | | 0.37 | 0.0 | 0.00 | 0.0 | |
| | 11/8/2017 12:07 | 6.14 | 6.14 | 48.00 | 7.00 | 0.0 | 7.0 | 6.55 | 7.01 | 0.46 | -1.42 | | 0.37 | 0.0 | 0.00 | 0.0 | |
| | 11/15/2017 11:28 | 6.97 | 6.97 | 54.98 | 7.00 | 0.0 | 7.0 | 8.68 | 9.47 | 0.79 | 0.71 | | 0.37 | 0.0 | 0.00 | 0.0 | |
| | 11/22/2017 10:17 | 6.95 | 6.95 | 61.93 | 7.00 | 0.0 | 7.0 | 7.53 | 8.25 | 0.72 | -0.44 | | 0.37 | 0.0 | 0.00 | 0.0 | |
| | 11/30/2017 9:57 | 7.99 | 7.99 | 69.91 | 7.00 | 0.0 | 7.0 | 9.96 | 11.00 | 1.04 | 1.99 | | 1.37 | 0.0 | 0.00 | 0.0 | |
| | *TEST CONCLUDED* | | | | | | | | | | | | | | | | |

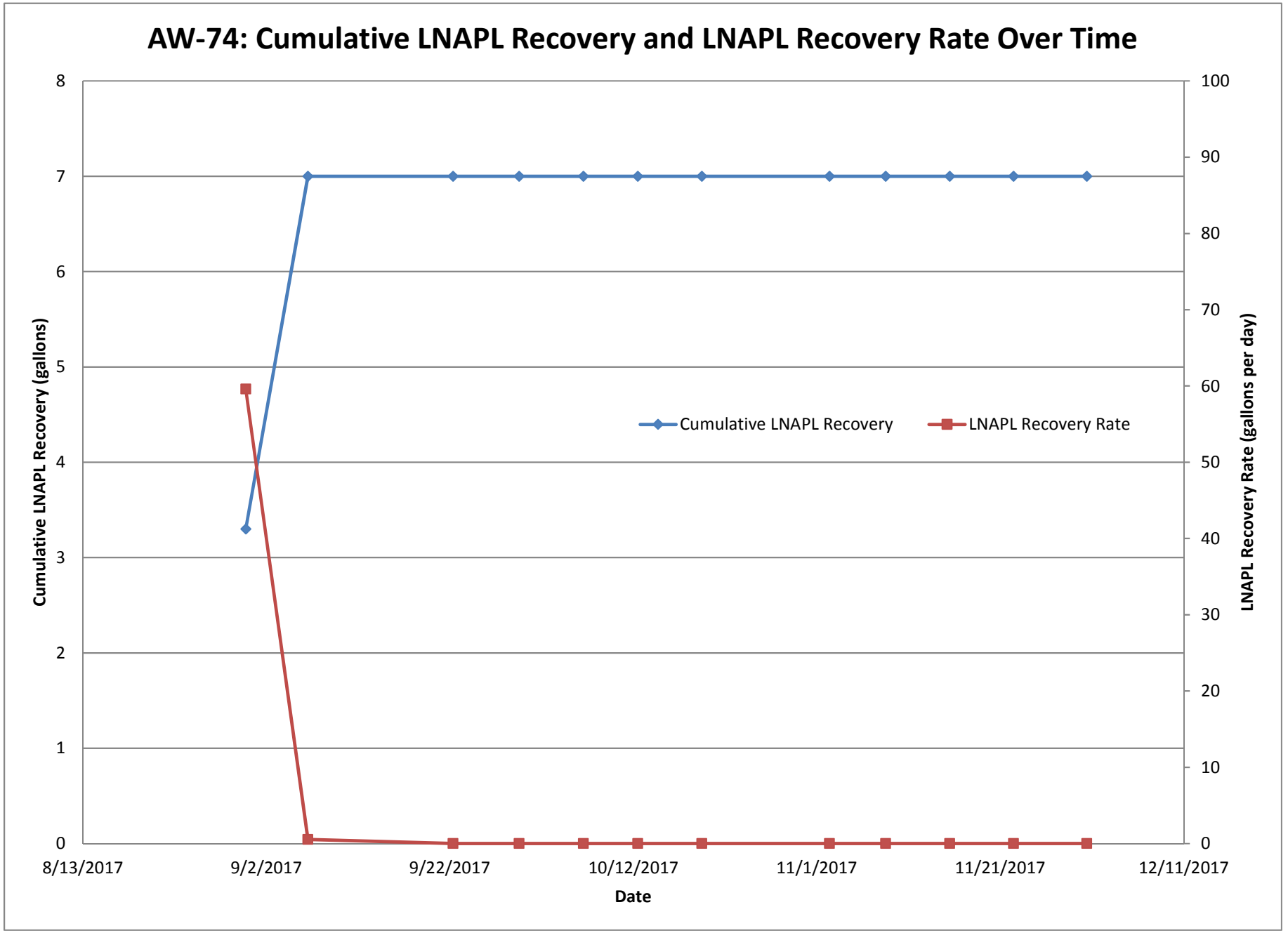
Assumed LNAPL specific gravity = 0.854

All calculations performed pursuant to the methodology detailed in ASTM E2856-13

[a]The maximum theoretical drawdown is used for each interval calculation where the measured drawdown is negative or where it exceeds the theoretical maximum.

[b]Represents the geometric mean of the stabilized recovery rates/LNAPL transmissivity estimates (i.e., excludes initial elevated values that would not represent potential long-term recovery rates).

Equilibrium data is an average of quarterly groundwater data collected from March 2016 through Februrary 2018 and excludes data collected during or following skimming operations.


AW-74: Cumulative LNAPL Recovery and LNAPL Recovery Rate Over Time
Cumulative LNAPL Recovery (gallons)
LNAPL Recovery Rate (gallons per day)
Date
Cumulative LNAPL Recovery
LNAPL Recovery Rate
0
1
2
3
4
5
6
7
8
0
10
20
30
40
50
60
70
80
90
100
8/13/2017
9/2/2017
9/22/2017
10/12/2017
11/1/2017
11/21/2017
12/11/2017

# AW-82 Skimming Evaluation

# Appendix A

## AW-82 LNAPL Skimming Test Results
## IMTT Savannah North Terminal
## Savannah, Georgia

| Well ID | Measurement Date & Time | Time Between Measurement Events (days) | Actual Skimmer Run-Time Between Measurement Events (days) | Cumulative Run Time (days) | Total Volume of LNAPL Recovered (gallons) | Volume of LNAPL Recovered During Measurement Interval (gallons) | RUNNING Total Volume of LNAPL Recovered (gallons) | Depth to LNAPL (feet btoc) | Depth to Water (feet btoc) | In-Well LNAPL Thickness (feet) | LNAPL Drawdown (feet) | Maximum Theoretical Unconfined LNAPL Drawdown (feet) | LNAPL Drawdown Used in Transmissivity Estimate[a] (feet) | Average LNAPL Recovery Rate for Interval (gal/day) | Average LNAPL Recovery Rate for Interval ($ft^3$/day) | Estimated LNAPL Transmissivity for Interval ($ft^2$/day) | Overall Average LNAPL Transmissivity[b] ($ft^2$/day) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AW-82 Short term test | Equilibrium | | | | | | | 9.58 | 12.46 | 2.88 | -- | 0.42 | | -- | -- | -- | |
| | 6/28/2016 11:00 | -- | | -- | -- | -- | | 9.11 | 12.62 | 3.51 | -- | | -- | -- | -- | -- | |
| | 6/28/2016 14:15 | 0.14 | 0.13 | 0.13 | 4.1 | 4.1 | 4.1 | -- | -- | -- | | | 0.42 | 30.4 | 4.07 | 7.1 | |
| | 7/1/2016 9:25 | 2.80 | 2.78 | 2.92 | 6.0 | 1.9 | 6.0 | 8.89 | 12.33 | 3.44 | -0.69 | | 0.42 | 0.7 | 0.09 | 0.2 | |
| | 7/7/2016 13:10 | 6.16 | 6.16 | 9.08 | 12.3 | 6.3 | 12.3 | 9.27 | 12.42 | 3.15 | -0.31 | | 0.42 | 1.0 | 0.14 | 0.2 | |
| | 7/11/2016 12:00 | 3.95 | 2.24 | 11.31 | 22.7 | 10.4 | 22.7 | 9.66 | 13.36 | 3.70 | 0.08 | | 0.42 | 4.7 | 0.62 | 1.1 | |
| | 7/12/2016 9:35 | 0.90 | 0.65 | 11.96 | 26.0 | 3.3 | 26.0 | 9.63 | 12.65 | 3.02 | 0.05 | | 0.42 | 5.1 | 0.68 | 1.2 | |
| | 7/12/2016 12:25 | 0.12 | 0.12 | 12.08 | 26.4 | 0.4 | 26.4 | 9.82 | 12.74 | 2.92 | 0.24 | | 0.42 | 3.4 | 0.45 | 0.8 | |
| | 7/19/2016 12:00 | 6.98 | 6.98 | 19.06 | 49.7 | 23.3 | 49.7 | 9.69 | 12.56 | 2.87 | 0.11 | | 0.42 | 3.3 | 0.45 | 0.8 | |
| | 7/21/2016 13:45 | 2.07 | 2.02 | 21.08 | 57.8 | 8.1 | 57.8 | 9.53 | 12.85 | 3.32 | -0.05 | | 0.42 | 4.0 | 0.53 | 0.9 | |
| | 7/27/2016 11:25 | 5.90 | 5.84 | 26.93 | 79.1 | 21.3 | 79.1 | 10.00 | 13.00 | 3.00 | 0.42 | | 0.42 | 3.6 | 0.49 | 0.8 | 0.6 |
| | *END OF TEST INTERVAL* | | | | | | | | | | | | | | | | |
| | 11/16/2016 10:05 | -- | -- | -- | -- | -- | | 9.04 | 11.81 | 2.77 | -- | | -- | -- | -- | -- | |
| | 11/22/2016 11:20 | 6.05 | 5.94 | 5.94 | 16.2 | 16.2 | 95.3 | 10.82 | 10.96 | 0.14 | 1.24 | | 0.42 | 2.7 | 0.36 | 0.6 | |
| | 11/29/2016 11:55 | 7.02 | 7.02 | 12.96 | 42.1 | 25.9 | 121.2 | 10.29 | 11.80 | 1.51 | 0.71 | | 0.42 | 3.7 | 0.49 | 0.9 | |
| | 12/5/2016 11:55 | 6.00 | 5.77 | 18.73 | 80.9 | 38.8 | 160.0 | 10.56 | 11.30 | 0.74 | 0.98 | | 0.42 | 6.7 | 0.90 | 1.6 | |
| | 12/7/2016 12:10 | 2.01 | 2.00 | 20.73 | 89.0 | 8.1 | 168.1 | 10.54 | 10.92 | 0.38 | 0.96 | | 0.42 | 4.0 | 0.54 | 0.9 | |
| | 12/14/2016 9:10 | 6.88 | 6.82 | 27.55 | 104.3 | 15.4 | 183.4 | 10.45 | 10.58 | 0.13 | 0.87 | | 0.42 | 2.3 | 0.30 | 0.5 | |
| | 12/21/2016 8:48 | 6.98 | 6.94 | 34.50 | 114.1 | 9.7 | 193.2 | 10.45 | 11.40 | 0.95 | 0.87 | | 0.42 | 1.4 | 0.19 | 0.3 | |
| | 12/27/2016 11:40 | 6.12 | 6.00 | 40.50 | 125.3 | 11.2 | 204.4 | 10.37 | 10.56 | 0.19 | 0.79 | | 0.42 | 1.9 | 0.25 | 0.4 | |
| | 1/4/2017 10:46 | 7.96 | 7.92 | 48.41 | 150.1 | 24.8 | 229.2 | 11.14 | 11.56 | 0.42 | 1.56 | | 0.42 | 3.1 | 0.42 | 0.7 | |
| | 1/9/2017 11:04 | 5.01 | 4.80 | 53.21 | 165.3 | 15.2 | 244.4 | 10.87 | 10.96 | 0.09 | 1.29 | | 0.42 | 3.2 | 0.42 | 0.7 | |
| | 1/19/2017 9:45 | 9.95 | 9.81 | 63.02 | 190.7 | 25.4 | 269.8 | 11.10 | 11.28 | 0.18 | 1.52 | | 0.42 | 2.6 | 0.35 | 0.6 | 0.7 |
| | *END OF TEST INTERVAL* | | | | | | | | | | | | | | | | |
| | 4/27/2017 11:50 | -- | -- | 0.00 | -- | -- | -- | 9.97 | 13.02 | 3.05 | -- | | | -- | -- | -- | |
| | 5/2/2017 13:01 | 5.05 | 5.05 | 5.05 | 119.0 | 119.0 | 388.8 | 11.23 | 11.38 | 0.15 | 1.65 | | 0.42 | 23.6 | 3.15 | 5.5 | |
| | 5/10/2017 10:17 | 7.89 | 7.89 | 12.94 | 194.0 | 75.0 | 463.8 | 10.85 | 12.26 | 1.41 | 1.27 | | 0.42 | 9.5 | 1.27 | 2.2 | |
| | 5/17/2017 7:24 | 6.88 | 6.88 | 19.82 | 246.0 | 52.0 | 515.8 | 10.93 | 11.09 | 0.16 | 1.35 | | 0.42 | 7.6 | 1.01 | 1.8 | |
| | 5/26/2017 10:34 | 9.13 | 9.13 | 28.95 | 306.0 | 60.0 | 575.8 | 10.96 | 11.15 | 0.19 | 1.38 | | 0.42 | 6.6 | 0.88 | 1.5 | |
| | 6/1/2017 7:34 | 5.88 | 5.88 | 34.82 | 327.0 | 21.0 | 596.8 | 10.61 | 10.80 | 0.19 | 1.03 | | 0.42 | 3.6 | 0.48 | 0.8 | |
| | 6/8/2017 11:05 | 7.15 | 6.88 | 41.70 | 352.0 | 25.0 | 621.8 | 10.31 | 10.45 | 0.14 | 0.73 | | 0.42 | 3.6 | 0.49 | 0.8 | |
| | 6/15/2017 10:20 | 6.97 | 6.97 | 48.67 | 367.9 | 15.9 | 637.7 | 10.81 | 10.98 | 0.17 | 1.23 | | 0.42 | 2.3 | 0.30 | 0.5 | |
| | 6/22/2017 11:00 | 7.03 | 7.03 | 55.70 | 392.9 | 25.0 | 662.7 | 10.48 | 10.63 | 0.15 | 0.90 | | 0.42 | 3.6 | 0.48 | 0.8 | |
| | 6/26/2017 12:38 | 4.07 | 4.07 | 59.77 | 406.0 | 13.1 | 675.8 | 10.51 | 10.66 | 0.15 | 0.93 | | 0.42 | 3.2 | 0.43 | 0.8 | |
| | 6/30/2017 12:34 | 4.00 | 4.00 | 63.76 | 459.5 | 53.5 | 729.3 | 10.56 | 11.45 | 0.89 | 0.98 | | 0.42 | 13.4 | 1.79 | 3.1 | |
| | 7/7/2017 7:55 | 6.81 | 5.40 | 69.17 | 469.0 | 9.5 | 738.8 | 10.00 | 10.90 | 0.90 | 0.42 | | 0.42 | 1.8 | 0.23 | 0.4 | |
| | 7/12/2017 15:11 | 5.30 | 5.30 | 74.47 | 486.8 | 17.8 | 756.6 | 10.08 | 10.16 | 0.08 | 0.50 | | 0.42 | 3.4 | 0.45 | 0.8 | |
| | 7/19/2017 11:52 | 6.86 | 6.59 | 81.06 | 497.0 | 10.2 | 766.8 | 10.15 | 10.24 | 0.09 | 0.57 | | 0.42 | 1.5 | 0.21 | 0.4 | |
| | 7/26/2017 11:35 | 6.99 | 6.99 | 88.05 | 540.9 | 43.9 | 810.7 | 10.04 | 10.06 | 0.02 | 0.46 | | 0.42 | 6.3 | 0.84 | 1.5 | |
| | 8/2/2017 12:26 | 7.04 | 7.04 | 95.08 | 549.0 | 8.1 | 818.8 | 9.70 | 9.91 | 0.21 | 0.12 | | 0.42 | 1.2 | 0.15 | 0.3 | |
| | 8/9/2017 10:03 | 6.90 | 6.90 | 101.98 | 552.0 | 3.0 | 821.8 | 9.75 | 9.90 | 0.15 | 0.17 | | 0.42 | 0.4 | 0.06 | 0.1 | |
| | 8/17/2017 8:21 | 7.93 | 7.93 | 109.91 | 554.0 | 2.0 | 823.8 | 9.42 | 9.45 | 0.03 | -0.16 | | 0.42 | 0.3 | 0.03 | 0.1 | |
| | 8/22/2017 12:15 | 5.16 | 5.16 | 115.07 | 563.0 | 9.0 | 832.8 | 9.48 | 9.58 | 0.10 | -0.10 | | 0.42 | 1.7 | 0.23 | 0.4 | |
| | 8/30/2017 17:42 | 8.23 | 7.97 | 123.04 | 568.7 | 5.7 | 838.5 | 9.52 | 9.66 | 0.14 | -0.06 | | 0.42 | 0.7 | 0.10 | 0.2 | |
| | 9/6/2017 14:20 | 6.86 | 6.86 | 129.90 | 574.0 | 5.3 | 843.8 | -- | -- | -- | -- | | 0.42 | 0.8 | 0.10 | 0.2 | |
| | *END OF TEST INTERVAL - SHUTDOWN DUE TO HURRICANE* | | | | | | | | | | | | | | | | |

## Appendix A

## AW-82 LNAPL Skimming Test Results
## IMTT Savannah North Terminal
## Savannah, Georgia

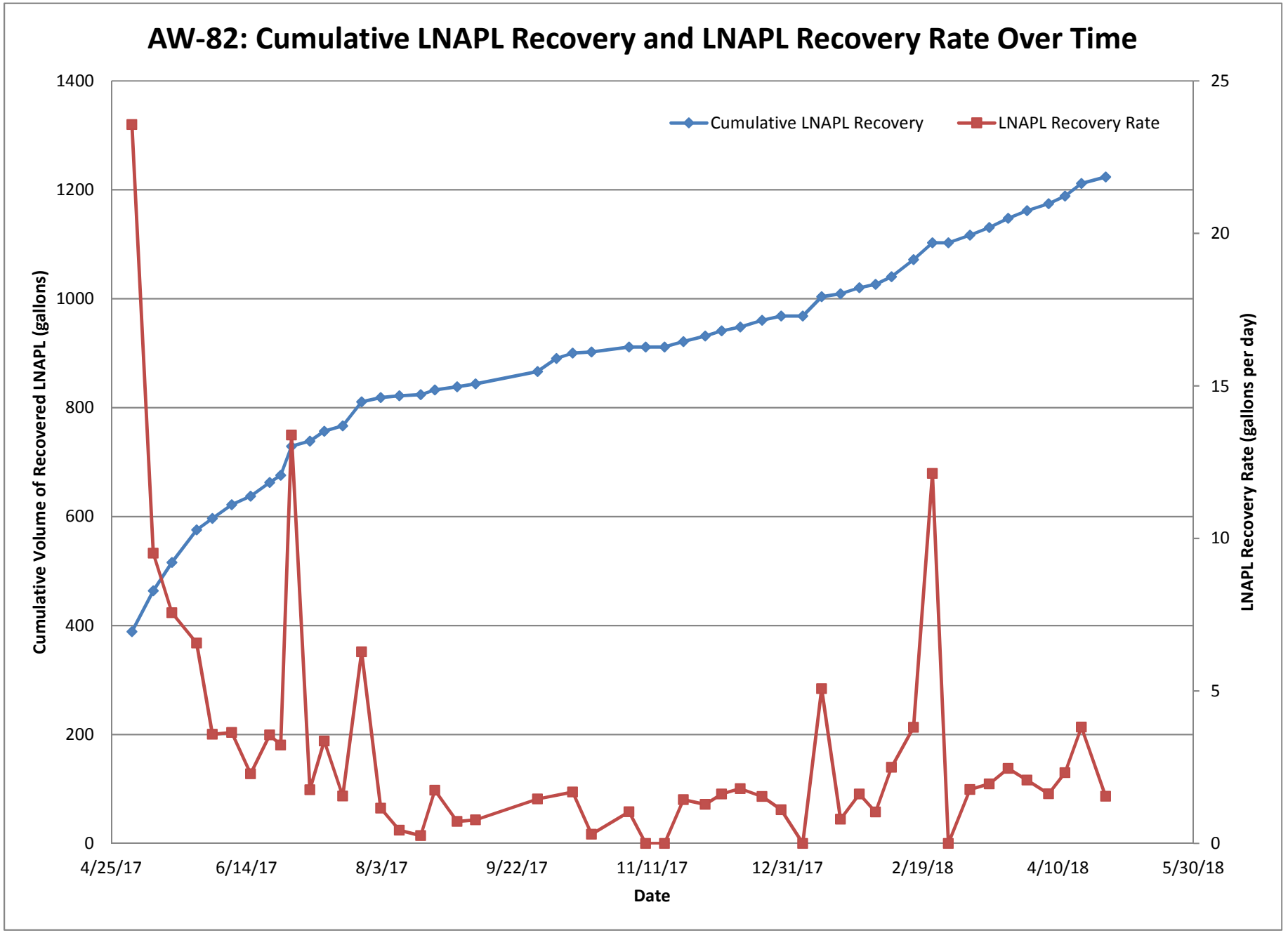
| Well ID | Measurement Date & Time | Time Between Measurement Events (days) | Actual Skimmer Run-Time Between Measurement Events (days) | Cumulative Run Time (days) | Total Volume of LNAPL Recovered (gallons) | Volume of LNAPL Recovered During Measurement Interval (gallons) | RUNNING Total Volume of LNAPL Recovered (gallons) | Depth to LNAPL (feet btoc) | Depth to Water (feet btoc) | In-Well LNAPL Thickness (feet) | LNAPL Drawdown (feet) | Maximum Theoretical Unconfined LNAPL Drawdown (feet) | LNAPL Drawdown Used in Transmissivity Estimate[a] (feet) | Average LNAPL Recovery Rate for Interval (gal/day) | Average LNAPL Recovery Rate for Interval ($ft^3$/day) | Estimated LNAPL Transmissivity for Interval ($ft^2$/day) | Overall Average LNAPL Transmissivity[b] ($ft^2$/day) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AW-82 Long term test | 9/21/2017 11:28 | -- | -- | -- | -- | -- | 843.8 | 8.59 | 10.61 | 2.02 | -- | | | -- | -- | -- | |
| | 9/22/2017 8:51 | 0.89 | 0.89 | 130.79 | 12.3 | 12.3 | 856.1 | 9.35 | 9.41 | 0.06 | -0.23 | | 0.42 | 13.8 | 1.85 | 3.2 | |
| | 9/29/2017 12:35 | 7.16 | 7.16 | 137.95 | 22.7 | 10.4 | 866.5 | 9.54 | 9.70 | 0.16 | -0.04 | | 0.42 | 1.5 | 0.19 | 0.3 | |
| | 10/6/2017 12:23 | 6.99 | 0.74 | 138.69 | 46.4 | 23.7 | 890.2 | 9.05 | 10.36 | 1.31 | -0.53 | | 0.42 | 32.0 | 4.27 | 7.5 | |
| | 10/12/2017 10:45 | 5.93 | 5.93 | 144.62 | 56.4 | 10.0 | 900.2 | 9.75 | 9.92 | 0.17 | 0.17 | | 0.42 | 1.7 | 0.23 | 0.4 | |
| | 10/19/2017 11:30 | 7.03 | 7.03 | 151.65 | 58.5 | 2.1 | 902.3 | 9.27 | 9.39 | 0.12 | -0.31 | | 0.42 | 0.3 | 0.04 | 0.1 | |
| | 11/2/2017 8:34 | 13.88 | 8.91 | 160.56 | 67.7 | 9.2 | 911.5 | 10.20 | 10.44 | 0.24 | 0.62 | | 0.42 | 1.0 | 0.14 | 0.2 | |
| | 11/8/2017 11:50 | 6.14 | 6.14 | 166.69 | 67.7 | 0.0 | 911.5 | 10.06 | 10.29 | 0.23 | 0.48 | | 0.42 | 0.0 | 0.00 | 0.0 | |
| | 11/15/2017 11:01 | 6.97 | 6.97 | 173.66 | 67.7 | 0.0 | 911.5 | 9.87 | 10.50 | 0.63 | 0.29 | | 0.42 | 0.0 | 0.00 | 0.0 | |
| | 11/22/2017 10:09 | 6.96 | 6.96 | 180.62 | 77.7 | 10.0 | 921.5 | 10.53 | 10.79 | 0.26 | 0.95 | | 0.42 | 1.4 | 0.19 | 0.3 | |
| | 11/30/2017 11:40 | 8.06 | 7.84 | 188.46 | 87.7 | 10.0 | 931.5 | 10.41 | 10.68 | 0.27 | 0.83 | | 0.42 | 1.3 | 0.17 | 0.3 | |
| | 12/6/2017 13:00 | 6.06 | 6.06 | 194.52 | 97.5 | 9.8 | 941.3 | 10.13 | 10.38 | 0.25 | 0.55 | | 0.42 | 1.6 | 0.22 | 0.4 | |
| | 12/13/2017 10:10 | 6.88 | 3.79 | 198.31 | 104.3 | 6.8 | 948.1 | 10.22 | 12.18 | 1.96 | 0.64 | | 0.42 | 1.8 | 0.24 | 0.4 | |
| | 12/21/2017 12:03 | 8.08 | 8.08 | 206.39 | 116.7 | 12.4 | 960.5 | 10.31 | 12.17 | 1.86 | 0.73 | | 0.42 | 1.5 | 0.21 | 0.4 | |
| | 12/28/2017 13:35 | 7.06 | 7.06 | 213.45 | 124.5 | 7.8 | 968.3 | 10.97 | 11.20 | 0.23 | 1.39 | | 0.42 | 1.1 | 0.15 | 0.3 | |
| | 1/5/2018 13:18 | 7.99 | 7.75 | 221.21 | 124.5 | 0.0 | 968.3 | 10.74 | 10.98 | 0.24 | 1.16 | | 0.42 | 0.0 | 0.00 | 0.0 | |
| | 1/12/2018 13:35 | 7.01 | 7.00 | 228.21 | 160.0 | 35.5 | 1003.8 | 10.76 | 10.98 | 0.22 | 1.18 | | 0.42 | 5.1 | 0.68 | 1.2 | |
| | 1/19/2018 12:44 | 6.96 | 6.96 | 235.17 | 165.5 | 5.5 | 1009.3 | 10.65 | 10.90 | 0.25 | 1.07 | | 0.42 | 0.8 | 0.11 | 0.2 | |
| | 1/26/2018 10:57 | 6.93 | 6.93 | 242.10 | 176.7 | 11.2 | 1020.5 | 11.30 | 11.36 | 0.06 | 1.72 | | 0.42 | 1.6 | 0.22 | 0.4 | |
| | 2/1/2018 11:28 | 6.02 | 6.02 | 248.12 | 182.9 | 6.2 | 1026.7 | 10.66 | 10.90 | 0.24 | 1.08 | | 0.42 | 1.0 | 0.14 | 0.2 | |
| | 2/7/2018 8:07 | 5.86 | 5.62 | 253.74 | 196.9 | 14.0 | 1040.7 | 10.83 | 11.13 | 0.30 | 1.25 | | 0.42 | 2.5 | 0.33 | 0.6 | |
| | 2/15/2018 11:35 | 8.14 | 8.14 | 261.88 | 227.9 | 31.0 | 1071.7 | 10.23 | 10.64 | 0.41 | 0.65 | | 0.42 | 3.8 | 0.51 | 0.9 | |
| | 2/22/2018 12:50 | 7.05 | 2.56 | 264.44 | 258.9 | 31.0 | 1102.7 | 10.48 | 12.24 | 1.76 | 0.90 | | 0.42 | 12.1 | 1.62 | 2.8 | |
| | 2/28/2018 10:07 | 5.89 | 0.00 | 264.44 | 258.9 | 0.0 | 1102.7 | 9.85 | 12.17 | 2.32 | 0.27 | | 0.42 | 0.0 | 0.00 | 0.0 | |
| | 3/8/2018 8:20 | 7.93 | 7.93 | 272.36 | 272.9 | 14.0 | 1116.7 | 10.67 | 10.89 | 0.22 | 1.09 | | 0.42 | 1.8 | 0.24 | 0.4 | |
| | 3/15/2018 12:40 | 7.18 | 7.18 | 279.54 | 286.9 | 14.0 | 1130.7 | 10.75 | 10.96 | 0.21 | 1.17 | | 0.42 | 1.9 | 0.26 | 0.5 | |
| | 3/22/2018 10:58 | 6.93 | 6.93 | 286.47 | 303.9 | 17.0 | 1147.7 | 11.40 | 11.61 | 0.21 | 1.82 | | 0.42 | 2.5 | 0.33 | 0.6 | |
| | 3/29/2018 10:57 | 7.00 | 6.76 | 293.24 | 317.9 | 14.0 | 1161.7 | 10.60 | 10.78 | 0.18 | 1.02 | | 0.42 | 2.1 | 0.28 | 0.5 | |
| | 4/6/2018 10:55 | 8.00 | 8.00 | 301.23 | 330.9 | 13.0 | 1174.7 | 11.14 | 11.39 | 0.25 | 1.56 | | 0.42 | 1.6 | 0.22 | 0.4 | |
| | 4/12/2018 12:10 | 6.05 | 6.05 | 307.29 | 344.9 | 14.0 | 1188.7 | 10.94 | 11.20 | 0.26 | 1.36 | | 0.42 | 2.3 | 0.31 | 0.5 | |
| | 4/18/2018 13:03 | 6.04 | 6.04 | 313.32 | 367.9 | 23.0 | 1211.7 | 10.09 | 10.34 | 0.25 | 0.51 | | 0.42 | 3.8 | 0.51 | 0.9 | |
| | 4/27/2018 13:01 | 9.00 | 7.77 | 321.09 | 379.9 | 12.0 | 1223.7 | 10.57 | 10.81 | 0.24 | 0.99 | | 0.42 | 1.5 | 0.21 | 0.4 | 0.55 |
| | | | | | | | | | | | | | | | | | |

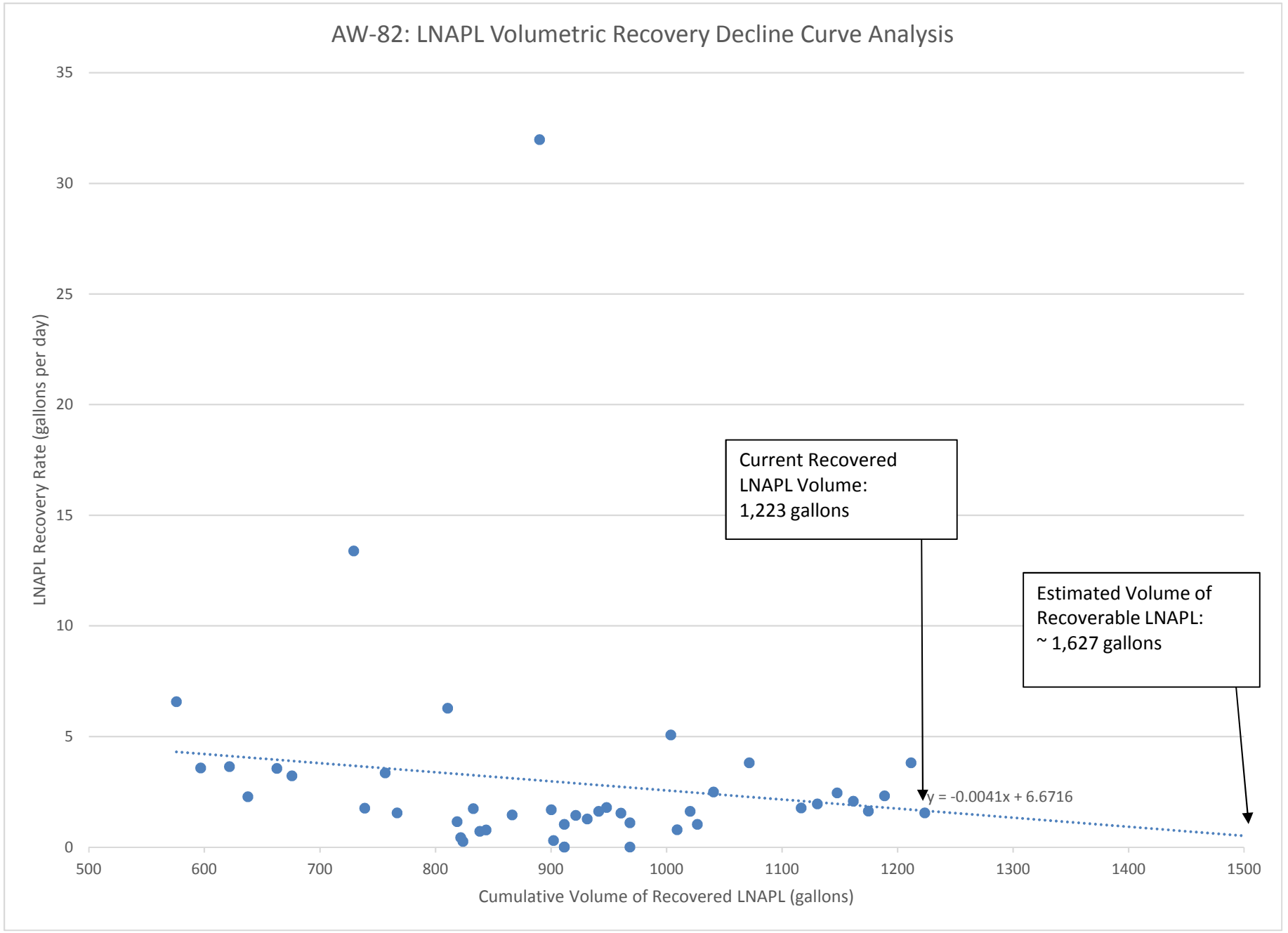
Assumed LNAPL specific gravity = 0.854

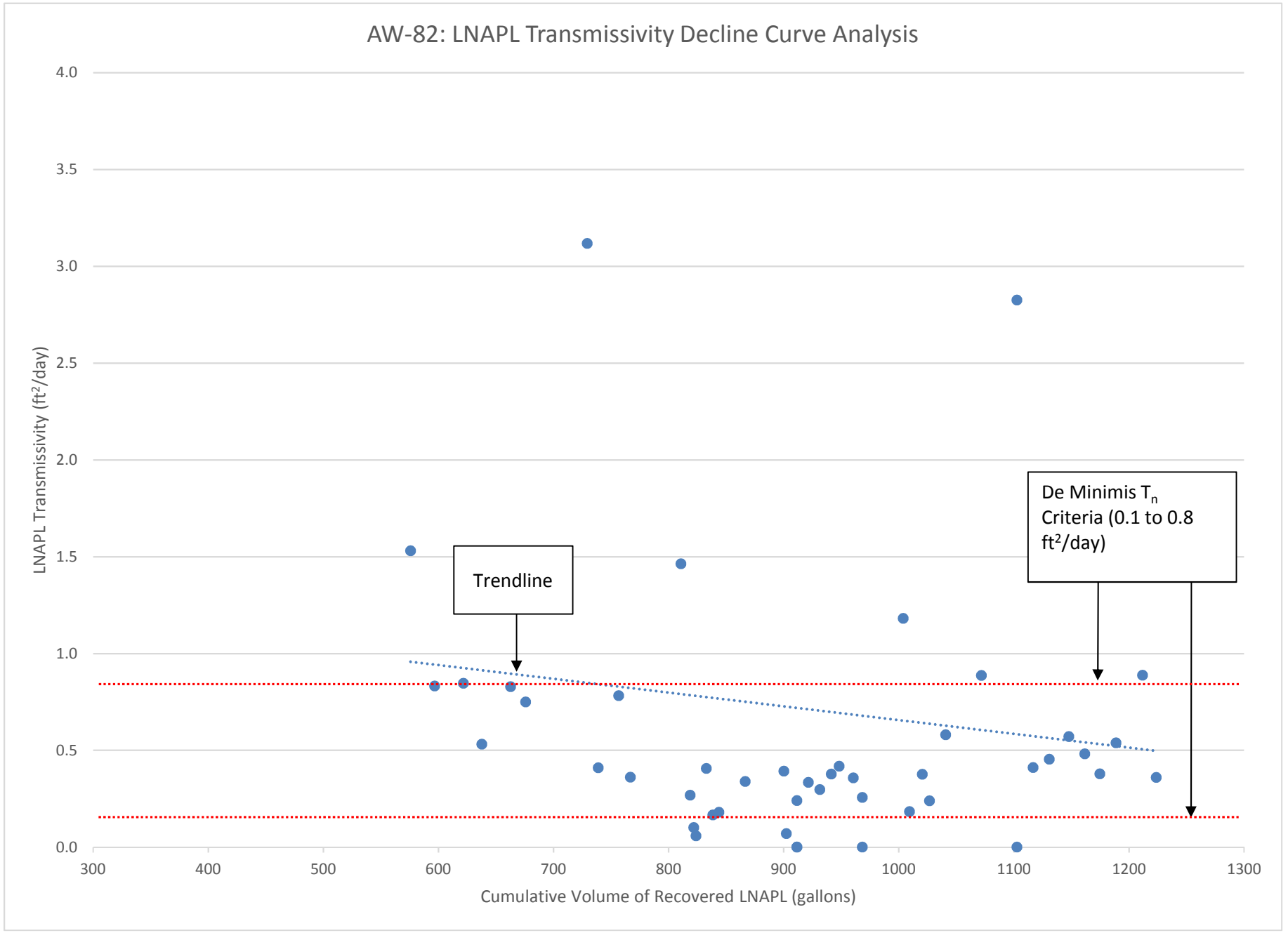
All calculations performed pursuant to the methodology detailed in ASTM E2856-13

[a]The maximum theoretical drawdown is used for each interval calculation where the measured drawdown is negative or where it exceeds the theoretical maximum.

[b]Represents the geometric mean of the stabilized recovery rates/LNAPL transmissivity estimates (i.e., excludes initial elevated values that would not represent potential long-term recovery rates).


AW-82: Cumulative LNAPL Recovery and LNAPL Recovery Rate Over Time
Cumulative LNAPL Recovery
LNAPL Recovery Rate
Cumulative Volume of Recovered LNAPL (gallons)
LNAPL Recovery Rate (gallons per day)
Date
1400
1200
1000
800
600
400
200
0
25
20
15
10
5
0
4/25/17
6/14/17
8/3/17
9/22/17
11/11/17
12/31/17
2/19/18
4/10/18
5/30/18


AW-82: LNAPL Volumetric Recovery Decline Curve Analysis
LNAPL Recovery Rate (gallons per day)
Cumulative Volume of Recovered LNAPL (gallons)
0
5
10
15
20
25
30
35
500
600
700
800
900
1000
1100
1200
1300
1400
1500
Current Recovered LNAPL Volume: 1,223 gallons
Estimated Volume of Recoverable LNAPL: ~ 1,627 gallons
y = -0.0041x + 6.6716


AW-82: LNAPL Transmissivity Decline Curve Analysis
LNAPL Transmissivity (ft²/day)
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
300
400
500
600
700
800
900
1000
1100
1200
1300
Cumulative Volume of Recovered LNAPL (gallons)
Trendline
De Minimis Tn Criteria (0.1 to 0.8 ft²/day)

# about GHD

GHD is one of the world's leading professional services companies operating in the global markets of water, energy and resources, environment, property and buildings, and transportation. We provide engineering, environmental, and construction services to private and public sector clients.

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