NPDES Permit No. MA0001929

Stormwater Pollution Prevention Plan (SWPPP)

Revision Date

February 2023

IRVING

Irving Oil Terminals Inc.
Revere Marine Terminal
40/41 Lee Burbank Highway
Revere, Massachusetts 02151

TERMINAL IDENTIFICATION AND CONTACTS

Terminal Type	Bulk Oil Terminal
Terminal Name/Operator	Irving Oil Terminals Inc. 41 Lee Burbank Highway Suffolk County, Revere, Massachusetts 02151 Phone Number: (781) 289-4201 Fax Number: (781) 289-3229
Terminal Latitude **Longitude**	42 Degrees 23 Minutes 48 Seconds North -71 Degrees 00 Minutes 44 Seconds West
Terminal Location	The Terminal is located on Boston's Inner Harbor, in Revere, Massachusetts, which is north of Boston. The Terminal extends east from the Chelsea River and covers approximately 25 acres.
Terminal Owner	Irving Oil Terminals Inc. 190 Commerce Way Portsmouth, New Hampshire 03801 Phone Number: (603) 559-8736

Designated Person Responsible for Stormwater Pollution Prevention Plan

Name	Job Title	Phone (Work)	Phone (Mobile)
Jared Mullins	Terminal Manager	(781) 289-4201 x315	(781) 853-1311

Stormwater Pollution Prevention Plan Team (See Section 4.0)

Name	Job Title	Phone (Work)
Jared Mullins	Terminal Manager **(Team Coordinator)**	(781) 289-4201 x315
Joe Solimine	Asst. Terminal Manager (**Team Member**)	(781) 289-4201 x304
Brandon Fournier	Terminal Ops Specialist (**Team Member**)	(781) 289-4201 x302
Andrew Bate	Terminal Ops Specialist (**Team Member**)	(781) 289-4201 x301
Augustus Flemmi	Terminal Ops Specialist (**Team Member**)	(781) 289-4201 x300
Frank Draskovics	Terminal Team Leader (**Team Member**)	(781) 289-4201 x306

PLAN CERTIFICATION

This Stormwater Pollution Prevention Plan (SWPPP) has been reviewed by appropriate Officers or Managers of the Owners or Operators and will be implemented as described herein. The SWPPP meets the requirements of the Irving Revere Terminal National Pollutant Discharge Elimination System (NPDES) Permit, Permit No. MA0001929, and reduces the pollutants in the discharge to the extent practicable. I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the persons who manage the system or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Jared Mullins Terminal Manager
Authorized Signature, Title

Jared Mullins
Printed Name

28-FEB-2023
Date

NON-STORMWATER DISCHARGE CERTIFICATION

I certify that the discharge has been evaluated for the presence of non-stormwater discharges by on-site observations, a review of the piping schematics for the stormwater drainage systems identified in this plan, by visual observation of the discharge outfall and by interviews with Irving personnel. It has been determined that non-stormwater discharges at the Terminal may include: flows from fire-fighting activities, processed hydrostatic test water, vehicle and loading rack washings that do not contain detergents, and pavement wash down in areas where spills or leaks have not occurred, unless the spill or leak has been cleaned up.

Jared Mullins Terminal Manager
Authorized Signature, Title

Printed Name

28-FEB-2023
Date

Jared Mullins

RECORD OF PLAN MODIFICATIONS

Modification Number	Date of Modification	Page #	Description of Modification	Signature of Authorized Personnel
1	Feb 29, 2016	i, 10, Sec. 6	New Terminal Manager Added BMPs for TSS Reduction, added Corrective Action Form	
2	Dec 22, 2016	i, 10	SWPPP Team Member Change	
3	Feb 28, 2018	I, 10, 24	SWPPP Team Member Change, Added Ultra to Low Sulfur Diesel	
4	Feb 28, 2018	Table 5.6.1A, 5.6.1B	Removed No 2 Fuel Oil, Removed gasoline additive trade names	
5	Feb 28, 2018	Table 5.4.3	Corrected spill history date and amount	
6	Feb 28, 2018	24	Removed Knock out tank	
7	Dec 21, 2018	i,10	SWPPP Team Member Change	
8	Jan 22, 2019	23	Table 5.6.1B	
9	Jan 22, 2019	23,24	Description Updates	
10	Nov 22, 2019	i,10	SWPPP Team Member Change	
11	Nov 22, 2019	Figures 2/2A, 3, 4	Site Plan Update(s) Addition of Thrifty Site Plan	
12	Dec 8, 2020	Sec 4.0	SWPPP Team Member Update	
13	Feb 10, 2023	Through-out	Revision and Updates per new NPDES Permit Effective Dec. 1, 2022	
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1.0 INTRODUCTION

1.1 BACKGROUND

The United States Environmental Protection Agency (USEPA) developed the stormwater permit program under the authority of the Clean Water Act Amendments of 1987 to reduce discharges of impacted stormwater associated with industrial facilities. The National Pollutant Discharge Elimination System (NPDES) program is how the USEPA regulates discharges of potentially impacted wastewater and stormwater into waters of the United States. The USEPA issued a NPDES stormwater permit to the Irving Oil Terminal, located at 40/41 Lee Burbank Highway, Revere, Massachusetts (the "Terminal") on September 24, 2014. The NPDES stormwater permit (No. MA0001929, the "Permit") was reissued on September 30, 2022 and became effective on December 1, 2022 (Appendix A).

1.2 SCOPE OF PLAN

As required by Section C.2 of the Permit, the Terminal developed this updated Stormwater Pollution Prevention Plan (SWPPP) (or "Plan") to identify potential sources of stormwater pollution from on-site industrial activities and to develop and implement management practices to minimize pollution in stormwater discharges from the Terminal outfalls. This updated Plan, which was based on the original SWPPP that was developed for the Terminal in March 2005, updated for subsequent authorized NPDES permits, and last updated in December 2020, was prepared in accordance with good engineering practices.

It is the environmental policy of Irving Oil Terminals Inc. (Irving) to comply with all applicable laws, regulations, permits and orders. This Plan addresses the requirements of the SWPPP as specified by the NPDES Individual Permit, which is consistent with the general provisions for SWPPP requirements outlined in Part 6 and Part 8.AD of the current Multi-Sector General Permit (MSGP, effective September 29, 2021). The Terminal shall inspect, operate, and maintain the stormwater treatment systems at the Terminal to ensure that the Effluent Limitation and permit conditions are met. As required by Part I.C of the Permit, the Terminal will also ensure that all components of the SWPPP, including Best Management Practices (BMPs) which specifically address the operation and maintenance of the oil/water separators (OWSs), pumps and other components of the stormwater collection and treatment systems, are complied with.

1.3 GENERAL TERMINAL DESCRIPTION

The Terminal, located on approximately 25 acres on the east bank of the Chelsea River and bisected by Lee Burbank Highway approximately two and one-half miles northeast of the confluence of the Mystic and Chelsea Rivers, is a petroleum product bulk storage terminal (refer to Figure 1 for a Terminal Locus and Figure 2/2A for a Terminal Site Plan / Facility Layout). Stormwater monitoring is performed at the discharge from the oil water separator, referred to as the "meter well" that is located at:

Latitude 42° 23’ 44” N Longitude -71° 00’ 29” W.

Operations began at the Terminal in 1935 and Irving purchased the Terminal in August 1998. The dock area is located to the west of the highway (referred to as the “Dock Side” area) and the main Terminal is to the east of the highway (referred to as the “Terminal Side” area). The surrounding area includes industrial, residential and commercial activities.

Products received, stored and distributed include gasoline, gasoline and diesel fuel additives, No. 2 heating oil, low sulfur diesel, and ethanol. These significant materials are described in detail in Section 5.6. Bulk petroleum products are received either by barge, ship, truck, or pipeline, while additives (e.g., dye) are delivered by truck in bulk and/or 55-gallon drums. Product is distributed via truck or can be transferred to a neighboring terminal (Global Petroleum) via common dock lines.

An office building and several outbuildings are located on the eastern or Terminal Side of the Terminal. On the Dock Side of the Terminal, there is a main building leased from Irving by a car rental company for offices and fleet vehicle maintenance and a marine dock used by Irving.

1.4 DESCRIPTION OF DISCHARGE

The updated 2022 permit regulates stormwater collected at the Terminal from the Terminal yard and the secondary containment areas of the tank farm. The property leased by a car rental company is not subject to the terms of NPDES permit MA0001929. The tank farm and Terminal yard are located on the east side of Lee Burbank Highway and have their own stormwater collection and treatment system. The treatment system includes settling and filtration through OWS-1 located on the Terminal Side. The NPDES permitted discharge to the Chelsea River via Outfall 001 consists of treated stormwater runoff and hydrostatic test water from OWS 1, collected from the flow metering weir located upstream of the car rental company (OWS-2) discharge location.

1.5 ALLOWABLE AND UNAUTHORIZED DISCHARGES

The Terminal is authorized to discharge only the effluent types listed in Parts I.A.1 of the Permit with the exception of the following discharges allowable under Section 1.2.2.1 of the MSGP, provided these discharges meet all effluent limitations in the Permit:

- discharges from fire-fighting activities;
- fire hydrant flushings;
- potable water, including uncontaminated water line flushings;
- uncontaminated condensate from air conditioners, coolers, and other compressors and from the outside storage of refrigerated gases or liquids;

- irrigation drainage;
- landscape watering provided all pesticides, herbicides, and fertilizer have been applied in accordance with the approved labeling;
- pavement wash waters where detergents are not used and spills or leaks of toxic or hazardous materials have not occurred or could occur;
- routine external building washdown that does not use detergents;
- uncontaminated groundwater;
- foundation or footing drains where flows are not contaminated with process materials; and
- incidental windblown mist from boilers and/or cooling towers that collects on rooftops or adjacent portions of the Terminal, but not intentional discharges from these structures (e.g., blowdown or drains).

The following discharges are expressly prohibited:

- tank bottom water and/or bilge water alone or in combination with stormwater discharge or other wastewater;
- any sludge and/or bottom deposits from any storage tank(s), basin(s), and/or diked area(s) to the receiving waters;
- liquid hazardous waste alone or in combination with stormwater or other wastewater;
- runoff from any vehicle and equipment washing alone or in combination with stormwater or other wastewater, including from the leased property;
- ballast water alone or in combination with stormwater or other wastewater;
- runoff resulting from accidental spill or release, alone or in combination with stormwater or other wastewater;
- emulsion chemicals, including surfactants (e.g., detergents and soaps) alone or in combination with stormwater or other wastewater;
- contaminated groundwater, including, but not limited to wastewater generated during activities conducted under the Massachusetts Contingency Plan, alone or in combination with stormwater or other wastewater;
- stormwater containing ethanol;

- aqueous film-forming foam and alcohol resistant foam either in concentrate form or as foam diluted with water during testing or maintenance of the fires suppression system at the Facility’s marine vessel dock

2.0 PLAN MAINTENANCE

2.1 AVAILABILITY OF PLAN

A copy of this SWPPP and certification will be maintained at the Terminal at all times and made available to the USEPA, the Massachusetts Department of Environmental Protection (MassDEP) and/or the City of Revere. Each member of the Stormwater Pollution Prevention Team will have ready access to either an electronic or paper copy of the SWPPP. The Terminal shall, if practicable, post a copy of the SWPPP in portable document format to the Terminal's publicly accessible website. The location of this document (i.e., a valid, direct hyperlink) must be provided to the USEPA and MassDEP with the Terminal's certification.

2.2 PLAN REVIEW AND MODIFICATION

The Terminal shall amend and update the SWPPP within 14 days for any changes at the Terminal that result in a significant effect on the potential for the discharge of pollutants to the waters of the United States or that affects the SWPPP. A record of Plan changes will be maintained (see Page iii). Refer to Section 2.3 of this SWPPP for a summary of conditions that would require the Terminal to update the SWPPP.

Any amended, modified, or new versions of the SWPPP shall be re-certified and signed by the Terminal in accordance with the requirements identified in Part I.C.2 of the Permit.

2.3 CONTROL MEASURE REVIEW AND MODIFICATION

If any of the following listed conditions occur, the Terminal must review and revise the selection, design, installation, and implementation of control measures (including BMPs) to ensure that the condition is eliminated:

- **an unauthorized release** or discharge (e.g., spill, leak, or discharge of non-stormwater not authorized under the Permit;

- **a discharge violates a numeric effluent limit** listed in Part I.A of the Permit;

- **the stormwater control measures are not stringent enough** to control stormwater discharges as necessary such that the receiving water will meet applicable water quality standards and/or the non-numeric limits in Part I.C of this permit;

- **a required control measure was never installed**, was installed incorrectly, or is not being properly operated or maintained; or

- whenever a **visual assessment shows evidence of stormwater pollution** (e.g., color, odor, floating solids, settled solids, suspended solids, foam).

For corrective actions, the Terminal will document the discovery of any of the previously listed conditions within 24 hours of making such discovery. Within 14 days of such discovery, the Terminal will document any corrective action(s) to be taken to eliminate or further investigate the deficiency or, if no corrective action is needed, the basis for that determination. Specific documentation required is detailed in Part I.C.2.b of the Permit. A Corrective Action Form is included in Appendix F. If it is determined that changes are necessary, any modifications to control measures will be made before the next storm event if possible, or as soon as practicable following that storm event. These time intervals are not grace periods, but are schedules considered reasonable for documenting findings and for making repairs and improvements.

3.0 PLAN CERTIFICATION

3.1 DESIGNATED SIGNATORY AUTHORITY

All reports, SWPPP, certifications, or other information requested by the USEPA, MassDEP, or required by the Plan, must be reviewed, approved, signed and certified by the designated signatory authority representing Irving. The person that completed the certifications must meet the requirements identified in 40 C.F.R. §122.22 and Appendix B, Subsection 11.A or 11.B, of the MSGP.

3.2 INITIAL PLAN CERTIFICATION

The Certification Statement, included as Page ii in this Plan, must be signed and dated at the time of the Plan issuance.

3.3 PLAN AMENDMENT CERTIFICATION

Any amended, modified, or new versions of the SWPPP shall be re-certified and signed by the Terminal.

3.4 ANNUAL PLAN CERTIFICATIONS

The Terminal shall certify at least annually that the Terminal is in compliance with the SWPPP requirement. If the Terminal is not in compliance with any aspect of the SWPPP requirement, the annual certification shall state the non-compliance and the remedies which are being undertaken.

In addition, the Terminal shall certify, at least annually, that the previous year's inspections and maintenance activities were conducted, results recorded, records maintained, and that the Terminal is in compliance with this permit. Certifications must be submitted by January 15th of the following calendar year. If the Terminal is not in compliance with any aspect of the Permit, the annual certification shall state the noncompliance and the remedies which are being undertaken. The Terminal shall document in the SWPPP any violation of numeric or non-numeric effluent limitations with a date and description of the corrective actions taken.

Copies of the annual SWPPP requirement certifications are included in Appendix B.

3.5 NON STORMWATER DISCHARGE CERTIFICATION

The Terminal has been evaluated for the presence of non-stormwater discharges by on-site observations, a review of the piping schematics for the stormwater drainage systems identified in this Plan, by visual observation of the discharge outfall and by interviews with Irving personnel. It has been determined that non-stormwater discharges at the Terminal may include: flows from fire-fighting activities, processed hydrostatic test water, vehicle and loading rack washings that do not contain detergents, and pavement wash down in areas where spills or leaks have not occurred, unless the spill or leak has been cleaned up. The Non-Stormwater Discharge Certification is included on Page ii of this Plan.

4.0 POLLUTION PREVENTION TEAM

4.1 INTRODUCTION

The Pollution Prevention Team consists of a Team Coordinator and members that are responsible for developing and revising the Terminal's SWPPP, implementing and maintaining control measures and BMPs, and taking corrective actions where required. SWPPP implementation includes assessment of potential impacts, BMPs, spill response, employee training, regular inspections, and annual plan evaluation. A list of Pollution Prevention Team members and their contact information is provided in the following table.

Table 4.1
Irving Revere Terminal Pollution Prevention Team

Name	Job Title	Phone (Work)
Jared Mullins	Terminal Manager **(Team Coordinator)**	(781) 289-4201 x315
Joe Solimine	Asst. Terminal Manager (**Team Member**)	(781) 289-4201 x304
Brandon Fournier	Terminal Ops Specialist (**Team Member**)	(781) 289-4201 x302
Andrew Bate	Terminal Ops Specialist (**Team Member**)	(781) 289-4201 x301
Augustus Flemmi	Terminal Ops Specialist (**Team Member**)	(781) 289-4201 x300
Frank Draskovics	Terminal Team Leader (**Team Member**)	(781) 289-4201 x306

4.2 TEAM COORDINATOR/TEAM LEADER

The Team Coordinator is responsible for ensuring that the components of the SWPPP are implemented. Specific tasks include maintaining inspection schedules, records, and employee training, as well as coordinating responses to spill emergencies. In addition, the Team Coordinator will direct evaluation and modification of the Terminal structures, systems, procedures, and SWPPP provisions as needed. Modifications may include:

- revisions to the list of potentially significant materials;
- relocation or alteration of material storage or handling areas;
- revision of BMPs;

- alteration of drainage patterns;
- addition of structural control measures; and
- documentation of significant leaks or spill events.

The Team Coordinator is the point of contact for Terminal personnel and regulatory officials who wish to discuss the SWPPP or obtain information concerning spill events. The Team Coordinator will be familiar with all elements of the Terminal operation to ensure that potential sources of pollution are considered during implementation and periodic evaluations of the SWPPP. The Team Leader will provide back-up to the Team Coordinator in executing SWPPP responsibilities.

4.3 TEAM MEMBERS

Team Members are responsible to:

- conduct inspections;
- respond to spill events;
- maintain BMPs; and
- participate in employee training at regular intervals (at least annually), as well as new employee training.

Team Members also meet with the Team Leader and Team Coordinator at regular intervals (at least annually), following spill events, or when any of the conditions listed in Section 2.3 occur to evaluate and modify the SWPPP, as needed.

In the event that a Team Member is to be replaced, the Team Coordinator will appoint a replacement. If a replacement cannot be found immediately, the remaining Team Members will assume the open responsibilities during the interim. Current Team Members with areas of responsibility are identified in Table 4.1. This list will be updated at least annually or as personnel assigned to the team change.

5.0 TERMINAL INFORMATION

5.1 TERMINAL DESCRIPTION

Irving's Revere Terminal is a bulk storage Terminal with operations consisting of the receipt, storage and distribution of petroleum products. The Terminal consists of three principle areas including a tank farm, a Terminal yard, and one vessel dock. A rental car agency leases a portion of the Dock Side property west of Lee Burbank Highway for storage, fueling and maintenance of vehicles. Figures 2 and 3 illustrate the Terminal layout and components described in this Section.

5.1.1 Tank Farm

The tank farm generally consists of bulk aboveground storage tanks, pumping, systems, and product piping. The Terminal currently manages both gasoline and distillate products. Refer to Section 5.6 for a list of tank volumes and contents. There are eleven (11) large aboveground product storage tanks (nine contain petroleum product and two contain ethanol). Six of the tanks have internal floating roofs. Earthen secondary containment dikes surround the tank farm. Active tanks are equipped with Varec® Gauges and high-level alarms. service. A foam fire protection system protects the tanks. Product is distributed via the Terminal's truck loading rack.

In addition to petroleum products, the Terminal stores and uses petroleum additives, which are mixed with gasoline or diesel on-site at the truck loading rack. The tank farm contains seven fuel additive tanks. In addition to additives specific to branded gasoline, the Terminal mixes and distributes gasoline containing ethanol, which is also received by ship or barge.

5.1.2 Terminal Yard

The Terminal yard consists of the area outside of the tank farm secondary containment structures. The Terminal yard has an office building, workshop trailer, equipment storage building, fire foam system house, truck loading rack, Bill of Lading house, testing shed (contains equipment for testing product), waste storage area, sample retention area, electrical house, and forklift shed. There is also a 10,000-gallon balance return tank located within the Terminal yard. This underground fiberglass storage tank contains residual petroleum product, which is collected from truck loading operations. Additional aboveground and underground storage tanks that are used for the fire protection system and storing of heating oil for the Irving’s own use are located throughout the Terminal.

5.1.3 Vessel Dock

The dock owned by Irving has one active berth that can handle ships or barges. Irving and Global Petroleum jointly own this dock. Product is transferred to the Terminal via pipelines routed beneath Lee Burbank Highway.

5.1.4 Leased Property

A rental car agency leases Irving's dock-side property west of Lee Burbank Highway for storage, fueling, and maintenance of vehicles. Fuel is dispensed via a split compartment steel aboveground storage tank containing 10,000 gallons of gasoline and 2,000 gallons of diesel fuel. The diesel portion of the tank has been temporarily closed. The double-walled tank is equipped with interstitial monitoring and overfill prevention. Smaller aboveground storage tanks containing waste oil, heating oil, and motor oil are also contained within the car rental agency's maintenance building. The leased property maintains an OWS historically designated OWS-2 that filtered stormwater from this area. Stormwater from the leased property is not covered by the 2022 Permit for the Terminal.

5.2 TERMINAL PLANS AND FIGURES

Figure 2/2A and 3 identify the following features, as required by the MSGP:

- the general Terminal layout;
- the location and extent of significant structures and impervious surfaces;
- stormwater NPDES outfalls of the area draining to each outfall;
- directions of stormwater flow (i.e., arrows indicate the general direction of stormwater flow);
- significant flow pathways and conveyance structures;
- potential pollutant sources and where significant materials are or may be exposed to precipitation;
- locations of all receiving surface water bodies (including wetlands);
- locations and descriptions of non-stormwater discharges;
- vehicle and equipment maintenance and/or cleaning areas;
- loading/unloading areas;
- locations used for the treatment, storage, or disposal of wastes;
- liquid storage tanks;
- processing and storage areas;

- immediate access roads used or traveled by carriers of raw materials, manufactured products, waste material, or by-products handled by the Terminal;

- transfer areas for substances in bulk; and

- machinery.

5.3 RECEIVING WATERS AND WETLANDS

The Terminal stormwater outfalls lead to the Chelsea River, which is part of the Mystic River Watershed. The Boston Inner Harbor extends from Boston Harbor between Castle and Governors Islands to the convergence of the Mystic River from the west and the Chelsea River from the East. The Inner Harbor, Mystic River, Chelsea River, and their watersheds are largely developed and urbanized.

Tidal influence in the Boston Inner Harbor results in two high tides and two low tides recurring diurnally. The predicted average flood and velocities on the Chelsea River near the Terminal pier are generally low, in the range of approximately 0.5 to 1.0 knots. A complete tidal current reversal, associated with tidal fluctuations, occurs approximately every 13 hours. Scattered tidal flats and salt marshes are located along the banks of the Chelsea River near the Terminal pier. The salt/brackish water marshes are located at Mill Creek, where it enters the head of the Chelsea River. Sheltered tidal flats are located across the Chelsea River from the Terminal pier. Other sheltered tidal flats are located upstream and downstream from the pier.

5.4 SPILLS AND LEAKS

5.4.1 Introduction

The MSGP requires a description of where potential spills and leaks could occur at the Terminal that could contribute pollutants to stormwater discharge, including outfall(s) that would likely be affected by such spills and leaks. The MSGP also requires a description of significant leaks or spills of toxic or hazardous pollutants that occurred at areas exposed to precipitation or that drain to stormwater conveyance systems within three (3) years prior to the effective date of the Permit. The USEPA defines "significant spills" to include releases within a 24-hour period of hazardous substances in excess of minimum reportable quantities as defined under Section 311 of the Clean Water Act (CWA, 40 CFR 110.6 and 40 CFR 117.21) and Section 102 of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA, 40 CFR Part 117 and 40 CFR Part 302). 40 CFR Part 110 defines reportable quantities of oils and fuel as those that produce sheens on receiving waters or result in the deposition of sludge.

5.4.2 Potential Spills and Leaks and Control Measures

Detailed information regarding the potential for Terminal spills and leaks is included in the Terminal's Integrated Facility Response Plan (FRP). A summary of the FRP spill control information is presented in the Sections below. Due to the increased risk of environmental impact, the Terminal has developed specific release response procedures for ethanol and alcohol resistant firefighting foam spills, located in Appendix H.

5.4.2.1 Tanks and Associated Piping

Spills can occur as a result of tank or piping failures or human error. The spill control measures that the Terminal maintains include the following:

- Equipment is constructed to industry standards of material that will be relatively maintenance-free over the life of the equipment.

- The dock lines are equipped with check valves at the pier (the valve station located near the foot of the pier) to prevent lines from draining back to the pier.

- Terminal dock lines are pressure tested annually to 150 percent of the working pressure of the piping system, in accordance with United States Coast Guard (USCG) requirements.

- Terminal piping has pressure gauges that could indicate a potential problem, as well as emergency shutdown procedures to control potential problems.

- Terminal personnel conduct tours to inspect valves, storage sites, and general housekeeping at least once per shift and three (3) times between 3:00 PM and 7:00 AM.

- Containment systems are regularly inspected for cracks or deterioration, and deficiencies are noted and repaired.

5.4.2.2 Loading and Unloading Areas

Spills can occur as a result of equipment failures or operator error. The spill controls that the Terminal maintains include the following:

- The loading rack is roofed to minimize the contamination of collected runoff.

- The loading bays are paved with concrete that is sufficiently impervious to prevent released petroleum from infiltrating into the soil before it can be removed by Terminal personnel.

- The loading rack is sloped to direct runoff flow to trench drains located around the rack.

- Collected runoff flows through a holding tank (which is designed to act as an oil separator) and water flows to a lift station before being pumped to the Terminal OWS 1 for treatment prior to discharging into the Chelsea River.

- The storage capacity in the rack stormwater collection and treatment system (including the OWS 1) is greater than 30,000 gallons; which provides adequate containment capacity for the largest single compartment (i.e., 10,000 gallons) of any truck using the Terminal.

- The truck drivers are responsible for monitoring and controlling truck loading.

- Valves and fittings are inspected before transfer is initiated to be sure that connections have been properly made.

- The vehicle is attended at all times during the transfer.

- Emergency shut-off switches are located at the loading rack and in the Terminal office.

- After the transfer is complete, the vehicle will not be moved until all connections have been checked to be sure that they are undone, and that there is no restraint on the truck that could possibly damage equipment and cause a leak.

- Products delivered to the Terminal via truck are transferred directly from the truck into the appropriate tanks. The tank fill ports are located at the "pump back station" in the northeast corner of the Terminal yard.

- Tank 16 (which has integral containment) is located in the Terminal yard west of the loading rack, and its fill port is located on the side of the tank.

- The Terminal yard is paved and graded to direct runoff and potential releases into nine catch basins located around the yard which flow to a concrete sump. From the sump, collected runoff and potential releases are pumped into the containment area for Tank 3, and from this containment area are routed through the Terminal OWS 1 for treatment prior to discharge to the Chelsea River.

5.4.2.3 Vessel Dock Transfer

Spills can occur as a result of equipment failures or operator error. The spill controls that the Terminal maintains include the following:

- During marine transfers, Irving personnel maintain radio communications with the Irving Person in Charge (PIC) working at the dock and the PIC maintains communications with the vessel.

- Weather forecasts are monitored prior to transfer operations and transfer operations will be canceled if reports indicate imminent storms or other conditions that would substantially increase the risk of transfer accidents.

- The pier has a 1,500-foot containment boom (located on the trailer at the Global terminal adjacent to the pier) that can be placed around the vessel or to enclose the area around the vessel and shore in the event of a spill.

- Should a discharge occur, transfer operations will be halted.

- Restarting the transfer operation will not commence until the Federal, State and Local agencies are satisfied that suitable measures have been taken or that unloading of the vessel is essential to prevent further leaks.

5.4.3 Summary of Reportable Spills or Leaks

The Terminal maintains an integrated FRP which outlines preventive activities, such as training, to minimize the occurrence of releases at the Terminal as well as response actions to be implemented in the event of a release. In general, spills will be addressed to stop further release from the source to minimize migration of released material and to cleanup released material.

There have been twelve MassDEP reportable spills at the Terminal's address, which are summarized in the following table.

Table 5.4.3
Irving Revere Terminal MassDEP Reportable Spills

Date	Quantity and Type	Location	Cause
05/18/1987	Unknown/Unknown	BP Gibbs Gasoline Station	Pipe and underground storage tank
05/02/2001	Unknown/Kerosene	Unknown	Pipe
11/10/2001	100 gallons of Diesel Fuel	Terminal	Vessel
01/19/2003	1,400 gallons of No. 2 Fuel Oil	Tank 3 Containment	Pin hole in pipe from side of tank
05/07/2003	50 gallons of No. 6 Fuel Oil And 100 gallons of Oil	Terminal	Boat
09/08/2005	100 gallons of Diesel Fuel	Terminal	Saddle Tank/Vehicle
10/21/2005	100 gallons of Gasoline	Tank Farm/ Tank 12	Pipe
03/08/2006	1,000 gallons of No. 2 Fuel Oil and 19,500 gallons of Diesel	Terminal	Pipe/Tank vessel
04/12/2008	1,200 gallons of Diesel Fuel and 100 gallons of Diesel Fuel	Tank 6 Containment	Line

Date	Quantity and Type	Location	Cause
03/30/2010	10,000 gallons of Ultra Low Sulfur Diesel	Terminal	Tank seal failure
08/25/2012	>10 gallons of Gasoline	Terminal	Tank
05/20/2013	300 gallons of Gasoline	Loading Rack	Overfill of truck

An updated list of such releases will be maintained with the Terminal FRP and in Appendix C of this Plan.

5.5 HISTORIC DISCHARGE SAMPLING DATA

Discharge monitoring data from the previous five (5) years (i.e., January 1, 2017 through December 31, 2022) for Outfall 001, as summarized by the USEPA, are included in Appendix D. The Terminal monitored the Outfall 001 effluent for pH, total suspended solids (TSS) and oil and grease. The discharge flow rate and total flow were estimated based upon the design capacity of OWS-1.

5.6 POTENTIAL POLLUTANTS

Section 5.6 summarizes the significant materials storage as well as the industrial activities exposed to stormwater and the potential pollutants associated with these activities.

5.6.1 Significant Material Storage

For the purposes of this Plan, "significant materials" are defined as: raw materials, fuels, solvents, detergents, plastic pellets, finished materials, raw materials used in food processing or production, hazardous substances under Section 101(14) of CERCLA, chemicals reported under Section 313 of Title III of SARA, fertilizers, pesticides, waste products (ashes, slag, sludge) that have the potential to be released with stormwater discharges. This Plan includes an inventory of various types of significant materials handled and/or present at the Terminal that may be exposed to precipitation and have the potential to adversely impact stormwater quality.

The Significant Materials stored on-site at the Terminal are listed in Table 5.6.1 A. Although spills have occurred within the confines of the Terminal (see Section 5.4.3), no significant materials have been spilled or leaked to waters of the United States since the date of this Plan. Significant materials are managed to minimize the potential for contact with stormwater. The volumes of the significant materials stored are summarized in Table 5.6.1 B. During construction operations, the Terminal may temporarily store debris and scrap metal in covered portable dumpster containers.

Table 5.6.1 A
Irving Revere Terminal Significant Material Storage Methods

Material	Stored	Treated	Disposed	Leak/Spill
Gasoline, Regular Unleaded	X			X
Gasoline, Premium Unleaded	X			X
Diesel Fuel	X			X
Ethanol	X			
Fuel Additives	X			
Solid Waste	X			
Recyclables-Cardboard	X			
Recyclables-Commingled	X			
Oily Wastes-Solids	X			
Tank Bottoms / Wastewaters				
Concentrated Fire Protection Foam	X			
Salt Pile	X			
Activated Carbon	X			
General Maintenance Materials	X			

Table 5.6.1 B
Irving Revere Terminal Significant Material Storage Volumes

Material	Tank No/ Type	Tank Safe Fill Capacity (gallons)	Drums	Containers	Other
Tank Farm Side					
Gasoline, Unleaded Regular	12,14/AST	4,908,792/ 7,057,008			
Gasoline/Distillate/Ethanol, Swing	2/AST	2,790,606			
Gasoline, Unleaded Premium	1/AST	2,772,252			
Diesel Fuel, Ultra-Low Sulfur	3,4,5,6,7/ AST	2,907,072/ 2,950,374 1,231,314/ 1,233,246/ 1,290,240			
Ethanol, Denatured Fuel	10,11/AST	2,911,776/ 1,191,792			
Diesel Additive	15/AST	7,642			
Diesel Additive, Red Dye	23/AST	14,100			
Gasoline Additive, Detergent	8/AST	7,637			
Gasoline Additive, Detergent (O.O.S.)	16/AST	7,814			

Material	Tank No/ Type	Tank Safe Fill Capacity (gallons)	Drums	Containers	Other
Gasoline Additive, Detergent	9/AST	23,575			
Gasoline Additive, Detergent	22/AST	14,100			
Heating Oil, Office Building	18/UST	3,705			
Heating Oil, Foam Building	17/UST	850			
Balance Tanks (Slop)	19/UST	8,900			
Diesel Additive, Red Dye (O.O.S.)	24/AST	1,800			
Solid Waste				X	X
Recyclables-Cardboard				X	
Recyclables-Commingled				X	
Oily Debris-Solids			X	X	X
Tank Bottoms / Wastewaters					X
Concentrated Fire Protection Foam		41,700 lbs.			X
Salt Pile		44,000 lbs.			X
Activated Carbon	AST	63,000 lbs.			
General Maintenance Materials					X
Dock Side					
Solid Waste				X	

NOTE: Tank safe fill capacity in listed gallons, except for materials listed in pounds.
(O.O.S. = Out of Service)

The following is a description of significant materials stored on the tank farm side of the Terminal:

Gasoline: Two grades of gasoline, premium and regular are stored in Tank 1, 2 (Swing Tank), 12 and 14. These tanks are equipped with automatic Varec® Gauges. All of the tanks have high-level alarms. Each tank is located within a dike which is large enough to contain a spill which may occur in that area. Components of gasoline include volatile organic compounds (VOCs), including several hazardous air pollutants (HAPs) such as benzene, ethylbenzene, n-hexane, naphthalene, toluene, xylene, and iso-octane.

Diesel, Ultra-Low Sulfur (ULSD): Stored in Tank 2 (Swing Tank), 3, 4, 5, 6, and 7. All of the storage tanks have high-level alarms. Each tank is located within a dike which is large enough to contain any spill which may occur in that area. The components of ULSD include VOCs, such as n-hexane and naphthalene, which are also HAPs. Infrequent deliveries of ULSD to an AST serving the terminal's Emergency Fire Pump occurs within the confines of the Terminal yard thus eliminating the potential for discharge to surface waters.

Ethanol, Denatured Fuel: Stored in Tank 2 (Swing Tank), 10 and 11. The tanks have high-level alarms and are located within a dike which is large enough to contain a spill which may occur in that area.

Additives: Stored in Tank 8, 9, 15, 16, 22, 23, and 24. All the tanks have high-level alarms, except for Tank 16 and 24. Each tank is located within a dike, or other form of secondary containment (or currently out of service), which is large enough to contain a spill which may occur in that area. The components of the additives include VOCs as well as the HAPs ethylbenzene and xylene.

Heating Oil, Ultra-Low Sulfur (ULSHO): Deliveries of ULSHO to USTs serving the Terminal Side office and the foam building (Tank No. 18 and 19) occurs within the confines of the Terminal yard thus eliminating the potential for discharge to surface waters. The components of heating oil are the same as those in ULSD.

Balance Return: Residual from truck loading operations is transferred by drum to the to the 10,000-gallon underground storage tank (Tank 19; fiberglass balance return tank) which is located within the confines of the Terminal yard and is inspected daily for balance level.

Solid Waste: Office waste is stored in a dumpster near the office building. The dumpster is covered; therefore, it is unlikely that stormwater will come in contact with the solid waste.

Recyclables: Cardboard and commingled recyclables (aluminum, plastic and glass) are also stored in a dumpster near the office building. The dumpster is covered; therefore, it is unlikely that stormwater will come in contact with the recyclables.

Oily Debris - Solids: Dry absorbent used to clean-up and absorb minor drips and spills is collected and stored in covered 55-gallon drums and temporarily stored in the hazardous waste building. This building is located to the south of the truck loading rack and is completely enclosed; therefore, it is unlikely that stormwater will come in contact with the solid waste. The waste is inspected on a weekly basis and removed by a certified hazardous waste transporter in accordance with applicable regulated waste requirements.

Tank Bottoms and Wastewater: Generated during tank cleaning/maintenance activities are occasionally generated. The waste oil material is pumped directly from the tanks to a vacuum truck for off-site removal by a certified hazardous waste contractor. The wastewater generated during tank cleaning operations is contained in a fractionation tank and transported off site by a certified hazardous waste contractor. All waste removal activities are conducted within the confines of the Terminal drainage area, thus minimizing the potential for discharge to surface waters.

Activated Carbon: Activated carbon is used in the vapor recovery unit. Extra carbon is stored on-site in case the Terminal is required to replenish the carbon bed in the vessels for the vapor recovery unit.

Salt: Salt is stored seasonally and used for deicing activities.

Fire Suppression Foam: Fire suppression foam is stored in an aboveground storage tank located in the fire suppression building.

5.6.2 Loading and Unloading Activities

Current materials management practices associated with loading and access areas are focused on eliminating discharges of materials transported, loaded, and unloaded on-site, thus minimizing potential contact of the materials with stormwater.

The materials loading and unloading area at the Tank Farm side of the Terminal is the loading rack. The loading rack is covered by a roof. Vehicles loading petroleum products access the loading rack from Lee Burbank Highway. The location of loading, unloading and storage areas for significant materials is shown on the Terminal Drainage Plan (Figure 3). A truck brake interlock system is controlled at the truck manifold when the loader is connected to the valves. This system prevents premature departure of the vehicle being loaded before loading operations are complete. Drains and outlets on tank trucks are checked for leakage before loading/unloading or departure by individual drivers.

The materials loading and unloading areas at the Dock Side of the Terminal include the barges and ships unloading or loading product access the dock from the Chelsea River.

5.6.3 Terminal Pipeline Transfer Operations

Buried pipelines are wrapped and coated to reduce corrosion. Cathodic protection is provided for pipelines, as determined necessary by electrolytic testing. When a pipeline section is exposed, it is examined and corrective action is taken as necessary. Pipelines are identified by labeling with the product name. Lines taken out of service are capped or blank-flanged. Pipe supports are designed to minimize abrasion, having smooth bearing surfaces to permit free movement of the pipeline to allow for expansion and contraction.

5.6.4 Bulk Storage Tanks

The primary method storage of petroleum products is in aboveground storage tanks which prevent direct contact with stormwater. Bulk storage tanks are located within the tank farm and constructed of steel and have American Petroleum Institute (API) approved venting systems and high-level liquid alarms. Mobile tanks are not located at the Terminal. Hydrostatic testing, or an alternate approved method, is conducted when substantial repairs are made to the tanks. Secondary containment at this Terminal consists of earthen dikes which enclose each storage tank. The dike floor and walls are composed of clay which is sufficiently impermeable to hold a large spill until petroleum products can be recovered. Dike walls may be shared by adjacent tanks.

5.6.5 Vehicle Storage

Vehicles on both sides of the Terminal are stored on paved areas. Paved areas on the Tank Farm side of the property drain to catch basins routed to Tank 3 dike, prior to being pumped to OWS 1. Vehicles are not stored on gravel or dirt areas.

Paved areas on the Dock side of the property from the car rental area drain to catch basins leading to OWS 2, that is not included in this 2022 Permit.

5.6.6 Pesticide Application

A pre-emergent herbicide is spray-applied annually (in early spring and throughout the season, as necessary) by an outside contractor to the tank dike areas and gravel areas outside of the tank dikes. Pesticides or herbicides are not stored at the Terminal.

5.6.7 Salt Storage

The Terminal has outdoor storage of salt for deicing or other commercial or industrial purposes. The salt pile remains covered by a tarp when not being accessed. Small quantities of salt are also stored indoors, seasonally, and used to deice walkways. Subcontractors are hired by the Terminal to sand and salt paved driveways.

5.7 DESCRIPTION OF DRAINAGE AREAS

Stormwater is collected at the Terminal from the Terminal yard and the secondary containment area of the tank farm. The tank farm and Terminal yard are located on the east side of Lee Burbank Highway and as such have their own stormwater collection and treatment system (OWS 1). The discharge from all areas of the Terminal occurs via Outfall 001 into the Chelsea River. Groundwater remediation effluent is not discharged into the stormwater collection system. A summary of the drainage areas is presented in Section 5.7.1 through Section 5.7.7.

5.7.1 Vessel Dock Drainage

Petroleum products and/or stormwater that are captured during offloading operations at the marine vessel dock are transferred to a product tank located within the Terminal's tank farm. Water removed from the tank bottom is disposed offsite by a licensed waste disposal contractor. Therefore, flow from the marine vessel dock is not directed to the OWSs.

5.7.2 Tank Farm Drainage

Secondary containment for the tank farm consists of earthen berms surrounding each of the bulk storage tanks. The secondary containment is sized to hold at least 110 to 130 percent of the largest tank's storage capacity plus an added volume to hold any fire-extinguishing chemicals, water and/or precipitation. The berms are used to help prevent potentially spilled petroleum products from migrating from one secondary containment area to another or into surrounding waterways. There is a valve located within each secondary containment area that can be manually opened to allow the stormwater to drain into the stormwater collection system. When the valve is closed, stormwater is retained within that secondary containment area.

Stormwater accumulating within these areas evaporates or is directed to low elevation catch basins. Terminal personnel visually inspect accumulated water and if sheen is not visible, the valve is opened, thereby allowing water to drain by gravity into the bermed area (also referred to as diked area) surrounding Tank 3.

The stormwater accumulating in the secondary containment area around Tank 3 (i.e., from the tank farm and Terminal yard including the truck loading rack canopy gutters) also drains to OWS 1. The secondary containment water flows into a concrete sump located in the western corner of this area. The sump is equipped with two pumps, a primary and a back-up, each with a reported pumping capacity of approximately 375 gallons per minute (gpm). When one of the two pumps is activated, it transfers the stormwater to OWS 1.

5.7.3 Truck Loading Rack Drainage

At the truck loading rack, the roof directs stormwater away from the truck rack equipment and loading operations to perimeter drains and individual catch basins. Stormwater from this portion of the Terminal yard is directed to an underground holding tank that automatically pumps the water into the secondary containment area surrounding Tank 3, whenever the water in the tank reaches a set level. Runoff entering drains beneath the roof of the truck loading racks flows into a concrete holding tank located northwest of the rack. This tank acts as a small OWS for petroleum product that might have spilled during truck loading operations. Stormwater flows into a nearby lift station (PS2 on Figures), leaving accumulated petroleum product on the surface. A 250-gpm pump conveys water from the lift station to OWS 1.

5.7.4 Hydrostatic Test Water

The aboveground storage tanks are subject to annual external inspections (502 CMR 5.00) and their integrity is certified annually by a licensed tank inspector. Internal inspections of the aboveground storage tanks are conducted every 10 years. The testing procedures followed are detailed in American Petroleum Institute (API) 653 Standard. In addition, repairs are occasionally made at the Terminal to tanks and piping used for the storage and conveyance of petroleum products and additives. To ensure safe working conditions during this maintenance work, storage tanks and/or pipe networks are rigorously cleaned (e.g., “Poly-Brushed”, “Squeegee-Pigged”) and certified as being product-free. After completing certain maintenance work, the vessels and/or pipe networks may be hydrostatically tested for leaks. Hydrostatic testing involves filling the vessel or pipe with water under pressure and monitoring pressure drops over time. If the system maintains a constant pressure, there are no leaks. River water or potable water may be used as a source of hydrostatic test water. Thus, hydrostatic test water discharge may contain minimal amounts of foreign matter, trace amounts of hydrocarbons, background material found in the river, or residual chlorine. Hydrostatic test water is treated through the stormwater treatment system prior to be discharged to Outfall 001.

5.7.5 OWS 1

OWS 1 is located southeast of the administrative building near the Vapor Recovery Unit (VRU). Operation of the VRU does not involve groundwater extraction or discharge. The separator is an in-ground baffle/weir type unit with a storage capacity of approximately 25,000 gallons. The Terminal installed an orifice plate into the discharge line that reduces the size of the opening in the pipe from 8 inches to 2 inches. The discharge from OWS 1 flows by gravity via pipe underneath Lee Burbank Highway to Outfall 001, located on the eastern bank of the Chelsea River.

Flow rates through OWSs are not to exceed the design capacity of the separator (thereby minimizing the potential for pollutants to be entrained to the waterway). The Terminal controls the flow rate through OWS 1 through two mechanisms. First, the flow rate of stormwater from the tank farm area and a portion of the Terminal yard (i.e., water conveyed through the sump located nearby Tank 3) is limited through use of an electrical interlock system. The interlock system prevents both pumps in the sump from operating at the same time thereby limiting the flow rate from this portion of the Terminal into OWS 1 to approximately 375 gpm. Secondly, a flow restriction device (i.e., orifice plate) installed in the line conveying runoff from beneath the truck loading rack (PS2) to OWS 1 reduces the flow into the separator to approximately 180 gpm. With the controls provided by both mechanisms, the stormwater entering OWS 1 is limited to less than the design flow capacity of 615 gpm.

5.7.7 Septic System

Domestic sanitary sewage from the tank farm side of the Terminal is discharged to an on-site septic system located immediately east of the office building. Industrial wastewater or stormwater discharges do not enter the septic system.

5.8 TERMINAL SECURITY

The Terminal is enclosed by a 6-foot-high chain-link fence with 18-inch barbed wire outriggers. The Terminal is manned on a 24-hour basis. Valves which permit direct outward flow of a tank's contents are locked when in non-operating or standby status. Starter controls on oil transfer pumps are located at areas accessible only to authorized personnel. Pumping units are not locked in the “off” position, except when repairs are in progress, as they are in use on a 24-hour basis.

The loading rack is equipped with a card activated loading system. The driver must have approved driver and customer cards to initiate loading. Drivers are instructed in loading procedures before they are issued cards. Vessel loading/unloading is controlled by the dock man. The dock system is equipped with manual shut-off valves that can be closed immediately in the event of a hose rupture, etc.

Lights are located on the catwalks and around the pump areas in the tank farm. The dock area lighting is sufficient for night-time vessel operations. The truck loading rack is also lighted.

6.0 STORMWATER CONTROL MEASURES

6.1 INTRODUCTION

Stormwater structural and non-structural control measures, for the potential pollutant sources identified in Sections 5.6, are described in Section 6.2 and Section 6.3. In general, these BMPs include measures and controls to promote good housekeeping, runoff management, and preventive maintenance to minimize adverse impacts to stormwater quality. As a priority, materials will be managed to minimize their potential for contact with stormwater.

Controls measure (including BMPs) required for Section C. of the permit are addressed in this Section.–BMPs have been implemented to eliminate or reduce pollutants loading in stormwater discharged from the Terminal. The BMPs will continue to be evaluated and updated to address appropriateness, levels of priority for addressing potential stormwater pollutant sources, procedural changes at the Terminal, and compliance with the MSGP. The BMPs include practices that minimize exposure of potential pollutants to stormwater (such as containment systems) and those that reduce or remove pollutants from stormwater prior to discharge from the Terminal (such as the OWSs). Additionally, BMPs have been developed for upkeep and maintenance of the stormwater system.

6.2 STRUCTURAL CONTROLS

6.2.1 Tank 3 Dike and OWS 1

On the east (tank farm) side of the highway, stormwater from all of the tank dikes is directed through a series of catch basins and piping to the Tank 3 dike, which is equipped with a concrete sump. This sump is equipped with two 3-horsepower (hp) pumps, a primary and a backup, each capable of pumping 375 gpm. There is an interlock so that only one pump can be activated at a time. The pumps are manually operated, after the operator has verified there is no sheen on the water in the Tank 3 sump, or on the water in the tank dike. The stormwater is pumped from the Tank 3 sump to the OWS 1 for treatment. Stormwater collected in OWS 1 gravity flows over weirs and through underground piping to the Chelsea River.

In accordance with the Permit, the surface of the oil/water is routinely observed to determine if there is any detectable increase in the separated oil layer to prevent inadvertent hydrocarbon release to the Chelsea River. The Terminal personnel inspect the oil layer within the OWS on a daily basis.

6.2.2 Terminal Yard Holding Tank

Stormwater from the paved portions of the yard, which includes runoff from the loading rack canopy, enters the stormwater drainage system through a series of catch basins located throughout the yard where it is directed to the 3,000-gallon yard holding tank (sump). The sump is equipped with two 10-hp pumps. The pumps (PS1) automatically pump the water to the Tank 3 dike when activated by level controls.

6.2.3 Loading Rack Containment Tank

Runoff which enters the trench drains beneath the loading rack flows into the concrete holding tank located immediately northwest of the truck loading rack. The concrete holding tank was designed to be a small OWS. As oil and water enter the tank, the water flows from the bottom of the baffled tank into a 1,000-gallon metal tank (lift station), while the oil remains in the concrete tank. Water is then pumped from the lift station (PS2) to the 25,000-gallon OWS 1. The concrete tank is equipped with level indicator lights, which provide a signal to the Terminal operators when there is a substantial accumulation of oil in the tank. If this condition occurs, a certified waste oil contractor skims the oil from the surface of the tank. The only time that oil may be pumped to the main separator is if a substantial spill occurs at the loading rack.

6.2.4 Vessel Dock Drip Pans

The vessel dock located along the Chelsea River has two drip pans. The drip pans are provided to contain residual product in cargo transfer hoses connected to the docked vessels. One of the pans is covered when not in use. The other pan does not receive any product because of the arrangement of the hoses and drain process. Stormwater and product accumulated in the drain pans are transferred via scupper pump to one of the Terminal aboveground storage tanks via pipelines routed beneath Lee Burbank Highway.

6.2.5 Tank Automated Discharge Detection

Tanks 1 through 7, 10, 11, 12, and 14 are equipped with automated discharge detection in high-level and high-high-level alarms to prevent overfilling during marine transfers. High-level alarms are set to activate at the maximum normal operating level of the tank (i.e., the tank's working capacity, which is approximately 90 percent of the tank's shell capacity). Triggering a high-level alarm activates visual (light) and audible signals on the tank control console in the control room of the Terminal office. A high-level alarm signal can be disabled by the Terminal operator using the "Reset" button on the control panel to reset the system.

High-high-level alarms are set to activate at each tank's maximum fill level (i.e., approximately 95 percent of the tank's shell capacity). The high-high-level alarm also activates an audible signal in the Terminal yard, outside of the office. Triggering a high-high-level alarm activates visual (light) and audible signals on the tank control console in the control room of the Terminal office, as well as an audible signal in the Terminal yard. A high-high-level alarm signal can be disabled by the Terminal operator by using the key switch on the control panel.

In the event a high-level alarm is activated, marine or internal (i.e., tank to tank) transfers to the tank that triggered the alarm are stopped. After activation of a high-level alarm, the indicated tank is manually gauged to confirm the product level. Transfer operations to the indicated tank are not resumed until issues causing the alarm are resolved. In the event a high-

high-level alarm is activated, all marine and internal tank transfers are stopped, and the indicated tank is manually gauged to confirm the product level. Transfer operations at the Terminal are not resumed until issues causing the alarm are resolved. Prior to marine or intra-Terminal transfer to a bulk aboveground storage tank, the high-level alarm is tested when the receiving aboveground storage tank is gauged. Alarm testing consists of checking the alarm electrical system with a test button on the control console, and mechanically testing the displacement switch on the aboveground storage tank alarm trigger. The high-level alarm console will also be checked weekly and the findings recorded in the Terminal's log.

6.2.6 Tank Containment System

The eleven (11) bulk aboveground storage tanks and five of the additive tanks (Tanks 8, 9, 15, 22, and 23) are located in the tank farm. An earthen perimeter dike surrounds the tank farm, and within the tank farm, interior earthen dikes form a separate containment area for each bulk aboveground storage tank. The dikes and floor of the tank farm are sufficiently impervious to contain oil. The crest elevations of the interior dikes are lower than the minimum crest elevation of the perimeter dike, so releases from any of the tanks would be contained in the tank farm. Details of the secondary containment for tanks at the Terminal are provided in the Terminals integrated FRP. The effective total containment capacity for the tank farm is 432,400 barrels (18,161,000 gallons), which is adequate volume to contain the maximum volume of the largest bulk aboveground storage tank (Tank 14 shell capacity of 185,000 bbls) and collected runoff from the 25-year, 24-hour precipitation event.

6.2.7 Truck Loading Rack Controls

The truck loading rack is designed to provide positive and effective protection against discharge of contaminants to the surrounding waters and underlying soil and is equipped with automated discharge detection. Products are loaded onto trucks for deliveries to customers at the loading rack, which has 12 loading bays. Trucks are top loaded at Bays 9 and 11, and bottom loaded at the other bays (Bays 1 through 8, 10, and 12). The bays for bottom loading are equipped with Scully and CSI systems. With the CSI system, the operator has to enter the amount of product that will be dispensed and the Scully system prevents overflows. In addition, the Scully system will not dispense product if the truck is not properly grounded. Bays 9 and 11 have manually operated top loading positions where the spouts are spring-loaded and will stop product flow if not controlled by the driver. Trucks are required to be grounded and have the wheels chocked during loading. In addition, there are emergency shut-off switches at the loading rack, and in the Terminal control room that overlooks the truck loading rack, to stop the transfer pumps. Trucks are typically loaded with a total of 3,000 to 10,000 gallons of product and have compartments to minimize the volume that can be spilled in the event of a failure.

6.3 PERMIT NON-STRUCTURAL CONTROL MEASURES

In addition to the structural controls described in Section 6.2, the Terminal has implemented the following control measures, consisting of non-structural control measure, to minimize pollutants discharged to stormwater.

6.3.1 Minimize Exposure (Permit Part I.C.1.a.1)

6.3.1.1 Material Storage Areas

Petroleum products are stored in aboveground storage tanks which prevent direct contact with stormwater. Other Significant Materials are stored in drums with tight fitting lids, which prevent contact with stormwater. These containers are either stored indoors, or on the paved area of the Terminal. Stormwater from the paved area is pumped to the Tank 3 containment dike, and then to the OWS 1. Absorbent materials used in minor spill cleanups are properly containerized and temporarily stored in the waste storage area until pick up by licensed hazardous waste disposal contractor.

In construction areas, use of erosion control barriers around construction activities is implemented to isolate construction areas from stormwater inlets and staged materials are covered with tarps at the end of each day.

6.3.1.2 Vehicle and Equipment Storage Areas

Vehicles are parked in the paved areas of the Terminal. Vehicle parking areas are inspected and maintained regularly. This maintenance program minimizes the potential for petroleum drips, spills and leaks to be discharged with stormwater. As previously noted, stormwater runoff from the Terminal pavement is pumped to the Tank 3 containment dike, and then to the OWS 1.

6.3.1.3 Waste Management Areas

Solid and hazardous wastes are disposed at permitted off-site facilities, in compliance with applicable Local, State, and Federal regulations. Wastewater containing oil from tank cleaning or from the OWSs may be shipped to commercial treatment, storage, and disposal or recycling facilities, as necessary. Other solid wastes are containerized in either Department of Transportation (DOT) approved drums or in roll-offs with tight fitting tarps. Liquid wastes may also be stored in the tank where generated, before being loaded directly onto a tank truck for management. Tank washdown waters may be picked up directly by vacuum truck and taken offsite for disposal.

6.3.2 Good Housekeeping (Permit Part I.C.1.a.2)

Housekeeping measures used at the Terminal to minimize potential pollution from on-site sources include: pavement sweeping, establishment of spill response procedures, neat and orderly storage of materials in approved containers, maintenance of the stormwater collection system. The area-specific measures are outlined in Section 6.3.1.1 through Section 6.3.1.3.

Members of the Pollution Prevention Team receive initial and refresher training on the components and goals of the SWPPP and on each individual's responsibilities as part of the program. The training is also used to help Terminal personnel recognize conditions that may potentially impact stormwater quality and how to correct the conditions. Refer to Section 9.0 for additional information on the employee Training Program.

6.3.2.1 Vehicle and Equipment Cleaning

Periodic non-detergent washing of the loading rack area and non-detergent wash down of paved surfaces is conducted, as needed. All rinse water is directed to the OWS 1.

6.3.2.2 Pavement Sweeping

Sweeping of paved areas is conducted to reduce the transportation of particulate matter to stormwater conveyance and treatment devices at the Terminal. Sweeping events occur two times per year, or as needed, to maximize the removal of solids which may have accumulated at the Terminal over the winter. Terminal personnel routinely sweep paved surfaces and remove debris, specifically in the parking areas, the waste storage areas, and the loading/unloading areas, to prevent dust generation and tracking of industrial materials.

6.3.2.3 Inventory Management

The Terminal has an inventory management program to track the throughput of petroleum products, including additives. The tracking information is maintained daily and is used to help to confirm that their leaks or spills have not occurred and to complete environmental reporting obligations (i.e., air emissions tracking).

6.3.3 Preventive Maintenance (Permit Part I.C.1.a.3)

The Terminal has an active preventive maintenance program to minimize production downtime and environmental impact. The Terminal's preventive maintenance program includes documented inspections of equipment and systems (e.g., aboveground storage tanks, containment structures, piping, conveyance systems, valves and manifolds, transport equipment, and product-moving equipment) to identify conditions that could cause breakdowns or failures resulting in discharges of potential pollutants to stormwater. The preventative maintenance program also includes the inspection of the stormwater collection and treatment systems. The Terminal tracks repairs of equipment and systems using an internal work-order system to facilitate prompt corrective action and to reduce the potential for a leak, spill, or other release to the environment. Specific operating and maintenance procedures have been developed, see Appendix J, that include berm, catch basin, and oil water separator inspections and scheduled maintenance items including sediment removal.

6.3.4 Spill Prevention and Response (Permit Part I.C.1.a.4))

Another housekeeping measure implemented by the Terminal is to clean-up leaks, drips, and spills promptly and with the use of absorbents for dry clean-up whenever possible. The Terminal has a comprehensive spill response program outlined in their FRP.

As required by the Permit, Part I.C.1.a.4, the Terminal shall implement spill prevention and response procedures to ensure effective response to spills and leaks if or when they occur, including, but not limited to, those required by Section 311 of the CWA, 33 U.S.C. § 1321. The Permittee shall report immediately the appearance of any size sheen attributable to the discharge from the Facility to the appropriate agency of the United States Government in accordance with Section 311 of the CWA.

The Terminal has developed detailed response actions in the event of a spill of reportable quantities at the Terminal in the Terminal's FRP. The notification procedures are outlined in Section 1.0 and Section 6.1 of the FRP. A list of past significant spills and significant leaks of toxic or hazardous pollutants that occurred at the Terminal are presented in Section 5.4.3 of this Plan. As outlined in Section 5.4.3, the Terminal will maintain a record of significant spills as of the effective date of this Plan that is included in Appendix C.

6.3.5 Sediment and Erosion Control (Permit Part I.C.1.a.5)

Should signs or evidence of erosion or sedimentation develop, it will be noted in inspection reports located in Appendix J and appropriate corrective actions will be identified and implemented. Furthermore, should the Terminal conduct construction activities, the Terminal will install BMP controls to those areas where soil is exposed to stormwater to limit the potential for sedimentation and erosion.

Erosion control devices used in Tank Yards should include synthetic filter socks to trap fine particles and inlet protection devices.

6.3.6 Run-off and Run-On Management Practices (Permit Part I.C.1.a.6)

The Facility holds collected stormwater in the diked areas to allow for particulate settling and evaporation. The dikes are managed per Appendix J to minimize pollutant discharge from dike area conditions.

6.3.7 Snow and Ice Control (Permit Part I.C.1.a.7)

As described in Section 5.6.7, the Terminal has outdoor storage of salt for deicing or other commercial or industrial purposes. The salt pile remains covered with a tarp to minimize exposure to stormwater. Small quantities of salt are also stored indoors, seasonally, and used to deice walkways. Subcontractors are hired by the Terminal to remove snow from the Terminal property and sand and salt paved areas, as necessary.

6.3.8 Training (Permit Part I.C.1.a.8)

Employees are annually trained to recognize potential spill situations and respond to them appropriately (See Section 9 of this Plan). Inspections of significant materials storage locations are made on a regular basis, and therefore prompt response to a release can be made. Spill Response Procedures are described in detail in the Terminal's FRP.

6.3.9 Non-Stormwater Discharge Evaluation (Permit Part I.C.1.a.9)

The Terminal will evaluate for the presence of non-stormwater discharges and illicit discharges by evaluating the integrity of the stormwater system. See *Section 6.4.8- Stormwater System Integrity BMP-8 (Part I.C.1.b.8))* that includes the approach to address this requirement.

6.3.10 Minimize Dust Generation (Permit Part I.C.1.a.10)

The Terminal minimizes dust by keeping vehicle traffic on paved areas, to the extent practicable. Sweeping of paved areas is conducted to reduce the transportation of particulate matter to stormwater conveyance and treatment devices at the Terminal. See Section 6.3.2.2 for the sweeping schedule. Sweeping events prevent dust generation and tracking of industrial materials.

Construction activities performed by the Terminal or contractors are required to follow the BMPs included in this SWPPP and are included in project pre-planning. In construction areas, staged materials are covered with tarps at the end of each day to minimize wind blow disturbance of soil. Furthermore, should the Terminal conduct construction activities, the Terminal will install BMP controls to those areas where soil is exposed to stormwater to limit the potential for sedimentation and erosion, leading to dust generation.

6.3.11 No Illicit Discharge Demonstration (Permit Part I.C.1.a.11)

The Terminal will demonstrate that illicit discharges, to the extent practicable, are not present by providing the findings of the stormwater integrity evaluation. See *Section 6.4.8- Stormwater System Integrity BMP-8 (Part I.C.1.b.8))* which includes the approach to address this requirement.

6.3.12 Animal Control (Permit Part I.C.1.a.12)

The Terminal shall monitor effluent and on-site conditions to minimize impacts of animals feeding or roosting on site. Known, available, and reasonable methods will be implemented to deter animal behavior as needed, provided that such methods do not violate federal, state, or local statues.

The Terminal has developed an Operation and Maintenance Plan for the Terminal's stormwater system with the aim to maintain flow and reduce ponding of stormwater on site. Minimizing stormwater ponding will reduce waterfowl activity on site and in the stormwater system components. Should waterfowl activity be observed, the Terminal will review and implement active deterrents including, but not limited to, an active visual deterrent, such as predatory figures or distraction devices.

6.3.13 Bacterial Control (Permit Part I.C.1.a.13)

The Terminal shall monitor effluent and on-site conditions to minimize known sources of bacteria. Known, available, and reasonable methods will be implemented to reduce bacterial impacts to stormwater, provided that such methods do not violate federal, state, or local statues.

The Terminal has identified ponding in the stormwater system dikes for potential bacterial input to the stormwater system. The Terminal developed an Operation and Maintenance Plan that includes procedures to minimize site ponding. Additionally, waterfowl activity on site has been identified as a vector for fecal bacterial input. The Terminal will follow the procedures listed in 6.3.12 to help deter animal bacterial input.

6.4 PERMIT SPECIFIC BMPs (Permit Part I.C.1.b)

6.4.1 Inspection and Corrective Action Requirements (Permit Part I.C.1.b.1)

The Terminal will comply with the inspection requirements in Parts 3.1 and 3.2 of the 2021 MSGP, the corrective action requirements in Part 5.1 of the 2021 MSGP, and the corrective action documentation requirements in Part 5.3 of the 2021 MSGP. Should the listed conditions below occur, the Terminal will review and revise the SWPPP so that the effluent limits are achieved and pollutant discharge is minimized. Conditions which require corrective action may include:

- An unauthorized release or discharge (e.g., spill, leak, or discharge of non-stormwater) not authorized by this or another NPDES permit;
- A discharge that violates a numeric effluent limit listed in Part I.A of this permit;
- A stormwater control measure which is not sufficient to control stormwater discharges as necessary such that the receiving water meets applicable water quality standards and/or the non-numeric limits in Part I.C of this permit;
- A required control measure which was never installed, was installed incorrectly, or is not being properly operated or maintained; and
- A visual assessment which shows evidence of stormwater pollution (e.g., color, odor, floating solids, settled solids, suspended solids, foam).

6.4.2 Control Measure Requirements (Permit Part I.C.1.b.2)

The Terminal will comply with the control measure requirements in Part 2.1 and 2.1.1 of the 2021 MSGP to identify pollutant sources and select, design, install and maintain the pollution control technology necessary to meet the effluent limitations in the permit that ensure dilution is not used as a form of treatment.

The Terminal has summarized USEPA discharge monitoring data in Appendix D and will implement notification, inspection, and stormwater system design updates in the event an effluent parameter exceedance is identified. Additionally, the Terminal contracted Verdantas to review the existing stormwater system control measures and review site for potential pollutants. Verdantas reviewed the following stormwater system components and potential pollutant sources:

- Condition of existing stormwater dike areas, catch basins, and trench drains;
- Condition of the Oil Water Separators;
- Discharge point and meter well location;
- Loading rack area;
- Bulk storage tanks;
- Parking areas;
- Waste storage (i.e., dumpsters); and
- Terminal dock area.

Verdantas identified sediment as a potential pollutant source in the Terminals current stormwater system and developed an Operation and Maintenance Plan (Appendix J) in response to the observations. The Terminal is working with Verdantas to gather additional data and perform a hydrologic analysis of the Terminal's stormwater system. Data collection and analysis will be collected over the course of the NPDES permit and in conjunction with the groundwater evaluation detailed in the Permit, Part I.C.1.b.8.

6.4.3 Discharge Practices BMP (Permit Part I.C.1.b.3)

To the extent practicable, the Terminal shall develop a process for the initiation of discharge of stormwater and hydrostatic test water which identifies the conditions which meet the requirements of a qualifying event, and the methods for avoiding worst-case conditions, and conditions under which discharges should not occur. The Discharge Initiation Process BMP includes the following:

<u>Permit Specific: Discharge Initiation Process</u>
The Terminal is required by the Permit to limit discharges during worst-case conditions in the receiving water (defined in the Permit as approximately 1 hour before and after slack tides). The Terminal should not discharge when visible oil sheen is observed, receiving water is under low flow conditions, or other site-specific factors that lead Terminal personnel to believe that there is a potential to discharge pollutants to the receiving waters. Tidal information is already tracked for fuel shipments, so that information will be used to determine the ideal times to perform stormwater discharges to the receiving water. Additionally, as a best management practice, the Facility typically limits discharge to times where the dock is not occupied by a fuel ship that is actively transferring petroleum products to the terminal's tank farm.

To the extent practicable, the Terminal will only discharge to the receiving water during an outgoing tide at least 1 hour from both the low and high slack tide, with the exception of emergency situations (i.e., heavy rainfall that could potentially cause flooding at the Terminal, decreased effectiveness of the secondary containment system for the tank farm, unsafe working conditions in tank yard, decreased protection of pumps and electrical equipment etc.). Annual, Quarterly and monthly sampling will be performed in accordance with the Permit and the site-specific sampling plan. Refer to the site-specific sampling plan, included in Appendix E, for procedures regarding sampling.

6.4.4 Flow Control BMP (Permit Part I.C.1.b.4)

The Terminal shall document the measures and methods used to control flow through the stormwater treatment system to ensure that the design flow of the treatment system is not exceeded. Flow controls are described in Section 5.7.5.

6.4.5 Ethanol Storage and Response Procedures (Permit Part I.C.1.b.5))

The Terminal shall design and implement response procedures for ethanol, materials that are used for spill and fire control (e.g., aqueous film-forming foam). This must include specific provisions for the treatment of ethanol and/or pollutants in materials that are used for spill and fire control, should release occur. A copy of the Terminals Ethanol and Alcohol Resistant Firefighting Foam Release Response Procedure is located in Appendix H.

6.4.6 Major Storm and Flood Event Procedures (Permit Part I.C.1.b.6))

The Terminal will implement structural improvements, enhanced/resilient pollution prevention measures, and/or other mitigation measures to minimize discharges that result from impacts of major storm and flood events. The Terminal will incorporate past storm events and projections of 25- and 100-year storm events in the evaluation of flood risk. The Terminal will document in the SWPPP its evaluation of the major storm and flood risks at the Facility, and control measures considered to address discharges resulting from these risks. For the control measures considered, the Terminal will document in the SWPPP the factual basis (i.e., the maps, data sets and calculations for the analysis). See Appendix I for the Terminals Flood Risk Assessment of the Terminal.

As a result of the evaluation (Appendix I), the Terminal identified that the Tank Farm area is above the 100-year storm event levels, and may be protected by existing berm heights and containment. Also, the Tank Farm berms were identified to be of sufficient capacity to contain and control stormwater from a worst case 100-year storm event. However, the Terminal Loading Rack area has been identified as a possible area of increased risk because the elevation of this area is at the area of FEMA flood elevation of 10 feet. This area will be further evaluated with site-specific data.

The Terminal is gathering additional data, in conjunction with the Stormwater System Integrity Evaluation detailed in Section 6.4.8, to perform a complete stormwater system model. Once the stormwater system evaluation and modeling is complete, the Terminal will review recommended system and control measure options. Implementation of recommended options will be detailed in revisions to this SWPPP.

The Terminal has identified that regular maintenance and housekeeping of the stormwater system will mitigate risk of pollutant discharge during storm events. An Operation and Maintenance Plan was developed and is included in Appendix J. Implementation of the O&M Plan will help reduce held stormwater at the Terminal and reduce the potential for pollutant discharge during major storm and flooding events. Procedures are in place, as outlined below, to remove stormwater from the Terminal prior to a major storm event, if practicable.

The Terminal has existing major storm and flood risk controls and procedures in place. The major storm event and storm surge procedures, preparation, and response plans are summarized below:

Severe Weather Preparedness:

This Irving Oil procedure applies to all locations within the United States and Canada. The Terminal will implement the preparedness items in response to severe weather events including, but not limited to, high winds, tropical cyclones, blizzard, ice storms, heavy rainfall/flooding, and storm surges. The Terminal will assess the weather event and evaluate the potential risks at the Terminal and implement mitigation measures. Additionally, the Terminal will review ship arrivals and departures and divert or suspend ship operations to mitigate risk to the environment. A major storm, tropical cyclone, or storm surge event would have the following stormwater specific considerations under the Terminals Severe Weather Preparedness plan:

- Draining of the oil water separator, if practicable and required to mitigate pollutant release risk;
- Clear drains and catch basins at the Terminal;
- Clean and re-enforce drainage berms as needed;
- Reposition or secure dock area for equipment or material that may be impacted by a storm surge; and
- Secure and remove tank field materials, dumpsters, equipment, and other Terminal materials as appropriate.

US Coast Guard Operations Manual

The Terminal maintains a United States Coast Guard Operations Manual as required by 33 CFR Part 154, last revised in December 2022. This plan dictates ship and dock operations during severe storm events. Ship transfer operations are not allowed during severe weather events and transfers in progress during a sudden unforeseen severe weather event would be secured as soon as practicable. The following actions are included in the severe weather checklists:

- Storage of material inside buildings where practicable;
- Cleaning drip pans in use during active repairs and wrapping with absorbent material to prevent an oil release;
- Closing tank valves;
- Verifying tank levels are adequate to ballast tanks; and
- Preparing drainage valves.

<u>Severe Weather Readiness: General and High Winds and Hurricane procedures</u>

The Terminal has operating procedures in place for situations including Severe Weather Readiness Operating procedures for general severe weather conditions and for high wind or hurricane conditions. In addition to the readiness items referenced above, the plans include the following steps:

- Securing Terminal secondary buildings and storage containers on site;
- Securing truck rack equipment and material;
- Removal of construction material and equipment, including coordination with contractors to secure or remove contractor trailers, vehicles, material, and equipment;
- Drain tank farm dike yard of water, if practicable; and
- Coordination of staffing to allow for only essential personnel and vehicles on site, if evacuation has not been implemented.

The Terminal has evaluated the following permit specific control measures referenced in NPDES permit Part I.C.1.b.6 to minimize discharges during severe storms and flood events. The required control measure considerations and their implementation are detailed below:

<u>Permit Specific Stormwater System Control Measures</u>

- Reinforce materials storage structures to withstand flooding and additional exertion of force; *(included in existing Severe Weather Preparedness plan);*
- Prevent floating of semi-stationary structures by elevating above the relative base flood elevation or securing with non-corrosive device; *(included in existing severe weather preparedness procedure, severe weather readiness procedures, and USCG operations manual);*
- When a delivery of materials is expected, and a storm is anticipated within 48 hours, delay delivery until after the storm or store materials as appropriate (refer to emergency procedures); *(included in existing severe weather preparedness procedure and USCG operations manual);*
- Temporarily store materials and waste above the relative base flood elevation; *(included in existing severe weather preparedness procedure and severe weather readiness procedures);*
- Temporarily reduce or eliminate outdoor storage; *(included in existing severe weather*

preparedness procedure and severe weather readiness procedures);

- Temporarily relocate any mobile vehicles and equipment to upland areas; *(included in existing severe weather preparedness procedure and severe weather readiness procedures);* and
- Develop scenario-based emergency procedures for major storms that are complementary to regular stormwater pollution prevention planning and identify emergency contacts for staff and contractors; and *(severe weather preparedness procedure, severe weather readiness procedures, and USCG operations manual)*
- Conduct staff training for implementing emergency procedures at regular intervals *(Review and training of procedures would be implemented when major storm events are identified and routinely during annual SWPPP training).*

6.4.7 Stormwater Quality Assurance (Part I.C.1.b.7))

The Terminal will document quality assurance/quality control (QA/QC) practices, see Appendix E for the Terminals Stormwater Sampling Plan:

- A summary of the monitoring requirements specified in the permit;
- A map and/or treatment system diagram indicating the location of each sampling location with a geographic identifier (i.e., latitude and longitude coordinates);
- Specifications for the number of samples, type of samples, type and number of containers, type of preservation, type and number of quality assurance samples, if applicable, type and number of field samples, if applicable, and sample storage, holding times, and shipping methods, including chain-of-custody procedures;
- Specifications for USEPA-approved test methods and sufficiently sensitive minimum levels for each required parameter;
- A schedule for review of sample results; and
- A description of data validation and data reporting processes.

6.4.8 Stormwater System Integrity (Part I.C.1.b.8))

The Terminal will implement a stormwater system BMP that ensures the integrity of stormwater system components through elimination of the infiltration of impacted groundwater to the stormwater conveyance system where such infiltration contributes pollutants but are not otherwise explicitly authorized (i.e., by another NPDES permit). Within one year of the effective date of the permit, the Terminal will complete a stormwater system evaluation detailed in permit part 1.C.1.b.8. The Terminal contracted Verdantas to perform a stormwater system evaluation which may include:

- A one-time cross-connection evaluation;
- A visual and video inspection of the accessible portions of the stormwater system below the ground surface;
- Evaluation of groundwater and review of known groundwater pollutants;
- Sampling of MtBE at points representative of groundwater conditions at the Facility,

collected during dry weather absent of tidal influence;

- Sampling of MtBE at accumulation points within the stormwater system susceptible to groundwater infiltration, collected during dry weather absent of tidal influence; and
  Develop, as required, a corrective action procedure for Terminal implementation if MtBE is identified as impacting the stormwater system. This corrective action will follow the requirements of permit part 1.C.1.b.1 and sampling of MtBE at the monitoring point will follow the schedule detailed in permit part 1.A and part 1.C.1.b.1.

7.0 MONITORING REQUIREMENTS

7.1 EFFLUENT AND RECEIVING WATER MONITORING

As outlined in Part I.A. of the Terminal's Permit, stormwater effluent and receiving water samples must be collected for monitoring purposes. Samples taken for the purpose of monitoring shall be representative of the monitored activity (i.e., stormwater discharge from Outfall 001). Samples shall be collected on a bi-monthly, monthly, and quarterly basis. The Terminal's Stormwater Sampling Plan, included as Appendix E, was developed to provide specific instructions to Terminal personnel on the sample collection, handling, analysis, and reporting obligations required by the Permit. This sampling plan includes a summary of the following:

- sample collection methods;
- sample handling and Chain of Custody (COC) records;
- data review and interpretation; and
- recordkeeping and reporting requirements.

Instructions on hydrostatic test water sampling, when it occurs, as outlined in Part I.C.3 of the Permit, as detailed in Section 7.2 of this Plan.

If any additional sampling that is conducted in accordance with the USEPA approved methods and consistent with the provisions of 40 CFR 122.41(1)(4)(ii), the results must be submitted to both the USEPA and the MassDEP.

7.2 HYDROSTATIC TEST WATER SAMPLING

Hydrostatic test water shall be monitored and treated through the stormwater treatment system prior to being discharged through Outfall 001 to the Chelsea River, and is subject to the Effluent Limitations in Part I.A.1 of the Permit. The flow of hydrostatic test water into the stormwater treatment system will be controlled to prevent it from exceeding the maximum design flow rate of the system (i.e., 615 gpm at OWS 1).

For tanks, the Terminal will collect:

- one in-process sample of the tank water following maintenance or testing, but before draining.

For Pipelines, the Terminal will collect:

- one in-process sample of the pipeline water following depressurization, but before draining.

The operator shall analyze and review the results of the in-process sample prior to initiating discharge. If the analysis indicates that the tanks or pipeline water does not meet the effluent limitations in this permit, the operator shall not discharge the pipeline water unless treatment will reduce the pollutant levels below the effluent levels established in this permit.

Three grab samples of the effluent (at the discharge point for the treatment system), one sample during the first 10% of discharge, one sample at the approximate midpoint of discharge, and one sample during the last 10% of discharge after treatment. One grab sample of the effluent during the first 10% of discharge is sufficient for discharges from tanks with volumes no greater than 50,000 gallons. If at any time analysis indicates that the hydrostatic test water does not meet the effluent limitations in this permit, corrective action must be taken in accordance with Part I.C.1.b(1), above.

The in-process and effluent samples of hydrostatic test water shall be analyzed for the following parameters:

1) Total Flow;
2) Flow Rate;
3) Total Suspended Solids;
4) Oil & Grease;
5) pH;
6) Chemical Oxygen Demand;
7) Dissolved Oxygen;
8) Total Surfactants;
9) VOCs (benzene, toluene, ethylbenzene, and total xylenes);
10) PAHs (Group I and II PAHs listed in Part I.A.1 of the Permit, benzo(a)anthracene through pyrene);
11) Metals (total recoverable iron, and total recoverable metals listed in Part I.A.1 of the Permit, Whole Effluent Toxicity, cadmium through zinc);
12) Ethanol, if tank or line has been used to store and/or convey ethanol and/or petroleum products containing ethanol within the previous year; and
13) Total Residual Chlorine, if potable water or a similar source of water which is likely to contain residual chlorine concentrations is used for hydrostatic testing.

The Terminal shall submit a letter/report to the USEPA and the MassDEP, summarizing the results of the hydrostatic test within 90 days of completion of the test.

7.3 BIOASSESSMENT

The Terminal shall design and implement a bioassessment to characterize the extent to which, if any, pollutants discharged from the Facility to the receiving water affect the benthic morphology, substrate, and/or biota. Unless otherwise specified below, data collection activities shall be conducted:

- quarterly for one year starting 90 days following the effective date of the permit; and
- quarterly for one year in the fifth year of the permit term.

A bioassessment plan prior to assessment and a summary report must be submitted to USEPA and MassDEP per Part I.C.5 of the permit. The bioassessment must comply with applicable local, state, and federal regulations, and shall be consistent with Part I.C.5 of the permit. This plan was submitted to the USEPA for review on January 30, 2023.

8.0 INSPECTIONS

8.1 DAILY INSPECTIONS

Routine visual inspections of designated equipment and areas of the Terminal are conducted by qualified Terminal personnel. These documented inspections, which are completed daily, include storage areas for vehicles or equipment awaiting maintenance, the truck loading rack, material storage areas, and loading/unloading areas.

Follow-up procedures must be used to ensure that appropriate actions are taken in response to the inspections. Records of the inspections are documented and maintained on-site using the Daily Terminal Inspection Form located in Appendix F. The SWPPP inspections are part of a combined Daily Terminal Inspection Form that is also used to complete visual Spill Prevention, Control, and Countermeasure (SPCC) inspections. Terminal personnel are in the tank farm daily and have an opportunity to observe conditions.

Specific items noted in the SPCC inspections include:

- pipe and pump leaks
- OWSs
- paved area surface
- containment areas
- tank corrosion
- deterioration of supports or foundations
- staining in drainage areas and on tanks

Each system and piece of equipment is inspected on a monthly basis. Storage tanks and ancillary equipment are inspected in accordance with API-653 requirements. A log book of those inspections is kept at the Terminal. The major elements of these inspections include:

- condition of tank shell
- corrosion
- condition of tank foundation
- leaks
- condition of tank dike
- pipe support systems

OWS-1 is inspected daily for sheen or oil. These inspections are made as part of the Terminal operator's Terminal-wide inspection checklist and are recorded with those inspections. Any oil layer observed in the separator is removed as needed. The OWS is also inspected for bottom sludge on a monthly basis. Irving hires a contractor, on an annual basis or as needed, to pump out and inspect catch basins, sumps and the OWS.

Routine visual inspections are conducted at significant material storage locations in accordance with SPCC requirements. These inspections, which are completed on a daily basis include: identifying any spills or leaks from aboveground storage tanks, corroded pipes and tanks, equipment deterioration, and stains or windblown materials.

8.2 QUARTERLY STORMWATER INSPECTIONS

The Terminal will conduct Quarterly Stormwater Inspections that include areas of the Terminal where industrial materials or activities are exposed to stormwater and of all stormwater control measures used to comply with the effluent limits. Stormwater conveyance structures will be inspected for proper operation and function and evidence of problems such as cracks, breaks, obstructions, erosion, oily sheens, and any other circumstances that could adversely affect stormwater flow, treatment, and purity. Vehicle, equipment, and material handling areas that could adversely affect stormwater discharges will be inspected for leaks, spill, odors, poor housekeeping, staining, corrosion, cracks, equipment problems, smoke, dirt (or other erodible material), poor labeling, and any other circumstances that could potentially result in stormwater contamination.

In addition to the visual inspections of the Terminal, each inspection will also include a visual assessment of a stormwater outfall sample, collected within the first 15 minutes of discharge, stored in a clean, clear glass or plastic container, and examined in a well-lit area for the following water quality characteristics: color, odor, clarity, floating solids, settled solids, suspended solids, foam, oil sheen, and other obvious indicators of pollution. These inspections shall be conducted concurrent with the quarterly monitoring sample collection. The inspections shall be conducted by qualified personnel with one or more members of the SWPP Team. If the inspector identifies a need for housekeeping, he or she will complete the required task, if practicable, or notify the Team Coordinator to arrange for completion of the task.

Quarterly Stormwater Inspections will be conducted at least quarterly (i.e., once each calendar quarter). At least once each calendar year, the routine Terminal inspection will be conducted during a period when a stormwater discharge is occurring. The USEPA considers quarters as follows: January to March; April to June; July to September; and October to December. A copy of the Routine Terminal Inspection Log is included in Appendix F.

8.3 ANNUAL STORMWATER COMPLIANCE EVALUATION

The Terminal will complete Annual Stormwater Compliance Evaluation (Annual Evaluation) each year. The Annual Stormwater Compliance Evaluation will take the place of one of the four Routine Terminal Inspections.

The Annual Stormwater Compliance Evaluation will note significant changes to the physical structures and operational practices at the Terminal. These changes will be reflected on the Terminal map and incorporated into a revised SWPPP.

The Annual Stormwater Compliance evaluation will consist of the following:

- Visual observation of:
  - industrial materials, residue, or trash on the ground that could contaminate or be

washed away in stormwater;
    - leaks or spills from industrial equipment, drums, barrels, tanks, or similar containers;
    - off-site tracking of industrial materials or sediment where vehicles enter or exit the Terminal;
    - tracking or blowing of raw, final, or waste materials; and
    - evidence of, or the potential for, pollutants entering the drainage system;

- Evaluation of the integrity and correct operation of control measures;

- Inspection of accessible discharge locations to evaluate the effectiveness of BMPs in preventing significant impacts to receiving waters;

- Inspection of inaccessible discharge locations by evaluating nearby downstream locations to evaluate the effectiveness of BMPs in preventing significant impacts to receiving waters;

- Updating the Pollution Prevention Team list (as needed) and documenting employee training;

- Revision of the inventory of significant materials (as needed);

- Completion of inspections/evaluations necessary to complete the non-stormwater discharge certification; and

- Updating the site plan information, if required.

A review of the Terminal's records and recordkeeping procedures will be completed during the Annual Stormwater Compliance Evaluation to evaluate whether changes occurring between inspections that may materially affect the SWPPP are reported to the Pollution Prevention Team so that the team is able to make necessary modifications to the SWPPP in a timely manner.

The Annual Stormwater Compliance Evaluation will be documented on the log included in Appendix F. The SWPPP will be revised following each annual evaluation if significant inaccuracies in the SWPPP are discovered during the evaluation. Changes in measures and controls that are identified during the evaluation will be implemented as soon as possible (generally before the next sampling event) after completing the evaluation.

As part of the Annual Stormwater Compliance Evaluation, the Terminal will complete the annual SWPPP certifications outlined in Section 3.4 of this Plan.

8.4 STORMWATER INSPECTION DOCUMENTATION

The Terminal shall document the following information for the Quarterly and Annual Inspections and maintain the records along with the SWPPP:

- The date and time of the inspection and at which any samples were collected;
- The name(s) and signature(s) of the inspector(s)/sample collector(s);
- If applicable, why it was not possible to take samples within the first 15 minutes;
- Weather information and a description of any discharges occurring at the time of the inspection;
- All observations relating to the implementation of stormwater control measures at the facility including:
    - A description of any stormwater discharges occurring at the time of the inspection;
    - Any previously unidentified stormwater discharges from and/or pollutants at the facility;
    - Any evidence of, or the potential for, pollutants entering the stormwater drainage system;
    - Observations regarding the physical condition of and around all stormwater discharge points, including any flow dissipation devices, and evidence of pollutants in discharges and/or the receiving water;
    - Any stormwater control measures needing maintenance, repairs, or replacement;
- Any additional control measures needed to comply with Permit requirements;
- Any incidents of noncompliance; and
- A statement, signed and certified in accordance with appendix b, subsection 11 of the MSGP.

9.0 TRAINING

9.1 INTRODUCTION

Employee training programs have been developed to inform Terminal personnel responsible for implementing activities identified in the SWPPP of the components and goals of the plan, as well as other plans including the FRP, SPCC, and Emergency Response Action Plan (ERAP). The training includes the Terminal's SWPPP requirements, practices for preventing spills, general good housekeeping practices, and the procedures for responding properly and rapidly to spills. Personnel are trained initially prior to work assignments and annually thereafter.

9.2 EMPLOYEE TRAINING MEETINGS

Employee training meetings are held annually as part of the basic Spill Response Training session. The meetings emphasize spill events or failures, malfunctioning equipment, new policies or programs regarding spill prevention or response and employee roles and responsibilities.

9.3 SCOPE OF SWPPP TRAINING

The training is provided or arranged by the SWPP Team Coordinator, and is given:

- to new members of the Pollution Prevention Team before they assume their responsibilities; and
- at least annually to all members of the Pollution Prevention Team.

The training program is reviewed annually by the SWPP Team Coordinator to evaluate its effectiveness and to make any necessary changes to the program. Training topics include:

- environmental laws and regulations relating to stormwater;
- components and goals of the Plan;
- spill response;
- good housekeeping;
- material management practices;
- individual responsibilities;
- inspections; and
- monitoring.

An employee sign-in sheet (Appendix G) is completed to document that training has been completed.

10.0 REPORTING AND RECORDKEEPING

10.1 INTRODUCTION

As outlined in the Terminal's Permit, the records of all monitoring information, including all calibration and maintenance records, should be kept for a period of at least five (5) years from the date of the sample, measurement, report, or application. Sampling monitoring data records required by the permit include:

- the date, exact place, and time of the sampling or measurement;
- the name of the individual who performed the sampling or measurement;
- the date(s) any analysis was performed;
- the name of the individual(s) who performed the analysis;
- the analytical techniques or methods used; and
- the results of the measurement or analysis.

10.2 DISCHARGE MONITORING REPORT SUBMITTAL

The Terminal shall submit discharge monitoring report (DMR) data and other reports to the USEPA electronically using NetDMR, a web-based tool that allows permittees to electronically submit DMRs and other required reports via a secure internet connection. Analytical monitoring results for Outfall 001 and the receiving water must be submitted electronically no later than the 15th day of the month following the completed reporting period.

All reports required under the permit shall be submitted to USEPA as an electronic attachment to the DMR.

10.3 HYDROSTATIC TEST SUMMARY LETTERS AND OTHER SUBMITTALS

The Terminal shall send hard copies of Hydrostatic Test Summary Letters/Reports to the USEPA and MassDEP, until further notice from the MassDEP. A duplicate signed hard copy of each hydrostatic test summary letter/report required in Part I.A.15.e., shall be submitted to the USEPA at the following address:

U.S. Environmental Protection Agency
Enforcement and Compliance Assurance Division
Water Compliance Section
5 Post Office Square – Suite 100 (04-SMR)
Boston, Massachusetts 02109-3912

Hydrostatic test summary letters/reports and other reports or notifications (non-DMR related reports), with the exception of Toxicity Test Results, shall be submitted to the MassDEP at the following address:

Massachusetts Department of Environmental Protection

Bureau of Water Resources
Division of Watershed Management
8 New Bond Street
Worcester, Massachusetts 01606

10.4 TOXICITY TESTING REPORT SUBMITTALS

The Toxicity Test Reports must be mailed to the MassDEP at the following address:

Massachusetts Department of Environmental Protection
Surface Water Discharge Permit Program
8 New Bond Street
Worcester, Massachusetts 01606

10.5 PUBLIC POSTING OF DMRS AND SWPPP

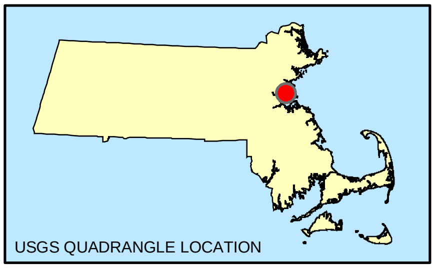
The Terminal shall, submit a copy of the current SWPPP and all SWPPP certifications (i.e., the initial certification, recertifications, and annual certifications) signed during the effective period of this Permit to USEPA for posting on USEPA Region 1's Chelsea River Terminals public website. All documentation of SWPPP activities shall be kept at the Facility for at least five years and provided to USEPA upon request.

10.6 ON-SITE RECORDS

Discharge sampling data, calibration records, inspection records, certifications, and corrective actions must be kept in a separate file by the Terminal Manager and retained for at least five (5) years. This data must be made available for review upon request.

The Terminal shall furnish to the USEPA, within a reasonable time, any information which the USEPA may request to determine whether cause exists for modifying, revoking and reissuing, or terminating this permit, or to determine compliance with this permit. The Terminal shall also furnish to the USEPA, upon request, copies of records required to be kept by this Permit.

FIGURES



LEGEND

APPROXIMATE SITE BOUNDARY

SOURCE : SCANNED USGS TOPOGRAPHIC QUADRANGLES
SCANNED BY THE MASSACHUSETTS EXECUTIVE OFFICE OF
ENVIRONMENTAL AFFAIRS, MASSGIS. DISTRIBUTED JUNE, 2001.

0 500 1,000 2,000 3,000 4,000 Feet

Data Supplied by :

MASS GIS

N W E S

GZA

PROJ. MGR.: DJF
DESIGNED BY: EMD
REVIEWED BY: DJF
OPERATOR: GAS

DATE: 11-12-2009

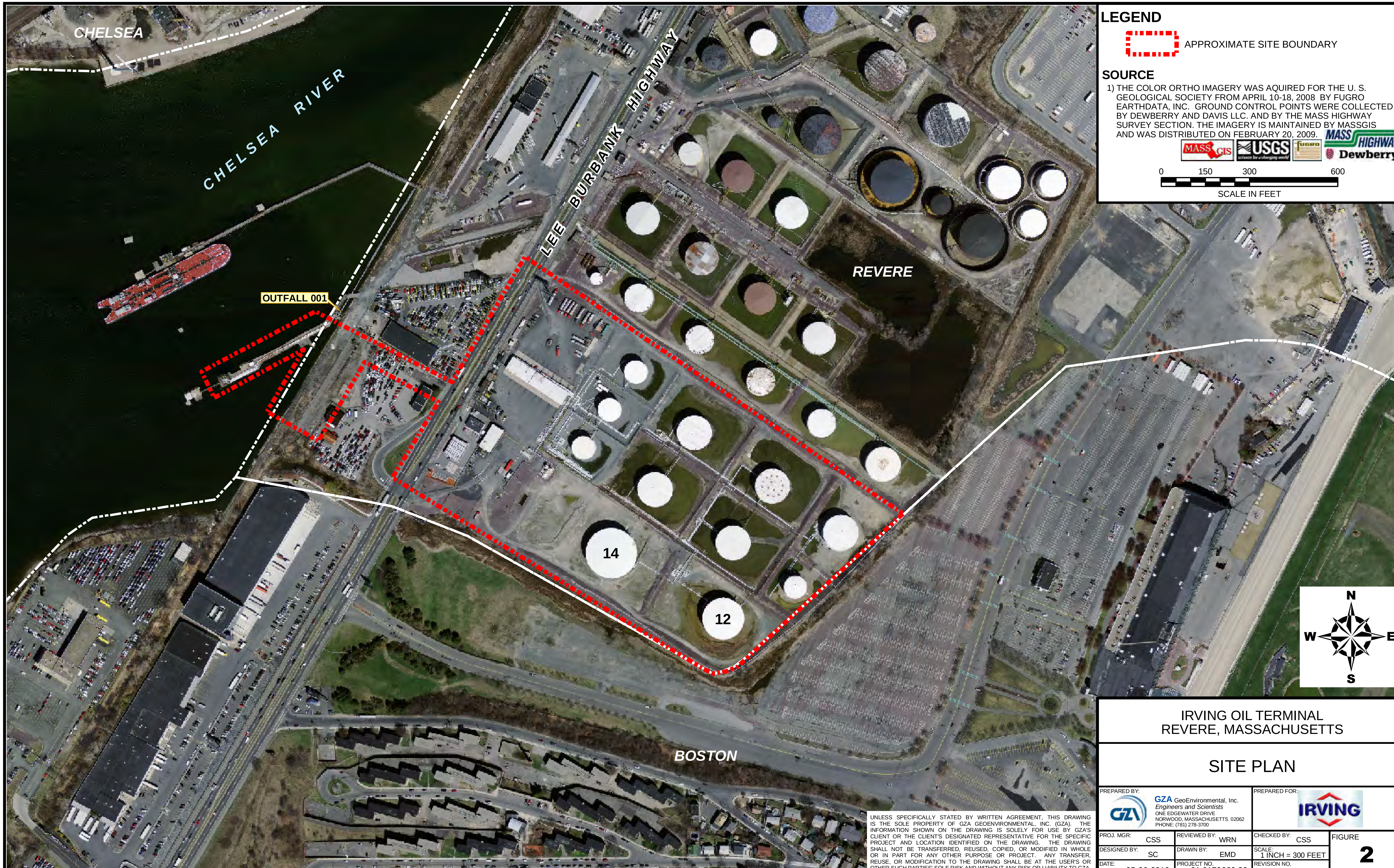
SITE LOCUS MAP

REVERE MARINE OIL TERMINAL
REVERE, MASSACHUSETTS

JOB NO.
170089.10

FIGURE NO.
1

J:\170,000-179,999\170089\170089-10.CSS\FIGURES\Figure 1 - Site Location Map.mxd



IRVING OIL TERMINAL
REVERE, MASSACHUSETTS

SITE PLAN

UNLESS SPECIFICALLY STATED BY WRITTEN AGREEMENT, THIS DRAWING IS THE SOLE PROPERTY OF GZA GEOENVIRONMENTAL, INC. (GZA). THE INFORMATION SHOWN ON THE DRAWING IS SOLELY FOR USE BY GZA'S CLIENT OR THE CLIENT'S DESIGNATED REPRESENTATIVE FOR THE SPECIFIC PROJECT AND LOCATION IDENTIFIED ON THE DRAWING. THE DRAWING SHALL NOT BE TRANSFERRED, REUSED, COPIED, OR MODIFIED IN WHOLE OR IN PART FOR ANY OTHER PURPOSE OR PROJECT. ANY TRANSFER, REUSE, OR MODIFICATION TO THE DRAWING SHALL BE AT THE USER'S OR OTHER SUCH PARTIES' SOLE RISK AND WITHOUT ANY RISK OR LIABILITY TO GZA.

PREPARED BY:
GZA GeoEnvironmental, Inc.
Engineers and Scientists
ONE EDGEWATER DRIVE
NORWOOD, MASSACHUSETTS 02062
PHONE: (781) 278-3700

PREPARED FOR:
IRVING

PROJ. MGR: CSS	REVIEWED BY: WRN	CHECKED BY: CSS	FIGURE
DESIGNED BY: SC	DRAWN BY: EMD	SCALE: 1 INCH = 300 FEET	2
DATE: 05-06-2010	PROJECT NO. 01.0170089.20	REVISION NO.	

J:\170,000-179,999\170089\170089-20.CSS\FIGURES\2010-05-06_Figures\170089-20_SITE-PLAN-w-2008-Aerial-v2_FIG-3.mxd

STORAGE TANKS

TANK ID	PRODUCT	SHELL CAPACITY (BARRELS)	SHELL CAPACITY (GALLONS)	AVERAGE STORAGE (BARRELS)	AVERAGE STORAGE (GALLONS)	SECONDARY CONTAINMENT CONSTRUCTION	SECONDARY CONTAINMENT CAPACITY (BARRELS)	SECONDARY CONTAINMENT CAPACITY (GALLONS)
ABOVE GROUND STORAGE TANKS								
1	GASOLINE	80 000	3 360 000	66 006	2 772 252	EARTH BERM	50 805	2 133 804
2	GASOLINE / DIESEL	80 000	3 360 000	65 360	2 745 120	EARTH BERM	65 144	2 736 035
3	DIESEL	76 000	3 192 000	72 301	3 036 642	EARTH BERM	42 765	1 796 146
4	DIESEL	80 000	3 360 000	70 887	2 977 254	EARTH BERM	56 311	2 365 063
5	DIESEL	35 000	1 470 000	30 669	1 288 098	EARTH BERM	28 189	1 183 930
6	DIESEL	35 000	1 470 000	30 553	1 283 226	EARTH BERM	22 855	959 920
7	DIESEL	35 000	1 470 000	30 720	1 290 240	EARTH BERM	17 046	715 930
8	GASOLINE ADDITIVE	190	8000	171	7200	EARTH BERM	–	–
9	GASOLINE ADDITIVE	595	25 000	536	22 500	EARTH BERM	–	–
10	ETHANOL	80 000	3 360 000	69 496	2 918 832	EARTH BERM	67 940	2 853 467
11	ETHANOL	32 000	1 344 000	28 518	1 197 756	EARTH BERM	28 368	1 191 458
12	GASOLINE	126 000	5 292 000	119 352	5 012 784	EARTH BERM	65 847	2 765 569
14	GASOLINE	185 000	7 770 000	169 725	7 128 450	EARTH BERM	47 569	1 997 914
15	DIESEL ADDITIVE	190	8000	171	7200	EARTH BERM	–	–
16	GASOLINE ADDITIVE	190	8000	171	7200	STEEL DIKE	–	–
22	GASOLINE ADDITIVE	357	15 000	321	13 500	EARTH BERM	–	–
23	DIESEL ADDITIVE	357	15 000	321	13 500	EARTH BERM	–	–
24	DIESEL ADDITIVE	48	2000	43	1800	DOUBLE WALL TANK	48	2000
UNDERGROUND STORAGE TANKS								
17	HEATING OIL (EXEMPT UST)	24	24	21	900	DOUBLE WALL TANK	24	1000
18	HEATING OIL (EXEMPT UST)	95	4000	86	3600	DOUBLE WALL TANK	95	4000
19	USED OIL	238	10 000	214	9000	DOUBLE WALL TANK	238	10 000
DRUM	USED OIL	–	3 x 55	–	3 x 55	OIL WATER SEPARATOR	–	–
OIL–FILLED OPERATIONAL EQUIPMENT								
OFOE	TRANSFORMER OIL	–	3 x 85	–	3 x 85	–	–	–
						REQUIRED STORAGE CAPACITY BY CODE:	185 000	7 770 000
						OVERALL STORAGE CAPACITY:	846 284	35 543 928

LEGEND

- UTILITY POLE
- LIGHT POLE
- MANHOLE
- CATCH BASIN
- SIGN
- TRENCH DRAIN
- FENCE
- LIMITS OF ROAD AND PARKING AREAS
- PROPERTY BOUNDARY
- ABOVE GROUND OIL PIPELINES (APPROX. LOCATIONS)
- UNDERGROUND OIL PIPELINES (APPROX. LOCATIONS)
- 1 CLOSED CIRCUIT TV CAMERA
- GATE P3 GATE
- TOP OF CONTAINMENT DIKE
- FIRST VALVE INSIDE CONTAINMENT
- U.S.C.G. JURISDICTIONAL VALVE

1 PLAN
– FACILITY LAYOUT
SCALE: 1" = 80'–0"

ENGINEERING
HATCH
PROJECT NO: 353559

IRVING OIL TERMINALS INC.

REVERE, MASSACHUSETTS

DRAWN: HPC/DM	DATE: 17/09/22	DWG SCALE: 1" = 80'–0"	
CHECKED: MMI	DATE: 17/09/22	PLOT SCALE: 1:1	
APPROVED: KM	DATE: 17/09/22		
PROJECT NO:			

REVERE, MA

SITE PLAN / FACILITY LAYOUT

FIGURE No. 2A

REV
E

LEGEND

- UTILITY POLE
- LIGHT POLE
- MANHOLE
- CATCH BASIN
- SIGN
- TRENCH DRAIN
- FENCE
- LIMITS OF ROAD AND PARKING AREAS
- PROPERTY BOUNDARY
- ABOVE GROUND OIL PIPELINES (APPROX. LOCATIONS)
- UNDERGROUND OIL PIPELINES (APPROX. LOCATIONS)
- MW-11 5.21 MONITORING WELL WITH DESIGNATION AND GROUNDWATER ELEV.
- TOP OF CONTAINMENT DIKE
- RUNOFF FLOW DIRECTION
- APPROXIMATE STORM DRAIN LOCATION AND FLOW DIRECTION

NOTES:

1. THIS FIGURE WAS BASED UPON A PLAN BY GZA TITLED "TERMINAL LAYOUT AND POTENTIAL FLOW DIRECTIONS", DATED 05/06/10 AND A TOSCO REFINING CO. PLAN TITLED "STORMWATER POLLUTION PREVENTION PLAN" DATED 4/22/98

CLIENT: IRVING OIL TERMINALS, INC.			
PROJECT: 40/41 LEE BURBANK HIGHWAY REVERE, MASSACHUSETTS			
TITLE: TERMINAL LAYOUT AND STORMWATER DRAINAGE			
DESIGNED: ATB	DRAWN: ATB	CHECKED: CAB	APPROVED: SLP
SCALE: 1" = 100'	DATE: 02/17/23	FILE NO.: 16653-Fig3	PROJECT NO.: 16653

verdantas

FIGURE NO.: 3

PLOT DATE: 2-27-23

APPENDICES

APPENDIX A

COPY OF NPDES PERMIT

AUTHORIZATION TO DISCHARGE UNDER THE NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM

In compliance with the provisions of the Federal Clean Water Act, as amended, 33 U.S.C. §§ 1251 et seq. (the "CWA"),

Irving Oil Terminals, Inc.

is authorized to discharge from a facility located at

Irving Oil Revere Terminal
40/41 Lee Burbank Highway
Revere, MA 02151

to receiving water named

Chelsea River (MA71-06)
Mystic River Watershed

in accordance with effluent limitations, monitoring requirements and other conditions set forth herein.

This permit shall become effective on December 1, 2022.

This permit expires at midnight on November 30, 2027.

This permit supersedes the permit issued on September 24, 2014.

This permit consists of this **cover page**, **Part I**, **Attachment A** (Marine Acute Toxicity Test Procedure and Protocol, July 2012), and **Part II** (NPDES Part II Standard Conditions, April 2018).

Signed this 30th day of September

Ken Moraff, Director
Water Division
Environmental Protection Agency
Region 1
Boston, MA

PART I

A. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

1. During the period beginning on the effective date and lasting through the expiration date, the Permittee is authorized to discharge treated stormwater and hydrostatic test water through **Outfall Serial Number 001** to the Chelsea River. The discharge shall be limited and monitored as specified below; the receiving water shall be monitored as specified below.

Effluent Characteristic	**Effluent Limitation**		**Monitoring Requirements**[1,2,3]	
	Average Monthly	**Maximum Daily**	**Measurement Frequency**[4]	**Sample Type**
Flow Rate[5]	---	615 GPM	When Discharging	Estimate
Total Effluent Flow[6]	---	Report MGal/Mo	When Discharging	Meter
Number of Events	---	Report #	When Discharging	Count
Total Suspended Solids (TSS)	30 mg/L	100 mg/L	2/Month	Grab
Turbidity	Report NTU	Report NTU	2/Month	Grab
pH[7]	6.5 - 8.5 S.U.		1/Month	Grab
Chemical Oxygen Demand	---	Report mg/L	1.Month	Grab
Oil and Grease	---	15 mg/L	1/Month	Grab
Fecal Coliform[8]	---	Report MPN	1/Month	Grab
Enterococcus[8]	---	Report CFU	1/Month	Grab
Benzene[9]	---	5 µg/L	1/Month	Grab

Ethylbenzene[9]	---	Report µg/L	1/Year[10]	Grab
Toluene[9]	---	Report µg/L	1/Year[10]	Grab
Total Xylenes[9]	---	Report µg/L	1/Year[10]	Grab
Benzo(a)pyrene[11]	0.00013 µg/L	---	1/Month	Grab
Benzo(a)anthracene[11]	---	Report µg/L	1/Month	Grab
Benzo(b)fluoranthene[11]	---	Report µg/L	1/Month	Grab
Benzo(k)fluoranthene[11]	---	Report µg/L	1/Month	Grab
Chrysene[11]	---	Report µg/L	1/Month	Grab
Dibenzo(a,h)anthracene[11]	---	Report µg/L	1/Month	Grab
Indeno(1,2,3-cd)pyrene[11]	---	Report µg/L	1/Month	Grab
Naphthalene	---	20 µg/L	1/Month	Grab
Acenaphthene	---	Report µg/L	1/Year[10]	Grab
Acenaphthylene	---	Report µg/L	1/Year[10]	Grab
Anthracene	---	Report µg/L	1/Year[10]	Grab
Benzo(g,h,i)perylene	---	Report µg/L	1/Year[10]	Grab
Fluoranthene	---	Report µg/L	1/Year[10]	Grab
Fluorene	---	Report µg/L	1/Year[10]	Grab
Phenanthrene	---	Report µg/L	1/Year[10]	Grab

Pyrene	---	Report µg/L	1/Year[10]	Grab
Total Residual Chlorine[12]	---	13 µg/L	1/Month	Grab
Ethanol[13]	---	Report mg/L	1/Year	Grab
Methyl tert-butyl ether	20 µg/L	Report	1/Quarter	Grab
Tert-butyl alcohol	---	Report µg/L	1/Year	Grab
Perfluorohexanesulfonic acid (PFHxS)[14]	---	Report ng/L	1/Quarter	Grab
Perfluoroheptanoic acid (PFHpA)[14]	---	Report ng/L	1/Quarter	Grab
Perfluorononanoic acid (PFNA)[14]	---	Report ng/L	1/Quarter	Grab
Perfluorooctanesulfonic acid (PFOS)[14]	---	Report ng/L	1/Quarter	Grab
Perfluorooctanoic acid (PFOA)[14]	---	Report ng/L	1/Quarter	Grab
Perfluorodecanoic (PFDA)[14]	---	Report ng/L	1/Quarter	Grab
Total Copper	---	5.8 µg/L	1/Month	Grab
Total Zinc	---	95.1 µg/L	1/Month	Grab
Total Ammonia (as N) (April 1 through October 31)	---	1.8 mg/L	1/Month	Grab
Whole Effluent Toxicity (WET) Testing[15,16]				
LC_{50}	---	≥100 %	1/Quarter	Grab
Total Residual Chlorine	---	Report mg/L	1/Quarter	Grab
Salinity	---	Report g/kg	1/Quarter	Grab

pH	---	Report S.U.	1/Quarter	Grab
Total Solids	---	Report mg/L	1/Quarter	Grab
Total Suspended Solids	---	Report mg/L	1/Quarter	Grab
Ammonia Nitrogen	---	Report mg/L	1/Quarter	Grab
Total Organic Carbon	---	Report mg/L	1/Quarter	Grab
Total Cadmium	---	Report µg/L	1/Quarter	Grab
Total Copper	---	Report µg/L	1/Quarter	Grab
Total Lead	---	Report µg/L	1/Quarter	Grab
Total Nickel	---	Report µg/L	1/Quarter	Grab
Total Zinc	---	Report µg/L	1/Quarter	Grab

Ambient Characteristic[17]	**Reporting Requirements**		**Monitoring Requirements**[1,2,3]	
	Average Monthly	**Maximum Daily**	**Measurement Frequency**[4]	**Sample Type**[5]
Salinity	---	Report g/kg	1/Quarter	Grab
Ammonia Nitrogen	---	Report mg/L	1/Quarter	Grab
Total Cadmium	---	Report µg/L	1/Quarter	Grab
Total Copper	---	Report µg/L	1/Quarter	Grab

Total Nickel	---	Report µg/L	1/Quarter	Grab
Total Lead	---	Report µg/L	1/Quarter	Grab
Total Zinc	---	Report µg/L	1/Quarter	Grab
pH[18]	---	Report S.U.	1/Quarter	Grab
Temperature[18]	---	Report °C	1/Quarter	Grab
Benzene	---	Report µg/L	1/Year[19]	Grab
Ethylbenzene	---	Report µg/L	1/Year[19]	Grab
Toluene	---	Report µg/L	1/Year[19]	Grab
Total Xylenes	---	Report µg/L	1/Year[19]	Grab
Benzo(a)anthracene	---	Report µg/L	1/Year[19]	Grab
Benzo(a)pyrene	---	Report µg/L	1/Year[19]	Grab
Benzo(b)fluoranthene	---	Report µg/L	1/Year[19]	Grab
Benzo(k)fluoranthene	---	Report µg/L	1/Year[19]	Grab
Chrysene	---	Report µg/L	1/Year[19]	Grab
Dibenzo(a,h)anthracene	---	Report µg/L	1/Year[19]	Grab
Indeno(1,2,3-cd)pyrene	---	Report µg/L	1/Year[19]	Grab
Acenaphthene	---	Report µg/L	1/Year[19]	Grab
Acenaphthylene	---	Report µg/L	1/Year[19]	Grab

Anthracene	---	Report µg/L	1/Year[19]	Grab
Benzo(g,h,i)perylene	---	Report µg/L	1/Year[19]	Grab
Fluoranthene	---	Report µg/L	1/Year[19]	Grab
Fluorene	---	Report µg/L	1/Year[19]	Grab
Naphthalene	---	Report µg/L	1/Year[19]	Grab
Phenanthrene	---	Report µg/L	1/Year[19]	Grab
Pyrene	---	Report µg/L	1/Year[19]	Grab

Footnotes:

1. Grab samples for Outfall 001 shall be collected at the discharge point from the Facility's oil/water separator (OWS) prior to comingling with any stormwater from the property west of Lee Burbank Highway. Samples shall be collected after treatment through the stormwater treatment system and free from tidal influence. Samples shall be grab samples taken within 15 minutes of the initiation of a discharge where practicable, but in no case later than within the first hour of discharge from the outfall. Changes in sampling location must be approved in writing by the Environmental Protection Agency Region 1 (EPA). The Permittee shall report the results to EPA and the State of any additional testing above that required herein, if testing is done in accordance with 40 Code of Federal Regulations (CFR) Part 136.

2. In accordance with 40 CFR § 122.44(i)(1)(iv), the Permittee shall monitor according to sufficiently sensitive test procedures (i.e., methods) approved under 40 CFR Part 136 or required under 40 CFR chapter I, subchapter N or O, for the analysis of pollutants or pollutant parameters (except WET). A method is "sufficiently sensitive" when: 1) the method minimum level (ML) is at or below the level of the effluent limitation established in the permit for the measured pollutant or pollutant parameter; or 2) the method has the lowest ML of the analytical methods approved under 40 CFR Part 136 or required under 40 CFR chapter I, subchapter N or O for the measured pollutant or pollutant parameter. The term "minimum level" refers to either the sample concentration equivalent to the lowest calibration point in a method or a multiple of the method detection limit (MDL), whichever is higher. Minimum levels may be obtained in several ways: They may be published in a method; they may be based on the lowest acceptable calibration point

used by a laboratory; or they may be calculated by multiplying the MDL in a method, or the MDL determined by a laboratory, by a factor.

3. When a parameter is not detected above the ML, the Permittee must report the data qualifier signifying less than the sample ML for that parameter (e.g., < 5 µg/L, if the sample ML for a parameter is 5 µg/L). For calculating and reporting the average monthly concentration when one or more values are not detected, assign a value of zero to all non-detects and report the average of all the results. The number of exceedances shall be enumerated for each parameter in the field provided on every Discharge Monitoring Report (DMR).

4. Measurement frequency of "when discharging" is defined as the sampling of any measurable discharge event, reported for each calendar month. Sampling frequency of 1/month is defined as the sampling of one discharge event in each calendar month. Sampling frequency of 1/quarter is defined as the sampling of one discharge event in each quarter. Calendar quarters are defined as January through March, inclusive, April through June, inclusive, July through September, inclusive and October through December, inclusive. Sampling frequency of 1/year is defined as the sampling of one discharge event during one calendar year, unless otherwise specified. If no sample is collected during the measurement frequencies defined above, the Permittee must report an appropriate No Data Indicator Code.

5. For Flow Rate, the maximum daily value represents the maximum instantaneous flow rate measured by the Facility as passing through the treatment system for each day that a discharge occurs during the reported period. The maximum instantaneous flow rate, which is to be reported in units of gallons per minute (GPM), shall be an estimate based on the summation of the pump curve value(s) for all pumps in operation which control the rate of flow through the OWS when discharge is occurring. The Permittee shall at no time exceed the design flow rate of the treatment system.

6. For Total Flow, the value reported represents the sum of the recorded discharge volume for each day that effluent is discharged during that month, measured at the treatment system using a totalizer or similar device. Total Flow shall be reported in the units of millions of gallons per month (Mgal/Mo). The Permittee shall also report the total number of days during the reporting period discharges from the outfall occurred (i.e., a measurable volume of effluent passes through the totalizer or similar device), noted on the DMR form under "Event Total."

7. The pH shall be within the specified range at all times. The minimum and maximum pH sample measurement values for the month shall be reported in standard units (S.U.).

8. Results must be reported as colony forming units (CFU). After a minimum one year following the effective date of the permit and 12 samples, the sampling frequency for *Enterococcus* shall reduce to 1/year if all sample results are less than the applicable water quality criteria.

9. The ML for analysis for benzene, ethylbenzene, toluene, and total xylenes shall be no greater than 2 µg/L.

10. The Permittee shall conduct annual monitoring of the effluent during the month of April for the following compounds: acenaphthene, acenaphthylene, anthracene, benzo(g,h,i)perylene, fluoranthene, fluorene, phenanthrene, pyrene, toluene, ethylbenzene, and total xylenes. Sampling shall be performed during the first Qualifying Event and concurrently with the April monthly monitoring event. A Qualifying Event shall be defined as a discharge that occurs during daylight hours on an outgoing tide at least one hour from both the low and high slack tide. To identify a Qualifying Event, the permittee may use tide charts to predict the two four-hour intervals of an outgoing tide each day that are one hour from both low and high slack tide. If a measurable discharge does not occur such that sampling cannot be completed during the first Qualifying Event of the required sampling frequency, the permittee is to sample the next Qualifying Event. If no discharge occurs during the month of April, the Permittee shall sample the next qualifying event.

11. Analysis for the Group I and Group II Polycyclic Aromatic Hydrocarbons (PAHs) shall use Method 625.1 (low level GC/MS). The expected ML for benzo(a)pyrene, benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, and chrysene is 0.05 µg/L. The expected ML for dibenzo(a,h)anthracene, and indeno(1,2,3-cd)pyrene is 0.1 µg/L. The expected ML for acenaphthene, acenaphthylene, anthracene, benzo(g,h,i)perylene, fluoranthene, fluorene, naphthalene, phenanthrene, and pyrene is 5 µg/L. The compliance level for Group I PAHs with numeric effluent limits less than the detection limit shall be non-detect at any sample ML above the numeric limit.

12. For the purposes of this permit, TRC analysis must be completed using a test method in 40 CFR Part 136 that achieves a minimum level of detection no greater than 30 µg/L. The compliance level for TRC is 30 µg/L. The Permittee may request that this limit and associated monitoring apply only to discharges that have been previously chlorinated or that contain residual chlorine following completion of a source identification study demonstrating the source of TRC and implementation of BMPs to control TRC in the effluent.

13. The ML for analysis for ethanol shall be no greater than 0.4 mg/L.

14. This monitoring requirement takes effect during the first quarter following six months after receiving written notification of availability of the multi-laboratory validation of analytical test Method 1633 for the analysis of PFAS in wastewater and biosolids.

Results must be reported in nanograms per liter (ng/L). After three years of monitoring or a minimum of 12 samples, if all samples are non-detect for all six PFS compounds using EPA's multi-lab validated method for wastewater, the Permittee may request to remove the requirement for PFAS monitoring.

15. The Permittee shall conduct acute toxicity tests (LC_{50}) 1/quarter in accordance with test procedures and protocol specified in **Attachment A** of this permit. LC_{50} is defined in Part II.E. of this permit. Sampling during the second quarter of the calendar year shall be conducted in April during a Qualifying Event concurrently with the annual effluent monitoring described above. The Permittee shall test the mysid shrimp, *Americamysis bahia*, and the inland silverside, *Menidia beryllina*. The complete report for each toxicity test shall be submitted as an attachment to the monthly DMR submittal immediately following the completion of the test. After three years following the effective date of the permit and 12 samples, the Permittee may request a reduction in monitoring frequency to no less than 1/year. Whole effluent toxicity shall continue to be monitored quarterly until the Permittee receives written notification of a reduction.

16. For Part I.A.1., Whole Effluent Toxicity Testing, the Permittee shall conduct the analyses specified in **Attachment A**, Part VI. CHEMICAL ANALYSIS for the effluent sample. If toxicity test(s) using the receiving water as diluent show the receiving water to be toxic or unreliable, the Permittee shall follow procedures outlined in **Attachment A**, Section IV., DILUTION WATER. Even where alternate dilution water has been used, the results of the receiving water control (0% effluent) analyses must be reported. Minimum levels and test methods are specified in **Attachment A**, Part VI. CHEMICAL ANALYSIS.

17. For Part I.A.1., Ambient Characteristic, the Permittee shall conduct the analyses specified in **Attachment A**, Part VI. CHEMICAL ANALYSIS for the receiving water sample collected as part of the WET testing requirements. Such samples shall be taken from the receiving water at a point immediately upstream of the permitted discharge's zone of influence at a reasonably accessible location, as specified in **Attachment A**. Minimum levels and test methods are specified in **Attachment A**, Part VI. CHEMICAL ANALYSIS.

18. A pH and temperature measurement shall be taken of each receiving water sample at the time of collection and the results reported on the appropriate DMR. These pH and temperature measurements are independent from any pH and temperature measurements required by the WET testing protocols.

19. The Permittee shall conduct annual monitoring of the receiving water during the month of April for the following compounds: benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenzo(a,h)anthracene, indeno(1,2,3-cd)pyrene, acenaphthene, acenaphthylene, anthracene, benzo(g,h,i)perylene, fluoranthene, fluorene, naphthalene, phenanthrene, pyrene, benzene, toluene, ethylbenzene, and total xylenes. The ML for analysis shall be equivalent to the MLs for effluent

monitoring. The receiving water sample shall be collected from the Chelsea River at a point immediately outside of Outfall 001's zone of influence at a reasonably accessible location. Sampling shall be performed during a Qualifying Event concurrently with the quarterly toxicity monitoring and annual effluent monitoring described above.

Part I.A. continued.

2. The discharge shall not cause a violation of the water quality standards of the receiving water.

3. The discharge shall be free from pollutants in concentrations or combinations that, in the receiving water, settle to form objectionable deposits; float as debris, scum or other matter to form nuisances; produce objectionable odor, color, taste or turbidity; or produce undesirable or nuisance species of aquatic life.

4. The discharge shall be free from pollutants in concentrations or combinations that adversely affect the physical, chemical, or biological nature of the bottom.

5. The discharge shall not result in pollutants in concentrations or combinations in the receiving water that are toxic to humans, aquatic life, or wildlife.

6. The discharge shall be free from floating, suspended and settleable solids in concentrations or combinations that would impair any use assigned to the receiving water.

7. The discharge shall be free from oil, grease and petrochemicals that produce a visible film on the surface of the water, impart an oily taste to the water or an oily or other undesirable taste to the edible portions of aquatic life, coat the banks or bottom of the water course, or are deleterious or become toxic to aquatic life.

8. All existing manufacturing, commercial, mining, and silvicultural dischargers must notify the Director as soon as they know or have reason to believe (40 CFR § 122.42):

   a. That any activity has occurred or will occur which would result in the discharge, on a routine or frequent basis, of any toxic pollutant which is not limited in the permit, if that discharge will exceed the highest of the following "notification levels":

      (1) 100 micrograms per liter (µg/L);
      (2) 200 µg/L for acrolein and acrylonitrile; 500 µg/L for 2,4-dinitrophenol and for 2-methyl-4,6-dinitrophenol; and one milligram per liter (mg/L) for antimony;
      (3) Five times the maximum concentration value reported for that pollutant in the permit application in accordance with 40 CFR § 122.21(g)(7); or
      (4) Any other notification level established by the Director in accordance with 40 CFR § 122.44(f) and State regulations.

   b. That any activity has occurred or will occur which would result in the discharge, on a non-routine or infrequent basis, of any toxic pollutant which is not limited in the permit, if that discharge will exceed the highest of the following "notification levels":

      (1) 500 µg/L;
      (2) One mg/L for antimony;
      (3) 10 times the maximum concentration value reported for that pollutant in the permit application in accordance with 40 CFR § 122.21(g)(7); or

(4) Any other notification level established by the Director in accordance with 40 CFR § 122.44(f) and State regulations.

c. That they have begun or expect to begin to use or manufacture as an intermediate or final product or byproduct any toxic pollutant which was not reported in the permit application.

B. UNAUTHORIZED DISCHARGES

1. This permit authorizes discharges only from the outfall(s) listed in Part I.A.1, in accordance with the terms and conditions of this permit. Discharges of wastewater from any other point sources are not authorized by this permit and shall be reported in accordance with Part D.1.e.(1) of the Standard Conditions of this permit (24-hour reporting).

2. The following discharges are expressly prohibited:

   a. Discharge of tank bottom water and/or bilge water alone or in combination with stormwater discharge or other wastewater;

   b. Discharge of any sludge and/or bottom deposits from any storage tank(s), basin(s), and/or diked area(s) to the receiving waters. Examples of storage tanks and/or basins include, but are not limited to: primary catch basins, oil/water separators, petroleum product storage tanks, baffled storage tanks collecting spills, and tank truck loading rack sumps;

   c. Discharge of liquid hazardous waste alone or in combination with stormwater or other wastewater;

   d. Discharges of runoff from any vehicle and equipment washing alone or in combination with stormwater or other wastewater, including from the leased property;

   e. Discharges of ballast water alone or in combination with stormwater or other wastewater;

   f. Runoff resulting from accidental spill or release, alone or in combination with stormwater or other wastewater;

   g. Discharges of emulsion chemicals, including surfactants (e.g., detergents and soaps) alone or in combination with stormwater or other wastewater;

   h. Discharges of contaminated groundwater, including, but not limited to wastewater generated during activities conducted under the Massachusetts Contingency Plan, alone or in combination with stormwater or other wastewater;

   i. Discharges of aqueous film-forming foam and alcohol resistant foam either in concentrate form or as foam diluted with water during testing or maintenance of the fires suppression system at the Facility’s marine vessel dock

C. SPECIAL CONDITIONS

1. Best Management Practices (BMPs)

a. The Permittee shall design, install, and implement control measures to minimize pollutants discharged from stormwater associated with the Facility operations to the receiving water. At a minimum, the Permittee must implement control measures, both structural controls (e.g., OWS, containment areas, holding tanks) and non-structural (e.g., operational procedures and operator training) consistent with those described in Part 2.1.2 and of EPA's Multi-Sector General Permit (MSGP).[1] The control measures must ensure the following non-numeric effluent limitations are met:

(1) Minimize exposure of processing and material storage areas to stormwater discharges;
(2) Design good housekeeping measures to maintain areas that are potential sources of pollutants;
(3) Implement preventative maintenance programs to avoid leaks, spills, and other releases of pollutants to stormwater that is discharged to receiving waters;
(4) Implement spill prevention and response procedures to ensure effective response to spills and leaks if or when they occur, including, but not limited to, those required by Section 311 of the CWA, 33 U.S.C. § 1321. The Permittee shall report immediately the appearance of any size sheen attributable to the discharge from the Facility to the appropriate agency of the United States Government in accordance with Section 311 of the CWA;
(5) Design of erosion and sediment controls to stabilize exposed areas and contain runoff using structural and/or non-structural control measures to minimize onsite erosion and sedimentation, and the resulting discharge of pollutants;
(6) Utilize runoff management practices to divert, infiltrate, reuse, contain, or otherwise reduce stormwater runoff;
(7) Develop proper handling procedures for salt or materials containing chlorides that are used for snow and ice control;
(8) Conduct employee training to ensure personnel understand the requirements of this permit;
(9) Evaluate for the presence of non-stormwater discharges and require the elimination of any non-stormwater discharges not explicitly authorized in this permit or covered by another NPDES permit; and
(10) Minimize dust generation and vehicle tracking of industrial materials.
(11) Demonstrate that no illicit discharges exist, including, but not limited to, sanitary sewer cross connections. If any illicit discharge is detected, the Permittee shall locate, identify, and eliminate the illicit discharge as expeditiously as possible;
(12) Use known, available, and reasonable methods to prevent rodents, birds, and other animals from feeding/nesting/roosting at the Facility. Known, available, and reasonable methods do not include methods that would be construed as a violations of

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[1] The current MSGP was effective March 1, 2021 and is available https://www.epa.gov/npdes/stormwater-discharges-industrial-activities-epas-2021-msgp.

any applicable federal, state, or local statutes, ordinances, or regulations, including the Migratory Bird Act;

(13) Implement practices to minimize bacteria from known sources (e.g., dumpsters, food waste, or animal waste).

b. In addition, the Permittee must design, install, and/or implement the following BMPs:

(1) The Permittee shall comply with the inspection requirements in Parts 3.1 and 3.2 of the 2021 MSGP, the corrective action requirements in Part 5.1 of the 2021 MSGP, and the corrective action documentation requirements in Part 5.3 of the 2021 MSGP. If any of the following conditions occur or are detected during an inspection, monitoring or by other means, the Permittee shall review and revise, as appropriate, the SWPPP so that the permit's effluent limits are met and pollutant discharges are minimized:

i. An unauthorized release or discharge (e.g., spill, leak, or discharge of non-stormwater not authorized by this or another NPDES permit;
ii. A discharge violates a numeric effluent limit listed in Part I.A of this permit;
iii. The stormwater control measures are not stringent enough to control stormwater discharges as necessary such that the receiving water will meet applicable water quality standards and/or the non-numeric limits in Part I.C of this permit;
iv. A required control measure was never installed, was installed incorrectly, or is not being properly operated or maintained; and
v. Whenever a visual assessment shows evidence of stormwater pollution (e.g., color, odor, floating solids, settled solids, suspended solids, foam).

(2) The Permittee shall comply with the control measure requirements in Part 2.1 and 2.1.1 of the 2021 MSGP in order to identify pollutant sources and select, design, install and maintain the pollution control technology necessary to meet the effluent limitations in the permit that ensure dilution is not used as a form of treatment.

(3) The Permittee shall minimize, to the maximum extent practicable, discharging stormwater and hydrostatic test water during worst-case conditions (i.e., approximately one hour before and after slack tide and during periods of lowest receiving water flow) The Permittee shall, to the maximum extent practicable, discharge stormwater and hydrostatic test water on an outgoing tide. In the event that a discharge outside of the parameters described above cannot be avoided, the Permittee shall document the reason for the discharge in an attachment to the SWPPP.

(4) The Permittee shall document the measures and methods used to control flow through the stormwater treatment system to ensure that the design flow of the treatment system is not exceeded.

(5) The Permittee shall design and implement response procedures for ethanol, materials that are used for spill and fire control (e.g. aqueous film-forming foam). This must include specific provisions for the treatment of ethanol and/or pollutants in materials that are used for spill and fire control, should release occur.

(6) The Permittee shall implement structural improvements, enhanced/resilient pollution prevention measures, and/or other mitigation measures to minimize[2] discharges that result from impacts of major storm and flood events.[3] The Permittee must document in the SWPPP its evaluation of the major storm and flood risks at the Facility, and all control measures considered to address discharges resulting from these risks. For all control measures considered, the Permittee must document in the SWPPP the factual basis (i.e., the maps, data sets and calculations for the analysis), for either implementing or not implementing the measure. The factual basis and analysis must be presented in sufficient detail to allow EPA, the public, or an independent qualified person to evaluate the reasonableness of the decision. For control measures already in place, including requirements from state, local or federal agencies, a description of the controls and how they meet the requirement(s) of this permit must be documented in the SWPPP. The Permittee must consider, at a minimum, the following control measures to minimize discharges:[4,5]

i. Reinforce materials storage structures to withstand flooding and additional exertion of force;
ii. Prevent floating of semi-stationary structures by elevating above the relative base flood elevation[6] or securing with non-corrosive device;
iii. When a delivery of materials is expected, and a storm is anticipated within 48 hours, delay delivery until after the storm or store materials as appropriate (refer to emergency procedures);
iv. Temporarily store materials and waste above the relative base flood elevation;

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[2] For the purposes of this provision, the term "minimize" means to reduce and/or eliminate to the extent achievable using stormwater control measures (including best management practices) that are technologically available and economically practicable and achievable in light of best industry practice.

[3] "Major storm and flood events" refers to instances resulting from major storms such as hurricanes, extreme/heavy precipitation events, and pluvial, fluvial, and flash flood events such as high-water events, storm surge, and high-tide flooding. "Extreme/heavy precipitation" refers to instances during which the amount of rain or snow experienced in a location substantially exceeds what is normal. What constitutes a period of heavy precipitation varies according to location and season. "Extreme/heavy precipitation" does not necessarily mean the total amount of precipitation at a location has increased—just that precipitation is occurring in more intense or more frequent events.

[4] To determine the risks at the Facility of discharges from major storm and flood events, you must conduct the evaluation using, at a minimum, the worst-case data relating to changes in precipitation, sea level rise, extreme weather events, coastal flooding, and inland flooding, and relevant to the facility's discharges from: 1) the data generated by the 13 federal agencies that conduct or use research on global change that contributed to the latest National Climate Assessment produced by the U.S. Global Change Research Program (USGCRP); 2) climate data generated by the Commonwealth of Massachusetts; and 3) resiliency planning completed by the municipality in which a given facility is located (i.e., City of Boston, Revere, and Chelsea) and incorporate the results of the evaluation in a manner that demonstrates that the control measures taken are precautionary and sufficiently protective. Evaluation must be completed by a qualified person on a rolling annual basis considering: 1) historical observations from all years the Permittee has operated the facility prior to this permit's term; 2) all observations of events that occurred in the calendar year; and 3) the 25 to 100 years forward-looking from the review year to assess impacts that are likely to occur.

[5] EPA Region 1 currently maintains a resource of additional data sources for evaluation and incorporation pursuant to this BMP at https://www.epa.gov/npdes-permits/dewatering-and-remediation-general-permit-drgp.

[6] Relative base flood elevation is the computed elevation to which floodwater is anticipated to rise during the reference flood. BFEs shown on the Federal Emergency Management Agency's Flood Maps, for example, are the elevation of surface water resulting from a flood that has a 1% chance of equaling or exceeding that level in any given year. This is the regulatory standard also referred to as the "100-year flood." The base flood is the national standard used by the National Flood Insurance Program (NFIP), accessed at https://msc.fema.gov/portal/search.

v. Temporarily reduce or eliminate outdoor storage;
vi. Temporarily relocate any mobile vehicles and equipment to upland areas;
vii. Develop scenario-based emergency procedures for major storms that are complementary to regular stormwater pollution prevention planning and identify emergency contacts for staff and contractors; and
viii. Conduct staff training for implementing your emergency procedures at regular intervals.

(7) The Permittee shall document quality assurance/quality control (QA/QC) practices including, at a minimum:

i. A summary of the monitoring requirements specified in the permit;
ii. A map and/or treatment system diagram indicating the location of each sampling location with a geographic identifier (i.e., latitude and longitude coordinates);
iii. Specifications for the number of samples, type of samples, type and number of containers, type of preservation, type and number of quality assurance samples, if applicable, type and number of field samples, if applicable, and sample storage, holding times, and shipping methods, including chain-of-custody procedures;
iv. Specifications for EPA-approved test methods and sufficiently sensitive minimum levels for each required parameter;
v. A schedule for review of sample results; and
vi. A description of data validation and data reporting processes.

(8) The Permittee shall implement a stormwater system BMP that ensures the integrity of stormwater system components through elimination of the infiltration of contaminated groundwater to the stormwater conveyance system where such infiltration contributes pollutants but are not otherwise explicitly authorized (i.e., by another NPDES permit). Within one year of the effective date of the permit, the Permittee must complete:

i. One-time cross-connection evaluation, to ensure that the stormwater conveyance system does not contribute pollutants to or convey pollutants from a municipal separate storm sewer system (MS4) to the receiving water;
ii. A schedule for routine visual or video inspection of the readily accessible portions of the stormwater system installed below grade;
iii. Measurement of the flow rate, and flow direction of known areas of groundwater contamination;
iv. Sampling of MtBE at groundwater monitoring points representative of groundwater conditions at the Facility, including known areas of contamination, collected during dry weather absent of tidal influence;
v. Sampling of MtBE at accumulation points within the stormwater system that are likely susceptible to groundwater infiltration, including points located in known areas of contamination, collected during dry weather absent of tidal influence in addition to MtBE monitoring at Outfall 001 as required in Part I.A; and
vi. A procedure for implementation and confirmation of corrective actions in accordance with Part I.C.1.b.(1), above, to eliminate infiltration of groundwater to the stormwater conveyance system where such infiltration is identified through the MtBE sampling at Outfall 001 as required in Part I.A and/or described above. If MtBE is detected above the minimum level in any of the samples taken within a calendar year, the Permittee shall repeat the sampling requirements identified in

(ii) through (v) during the following calendar year. Confirmation of monitoring the stormwater system integrity shall be documented in the first annual SWPPP certification and, when required based on MtBE detection, in the SWPPP certification for any subsequent years.

2. Stormwater Pollution Prevention Plan

The Permittee shall develop and implement a Stormwater Pollution Prevention Plan (SWPPP) that documents the selection, design and installation of control measures, including BMPs designed to meet the effluent limitations required in this permit to minimize the discharge of pollutants from the Facility's operations to the receiving water. The SWPPP shall be a written document and consistent with the terms of this Permit.

a. The SWPPP shall be developed and signed consistent with the signatory requirements in Part II.D.2 of this Permit within 90 days after the effective date of this Permit.

b. The SWPPP shall be consistent with the general provisions for SWPPPs included in Part 6 of EPA's 2021 MSGP. The SWPPP shall be prepared in accordance with good engineering practices and manufacturer's specifications and must take future conditions into consideration. The SWPPP must identify potential sources of pollution that may reasonably be expected to affect the quality of the stormwater discharges, and document the implementation of non-numeric technology based effluent limitations in Part I.C.1 that will be used to reduce the pollutants and assure compliance with this Permit, including any remedies taken when non-compliance occurs. Specifically, the SWPPP shall contain the elements listed in Parts 6.2.1 through 6.2.5 of the 2021 MSGP and briefly described below:

(1) Stormwater pollution prevention team;
(2) Site description;
(3) Drainage area site map;
(4) Summary of potential pollutant sources;
(5) Description of all stormwater control measures; and
(6) Schedules and procedures pertaining to implementation of stormwater control measures, inspections and assessments, and monitoring.

c. The Permittee shall amend and update the SWPPP within fourteen (14) days of any changes at the Facility affecting the SWPPP. Changes that may affect the SWPPP include, but are not limited to: 1) a change in design, construction, operation, or maintenance, which has a significant effect on the potential for the discharge of pollutants to the waters of the United States; 2) a release of a reportable quantity of pollutants as described in 40 CFR § 302; 3) a determination by the Permittee or EPA that the SWPPP appears to be ineffective in achieving the general objective of controlling pollutants in stormwater discharges associated with industrial activity; and 4) any revisions or improvements made to the Facility's stormwater management program based on new information and experiences with wet weather events, including major storm events and extreme flooding conditions. Any amended or updated versions of the SWPPP shall be re-certified by the Permittee. Such re-certifications also shall be signed in accordance with the requirements identified in Part II.D.2 of this Permit.

d. The Permittee shall certify at least annually that the previous year's inspections, corrective actions, control measures, and training activities were conducted, results were recorded, and records were maintained, as described in the SWPPP. Certifications must be submitted by January 15th of the following calendar year. If the Facility is not in compliance with any limitations and/or BMPs described in the SWPPP, the annual certification shall state the non-compliance and the remedies which are being undertaken. Such annual certifications also shall be signed in accordance with the requirements identified in Part II.D.2 of this Permit. The Permittee shall submit a copy of the current SWPPP and all SWPPP certifications (i.e., the initial certification, recertifications, and annual certifications) signed during the effective period of this Permit to EPA for posting on EPA Region 1's Chelsea River Terminals public website. All documentation of SWPPP activities shall be kept at the Facility for at least five years and provided to EPA upon request.

3. Hydrostatic Test Water

Hydrostatic test water shall be monitored as described below and treated through the stormwater treatment system prior to being discharged through Outfall to Chelsea River and is subject to the Effluent Limitations in Part I.A.1., above.

a. The flow of hydrostatic test water into the stormwater treatment system shall be controlled to prevent it from exceeding the maximum design flow rate of the system (i.e., 615 GPM at OWS to Outfall 001).

b. The Permittee shall take a minimum of five representative samples of the hydrostatic test water:

(1) For tanks, one in-process sample of the tank water following maintenance or testing, but before draining. The operator shall analyze and review the results of the in-process sample prior to initiating discharge. If the analysis indicates that the tank water does not meet the effluent limitations in this permit, the operator shall not discharge the tank water to the river unless treatment will reduce the pollutant levels below the effluent levels established in this permit;

(2) For pipelines, one in-process sample of the pipeline water following depressurization, but before draining. The operator shall analyze and review the results of the in-process sample prior to initiating discharge. If the analysis indicates that the pipeline water does not meet the effluent limitations in this permit, the operator shall not discharge the pipeline water unless treatment will reduce the pollutant levels below the effluent levels established in this permit; and

(3) Three grab samples of the effluent (at the discharge point for the treatment system), one sample during the first 10% of discharge, one sample at the approximate midpoint of discharge, and one sample during the last 10% of discharge after treatment. One grab sample of the effluent during the first 10% of discharge is

sufficient for discharges from tanks with volumes no greater than 50,000 gallons. If at any time analysis indicates that the hydrostatic test water does not meet the effluent limitations in this permit, corrective action must be taken in accordance with Part I.C.1.b(1), above.

c. The in-process and effluent samples of hydrostatic test water shall be analyzed for the following parameters:

(1) Total Flow;
(2) Flow Rate;
(3) Total Suspended Solids (TSS);
(4) Oil & Grease (O&G);
(5) pH;
(6) Chemical Oxygen Demand (COD);
(7) Dissolved Oxygen (DO);
(8) Total Surfactants;
(9) VOCs (benzene, toluene, ethylbenzene, and total xylenes);
(10) PAHs (Group I and II PAHs listed in Part I.A.1., benzo(a)anthracene through pyrene);
(11) Metals (total recoverable iron, and total recoverable metals listed in Part I.A.1., Whole Effluent Toxicity, cadmium through zinc);
(12) Ethanol, if tank or line has been used to store and/or convey ethanol and/or petroleum products containing ethanol within the previous year; and
(13) Total Residual Chlorine, if potable water or a similar source of water which is likely to contain residual chlorine concentrations is used for hydrostatic testing.

d. The Permittee shall submit a letter/report to EPA and the MassDEP, summarizing the results of the hydrostatic test **within 90 days of completion of the test**. This report shall contain:

(1) The date(s) during which the hydrostatic testing occurred;
(2) The volume of hydrostatic test water discharged;
(3) A copy of the laboratory data sheets for each analysis, providing the test method, the detection limits for each analyte, and a brief discussion of whether all appropriate QA/QC procedures were met and were within acceptable limits; and
(4) A brief discussion of the overall test results and how they relate to the Effluent Limitations in this permit.

f. EPA reserves the right to re-open this permit, in accordance with 40 CFR § 122.62(a)(2), to examine hydrostatic test water discharges in the event that sampling results indicate that the water quality standards for the assigned classification of the Chelsea River might not be attained.

4. Discharges of Chemicals and Additives

The discharge of any chemical or additive, including chemical substitution, which was not reported in the application submitted to EPA or provided through a subsequent written notification submitted to EPA is prohibited. Upon the effective date of this permit, chemicals and/or additives which have been disclosed to EPA may be discharged up to the frequency and level disclosed, provided that such discharge does not violate §§ 307 or 311 of the CWA or applicable State water quality standards. Discharges of a new chemical or additive are authorized under this permit 30 days following written notification to EPA unless otherwise notified by EPA. To request authorization to discharge a new chemical or additive, the Permittee must submit a written notification to EPA in accordance with Part I.D.3 of this permit. The written notification must include the following information, at a minimum:

a. The following information for each chemical and/or additive that will be discharged:

   (1) Product name, chemical formula, general description, and manufacturer of the chemical/additive;
   (2) Purpose or use of the chemical/additive;
   (3) Safety Data Sheet (SDS), Chemical Abstracts Service (CAS) Registry number, and EPA registration number, if applicable, for each chemical/additive;
   (4) The frequency (e.g., daily), magnitude (i.e., maximum application concentration), duration (e.g., hours), and method of application for the chemical/additive;
   (5) The maximum discharge concentration; and
   (6) The vendor's reported aquatic toxicity, if available (i.e., NOAEL and/or LC_{50} in percent for aquatic organism(s)).

b. Written rationale which demonstrates that the discharge of such chemicals and/or additives as proposed will not: 1) add any pollutants in concentrations which exceed any permit effluent limitation; and 2) add any pollutants that would justify the application of permit conditions different from, or in addition to those currently in this permit.

c. Discharges of glutaraldehyde, ethylene glycol, butoxyethanol, alkylacrelate nitrito styrene polymer, coco alkylamine, 1,2,3 and 4-trimethylbenzene, 1,3,5-trimethylbenzene and methyl isobutyl ketone are prohibited.

5. Bioassessment

The Permittee shall design and implement a bioassessment to characterize the extent to which, if any, pollutants discharged from the Facility to the receiving water affect the benthic morphology, substrate, and/or biota. Unless otherwise specified below, data collection activities shall be conducted: 1) quarterly for one year starting 90 days following the effective date of the permit; and 2) quarterly for one year in the fifth year of the permit term. Within 60 days of the effective date of the permit, the Permittee shall submit a plan for conducting the bioassessment to EPA and MassDEP. EPA and MassDEP will provide any comments on the plan within 30 days of receipt of the plan, and comments will be reasonably considered by the Permittee for inclusion into the plan. The bioassessment must comply with applicable local, state, and federal regulations, and shall consist of the following elements, at a minimum:

a. Water Column Characterization

(1) One water quality monitoring station shall be established within the vicinity of Outfall 001. The station must be positioned to collect water quality data representative of incoming and outgoing tides.
(2) For each monitoring period, relative water quality data must be collected at the water quality monitoring station during the months of January, April, July, and October at approximately:
   i. one foot below the surface;
   ii. mid-depth; and
   iii. one foot above the bottom.
(3) At each collection depth, the following data shall be collected:
   i. depth from the surface (feet);
   ii. water temperature (degrees Fahrenheit);
   iii. pH (Standard Units);
   iv. dissolved oxygen (milligrams per liter);
   v. salinity (parts per thousand);
   vi. turbidity (nephelometric turbidity units);
   vii. nutrients; and
   viii. current velocity (feet per second).
(4) During each quarterly data collection period, all water quality data at all station depths shall be collected over a 48-hour period during the apex of the spring tide and the neap tide.
   i. continuous recording data sondes shall be used to collect water quality data for all parameters (except where noted otherwise in Part I.C.6) at all depths. The recording frequency shall be at least one reading for all parameters, every 15 minutes over the course of the 48-hour sampling period.
   ii. current velocity data may be collected manually at the water monitoring station, at the three depths, every three hours (when deemed safe to do so), over the course of the 48-hour sampling period.
(5) The following supporting environmental data, recorded concurrent with continuous water quality data collection, shall be obtained from a near-by official weather station and a near-by official tide gauge:
   i. local air temperature (degrees Fahrenheit), collected at least once per hour, over the 48-hour sampling period;
   ii. local total precipitation (inches) for each 24-hour period, beginning 48 hours before water quality data is collected through the end of the 48-hour sampling period (four days in total);
   iii. the river level in relation to mean low water level when data is collected over the 48-hour sampling period; and
   iv. the tidal stage (flood current, ebb current) when data is collected over the 48-hour sampling period.

b. Substrate Characterization

(1) For each year that data collection is required, substrate characterization shall be conducted once. The Permittee shall collect samples of the substrate as follows:
  i. Along a transect upstream of the outfall from the bank to the approximate edge of the navigation channel and a transect downstream of the outfall from the bank to the approximate edge of the navigation channel. Transects shall be positioned perpendicular to river current.
  ii. At each location, three substrate samples must be collected at evenly spaced intervals between the bank and the edge of the main navigational channel.
  iii. The location, depth, and analysis of each substrate sample shall be recorded. The depth information must be calibrated to the mean low water level.
  iv. The analysis of each substrate sample must include, at a minimum, grain size composition (percent of silt, sand, and clay); total organic carbon (TOC); and benthic infauna.
  v. Secchi disk readings shall be recorded at each location.

c. Benthic Pollutant Analysis

(1) Concurrent with substrate data collection and in the same locations, the Permittee shall collect additional substrate samples to determine contamination present within the benthic habitat. The parameters required for analysis shall include:
  i. Table I.A. pollutants;
  ii. Total volatile solids, acid volatile sulfides, sediment oxidation reduction potential; and
  iii. Sediment toxicity test (i.e., 10-day static test).

(2) Analysis shall be performed using the test method for each constituent in accordance with EPA-600-R-97-072.[7]

d. Qualitative Biological Monitoring

(1) The permittee shall conduct a qualitative biological assessment to determine the organisms present in the vicinity of the water quality monitoring station.

(2) The collection effort shall take place, at a minimum, in April, July and October, as specified above, and on a sequential basis during year two.

(3) The biological survey shall be designed to collect:
  i. fish (early life stages, juvenile, and adult);
  ii. benthic macroinvertebrates;
  iii. aquatic macrophytes;
  iv. phytoplankton;
  v. zooplankton;
  vi. epibenthos; and
  vii. paleoenvironmental remains (e.g., diatoms, dinoflagellates, and foraminifera)

[7] Methods for the Determination of Chemical Substances in Marine and Estuarine Environmental Matrices - 2nd Edition: EPA-600-R-97-072. Office of Research and Development, U.S. EPA, Washington, D.C. 1997, as specified in 314 CMR 4.03(6)(f).

(4) The organisms shall be identified to species. For larger bodied organisms that are collected, an evaluation of overall condition shall be recorded (e.g., spawning condition, lesions, or deformities).

e. Summary Report

(1) The Permittee shall prepare and submit a report to EPA and MassDEP within 60 days of the first permit year's (four quarters) data collection and the fifth permit year's (four quarters) data collection in accordance with Part I.D.3 of this Permit.

(2) The summary report shall consist of the following, at a minimum:

i. A description of the sampling locations, including a figure depicting the geographic locations, a figure depicting the vertical distribution relative to mean low tide, and a copy of the laboratory data sheets for each analysis.

ii. A brief discussion of the overall bioassessment results and how they relate to the effluent limitations in this permit.

iii. A description of the results of water column characterization, and a table summarizing the sample results.

iv. A description of the substrate characterization results, and a table summarizing the sample results.

v. A description of the benthic pollutant analysis, and a table summarizing the sample results.

vi. A description of the biological monitoring results, and a table summarizing the total number of each species of organisms found for each monitoring period, the date they were collected, the depth (if available), and location where they were collected.

vii. A brief discussion of whether any of the requirements of the QA/QC BMP were not met. If any QA/QC requirements impact the usability of data, the Permittee must repeat collection of the unacceptable data.

D. REPORTING REQUIREMENTS

Unless otherwise specified in this permit, the Permittee shall submit reports, requests, and information and provide notices in the manner described in this section.

1. Submittal of DMRs Using NetDMR

The Permittee shall continue to submit its monthly monitoring data in DMRs to EPA and the State no later than the 15th day of the month electronically using NetDMR. When the Permittee submits DMRs using NetDMR, it is not required to submit hard copies of DMRs to EPA or the State. NetDMR is accessible through EPA's Central Data Exchange at https://cdx.epa.gov/.

2. Submittal of Reports as NetDMR Attachments

Unless otherwise specified in this permit, the Permittee shall electronically submit all reports to EPA as NetDMR attachments rather than as hard copies. *See* Part I.D.5. for more information on State reporting. Because the due dates for reports described in this permit may not coincide with the due date for submitting DMRs (which is no later than the 15th day of the month), a report submitted electronically as a NetDMR attachment shall be considered timely if it is electronically submitted to EPA using NetDMR with the next DMR due following the particular report due date specified in this permit.

3. Submittal of Requests and Reports to EPA Water Division (WD)

a. The following requests, reports, and information described in this permit shall be submitted to the NPDES Applications Coordinator in EPA WD:

(1) Transfer of Permit notice;
(2) Request for changes in sampling location;
(3) BMP/SWPPP reports and certifications;
(4) Request to discharge new chemicals or additives;
(5) Request for change in WET testing requirements;
(6) Bioassessment reports; and
(7) Report on unacceptable dilution water/request for alternative dilution water.

b. These reports, information, and requests shall be submitted to EPA WD electronically at R1NPDESReporting@epa.gov or by hard copy mail to the following address:

U.S. Environmental Protection Agency
Water Division
NPDES Applications Coordinator
5 Post Office Square - Suite 100 (06-03)
Boston, MA 02109-3912

4. Submittal of Reports in Hard Copy Form

a. The following notifications and reports shall be signed and dated originals, submitted in hard copy, with a cover letter describing the submission:

(1) Written notifications required under Part II, Standard Conditions. Beginning December 21, 2025, such notifications must be done electronically using EPA's NPDES Electronic Reporting Tool ("NeT"), or another approved EPA system, which will be accessible through EPA's Central Data Exchange at https://cdx.epa.gov/.

b. This information shall be submitted to EPA Region 1's Enforcement and Compliance Assurance Division at the following address:

U.S. Environmental Protection Agency
Enforcement and Compliance Assurance Division
Water Compliance Section
5 Post Office Square, Suite 100 (04-SMR)
Boston, MA 02109-3912

5. State Reporting

Duplicate signed copies of all WET test reports shall be submitted to the Massachusetts Department of Environmental Protection, Division of Watershed Management, at the following address:

Massachusetts Department of Environmental Protection
Bureau of Water Resources
Division of Watershed Management
8 New Bond Street
Worcester, Massachusetts 01606

6. Verbal Reports and Verbal Notifications

a. Any verbal reports or verbal notifications, if required, in Parts I and/or II of this permit, shall be made to both EPA and to the State. This includes verbal reports and notifications which require reporting within 24 hours (e.g., Part II.B.4.c. (2), Part II.B.5.c. (3), and Part II.D.1.e.).

b. Verbal reports and verbal notifications shall be made to EPA's Enforcement and Compliance Assurance Division at:

617-918-1510

c. Verbal reports and verbal notifications shall be made to MassDEP's Emergency Response at:

888-304-1133

E. REOPENER CLAUSE

1. This permit may be modified or revoked and reissued in accordance with 40 C.F.R. §122.62. The reason for modification or revocation may include, but is not limited to:

a. Material and substantial alterations or additions to the Terminal or activity have occurred.

b. New information is received which was not available at the time of permit issuance and that would have justified the application of different permit conditions at the time of issuance.

c. An applicable effluent standard or limitation is issued or approved under Sections 301(b)(2)(C) and (D), 304(b)(2), and 307(a)(2) of the CWA, which:
(1) Contains different conditions or is otherwise more stringent than any effluent limitation in this permit; or

(2) Controls any pollutant not limited by this permit.

2. If the permit is modified or reissued, it shall be revised to reflect all currently applicable requirements of the CWA.

F. STATE PERMIT CONDITIONS

EPA has received the state water quality certification issued by the State under § 401(a) of the CWA and 40 CFR § 124.53. EPA incorporates by reference the following state water quality certification requirements into this final permit.

1. Pursuant to 314 CMR 3.11 (2)(a)(6), and in accordance with MassDEP's obligation under 314 CMR 4.05(5)(e) to maintain surface waters free from pollutants in concentrations or combinations that are toxic to humans, aquatic life, or wildlife, within 6 months of the effective date of the 2021 Federal NPDES permit, the permittee shall submit to MassDEP an evaluation of whether the facility uses any products containing any per- and polyfluoroalkyl substances (PFAS) and whether use of those products can be reduced or eliminated. The analysis shall be submitted electronically to massdep.npdes@mass.gov.

2. Pursuant to 314 CMR 3.11 (2)(a)(6), and in accordance with MassDEP's obligation under 314 CMR 4.05(5)(e) to maintain surface waters free from pollutants in concentrations or combinations that are toxic to humans, aquatic life, or wildlife, within 6 months after the permittee has been notified by EPA of a multi-lab validated method for wastewater, or two years from the effective date of the 2021 Federal NPDES permit, whichever is earlier, the permittee shall conduct monitoring of the effluent for PFAS compounds as detailed in the table below. If the permittee has not been notified by EPA of a multi-lab validated method for wastewater by two years from the effective date of the 2021 Federal NPDES permit, the permittee shall conduct monitoring of the effluent for PFAS compounds as detailed in the table below using a method specified by MassDEP. If EPA's multi-lab validated method is not available by 20 months after the effective date of the 2021 Federal NPDES permit, the permittee shall contact MassDEP (massdep.npdes@mass.gov) for guidance on an appropriate analytical method.

Effluent (Outfall 001)

Parameter	**Units**	**Measurement Frequency**	**Sample Type**
Perfluorohexanesulfonic acid (PFHxS)	ng/L	Quarterly[8]	Grab
Perfluoroheptanoic acid (PFHpA)	ng/L	Quarterly	Grab
Perfluorononanoic acid (PFNA)	ng/L	Quarterly	Grab
Perfluorooctanesulfonic acid (PFOS)	ng/L	Quarterly	Grab
Perfluorooctanoic acid (PFOA)	ng/L	Quarterly	Grab
Perfluorodecanoic acid (PFDA)	ng/L	Quarterly	Grab

[8] Quarters are defined as January to March, April to June, July to September, and October to December. Samples shall be taken during the same month each quarter and shall be taken 3 months apart (e.g., an example sampling schedule could be February, May, August, and November).

3. Pursuant to 314 CMR 3.11 (2)(a)(6), and in accordance with MassDEP's obligation under 314 CMR 4.05(5)(e) to maintain surface waters free from pollutants in concentrations or combinations that are toxic to humans, aquatic life, or wildlife, after completing one year of monitoring, if 4 consecutive samples are reported as non-detect for all 6 PFAS compounds, then the permittee may submit a request to MassDEP to discontinue PFAS monitoring. Any such request shall be made in writing and sent to massdep.npdes@mass.gov. The permittee shall continue such monitoring pending written approval from MassDEP to discontinue it.

APPENDIX B

ANNUAL SWPPP CERTIFICATIONS

ANNUAL SWPPP CERTIFICATIONS

I certify the Terminal is in compliance with the SWPPP requirement with the exception of the following aspects listed below. I also certify that the previous year's inspections and maintenance activities were conducted, results recorded, records maintained, and that the Terminal is in compliance with this permit with the exception of the following aspects listed below (complete the list of requirements and remedies being undertaken, if applicable. The Terminal shall document any violation of numeric or non-numeric effluent limitations with a date and description of the corrective actions taken.).

SWPPP Requirement	Date (if applicable)	Remedies Being Undertaken

____
Authorized Signature, Title

____
Printed Name

____
Date

APPENDIX C

SUMMARY OF SPILL DATA FROM DECEMBER 2017 TO PRESENT

Irving Revere Terminal Reportable Spills

Date	Quantity and Type	Location	Cause

APPENDIX D

USEPA SUMMARY OF THE TERMINALS DISCHARGE MONITORING DATA

TABLE 1
MONTHLY DISCHARGE MONITORING DATA - EFFLUENT (2017-2022)
IRVING TERMINAL - MA0001929
OUTFALL SERIAL NUMBER 001

Monitoring Date	pH		TSS		Oil & Grease
	Range (SU)		Monthly Avg. (mg/L)	Daily Max (mg/L)	Daily Max (mg/L)
	Minimum	Maximum			
	2014 Permit Limits				
	6.5 - 8.5 SU		30 mg/L	100 mg/L	15 mg/L
01/31/17	7.6	7.6	16	26	ND (5)
02/28/17	7.4	7.4	24	30	ND (5)
03/31/17	7.8	7.8	39	66	ND (5)
04/30/17	7.8	7.8	46	57	ND (5)
05/31/17	7.6	7.6	18.5	26	ND (5)
06/30/17	7.7	7.7	6.6	7.8	ND (5)
07/31/17	7.4	7.4	14.2	25	ND (5)
08/31/17	7.5	7.5	5	5	ND (5)
09/30/17	8	8	16.5	28	ND (5)
10/31/17	7.8	7.8	6.5	9	ND (5)
11/30/17	7.7	7.7	9	13	ND (5)
12/31/17	7.7	7.7	9.2	9.2	ND (5)
01/31/18	7.3	7.3	23	18	ND (5)
02/28/18	7.4	7.4	11.9	14	ND (5)
03/31/18	8.1	8.1	15.5	18	ND (5)
04/30/18	7.4	7.4	16.1	25	ND (5)
05/31/18	7.4	7.4	12.9	21	ND (5)
06/30/18	7.3	7.3	42	65	ND (5)
07/31/18	7.8	7.8	24.8	56	ND (5)
08/31/18	7.2	7.2	12.75	21	ND (5)
09/30/18	7.8	7.8	10	15	5
10/31/18	7.4	7.4	8.1	11	ND (5)
11/30/18	7.6	7.6	7.75	9.1	ND (6)
12/31/18	7.3	7.3	15.5	17	ND (6)
01/31/19	7.3	7.3	9.2	10	ND (6)
02/28/19	7.3	7.3	9.7	11	ND (6)
03/31/19	7.2	7.2	20.7	32	ND (6)
04/30/19	8	8	9.3	9.3	ND (6)
05/31/19	8	8	7.8	8.7	ND (6)
06/30/19	8.4	8.4	8.85	12	7
07/31/19	7.5	7.5	11.5	13	ND (6)
08/31/19	7.2	7.2	19.5	26	ND (6)
09/30/19	7.4	7.4	9.9	12	ND (6)

TABLE 1
MONTHLY DISCHARGE MONITORING DATA - EFFLUENT (2017-2022)
IRVING TERMINAL - MA0001929
OUTFALL SERIAL NUMBER 001

Monitoring Date	pH		TSS		Oil & Grease
	Range (SU)		Monthly Avg. (mg/L)	Daily Max (mg/L)	Daily Max (mg/L)
	Minimum	Maximum			
	2014 Permit Limits				
	6.5 - 8.5 SU		30 mg/L	100 mg/L	15 mg/L
10/31/19	7.7	7.7	9.9	11	ND (6)
11/30/19	7.8	7.8	3.8	4.6	ND (6)
12/31/19	7.6	7.6	9.1	9.1	ND (6)
01/31/20	7.6	7.6	15.7	28	ND (6)
02/29/20	7.7	7.7	14	14	ND (6)
03/31/20	7.7	7.7	6.6	7.6	ND (6)
04/30/20	7.6	7.6	14	17	ND (6)
05/31/20	8.4	8.4	11.9	14	ND (6)
06/30/20	7.7	7.7	15.4	23	ND (6)
07/31/20	7.5	7.5	8.2	8.8	ND (6)
08/31/20	No discharge				
09/30/20	8.4	8.4	8	11	ND (5)
10/31/20	7.9	7.9	23.5	60	ND (5)
11/30/20	7.2	7.2	8.7	13	ND (5)
12/31/20	7.7	7.7	6.2	10	ND (5)
01/31/21	7.5	7.5	7.2	11	ND (5)
02/28/21	7.3	7.3	7.4	9.5	ND (5)
03/31/21	7.4	7.4	13.5	15	ND (5)
04/30/21	7.7	7.7	3.3	6.7	ND (5)
05/31/21	7.5	7.5	23.4	37	ND (5)
06/30/21	7.8	7.8	11.5	17	ND (5)
07/31/21	8.1	8.1	10	11	ND (5)
08/31/21	8.1	8.1	12.5	14	ND (5)
09/30/21	7.5	7.5	8.7	12	ND (5)
10/31/21	7.4	7.4	2.1	4.2	ND (5)
11/30/21	7.2	7.2	4.3	6.1	ND (5)
12/31/21	7.2	7.2	4.2	4.4	ND (5)
01/31/22	7.4	7.4	5.9	6.1	ND (5)
02/28/22	7.2	7.2	7.5	15	ND (5)
03/31/22	7.1	7.1	11.5	14	ND (5)
04/30/22	7.9	7.9	6.05	9.5	ND (5)
05/31/22	7.7	7.7	3.6	7.2	ND (5)
06/30/22	7.9	7.9	12.75	17	ND (5)

TABLE 1
MONTHLY DISCHARGE MONITORING DATA - EFFLUENT (2017-2022)
IRVING TERMINAL - MA0001929
OUTFALL SERIAL NUMBER 001

Monitoring Date	pH		TSS		Oil & Grease
	Range (SU)		Monthly Avg. (mg/L)	Daily Max (mg/L)	Daily Max (mg/L)
	Minimum	Maximum			
	2014 Permit Limits				
	6.5 - 8.5 SU		30 mg/L	100 mg/L	15 mg/L
07/31/22	**7.9**	**7.9**	**9.9**	**11**	**8**
08/31/22	**7.5**	**7.5**	**21**	**28**	**12**
09/30/22	**8.4**	**8.4**	**11.5**	**12**	ND (5)
10/31/22	**8.1**	**8.1**	**10**	**10**	**5**
11/30/22	**7.7**	**7.7**	**10.4**	**13**	ND (5)

NOTES:
1. TSS = total suspended solids.
2. SU = standard units.
3. mg/L = milligrams per liter.
4. ND (x) = not detected above laboratory practical quantitation limits (PQLs) noted in parentheses.

TABLE 2
QUARTERLY REPORTING - EFFLUENT - PAHs AND NAPHTHALENE
IRVING TERMINAL - MA0001929
RECIEVING WATERS
OUTFALL SERIAL NUMBER 001

Monitoring/ End Date	Parameters																	
	Salinity	Total Solids	Total Suspended Solids	Total Zinc	pH	Benzo(g,h,i) Perylene	Benzo(k) fluoranthene	Chrysene	Dibenzo(a,h) anthracene	Ethylbenzene	Fluoranthene	Fluorene	Indeno (1,2,3-c,d) pyrene	Naphthalene[3]	Phenanthrene	Pyrene	Toluene	Xylene
	2014 Permit Limits																	
	Avg. Monthly ---	Avg. Monthly ---	Avg. Monthly ---	Avg. Monthly ---	Avg. Monthly 0.1 µg/L	Avg. Monthly ---	Avg. Monthly ---	Avg. Monthly ---	Avg. Monthly ---	Avg. Monthly ---	Avg. Monthly ---	Avg. Monthly ---	Avg. Monthly ---	Avg. Monthly 100 µg/L	Avg. Monthly ---	Avg. Monthly ---	Avg. Monthly ---	Avg. Monthly ---
	Daily Max Report	Daily Max Report	Daily Max Report	Daily Max Report	Daily Max Report	Daily Max Report	Daily Max Report	Daily Max Report	Daily Max Report	Daily Max Report	Daily Max Report	Daily Max Report	Daily Max Report	Daily Max Report	Daily Max Report	Daily Max Report	Daily Max Report	Daily Max Report
03/31/17	---	**61,000**	**9.1**	ND (0.05)	**8**	---	ND (0.1)	ND (0.1)	ND (0.1)	ND (2)	ND (0.5)	ND (0.5)	ND (0.1)	---	ND (0.5)	ND (0.5)	ND (2)	ND (2)
06/30/17	---	**32,000**	**10**	**0.03**	**7.7**	---	ND (0.1)	ND (0.1)	ND (0.1)	ND (2)	ND (0.5)	ND (0.5)	ND (0.1)	---	ND (0.5)	ND (0.5)	ND (2)	ND (2)
09/30/17	---	**40,000**	**8.1**	ND (0.12)	**7.6**	---	ND (0.1)	ND (0.1)	ND (0.1)	ND (2)	ND (0.5)	ND (0.5)	ND (0.1)	---	ND (0.5)	ND (0.5)	ND (2)	ND (2)
12/31/17	---	**33,000**	**40.6**	ND (0.08)	**7.4**	---	ND (0.1)	ND (0.1)	ND (0.1)	ND (2)	ND (0.5)	ND (0.5)	ND (0.1)	---	ND (0.5)	ND (0.5)	ND (2)	ND (2)
03/31/18	---	**33,000**	**6.6**	ND (5)	**7.7**	---	---	---	---	---	---	---	---	---	---	---	---	---
04/30/18	---	---	---	---	---	ND (0.5)	ND (0.1)	ND (0.1)	ND (0.1)	ND (2)	ND (0.5)	ND (0.5)	ND (0.1)	ND (0.5)	ND (0.5)	ND (0.5)	ND (2)	ND (2)
09/30/18	---	**22,000**	**12**	ND (10)	**7.9**	---	---	---	---	---	---	---	---	---	---	---	---	---
12/31/18	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
04/30/19	---	---	---	---	---	ND (0.5)	ND (0.1)	ND (0.1)	ND (0.1)	ND (2)	ND (0.5)	ND (0.5)	ND (0.1)	ND (0.5)	ND (0.5)	ND (0.5)	ND (2)	ND (2)
09/30/19	---	**23,000**	ND (25)	**20**	**7.7**	---	---	---	---	---	---	---	---	---	---	---	---	---
12/31/19	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
04/30/20	---	---	---	---	---	ND (0.5)	ND (0.1)	ND (0.1)	ND (0.1)	ND (2)	ND (0.5)	ND (0.5)	ND (0.1)	ND (0.5)	ND (0.5)	ND (0.5)	ND (2)	ND (2)
09/30/20	31	**31,000**	**3.8**	ND (2.5)	**7.9**	---	---	---	---	---	---	---	---	---	---	---	---	---
04/30/21	---	---	---	---	---	ND (0.5)	ND (0.1)	ND (0.5)	ND (0.1)	ND (2)	**4.33**	ND (0.5)	ND (0.1)	ND (0.5)	**8.42**	**2.08**	ND (2)	ND (2)
09/30/21	24	**25,000**	**5.7**	ND (5)	**7.5**	---	---	---	---	---	---	---	---	---	---	---	---	---
04/30/22	---	---	---	---	---	ND (0.5)	ND (0.1)	ND (0.1)	ND (0.1)	ND (2)	ND (0.5)	ND (0.5)	ND (0.1)	ND (0.5)	ND (0.5)	ND (0.5)	ND (2)	ND (2)
09/30/22	---	**30,000**	**3.8**	ND (25)	**7.6**	---	---	---	---	---	---	---	---	---	---	---	---	---

Note: Method limits may fluctuate, but should be consistent with EPAS test methods

NOTES:

1. Results in micrograms per liter (µg/L), which is approximately equivalent to parts per billion (ppb).
2. ND (x) = not detected above laboratory practical quantitation limits (PQLs) noted in parentheses; when provided in Discharge Monitoring Reports (DMRs), the PQLs are noted as <PQL for the analyte for the date of analysis.
3. Permittee shall analyze for naphthalene using analytical methods for semi-volatile organic compounds and volatile organic compounds.

TABLE 3
EFFLUENT - PAHs AND NAPHTHALENE
IRVING TERMINAL - MA0001929
OUTFALL SERIAL NUMBER 001

Monitoring Date	Polycyclic Aromatic Hydrocarbons															
	Acenaphthene	Acenaphthylene	Anthracene	Benzo(a) anthracene	Benzo(a) pyrene	Benzo(b) fluoranthene	Benzo(g,h,i) Perylene	Benzo(k) fluoranthene	Chrysene	Dibenzo(a,h) anthracene	Fluoranthene	Fluorene	Indeno (1,2,3-c,d) pyrene	Naphthalene[3]	Phenanthrene	Pyrene
	2014 Permit Limits															
	Avg. Monthly ---	Avg. Monthly ---	Avg. Monthly ---	Avg. Monthly ---	Avg. Monthly 0.1 µg/L	Avg. Monthly ---	Avg. Monthly ---	Avg. Monthly ---	Avg. Monthly ---	Avg. Monthly ---	Avg. Monthly ---	Avg. Monthly ---	Avg. Monthly ---	Avg. Monthly 100 µg/L	Avg. Monthly ---	Avg. Monthly ---
	Daily Max Report	Daily Max Report	Daily Max Report	Daily Max Report	Daily Max Report	Daily Max Report	Daily Max Report	Daily Max Report	Daily Max Report	Daily Max Report	Daily Max Report	Daily Max Report	Daily Max Report	Daily Max Report	Daily Max Report	Daily Max Report
01/04/17	---	---	---	---	ND (0.100)	---	---	---	---	---	---	---	---	ND (0.500)	---	---
02/13/17	---	---	---	---	ND(0.100)	---	---	---	---	---	---	---	---	ND (0.500)	---	---
03/22/17	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.1)	ND (0.100)	ND (0.1)	ND (0.5)	ND (0.1)	ND (0.1)	ND (0.1)	ND (0.5)	ND (0.5)	ND (0.1)	ND (0.5)	ND (0.5)	ND (0.5)
04/07/17	---	---	---	---	ND(0.100)	---	---	---	---	---	---	---	---	ND (0.500)	---	---
05/05/17	---	---	---	---	ND (0.1)	---	---	---	---	---	---	---	---	ND (0.5)	---	---
06/08/17	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.1)	ND (0.1)	ND (0.1)	ND (0.1)	ND (0.1)	ND (0.1)	ND (0.1)	ND (0.5)	ND (0.5)	ND (0.1)	ND (0.5)	ND (0.5)	ND (0.5)
07/17/17	---	---	---	---	ND (0.100)	---	---	---	---	---	---	---	---	ND (0.5)	---	---
08/15/17	---	---	---	---	ND (0.1)	---	---	---	---	---	---	---	---	ND (0.5)	---	---
09/07/17	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.1)	ND (0.1)	ND (0.1)	ND (0.5)	ND (0.1)	ND (0.1)	ND (0.1)	ND (0.5)	ND (0.5)	ND (0.1)	ND (0.5)	ND (0.5)	ND (0.5)
10/05/17	---	---	---	---	ND (0.1)	---	---	---	---	---	---	---	---	ND (0.5)	---	---
11/07/17	---	---	---	---	ND (0.1)	---	---	---	---	---	---	---	---	ND (0.5)	---	---
12/11/17	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.1)	ND (0.1)	ND (0.1)	ND (0.5)	ND (0.1)	ND (0.1)	ND (0.1)	ND (0.5)	ND (0.5)	ND (0.1)	ND (0.5)	ND (0.5)	ND (0.5)
01/22/18	---	---	---	---	ND (0.1)	---	---	---	---	---	---	---	---	ND (0.5)	---	---
02/09/18	---	---	---	---	ND (0.1)	---	---	---	---	---	---	---	---	ND (0.5)	---	---
03/12/18	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.1)	ND (0.1)	ND (0.1)	ND (0.5)	ND (0.1)	ND (0.1)	ND (0.1)	ND (0.5)	ND (0.5)	ND (0.1)	ND (0.5)	ND (0.5)	ND (0.5)
04/13/18	---	---	---	---	ND (0.1)	---	---	---	---	---	---	---	---	ND (0.5)	---	---
05/03/18	---	---	---	---	ND (0.1)	---	---	---	---	---	---	---	---	ND (0.5)	---	---
06/07/18	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.1)	ND (0.1)	ND (0.1)	ND (0.5)	ND (0.1)	ND (0.1)	ND (0.1)	ND (0.5)	ND (0.5)	ND (0.1)	ND (0.5)	ND (0.5)	ND (0.5)
07/23/18	---	---	---	---	ND (0.1)	---	---	---	---	---	---	---	---	ND (0.5)	---	---
08/10/18	---	---	---	---	ND (0.1)	---	---	---	---	---	---	---	---	ND (0.5)	---	---
09/17/18	---	---	---	---	ND (0.1)	---	---	---	---	---	---	---	---	ND (0.5)	---	---
10/05/18	---	---	---	---	ND (0.2)	---	---	---	---	---	---	---	---	ND (0.5)	---	---
11/01/18	---	---	---	---	ND (0.105)	---	---	---	---	---	---	---	---	ND (0.526)	---	---
12/05/18	---	---	---	---	ND (0.112)	---	---	---	---	---	---	---	---	ND (0.562)	---	---
01/03/19	---	---	---	---	ND (0.104)	---	---	---	---	---	---	---	---	ND (0.518)	---	---
02/05/19	---	---	---	---	ND (0.100)	---	---	---	---	---	---	---	---	ND (0.500)	---	---
03/05/19	---	---	---	---	ND (0.104)	---	---	---	---	---	---	---	---	ND (0.521)	---	---
04/11/19	ND (0.549)	ND (0.549)	ND (0.549)	ND (0.110)	ND (0.1)	ND (0.110)	ND (0.549)	ND (0.110)	ND (0.110)	ND (0.110)	ND (0.549)	ND (0.549)	ND (0.110)	ND (0.549)	ND (0.549)	ND (0.549)
05/31/2019	---	---	---	---	ND (0.1)	---	---	---	---	---	---	---	---	ND (5)	---	---
06/30/2019	---	---	---	---	ND (0.1)	---	---	---	---	---	---	---	---	ND (5)	---	---
07/31/2019	---	---	---	---	ND (0.1)	---	---	---	---	---	---	---	---	ND (5)	---	---
08/31/2019	---	---	---	---	ND (0.1)	---	---	---	---	---	---	---	---	ND (5)	---	---
09/30/2019	---	---	---	---	ND (0.1)	---	---	---	---	---	---	---	---	ND (5)	---	---
10/31/2019	---	---	---	---	ND (0.1)	---	---	---	---	---	---	---	---	ND (25)	---	---
11/30/2019	---	---	---	---	ND (0.1)	---	---	---	---	---	---	---	---	ND (5)	---	---
12/31/2019	---	---	---	---	ND (0.1)	---	---	---	---	---	---	---	---	ND (5)	---	---
01/31/2020	---	---	---	---	ND (0.1)	---	---	---	---	---	---	---	---	ND (5)	---	---
02/29/2020	---	---	---	---	ND (0.1)	---	---	---	---	---	---	---	---	ND (5)	---	---
03/31/2020	---	---	---	---	ND (0.1)	---	---	---	---	---	---	---	---	19.6	---	---
04/30/2020	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.1)	ND (0.1)	ND (0.1)	ND (0.5)	ND (0.1)	ND (0.1)	ND (0.1)	ND (0.5)	ND (0.5)	ND (.1)	ND (5)	ND (0.5)	ND (0.5)
05/31/2020	---	---	---	---	ND (0.1)	---	---	---	---	---	---	---	---	ND (5)	---	---
06/30/2020	---	---	---	---	ND (0.1)	---	---	---	---	---	---	---	---	ND (5)	---	---
07/31/2020	---	---	---	---	ND (0.1)	---	---	---	---	---	---	---	---	ND (5)	---	---
08/31/2020	---	---	---	---	ND (0.1)	---	---	---	---	---	---	---	---	ND (5)	---	---
09/30/2020	No Discharge															
10/31/2020	---	---	---	---	ND (0.1)	---	---	---	---	---	---	---	---	ND (25)	---	---
11/30/2020	---	---	---	---	ND (0.1)	---	---	---	---	---	---	---	---	ND (5)	---	---
12/31/2020	---	---	---	---	ND (0.1)	---	---	---	---	---	---	---	---	ND (5)	---	---
01/31/2021	---	---	---	---	ND (0.1)	---	---	---	---	---	---	---	---	ND (5)	---	---
02/28/2021	---	---	---	---	ND (0.1)	---	---	---	---	---	---	---	---	ND (5)	---	---
03/31/2021	---	---	---	---	ND (0.1)	---	---	---	---	---	---	---	---	ND (5)	---	---
04/30/2021	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.1)	ND (0.1)	ND (0.103)	ND (0.5)	ND (0.103)	ND (0.1)	ND (0.1)	ND (0.5)	ND (0.5)	ND (.1)	ND (5)	ND (0.5)	ND (0.5)
05/31/2021	---	---	---	---	ND (0.1)	---	---	---	---	---	---	---	---	ND (5)	---	---
06/30/2021	---	---	---	---	ND (0.1)	---	---	---	---	---	---	---	---	ND (5)	---	---
07/31/2021	---	---	---	---	ND (0.1)	---	---	---	---	---	---	---	---	ND (5)	---	---
08/31/2021	---	---	---	---	ND (0.1)	---	---	---	---	---	---	---	---	ND (5)	---	---
09/30/2021	---	---	---	---	ND (0.1)	---	---	---	---	---	---	---	---	ND (5)	---	---
10/31/2021	---	---	---	---	ND (0.1)	---	---	---	---	---	---	---	---	ND (5)	---	---
11/30/2021	---	---	---	---	ND (0.1)	---	---	---	---	---	---	---	---	ND (5)	---	---
12/31/2021	---	---	---	---	ND (0.1)	---	---	---	---	---	---	---	---	ND (5)	---	---
01/31/2022	---	---	---	---	ND (0.1)	---	---	---	---	---	---	---	---	ND (5)	---	---
02/28/2022	---	---	---	---	ND (0.1)	---	---	---	---	---	---	---	---	ND (5)	---	---
03/31/2022	---	---	---	---	ND (0.1)	---	---	---	---	---	---	---	---	ND (5)	---	---
04/30/2022	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.1)	ND (0.1)	ND (0.1)	ND (0.5)	ND (0.1)	ND (0.1)	ND (0.1)	ND (0.5)	ND (0.5)	ND (.1)	ND (5)	ND (0.5)	ND (0.5)
05/31/2022	---	---	---	---	ND (0.1)	---	---	---	---	---	---	---	---	ND (5)	---	---
06/30/2022	---	---	---	---	ND (0.1)	---	---	---	---	---	---	---	---	ND (5)	---	---
07/31/2022	---	---	---	---	ND (0.1)	---	---	---	---	---	---	---	---	ND (5)	---	---
08/31/2022	---	---	---	---	ND (0.1)	---	---	---	---	---	---	---	---	ND (5)	---	---
09/30/2022	---	---	---	---	ND (0.1)	---	---	---	---	---	---	---	---	ND (5)	---	---
10/31/2022	---	---	---	---	ND (0.1)	---	---	---	---	---	---	---	---	ND (5)	---	---
11/30/2022	---	---	---	---	ND (0.1)	---	---	---	---	---	---	---	---	ND (5)	---	---

Note: Method limits may fluctuate, but should

NOTES:

1. Results in micrograms per liter (µg/L), which is approximately equivalent to parts per billion (ppb).
2. ND (x) = not detected above laboratory practical quantitation limits (PQLs) noted in parentheses; when provided in Discharge Monitoring Reports (DMRs), the PQLs are noted as <PQL for the analyte for the date of analysis.
3. Permittee shall analyze for naphthalene using analytical methods for semi-volatile organic compounds and volatile organic compounds.

TABLE 4
QUARTLERY REPORTING - EFFLUENT - VOCs (2017 to 2022)
IRVING TERMINAL - MA0001929
OUTFALL SERIAL NUMBER 001

Monitoring Period/ Date	Volatile Organic Compounds						
	Benzene	Toluene	Ethylbenzene	Xylenes (total)	Methyl tert-butyl ether	Naphthalene[3]	tert-Butyl alcohol
	2014 Permit Limits						
	Avg. Monthly 51 µg/L	Avg. Monthly ---	Avg. Monthly ---	Avg. Monthly ---	Avg. Monthly 20 µg/L	Avg. Monthly 100 µg/L	Avg. Monthly ---
	Daily Max Report	Daily Max Report	Daily Max Report	Daily Max Report	Daily Max Report	Daily Max Report	Daily Max Report
01/04/17	ND (2)	---	---	---	---	ND (5)	---
02/13/17	**17**	---	---	---	---	ND(5)	---
03/22/17	**3.1**	ND (2)	ND (2)	**2.4**	**2.9**	ND (5)	**36.6**
04/07/17	**3.2**	---	---	---	---	ND (5)	---
05/05/17	ND (2)	---	---	---	---	ND (5)	---
06/08/17	ND (2)	ND (2)	ND (2)	ND (2)	**3.3**	ND (5)	**26.9**
07/17/17	ND (2)	---	---	---	---	ND (5)	---
08/15/17	ND (2)	---	---	---	---	ND (5)	---
09/07/17	**3.2**	ND (2)	ND (2)	10.8	ND (2)	ND (5)	ND (10)
10/05/17	ND (2)	---	---	---	---	ND (5)	---
11/07/17	ND (2)	---	---	---	---	ND (5)	---
12/11/17	**4.0**	ND (2)	ND (2)	ND (2)	**2.9**	ND (5)	**24.8**
01/22/18	**4.1**	---	---	---	---	ND (5)	---
02/09/18	**2.8**	---	---	---	---	ND (5)	---
03/12/18	ND (2)	ND (2)	ND (2)	**2.1**	ND (2)	ND (5)	**76.9**
04/13/18	ND (2)	---	---	---	---	ND (5)	---
05/03/18	ND (2)	---	---	---	---	ND (5)	---
06/07/18	ND (2)	ND (2)	ND (2)	ND (2)	**4**	ND (5)	**30**
07/23/18	ND (2)	---	---	---	---	ND (5)	---
08/10/18	ND (2)	---	---	---	---	ND (5)	---
09/17/18	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)	ND (5)	**11.3**
10/05/18	ND (2)	---	---	---	---	ND (5)	---
11/01/18	ND (2)	---	---	---	---	ND (5)	---
12/05/18	**5.51**	---	---	---	ND (2)	ND (5)	**24.2**
01/03/19	ND (2)	---	---	---	---	ND (5)	---
02/05/19	ND (2)	---	---	---	---	ND (5)	---
03/05/19	**7.78**	---	---	---	**2.10**	ND (5)	**35.1**
04/11/19	ND (2)	ND (2)	ND (2)	ND (4)	ND (2)	ND (5)	**16.1**
05/31/2019	ND (2)	---	---	---	---	ND (5)	---
06/30/2019	ND (2)	---	---	---	ND (2)	ND (5)	---
07/31/2019	ND (2)	---	---	---	---	ND (5)	---
08/31/2019	ND (2)	---	---	---	---	ND (5)	---
09/30/2019	ND (10)	---	---	---	< 10	ND (25)	---
10/31/2019	ND (2)	---	---	---	---	ND (5)	---
11/30/2019	ND (2)	---	---	---	---	ND (5)	---
12/31/2019	ND (2)	---	---	---	< 2	ND (5)	---
01/31/2020	ND (2)	---	---	---	---	ND (5)	---
02/29/2020	**31.1**	---	---	---	---	**19.6**	---
03/31/2020	ND (2)	---	---	---	< 2	ND (5)	---
04/30/2020	ND (2)	ND (2)	ND (2)	ND (2)	---	ND (5)	**29.8**
05/31/2020	ND (2)	---	---	---	---	ND (5)	---
06/30/2020	ND (2)	---	---	---	< 2	ND (5)	---
07/31/2020	ND (2)	---	---	---	---	ND (5)	---
08/31/2020	No Discharge						
09/30/2020	ND (10)	---	---	---	< 10	ND (25)	---
10/31/2020	ND (2)	---	---	---	---	ND (5)	---
11/30/2020	ND (2)	---	---	---	---	ND (5)	---

TABLE 4
QUARTLERY REPORTING - EFFLUENT - VOCs (2017 to 2022)
IRVING TERMINAL - MA0001929
OUTFALL SERIAL NUMBER 001

Monitoring Period/ Date	Volatile Organic Compounds						
	Benzene	Toluene	Ethylbenzene	Xylenes (total)	Methyl tert-butyl ether	Naphthalene[3]	tert-Butyl alcohol
	2014 Permit Limits						
	Avg. Monthly 51 µg/L	Avg. Monthly ---	Avg. Monthly ---	Avg. Monthly ---	Avg. Monthly 20 µg/L	Avg. Monthly 100 µg/L	Avg. Monthly ---
	Daily Max Report	Daily Max Report	Daily Max Report	Daily Max Report	Daily Max Report	Daily Max Report	Daily Max Report
12/31/2020	ND (2)	---	---	---	< 2	ND (5)	---
01/31/2021	ND (2)	---	---	---	---	ND (5)	---
02/28/2021	**7.89**	---	---	---	---	ND (5)	---
03/31/2021	**36.7**	---	---	---	**2.21**	ND (5)	---
04/30/2021	ND (2)	ND (2)	ND (2)	ND (2)	---	ND (5)	ND (10)
05/31/2021	ND (2)	---	---	---	---	ND (5)	---
06/30/2021	**7.66**	---	---	---	< 2	ND (5)	---
07/31/2021	ND (2)	---	---	---	---	ND (5)	---
08/31/2021	ND (2)	---	---	---	---	ND (5)	---
09/30/2021	**2.03**	---	---	---	< 2	ND (5)	---
10/31/2021	ND (2)	---	---	---	---	ND (5)	---
11/30/2021	ND (2)	---	---	---	---	ND (5)	---
12/31/2021	ND (2)	---	---	---	2.05	ND (5)	---
01/31/2022	ND (2)	---	---	---	---	ND (5)	---
02/28/2022	ND (2)	---	---	---	---	ND (5)	---
03/31/2022	**3.1**	---	---	---	**2.1**	ND (5)	---
04/30/2022	ND (2)	ND (2)	ND (2)	**7.42**	---	ND (5)	**28.3**
05/31/2022	ND (2)	---	---	---	---	ND (5)	---
06/30/2022	ND (2)	---	---	---	< 2	ND (5)	---
07/31/2022	ND (2)	---	---	---	---	ND (5)	---
08/31/2022	ND (2)	---	---	---	---	ND (5)	---
09/30/2022	ND (2)	---	---	---	< 2	ND (5)	---
10/31/2022	ND (10)	---	---	---	---	ND (25)	---
11/30/2022	ND (2)	---	---	---	---	ND (5)	---

NOTES:
1. Results in micrograms per liter (µg/L), which is approximately equivalent to parts per billion (ppb).
2. ND = not detected above laboratory practical quantitation limits (PQLs) noted in parentheses.
3. Permittee shall analyze for naphthalene using analytical methods for semi-volatile organic compounds and volatile organic compounds.
4. * = results shown are for tert-Butylbenzene because they were inadvertetly reported as tert-Butyl alcohol on DMRs before the new lab was selec
5. --- = data not recorded.
6. Parameters reported in DMR as both daily max and monthly average are reported in this table as monthy average values.

TABLE 4
QUARTERLY REPORTING - EFFLUENT - METALS AND OTHER ANALYTES (2017 to 2022)
IRVING TERMINAL - MA0001929
OUTFALL SERIAL NUMBER 001

Monitoring Date/End Date [6]	2014 Permit Limits	3/22/2017	6/8/2017	9/7/2017	12/11/2017	3/12/2018	9/17/2018	12/5/2018	3/5/2019	4/11/2019
Total Metals (mg/L)										
Cadmium	Report	ND (0.0002)	ND (0.0002)	ND (0.0002)	ND (0.0002)	ND (0.0002)	---	---	---	---
Chromium		**0.004**	**0.001**	**0.007**	ND (0.001)	**0.002**	---	---	---	**0.002**
Copper		**0.0047**	**0.004**	**0.0096**	**0.0027**	**0.0056**	---	---	---	---
Lead		**0.0064**	**0.0021**	**0.034**	**0.0029**	**0.0064**	---	---	---	---
Nickel		**0.0017**	**0.0009**	**0.0027**	**0.0008**	**0.0009**	---	---	---	---
Zinc		**0.032**	**0.01**	**0.13**	**0.015**	**0.011**	---	---	---	---
Other Analytes										
Total Solids (mg/L)	Report	**2300**	**570**	**880**	**1300**	**550**	---	---	---	---
Ammonia, as Nitrogen (mg/L)		**1.3**	**0.7**	**0.7**	ND (0.5)	ND (0.5)	---	---	---	**0.7**
Salinity (g/kg)		ND (2 ppt)	ND (2 ppt)	ND (8.6 ppt)	ND (2 ppt)	ND (2 ppt)	**1**	---	---	---
Total Organic Carbon (mg/L)		**5.5**	**4**	**6.4**	**6.0**	**7.7**	---	---	---	---
Total Residual Chlorine (mg/L)		ND (0.001)	ND (0.04)	ND (0.04)	**0.024**	**0.032**	**0.022**	---	---	---
Fecal Coliform (CFU/100 mL)		ND (10)	ND (10)	**20,000**	**16**	ND (10)	---	---	---	ND (10)
Total Phenol (mg/L)		ND (0.002)	ND (0.002)	ND (0.002)	ND (0.002)	ND (0.002)	---	---	---	ND (0.05)
Ethanol (mg/L)		ND (0.4)	ND (0.4)	ND (0.4)	ND (0.4)	**3,200**	ND (0.4)	**3,900**	ND (0.4)	---
Acute Aquatic Toxicity Test		Pass	Pass	Pass	Pass	Pass	Pass	---	---	---
Biochemical Oxygen Demand (mg/L)		---	---	---	---	---	---	---	---	---
Chemical Oxygen Demand (mg/L)		---	---	---	---	---	---	---	---	---
Total Nitrogen (mg/L)		---	---	---	---	---	---	---	---	---
Total Phosphorus (mg/L)		---	---	---	---	---	---	---	---	---

NOTES:
1. mg/L = milligrams per liter.
2. ND = Not detected above laboratory practical quantitation limits (PQLs) noted in parentheses.
3. g/kg = grams per kilogram.
4. CFU/100 mL = colony-forming unit per 100 milliliters.
5. --- = data not recorded.
6. WET testing parameters sampled in September, annual testing parameters sampled in April

TABLE 4
QUARTERLY REPORTING - EFFLUENT - METALS AND OTHER ANALYTES (2017 to 2022)
IRVING TERMINAL - MA0001929
OUTFALL SERIAL NUMBER 001

Monitoring Date/End Date [6]	2014 Permit Limits	4/17/2019	9/30/2019	12/31/2019	3/31/2020	6/30/2020	9/30/2020	12/31/2020	3/31/2021	6/30/2021
Total Metals (mg/L)										
Cadmium	Report	---	**0.4**	---	---	---	**ND (0 .0002)**	---	---	---
Chromium		---	---	---	---	**0.008**	---	---	---	**0.004**
Copper		---	**2.5**	---	---	---	**8.6**	---	---	---
Lead		---	**2.1**	---	---	---	**2.5**	---	---	---
Nickel		---	**1.4**	---	---	---	**.86**	---	---	---
Zinc		---	**13**	---	---	---	**8.2**	---	---	---
Other Analytes										
Total Solids (mg/L)	Report	---	**1200**	---	---	---	**2500**	---	---	---
Ammonia, as Nitrogen (mg/L)		---	**1.2**	---	---	---	**0.9**	---	---	---
Salinity (g/kg)		---	**1**	---	---	---	**3**	---	---	---
Total Organic Carbon (mg/L)		---	**8**	---	---	---	**10**	---	---	---
Total Residual Chlorine (mg/L)		---	**.037**	---	---	---	**.026**	---	---	---
Fecal Coliform (CFU/100 mL)		---	---	---	---	ND (10)	---	---	---	**10**
Total Phenol (mg/L)		ND (2.2)	---	---	---	ND (2)	---	---	---	ND (0.2)
Ethanol (mg/L)		ND (0.4)	ND (2)	ND (0.4)	ND (0.4)	ND (0.4)	ND (0.4)	ND (0.4)	ND (0.4)	ND (0.4)
Acute Aquatic Toxicity Test		---	Pass	---	---	---	Pass	---	---	---
Biochemical Oxygen Demand (mg/L)		ND (5)	---	---	---	---	---	---	---	---
Chemical Oxygen Demand (mg/L)		ND (25)	---	---	---	---	---	---	---	---
Total Nitrogen (mg/L)		ND (1)	1.2	---	---	---	0.9	---	---	---
Total Phosphorus (mg/L)		**0.09**	---	---	---	---	---	---	---	---

NOTES:

1. mg/L = milligrams per liter.
2. ND = Not detected above laboratory practical quantitation limits (PQLs) noted in parentheses.
3. g/kg = grams per kilogram.
4. CFU/100 mL = colony-forming unit per 100 milliliters.
5. --- = data not recorded.
6. WET testing parameters sampled in September, annual testing parameters sampled in April

TABLE 4
QUARTERLY REPORTING - EFFLUENT - METALS AND OTHER ANALYTES (2017 to 2022)
IRVING TERMINAL - MA0001929
OUTFALL SERIAL NUMBER 001

Monitoring Date/End Date [6]	2014 Permit Limits	9/30/2021	12/31/2021	3/31/2022	6/30/2022	9/30/2022
Total Metals (mg/L)						
Cadmium	Report	**ND (0 .2)**	---	---	---	**ND (0 .5)**
Chromium		---	---	---	**ND (0.005)**	---
Copper		**< 10**	---	---	---	**7.4**
Lead		**5.3**	---	---	---	**3.8**
Nickel		**.7**	---	---	---	**2.7**
Zinc		**15**	---	---	---	**17**
Other Analytes						
Total Solids (mg/L)	Report	**420**	---	---	---	**2800**
Ammonia, as Nitrogen (mg/L)		**0.7**	---	---	---	**1.1**
Salinity (g/kg)		ND (1)	---	---	---	**2**
Total Organic Carbon (mg/L)		**5.5**	---	---	---	**11**
Total Residual Chlorine (mg/L)		**.03**	---	---	---	**.006**
Fecal Coliform (CFU/100 mL)		---	---	---	ND (10)	---
Total Phenol (mg/L)		---	---	---	ND (2)	---
Ethanol (mg/L)		ND (0.4)	ND (0.4)	ND (0.4)	ND (0.4)	ND (0.4)
Acute Aquatic Toxicity Test		Pass	---	---	---	Pass
Biochemical Oxygen Demand (mg/L)		---	---	---	---	---
Chemical Oxygen Demand (mg/L)		---	---	---	---	---
Total Nitrogen (mg/L)		0.7	---	---	---	1.1
Total Phosphorus (mg/L)		---	---	---	---	---

NOTES:

1. mg/L = milligrams per liter.
2. ND = Not detected above laboratory practical quantitation limits (PQLs) noted in parentheses.
3. g/kg = grams per kilogram.
4. CFU/100 mL = colony-forming unit per 100 milliliters.
5. --- = data not recorded.
6. WET testing parameters sampled in September, annual testing parameters sampled in April

APPENDIX E

STORMWATER SAMPLING PLAN

STORMWATER SAMPLING PLAN
IRVING OIL REVERE TERMINAL
40/41 LEE BURBANK HIGHWAY
REVERE, MASSACHUSETTS

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Verdantas Project 16653

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IRVING OIL REVERE TERMINAL
40/41 LEE BURBANK HIGHWAY
REVERE, MASSACHUSETTS

1.0 PURPOSE

The Irving Oil Terminal, Inc. (Irving Oil) Revere Terminal, located at 40/41 Lee Burbank Highway, Revere Massachusetts (the Terminal), discharges treated stormwater and hydrostatic test water from Outfall Serial Number 001 (Outfall 001). As outlined in Part I.A. of the Terminal's National Pollutant Discharge Elimination System (NPDES) stormwater permit (the Permit), stormwater effluent and receiving water samples (samples) must be collected for monitoring purposes. The purpose of this Stormwater Sampling Plan is to provide instructions to Terminal personnel on the sample collection, handling, analysis, and reporting obligations required by the Permit. This sampling plan includes a summary of the following:

- sample collection methods;
- sample handling and Chain-of-Custody (COC) records;
- data review and interpretation; and
- recordkeeping and reporting requirements.

Instructions on hydrostatic test water sampling, when it occurs, are outlined in Part C.3 of the Permit.

2.0 SAMPLE COLLECTION METHODS

2.1 OVERVIEW

Stormwater effluent and receiving water samples collected for monitoring purposes, as outlined in Part I.A. of the Terminal's Permit, shall be representative of the monitored activity (i.e., discharge point from the Facility's oil/water separator (OWS) prior to stormwater discharge from Outfall 001).

Routine stormwater monitoring samples shall be collected on a Bi-Monthly, Monthly, Quarterly, and Annual basis during a qualifying discharge event. The Terminal will also monitor influent and effluent hydrostatic test water when used to evaluate the structural integrity of tanks or piping upon completion of repairs.

Sections 2.2 and 2.3 describe sampling locations and qualifying discharge events. Sections 2.4 through 2.8 provide information regarding effluent and receiving water monitoring frequency requirements. Section 2.9 describes hydrostatic test water monitoring requirements, and Section 2.10 provides analytical detection limit requirements.

An Analyte Summary Table is included as Table 1. The table summarizes information on the number of sample containers, sample volume, sample preservative, holding times, appropriate United Stated Environmental Protection Agency (USEPA) analytical test methods [per 40 C.F.R. Part 136], and detection limits for the individual analytes required for each monitoring event.

When gathering samples, employees must wear the appropriate personal protective equipment to help prevent injury and avoid sample contamination. Refer to Section 3.0 for guidelines on sample collection and handling. Examples of Chain-of-Custody forms and procedures are provided in Attachment A. The Oil/Water Separator Log Sheet that should be maintained to track discharge events is provided in Attachment B.

2.2 SAMPLING LOCATIONS

Effluent monitoring samples shall be collected at the discharge point from the Facility's oil/water separator (OWS) prior to comingling with any stormwater from the property of Lee Burbank highway. Samples are collected from the meter well sampling location after OWS1.

Receiving water samples shall be collected from the Chelsea River immediately outside the zone of influence of Outfall 001 (immediately <u>upstream</u> of the permitted discharge's zone of influence), at a reasonably accessible location.

2.3 QUALIFYING DISCHARGE EVENT

A qualifying event shall be defined as a discharge that occurs during daylight hours on an outgoing tide at least one hour from both the low and high slack tide. To identify a qualifying event, the permittee may use tide charts (link below) to predict the two-four hour intervals of an outgoing tide each day that are one hour from both low and high slack tide. Tide charts can be found on the National Oceanic and Atmospheric Administration tide prediction chart, which can be accessed at http://tidesandcurrents.noaa.gov/tide_predictions.html.

All samples shall be grab samples taken within 15 minutes after the initiation of a discharge during a qualifying event from Outfall 001 where practicable, but in no case later than within the first hour after initiation of a discharge.

If a measurable discharge does not occur such that sampling cannot be completed during the first qualifying event of the required sampling frequency, the permittee is to sample the next qualifying event.

2.4 BI-MONTHLY EFFLUENT MONITORING REQUIREMENTS

Bi-Monthly (twice per month; minimum) effluent monitoring for total suspended solids (TSS) and turbidity consists of collecting samples during two qualifying discharge events in a calendar month.

One discrete effluent sample will be collected during each calendar month to be submitted for TSS and turbidity analyses only. A second TSS and turbidity Bi-Monthly sampling event will be completed concurrent with a regular Monthly, Quarterly, or Annual effluent sampling event outlined in Section 2.5, and Section 2.6.

2.5 MONTHLY EFFLUENT MONITORING REQUIREMENTS

Monthly (once per month; minimum) effluent sampling consists of collecting an effluent grab sample during one qualifying event in the calendar month. The sample should be divided into the sample containers which are listed in the Analyte Summary Table (Table 1) for Monthly Effluent Monitoring. The sample taken for fecal coliform and enterococcus should be submitted to Nashoba Analytical, LLC of Ayer, Massachusetts, or laboratory able to perform bacterial testing in accordance to required test methods. The sample taken for total chlorine should be analyzed onsite by Verdantas personnel using a colorimeter. The colorimeter should be rented monthly from PALMS Environmental of Wilmington, Massachusetts. All other samples should be submitted to Absolute Resource Associates of Portsmouth, New Hampshire (Absolute Resource Associates) for analysis.

If the month is designated a “quarterly” event month (i.e., February, April, August, or November), the Quarterly effluent monitoring event outlined in Section 2.6 will satisfy both the Monthly and Quarterly sampling requirements.

If a “qualifying event” does not occur during the month, it should be documented. Bi-Monthly, Monthly, and Quarterly sampling events should continue as scheduled in the following month.

2.6 QUARTERLY EFFLUENT MONITORING REQUIREMENTS

Quarterly (once per quarter; minimum) effluent sampling consists of collecting an effluent grab sample during one qualifying event in a designated “quarterly” calendar month (i.e., February, April, August, or November). The sample should be divided into the sample containers which are listed in the Analyte Summary Table (Table 1) for Quarterly Effluent Monitoring. The sample taken for toxicity testing (i.e., LC50) should be submitted to New England Bioassay of Manchester, Connecticut for laboratory analysis. The sample for total residual chlorine should be tested onside by Verdantas personnel. The sample taken for fecal coliform and enterococcus should be submitted to Nashoba Analytical, LLC of Ayer, Massachusetts, or laboratory able to perform bacterial testing in accordance to required test methods. The sample taken for total chlorine should be analyzed onsite by Verdantas personnel using a colorimeter. The colorimeter should be rented monthly from PALMS Environmental of Wilmington, Massachusetts. All other samples should be submitted to Absolute Resource Associates for laboratory analysis.

2.7 QUARTERLY RECEIVING WATER MONITORING REQUIREMENTS

Quarterly (once per quarter; minimum) receiving water sampling must be conducted <u>concurrent</u> with any Quarterly effluent monitoring event which is outlined in Section 2.6 (i.e., February, April, August, or November).

When the Quarterly receiving water sample is collected, the sample should be divided into the sample containers which are listed in the Analyte Summary Table (Table 1) for Quarterly Receiving Water Monitoring. The sample taken for toxicity testing (i.e., Dilution Water for Effluent LC50 analysis and total residual chlorine) should be submitted to New England Bioassay of Manchester, Connecticut for laboratory analysis. All other samples, including those taken for chemical analysis for toxicity testing, should be submitted to Absolute Resource Associates for laboratory analysis.

2.8 ANNUAL EFFLUENT WATER MONITORING REQUIREMENTS

Annual (once per calendar year), effluent sampling costs of collecting an effluent grab sample during one qualifying event in a designated “annual” calendar month (i.e., April). The sample should be divided into the sample containers which are listed in the Analyte Summary Table for Annual Effluent monitoring. The sample taken for toxicity testing (i.e., LC50 and total residual chlorine) should be submitted to New England Bioassay of Manchester, Connecticut for laboratory analysis. The sample taken for fecal coliform and enterococcus should be submitted to Nashoba Analytical, LLC of Ayer, Massachusetts, or laboratory able to perform bacterial testing in accordance to required test methods. The sample taken for total chlorine should be analyzed onsite by Verdantas personnel using a colorimeter. The colorimeter should be rented monthly from PALMS Environmental of Wilmington, Massachusetts. All other samples, including those taken for chemical analysis for toxicity testing, should be submitted to Absolute Resource Associates for laboratory analysis.

2.9 ANNUAL RECEIVING WATER MONITORING REQUIREMENTS

Annual (once per calendar year), effluent sampling costs of collecting an effluent grab sample during one qualifying event in a designated “annual” calendar month (i.e., April). The sample should be divided into the sample containers which are listed in the Analyte Summary Table for Annual Effluent monitoring. The sample taken for toxicity testing (i.e., LC50 and total residual chlorine) should be submitted to New England Bioassay of Manchester, Connecticut for laboratory analysis. The sample taken for fecal coliform and enterococcus should be submitted to Nashoba Analytical, LLC of Ayer, Massachusetts, or laboratory able to perform bacterial testing in accordance to required test methods. All other samples, including those taken for chemical analysis for toxicity testing, should be submitted to Absolute Resource Associates for laboratory analysis.

2.10 SUMMARY OF MONITORING FREQUENCY REQUIREMENTS

Annual routine effluent and receiving water monitoring event frequencies are summarized below. Hydrostatic test water monitoring is conducted as needed when repairs are made.

MONTH	MONITORING EVENTS
January	Monthly Effluent, Bi-Monthly Effluent
February	Quarterly Effluent, Bi-Monthly Effluent, Quarterly Receiving
March	Monthly Effluent, Bi-Monthly Effluent
April	Annual Effluent, Bi-Monthly Effluent, Annual Receiving
May	Monthly Effluent, Bi-Monthly Effluent
June	Monthly Effluent, Bi-Monthly Effluent
July	Monthly Effluent, Bi-Monthly Effluent
August	Quarterly Effluent, Bi-Monthly Effluent, Quarterly Receiving
September	Monthly Effluent, Bi-Monthly Effluent
October	Monthly Effluent, Bi-Monthly Effluent
November	Quarterly Effluent, Bi-Monthly Effluent, Quarterly Receiving
December	Monthly Effluent, Bi-Monthly Effluent

2.11 HYDROSTATIC TEST WATER MONITORING REQUIREMENTS

On occasions when the Terminal completes tank or piping repairs, hydrostatic testing is required to evaluate the structural integrity of the repaired components. Hydrostatic test water monitoring shall consist of collecting the following grab samples:

1. one grab sample of the influent (fill source) water during the first 10% of the estimated fill segment time (at the intake);
2. one grab sample of the effluent (at the discharge point) during the first 10% of discharge;
3. one grab sample of the effluent at the approximate midpoint of discharge; and
4. one grab sample of the effluent during the last 10% of discharge.

Each of the grab samples described above should be divided into the sample containers which are listed in the Analyte Summary Table (Table 1) for Hydrostatic Test Water Monitoring and submitted to Absolute Resource Associates for laboratory analysis.

2.12 DETECTION LIMIT REQUIREMENTS

The analytical laboratory will be informed of the following analytical detection limit requirements:

- The Minimum Level (ML) for benzene shall be less than or equal to (≤) 2 micrograms per liter (µg/L). The ML shall be the lowest level at which the test equipment produces a recognizable signal and acceptable calibration point for an analyte, representative of the lowest concentration at which an analyte can be measured with a known level of confidence.

- The ML for Polycyclic Aromatic Hydrocarbons (PAHs) shall be ≤ 0.1 µg/L for benzo(a)pyrene. The ML for this compound shall represent the compliance level for that compound using a USEPA approved method. The USEPA indicated that the minimum detection limit was set at 0.1 µg/L because USEPA knows that some methods and analytical laboratories cannot go below 0.1 µg/L. However, USEPA was required to set the Permit limit for benzo(a)pyrene at 0.00013 µg/L. USEPA indicated that if the result is between 0.00013 µg/Land 0.1 µg/L it will not be identified as an exceedance.

- The ML for PAHs shall be ≤ 5 µg/L for naphthalene and shall be analyzed using methods for semi-volatile organic compounds (SVOCs) <u>and</u> volatile organic compounds (VOCs).

- For ethanol, analysis must be completed using a Practical Quantitation Limit (PQL) for analysis of ≤ 400 µg/L.

- The ML for Group I PAHs [benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenzo(a,h)anthracene, and indeno(1,2,3-cd)pyrene] shall be ≤ 0.1 µg/L.

- The ML for Group II PAHs [acenaphthene, acenaphthylene, anthracene, benzo(g,h,i)perylene, fluoranthene, fluorene, phenanthrene, and pyrene] shall be ≤ 5 µg/L.

- The ML for ethylbenzene, toluene, and total xylenes shall be ≤ 2 µg/L.

- The ML for tert-butyl alcohol shall be ≤ 20 µg/L.

- The ML for total recoverable cadmium, total recoverable lead, and total recoverable nickel shall be ≤ 0.2 µg/L.

- The ML for total copper shall be ≤ 5.8 µg/L.

- The ML for total recoverable zinc shall be ≤ 95.1 μg/L.
- The ML for total residual chlorine (TRC) shall be ≤ 13 μg/L.
- The ML for salinity shall be ≤ 0.000000002 g/kg.
- The ML for total organic carbon shall be ≤ 1 mg/L.
- The ML for total suspended solids (TSS) shall be ≤ 5 mg/L.
- The ML for total solids shall be ≤ 1 mg/L.
- The ML for total ammonia (as N) shall be ≤ 1.8 mg/L.

2.13 PFAS MONITORING REQUIREMENTS

Polyfluoroalkyl substances (PFAS) monitoring shall take effect during the first quarter following six months after receiving written notification of availability of the multi-laboratory validation of analytical test Method 1633. After three years of monitoring or a minimum of 12 samples are non-detect for all six PFAS compounds, the Terminal may request to MassDEP to remove the requirements for PFAS monitoring. Sample collections requirements shall be conducted based upon United States Environmental Protection Agency's Perfluoroalkyl and Polyfluoroalkyl Substances (PFAS), methods and guidance for sampling and analyzing water and other environmental media requirements. The samples taken for PFAS testing should be submitted to Absolute Resource Associates of Portsmouth, New Hampshire for laboratory analysis.

3.0 SAMPLE COLLECTION AND HANDLING

3.1 COORDINATION WITH ANALYTICAL LABORATORIES

Each month, prior to sample collection, personnel from the Terminal's contracted consultant (Verdantas) will coordinate with the contracted analytical laboratory (Absolute Resource Associates) to deliver the required sample containers. Verdantas personnel will collect the Monthly samples and coordinate with the laboratory for sample pick-up. Bacterial sampling bottles will be collected by Verdantas personnel for monthly samples.

If the month is designated a "Quarterly" month, Verdantas personnel will coordinate with the contracted analytical laboratories (Absolute Resource Associates and New England Bioassay (for toxicity testing)) to deliver the required sample containers. Verdantas personnel will collect the Quarterly samples, both effluent and receiving water, and coordinate with the laboratories for sample pick-up.

Additionally, during a separate qualifying event each month, Terminal personnel will collect a discrete sample for Total Suspended Solids and Turbidity analyses for the Bi-Monthly Effluent Monitoring event. Terminal personnel will coordinate directly with the laboratory (Absolute Resource Associates) for delivery of sample containers and sample pick-up for these events.

Coordination with the laboratories prior to the qualifying event is necessary to meet the sample hold times discussed in Section 3.4. For example, fecal coliform must be submitted to the laboratory for analysis within eight (8) hours.

3.2 SAMPLE HANDLING

When gathering samples, employees must wear the appropriate personal protective equipment which includes chemical resistant gloves, steel-toe boots, reflective vest, life vest, and safety glasses. One pair of new clean gloves shall be worn when adding stormwater samples into containers for analysis. Gloves shall be changed if gloved hands come into contact with non-sample equipment or debris, so as to avoid contamination of the samples. Additional PFAS procedures will be developed as needed on approval of USEPA test method 1633.

Each sampling event consists of collecting a grab sample and dividing the sample into the sample containers listed in the Analyte Summary Table (Table 1) for that specific monitoring event (e.g., Bi-Monthly Effluent Monitoring, Monthly Effluent Monitoring, Quarterly Effluent Monitoring, Quarterly Receiving Water Monitoring, or Hydrostatic Test Water Monitoring). VOA bottles, required for test method 624 have specific filling instructions detailed below. Other containers do not require removal of air bubbles in sample bottles.

The pH of the grab sample should also be monitored using the Terminal's pH meter. Record the pH readings on the Chain-of-Custody form so that it may be reported with the monthly/quarterly laboratory analytical results. Instructions on how to calibrate and use the pH meter can be found in Attachment C – pH Meter Calibration, Testing, and Manual.

VOA VIAL (40 mL) CONTAINER SPECIFIC FILLING INSTRUCTIONS:

- The VOA sample vials should be held upright and filled to the top keeping the water meniscus above the top of the vial.
- Note that the Teflon septa cap should be carefully screwed onto the vial. Sample vials should then be inverted, tapped lightly, and checked for the presence of air bubbles.
- If air bubbles are present, the sample vial should be opened and an additional minimum volume of water should be slowly added to the vial and checked for air bubbles as described previously.
- This process should be repeated until the vial is free of air bubbles.
- Care should be used to prevent loss of sample, and preservatives, if any are used, by avoiding spilling any sample.

After each required sample container has been filled, employees shall appropriately label and store each sample in preparation for laboratory sample pick-up. Sample labeling and preservation requirements are outlined below.

3.3 SAMPLE LABELING

Each sample container will be accompanied with an adhesive label to be affixed to each sample. Each label shall contain all of the information listed in the table below. Sample labels shall be filled out in permanent ink, which will prevent sample identification from coming off the label during the collection and/or storage processes. Use care when filling out labels; permanent ink can create cross-contamination if it comes into direct contact with the sample.

SAMPLE CONTAINER LABELING: Example Identification
Client: ____________________(i.e., Name Location/Address)
Sampler:____________________(i.e., Name or Initials of Sampler)
Project ID: ____________________(i.e., Name Location/Address)
Sample ID: ____________________(i.e., Effluent or Receiving)
Collection Date: ____________________(i.e., 08/15/2014)
Time: ____________________(i.e., 12:56 PM)
Tests:____________________(i.e., BOD, TSS, pH, VOCs, PAHs)

3.4 SAMPLE PRESERVATION AND HOLD TIMES

After sample collection, it is important to store the filled sample containers in a refrigerator or in cooler with ice for transport. Other than chilling samples, other methods of sample preservation are generally intended to retard biological action and chemical reactions after sample collection. Preservation methods include pH adjustment, chemical addition, and protection from light.

Samples intended for certain analysis may require specific preservation techniques and may have strict holding times. The "holding time" refers to the period that begins when the sample is collected in the field and ends with its extraction or analysis at the laboratory. Consult with the analytical laboratory for guidance on sample- and analyte-specific preservation requirements and applicable holding times. Some holding times are short and require careful planning to make sure the laboratory receives and begins testing the sample on time.

Details on specific preservatives and holding times for each sample to be analyzed can be found in the Analyte Summary Table (Table 1).

4.0 RECORDKEEPING/ REPORTING PROCEDURES

4.1 INTRODUCTION

As outlined in the Terminal's Permit, the records of all monitoring information, including all calibration and maintenance records, should be kept for a period of at least three (3) years from the date of the sample, measurement, report, or application. Sampling monitoring data records required by the permit include:

- the date, exact place, and time of the sampling or measurement;
- the name of the individual who performed the sampling or measurement;
- the date(s) any analysis was performed;
- the name of the individual(s) who performed the analysis
- the analytical techniques or methods used; and
- the results of the measurement or analysis.

4.2 DISCHARGE MONITORING REPORT SUBMITTAL

The Terminal shall submit discharge monitoring report (DMR) data and other reports to the USEPA electronically using NetDMR, a web-based tool that allows permittees to electronically submit DMRs and other required reports via a secure internet connection. Analytical monitoring results for Outfall 001 and the receiving water must be submitted electronically **no later than the 15th day of the month following the completed reporting period**.

All reports required under the permit shall be submitted to USEPA as an electronic attachment to the DMR.

4.3 HYDROSTATIC TEST SUMMARY LETTERS AND OTHER SUBMITTALS

Within 90 days of completion of the test, the Terminal shall submit Hydrostatic Test Summary Letters/Reports to the USEPA electronically using NetDMR and send hard copies to USEPA and Massachusetts Department of Environmental Protection (MassDEP) as outlined below, until further notice from the MassDEP. A duplicate signed hard copy of each hydrostatic test summary letter/report required in Part I.A.15.e., shall be submitted to the USEPA at the following address:

U.S. Environmental Protection Agency
Water Division
NPDES Applications Coordinator
5 Post Office Square - Suite 100 (06-03)
Boston, MA 02109-3912

Hydrostatic test summary letters/reports and other reports or notifications (non-DRM related reports), with the exception of Toxicity Test Results, shall be submitted to the MassDEP at the following address:

Massachusetts Department of Environmental Protection
Bureau of Waste Prevention
Northeast Regional Office
205B Lowell Street
Wilmington, Massachusetts 01887

4.4 TOXICTY TESTING REPORT SUBMITTALS

A hard copy of the Toxicity Test Reports must be signed by Terminal personnel and mailed to the MassDEP at the following address:

Massachusetts Department of Environmental Protection
Bureau of Water Resources
Division of Watershed Management
8 New Bond Street
Worcester, Massachusetts 01606

The Terminal's contracted consultant (Verdantas) will coordinate with Terminal personnel to ensure that a duplicate signed copy of Toxicity Testing Reports are reported to the Massachusetts Department of Environmental Protection.

4.5 PUBLIC POSTING OF DMRS

The Terminal shall, if practicable, post a copy of the DMR data in portable document format to the Terminal's publicly-accessible website in conjunction with the submission of DMRs via NetDMR. The location of these documents (i.e., a valid, direct hyperlink) must be consistent with the location of the Terminal's publicly-accessible SWPPP, specified in Part I.D of the Permit.

4.6 ON-SITE RECORDS

Historical discharge sampling data must be kept in a separate file by the Terminal Manager. This data must be made available for review upon request.

If any additional sampling is conducted in accordance with the USEPA approved methods and consistent with the provisions of 40 CFR 122.41(1)(4)(ii), the results must be submitted to both the USEPA and the MassDEP.

TABLES

ANALYTE SUMMARY TABLE
STORMWATER SAMPLING
REVERE TERMINAL

BI-MONTHLY EFFLUENT MONITORING (STORED WATER RELEASED BY TERMINAL)								
One TSS and Turbidity sample will be collected each month. The second Bi-Monthly TSS and tubridity sample will be collected during the Monthly, Quarterly, or Annual Effluent Monitoring event for that month.								
Sampling Parameter		Number of Containers per Sample	Container Size	Container Type	Preservative	Minimum Detection Limit	USEPA Test Method	Holding Time
Other	Total Suspended Solids	1	500mL	Plastic	None	Report mg/L	2540D	7 Days
Other	Turbidity	1	125mL	Plastic	None	Report NTU	180.1	48 Hours

ANALYTE SUMMARY TABLE
STORMWATER SAMPLING
REVERE TERMINAL

MONTHLY EFFLUENT MONITORING (STORED WATER RELEASED BY TERMINAL)								
The following samples will be collected for each month in which a Quarterly or Annual Effluent Monitoring event does not occur. For the remaining months, the Quarterly or Annual Effluent Monitoring events will provide results for these analytes.								
Sampling Parameter		Number of Containers per Sample	Container Size	Container Type	Preservative	Minimum Detection Limit	USEPA Test Method	Holding Time
VOCs	Benzene	2	40mL	Glass VOA	HCl	2 µg/L	624	14 Days
SVOCs	Benzo(a)pyrene	1	1L	Amber Glass	None	0.05 µg/L	625.1	7 Days
	Benzo(a)anthracene					0.05 µg/L		
	Benzo(b)fluoranthene					0.05 µg/L		
	Benzo(k)fluoranthene					0.05 µg/L		
	Chrysene					0.05 µg/L		
	Dibenzo(a,h)anthracene					0.1 µg/L		
	Indeno(1,2,3-cd)pyrene					0.1 µg/L		
	Naphthalene					5 µg/L		
Other	Chemical Oxygen Demand	1	60mL	Plastic	H2SO4 (pH<2)	Report mg/L	410.4	28 Days
	Enterococcus	1	100mL	Coliform Cup	Na2S2O3	Report CFU	1609.1	6 hours
	Fecal Coliform	1	100mL	Coliform Cup	Na2S2O3	Report MPN	SM9222D	8 Hours
	Oil and Grease	1	1L	Amber Glass	HCl	15 mg/L*	1664B	28 Days
	pH	---	---	---	None	Report S.U.	TEST ON-SITE	Immediate
	Total Ammonia (as N) **(April 1 through Octover 31)**	1	250mL	Plastic	H2SO4	1.8 mg/L	350.1	28 Days
	Total Residual Chlorine	1	2.5L	Plastic	None	13 µg/L	SM 4500-Cl G	15 Minutes
	Total Suspended Solids	1	500mL	Plastic	None	5 mg/L*	2540D	7 Days
	Turbidity	1	125mL	Plastic	None	Report NTU	180.1	48 Hours
Total Metals	Total Copper	1	250mL	Plastic	HNO3	5.8 µg/L	ICP/MS 200.8	180 Days
	Total Zinc					95.1 µg/L		

ANALYTE SUMMARY TABLE
STORMWATER SAMPLING
REVERE TERMINAL

QUARTERLY EFFLUENT MONITORING
(STORED WATER RELEASED BY TERMINAL)

(Will also qualify as a Monthly Effluent Monitoring event.)

Sampling Parameter		Number of Containers per Sample	Container Size	Container Type	Preservative	Minimum Detection Limit	USEPA Test Method	Holding Time
VOCs	Benzene	2	40mL	Glass VOA	HCl	2 µg/L	624	14 Days
	Methyl tert-butyl ether (MTBE)					20 µg/L*		
SVOCs	Benzo(a)pyrene	1	1L	Amber Glass	None	0.05 µg/L	625.1	7 Days
	Benzo(a)anthracene					0.05 µg/L		
	Benzo(b)fluoranthene					0.05 µg/L		
	Benzo(k)fluoranthene					0.05 µg/L		
	Chrysene					0.05 µg/L		
	Dibenzo(a,h)anthracene					0.1 µg/L		
	Indeno(1,2,3-cd)pyrene					0.1 µg/L		
	Naphthalene					5 µg/L		
Other	Chemical Oxygen Demand	1	60mL	Plastic	H2SO4 (pH<2)	Report mg/L	410.4	28 Days
	Enterococcus	1	100mL	Coliform Cup	Na2S2O3	Report CFU	1609.1	6 hours
	Fecal Coliform	1	100mL	Coliform Cup	Na2S2O3	Report MPN	SM9222D	8 Hours
	Oil and Grease	1	1L	Amber Glass	HCl	15 mg/L*	1664B	28 Days
	pH	---	---	---	None	Report S.U.	TEST ON-SITE	Immediate
	Total Ammonia (as N) **(April 1 through Octover 31)**	1	250mL	Plastic	H2SO4	1.8 mg/L	350.1	28 Days
	Total Residual Chlorine	1	2.5L	Plastic	None	13 µg/L	SM 4500-Cl G	15 Minutes
	Total Suspended Solids	1	500mL	Plastic	None	5 mg/L*	2540D	7 Days
	Turbidity	1	125mL	Plastic	None	Report NTU	180.1	48 Hours
Total Metals	Total Copper	1	250mL	Plastic	HNO3	5.8 µg/L	ICP/MS 200.8	180 Days
	Total Zinc					95.1 µg/L		
Toxicity Testing	LC50 (Menidia beryllina, Americamysis bahia)	1	2.5L	Plastic	None	---	2006.0/2007.0	36 Hours
	Total Residual Chlorine	---	---	---	None	13 µg/L	SM 4500-Cl G	15 Minutes
Chemical Analysis for Toxicity Testing	Ammonia Nitrogen(**see Other**)	1	250mL	Plastic	H2SO4	Report mg/L	350.1	28 Days
	Salinity	1	500mL	Plastic	None	Report g/kg	SM2520B	14 Days
	Total Organic Carbon	2	40mL	Amber Glass	H2SO4	Report mg/L	SM5310C	28 Days
	Total Solids	1	250mL	Plastic	None	Report mg/L	SM2540B, G	7 Days
	Total Cadmium	1	250mL	Plastic	HNO3	Report µg/L	ICP/MS 200.8	180 days
	Total Copper					Report µg/L		
	Total Lead					Report µg/L		
	Total Nickel					Report µg/L		
	Total Zinc					Report µg/L		
PFAS	Perfluorohexanesulfonic acid (PFHxS)[14]					Report ng/L	1633	
	Perfluoroheptanoic acid (PFHpA)[14]					Report ng/L		
	Perfluorononanoic acid (PFNA)[14]					Report ng/L		
	Perfluorooctanesulfonic acid (PFOS)[14]					Report ng/L		
	Perfluorooctanoic acid (PFOA)[14]					Report ng/L		
	Perfluorodecanoic (PFDA)[14]					Report ng/L		

ANALYTE SUMMARY TABLE
STORMWATER SAMPLING
REVERE TERMINAL

ANNUAL EFFLUENT MONITORING
(STORED WATER RELEASED BY TERMINAL)

Sampling Parameter		Number of Containers per Sample	Container Size	Container Type	Preservative	Minimum Detection Limit	USEPA Test Method	Holding Time
VOCs	Benzene	2	40mL	Glass VOA	HCl	2 µg/L	624	14 Days
	Ethybenzene					2 µg/L		
	Methyl tert-butyl ether (MTBE)					20 µg/L*		
	Tert-butyl alcohol					10 µg/L		
	Toluene					2 µg/L		
SVOCs	Acenaphthene	1	1L	Amber Glass	None	5 µg/L	625.1	7 Days
	Acenaphthylene					5 µg/L		
	Anthracene					5 µg/L		
	Benzo(a)pyrene					0.05 µg/L		
	Benzo(a)anthracene					0.05 µg/L		
	Benzo(b)fluoranthene					0.05 µg/L		
	Benzo(g, h, i)perylene					5 µg/L		
	Benzo(k)fluoranthene					0.05 µg/L		
	Chrysene					0.05 µg/L		
	Dibenzo(a,h)anthracene					0.1 µg/L		
	Fluoranthene					5 µg/L		
	Fluorene					5 µg/L		
	Indeno(1,2,3-cd)pyrene					0.1 µg/L		
	Naphthalene					5 µg/L		
	Phenanthrene					5 µg/L		
	Pyrene					5 µg/L		
Other	Total Suspended Solids	1	500mL	Plastic	None	5 mg/L*	2540D	7 Days
	Total Residual Chlorine	1	2.5L	Plastic	None	13 µg/L	SM 4500-Cl G	15 Minutes
	Chemical Oxygen Demand	1	60mL	Plastic	H2SO4 (pH<2)	Report mg/L	410.4	28 Days
	Fecal Coliform	1	100mL	Coliform Cup	Na2S2O3	Report MPN	SM9222D	8 Hours
	Enterococcus	1	100mL	Coliform Cup	Na2S2O3	Report CFU	1609.1	6 hours
	Oil and Grease	1	1L	Amber Glass	HCl	15 mg/L*	1664B	28 Days
	pH	---	---	---	None	Report S.U.	TEST ON-SITE	Immediate
	Total Ammonia (as N) **(April 1 through Octover 31)**	1	250mL	Plastic	H2SO4	1.8 mg/L	350.1	28 Days
	Ethanol	2	40mL	Glass VOA	HCl	.4 mg/L	1666/1671	14 days
	Turbidity	1	125mL	Plastic	None	Report NTU	180.1	48 Hours
Total Metals	Total Copper	1	250mL	Plastic	HNO3	5.8 µg/L	ICP/MS 200.8	180 Days
	Total Zinc					95.1 µg/L		
Toxicity Testing	LC50 (Menidia beryllina, Americamysis bahia)	1	2.5L	Plastic	None	---	2006.0/2007.0	36 Hours
	Total Residual Chlorine	---	---	---	None	13 µg/L	SM 4500-Cl G	15 Minutes
Chemical Analysis for Toxicity Testing	Ammonia Nitrogen(**see Other**)	1	250mL	Plastic	H2SO4	Report mg/L	350.1	28 Days
	Salinity	1	500mL	Plastic	None	Report g/kg	SM2520B	14 Days
	Total Organic Carbon	2	40mL	Amber Glass	H2SO4	Report mg/L	SM5310C	28 Days
	Total Solids	1	250mL	Plastic	None	Report mg/L	SM2540B, G	7 Days
	Total Cadmium	1	250mL	Plastic	HNO3	Report µg/L	ICP/MS 200.8	180 days
	Total Copper					Report µg/L		
	Total Lead					Report µg/L		
	Total Nickel					Report µg/L		
	Total Zinc					Report µg/L		
PFAS	Perfluorohexanesulfonic acid (PFHxS)[14]					Report ng/L	1633	
	Perfluoroheptanoic acid (PFHpA)[14]					Report ng/L		
	Perfluorononanoic acid (PFNA)[14]					Report ng/L		
	Perfluorooctanesulfonic acid (PFOS)[14]					Report ng/L		
	Perfluorooctanoic acid (PFOA)[14]					Report ng/L		
	Perfluorodecanoic (PFDA)[14]					Report ng/L		

ANALYTE SUMMARY TABLE
STORMWATER SAMPLING
REVERE TERMINAL

QUARTERLY RECEIVING WATER MONITORING									
Sampling Parameter		Number of Containers per Sample	Container Size	Container Type	Preservative	Minimum Detection Limit	USEPA Test Method	Holding Time
Toxicity Testing	LC50 (Dilution Water for Effluent Testing)	1	2.5L	Plastic	None	---	---	---
	Total Residual Chlorine					13 µg/L	SM 4500-Cl G	15 Minutes
Chemical Analysis for Toxicity Testing	Ammonia Nitrogen	1	250mL	Plastic	H_2SO_4	1.8 mg/L	350.1	28 Days
	pH	---	---	---	---	TEST ON-SITE	TEST ON-SITE	Immediate
	Salinity	1	500mL	Plastic	None	0.000000002 g/kg *	SM2520B	14 Days
	Total Cadmium	1	250mL	Plastic	HNO_3	0.2 µg/L	ICP/MS 200.8	180 days
	Total Copper					0.5 µg/L		
	Total Lead					0.2 µg/L		
	Total Nickel					0.2 µg/L		
	Total Zinc					5 µg/L		
Other	Temperature[18]	---	---	---	---	TEST ON-SITE	TEST ON-SITE	Immediate

ANALYTE SUMMARY TABLE
STORMWATER SAMPLING
REVERE TERMINAL

ANNUAL RECEIVING WATER MONITORING								
Sampling Parameter		Number of Containers per Sample	Container Size	Container Type	Preservative	Minimum Detection Limit	USEPA Test Method	Holding Time
VOCs	Benzene	2	40mL	Glass VOA	HCl	2 µg/L	624	14 Days
	Toluene					2 µg/L		
	Ethybenzene					2 µg/L		
	Total Xylenes					2 µg/L		
SVOCs	Benzo(a)anthracene	1	1L	Amber Glass	None	0.05 µg/L	625.1	7 Days
	Benzo(a)pyrene					0.05 µg/L		
	Benzo(b)fluoranthene					0.05 µg/L		
	Benzo(k)fluoranthene					0.05 µg/L		
	Chrysene					0.05 µg/L		
	Dibenzo(a,h)anthracene					0.1 µg/L		
	Indeno(1,2,3-cd)pyrene					0.1 µg/L		
	Acenaphthene					5 µg/L		
	Acenaphthylene					5 µg/L		
	Anthracene					5 µg/L		
	Benzo(g, h, i)perylene					5 µg/L		
	Fluoranthene					5 µg/L		
	Fluorene					5 µg/L		
	Napthalene					5 µg/L		
	Phenanthrene					5 µg/L		
	Pyrene					5 µg/L		

HYDROSTATIC TESTING
ANALYTE SUMMARY TABLE
REVERE TERMINAL

HYDROSTATIC TESTING							
Sampling Parameter		Number of Containers per Sample	Container Size	Container Type	Preservative	USEPA Test Method	Holding Time
	Total Flow	---	---	---	None	MONITOR ON-SITE	---
	Flow Rate						
Other	Total Suspended Solids	1	500mL	Plastic	None	2540D	7 Days
	Oil and Grease	1	1L	Amber Glass	HCl	1664B	28 Days
	pH	---	---	---	None	TEST ON-SITE	Immediate
	Chemical Oxygen Demand	1	60mL	Plastic	H_2SO_4 (pH<2)	410.4	28 Days
	Dissolved Oxygen	1	500mL	Plastic	None	SM4500	48 Hours
	Total Residual Chlorine	1	2.5L	Plastic	None	SM 4500-Cl G	15 Minutes
	Total Surfactants	1	250mL	Amber Glass	None	SM5540C	48 Hours
	Ethanol	2	40mL	Glass VOA	HCl	1666/1671	14 days
VOCs	Benzene	2	40mL	Glass VOA	HCl	624	14 Days
	Toluene						
	Ethybenzene						
	Total Xylenes						
Metals	Total Recoverable Iron	1	250mL	Plastic	HNO_3	ICP/MS 200.8	180 days
	Total Cadmium						
	Total Copper						
	Total Lead						
	Total Nickel						
	Total Zinc						
PAHs	Benzo(a)anthracene	1	1L	Amber Glass	None	625.1	7 Days
	Benzo(a)pyrene						
	Benzo(b)fluoranthene						
	Benzo(k)fluoranthene						
	Chrysene						
	Dibenzo(a,h)anthracene						
	Indeno(1,2,3-cd)pyrene						
	Acenaphthene						
	Acenaphthylene						
	Anthracene						
	Benzo(g, h, i)perylene						
	Fluoranthene						
	Fluorene						
	Napthalene						
	Phenanthrene						
	Pyrene						

ANALYTE MONITORING SCHEDULE
STORMWATER SAMPLING
REVERE TERMINAL

TABLE 2 - UPDATED MONITORING SCHEDULE - 2023				E=Sample Effluent EE= Sample Effluent twice per month R= Sample Receiving											
Category	**Parameter**	**EFFLUENT Sampling Frequency**	**RECEIVING Water Sampling Frequency**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
VOCs (624 analysis)	Benzene	Monthly	Annual (April)	E	E	E	ER	E	E	E	E	E	E	E	E
	Methyl tert-butyl ether (MTBE)	Quarterly	None		E		E				E			E	
	Tert-Butyl Alcohol (TBA)	Annual (April)	None				E								
	Toluene	Annual (April)	Annual (April)				ER								
	Ethybenzene	Annual (April)	Annual (April)				ER								
	Total Xylenes	Annual (April)	Annual (April)				ER								
SVOCs (625.1 analysis)	Benzo(a)pyrene	Monthly	Annual (April)	E	E	E	ER	E	E	E	E	E	E	E	E
	Benzo(a)anthracene	Monthly	Annual (April)	E	E	E	ER	E	E	E	E	E	E	E	E
	Benzo(b)fluoranthene	Monthly	Annual (April)	E	E	E	ER	E	E	E	E	E	E	E	E
	Benzo(k)fluoranthene	Monthly	Annual (April)	E	E	E	ER	E	E	E	E	E	E	E	E
	Chrysene	Monthly	Annual (April)	E	E	E	ER	E	E	E	E	E	E	E	E
	Dibenzo(a,h)anthracene	Monthly	Annual (April)	E	E	E	ER	E	E	E	E	E	E	E	E
	Indeno(1,2,3-cd)pyrene	Monthly	Annual (April)	E	E	E	ER	E	E	E	E	E	E	E	E
	Acenaphthene	Annual (April)	Annual (April)				ER								
	Acenaphthylene	Annual (April)	Annual (April)				ER								
	Anthracene	Annual (April)	Annual (April)				ER								
	Benzo(g, h, i)perylene	Annual (April)	Annual (April)				ER								
	Fluoranthene	Annual (April)	Annual (April)				ER								
	Fluorene	Annual (April)	Annual (April)				ER								
	Naphthalene	Monthly	Annual (April)	E	E	E	ER	E	E	E	E	E	E	E	E
	Phenanthrene	Annual (April)	Annual (April)				ER								
	Pyrene	Annual (April)	Annual (April)				ER								
Other	Ethanol	Annual (April)	None				E								
	Fecal Coliform	Monthly	None	E	E	E	E	E	E	E	E	E	E	E	E
	Enterococcus	Monthly	None	E	E	E	E	E	E	E	E	E	E	E	E
	Total Suspended Solids	Bi-monthly	None	EE	EE	EE	EE	EE	EE	EE	EE	EE	EE	EE	EE
	Turbitity	Bi-monthly	None	EE	EE	EE	EE	EE	EE	EE	EE	EE	EE	EE	EE
	Oil and Grease	Monthly	None	E	E	E	E	E	E	E	E	E	E	E	E
	pH	Monthly	Quarterly	E	ER	E	ER	E	E	E	ER	E	E	ER	E
	Chemical Oxygen Demand	Monthly	None	E	E	E	E	E	E	E	E	E	E	E	E
	Copper	Monthly	Quarterly	E	ER	E	ER	E	E	E	ER	E	E	ER	E
	Zinc	Monthly	Quarterly	E	ER	E	ER	E	E	E	ER	E	E	ER	E
	Temperature	None	Quarterly		R		R				R			R	
	Total Residual Chlorine	**Monthly**	None	E	E	E	E	E	E	E	E	E	E	E	E
Whole Effluent Toxicity Testing (Requested elimination of this testing requirement in 5/31/2018 letter to USEPA)	LC50 (Menidia beryllina, Americamysis bahia)	Quarterly	Quarterly		ER		ER				ER			ER	
	Total Residual Chlorine (see **Other**)	**Quarterly**	Quarterly		ER		ER				ER			ER	
	Salinity	Quarterly	Quarterly		ER		ER				ER			ER	
	Total Solids	Quarterly	None		E		E				E			ER	
	Total Suspended Solids	Quarterly	None		ER		ER				ER			ER	
	pH (**see Other**)	**Quarterly**	Quarterly		ER		ER				ER			ER	
	Total Ammonia (as N)	Monthly	None	E	E	E	E	E	E	E	E	E	E	E	E
	Ammonia Nitrogen	Quarterly	Quarterly		ER		ER				ER			ER	
	Total Organic Carbon	Quarterly	None		E		E				E			E	
	Cadmium	Quarterly	Quarterly		ER		ER				ER			ER	
	Copper (see **Other**)	Quarterly	Quarterly		ER		ER				ER			ER	
	Lead	Quarterly	Quarterly		ER		ER				ER			ER	
	Nickel	Quarterly	Quarterly		ER		ER				ER			ER	
	Zinc	Quarterly	Quarterly		ER		ER				ER			ER	
PFAS	Perfluorohexanesulfonic acid (PFHxS)[14]	TBD	TBD												
	Perfluoroheptanoic acid (PFHpA)[14]	TBD	TBD												
	Perfluorononanoic acid (PFNA)[14]	TBD	TBD												
	Perfluorooctanesulfonic acid (PFOS)[14]	TBD	TBD												
	Perfluorooctanoic acid (PFOA)[14]	TBD	TBD												
	Perfluorodecanoic (PFDA)[14]	TBD	TBD												
All Samples submitted to Absolute Resource Associates (ARA) unless indicated otherwise			Chain of Custody Used M=Monthly Q=Quarterly A=Annual (Effluent and Receiving) T=Toxicity (Effluent and Receiving)	**M**	**Q**	**M**	**A**	**M**	**M**	**M**	**Q**	**M**	**M**	**Q**	**M**

ATTACHMENT A

EXAMPLE CHAIN-OF-CUSTODY (COC) FORMS AND PROCEDURES

EXAMPLE CHAIN OF CUSTODY (COC) FORM AND PROCEDURES

1.0 Introduction

The purpose of this Guideline is to establish general procedures for preparing and documenting sample COC and sample labeling, packing, and shipment/transportation to promote sample integrity.

2.0 Chain-of-Custody Procedures

Sample possession and handling ("custody") will be tracked from collection in the field to the final disposition of the sample at the laboratory. The purpose of documenting the possession is to provide some formal verification that the sample containers (in an unfilled or filled state) were not tampered with or subject to conditions that could adversely influence the sample. Prior to receipt by the laboratory, sample custody will be maintained as long as a sample is managed under one of the following circumstances:

- continually in the possession of an authorized person;
- in view of an authorized person after being in his/her direct possession;
- locked or sealed after being in possession of an authorized person; and/or
- in a secure storage room or similar area familiar to the authorized person.

Sample custody is necessary to maintain and document sample possession after sampling and prior to and during shipping. The principal document used to identify samples and document possession is a COC record. Sampling personnel are responsible for initiating the COC record and maintaining custody of samples until they are relinquished to another custodian (shipping service or laboratory personnel). A line item on the field COC record will be immediately filled out by field personnel after sample collection. When all line items are completed, and/or when the samples are prepared for final packaging before shipment, the sampling personnel will sign, date, and write the time on the form. Each individual who handles the samples and subsequently assumes responsibility for the samples will sign the COC form.

Sample containers will be labeled in the field at the time of sample collection by field personnel performing the sampling. It is important for the information on the COC form to match the information on the container labels, with a separate COC line being used for each sample location. Both the sample container label and COC records completed in the field should include the following minimum information to describe and identify a sample and the associated requested analysis to be performed by the laboratory:

- project name;
- project identification number;
- sample designation/identification;
- sample matrix type;
- collector's name/initials;
- date and time of collection;
- preservatives used; and
- requested analyses.

In addition, COC records should identify additional project identification information (generally in the header of the COC), including a brief description, terminal address, and telephone number. Special notes may also be placed in the appropriate sections of COC records to identify specific laboratory report limits or project specific Quality Assurance/Quality Control procedures.

After sample collection and when the COC is complete, possession of the samples is transferred (or "relinquished") from the field sampler(s) by signing the "Relinquished by" section of the COC and indicating the party or location receiving the samples in the "Received by" section. Field samplers can relinquish custody of samples to secure cold storage at Irving Oil, directly to a laboratory or laboratory courier, an authorized individual for temporary storage or transport, or to a shipping service. When sample custody is transferred, each transfer event should be noted on the COC including the party relinquishing the custody and the party receiving the custody of the samples. Placement of samples in secure "cold storage" should be noted on the COC by relinquishing the samples to cold storage. When the samples are removed from cold storage for transport to the laboratory and entry should be placed on the COC indicating that the samples were "received from cold storage." When samples are transported by a shipping service, the "airbill/waybill" or other official shipping documentation shall be retained to supplement the COC record.

Field COC procedures end when the laboratory receives the samples. Laboratory COC procedures will be implemented in accordance with the subcontracted laboratory's operating procedures.

Field personnel should provide the Team Lead with a completed COC as soon as practicable after sample collection. The Team Lead will review the COC for completeness as soon as practicable after receipt of the COC.

A copy of the current COC forms used for stormwater sampling for the Terminal are presented in Attachment A. These forms, or an appropriate alternative provided by a laboratory, shall be used to record sample custody.

3.0 Sample Packaging and Storage

Sample containers are generally stored in insulated containers ("coolers") prior to sampling, immediately following sample collection, and in transit to the laboratory. The samples should be packaged, stored, and transported in a manner to minimize container agitation and breakage. The following general procedures shall be followed:

- sample containers should be placed in the cooler in an upright position;
- glass containers should be protected with cardboard or bubble-wrap to minimize breakage;
- ice should be added to the cooler;
- the original completed COC should be placed in a sealed polyethylene bag and included inside of the cooler; and
- coolers should be sealed for shipment with packing tape.

Sample coolers containing potentially hazardous samples or preservation materials may need to be accompanied by special shipping paperwork and may have special container labeling requirements. In these instances, the Terminal personnel should consult with the Terminal Manager prior to shipping the samples.

Samples placed into temporary storage at Irving Oil should remain inside a refrigerator to assist in maintaining the preservation temperature of 4 °C.

4.0 Laboratory Sample Pick-Up/Shipment

For Monthly Effluent Monitoring, Quarterly Effluent Monitoring, and Hydrostatic Test Water Monitoring events, Verdantas will be responsible for coordinating with the laboratories for sample pick-up or for delivering the samples directly to the laboratory.

For Bi-Monthly Effluent Monitoring (TSS) events, unless otherwise instructed by the Terminal Manager, designated Terminal personnel will be responsible for coordinating with the laboratory for sample pickup via courier, for shipping the samples to the laboratory, or for delivering the samples directly to the laboratory. Delivery of samples to the laboratory should occur as soon as practicable after sample collection. If delivery of samples to the laboratory is delayed (e.g., because samples were collected on a Friday and receipt of the samples by the laboratory cannot occur until the following Monday), field personnel should notify the laboratory of the delay so appropriate actions can be taken (if needed) for sample preparation and analysis within allowable holding times.

5.0 References

Massachusetts Department of Environmental Protection, Standard References for Monitoring Wells, 1991, DEP Publication #WSC-310-91.

Sanders, Laura L, "A Manual of Field Hydrogeology," 1998. Prentice-Hall.

U.S. Environmental Protection Agency, "Practical Guide for Ground-Water Sampling," September 1985. EPA 600/2-85/104.

ATTACHMENT B

OIL/WATER SEPARATOR LOG SHEET

WATER SEPERATOR OPERATION
Irving Oil Terminals
Revere Marine Terminal

The first disharge of each Month needs to be co-ordinated with sampling and during a "Qualifying Event" Do not turn OWS *on until* sampling can be accomplished / confirmed.

Samples taken	Turned ON			Turned OFF		
Initials	DATE	TIME	INITIALS	DATE	TIME	INITIALS

Monthly Storm Water Discharge Log Book

Instructions:

- Use a new Monthly Stormwater Discharge Log Book page for each calendar month.
- Use the *NOAA Tide Prediction Table* to determine if a proposed discharge will meet the following 'Qualifying Event' criteria:
  - During daylight hours on an outgoing tide at least one hour from both the low and high slack tide (i.e. a 4-hour window occurring twice per day).
  - Note: In the event that a discharge outside of the parameters described above cannot be avoided, document the reason for the discharge in the last column, below. Reasons include, but are not limited to, the following: Safe Access to Tank Farm, Terminal Maintenance/Project Work,
- Initiate the discharge of accumulated storm water through the facility's oil/water separator (OWS) in accordance with *RMT-TOP-343 Stormwater Discharge Procedure*.
  - Note: All samples shall be taken within 15 minutes of the initiation of a discharge, but in no case later than within the first hour of discharge from the outfall.
- Complete all fields in the summary table below. Include the final OWS-1 flowmeter reading at the end of each month – see bottom of page.
- Maintain all Monthly Storm Water Discharge Log Book records for a minimum of 5 years, or the NPDES Permit term, whichever is longer.

Start Date (DD/MM/YYYY)	**Start Time** (HH:MM)	**Initials**	**Samples Collected?**	**Stop Time** (HH:MM)	**Stop Date** (DD/MM/YYYY)	**Initials**	**Qualifying Event?**	**If NO, Document Reason for Discharge**
			YES ☐ NO ☐				YES ☐ NO ☐	
			YES ☐ NO ☐				YES ☐ NO ☐	
			YES ☐ NO ☐				YES ☐ NO ☐	
			YES ☐ NO ☐				YES ☐ NO ☐	
			YES ☐ NO ☐				YES ☐ NO ☐	
			YES ☐ NO ☐				YES ☐ NO ☐	
			YES ☐ NO ☐				YES ☐ NO ☐	
			YES ☐ NO ☐				YES ☐ NO ☐	
			YES ☐ NO ☐				YES ☐ NO ☐	
			YES ☐ NO ☐				YES ☐ NO ☐	
			YES ☐ NO ☐				YES ☐ NO ☐	
			YES ☐ NO ☐				YES ☐ NO ☐	

Final Oil/Water Separator #1 Flowmeter Reading: ______________________________ gallons

ATTACHMENT C

pH METER CALIBRATION, TESTING, AND MANUAL

PH METER CALIBRATION AND TESTING REQUIREMENTS

STEP ONE: Meter Calibration

1. Pour a small volume of the pH 7.01 (HI 7007) solution into a clean, plastic beaker to take a pH measurement sample.

2. Connect the pH meter to the pH probe, and press "On" to activate the probe.

3. Press the "pH" key to display pH values.

4. Remove the protective cap from the probe.

5. Rinse the probe by squirting a small amount of the neutral pH solution onto the end of the probe; holding the probe over the beaker.

6. Immerse the probe into the neutral pH solution and stir gently; waiting 1 to 2 minutes for the reading to stabilize.

7. Take the temperature of the buffer solution by selecting the "°C" key on the meter, and reading the temperature display.

8. Adjust the pH calibration knob until the display screen on the meter shows the appropriate pH value, based on the "pH Values at Various Temperatures" on the located on the opposite side of this page.

STEP TWO: Sample Testing - taking pH measurements

1. Immerse the tip of the pH probe into the HI 70300 storage solution for 2 to 3 minutes to reactivate the probe. If probe is wet, let dry and then soak into solution.

2. Submerge the tip of the probe about 1.5-inch into the sample to be measured.

3. Press the "pH" key to display pH value.

4. Stir probe in the sample briefly, and wait 1 to 2 minutes for the reading to adjust/stabilize.

5. Record and log the pH value shown on the display of the meter.

*** For additional information, meter guidance, and/or instructions on how and when to use other pH calibration solutions, please refer to the manufacturer's (HANNA) Instruction Manual, following this guidance***

pH VALUES AT VARIOUS TEMPERATURES

For temperature compensation during calibration, please refer to the following chart.

TEMP		pH VALUES				
°C	°F	**4.01**	**6.86**	**7.01**	**9.18**	**10.01**
0	32	4.01	6.98	7.13	9.46	10.32
5	41	4.00	6.95	7.10	9.39	10.24
10	50	4.00	6.92	7.07	9.33	10.18
15	59	4.00	6.90	7.04	9.27	10.12
20	68	4.00	6.88	7.03	9.22	10.06
25	77	4.01	6.86	7.01	9.18	10.01
30	86	4.02	6.85	7.00	9.14	9.96
35	95	4.03	6.84	6.99	9.10	9.92
40	104	4.04	6.84	6.98	9.07	9.88
45	113	4.05	6.83	6.98	9.04	9.85
50	122	4.06	6.83	6.98	9.01	9.82
55	131	4.07	6.84	6.98	8.99	9.79
60	140	4.09	6.84	6.98	8.97	9.77
65	149	4.11	6.85	6.99	8.95	9.76
70	158	4.12	6.85	6.99	8.93	9.75

For instance, if the buffer temperature is 25°C, the display should show pH 4.0 or 7.0 or 10.0.

If the buffer temperature is 10°C, the display should show pH 4.0 or 7.0 or 10.1.

ATTACHMENT D

COLORIMETER TESTING AND MANUAL

COLORIMETER SAMPLING

SAMPLE TESTING:

1. Press the power button to turn on the device.

2. Press **Program**, then press **114 Enter** (Chlorine, Total). The display will show mg/L, C12 and the zero icon.

3. Install the cell adapter, if necessary.

5. Prepare the blank by filling a sample cell with 10mL of sample. Close the sample cell and clean the optical faces of the sample cell with a lint-free cloth.

6. Insert the blank sample cell into the cell compartment. Make sure to install the blank sample cell in the correct and in a consistent orientation so that the results are more repeatable and precise.

7. Tightly close the instrument cap to prevent light interferences.

8. Press **Zero**. The display will show a concentration of zero (mg/L).

9. Prepare the sample by filling a second cell with 10mL of sample. Add the contents of one DPD Total Chlorine Powder Pillow to the sample cell (the prepared sample). Cap and swirl the sample cell vigorously to dissolve the powder. It is not necessary that all the powder dissolves.

10. Select **TIMER ENTER**. A three-minute reaction period will begin. A pink color will develop if chlorine is present.

11. After the timer beeps, remove the blank sample cell from the device and place the prepared sample into the cell holder. Tightly cover the sample cell with the instrument cap.

14. Press **Read**. The display shows the results in mg/L.

APPENDIX F

INSPECTION DOCUMENTATION

Irving Oil - Revere Terminal
Daily Terminal Inspection Form

Inspector's Initials: *Note: Report All Unsatisfactory Items to Terminal Manager*								
Year: **Date:**								
ITEM: (✓) for Satisfactory or (**X**) for Unsatisfactory (Explain below – Comments)		**M**	**Tu**	**W**	**Th**	**F**	**Sa***	**Su***
TRUCK LOADING RACK								
1	Loading arms							
2	Load valves							
3	Ground cables							
4	Leaks? (Vapor or Liquid)							
5	Meters							
6	Piping							
7	Overhead covering O.K. and rack drains clear for drainage							
8	Pressure relief valves open							
9	Check that rack separator pump is on and operational							
10	Cleanliness of load rack area							
11	Visually inspect Rack OWS for product and working condition							
UNLOADING AREA								
1	Caps secure							
2	Valves shut							
3	Catch basin clear for drainage							
4	Ground straps serviceable							
5	Drip pans emptied							
6	No fresh product on the ground or slab							
7	Pressure relief valves open							
8	Leaks? (Liquid or Vapor)							
TANK FARM AREAS								
1	Valves shut, not leaking, and locked when not attended							

		M	Tu	W	Th	F	Sa*	Su*
Inspector's Initials: *Note: Report All Unsatisfactory Items to Terminal Manager*								
Year: **Date:**								
ITEM: (✓) for Satisfactory or (**X**) for Unsatisfactory (Explain below – Comments)		**M**	**Tu**	**W**	**Th**	**F**	**Sa***	**Su***
2	No visible leaking of product from piping; check supports							
3	Liquid in dike areas? (specify product or water under **Comments**)							
4	Pressure relief valves open							
5	No apparent tank leakage, drip marks, corrosion, and cracks							
6	Tank foundations are free from cracks, gaps between tank and foundation and have no visible settling							
7	Leaks? (Liquid or Vapor)							
9	Visually inspect Main OWS for product and working condition							
YARD AND FENCE								
1	Fencing secure							
2	Gates secure and operable (locked when not attended)							
3	Yard clean, debris picked up							
4	Yard lighting adequate and in working order							
5	Paved areas, Inspect parked vehicles for leaks.							
BULLPEN AND DOCK								
1	All valves not in use are closed and locked. (Global/Irving locks)							
2	No visible leaks from piping or valves							
3	Ground cables							
4	Dock house is clean and Retain samples have been brought back to the Terminal.							
5	Hose tower and Hydraulic pump containment are drained and free of product.							
6	Barge containment has adequate space.							

		M	Tu	W	Th	F	Sa*	Su*
Inspector's Initials: *Note: Report All Unsatisfactory Items to Terminal Manager*								
Year: **Date:**								
ITEM: (✓) for Satisfactory or (**X**) for Unsatisfactory (Explain below – Comments)		**M**	**Tu**	**W**	**Th**	**F**	**Sa***	**Su***
7	All hoses are in good working order and free from defects							
8	Pressure relief valves open							
9	Leaks? (Liquid or Vapor)							
10	Visually inspect "Thrifty" OWS for product and working condition							

COMMENTS:

____

____

____

____

____

____

***If Terminal is in operation.**

Irving Oil - Revere Terminal
Monthly Oil/Water Separator Inspection Form

Inspector Name: ____

Inspector Signature: ____

Date of Inspection: ____

Area Checked	Product/Sludge Present		Equipment Needs Maintenance		Comments
Tank Farm Separator	☐ YES	☐ NO	☐ YES	☐ NO	
Outflow Well	☐ YES	☐ NO	☐ YES	☐ NO	
Load Rack Separator	☐ YES	☐ NO	☐ YES	☐ NO	
Yard Pump	☐ YES	☐ NO	☐ YES	☐ NO	
Outflow at Dock	☐ YES	☐ NO	☐ YES	☐ NO	
Thrifty Separator	☐ YES	☐ NO	☐ YES	☐ NO	

Additional Notes:

Stormwater Industrial Routine Facility Inspection Report

General Information			
Facility Name	Irving Oil Revere Terminal		
NPDES Tracking No.	MA0001929		
Date of Inspection		**Start/End Time**	
Inspector's Name(s)			
Inspector's Title(s)			
Inspector's Contact Information			
Inspector's Qualifications			

Weather Information
Weather at time of this inspection? ❑ Clear ❑Cloudy ❑ Rain ❑ Sleet ❑ Fog ❑ Snow ❑ High Winds ❑ Other: Temperature:
Have any previously unidentified discharges of pollutants occurred since the last inspection? ❑Yes ❑No **If yes, describe:**
Are there any discharges occurring at the time of inspection? ❑Yes ❑No **If yes, describe:**

Control Measures

- *Number the structural stormwater control measures identified in your SWPPP on your site map and list them below (add as many control measures as are implemented on-site). Carry a copy of the numbered site map with you during your inspections. This list will ensure that you are inspecting all required control measures at your facility.*
- *Stormwater conveyance structures will be inspected for proper operation and function and evidence of problems such as cracks, breaks, obstructions, erosion, oily sheens, and any other circumstances that could adversely affect stormwater flow, treatment, and purity.*
- *Describe corrective actions initiated, date completed, and note the person that completed the work in the Corrective Action Log.*

	Structural Control Measure	**Control Measure is Operating Effectively?**	**If No, In Need of Maintenance, Repair, or Replacement?**	**Corrective Action Needed and Notes** (identify needed maintenance and repairs, or any failed control measures that need replacement)
1	Tank 3 dike – sump pumps are operating properly	❑Yes ❑No	❑ Maintenance ❑ Repair ❑ Replacement	
2	Tank 3 dike – no oil sheen and discharged to OWS	❑Yes ❑No	❑ Maintenance ❑ Repair ❑ Replacement	
3	OWS daily inspections completed and documented	❑Yes ❑No	❑ Maintenance ❑ Repair ❑ Replacement	
4	Holding Tank pumps are operating properly	❑Yes ❑No	❑ Maintenance ❑ Repair ❑ Replacement	
5	Loading Rack Containment Tank has been routinely pumped out	❑Yes ❑No	❑ Maintenance ❑ Repair ❑ Replacement	

	Structural Control Measure	Control Measure is Operating Effectively?	If No, In Need of Maintenance, Repair, or Replacement?	Corrective Action Needed and Notes (identify needed maintenance and repairs, or any failed control measures that need replacement)
6	OWS 2 inspected for increase in separated oil layer	❑Yes ❑No	❑ Maintenance ❑ Repair ❑ Replacement	
7	Vessel dock drip pans present and in good repair	❑Yes ❑No	❑ Maintenance ❑ Repair ❑ Replacement	
8	Vessel dock drip pans accumulated stormwater and product disposed of properly	❑Yes ❑No	❑ Maintenance ❑ Repair ❑ Replacement	
9	Alarm system test button on control console functions properly	❑Yes ❑No	❑ Maintenance ❑ Repair ❑ Replacement	
10	Displacement switch on the AST alarm trigger was mechanically tested	❑Yes ❑No	❑ Maintenance ❑ Repair ❑ Replacement	
11	Terminal's log contains weekly checks of the high-level alarm console	❑Yes ❑No	❑ Maintenance ❑ Repair ❑ Replacement	
12	Tank Farm Containment System is in good condition and sufficiently impervious to contain oil	❑Yes ❑No	❑ Maintenance ❑ Repair ❑ Replacement	
13	Truck Loading Rack Controls are functioning properly	❑Yes ❑No	❑ Maintenance ❑ Repair ❑ Replacement	

Areas of Industrial Materials or Activities exposed to stormwater

Below are some general areas that should be assessed during routine inspections. Customize this list as needed for the specific types of industrial materials or activities at your facility.

- *Vehicle, equipment, and material handling areas that could adversely affect stormwater discharges will be inspected for leaks, spill, odors, poor housekeeping, staining, corrosion, cracks, equipment problems, smoke, dirt (or other erodible material), poor labeling, and any other circumstances that could potentially result in stormwater contamination.*

	Area/Activity	Inspected?	Controls Adequate (appropriate, effective, and operating)?	Corrective Action Needed and Notes
1	Outdoor vehicle and equipment washing areas are inspected to ensure rinse water is directed to OWS	❑Yes ❑No ❑ N/A	❑Yes ❑No	
2	Pavement sweeping and debris removal has been routinely completed	❑Yes ❑No ❑ N/A	❑Yes ❑No	
3	Spill response program has been reviewed for prompt responses to spill events	❑Yes ❑No ❑ N/A	❑Yes ❑No	

	Area/Activity	Inspected?	Controls Adequate (appropriate, effective, and operating)?	Corrective Action Needed and Notes
4	Specific response actions are defined for personnel in the event of a spill of reportable quantities at the Terminal	❑Yes ❑No ❑ N/A	❑Yes ❑No	
5	Notification procedures for spill events are defined for notification requirements to EPA, MassDEP, USCG, and/or City of Revere	❑Yes ❑No ❑ N/A	❑Yes ❑No	
6	The list of significant spills and leaks of toxic or hazardous pollutants is up-to-date	❑Yes ❑No ❑ N/A	❑Yes ❑No	
7	Material inventory management system is documented and spills addressed	❑Yes ❑No ❑ N/A	❑Yes ❑No	
8	Material loading/unloading and storage areas are in good condition	❑Yes ❑No ❑ N/A	❑Yes ❑No	
9	Vehicle and Equipment Storage Areas are free from drips, spills and leaks	❑Yes ❑No ❑ N/A	❑Yes ❑No	
10	Waste management areas are in good condition, integrity of storage containers is sufficient and no spills observed	❑Yes ❑No ❑ N/A	❑Yes ❑No	
11	Preventative maintenance program documentation is maintained and up-to-date	❑Yes ❑No ❑ N/A	❑Yes ❑No	
12	Signs of sedimentation and/or erosion at the Terminal	❑Yes ❑No ❑ N/A	❑Yes ❑No	
13	Employee Training was completed and documented	❑Yes ❑No ❑ N/A	❑Yes ❑No	
TERMINAL SPECIFIC PERMIT BMPS				
1	Discharge initiation process program documentation is complete and performed within the permit requirements	❑Yes ❑No ❑ N/A	❑Yes ❑No	
2	Assessment of site-specific factors that may increase the potential to contribute pollutants in the stormwater discharge	❑Yes ❑No ❑ N/A	❑Yes ❑No	

	Area/Activity	Inspected?	Controls Adequate (appropriate, effective, and operating)?	Corrective Action Needed and Notes
3	Examine alternate procedures or improvements to current procedures to increase the efficiency of pollutant removal prior to discharge to the receiving water	❑Yes ❑No ❑ N/A	❑Yes ❑No	
4	Sampling coordination email was sent with proposed sample date at least 24-hrs prior to event during a “qualifying event”	❑Yes ❑No ❑ N/A	❑Yes ❑No	
5	Develop and implement stormwater system integrity evaluation plan by December, 2015	❑Yes ❑No ❑ N/A	❑Yes ❑No	NOTE STATUS:

Non-Compliance

Describe any incidents of non-compliance observed and not described above:

Additional Control Measures

Describe any additional control measures needed to comply with the permit requirements:

Notes

Use this space for any additional notes or observations from the inspection:

CERTIFICATION STATEMENT

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

Print name and title: ____

Signature:____Date:_____________________

Irving Oil - Revere Terminal
Annual Stormwater Comprehensive Evaluation

The **Stormwater Industrial Routine Facility Inspection Report** should be completed in conjunction with this annual stormwater comprehensive evaluation.

Inspector Name: ____

Inspector Signature: ____

Date of Inspection: ____

Review the checklist on the next page. Use it to update the site map, pollutants list and maintenance practices as necessary. Note changes here and on the Plan.

Update the pollution prevention team if necessary.

Updated: Y_____ N_____

Was the non-stormwater discharge inspection/evaluation completed: Y_____ N_____

Updated non-stormwater discharge certification: Y_____ N_____

Updated the site plan information: Y_____ N_____

Review the SWPPP. Are there any other areas, which need to be updated:

Updated: Y_____ N_____

If so, note them here and on the Plan:

Additional Comments:

Quarterly Visual Assessment Form

(Complete a separate form for each outfall you assess)

Name of Terminal: NPDES Tracking No.

Outfall Name: "Substantially Identical Outfall"? ☐ No ☐ Yes

Person(s)/Title(s) collecting sample:

Person(s)/Title(s) examining sample:

Date & Time Discharge Began: Date & Time Sample Collected: Date & Time Sample Examined:

Substitute Sample? ☐ No ☐ Yes

Nature of Discharge: ☐ Rainfall ☐ Snowmelt

If rainfall: Rainfall Amount: inches Previous Storm Ended > 72 hours Before Start of This Storm? ☐ Yes ☐ No* (explain):

Parameter

Color ☐ None ☐ Other (describe):

Odor ☐ None ☐ Musty ☐ Sewage ☐ Sulfur ☐ Sour ☐ Petroleum/Gas ______________________
☐ Solvents ☐ Other (describe):

Clarity ☐ Clear ☐ Slightly Cloudy ☐ Cloudy ☐ Opaque ☐ Other

Floating Solids ☐ No ☐ Yes (describe):

Settled Solids** ☐ No ☐ Yes (describe):

Suspended Solids ☐ No ☐ Yes (describe):

Foam (gently shake sample) ☐ No ☐ Yes (describe):

Oil Sheen ☐ None ☐ Flecks ☐ Globs ☐ Sheen ☐ Slick
☐ Other (describe):

Other Obvious Indicators of Stormwater Pollution ☐ No ☐ Yes (describe):

* The 72-hour interval can be waived when the previous storm did not yield a measurable discharge or if you are able to document (attach applicable documentation) that less than a 72-hour interval is representative of local storm events during the sampling period.

** Observe for settled solids after allowing the sample to sit for approximately one-half hour.

Detail any concerns, additional comments, descriptions of pictures taken, and any corrective actions taken below (attach additional sheets as necessary).

Certification by Terminal Responsible Official (Refer to MSGP Subpart 11 Appendix B for Signatory Requirements)

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

A. Name: B. Title:

C. Signature: D. Date Signed:

APPENDIX G

EMPLOYEE TRAINING SIGN-IN SHEET

Irving Oil - Revere Terminal
SWPPP Annual Training Log

Course Agenda:			
Session Attendees:			
Name (Printed)	Signature	Company	Telephone Number
Comments:			

Course Instructor: __________________________**Date:** ___________________________________

Course Title: ______________________________ **Location:** ______________________________

APPENDIX H

Response Procedures for Ethanol and Alcohol Resistant Fire Fighting foam spills

ETHANOL AND ALCOHOL RESISTANT AQUEOUS FILM FORMING FOAM (AR-AFFF) RELEASE RESPONSE PROCEDURES

IRVING OIL TERMINALS INC.
REVERE MARINE TERMINAL
40/41 LEE BURBANK HIGHWAY
REVERE, MASSACHUSETTS 02151

March 2023

Prepared For:

Irving Oil Terminals Inc.
Revere Marine Terminal
40/41 Lee Burbank Highway
Revere, Massachusetts 02151

Prepared By:

Verdantas LLC
30 Shrewsbury Street
Holden, MA 01520
978-679-1600

Ref: Z:\Project Files\16000\16653\Working\Ethanol And Foam Release Response\Appendix H Ethanol And AR-FFF Response Procedures-DRAFT.Docx

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1.0 Introduction

1.1 SCOPE

These **Ethanol and Alcohol-Resistant Aqueous Film Forming Foam (AR-AFFF), Release Response Procedures** were prepared for the Irving Oil (the Terminal) Revere Marine Terminal located at 40/41 Lee Burbank Highway, Revere Massachusetts to address potential spills or releases of ethanol, a highly flammable liquid, and the fire-fighting foam.

1.2 CHEMICAL STORAGE AND USE

Denatured ethanol is stored at the Terminal in bulk quantities for use as an additive for motor vehicle gasoline. Due to the chemical and physical properties of ethanol, a release of ethanol to navigable waters, groundwater, or the Terminals stormwater system has an increased risk of a potential impact to human health and the environment. As required by the 2022 National Pollutant Discharge Elimination System (NPDES) permit condition Part I C.b.5, the Terminal developed specific procedures for the response to an ethanol release to surface waters via the stormwater system. Additionally, bulk denatured ethanol typically contains approximately three (3) percent gasoline, requiring additional oil spill response actions in certain situations.

The Terminal stores aAR-AFFF) for use in emergency situations to extinguish hydrocarbon and polar solvent (water miscible) fires. . AR-AFFF is stored in a concentrated form and is diluted with water, typically to a concentration of 3 percent. The potential AR-AFFF release locations include the following:

- Terminal Tank Farm (East Side of Lee Burbank Highway);
- Terminal Dock (west side of Lee Burbank Highway); and
- Terminal Loading Rack (East Side of Lee Burbank Highway).

1.3 REQUIREMENT FOR RESPONSE MEASURES

Discharge of AR-AFFF from testing or maintenance activities is restricted by NPDES permit condition Part I.B.2.i. However, use of AR-AFFF is required in certain emergency situations and for specific material releases (i.e., to create a foam blanket that seals the fuel surface and prevents the release of fuel vapors to atmosphere).

Due to permit conditions, the Terminal is also prohibited from discharging runoff from a spill or release (alone or with stormwater) and from using dilution as a form of treatment.

Response measures for a release of AR-AFFF at the Terminal include containment and treatment on or offsite. Containment is achieved in the Terminal loading rack area, and within diked areas, and controls are in place to isolate impacted areas from the remaining stormwater system.

Certain releases of ethanol require the use of AR-AFFF, which would follow the same response procedures as an accidental release of AR-AFFF.

The Terminal maintains a **Facility Response Plan** (FRP) which includes an oil **Spill Prevention Control and Countermeasure** (SPCC) plan. In the event of a release of ethanol or AR-AFFF the Terminal would follow the FRP internal and external release notification procedures, as appropriate. The Terminal is required to have an active emergency response agreement in place with an Oil Spill Response Organization (OSRO), who have the capability and knowledge to respond to a release.

2.0 Release Scenarios and Response

2.1 RELEASE TO NAVIGABLE WATERS AT TERMINAL DOCK

Ethanol is transported to the Terminal via tanker ships or barge and loaded at the Terminal Dock area. AR-AFFF is in place at the dock loading area and may be released in an emergency situation or because of an accidental release from the system (i.e., unintentional foam/water system startup). Containment of a release to the waterway from the dock area is not feasible due to rapid mixing into the surface water. While booms may be used in a limited capacity for oil involved in a release, subsurface mixing of ethanol and AR-AFFF prevents their containment.

To address a release at the Terminal Dock area, the Terminal, to the extent practicable, will limit the release area, immediately notify the MassDEP and USEPA, and immediately implement the procedures outlined in the Terminal FRP. The Terminal will work to identify and mitigate the impacts, with measures including aeration or sparging of impacted waters to help limit potential oxygen depletion. Aeration and sparging would commence from land and barge-based pumps and aerators provided by the Terminal's OSRO. The Terminal will monitor marine environmental conditions, i.e., oxygen levels, to mitigate release impacts to the extent practicable. Trace components which come to the surface, such as gasoline, would be collected with absorbent booms and/or skimmers, if deemed safe to do so.

2.2 RELEASE IN TERMINAL LOADING RACK AREA

The Terminal Loading Rack area has a fire suppression system covering the tank truck loading area. The Terminal Loading Rack area has a trench drain in place which connects to an oil-water separator (OWS-1). A potential release of AR-AFFF may be from an inadvertent release from the automatic fire suppression system or in response to a tank truck fire.

The most likely release scenario in this area includes a release from a tanker truck, as described below:

- A release of ethanol could occur from a tanker truck filling with ethanol, releasing ethanol to the ground surface and flowing into the trench drain around the rack.
- Due to the ignitability of ethanol liquid and vapors, the fire suppression system would apply a surface coating of AR-AFFF once ethanol enters enclosed areas of the stormwater collection system.
- Collected runoff in the rack stormwater collection system will flow into a holding tank (which is designed to act as an initial oil separator) and then to a lift station before being pumped to the Terminal OWS-1 for treatment prior to discharging into the Chelsea River.

- The storage capacity in the rack stormwater collection and treatment system (including the OWS 1) is greater than 30,000 gallons which provides adequate containment capacity for the largest single compartment (i.e., 10,000 gallons) of a tanker truck that would come to the Terminal.

- Once a release occurs at the Terminal Loading Rack area, Terminal operators will manually shut down discharge from the loading rack oil-water separator and isolate the stormwater valve leading from the loading racks to the OWS-1.

- The Terminal works with its established waste management vendorand OSRO to identify appropriate treatment and/or offsite disposal of any impacted water.

As feasible, the impacted stormwater will be removed via truck from the oil-water separator reservoir tank and system piping for disposal off-site by the Terminal's OSRO. Depending on the quantity of the release, the impacted stormwater will be stored on-site in frac tanks until either: 1) a treatment system can be brought on site and the stormwater can be appropriately treated, tested, and discharged, or 2) all the impacted stormwater can be removed for appropriate disposal off-site by the Terminal's OSRO. Stormwater held in the tank dike areas, <u>which is not impacted</u> by a spill/release, will be discharged following confirmation sampling for ethanol and potential AR-AFFF constituents.

Sampling of stored non-impacted stormwater will occur before discharge and at the following times: at 10% of discharge, at midpoint of discharge, and at 90% discharge. The release of stormwater will follow the procedure for hydrostatic test water discharge listed in NPDES MA0001929 Part C.3. Sampling will include ethanol Perfluorohexanesulfonic acid (PFHxS), Perfluoroheptanoic acid (PFHpA), Perfluorononanoic acid (PFNA), Perfluorooctanesulfonic acid (PFOS), Perfluorooctanoic acid (PFOA), and Perfluorodecanoic (PFDA). Additional sampling parameters will be added as appropriate or if requested by USEPA or MassDEP. Confirmation of the lack of PFAS compounds will be performed via USEPA test methods 533, 537.1, or 1633 as approved by USEPA. Testing of PFHxS, PFHpA, PFNA, PFOS, PFOA, and PFDA will occur regardless of the status of multi-laboratory validation of USEPA method 1633.

Treatment of impacted stormwater will include the use of carbon filter systems and/or other specialized resins. Carbon filtration may have reduced effectiveness for ethanol impacted waters. These systems will effectively remove AR-AFFF and trace gasoline components. Aeration and sparging of impacted water would occur using pump equipment provided by the Terminal's ORSO, to assist in oxygen recovery and VOC expulsion. If treatment does not reduce ethanol concentrations, then the ethanol impacted water will be transported off site for disposal. The Terminal will work to mitigate the volume of water impacted by ethanol to mitigate the need for on-site ethanol treatment.

2.3 RELEASE IN TERMINAL TANK DIKE AREA

Ethanol is stored in bulk quantities in several tanks, which are contained within individual dikes of at least 110% tank capacity. A release of ethanol or AR-AFFF has the potential to impact a significant amount of stormwater in diked areas due to the Terminal's practice of holding collected stormwater for discharge after precipitation events. In the event of a release, storage of impacted water on site in frac tanks and removing after treatment may not be feasible.

To address a release in the Terminal Tank Dike area:

- the impacted dike(s) would be isolated from the non-impacted dikes and stormwater system areas;

- MassDEP, USEPA, and the Terminal's waste management vendor would be contacted and consulted for treatment and disposal actions;

- AR-AFFF impacted water in dike areas will be treated on site via carbon filters or other specialized resins and tested for PFHxS, PFHpA, PFNA, PFOS, PFOA, and PFD at pre-treatment, 10% of discharge, midpoint of discharge, and 90% discharge; and

- Treated water will then be discharged via the Terminals stormwater system following approval from MassDEP and USEPA, if pollutants are below permit thresholds.

If feasible, the Terminal will isolate ethanol impacted stormwater for transport off site for disposal. Should the volume of impacted water yield off-site disposal infeasible, the Terminal will work to initiate on-site treatment of impacted water via carbon filters to treat trace AR-AFFF and gasoline components of impacted water. Residual ethanol will be reduced via natural attenuation by oxygen aeration on site. Aeration and sparging of impacted water would occur using pump equipment provided by the Terminal's ORSO, to assist in oxygen recovery and VOC expulsion. Once treated impacted stormwater has reached concentrations below permit thresholds, the Terminal will discharge the treated stormwater.

Monitoring of ethanol in the stormwater and associated gas concentrations in surrounding breathing zones will be performed to assess conditions and mitigate safety risks and environmental impacts.

APPENDIX I

Major Storm and Flood Risk Assessment

APPENDIX I – FLOOD RISK ASSESSMENT

IRVING OIL TERMINAL, INC.
41 LEE BURBANK HIGHWAY
SUFFOLK COUNTY, REVERE, MA 02151
NPDES PERMIT NO. MA0001929

FEBRUARY 2023

Prepared For:

Irving Oil Terminals, Inc.
190 Commerce Way
Portsmouth, New Hampshire 03801
Tel: 603-559-8736

Prepared By:

Verdantas LLC
1005 Main Street, Suite No.: 8120
Pawtucket, Rhode Island 02860
Tel: 401-648-8675

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ATTACHMENTS

1.0 INTRODUCTION

Verdantas LLC (Verdantas) prepared the following Flood Risk Assessment for Irving Oil Terminals, Inc. (the Owner) to identify potential flood elevations for the subject property terminal located at 41 Lee Burbank Highway, Revere, MA 02151 (the Terminal). The assessment was completed in accordance with the Massachusetts Stormwater Handbook and shall be used by the Owner as a reference document to the Stormwater Pollution Prevention Plan (SWPPP), detailing the existing stormwater system, containment areas, and controls measures to assist in management of potential flood risks.

1.1 FACILITY DESCRIPTION

The Terminal, located on approximately 25 acres on the east bank of the Chelsea River, bisected by Lee Burbank Highway and approximately two and one-half miles northeast of the confluence of the Mystic and Chelsea Rivers, is a petroleum product bulk storage terminal (refer to Figure 1 in the SWPPP for a Terminal Locus and Figure 2 in the SWPPP for a Terminal Site Plan / Facility Layout). Stormwater monitoring is performed at the Meter Well, downgradient of OWS1, located at Latitude 42° 23’ 48” N, Longitude -71° 00’ 44” W. The final discharge point to the Chelsea Creek is located on the west side of Lee Burbank Highway, adjacent to the dock area, and is designated as “Outfall 001.”

Operations began at the Terminal in 1935 and Irving purchased the Terminal in August 1998. The dock area is located to the west of the highway (referred to as the “Dock Side” area) and the main Terminal is to the east of the highway (referred to as the “Terminal Side” area).

The area surrounding the Terminal includes industrial, residential, and commercial activities. Products received, stored, and distributed at the Terminal include gasoline, gasoline and diesel fuel additives, No. 2 heating oil, low sulfur diesel, and ethanol. The products managed at the Terminal are described in further detail in Section 5.6. Bulk petroleum products are received either by barge, ship, truck, or transfer pipeline, while additives (e.g., dye) are delivered by truck in bulk and/or 55-gallon drums. Product is distributed from the Terminal via truck or can be transferred to a neighboring terminal (Global Petroleum) via common dock lines.

An office building and several outbuildings are located on the eastern or Terminal Side of the Terminal. On the Dock Side of the Terminal, there is a main building leased from Irving by a car rental company for offices and fleet vehicle maintenance, and an outbuilding used by Irving.

2.0 SITE DRAINAGE

2.1 STORMWATER SYSTEM

Stormwater is collected at the Terminal from the Terminal yard and the secondary containment areas of the tank farm. The tank farm and Terminal yard are located on the east side of Lee Burbank Highway and as such have their own stormwater collection and treatment system, which includes oil- water separator 1 (OWS 1). A property leased from Irving by the car rental agency, located on the west side of the highway, has its own stormwater collection and treatment system. The discharge from all areas of the Terminal occurs via Outfall 001 into the Chelsea River.

2.1.1 Tank Farm Drainage

Secondary containment for the tank farm consists of an earthen perimeter dike surrounding the Tank Farm and a series of intermediate (interior) earthen dikes forming separate containment areas for each bulk AST. The dikes and floor of the Tank Farm are sufficiently impervious to contain oil. The secondary containment is sized to hold between 110 to 130 percent of the largest tank's storage capacity plus an added volume to hold accumulated fire-extinguishing agents, water and/or precipitation. The berms are used to help prevent potential petroleum releases from migrating from one secondary containment area to another or into surrounding waterways. There is a valve located within each secondary containment area that can be manually opened to allow the stormwater to drain into the stormwater collection system. When the valve is closed, stormwater is retained within the tanks' secondary containment area. Secondary containment stormwater valves are normally kept closed.

Stormwater accumulating within the dike areas evaporates or can be directed to low elevation catch basins. Terminal personnel are scheduled to visually inspect accumulated stormwater and if a sheen is not visible, the valve is opened, thereby allowing the stormwater to drain by gravity into the central diked area surrounding Tank 3.

The stormwater which accumulates in the secondary containment area around Tank 3 includes stormwater from the Tank Farm and Terminal Yard, and the truck loading rack canopy gutters. The stormwater accumulated within Tank 3's secondary containment flows into a concrete sump located adjacent to OWS 1. The sump is equipped with two pumps, a primary and a back-up, each with a reported pumping capacity of approximately 375 gallons per minute (gpm). When one of the two pumps is activated, the stormwater within the concrete sump is pumped to OWS 1 for treatment.

2.1.2 Truck Loading Rack Drainage

At the truck loading rack, the roof directs stormwater away from the truck rack equipment and loading operations to perimeter drains and individual catch basins. Stormwater from this portion of the Terminal yard is directed to an underground holding tank that automatically (i.e., via level controller) pumps the water into the secondary containment area surrounding Tank 3, whenever the water in the tank reaches a set level.

Runoff entering the drains located beneath the roof (the Trench Drains) of the truck loading racks flows into a concrete holding tank located northwest of the rack. This holding tank acts as a small OWS for petroleum products that might have spilled into the drains during truck loading operations. Stormwater from the holding tank flows into a nearby lift station, leaving accumulated petroleum product remaining on the surface. A 250-gpm pump conveys the stormwater from the lift station to OWS 1. Accumulated petroleum products in the holding tank would be removed by the Facility's waste vendor for disposal off site.

2.2 STORMWATER SYSTEM EVALUATION

To accurately depict and predict potential flood risks associated with the Terminal, an initial stormwater evaluation was conducted to obtain stormwater drainage structure rim, invert, and grade elevations for hydrologic modeling.

Within the tank farm, existing site features and survey data were obtained from the survey plan prepared by Hatch Mott MacDonald, entitled "Irving Oil Tank Site #1," surveyed by Philip Burrows (PLS #35778), dated March 11, 2015. The survey information allowed for the dike containment properties to be interpolated to properly map the hydrologic effects of increased rainfall intensity.

On January 18, 2023, Verdantas personnel conducted a limited site survey to confirm rim elevations and observed existing conditions of the stormwater system within the subject property. Verdantas was unable to survey all catch basins due to inclement weather at the time of the inspection.

On January 31, 2023, Verdantas personnel completed a further investigation into the existing stormwater drainage structures within the truck loading rack area and the accessway. The scope of the investigation was to evaluate the invert distance from the rim elevation, the depth to the bottom of the structure, the structure conditions and size, and the sediment thickness within the sump. Due to current site conditions and inclement weather, completion of the stormwater system evaluation and investigation within the tank yard was delayed and will be completed in the spring or early summer.

A summary of the preliminary stormwater system drainage structure list and conditions is included in the Operation & Maintenance Plan (O&M Plan) for the Terminal. The preliminary data was used to conduct the initial flood risk assessment included in this report. Once the final evaluation of the stormwater system is completed, an amended flood risk assessment will be performed and provided to the Owner.

3.0 HYDROLOGIC MODELING

Hydrologic modeling was implemented to determine potential flood risks within the subject property. Verdantas evaluated the potential flood elevations within the tank yard, the excess stormwater runoff and volume, and drainage flow direction subject to the existing conditions and topography of the Site.

3.1 RAINFALL INTENSITIES

In accordance with the requirements governing the flood risk assessment, Verdantas reviewed and evaluated the historical observations from the years the Permittee (i.e., Irving Oil) operated the facility (1998 to present), all observations of events that occurred in the calendar year, and the 25- and 100-year forecasted storm events.

Based upon the U.S. Department of Commerce, National Oceanic & Atmospheric Administration (NOAA) National Environmental Satellite Data and Information Service for the Boston Logan International Airport Rain Gage Station (USW00014729) from year 1998 to 2023, a maximum rainfall intensity of 4.71 inches of liquid precipitation occurred on September 10, 1999. As a point of reference, the Boston Logan International Airport is located approximately two (2) linear miles due south of the Site.

In addition, utilizing the same NOAA data service, the past calendar year yielded a maximum liquid precipitation of 1.87 inches for the Boston Logan International Airport. The historical data is included within Attachment 1.

NOAA Atlas 14, Volume 10, Version 3, dictates the Revere, MA point precipitation frequency estimates for the 25- and 100-year storm are 6.16 and 7.93 inches, respectively. The frequency estimate table is included within Attachment 2.

Based upon the observational and forecasted data provided, Verdantas implemented the worst case forecasted rainfall intensities when conducting the flood risk assessment of the Site.

3.2 METHODOLOGY

Hydrologic calculations for existing conditions were performed using HydroCAD software, which uses TR-55 methodology to calculate runoff and TR-20 methodology for storm routing through the stormwater facilities. Site hydrology was evaluated for the 25-, and 100-year storms.

The hydraulic design calculations were completed using the Rational Method to calculate the design flows to each inlet structure. The stormwater conveyance system was designed using Manning's Equation. Hydrologic analyses calculations for the 25 and 100-year storm events are included in Attachment 3. The existing drainage areas were modeled as "unconnected pavement" due to the impervious nature of the Site.

3.3 SUBCATCHMENT DELINEATION

Based upon the limited survey and investigation data of the existing stormwater conveyance system, the flood risk assessment was conducted by evaluating each tank containment impervious drainage area independently. Delineation was determined by the existing topography of the Site to depict potential stormwater runoff drainage paths.

The existing Site is entirely impervious. The Site is bounded by abutting commercial property to the North by parcel identification 5-80-4 owned by Global and the Lee Burbank Highway to the West, in the City of Revere. The Site is bounded to the South and East by parcel identification 0102524000 owned by McClellan Highway in the City of Boston. The abutting properties consist of similar site characteristics as the subject property.

According to the Soil Survey of Massachusetts, the soils located at the Site are Urban Land (Ur). Based on the “Soil Survey of Norfolk and Suffolk Counties, Massachusetts” (Peragallo, 1989), consists of areas where 75 percent or more of the land is covered with impervious surfaces, such as buildings, pavement, industrial parks, and railroad yards. The soil is classified within Hydrological Group D. There is no existing or proposed infiltration within the Site.

Eleven (11) tank containment areas, and two (2) loading rack accessway areas, were analyzed in the hydrologic modeling. The following is a summary of the existing drainage areas:

ID	Drainage Area	Description
EDA-1	83,722	Tank 1
EDA-2	86,412	Tank 2
EDA-3	79,598	Tank 3
EDA-4	81,970	Tank 4
EDA-5	47,265	Tank 5
EDA-6	37,562	Tank 6
EDA-7	40,096	Tank 7
EDA-10	75,382	Tank 10
EDA-11	35,410	Tank 11
EDA-12	121,528	Tank 12
EDA-14	165,502	Tank 14
EDA-100	116,869	Northern portion of the rack area
EDA-200	143,409	Southern portion of the rack area

All areas were modeled as impervious due to the cross-sectional composition of the dike containment berms (i.e., clay encapsulated by an impermeable membrane), existing pavement within the rack areas, and the overall intent of retention of potential spills or ruptures.

3.4 FEMA FLOOD MAPPING

The Federal Emergency Management Agency (FEMA) Natural Flood Hazard Layer FIRMette mapping details that the portion of the property modeled as EDA 100 & 200 (i.e., the loading rack area & accessway) are included within Zone AE with a flood elevation of 10.0 feet. Note that existing contour data within this area indicates general elevations of approximately 10.0 ft, with a +/- 1 foot variation, and are shown sloping downward towards Lee Burbank Highway. Since the FEMA flood elevation for the loading rack area is designated at 10.0 feet, review and/or obtaining additional survey information will be required in this area to better understand potential flood elevations in the rack loading area.

The FIRMette mapping (Attachment 4) does identify the entirety of the tank yard as outside the FEMA flood zone. This non-flood zone designation is likely due to the dike containment berms encompassing the subject area.

4.0 ASSESSMENT

4.1 MODELING RESULTS (RUNOFF, VOLUME, ELEVATIONS)

The hydrologic model demonstrates that each existing tank yard containment area can hold the 25- and 100-year flood event. The flood elevation within each dike containment is below the low-point top of berm elevation.

Sections of the existing stormwater conveyance underground piping may, however, not be sufficiently sized to handle the 25- or 100-year storm. A re-evaluation the existing stormwater system will be completed, once additional field investigation activities can be resumed, to identify which underground piping is or is not adequately sized, and where necessary, conduct a redesign of applicable stormwater pipelines to allow for adequate flow for the 25 and 100-year storm events.

A summary of the peak flow rates for the existing conditions within each drainage area is provided in Attachment 5.

4.2 POTENTIAL CONTROL MEASURES

Based upon the results of the hydrologic modeling of the forecasted NOAA rainfall intensities for the 25- and 100-year storm events, the Terminal will monitor potential flood risk causing events and implement the control measures, as outlined in the SWPPP, in the event of a significant rain event. These control measures will be conducted in conjunction with the existing preparedness and operational guidelines implemented at the facility in times of major storm events and/or storm surges.

Additional control measures may be required pending completion of the additional tasks as note below.

4.3 NEXT STEPS BASED UPON PRELIMINARY FINDINGS

The following addition flood risk evaluation actions are proposed to be completed for the Terminal:

1. Complete the field assessment of the existing stormwater system.

2. Perform additional site survey to obtain final topographic elevation data for the Loading Rack area and compare these data with flood elevation levels for forecasted higher intensity storm events.
3. Re-evaluate existing stormwater piping capacity for handling 25 and 100-year storm events.
4. Reassess the need for additional flood resiliency control measures.

Flood Risk Assessment

Attachment 1 – Area Historical Rainfall Data

U.S. Department of Commerce
National Oceanic & Atmospheric Administration
National Environmental Satellite, Data, and Information Service

Current Location: Elev: 10 ft. Lat: 42.3606° N Lon: -71.0098° W
Station: **BOSTON LOGAN INTERNATIONAL AIRPORT, MA US USW00014739**

Global Summary of the Year
1998 - 1998
Generated on 02/24/2023

Date	Liquid Precipitation (Inches)			Frozen Precipitation (Inches)						
Elem->	PRCP	EMXP		SNOW	EMSN		EMSD		DP01	DP10
Year	Total Liquid Content	Extreme Max Precip	Date of Occurrence	Snowfall	Extreme Max Snowfall	Date of Occurrence	Extreme Max Snow Depth	Date of Occurrence	Precip >= 0.01"	Precip >= 0.10"
1998	53.68	5.69	Jun-13	14.7	3.5	Mar-22			119	79

Notes

(Blank) Data element not reported or missing.

X Monthly means or totals based on incomplete time series.

\+ Occurred on one or more previous dates during the month. The date in the Date field is the last day of occurrence.

A Accumulated amount.

T Trace Amount.

U.S. Department of Commerce
National Oceanic & Atmospheric Administration
National Environmental Satellite, Data, and Information Service

Current Location: Elev: 10 ft. Lat: 42.3606° N Lon: -71.0098° W
Station: **BOSTON LOGAN INTERNATIONAL AIRPORT, MA US USW00014739**

Global Summary of the Year
1998 - 1998
Generated on 02/24/2023

Date	**Temperature (Fahrenheit)**			**Degree Days (Base 65 degrees)**		**Extremes**				
Elem->	TAVG	TMAX	TMIN	HTDD	CLDD	EMXT		EMNT		DX90
Year	Annual Mean Temp	Mean Max Temp	Mean Min Temp	Heating Degree Days	Cooling Degree Days	Extreme Max Temp	Date of Occurrence	Extreme Min Temp	Date of Occurrence	Max Temp >= 90F
1998	53.0	60.2	45.8	5386	727	93	Jul-22	7+	Feb-15	8

Notes

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U.S. Department of Commerce
National Oceanic & Atmospheric Administration
National Environmental Satellite, Data, and Information Service

Current Location: Elev: 10 ft. Lat: 42.3606° N Lon: -71.0098° W
Station: **BOSTON LOGAN INTERNATIONAL AIRPORT, MA US USW00014739**

Global Summary of the Year
1999 - 1999
Generated on 02/22/2023

Date	**Liquid Precipitation (Inches)**			**Frozen Precipitation (Inches)**						
Elem->	PRCP	EMXP		SNOW	EMSN		EMSD		DP01	DP10
Year	Total Liquid Content	Extreme Max Precip	Date of Occurrence	Snowfall	Extreme Max Snowfall	Date of Occurrence	Extreme Max Snow Depth	Date of Occurrence	Precip >= 0.01"	Precip >= 0.10"
1999	37.93	4.71	Sep-10	35.6	7.8	Jan-14	8	Jan-15	111	69

Notes

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National Oceanic & Atmospheric Administration
National Environmental Satellite, Data, and Information Service

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Global Summary of the Year
1999 - 1999
Generated on 02/22/2023

Date	Temperature (Fahrenheit)			Degree Days (Base 65 degrees)		Extremes				
Elem->	TAVG	TMAX	TMIN	HTDD	CLDD	EMXT		EMNT		DX90
Year	Annual Mean Temp	Mean Max Temp	Mean Min Temp	Heating Degree Days	Cooling Degree Days	Extreme Max Temp	Date of Occurrence	Extreme Min Temp	Date of Occurrence	Max Temp >= 90F
1999	52.8	60.5	45.0	5287	862	98+	Jul-17	2	Jan-02	16

Notes

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T Trace Amount.

U.S. Department of Commerce
National Oceanic & Atmospheric Administration
National Environmental Satellite, Data, and Information Service

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Station: **BOSTON LOGAN INTERNATIONAL AIRPORT, MA US USW00014739**

Global Summary of the Year
2000 - 2000
Generated on 02/22/2023

Date	Liquid Precipitation (Inches)			Frozen Precipitation (Inches)						
Elem->	PRCP	EMXP		SNOW	EMSN		EMSD		DP01	DP10
Year	Total Liquid Content	Extreme Max Precip	Date of Occurrence	Snowfall	Extreme Max Snowfall	Date of Occurrence	Extreme Max Snow Depth	Date of Occurrence	Precip >= 0.01"	Precip >= 0.10"
2000	45.64	4.00	Jun-06	29.0	6.5	Feb-18	8	Feb-20	129	81

Notes

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U.S. Department of Commerce
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Station: **BOSTON LOGAN INTERNATIONAL AIRPORT, MA US USW00014739**

Global Summary of the Year
2000 - 2000
Generated on 02/22/2023

Date	**Temperature (Fahrenheit)**			**Degree Days (Base 65 degrees)**		**Extremes**				
Elem->	TAVG	TMAX	TMIN	HTDD	CLDD	EMXT		EMNT		DX90
Year	Annual Mean Temp	Mean Max Temp	Mean Min Temp	Heating Degree Days	Cooling Degree Days	Extreme Max Temp	Date of Occurrence	Extreme Min Temp	Date of Occurrence	Max Temp >= 90F
2000	50.6	58.0	43.2	5387	560	92	Jun-17	0	Jan-17	4

Notes

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A Accumulated amount.

T Trace Amount.

U.S. Department of Commerce
National Oceanic & Atmospheric Administration
National Environmental Satellite, Data, and Information Service

Current Location: Elev: 10 ft. Lat: 42.3606° N Lon: -71.0098° W
Station: **BOSTON LOGAN INTERNATIONAL AIRPORT, MA US USW00014739**

Global Summary of the Year
2001 - 2001

Generated on 02/22/2023

Date	Liquid Precipitation (Inches)			Frozen Precipitation (Inches)						
Elem->	PRCP	EMXP		SNOW	EMSN		EMSD		DP01	DP10
Year	Total Liquid Content	Extreme Max Precip	Date of Occurrence	Snowfall	Extreme Max Snowfall	Date of Occurrence	Extreme Max Snow Depth	Date of Occurrence	Precip >= 0.01"	Precip >= 0.10"
2001	30.75	2.59	Mar-22	46.5	6.4	Jan-21	12	Mar-10	108	58

Notes

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National Oceanic & Atmospheric Administration
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Global Summary of the Year
2001 - 2001
Generated on 02/22/2023

Date	Temperature (Fahrenheit)			Degree Days (Base 65 degrees)		Extremes				
Elem->	TAVG	TMAX	TMIN	HTDD	CLDD	EMXT		EMNT		DX90
Year	Annual Mean Temp	Mean Max Temp	Mean Min Temp	Heating Degree Days	Cooling Degree Days	Extreme Max Temp	Date of Occurrence	Extreme Min Temp	Date of Occurrence	Max Temp >= 90F
2001	52.5	60.0	45.0	5899	792	97	Aug-09	10	Feb-12	16

Notes

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National Oceanic & Atmospheric Administration
National Environmental Satellite, Data, and Information Service

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Station: **BOSTON LOGAN INTERNATIONAL AIRPORT, MA US USW00014739**

Global Summary of the Year
2002 - 2002
Generated on 02/22/2023

Date	Liquid Precipitation (Inches)			Frozen Precipitation (Inches)						
Elem->	PRCP	EMXP		SNOW	EMSN		EMSD		DP01	DP10
Year	Total Liquid Content	Extreme Max Precip	Date of Occurrence	Snowfall	Extreme Max Snowfall	Date of Occurrence	Extreme Max Snow Depth	Date of Occurrence	Precip >= 0.01"	Precip >= 0.10"
2002	41.11	1.99	Dec-14	24.8	3.5	Nov-27	5	Dec-26	131	85

Notes

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A Accumulated amount.

T Trace Amount.

U.S. Department of Commerce
National Oceanic & Atmospheric Administration
National Environmental Satellite, Data, and Information Service

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Station: **BOSTON LOGAN INTERNATIONAL AIRPORT, MA US USW00014739**

Global Summary of the Year
2002 - 2002
Generated on 02/22/2023

Date	Temperature (Fahrenheit)			Degree Days (Base 65 degrees)		Extremes				
Elem->	TAVG	TMAX	TMIN	HTDD	CLDD	EMXT		EMNT		DX90
Year	Annual Mean Temp	Mean Max Temp	Mean Min Temp	Heating Degree Days	Cooling Degree Days	Extreme Max Temp	Date of Occurrence	Extreme Min Temp	Date of Occurrence	Max Temp >= 90F
2002	52.8	60.5	45.2	4868	946	101	Aug-14	12	Dec-09	27

Notes

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Station: **BOSTON LOGAN INTERNATIONAL AIRPORT, MA US USW00014739**

Global Summary of the Year
2003 - 2003
Generated on 02/22/2023

Date	Liquid Precipitation (Inches)			Frozen Precipitation (Inches)						
Elem->	PRCP	EMXP		SNOW	EMSN		EMSD		DP01	DP10
Year	Total Liquid Content	Extreme Max Precip	Date of Occurrence	Snowfall	Extreme Max Snowfall	Date of Occurrence	Extreme Max Snow Depth	Date of Occurrence	Precip >= 0.01"	Precip >= 0.10"
2003	44.39	2.00	Oct-12	77.8	23.6	Feb-17			139	80

Notes

(Blank) Data element not reported or missing.

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T Trace Amount.

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Global Summary of the Year
2003 - 2003
Generated on 02/22/2023

Date	**Temperature (Fahrenheit)**			**Degree Days (Base 65 degrees)**		**Extremes**				
Elem->	TAVG	TMAX	TMIN	HTDD	CLDD	EMXT		EMNT		DX90
Year	Annual Mean Temp	Mean Max Temp	Mean Min Temp	Heating Degree Days	Cooling Degree Days	Extreme Max Temp	Date of Occurrence	Extreme Min Temp	Date of Occurrence	Max Temp >= 90F
2003	50.2	57.3	43.1	6313	731	93+	Aug-22	0+	Feb-16	6

Notes

(Blank) Data element not reported or missing.

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A Accumulated amount.

T Trace Amount.

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Global Summary of the Year
2004 - 2004
Generated on 02/22/2023

Current Location: Elev: 10 ft. Lat: 42.3606° N Lon: -71.0098° W
Station: **BOSTON LOGAN INTERNATIONAL AIRPORT, MA US USW00014739**

Date	Liquid Precipitation (Inches)			Frozen Precipitation (Inches)						
Elem->	PRCP	EMXP		SNOW	EMSN		EMSD		DP01	DP10
Year	Total Liquid Content	Extreme Max Precip	Date of Occurrence	Snowfall	Extreme Max Snowfall	Date of Occurrence	Extreme Max Snow Depth	Date of Occurrence	Precip >= 0.01"	Precip >= 0.10"
2004	44.60	4.29	Apr-01	29.0	6.5	Mar-16			122	76

Notes

(Blank) Data element not reported or missing.

X Monthly means or totals based on incomplete time series.

\+ Occurred on one or more previous dates during the month. The date in the Date field is the last day of occurrence.

A Accumulated amount.

T Trace Amount.

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National Oceanic & Atmospheric Administration
National Environmental Satellite, Data, and Information Service

Current Location: Elev: 10 ft. Lat: 42.3606° N Lon: -71.0098° W
Station: **BOSTON LOGAN INTERNATIONAL AIRPORT, MA US USW00014739**

Global Summary of the Year
2004 - 2004

Generated on 02/22/2023

Date	Temperature (Fahrenheit)			Degree Days (Base 65 degrees)		Extremes				
Elem->	TAVG	TMAX	TMIN	HTDD	CLDD	EMXT		EMNT		DX90
Year	Annual Mean Temp	Mean Max Temp	Mean Min Temp	Heating Degree Days	Cooling Degree Days	Extreme Max Temp	Date of Occurrence	Extreme Min Temp	Date of Occurrence	Max Temp >= 90F
2004	50.8	58.1	43.4	5716	605	93	Jun-09	-7	Jan-16	4

Notes

(Blank) Data element not reported or missing.

X Monthly means or totals based on incomplete time series.

\+ Occurred on one or more previous dates during the month. The date in the Date field is the last day of occurrence.

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T Trace Amount.

U.S. Department of Commerce
National Oceanic & Atmospheric Administration
National Environmental Satellite, Data, and Information Service

Global Summary of the Year
2005 - 2005
Generated on 02/22/2023

Current Location: Elev: 10 ft. Lat: 42.3606° N Lon: -71.0098° W
Station: **BOSTON LOGAN INTERNATIONAL AIRPORT, MA US USW00014739**

Date	**Liquid Precipitation (Inches)**			**Frozen Precipitation (Inches)**						
Elem->	PRCP	EMXP		SNOW	EMSN		EMSD		DP01	DP10
Year	Total Liquid Content	Extreme Max Precip	Date of Occurrence	Snowfall	Extreme Max Snowfall	Date of Occurrence	Extreme Max Snow Depth	Date of Occurrence	Precip >= 0.01"	Precip >= 0.10"
2005	43.69	2.89	Oct-15	87.4	13.4	Jan-23			135	87

Notes

(Blank) Data element not reported or missing.

X Monthly means or totals based on incomplete time series.

\+ Occurred on one or more previous dates during the month. The date in the Date field is the last day of occurrence.

A Accumulated amount.

T Trace Amount.

U.S. Department of Commerce
National Oceanic & Atmospheric Administration
National Environmental Satellite, Data, and Information Service

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Global Summary of the Year
2005 - 2005
Generated on 02/22/2023

Date	Temperature (Fahrenheit)			Degree Days (Base 65 degrees)		Extremes				
Elem->	TAVG	TMAX	TMIN	HTDD	CLDD	EMXT		EMNT		DX90
Year	Annual Mean Temp	Mean Max Temp	Mean Min Temp	Heating Degree Days	Cooling Degree Days	Extreme Max Temp	Date of Occurrence	Extreme Min Temp	Date of Occurrence	Max Temp >= 90F
2005	51.0	58.2	43.8	5955	866	97	Aug-05	-2	Jan-22	14

Notes

(Blank) Data element not reported or missing.

X Monthly means or totals based on incomplete time series.

\+ Occurred on one or more previous dates during the month. The date in the Date field is the last day of occurrence.

A Accumulated amount.

T Trace Amount.

U.S. Department of Commerce
National Oceanic & Atmospheric Administration
National Environmental Satellite, Data, and Information Service

Current Location: Elev: 10 ft. Lat: 42.3606° N Lon: -71.0098° W
Station: **BOSTON LOGAN INTERNATIONAL AIRPORT, MA US USW00014739**

Global Summary of the Year
2006 - 2006
Generated on 02/22/2023

Date	**Liquid Precipitation (Inches)**			**Frozen Precipitation (Inches)**						
Elem->	PRCP	EMXP		SNOW	EMSN		EMSD		DP01	DP10
Year	Total Liquid Content	Extreme Max Precip	Date of Occurrence	Snowfall	Extreme Max Snowfall	Date of Occurrence	Extreme Max Snow Depth	Date of Occurrence	Precip >= 0.01"	Precip >= 0.10"
2006	52.90	3.84	May-13	29.0	17.5	Feb-12			129	92

Notes

(Blank) Data element not reported or missing.

X Monthly means or totals based on incomplete time series.

\+ Occurred on one or more previous dates during the month. The date in the Date field is the last day of occurrence.

A Accumulated amount.

T Trace Amount.

U.S. Department of Commerce
National Oceanic & Atmospheric Administration
National Environmental Satellite, Data, and Information Service

Global Summary of the Year
2006 - 2006
Generated on 02/22/2023

Current Location: Elev: 10 ft. Lat: 42.3606° N Lon: -71.0098° W
Station: **BOSTON LOGAN INTERNATIONAL AIRPORT, MA US USW00014739**

Date	Temperature (Fahrenheit)			Degree Days (Base 65 degrees)		Extremes				
Elem->	TAVG	TMAX	TMIN	HTDD	CLDD	EMXT		EMNT		DX90
Year	Annual Mean Temp	Mean Max Temp	Mean Min Temp	Heating Degree Days	Cooling Degree Days	Extreme Max Temp	Date of Occurrence	Extreme Min Temp	Date of Occurrence	Max Temp >= 90F
2006	53.1	60.5	45.8	5395	782	98	Aug-02	7	Feb-27	11

Notes

(Blank) Data element not reported or missing.

X Monthly means or totals based on incomplete time series.

\+ Occurred on one or more previous dates during the month. The date in the Date field is the last day of occurrence.

A Accumulated amount.

T Trace Amount.

U.S. Department of Commerce
National Oceanic & Atmospheric Administration
National Environmental Satellite, Data, and Information Service

Global Summary of the Year
2007 - 2007
Generated on 02/22/2023

Current Location: Elev: 10 ft. Lat: 42.3606° N Lon: -71.0098° W
Station: **BOSTON LOGAN INTERNATIONAL AIRPORT, MA US USW00014739**

Date	Liquid Precipitation (Inches)			Frozen Precipitation (Inches)						
Elem->	PRCP	EMXP		SNOW	EMSN		EMSD		DP01	DP10
Year	Total Liquid Content	Extreme Max Precip	Date of Occurrence	Snowfall	Extreme Max Snowfall	Date of Occurrence	Extreme Max Snow Depth	Date of Occurrence	Precip >= 0.01"	Precip >= 0.10"
2007	39.48	2.32	Jul-28	43.3	10.1	Dec-13			123	66

Notes

(Blank) Data element not reported or missing.

X Monthly means or totals based on incomplete time series.

\+ Occurred on one or more previous dates during the month. The date in the Date field is the last day of occurrence.

A Accumulated amount.

T Trace Amount.

U.S. Department of Commerce
National Oceanic & Atmospheric Administration
National Environmental Satellite, Data, and Information Service

Current Location: Elev: 10 ft. Lat: 42.3606° N Lon: -71.0098° W
Station: **BOSTON LOGAN INTERNATIONAL AIRPORT, MA US USW00014739**

Global Summary of the Year
2007 - 2007
Generated on 02/22/2023

Date	Temperature (Fahrenheit)			Degree Days (Base 65 degrees)		Extremes				
Elem->	TAVG	TMAX	TMIN	HTDD	CLDD	EMXT		EMNT		DX90
Year	Annual Mean Temp	Mean Max Temp	Mean Min Temp	Heating Degree Days	Cooling Degree Days	Extreme Max Temp	Date of Occurrence	Extreme Min Temp	Date of Occurrence	Max Temp >= 90F
2007	51.6	59.3	43.9	5407	882	96+	Aug-25	3	Jan-26	18

Notes

(Blank) Data element not reported or missing.

X Monthly means or totals based on incomplete time series.

\+ Occurred on one or more previous dates during the month. The date in the Date field is the last day of occurrence.

A Accumulated amount.

T Trace Amount.

U.S. Department of Commerce
National Oceanic & Atmospheric Administration
National Environmental Satellite, Data, and Information Service

Current Location: Elev: 10 ft. Lat: 42.3606° N Lon: -71.0098° W

Station: **BOSTON LOGAN INTERNATIONAL AIRPORT, MA US USW00014739**

Global Summary of the Year
2008 - 2008
Generated on 02/22/2023

Date	Liquid Precipitation (Inches)			Frozen Precipitation (Inches)						
Elem->	PRCP	EMXP		SNOW	EMSN		EMSD		DP01	DP10
Year	Total Liquid Content	Extreme Max Precip	Date of Occurrence	Snowfall	Extreme Max Snowfall	Date of Occurrence	Extreme Max Snow Depth	Date of Occurrence	Precip >= 0.01"	Precip >= 0.10"
2008	54.51	2.66	Feb-13	49.6	8.9	Feb-22			133	92

Notes

(Blank) Data element not reported or missing.

X Monthly means or totals based on incomplete time series.

\+ Occurred on one or more previous dates during the month. The date in the Date field is the last day of occurrence.

A Accumulated amount.

T Trace Amount.

U.S. Department of Commerce
National Oceanic & Atmospheric Administration
National Environmental Satellite, Data, and Information Service

Global Summary of the Year
2008 - 2008
Generated on 02/22/2023

Current Location: Elev: 10 ft. Lat: 42.3606° N Lon: -71.0098° W
Station: **BOSTON LOGAN INTERNATIONAL AIRPORT, MA US USW00014739**

Date	**Temperature (Fahrenheit)**			**Degree Days (Base 65 degrees)**		**Extremes**				
Elem->	TAVG	TMAX	TMIN	HTDD	CLDD	EMXT		EMNT		DX90
Year	Annual Mean Temp	Mean Max Temp	Mean Min Temp	Heating Degree Days	Cooling Degree Days	Extreme Max Temp	Date of Occurrence	Extreme Min Temp	Date of Occurrence	Max Temp >= 90F
2008	52.0	59.3	44.7	5434	763	95+	Jul-19	7	Jan-03	8

Notes

(Blank) Data element not reported or missing.

X Monthly means or totals based on incomplete time series.

\+ Occurred on one or more previous dates during the month. The date in the Date field is the last day of occurrence.

A Accumulated amount.

T Trace Amount.

U.S. Department of Commerce
National Oceanic & Atmospheric Administration
National Environmental Satellite, Data, and Information Service

Current Location: Elev: 10 ft. Lat: 42.3606° N Lon: -71.0098° W
Station: **BOSTON LOGAN INTERNATIONAL AIRPORT, MA US USW00014739**

Global Summary of the Year
2009 - 2009
Generated on 02/22/2023

Date	Liquid Precipitation (Inches)			Frozen Precipitation (Inches)						
Elem->	PRCP	EMXP		SNOW	EMSN		EMSD		DP01	DP10
Year	Total Liquid Content	Extreme Max Precip	Date of Occurrence	Snowfall	Extreme Max Snowfall	Date of Occurrence	Extreme Max Snow Depth	Date of Occurrence	Precip >= 0.01"	Precip >= 0.10"
2009	43.52	2.11	Sep-12	56.0	10.0	Dec-20			131	80

Notes

(Blank) Data element not reported or missing.

X Monthly means or totals based on incomplete time series.

\+ Occurred on one or more previous dates during the month. The date in the Date field is the last day of occurrence.

A Accumulated amount.

T Trace Amount.

U.S. Department of Commerce
National Oceanic & Atmospheric Administration
National Environmental Satellite, Data, and Information Service

Global Summary of the Year
2009 - 2009
Generated on 02/22/2023

Current Location: Elev: 10 ft. Lat: 42.3606° N Lon: -71.0098° W
Station: **BOSTON LOGAN INTERNATIONAL AIRPORT, MA US USW00014739**

Date	Temperature (Fahrenheit)			Degree Days (Base 65 degrees)		Extremes				
Elem->	TAVG	TMAX	TMIN	HTDD	CLDD	EMXT		EMNT		DX90
Year	Annual Mean Temp	Mean Max Temp	Mean Min Temp	Heating Degree Days	Cooling Degree Days	Extreme Max Temp	Date of Occurrence	Extreme Min Temp	Date of Occurrence	Max Temp >= 90F
2009	50.8	57.9	43.7	5731	572	95	Aug-18	6+	Jan-16	6

Notes

(Blank) Data element not reported or missing.

X Monthly means or totals based on incomplete time series.

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A Accumulated amount.

T Trace Amount.

U.S. Department of Commerce
National Oceanic & Atmospheric Administration
National Environmental Satellite, Data, and Information Service

Current Location: Elev: 10 ft. Lat: 42.3606° N Lon: -71.0098° W
Station: **BOSTON LOGAN INTERNATIONAL AIRPORT, MA US USW00014739**

Global Summary of the Year
2010 - 2010
Generated on 02/22/2023

Date	Liquid Precipitation (Inches)			Frozen Precipitation (Inches)						
Elem->	PRCP	EMXP		SNOW	EMSN		EMSD		DP01	DP10
Year	Total Liquid Content	Extreme Max Precip	Date of Occurrence	Snowfall	Extreme Max Snowfall	Date of Occurrence	Extreme Max Snow Depth	Date of Occurrence	Precip >= 0.01"	Precip >= 0.10"
2010	49.67	3.40	Mar-14	42.4	9.9	Dec-26			112	67

Notes

(Blank) Data element not reported or missing.

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A Accumulated amount.

T Trace Amount.

U.S. Department of Commerce
National Oceanic & Atmospheric Administration
National Environmental Satellite, Data, and Information Service

Global Summary of the Year
2010 - 2010
Generated on 02/22/2023

Current Location: Elev: 10 ft. Lat: 42.3606° N Lon: -71.0098° W
Station: **BOSTON LOGAN INTERNATIONAL AIRPORT, MA US USW00014739**

Date	**Temperature (Fahrenheit)**			**Degree Days (Base 65 degrees)**		**Extremes**				
Elem->	TAVG	TMAX	TMIN	HTDD	CLDD	EMXT		EMNT		DX90
Year	Annual Mean Temp	Mean Max Temp	Mean Min Temp	Heating Degree Days	Cooling Degree Days	Extreme Max Temp	Date of Occurrence	Extreme Min Temp	Date of Occurrence	Max Temp >= 90F
2010	53.8	61.1	46.4	5154	1050	100	Jul-06	6	Jan-30	25

Notes

(Blank) Data element not reported or missing.

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A Accumulated amount.

T Trace Amount.

U.S. Department of Commerce
National Oceanic & Atmospheric Administration
National Environmental Satellite, Data, and Information Service

Global Summary of the Year
2011 - 2011
Generated on 02/22/2023

Current Location: Elev: 10 ft. Lat: 42.3606° N Lon: -71.0098° W
Station: **BOSTON LOGAN INTERNATIONAL AIRPORT, MA US USW00014739**

Date	**Liquid Precipitation (Inches)**			**Frozen Precipitation (Inches)**						
Elem->	PRCP	EMXP		SNOW	EMSN		EMSD		DP01	DP10
Year	Total Liquid Content	Extreme Max Precip	Date of Occurrence	Snowfall	Extreme Max Snowfall	Date of Occurrence	Extreme Max Snow Depth	Date of Occurrence	Precip >= 0.01"	Precip >= 0.10"
2011	52.42	1.82	Jun-22	60.0	14.6	Jan-12			138	86

Notes

(Blank) Data element not reported or missing.

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A Accumulated amount.

T Trace Amount.

U.S. Department of Commerce
National Oceanic & Atmospheric Administration
National Environmental Satellite, Data, and Information Service

Current Location: Elev: 10 ft. Lat: 42.3606° N Lon: -71.0098° W
Station: **BOSTON LOGAN INTERNATIONAL AIRPORT, MA US USW00014739**

Global Summary of the Year
2011 - 2011
Generated on 02/22/2023

Date	**Temperature (Fahrenheit)**			**Degree Days (Base 65 degrees)**		**Extremes**				
Elem->	TAVG	TMAX	TMIN	HTDD	CLDD	EMXT		EMNT		DX90
Year	Annual Mean Temp	Mean Max Temp	Mean Min Temp	Heating Degree Days	Cooling Degree Days	Extreme Max Temp	Date of Occurrence	Extreme Min Temp	Date of Occurrence	Max Temp >= 90F
2011	53.3	60.6	46.0	5634	981	103	Jul-22	-2	Jan-24	13

Notes

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A Accumulated amount.

T Trace Amount.

U.S. Department of Commerce
National Oceanic & Atmospheric Administration
National Environmental Satellite, Data, and Information Service

Global Summary of the Year
2012 - 2012
Generated on 02/22/2023

Current Location: Elev: 10 ft. Lat: 42.3606° N Lon: -71.0098° W
Station: **BOSTON LOGAN INTERNATIONAL AIRPORT, MA US USW00014739**

Date	Liquid Precipitation (Inches)			Frozen Precipitation (Inches)						
Elem->	PRCP	EMXP		SNOW	EMSN		EMSD		DP01	DP10
Year	Total Liquid Content	Extreme Max Precip	Date of Occurrence	Snowfall	Extreme Max Snowfall	Date of Occurrence	Extreme Max Snow Depth	Date of Occurrence	Precip >= 0.01"	Precip >= 0.10"
2012	36.75	1.74	Jul-18	12.2	2.9	Jan-21			122	63

Notes

(Blank) Data element not reported or missing.

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A Accumulated amount.

T Trace Amount.

U.S. Department of Commerce
National Oceanic & Atmospheric Administration
National Environmental Satellite, Data, and Information Service

Global Summary of the Year
2012 - 2012
Generated on 02/22/2023

Current Location: Elev: 10 ft. Lat: 42.3606° N Lon: -71.0098° W
Station: **BOSTON LOGAN INTERNATIONAL AIRPORT, MA US USW00014739**

Date	Temperature (Fahrenheit)			Degree Days (Base 65 degrees)		Extremes				
Elem->	TAVG	TMAX	TMIN	HTDD	CLDD	EMXT		EMNT		DX90
Year	Annual Mean Temp	Mean Max Temp	Mean Min Temp	Heating Degree Days	Cooling Degree Days	Extreme Max Temp	Date of Occurrence	Extreme Min Temp	Date of Occurrence	Max Temp >= 90F
2012	54.2	61.4	46.9	4479	880	97+	Jul-17	6	Jan-15	12

Notes

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A Accumulated amount.

T Trace Amount.

U.S. Department of Commerce
National Oceanic & Atmospheric Administration
National Environmental Satellite, Data, and Information Service

Current Location: Elev: 10 ft. Lat: 42.3606° N Lon: -71.0098° W
Station: **BOSTON LOGAN INTERNATIONAL AIRPORT, MA US USW00014739**

Global Summary of the Year
2013 - 2013

Generated on 02/22/2023

Date	Liquid Precipitation (Inches)			Frozen Precipitation (Inches)						
Elem->	PRCP	EMXP		SNOW	EMSN		EMSD		DP01	DP10
Year	Total Liquid Content	Extreme Max Precip	Date of Occurrence	Snowfall	Extreme Max Snowfall	Date of Occurrence	Extreme Max Snow Depth	Date of Occurrence	Precip >= 0.01"	Precip >= 0.10"
2013	40.43	3.07	Jun-07	71.4	14.8	Feb-09			129	67

Notes

(Blank) Data element not reported or missing.

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A Accumulated amount.

T Trace Amount.

U.S. Department of Commerce
National Oceanic & Atmospheric Administration
National Environmental Satellite, Data, and Information Service

Current Location: Elev: 10 ft. Lat: 42.3606° N Lon: -71.0098° W
Station: **BOSTON LOGAN INTERNATIONAL AIRPORT, MA US USW00014739**

Global Summary of the Year
2013 - 2013
Generated on 02/22/2023

Date	Temperature (Fahrenheit)			Degree Days (Base 65 degrees)		Extremes				
Elem->	TAVG	TMAX	TMIN	HTDD	CLDD	EMXT		EMNT		DX90
Year	Annual Mean Temp	Mean Max Temp	Mean Min Temp	Heating Degree Days	Cooling Degree Days	Extreme Max Temp	Date of Occurrence	Extreme Min Temp	Date of Occurrence	Max Temp >= 90F
2013	52.0	59.5	44.5	5427	897	99	Jul-19	4	Jan-24	18

Notes

(Blank) Data element not reported or missing.

X Monthly means or totals based on incomplete time series.

\+ Occurred on one or more previous dates during the month. The date in the Date field is the last day of occurrence.

A Accumulated amount.

T Trace Amount.

U.S. Department of Commerce
National Oceanic & Atmospheric Administration
National Environmental Satellite, Data, and Information Service

Current Location: Elev: 10 ft. Lat: 42.3606° N Lon: -71.0098° W
Station: **BOSTON LOGAN INTERNATIONAL AIRPORT, MA US USW00014739**

Global Summary of the Year
2014 - 2014
Generated on 02/22/2023

Date	Liquid Precipitation (Inches)			Frozen Precipitation (Inches)						
Elem->	PRCP	EMXP		SNOW	EMSN		EMSD		DP01	DP10
Year	Total Liquid Content	Extreme Max Precip	Date of Occurrence	Snowfall	Extreme Max Snowfall	Date of Occurrence	Extreme Max Snow Depth	Date of Occurrence	Precip >= 0.01"	Precip >= 0.10"
2014	45.29	2.90	Dec-09	50.2	10.7	Feb-05			127	80

Notes

(Blank) Data element not reported or missing.

X Monthly means or totals based on incomplete time series.

\+ Occurred on one or more previous dates during the month. The date in the Date field is the last day of occurrence.

A Accumulated amount.

T Trace Amount.

U.S. Department of Commerce
National Oceanic & Atmospheric Administration
National Environmental Satellite, Data, and Information Service

Current Location: Elev: 10 ft. Lat: 42.3606° N Lon: -71.0098° W
Station: **BOSTON LOGAN INTERNATIONAL AIRPORT, MA US USW00014739**

Global Summary of the Year
2014 - 2014
Generated on 02/22/2023

Date	**Temperature (Fahrenheit)**			**Degree Days (Base 65 degrees)**		**Extremes**				
Elem->	TAVG	TMAX	TMIN	HTDD	CLDD	EMXT		EMNT		DX90
Year	Annual Mean Temp	Mean Max Temp	Mean Min Temp	Heating Degree Days	Cooling Degree Days	Extreme Max Temp	Date of Occurrence	Extreme Min Temp	Date of Occurrence	Max Temp >= 90F
2014	51.1	58.5	43.7	5911	737	93	Sep-02	2+	Jan-04	8

Notes

(Blank) Data element not reported or missing.

X Monthly means or totals based on incomplete time series.

\+ Occurred on one or more previous dates during the month. The date in the Date field is the last day of occurrence.

A Accumulated amount.

T Trace Amount.

U.S. Department of Commerce
National Oceanic & Atmospheric Administration
National Environmental Satellite, Data, and Information Service

Current Location: Elev: 10 ft. Lat: 42.3606° N Lon: -71.0098° W
Station: **BOSTON LOGAN INTERNATIONAL AIRPORT, MA US USW00014739**

Global Summary of the Year
2015 - 2015
Generated on 02/22/2023

Date	Liquid Precipitation (Inches)			Frozen Precipitation (Inches)						
Elem->	PRCP	EMXP		SNOW	EMSN		EMSD		DP01	DP10
Year	Total Liquid Content	Extreme Max Precip	Date of Occurrence	Snowfall	Extreme Max Snowfall	Date of Occurrence	Extreme Max Snow Depth	Date of Occurrence	Precip >= 0.01"	Precip >= 0.10"
2015	34.81	2.46	Sep-30	108.6	22.1	Jan-27			123	67

Notes

(Blank) Data element not reported or missing.

X Monthly means or totals based on incomplete time series.

\+ Occurred on one or more previous dates during the month. The date in the Date field is the last day of occurrence.

A Accumulated amount.

T Trace Amount.

U.S. Department of Commerce
National Oceanic & Atmospheric Administration
National Environmental Satellite, Data, and Information Service

Current Location: Elev: 10 ft. Lat: 42.3606° N Lon: -71.0098° W
Station: **BOSTON LOGAN INTERNATIONAL AIRPORT, MA US USW00014739**

Global Summary of the Year
2015 - 2015
Generated on 02/22/2023

Date	Temperature (Fahrenheit)			Degree Days (Base 65 degrees)		Extremes				
Elem->	TAVG	TMAX	TMIN	HTDD	CLDD	EMXT		EMNT		DX90
Year	Annual Mean Temp	Mean Max Temp	Mean Min Temp	Heating Degree Days	Cooling Degree Days	Extreme Max Temp	Date of Occurrence	Extreme Min Temp	Date of Occurrence	Max Temp >= 90F
2015	51.6	59.5	43.7	6086	893	96	Sep-08	-3	Feb-16	14

Notes

(Blank) Data element not reported or missing.

X Monthly means or totals based on incomplete time series.

\+ Occurred on one or more previous dates during the month. The date in the Date field is the last day of occurrence.

A Accumulated amount.

T Trace Amount.

U.S. Department of Commerce
National Oceanic & Atmospheric Administration
National Environmental Satellite, Data, and Information Service

Current Location: Elev: 10 ft. Lat: 42.3606° N Lon: -71.0098° W

Station: **BOSTON LOGAN INTERNATIONAL AIRPORT, MA US USW00014739**

Global Summary of the Year
2016 - 2016
Generated on 02/22/2023

Date	Liquid Precipitation (Inches)			Frozen Precipitation (Inches)						
Elem->	PRCP	EMXP		SNOW	EMSN		EMSD		DP01	DP10
Year	Total Liquid Content	Extreme Max Precip	Date of Occurrence	Snowfall	Extreme Max Snowfall	Date of Occurrence	Extreme Max Snow Depth	Date of Occurrence	Precip >= 0.01"	Precip >= 0.10"
2016	33.09	1.84	Oct-09	41.2	6.8	Feb-05			117	67

Notes

(Blank) Data element not reported or missing.

X Monthly means or totals based on incomplete time series.

\+ Occurred on one or more previous dates during the month. The date in the Date field is the last day of occurrence.

A Accumulated amount.

T Trace Amount.

U.S. Department of Commerce
National Oceanic & Atmospheric Administration
National Environmental Satellite, Data, and Information Service

Global Summary of the Year
2016 - 2016
Generated on 02/22/2023

Current Location: Elev: 10 ft. Lat: 42.3606° N Lon: -71.0098° W
Station: **BOSTON LOGAN INTERNATIONAL AIRPORT, MA US USW00014739**

Date	**Temperature (Fahrenheit)**			**Degree Days (Base 65 degrees)**		**Extremes**				
Elem->	TAVG	TMAX	TMIN	HTDD	CLDD	EMXT		EMNT		DX90
Year	Annual Mean Temp	Mean Max Temp	Mean Min Temp	Heating Degree Days	Cooling Degree Days	Extreme Max Temp	Date of Occurrence	Extreme Min Temp	Date of Occurrence	Max Temp >= 90F
2016	53.4	61.1	45.7	4861	1005	98+	Aug-12	-9	Feb-14	22

Notes

(Blank) Data element not reported or missing.

X Monthly means or totals based on incomplete time series.

\+ Occurred on one or more previous dates during the month. The date in the Date field is the last day of occurrence.

A Accumulated amount.

T Trace Amount.

U.S. Department of Commerce
National Oceanic & Atmospheric Administration
National Environmental Satellite, Data, and Information Service

Current Location: Elev: 10 ft. Lat: 42.3606° N Lon: -71.0098° W
Station: **BOSTON LOGAN INTERNATIONAL AIRPORT, MA US USW00014739**

Global Summary of the Year
2017 - 2017
Generated on 02/22/2023

Date	Liquid Precipitation (Inches)			Frozen Precipitation (Inches)						
Elem->	PRCP	EMXP		SNOW	EMSN		EMSD		DP01	DP10
Year	Total Liquid Content	Extreme Max Precip	Date of Occurrence	Snowfall	Extreme Max Snowfall	Date of Occurrence	Extreme Max Snow Depth	Date of Occurrence	Precip >= 0.01"	Precip >= 0.10"
2017	43.49	2.13	Jun-16	50.9	10.9	Feb-09			138	76

Notes

(Blank) Data element not reported or missing.

X Monthly means or totals based on incomplete time series.

\+ Occurred on one or more previous dates during the month. The date in the Date field is the last day of occurrence.

A Accumulated amount.

T Trace Amount.

U.S. Department of Commerce
National Oceanic & Atmospheric Administration
National Environmental Satellite, Data, and Information Service

Current Location: Elev: 10 ft. Lat: 42.3606° N Lon: -71.0098° W
Station: **BOSTON LOGAN INTERNATIONAL AIRPORT, MA US USW00014739**

Global Summary of the Year
2017 - 2017
Generated on 02/22/2023

Date	Temperature (Fahrenheit)			Degree Days (Base 65 degrees)		Extremes				
Elem->	TAVG	TMAX	TMIN	HTDD	CLDD	EMXT		EMNT		DX90
Year	Annual Mean Temp	Mean Max Temp	Mean Min Temp	Heating Degree Days	Cooling Degree Days	Extreme Max Temp	Date of Occurrence	Extreme Min Temp	Date of Occurrence	Max Temp >= 90F
2017	52.6	59.9	45.2	5308	851	95+	Jun-13	2	Dec-29	12

Notes

(Blank) Data element not reported or missing.

X Monthly means or totals based on incomplete time series.

\+ Occurred on one or more previous dates during the month. The date in the Date field is the last day of occurrence.

A Accumulated amount.

T Trace Amount.

U.S. Department of Commerce
National Oceanic & Atmospheric Administration
National Environmental Satellite, Data, and Information Service

Current Location: Elev: 10 ft. Lat: 42.3606° N Lon: -71.0098° W
Station: **BOSTON LOGAN INTERNATIONAL AIRPORT, MA US USW00014739**

Global Summary of the Year
2018 - 2018
Generated on 02/22/2023

Date	Liquid Precipitation (Inches)			Frozen Precipitation (Inches)						
Elem->	PRCP	EMXP		SNOW	EMSN		EMSD		DP01	DP10
Year	Total Liquid Content	Extreme Max Precip	Date of Occurrence	Snowfall	Extreme Max Snowfall	Date of Occurrence	Extreme Max Snow Depth	Date of Occurrence	Precip >= 0.01"	Precip >= 0.10"
2018	53.34	2.68	Jul-17	51.0	14.5	Mar-13			143	90

Notes

(Blank) Data element not reported or missing.

X Monthly means or totals based on incomplete time series.

\+ Occurred on one or more previous dates during the month. The date in the Date field is the last day of occurrence.

A Accumulated amount.

T Trace Amount.

U.S. Department of Commerce
National Oceanic & Atmospheric Administration
National Environmental Satellite, Data, and Information Service

Current Location: Elev: 10 ft. Lat: 42.3606° N Lon: -71.0098° W
Station: **BOSTON LOGAN INTERNATIONAL AIRPORT, MA US USW00014739**

Global Summary of the Year
2018 - 2018
Generated on 02/22/2023

Date	Temperature (Fahrenheit)			Degree Days (Base 65 degrees)		Extremes				
Elem->	TAVG	TMAX	TMIN	HTDD	CLDD	EMXT		EMNT		DX90
Year	Annual Mean Temp	Mean Max Temp	Mean Min Temp	Heating Degree Days	Cooling Degree Days	Extreme Max Temp	Date of Occurrence	Extreme Min Temp	Date of Occurrence	Max Temp >= 90F
2018	53.0	60.3	45.7	5449	1106	98+	Aug-29	-2	Jan-07	23

Notes

(Blank) Data element not reported or missing.

X Monthly means or totals based on incomplete time series.

\+ Occurred on one or more previous dates during the month. The date in the Date field is the last day of occurrence.

A Accumulated amount.

T Trace Amount.

U.S. Department of Commerce
National Oceanic & Atmospheric Administration
National Environmental Satellite, Data, and Information Service

Current Location: Elev: 10 ft. Lat: 42.3606° N Lon: -71.0098° W
Station: **BOSTON LOGAN INTERNATIONAL AIRPORT, MA US USW00014739**

Global Summary of the Year
2019 - 2019

Generated on 02/22/2023

Date	Liquid Precipitation (Inches)			Frozen Precipitation (Inches)						
Elem->	PRCP	EMXP		SNOW	EMSN		EMSD		DP01	DP10
Year	Total Liquid Content	Extreme Max Precip	Date of Occurrence	Snowfall	Extreme Max Snowfall	Date of Occurrence	Extreme Max Snow Depth	Date of Occurrence	Precip >= 0.01"	Precip >= 0.10"
2019	50.44	2.30	Apr-22	38.7	9.9	Mar-04			155	99

Notes

(Blank) Data element not reported or missing.

X Monthly means or totals based on incomplete time series.

\+ Occurred on one or more previous dates during the month. The date in the Date field is the last day of occurrence.

A Accumulated amount.

T Trace Amount.

U.S. Department of Commerce
National Oceanic & Atmospheric Administration
National Environmental Satellite, Data, and Information Service

Global Summary of the Year
2019 - 2019
Generated on 02/22/2023

Current Location: Elev: 10 ft. Lat: 42.3606° N Lon: -71.0098° W
Station: **BOSTON LOGAN INTERNATIONAL AIRPORT, MA US USW00014739**

Date	Temperature (Fahrenheit)			Degree Days (Base 65 degrees)		Extremes				
Elem->	TAVG	TMAX	TMIN	HTDD	CLDD	EMXT		EMNT		DX90
Year	Annual Mean Temp	Mean Max Temp	Mean Min Temp	Heating Degree Days	Cooling Degree Days	Extreme Max Temp	Date of Occurrence	Extreme Min Temp	Date of Occurrence	Max Temp >= 90F
2019	53.3	60.7	45.9	5310	980	98	Jul-21	5+	Jan-31	15

Notes

(Blank) Data element not reported or missing.

X Monthly means or totals based on incomplete time series.

\+ Occurred on one or more previous dates during the month. The date in the Date field is the last day of occurrence.

A Accumulated amount.

T Trace Amount.

U.S. Department of Commerce
National Oceanic & Atmospheric Administration
National Environmental Satellite, Data, and Information Service

Current Location: Elev: 10 ft. Lat: 42.3606° N Lon: -71.0098° W
Station: **BOSTON LOGAN INTERNATIONAL AIRPORT, MA US USW00014739**

Global Summary of the Year
2020 - 2020
Generated on 02/22/2023

Date	Liquid Precipitation (Inches)			Frozen Precipitation (Inches)						
Elem->	PRCP	EMXP		SNOW	EMSN		EMSD		DP01	DP10
Year	Total Liquid Content	Extreme Max Precip	Date of Occurrence	Snowfall	Extreme Max Snowfall	Date of Occurrence	Extreme Max Snow Depth	Date of Occurrence	Precip >= 0.01"	Precip >= 0.10"
2020	37.57	1.81	Nov-23	21.6	12.3	Dec-17			117	70

Notes

(Blank) Data element not reported or missing.

X Monthly means or totals based on incomplete time series.

\+ Occurred on one or more previous dates during the month. The date in the Date field is the last day of occurrence.

A Accumulated amount.

T Trace Amount.

U.S. Department of Commerce
National Oceanic & Atmospheric Administration
National Environmental Satellite, Data, and Information Service

Current Location: Elev: 10 ft. Lat: 42.3606° N Lon: -71.0098° W
Station: **BOSTON LOGAN INTERNATIONAL AIRPORT, MA US USW00014739**

Global Summary of the Year
2020 - 2020
Generated on 02/22/2023

Date	**Temperature (Fahrenheit)**			**Degree Days (Base 65 degrees)**		**Extremes**				
Elem->	TAVG	TMAX	TMIN	HTDD	CLDD	EMXT		EMNT		DX90
Year	Annual Mean Temp	Mean Max Temp	Mean Min Temp	Heating Degree Days	Cooling Degree Days	Extreme Max Temp	Date of Occurrence	Extreme Min Temp	Date of Occurrence	Max Temp >= 90F
2020	53.5	61.1	45.9	5083	896	95+	Jul-28	12	Feb-15	14

Notes

(Blank) Data element not reported or missing.

X Monthly means or totals based on incomplete time series.

\+ Occurred on one or more previous dates during the month. The date in the Date field is the last day of occurrence.

A Accumulated amount.

T Trace Amount.

U.S. Department of Commerce
National Oceanic & Atmospheric Administration
National Environmental Satellite, Data, and Information Service

Global Summary of the Year
2021 - 2021
Generated on 02/22/2023

Current Location: Elev: 10 ft. Lat: 42.3606° N Lon: -71.0098° W
Station: **BOSTON LOGAN INTERNATIONAL AIRPORT, MA US USW00014739**

Date	**Liquid Precipitation (Inches)**			**Frozen Precipitation (Inches)**						
Elem->	PRCP	EMXP		SNOW	EMSN		EMSD		DP01	DP10
Year	Total Liquid Content	Extreme Max Precip	Date of Occurrence	Snowfall	Extreme Max Snowfall	Date of Occurrence	Extreme Max Snow Depth	Date of Occurrence	Precip >= 0.01"	Precip >= 0.10"
2021	52.37	2.54	Sep-02	21.8	5.3	Feb-07			134	87

Notes

(Blank) Data element not reported or missing.

X Monthly means or totals based on incomplete time series.

\+ Occurred on one or more previous dates during the month. The date in the Date field is the last day of occurrence.

A Accumulated amount.

T Trace Amount.

U.S. Department of Commerce
National Oceanic & Atmospheric Administration
National Environmental Satellite, Data, and Information Service

Global Summary of the Year
2021 - 2021
Generated on 02/22/2023

Current Location: Elev: 10 ft. Lat: 42.3606° N Lon: -71.0098° W
Station: **BOSTON LOGAN INTERNATIONAL AIRPORT, MA US USW00014739**

Date	Temperature (Fahrenheit)			Degree Days (Base 65 degrees)		Extremes				
Elem->	TAVG	TMAX	TMIN	HTDD	CLDD	EMXT		EMNT		DX90
Year	Annual Mean Temp	Mean Max Temp	Mean Min Temp	Heating Degree Days	Cooling Degree Days	Extreme Max Temp	Date of Occurrence	Extreme Min Temp	Date of Occurrence	Max Temp >= 90F
2021	54.4	61.7	47.2	5124	1116	100	Jun-30	7+	Jan-31	24

Notes

(Blank) Data element not reported or missing.

X Monthly means or totals based on incomplete time series.

\+ Occurred on one or more previous dates during the month. The date in the Date field is the last day of occurrence.

A Accumulated amount.

T Trace Amount.

U.S. Department of Commerce
National Oceanic & Atmospheric Administration
National Environmental Satellite, Data, and Information Service

Current Location: Elev: 10 ft. Lat: 42.3606° N Lon: -71.0098° W
Station: **BOSTON LOGAN INTERNATIONAL AIRPORT, MA US USW00014739**

Global Summary of the Year
2022 - 2022
Generated on 02/22/2023

Date	Liquid Precipitation (Inches)			Frozen Precipitation (Inches)						
Elem->	PRCP	EMXP		SNOW	EMSN		EMSD		DP01	DP10
Year	Total Liquid Content	Extreme Max Precip	Date of Occurrence	Snowfall	Extreme Max Snowfall	Date of Occurrence	Extreme Max Snow Depth	Date of Occurrence	Precip >= 0.01"	Precip >= 0.10"
2022	31.30	1.87	Feb-04	54.6	23.6	Jan-29			122	72

Notes

(Blank) Data element not reported or missing.

X Monthly means or totals based on incomplete time series.

\+ Occurred on one or more previous dates during the month. The date in the Date field is the last day of occurrence.

A Accumulated amount.

T Trace Amount.

U.S. Department of Commerce
National Oceanic & Atmospheric Administration
National Environmental Satellite, Data, and Information Service

Current Location: Elev: 10 ft. Lat: 42.3606° N Lon: -71.0098° W
Station: **BOSTON LOGAN INTERNATIONAL AIRPORT, MA US USW00014739**

Global Summary of the Year
2022 - 2022

Generated on 02/22/2023

Date	**Temperature (Fahrenheit)**			**Degree Days (Base 65 degrees)**		**Extremes**				
Elem->	TAVG	TMAX	TMIN	HTDD	CLDD	EMXT		EMNT		DX90
Year	Annual Mean Temp	Mean Max Temp	Mean Min Temp	Heating Degree Days	Cooling Degree Days	Extreme Max Temp	Date of Occurrence	Extreme Min Temp	Date of Occurrence	Max Temp >= 90F
2022	53.6	61.5	45.6	5057	1006	100	Jul-24	4	Jan-15	21

Notes

(Blank) Data element not reported or missing.

X Monthly means or totals based on incomplete time series.

\+ Occurred on one or more previous dates during the month. The date in the Date field is the last day of occurrence.

A Accumulated amount.

T Trace Amount.

Flood Risk Assessment

Attachment 2 – Revere, MA Precipitation Frequency Data

NOAA Atlas 14, Volume 10, Version 3
Location name: Revere, Massachusetts, USA*
Latitude: 42.3961°, Longitude: -71.009°
Elevation: 10.2 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Sandra Pavlovic, Michael St. Laurent, Carl Trypaluk, Dale Unruh, Orlan Wilhite

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.298 (0.240-0.370)	0.367 (0.294-0.456)	0.479 (0.383-0.597)	0.571 (0.453-0.716)	0.698 (0.535-0.924)	0.792 (0.594-1.08)	0.894 (0.650-1.27)	1.02 (0.689-1.47)	1.20 (0.780-1.80)	1.36 (0.860-2.08)
10-min	0.423 (0.339-0.525)	0.519 (0.416-0.645)	0.677 (0.541-0.845)	0.808 (0.641-1.01)	0.989 (0.757-1.31)	1.12 (0.841-1.52)	1.27 (0.921-1.80)	1.44 (0.976-2.08)	1.70 (1.11-2.55)	1.93 (1.22-2.95)
15-min	0.497 (0.399-0.617)	0.611 (0.490-0.759)	0.797 (0.636-0.994)	0.951 (0.754-1.19)	1.16 (0.891-1.54)	1.32 (0.990-1.79)	1.49 (1.08-2.12)	1.69 (1.15-2.44)	2.00 (1.30-3.00)	2.27 (1.43-3.47)
30-min	0.668 (0.536-0.829)	0.822 (0.659-1.02)	1.07 (0.856-1.34)	1.28 (1.02-1.61)	1.57 (1.20-2.08)	1.78 (1.34-2.42)	2.01 (1.46-2.86)	2.29 (1.55-3.30)	2.71 (1.76-4.06)	3.06 (1.94-4.69)
60-min	0.839 (0.673-1.04)	1.03 (0.827-1.28)	1.35 (1.08-1.68)	1.61 (1.28-2.02)	1.97 (1.51-2.61)	2.24 (1.68-3.04)	2.53 (1.84-3.60)	2.88 (1.95-4.15)	3.41 (2.21-5.11)	3.86 (2.44-5.91)
2-hr	1.08 (0.876-1.34)	1.35 (1.09-1.67)	1.78 (1.43-2.21)	2.14 (1.71-2.67)	2.64 (2.04-3.48)	3.01 (2.27-4.07)	3.41 (2.50-4.83)	3.90 (2.65-5.58)	4.68 (3.05-6.94)	5.35 (3.39-8.10)
3-hr	1.26 (1.02-1.55)	1.58 (1.28-1.94)	2.09 (1.69-2.58)	2.52 (2.02-3.12)	3.10 (2.40-4.07)	3.53 (2.68-4.76)	4.00 (2.95-5.66)	4.60 (3.13-6.54)	5.52 (3.60-8.15)	6.33 (4.03-9.53)
6-hr	1.65 (1.35-2.01)	2.05 (1.67-2.50)	2.70 (2.19-3.31)	3.24 (2.62-4.00)	3.99 (3.11-5.19)	4.54 (3.46-6.06)	5.14 (3.81-7.19)	5.89 (4.03-8.30)	7.06 (4.62-10.3)	8.08 (5.15-12.0)
12-hr	2.12 (1.74-2.57)	2.61 (2.14-3.17)	3.41 (2.79-4.16)	4.08 (3.31-5.00)	5.00 (3.91-6.45)	5.67 (4.34-7.50)	6.41 (4.76-8.86)	7.32 (5.03-10.2)	8.72 (5.73-12.6)	9.93 (6.35-14.6)
24-hr	2.55 (2.11-3.07)	3.16 (2.61-3.82)	4.17 (3.43-5.05)	5.01 (4.09-6.09)	6.16 (4.85-7.89)	7.00 (5.40-9.20)	7.93 (5.93-10.9)	9.09 (6.27-12.6)	10.9 (7.19-15.6)	12.5 (8.02-18.2)
2-day	2.88 (2.39-3.44)	3.65 (3.03-4.37)	4.91 (4.07-5.90)	5.96 (4.90-7.20)	7.40 (5.88-9.46)	8.45 (6.57-11.1)	9.63 (7.28-13.2)	11.2 (7.72-15.3)	13.6 (9.00-19.3)	15.8 (10.2-22.8)
3-day	3.15 (2.63-3.75)	3.98 (3.32-4.74)	5.34 (4.43-6.39)	6.46 (5.33-7.78)	8.02 (6.39-10.2)	9.14 (7.14-11.9)	10.4 (7.91-14.3)	12.1 (8.37-16.4)	14.8 (9.79-20.8)	17.2 (11.1-24.6)
4-day	3.41 (2.85-4.05)	4.26 (3.56-5.07)	5.66 (4.71-6.75)	6.82 (5.64-8.18)	8.42 (6.73-10.7)	9.58 (7.49-12.5)	10.9 (8.28-14.8)	12.6 (8.75-17.1)	15.4 (10.2-21.6)	17.9 (11.6-25.5)
7-day	4.12 (3.47-4.87)	5.00 (4.21-5.92)	6.44 (5.40-7.65)	7.64 (6.36-9.12)	9.29 (7.46-11.7)	10.5 (8.24-13.5)	11.8 (9.03-16.0)	13.6 (9.49-18.3)	16.5 (11.0-22.9)	19.1 (12.3-27.0)
10-day	4.77 (4.03-5.62)	5.68 (4.79-6.69)	7.16 (6.02-8.47)	8.39 (7.00-9.97)	10.1 (8.11-12.6)	11.3 (8.90-14.5)	12.7 (9.67-17.0)	14.5 (10.1-19.3)	17.3 (11.5-23.9)	19.8 (12.8-27.9)
20-day	6.67 (5.67-7.80)	7.66 (6.51-8.97)	9.29 (7.86-10.9)	10.6 (8.93-12.6)	12.5 (10.1-15.4)	13.9 (10.9-17.4)	15.4 (11.6-20.0)	17.1 (12.0-22.6)	19.6 (13.2-26.8)	21.7 (14.1-30.2)
30-day	8.24 (7.04-9.60)	9.31 (7.94-10.9)	11.1 (9.39-12.9)	12.5 (10.5-14.7)	14.5 (11.7-17.6)	16.0 (12.6-19.8)	17.6 (13.2-22.4)	19.2 (13.6-25.2)	21.5 (14.5-29.1)	23.3 (15.2-32.2)
45-day	10.2 (8.77-11.9)	11.4 (9.73-13.2)	13.2 (11.3-15.4)	14.8 (12.5-17.3)	16.9 (13.7-20.4)	18.6 (14.6-22.8)	20.2 (15.1-25.5)	21.8 (15.5-28.4)	23.9 (16.1-32.1)	25.3 (16.5-34.8)
60-day	11.9 (10.2-13.8)	13.1 (11.3-15.2)	15.1 (12.9-17.5)	16.7 (14.2-19.5)	18.9 (15.3-22.7)	20.7 (16.2-25.2)	22.4 (16.7-27.9)	23.9 (17.0-31.0)	25.8 (17.5-34.5)	27.1 (17.7-37.0)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

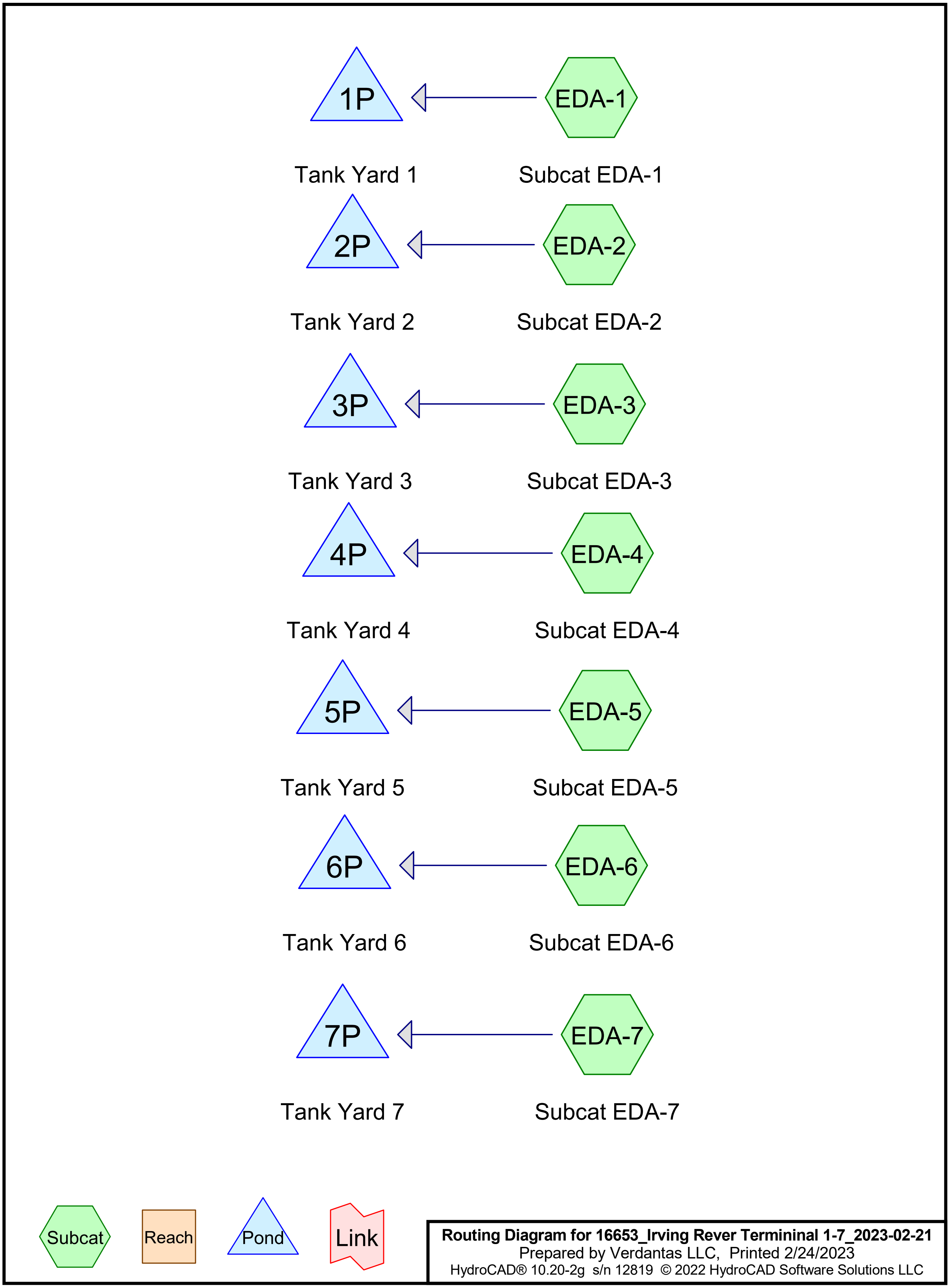
Please refer to NOAA Atlas 14 document for more information.

Back to Top

PF graphical

Flood Risk Assessment

Attachment 3 – Hydrologic Analyses Calculations



Routing Diagram for 16653_Irving Rever Termininal 1-7_2023-02-21
Prepared by Verdantas LLC, Printed 2/24/2023
HydroCAD® 10.20-2g s/n 12819 © 2022 HydroCAD Software Solutions LLC

Rainfall Events Listing (selected events)

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	25-yr	Type III 24-hr		Default	24.00	1	6.16	2
2	100-yr	Type III 24-hr		Default	24.00	1	7.93	2

Area Listing (all nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
456,625	98	Impervious Cover, HSG D (EDA-1, EDA-2, EDA-3, EDA-4, EDA-5, EDA-6, EDA-7)

Summary for Subcatchment EDA-1: Subcat EDA-1

[49] Hint: Tc<2dt may require smaller dt

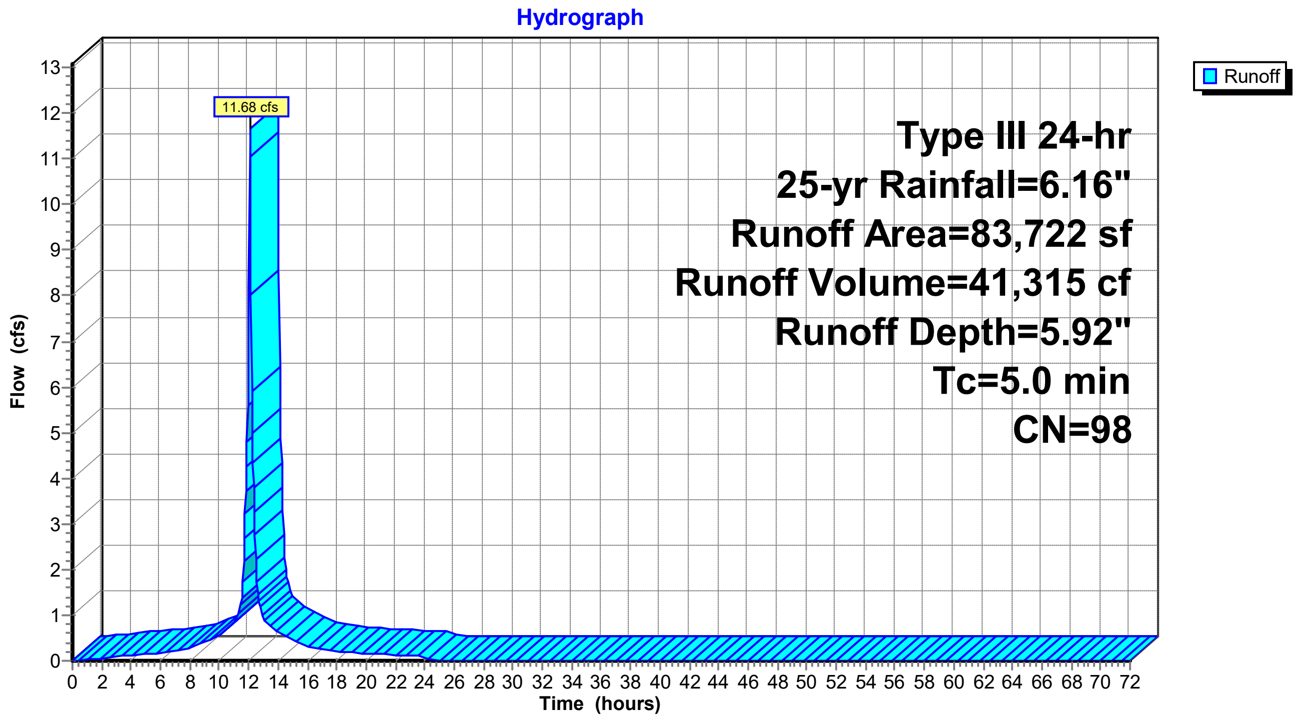
Runoff = 11.68 cfs @ 12.07 hrs, Volume= 41,315 cf, Depth= 5.92"
Routed to Pond 1P : Tank Yard 1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-yr Rainfall=6.16"

Area (sf)	CN	Description
83,722	98	Impervious Cover, HSG D
83,722		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, Minimum TC**

Subcatchment EDA-1: Subcat EDA-1



Summary for Subcatchment EDA-2: Subcat EDA-2

[49] Hint: Tc<2dt may require smaller dt

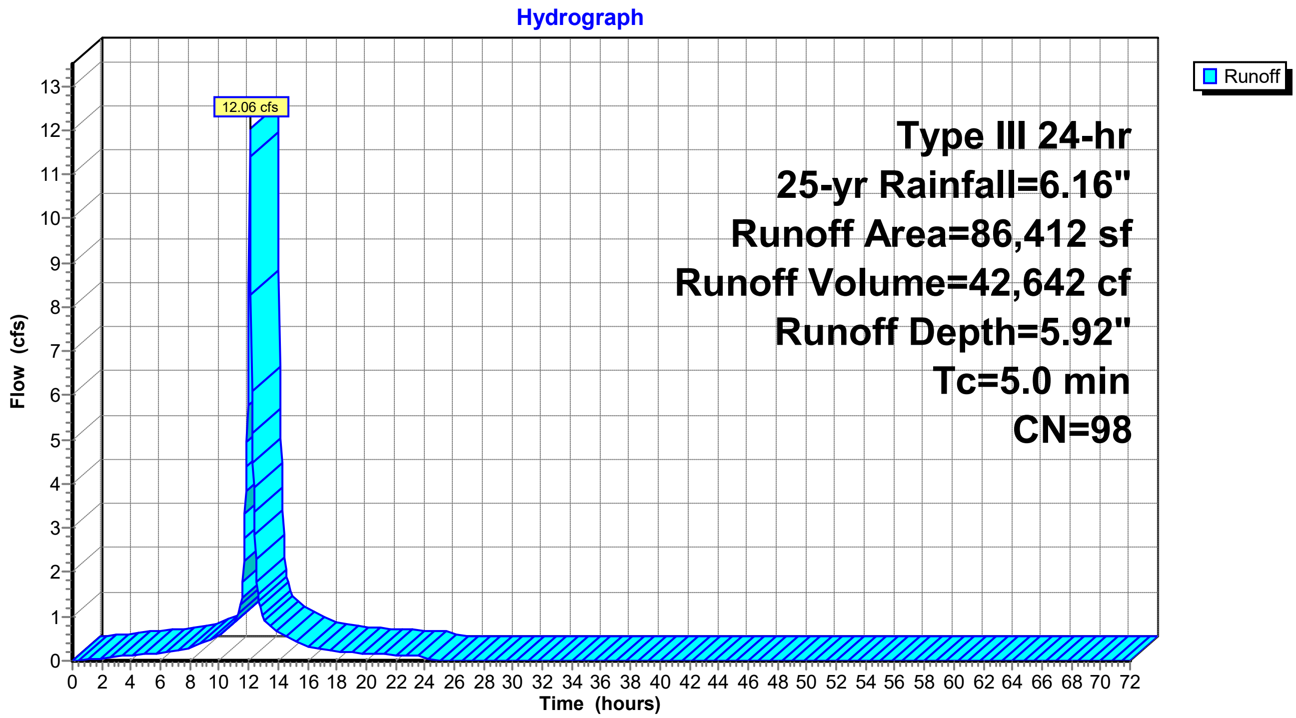
Runoff = 12.06 cfs @ 12.07 hrs, Volume= 42,642 cf, Depth= 5.92"
Routed to Pond 2P : Tank Yard 2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-yr Rainfall=6.16"

Area (sf)	CN	Description
86,412	98	Impervious Cover, HSG D
86,412		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, Minimum TC**

Subcatchment EDA-2: Subcat EDA-2



Summary for Subcatchment EDA-3: Subcat EDA-3

[49] Hint: Tc<2dt may require smaller dt

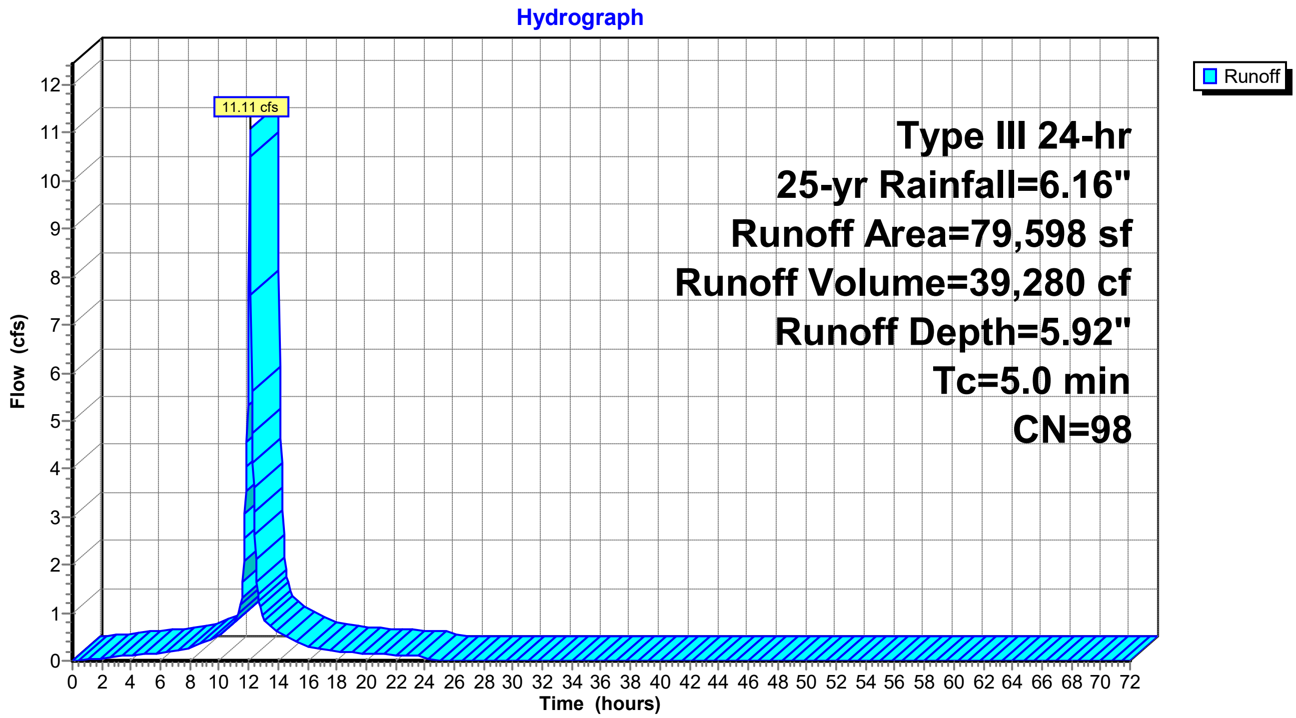
Runoff = 11.11 cfs @ 12.07 hrs, Volume= 39,280 cf, Depth= 5.92"
Routed to Pond 3P : Tank Yard 3

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-yr Rainfall=6.16"

Area (sf)	CN	Description
79,598	98	Impervious Cover, HSG D
79,598		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, Minimum TC**

Subcatchment EDA-3: Subcat EDA-3



Summary for Subcatchment EDA-4: Subcat EDA-4

[49] Hint: Tc<2dt may require smaller dt

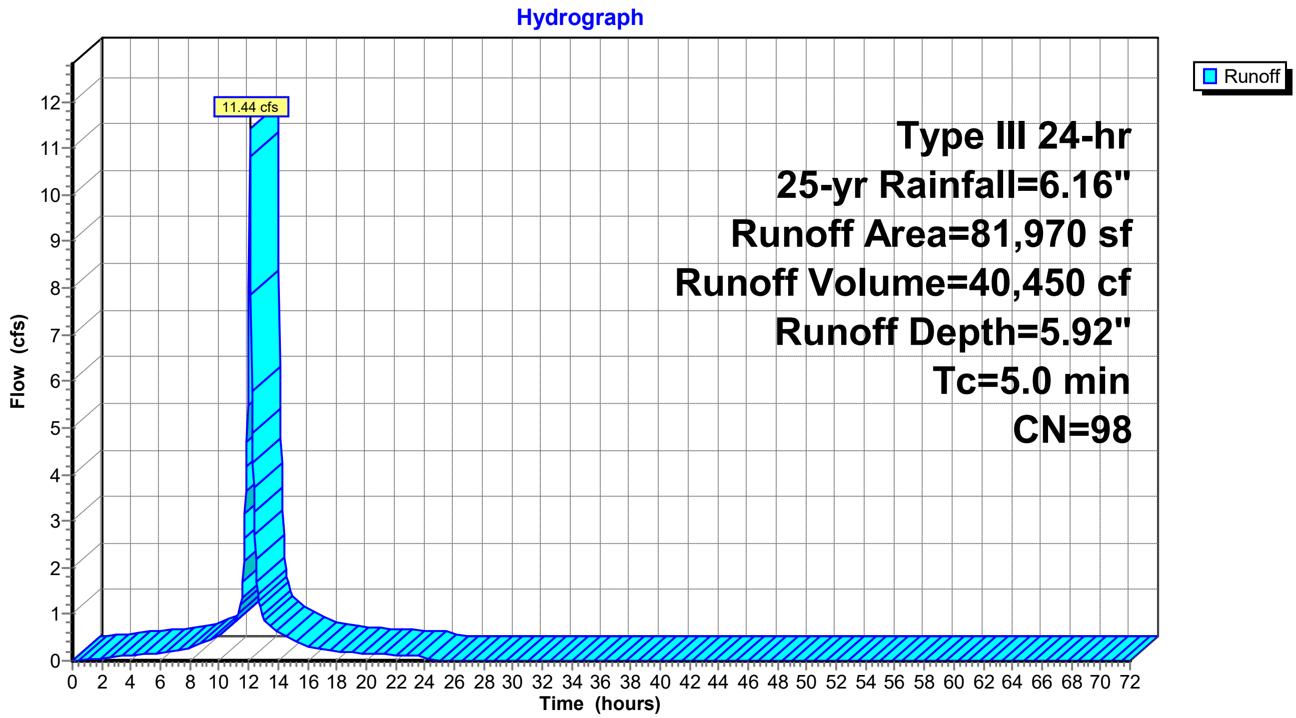
Runoff = 11.44 cfs @ 12.07 hrs, Volume= 40,450 cf, Depth= 5.92"
Routed to Pond 4P : Tank Yard 4

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-yr Rainfall=6.16"

Area (sf)	CN	Description
81,970	98	Impervious Cover, HSG D
81,970		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, Minimum TC**

Subcatchment EDA-4: Subcat EDA-4



Summary for Subcatchment EDA-5: Subcat EDA-5

[49] Hint: Tc<2dt may require smaller dt

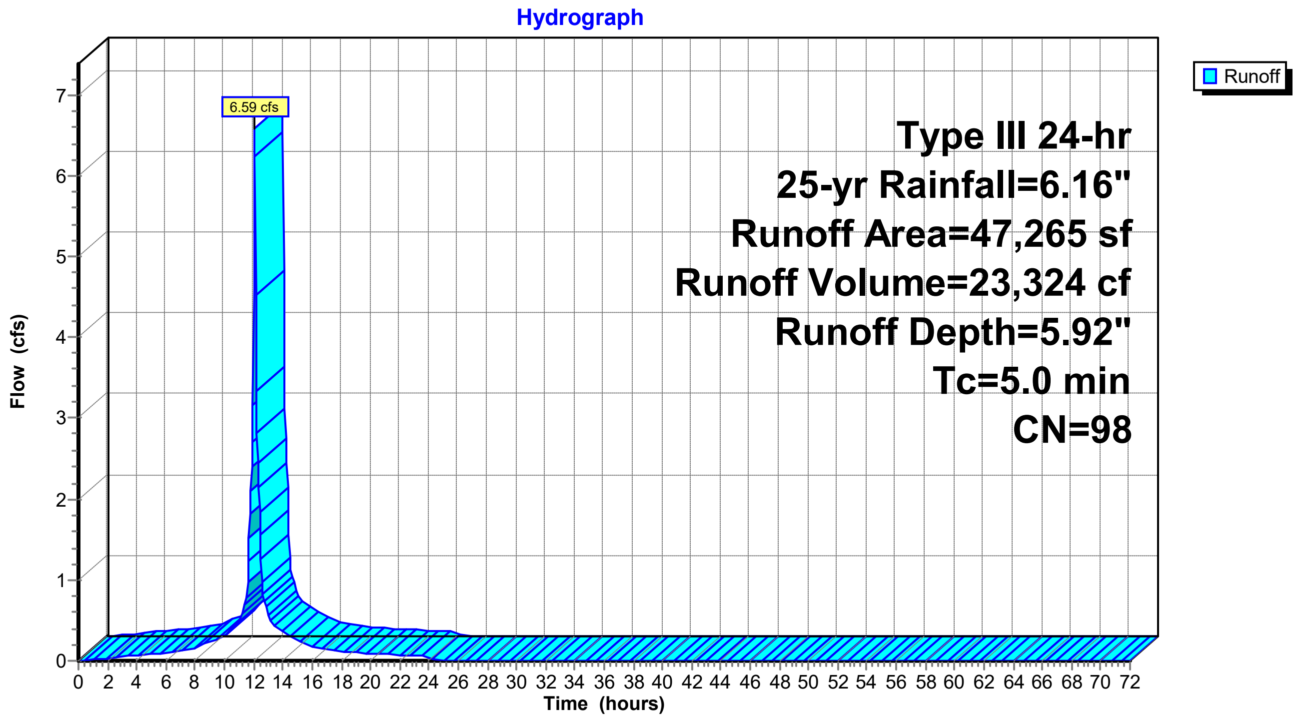
Runoff = 6.59 cfs @ 12.07 hrs, Volume= 23,324 cf, Depth= 5.92"
Routed to Pond 5P : Tank Yard 5

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-yr Rainfall=6.16"

Area (sf)	CN	Description
47,265	98	Impervious Cover, HSG D
47,265		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, Minimum TC**

Subcatchment EDA-5: Subcat EDA-5



Summary for Subcatchment EDA-6: Subcat EDA-6

[49] Hint: Tc<2dt may require smaller dt

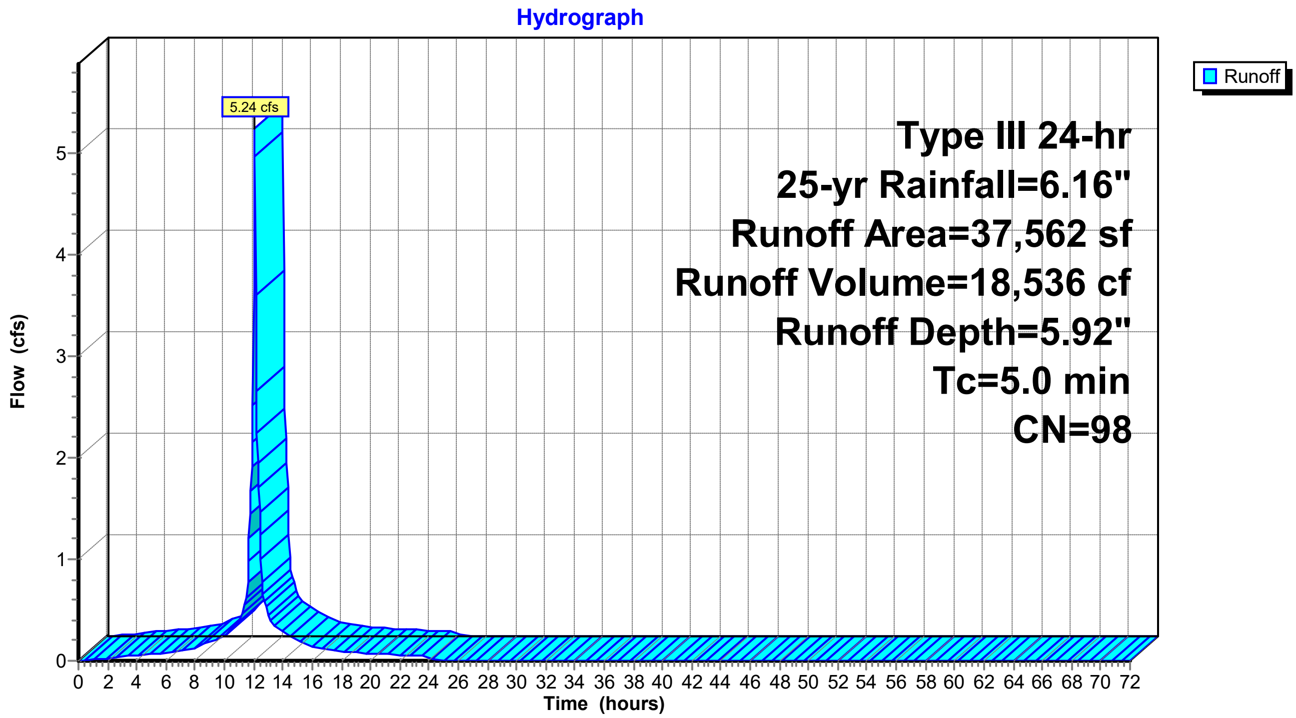
Runoff = 5.24 cfs @ 12.07 hrs, Volume= 18,536 cf, Depth= 5.92"
Routed to Pond 6P : Tank Yard 6

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-yr Rainfall=6.16"

Area (sf)	CN	Description
37,562	98	Impervious Cover, HSG D
37,562		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, Minimum TC**

Subcatchment EDA-6: Subcat EDA-6



Summary for Subcatchment EDA-7: Subcat EDA-7

[49] Hint: Tc<2dt may require smaller dt

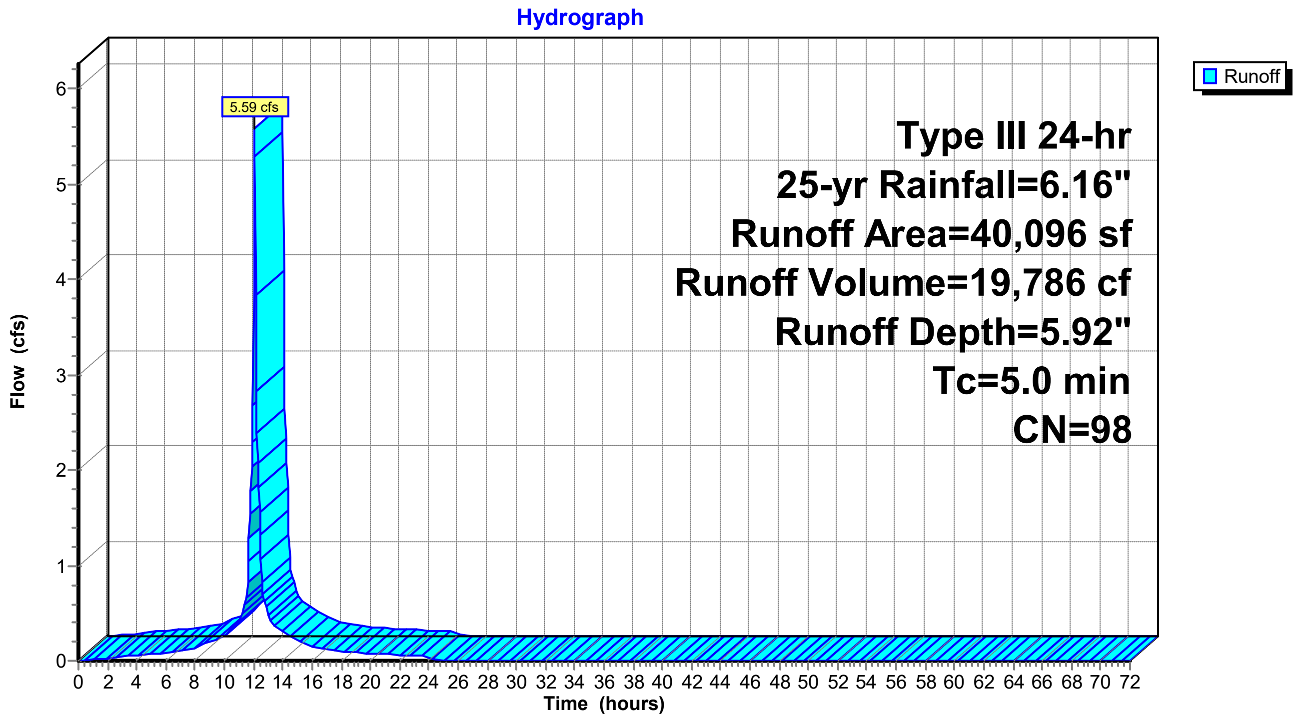
Runoff = 5.59 cfs @ 12.07 hrs, Volume= 19,786 cf, Depth= 5.92"
Routed to Pond 7P : Tank Yard 7

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-yr Rainfall=6.16"

Area (sf)	CN	Description
40,096	98	Impervious Cover, HSG D
40,096		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, Minimum TC**

Subcatchment EDA-7: Subcat EDA-7



Summary for Pond 1P: Tank Yard 1

Inflow Area = 83,722 sf,100.00% Impervious, Inflow Depth = 5.92" for 25-yr event
Inflow = 11.68 cfs @ 12.07 hrs, Volume= 41,315 cf
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Atten= 100%, Lag= 0.0 min

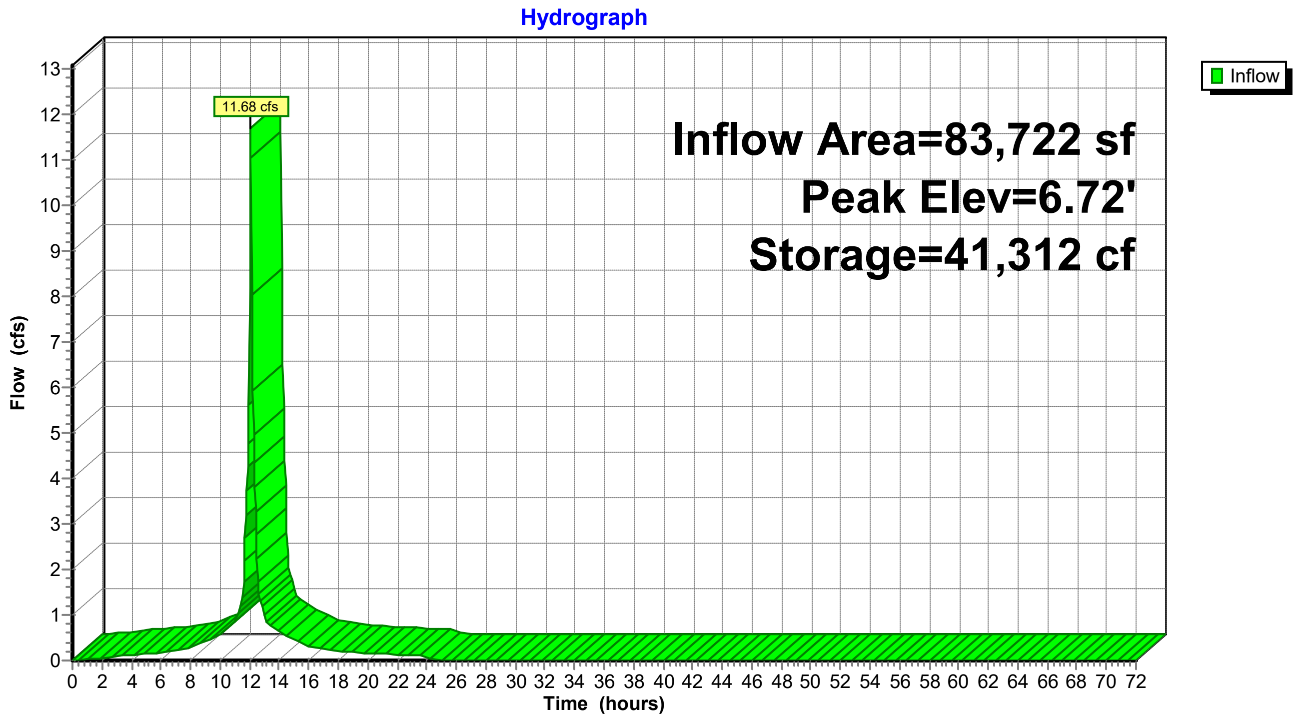
Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 6.72' @ 24.35 hrs Surf.Area= 53,288 sf Storage= 41,312 cf

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= (not calculated: no outflow)

Volume	Invert	Avail.Storage	Storage Description
#1	4.00'	233,528 cf	**Custom Stage Data (Irregular)** Listed below (Recalc) 283,736 cf Overall - 50,209 cf Embedded = 233,528 cf
#2	5.50'	0 cf	**117.00'D x 4.67'H Vertical Cone/Cylinder** Inside #1 50,209 cf Overall x 0.0% Voids
		233,528 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
4.00	102	57.0	0	0	102
5.00	2,261	386.0	948	948	11,702
6.00	43,652	822.0	18,616	19,564	53,619
7.00	57,282	944.0	50,313	69,877	70,787
8.00	65,722	1,017.0	61,454	131,330	82,221
9.00	70,195	1,056.0	67,946	199,276	88,737
10.00	73,622	1,083.0	71,902	271,178	93,456
10.17	74,121	1,105.0	12,558	283,736	97,291

Pond 1P: Tank Yard 1



Summary for Pond 2P: Tank Yard 2

Inflow Area = 86,412 sf,100.00% Impervious, Inflow Depth = 5.92" for 25-yr event
Inflow = 12.06 cfs @ 12.07 hrs, Volume= 42,642 cf
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Atten= 100%, Lag= 0.0 min

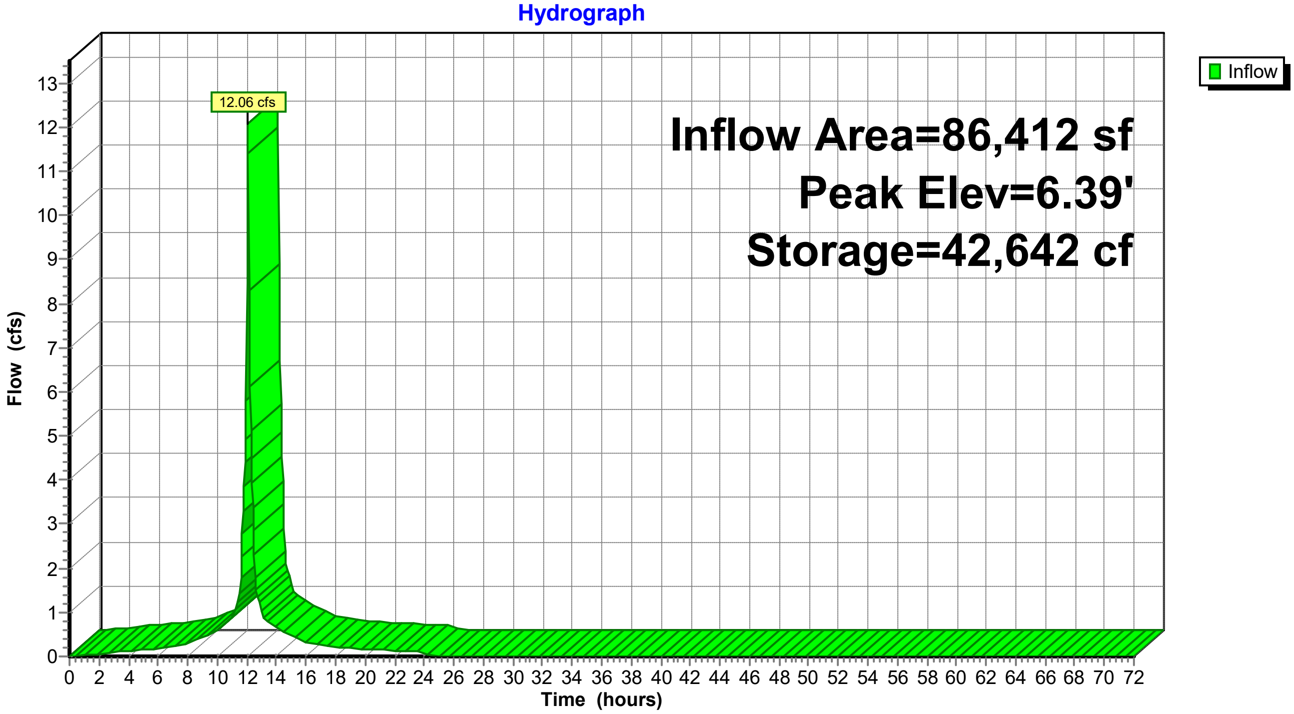
Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 6.39' @ 24.35 hrs Surf.Area= 57,644 sf Storage= 42,642 cf

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= (not calculated: no outflow)

Volume	Invert	Avail.Storage	Storage Description
#1	5.00'	286,434 cf	**Custom Stage Data (Irregular)** Listed below (Recalc) 340,621 cf Overall - 54,187 cf Embedded = 286,434 cf
#2	5.50'	0 cf	**117.00'D x 5.04'H Vertical Cone/Cylinder** Inside #1 54,187 cf Overall x 0.0% Voids
		286,434 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
5.00	11,691	1,127.0	0	0	11,691
6.00	54,463	1,026.0	30,462	30,462	29,029
7.00	62,856	978.0	58,609	89,072	36,749
8.00	69,196	1,025.0	66,001	155,073	44,307
9.00	72,304	1,055.0	70,744	225,817	49,380
10.00	75,232	1,116.0	73,763	299,580	59,975
10.54	76,773	1,112.0	41,041	340,621	60,905

Pond 2P: Tank Yard 2



Summary for Pond 3P: Tank Yard 3

Inflow Area = 79,598 sf,100.00% Impervious, Inflow Depth = 5.92" for 25-yr event
Inflow = 11.11 cfs @ 12.07 hrs, Volume= 39,280 cf
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Atten= 100%, Lag= 0.0 min

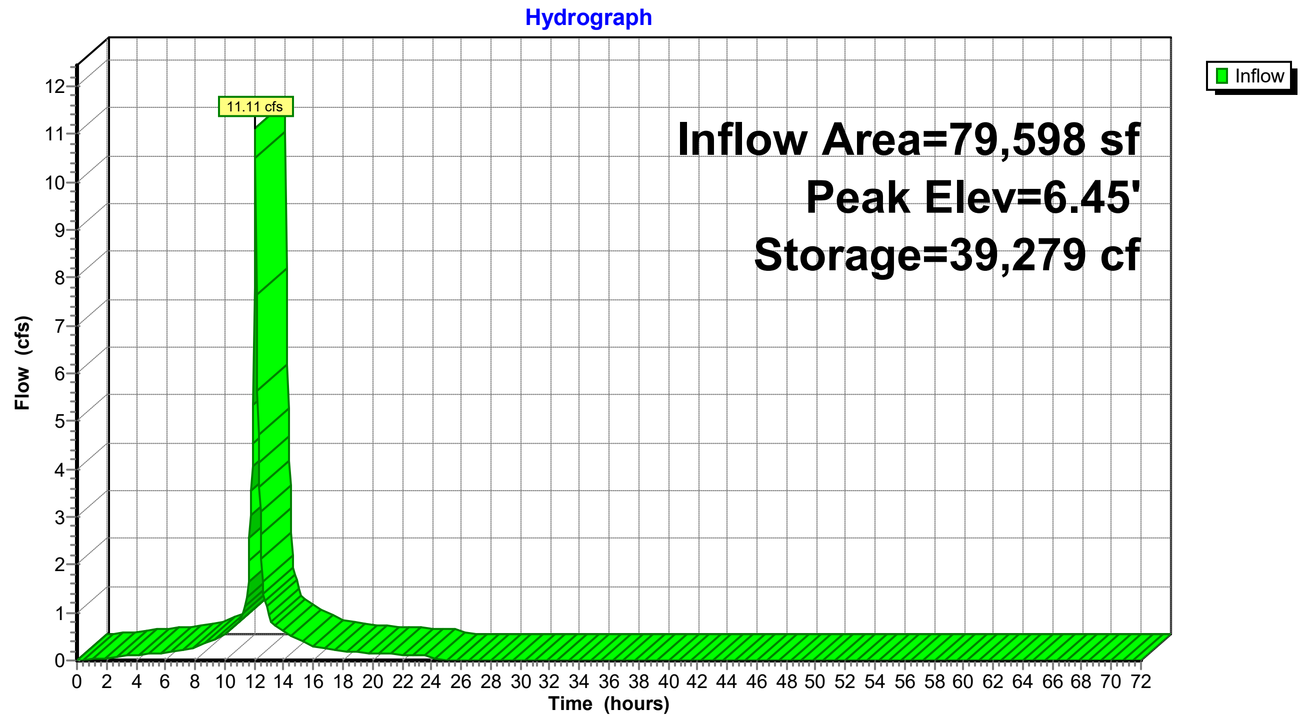
Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 6.45' @ 24.35 hrs Surf.Area= 57,747 sf Storage= 39,279 cf

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= (not calculated: no outflow)

Volume	Invert	Avail.Storage	Storage Description
#1	5.00'	194,308 cf	**Custom Stage Data (Irregular)** Listed below (Recalc) 234,948 cf Overall - 40,640 cf Embedded = 194,308 cf
#2	5.50'	0 cf	**117.00'D x 3.78'H Vertical Cone/Cylinder** Inside #1 40,640 cf Overall x 0.0% Voids
		194,308 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
5.00	4,618	573.0	0	0	4,618
6.00	53,005	985.0	24,423	24,423	55,704
7.00	63,729	1,016.0	58,285	82,708	60,741
8.00	66,464	991.0	65,092	147,799	64,858
9.00	68,885	958.0	67,671	215,470	70,068
9.28	70,247	1,246.0	19,478	234,948	120,581

Pond 3P: Tank Yard 3



Summary for Pond 4P: Tank Yard 4

Inflow Area = 81,970 sf,100.00% Impervious, Inflow Depth = 5.92" for 25-yr event
Inflow = 11.44 cfs @ 12.07 hrs, Volume= 40,450 cf
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Atten= 100%, Lag= 0.0 min

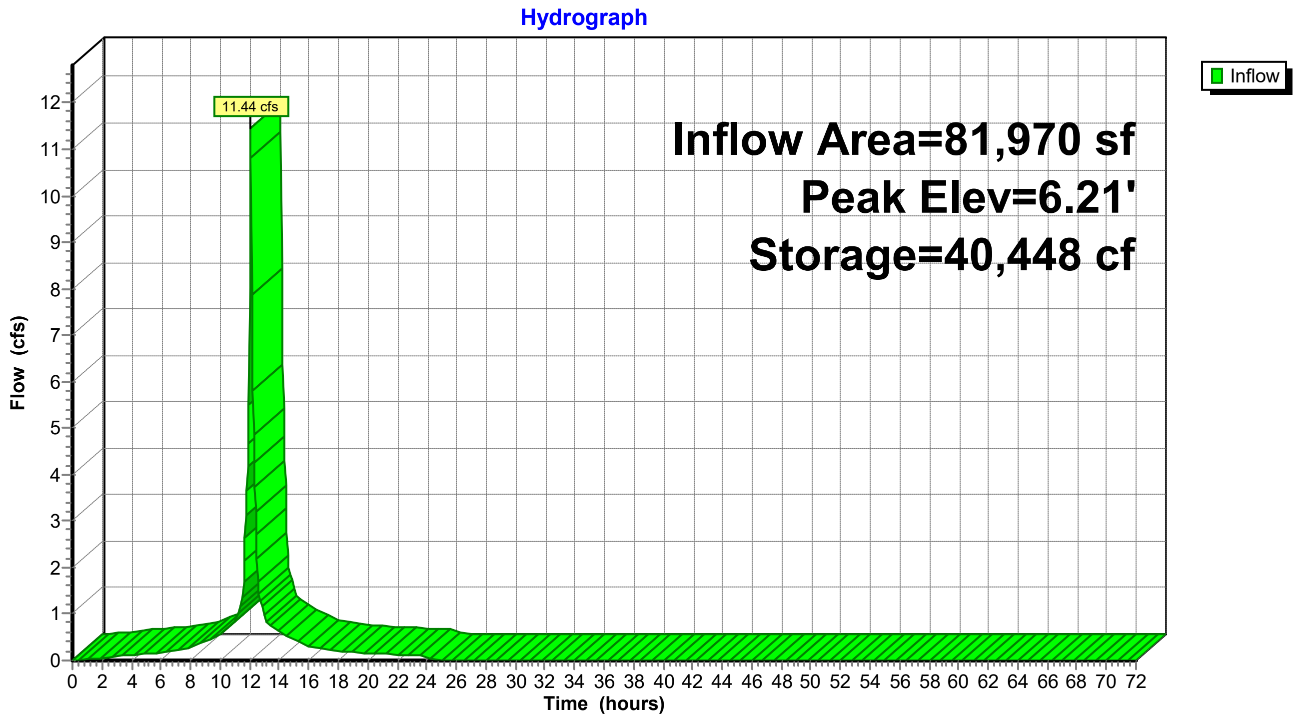
Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 6.21' @ 24.35 hrs Surf.Area= 59,750 sf Storage= 40,448 cf

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= (not calculated: no outflow)

Volume	Invert	Avail.Storage	Storage Description
#1	5.00'	247,948 cf	**Custom Stage Data (Irregular)** Listed below (Recalc) 293,856 cf Overall - 45,908 cf Embedded = 247,948 cf
#2	5.50'	0 cf	**117.00'D x 4.27'H Vertical Cone/Cylinder** Inside #1 45,908 cf Overall x 0.0% Voids
		247,948 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
5.00	17,353	1,356.0	0	0	17,353
6.00	57,877	965.0	35,640	35,640	89,580
7.00	66,980	1,089.0	62,373	98,014	109,874
8.00	69,881	1,038.0	68,425	166,439	118,571
9.00	72,302	1,055.0	71,088	237,527	121,590
9.77	74,011	1,071.0	56,329	293,856	124,418

Pond 4P: Tank Yard 4



Summary for Pond 5P: Tank Yard 5

Inflow Area = 47,265 sf,100.00% Impervious, Inflow Depth = 5.92" for 25-yr event
Inflow = 6.59 cfs @ 12.07 hrs, Volume= 23,324 cf
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Atten= 100%, Lag= 0.0 min

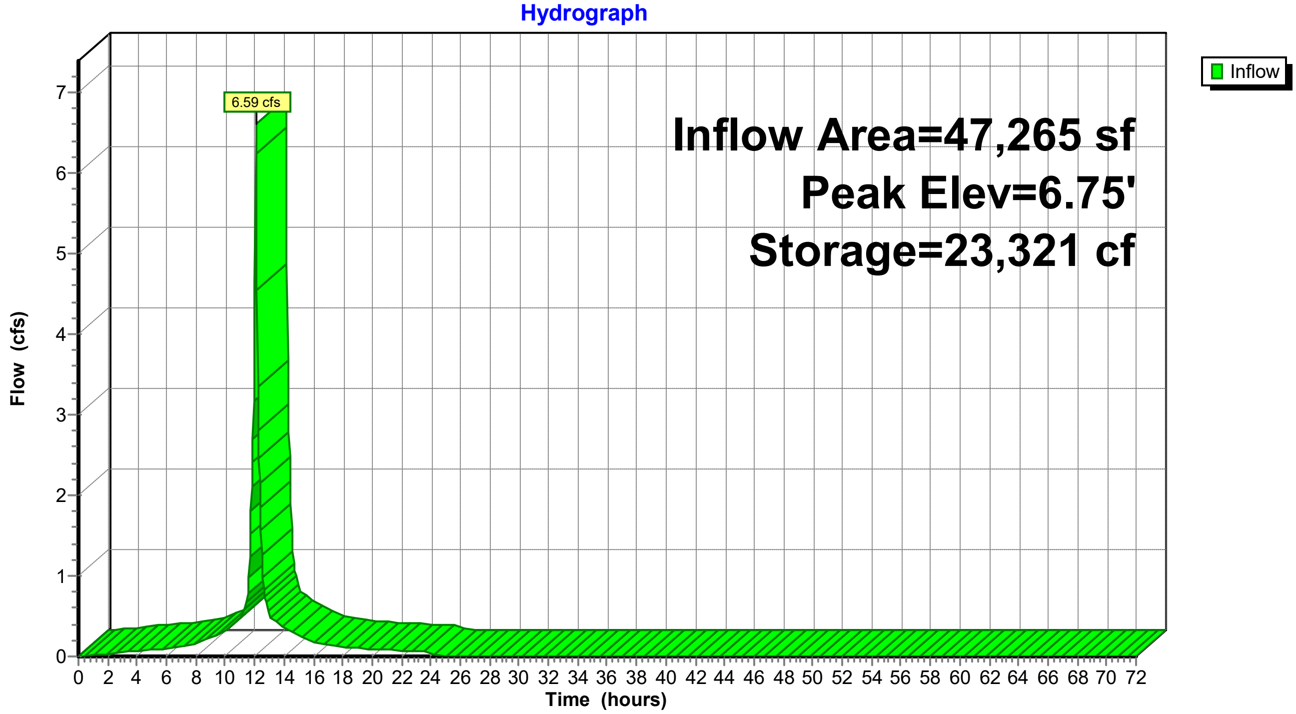
Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 6.75' @ 24.35 hrs Surf.Area= 26,879 sf Storage= 23,321 cf

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= (not calculated: no outflow)

Volume	Invert	Avail.Storage	Storage Description
#1	5.00'	135,799 cf	**Custom Stage Data (Irregular)** Listed below (Recalc) 160,073 cf Overall - 24,274 cf Embedded = 135,799 cf
#2	5.50'	0 cf	**78.00'D x 5.08'H Vertical Cone/Cylinder** Inside #1 24,274 cf Overall x 0.0% Voids
		135,799 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
5.00	3,400	294.0	0	0	3,400
6.00	21,435	609.0	11,124	11,124	26,040
7.00	28,781	671.0	25,018	36,142	32,388
8.00	32,483	718.0	30,613	66,755	37,629
9.00	35,781	749.0	34,119	100,874	41,321
10.00	37,975	776.0	36,873	137,747	44,685
10.58	39,016	805.0	22,327	160,073	48,363

Pond 5P: Tank Yard 5



Summary for Pond 6P: Tank Yard 6

Inflow Area = 37,562 sf,100.00% Impervious, Inflow Depth = 5.92" for 25-yr event
Inflow = 5.24 cfs @ 12.07 hrs, Volume= 18,536 cf
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Atten= 100%, Lag= 0.0 min

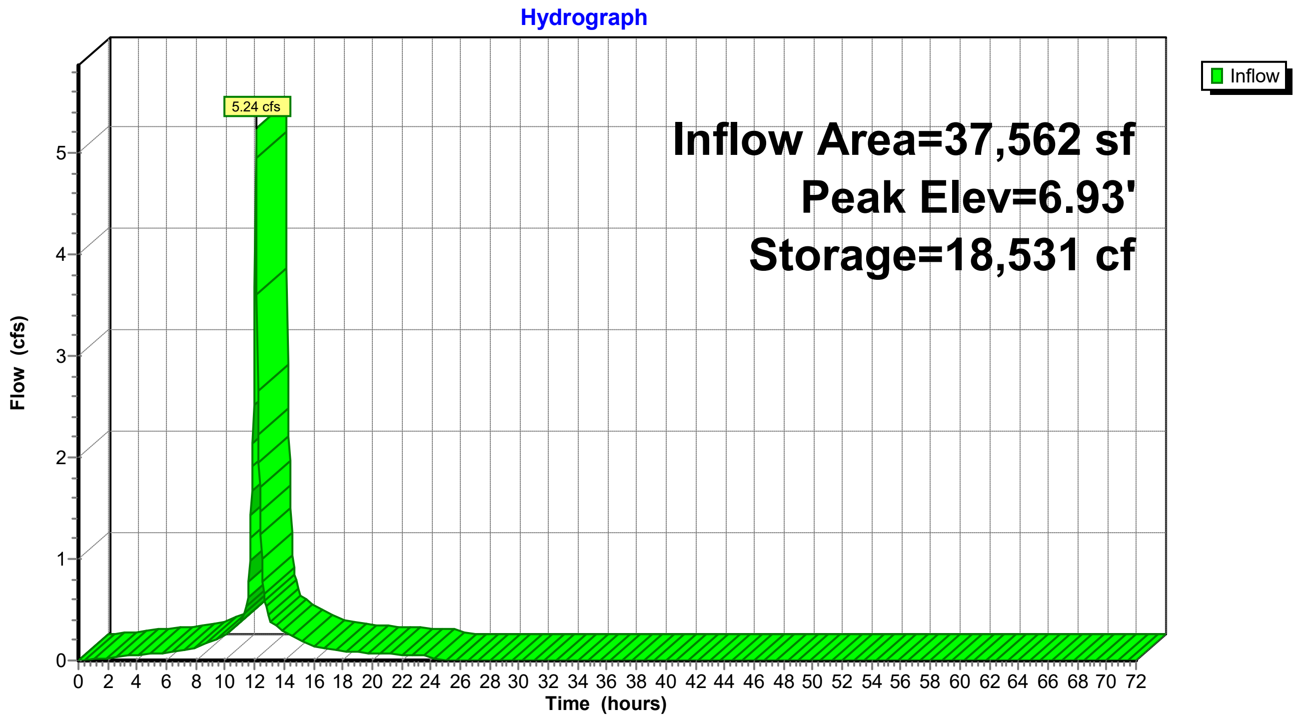
Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 6.93' @ 24.35 hrs Surf.Area= 23,261 sf Storage= 18,531 cf

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= (not calculated: no outflow)

Volume	Invert	Avail.Storage	Storage Description
#1	5.00'	108,149 cf	**Custom Stage Data (Irregular)** Listed below (Recalc) 130,081 cf Overall - 21,933 cf Embedded = 108,149 cf
#2	6.00'	0 cf	**78.00'D x 4.59'H Vertical Cone/Cylinder** Inside #1 21,933 cf Overall x 0.0% Voids
		108,149 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
5.00	821	125.0	0	0	821
6.00	13,779	527.0	5,988	5,988	21,681
7.00	24,116	636.0	18,708	24,696	31,786
8.00	28,696	711.0	26,373	51,069	39,853
9.00	30,086	703.0	29,388	80,457	40,998
10.00	31,498	718.0	30,789	111,246	42,837
10.59	32,352	730.0	18,835	130,081	44,284

Pond 6P: Tank Yard 6



Summary for Pond 7P: Tank Yard 7

Inflow Area = 40,096 sf,100.00% Impervious, Inflow Depth = 5.92" for 25-yr event
Inflow = 5.59 cfs @ 12.07 hrs, Volume= 19,786 cf
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Atten= 100%, Lag= 0.0 min

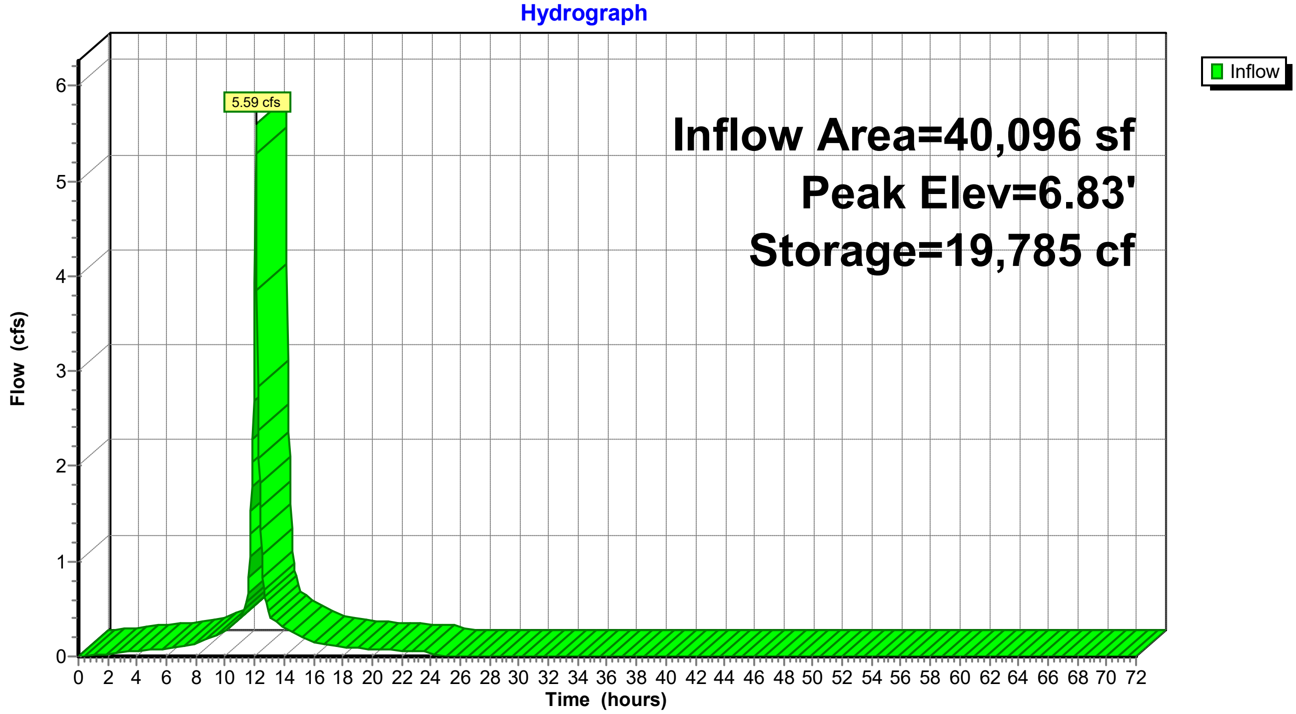
Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 6.83' @ 24.35 hrs Surf.Area= 24,590 sf Storage= 19,785 cf

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= (not calculated: no outflow)

Volume	Invert	Avail.Storage	Storage Description
#1	5.00'	75,892 cf	**Custom Stage Data (Irregular)** Listed below (Recalc) 93,524 cf Overall - 17,632 cf Embedded = 75,892 cf
#2	5.50'	0 cf	**78.00'D x 3.69'H Vertical Cone/Cylinder** Inside #1 17,632 cf Overall x 0.0% Voids
		75,892 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
5.00	1,422	280.0	0	0	1,422
6.00	18,440	541.0	8,328	8,328	18,479
7.00	25,949	648.0	22,088	30,415	28,620
8.00	29,011	690.0	27,466	57,881	33,142
9.00	30,595	703.0	29,799	87,681	34,743
9.19	30,913	714.0	5,843	93,524	35,990

Pond 7P: Tank Yard 7



Summary for Subcatchment EDA-1: Subcat EDA-1

[49] Hint: Tc<2dt may require smaller dt

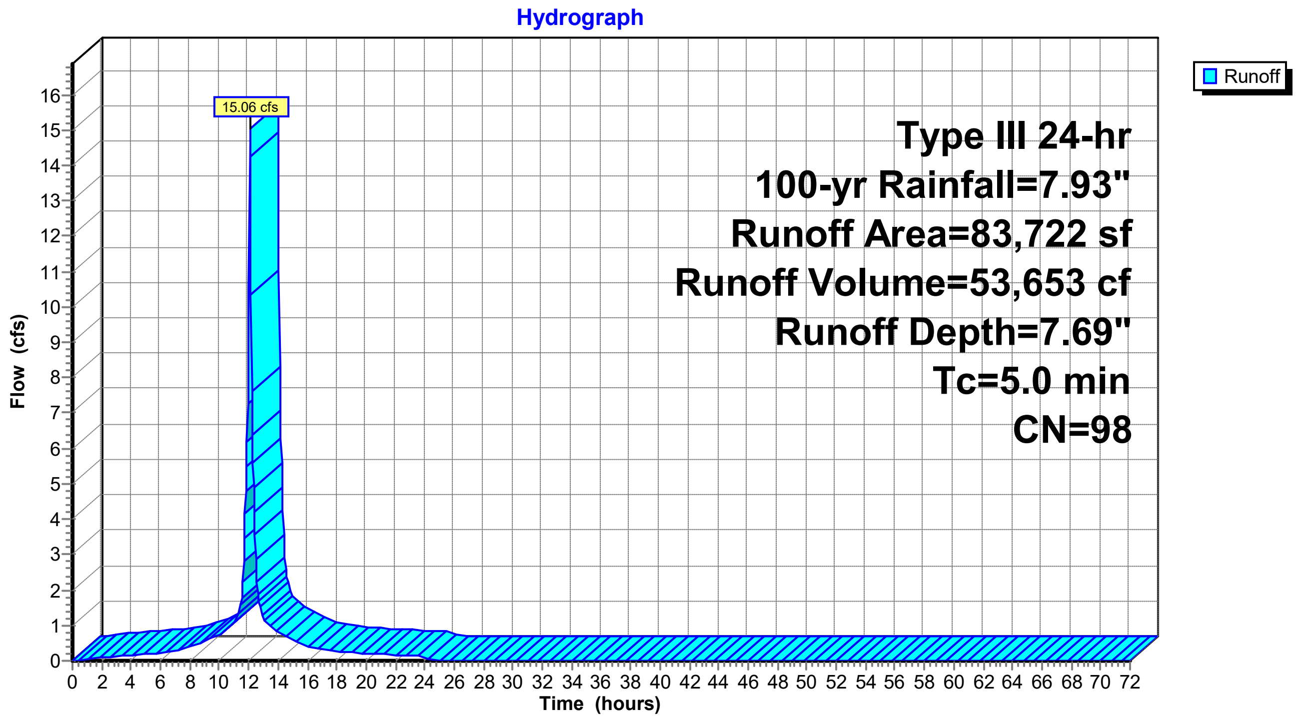
Runoff = 15.06 cfs @ 12.07 hrs, Volume= 53,653 cf, Depth= 7.69"
Routed to Pond 1P : Tank Yard 1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-yr Rainfall=7.93"

Area (sf)	CN	Description
83,722	98	Impervious Cover, HSG D
83,722		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, Minimum TC**

Subcatchment EDA-1: Subcat EDA-1



Summary for Subcatchment EDA-2: Subcat EDA-2

[49] Hint: Tc<2dt may require smaller dt

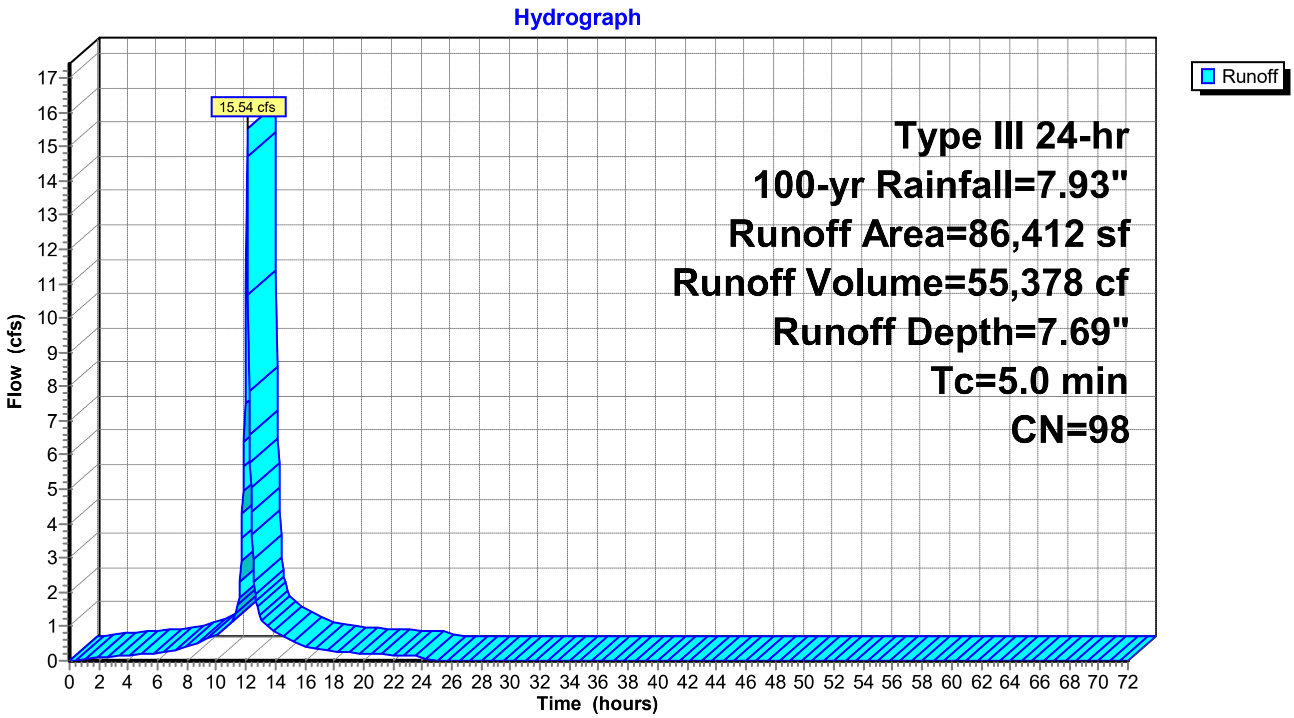
Runoff = 15.54 cfs @ 12.07 hrs, Volume= 55,378 cf, Depth= 7.69"
Routed to Pond 2P : Tank Yard 2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-yr Rainfall=7.93"

Area (sf)	CN	Description
86,412	98	Impervious Cover, HSG D
86,412		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, Minimum TC**

Subcatchment EDA-2: Subcat EDA-2



Summary for Subcatchment EDA-3: Subcat EDA-3

[49] Hint: Tc<2dt may require smaller dt

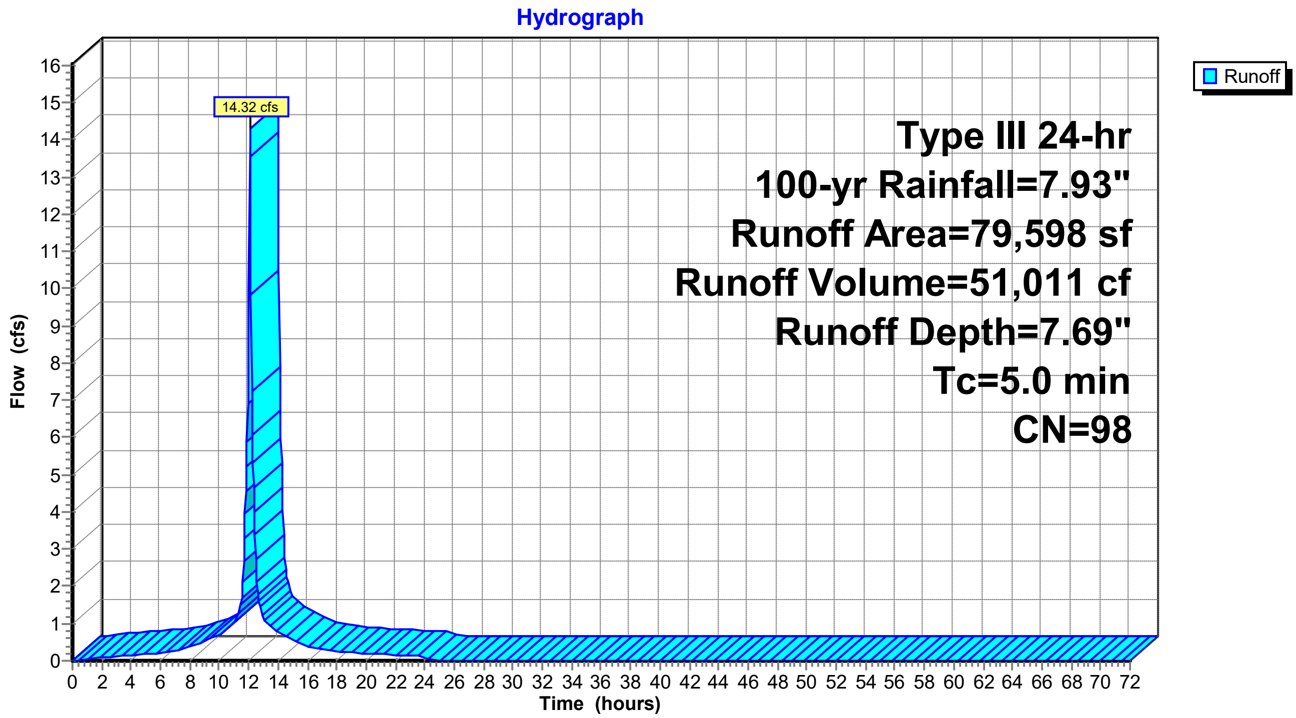
Runoff = 14.32 cfs @ 12.07 hrs, Volume= 51,011 cf, Depth= 7.69"
Routed to Pond 3P : Tank Yard 3

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-yr Rainfall=7.93"

Area (sf)	CN	Description
79,598	98	Impervious Cover, HSG D
79,598		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, Minimum TC**

Subcatchment EDA-3: Subcat EDA-3



Summary for Subcatchment EDA-4: Subcat EDA-4

[49] Hint: Tc<2dt may require smaller dt

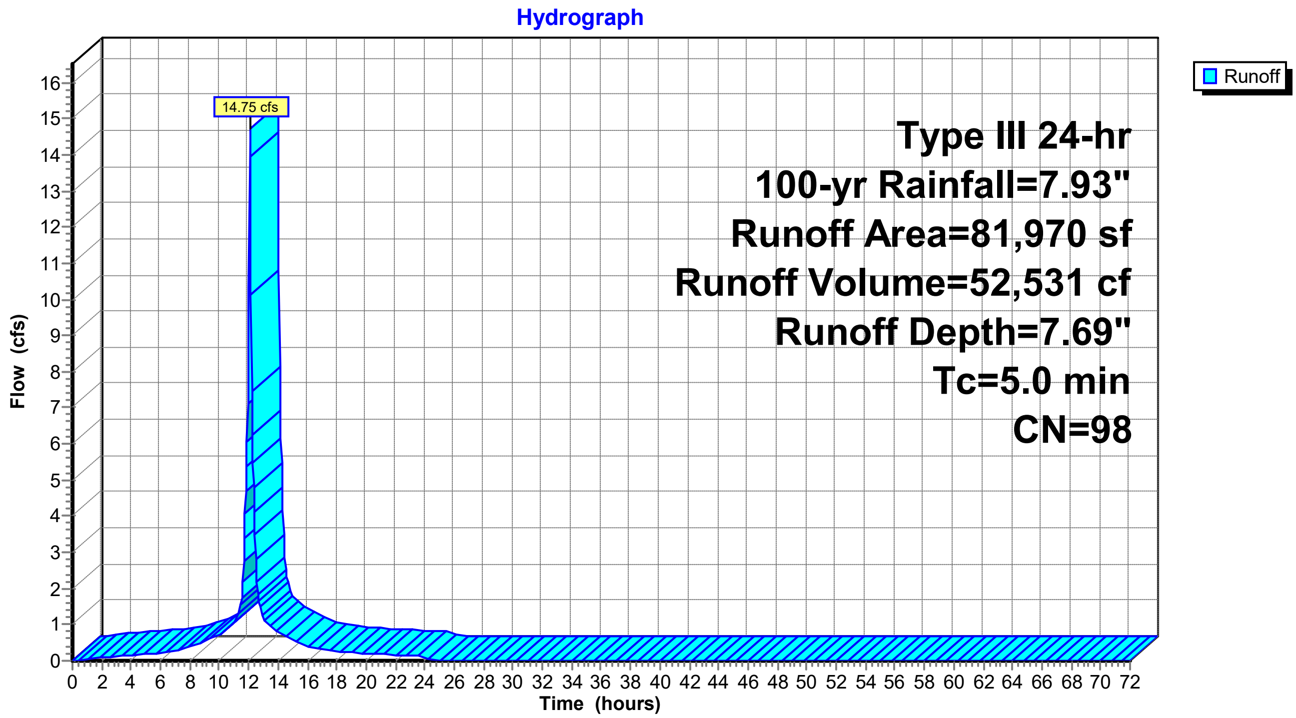
Runoff = 14.75 cfs @ 12.07 hrs, Volume= 52,531 cf, Depth= 7.69"
Routed to Pond 4P : Tank Yard 4

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-yr Rainfall=7.93"

Area (sf)	CN	Description
81,970	98	Impervious Cover, HSG D
81,970		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, Minimum TC**

Subcatchment EDA-4: Subcat EDA-4



Summary for Subcatchment EDA-5: Subcat EDA-5

[49] Hint: Tc<2dt may require smaller dt

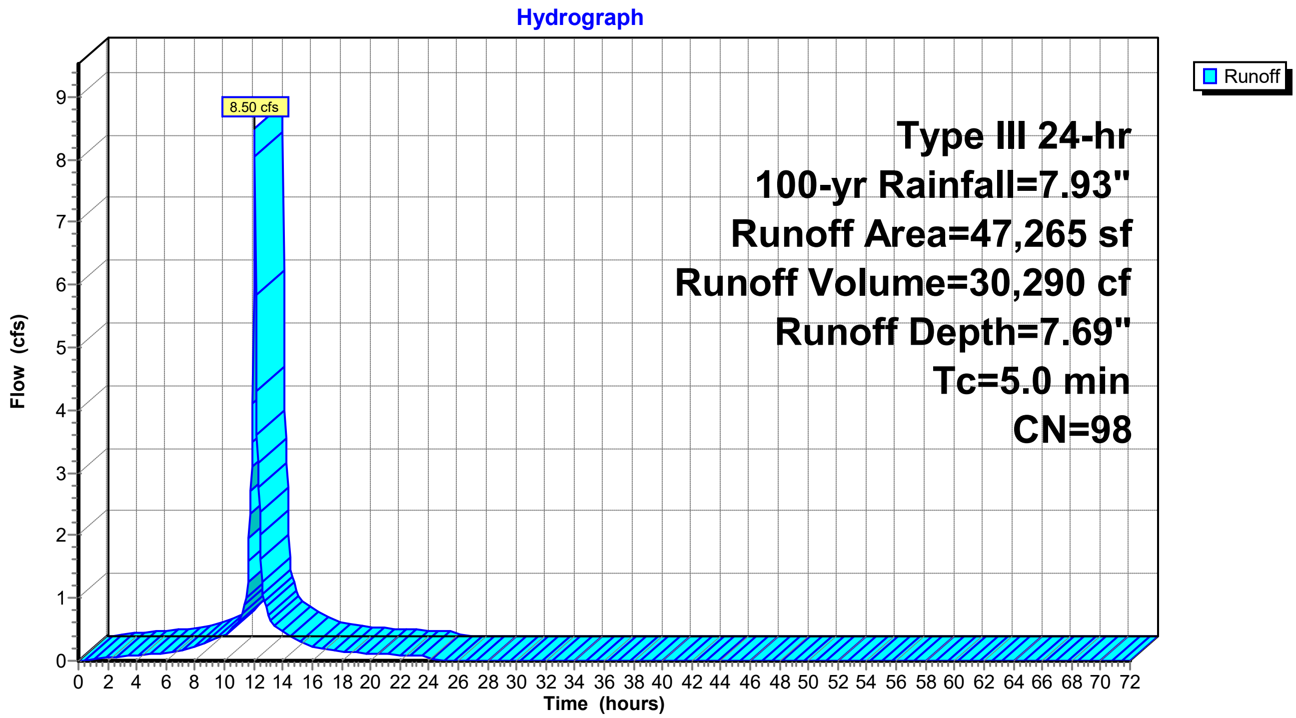
Runoff = 8.50 cfs @ 12.07 hrs, Volume= 30,290 cf, Depth= 7.69"
Routed to Pond 5P : Tank Yard 5

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-yr Rainfall=7.93"

Area (sf)	CN	Description
47,265	98	Impervious Cover, HSG D
47,265		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, Minimum TC**

Subcatchment EDA-5: Subcat EDA-5



Summary for Subcatchment EDA-6: Subcat EDA-6

[49] Hint: Tc<2dt may require smaller dt

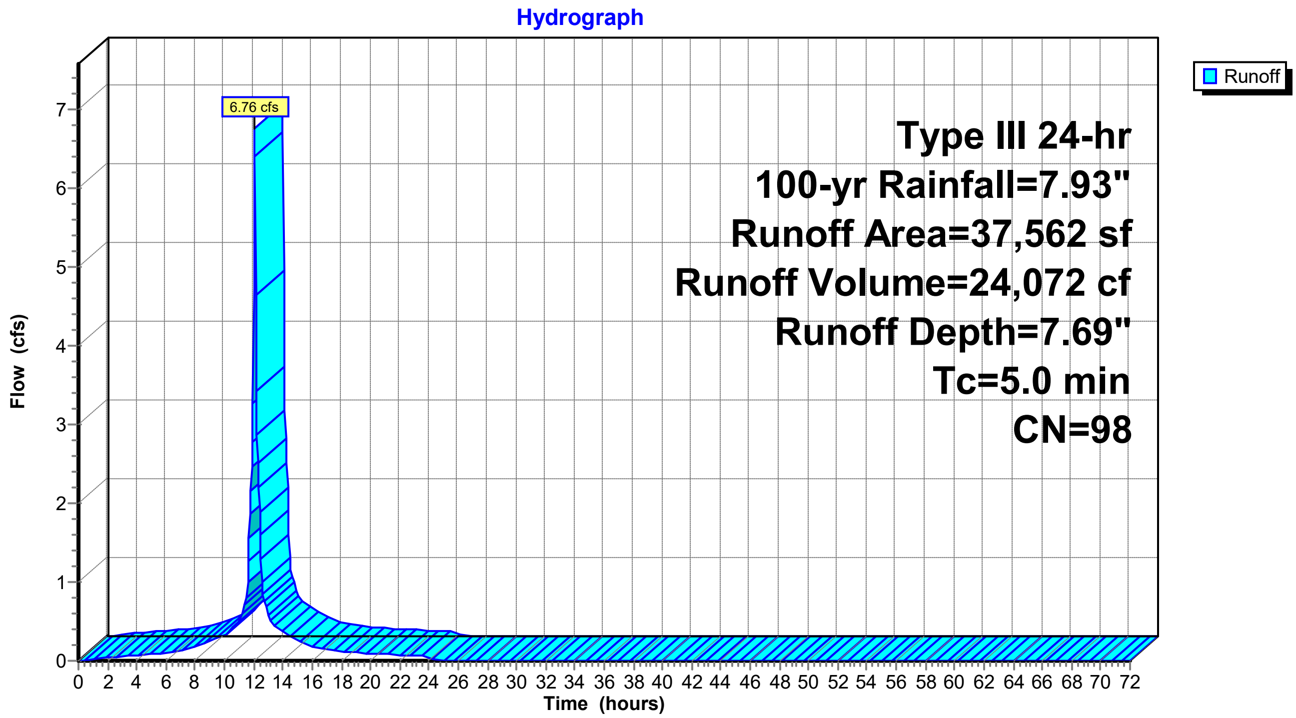
Runoff = 6.76 cfs @ 12.07 hrs, Volume= 24,072 cf, Depth= 7.69"
Routed to Pond 6P : Tank Yard 6

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-yr Rainfall=7.93"

Area (sf)	CN	Description
37,562	98	Impervious Cover, HSG D
37,562		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, Minimum TC**

Subcatchment EDA-6: Subcat EDA-6



Summary for Subcatchment EDA-7: Subcat EDA-7

[49] Hint: Tc<2dt may require smaller dt

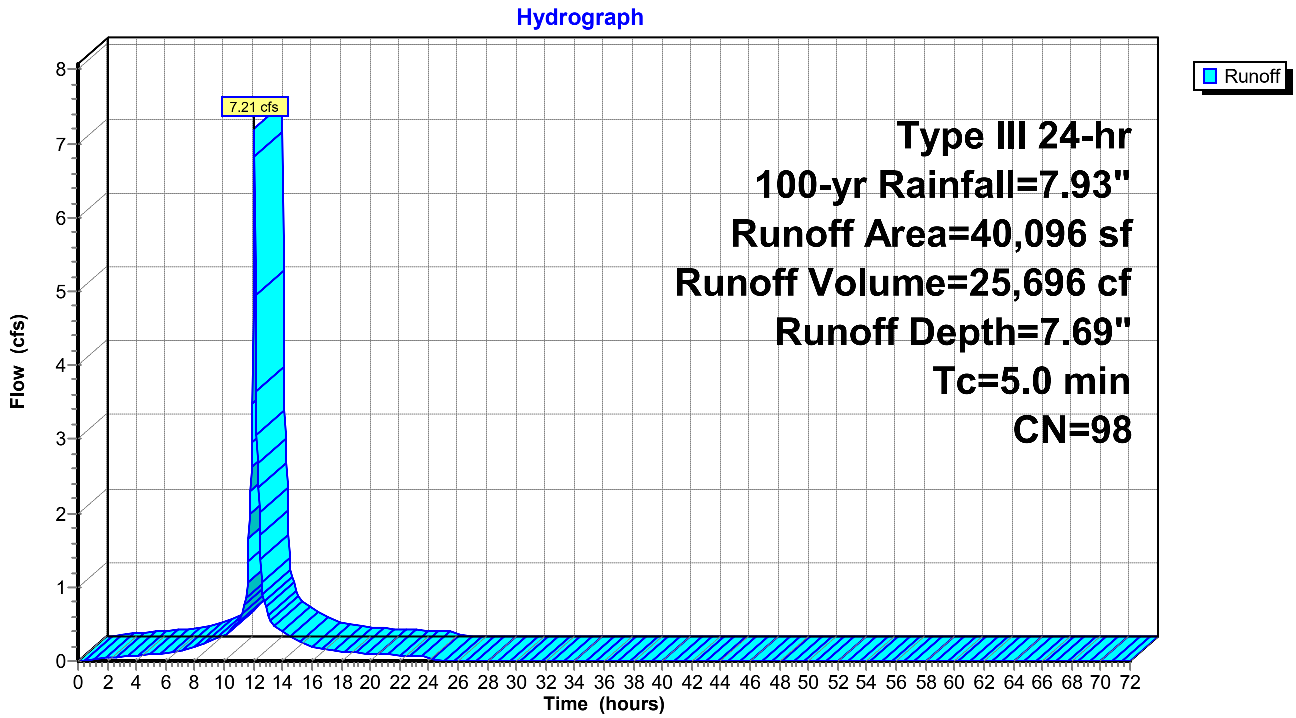
Runoff = 7.21 cfs @ 12.07 hrs, Volume= 25,696 cf, Depth= 7.69"
Routed to Pond 7P : Tank Yard 7

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-yr Rainfall=7.93"

Area (sf)	CN	Description
40,096	98	Impervious Cover, HSG D
40,096		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, Minimum TC**

Subcatchment EDA-7: Subcat EDA-7



Summary for Pond 1P: Tank Yard 1

Inflow Area = 83,722 sf,100.00% Impervious, Inflow Depth = 7.69" for 100-yr event
Inflow = 15.06 cfs @ 12.07 hrs, Volume= 53,653 cf
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Atten= 100%, Lag= 0.0 min

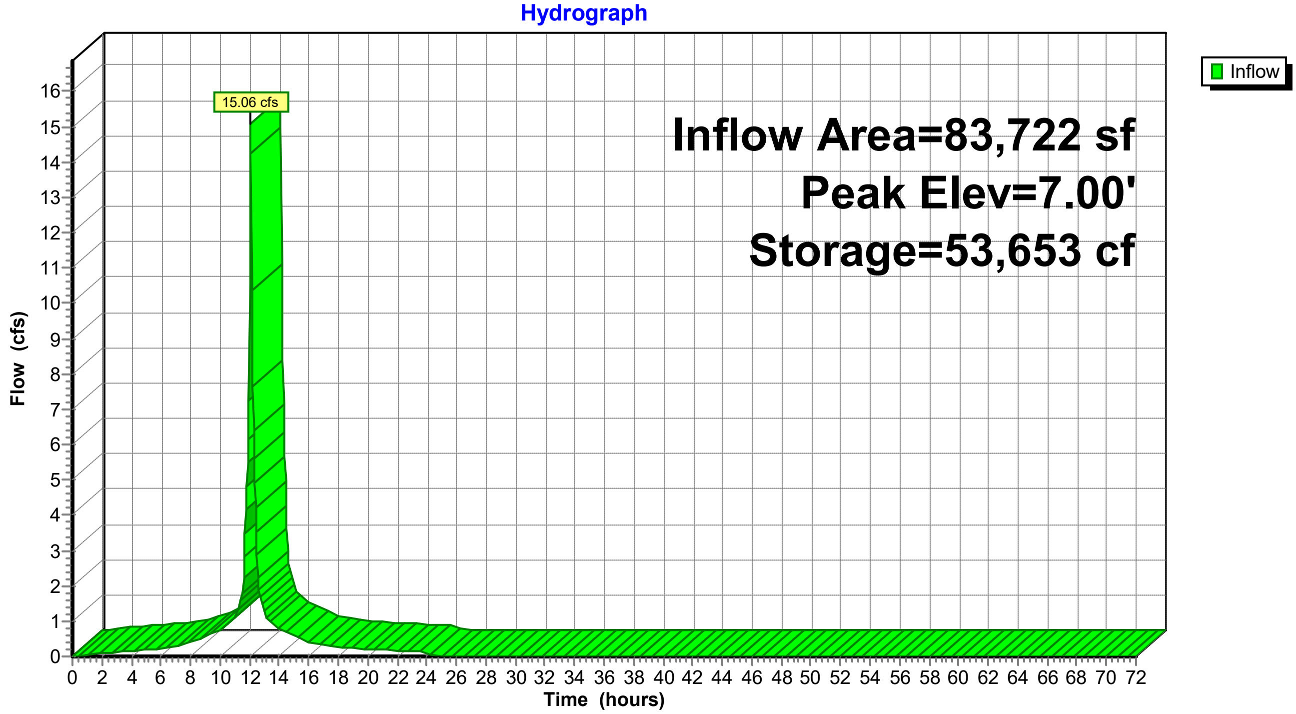
Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 7.00' @ 24.35 hrs Surf.Area= 57,252 sf Storage= 53,653 cf

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= (not calculated: no outflow)

Volume	Invert	Avail.Storage	Storage Description
#1	4.00'	233,528 cf	**Custom Stage Data (Irregular)** Listed below (Recalc) 283,736 cf Overall - 50,209 cf Embedded = 233,528 cf
#2	5.50'	0 cf	**117.00'D x 4.67'H Vertical Cone/Cylinder** Inside #1 50,209 cf Overall x 0.0% Voids
		233,528 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
4.00	102	57.0	0	0	102
5.00	2,261	386.0	948	948	11,702
6.00	43,652	822.0	18,616	19,564	53,619
7.00	57,282	944.0	50,313	69,877	70,787
8.00	65,722	1,017.0	61,454	131,330	82,221
9.00	70,195	1,056.0	67,946	199,276	88,737
10.00	73,622	1,083.0	71,902	271,178	93,456
10.17	74,121	1,105.0	12,558	283,736	97,291

Pond 1P: Tank Yard 1



Summary for Pond 2P: Tank Yard 2

Inflow Area = 86,412 sf,100.00% Impervious, Inflow Depth = 7.69" for 100-yr event
Inflow = 15.54 cfs @ 12.07 hrs, Volume= 55,378 cf
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Atten= 100%, Lag= 0.0 min

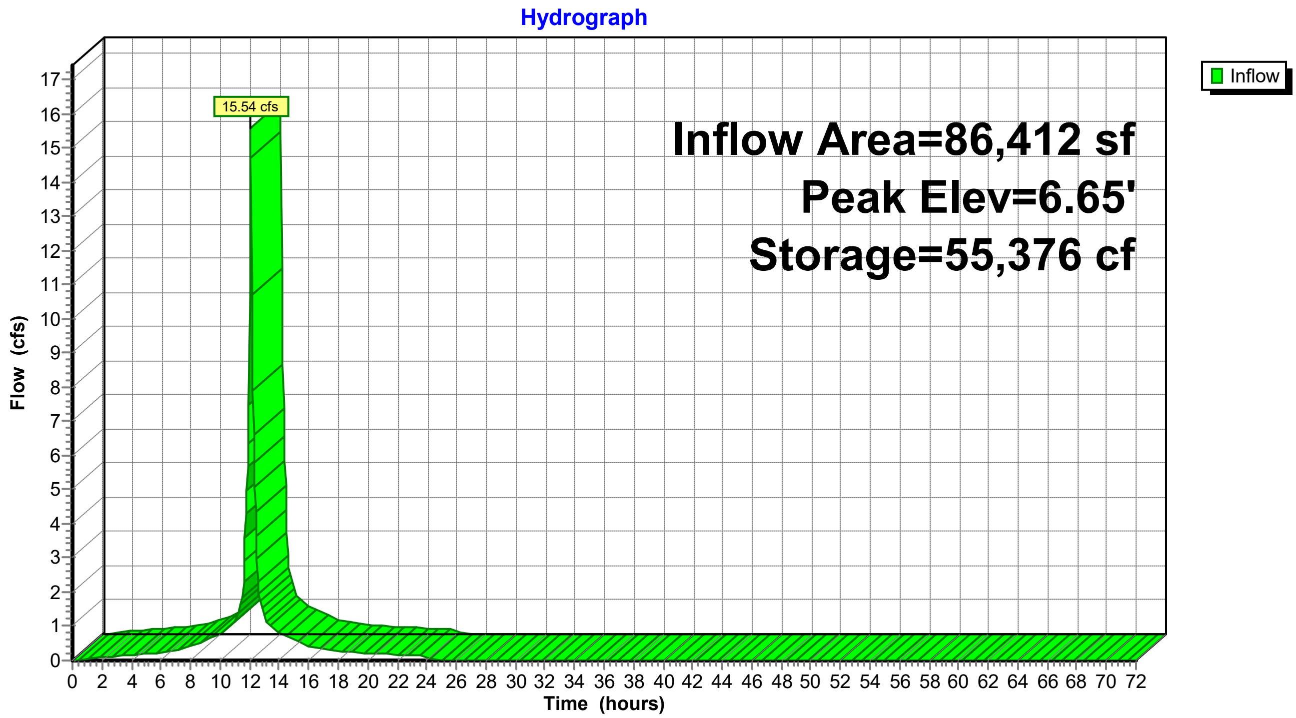
Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 6.65' @ 24.35 hrs Surf.Area= 59,874 sf Storage= 55,376 cf

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= (not calculated: no outflow)

Volume	Invert	Avail.Storage	Storage Description
#1	5.00'	286,434 cf	**Custom Stage Data (Irregular)** Listed below (Recalc) 340,621 cf Overall - 54,187 cf Embedded = 286,434 cf
#2	5.50'	0 cf	**117.00'D x 5.04'H Vertical Cone/Cylinder** Inside #1 54,187 cf Overall x 0.0% Voids
		286,434 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
5.00	11,691	1,127.0	0	0	11,691
6.00	54,463	1,026.0	30,462	30,462	29,029
7.00	62,856	978.0	58,609	89,072	36,749
8.00	69,196	1,025.0	66,001	155,073	44,307
9.00	72,304	1,055.0	70,744	225,817	49,380
10.00	75,232	1,116.0	73,763	299,580	59,975
10.54	76,773	1,112.0	41,041	340,621	60,905

Pond 2P: Tank Yard 2



Summary for Pond 3P: Tank Yard 3

Inflow Area = 79,598 sf,100.00% Impervious, Inflow Depth = 7.69" for 100-yr event
Inflow = 14.32 cfs @ 12.07 hrs, Volume= 51,011 cf
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Atten= 100%, Lag= 0.0 min

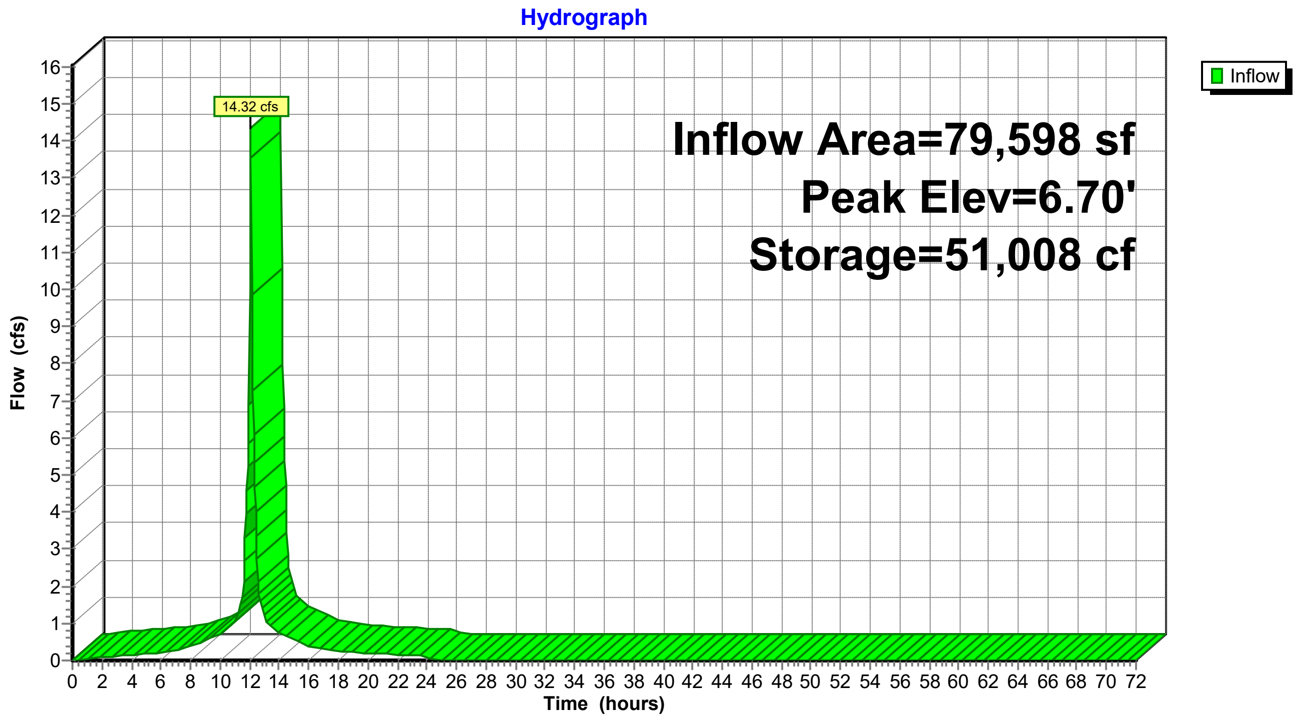
Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 6.70' @ 24.35 hrs Surf.Area= 60,369 sf Storage= 51,008 cf

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= (not calculated: no outflow)

Volume	Invert	Avail.Storage	Storage Description
#1	5.00'	194,308 cf	**Custom Stage Data (Irregular)** Listed below (Recalc) 234,948 cf Overall - 40,640 cf Embedded = 194,308 cf
#2	5.50'	0 cf	**117.00'D x 3.78'H Vertical Cone/Cylinder** Inside #1 40,640 cf Overall x 0.0% Voids
		194,308 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
5.00	4,618	573.0	0	0	4,618
6.00	53,005	985.0	24,423	24,423	55,704
7.00	63,729	1,016.0	58,285	82,708	60,741
8.00	66,464	991.0	65,092	147,799	64,858
9.00	68,885	958.0	67,671	215,470	70,068
9.28	70,247	1,246.0	19,478	234,948	120,581

Pond 3P: Tank Yard 3



Summary for Pond 4P: Tank Yard 4

Inflow Area = 81,970 sf,100.00% Impervious, Inflow Depth = 7.69" for 100-yr event
Inflow = 14.75 cfs @ 12.07 hrs, Volume= 52,531 cf
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Atten= 100%, Lag= 0.0 min

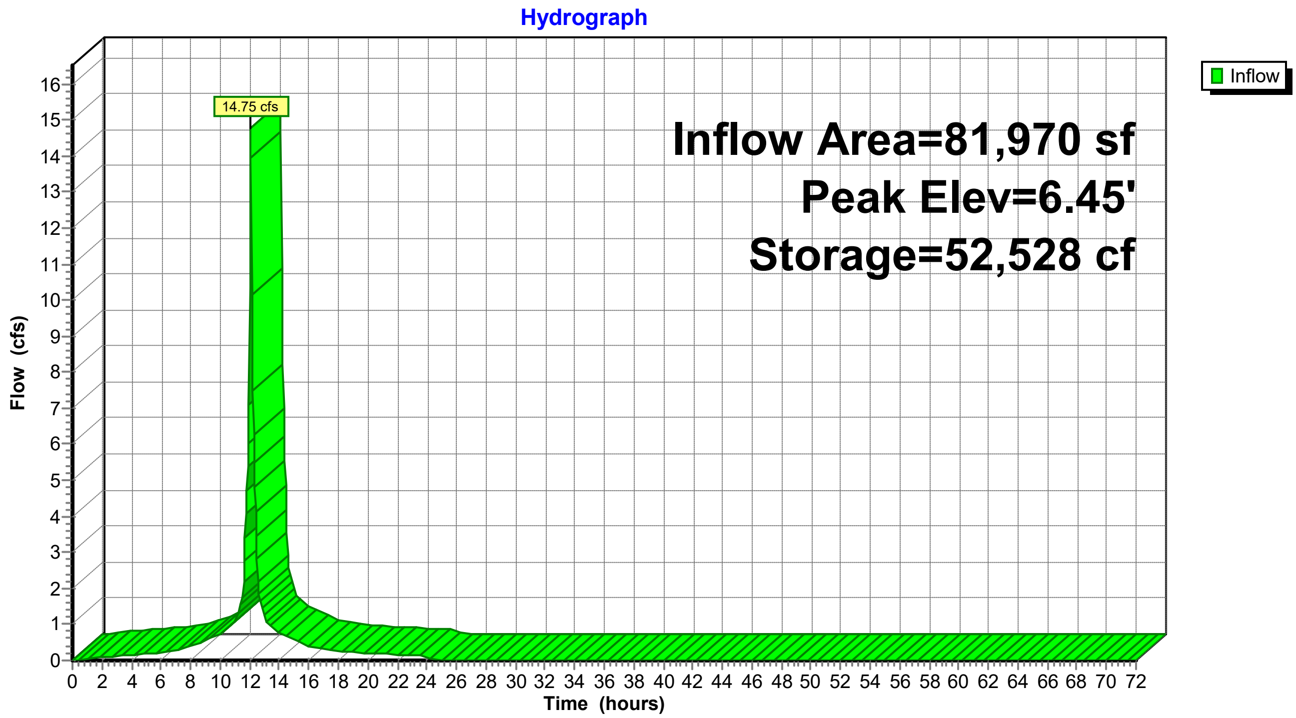
Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 6.45' @ 24.35 hrs Surf.Area= 61,919 sf Storage= 52,528 cf

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= (not calculated: no outflow)

Volume	Invert	Avail.Storage	Storage Description
#1	5.00'	247,948 cf	**Custom Stage Data (Irregular)** Listed below (Recalc) 293,856 cf Overall - 45,908 cf Embedded = 247,948 cf
#2	5.50'	0 cf	**117.00'D x 4.27'H Vertical Cone/Cylinder** Inside #1 45,908 cf Overall x 0.0% Voids
		247,948 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
5.00	17,353	1,356.0	0	0	17,353
6.00	57,877	965.0	35,640	35,640	89,580
7.00	66,980	1,089.0	62,373	98,014	109,874
8.00	69,881	1,038.0	68,425	166,439	118,571
9.00	72,302	1,055.0	71,088	237,527	121,590
9.77	74,011	1,071.0	56,329	293,856	124,418

Pond 4P: Tank Yard 4



Summary for Pond 5P: Tank Yard 5

Inflow Area = 47,265 sf,100.00% Impervious, Inflow Depth = 7.69" for 100-yr event
Inflow = 8.50 cfs @ 12.07 hrs, Volume= 30,290 cf
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Atten= 100%, Lag= 0.0 min

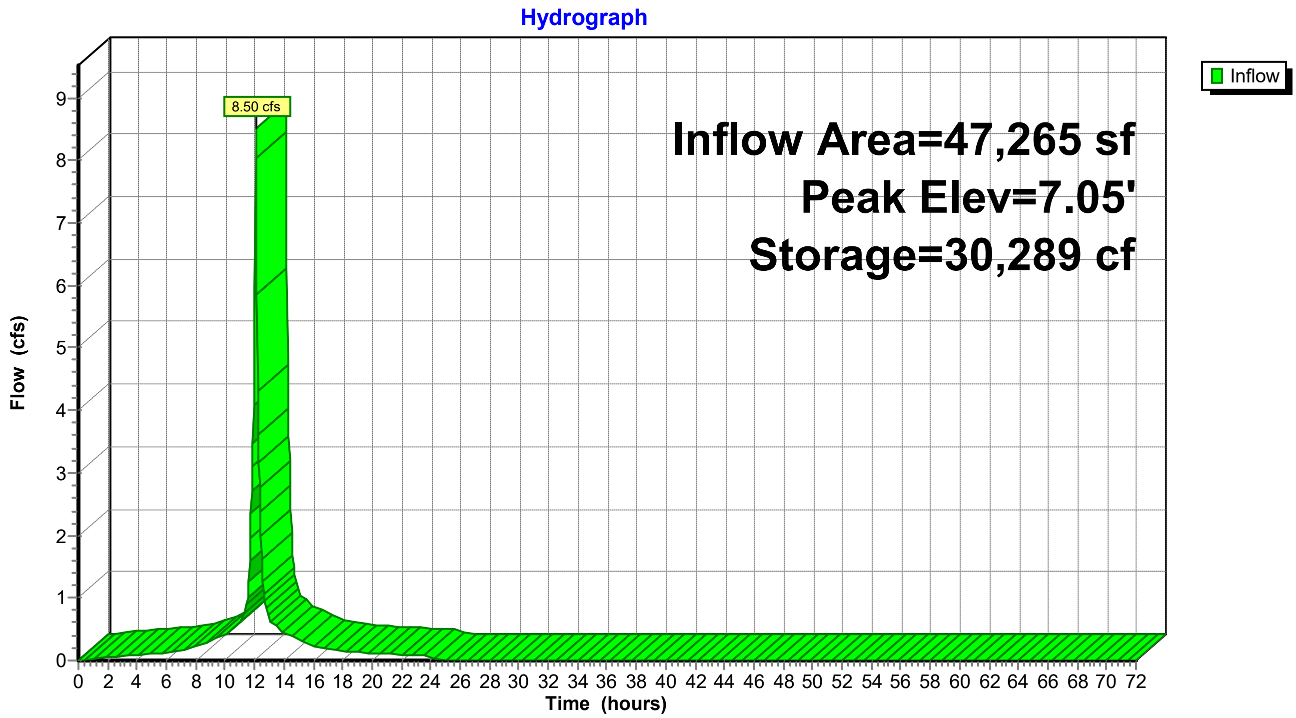
Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 7.05' @ 24.35 hrs Surf.Area= 28,977 sf Storage= 30,289 cf

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= (not calculated: no outflow)

Volume	Invert	Avail.Storage	Storage Description
#1	5.00'	135,799 cf	**Custom Stage Data (Irregular)** Listed below (Recalc) 160,073 cf Overall - 24,274 cf Embedded = 135,799 cf
#2	5.50'	0 cf	**78.00'D x 5.08'H Vertical Cone/Cylinder** Inside #1 24,274 cf Overall x 0.0% Voids
		135,799 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
5.00	3,400	294.0	0	0	3,400
6.00	21,435	609.0	11,124	11,124	26,040
7.00	28,781	671.0	25,018	36,142	32,388
8.00	32,483	718.0	30,613	66,755	37,629
9.00	35,781	749.0	34,119	100,874	41,321
10.00	37,975	776.0	36,873	137,747	44,685
10.58	39,016	805.0	22,327	160,073	48,363

Pond 5P: Tank Yard 5



Summary for Pond 6P: Tank Yard 6

Inflow Area = 37,562 sf,100.00% Impervious, Inflow Depth = 7.69" for 100-yr event
Inflow = 6.76 cfs @ 12.07 hrs, Volume= 24,072 cf
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Atten= 100%, Lag= 0.0 min

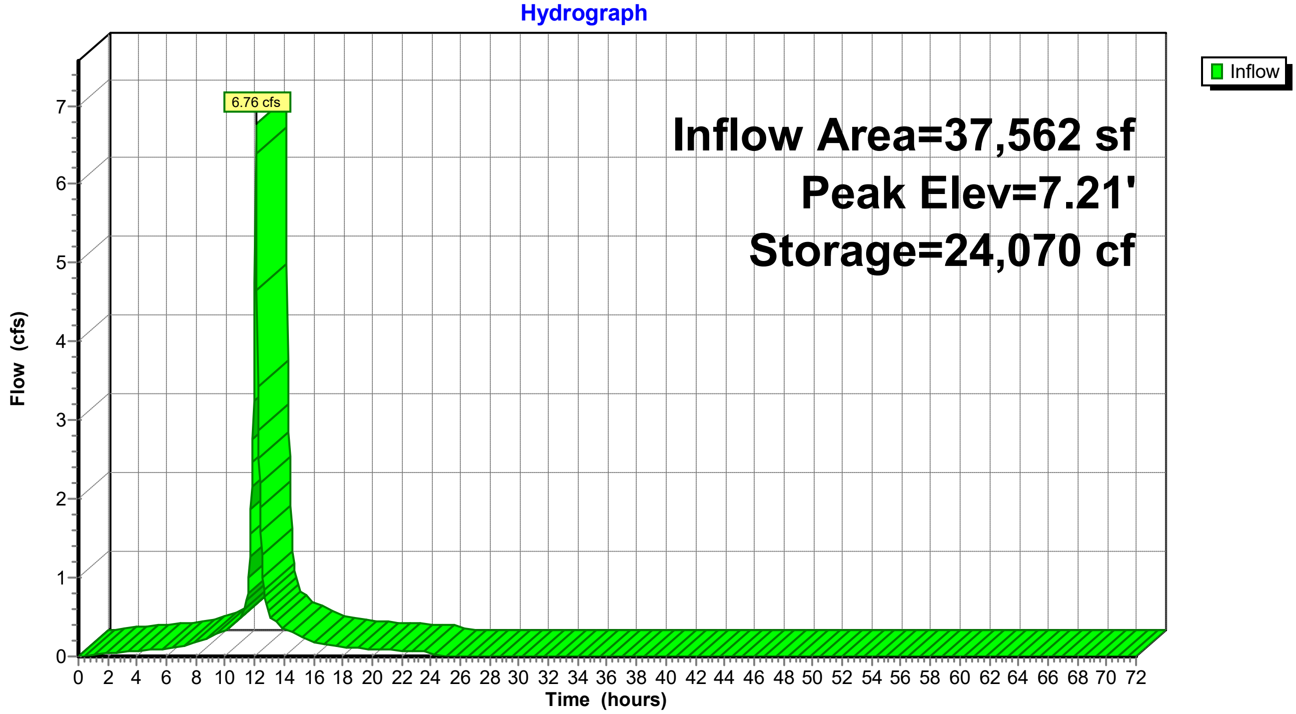
Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 7.21' @ 24.35 hrs Surf.Area= 25,044 sf Storage= 24,070 cf

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= (not calculated: no outflow)

Volume	Invert	Avail.Storage	Storage Description
#1	5.00'	108,149 cf	**Custom Stage Data (Irregular)** Listed below (Recalc) 130,081 cf Overall - 21,933 cf Embedded = 108,149 cf
#2	6.00'	0 cf	**78.00'D x 4.59'H Vertical Cone/Cylinder** Inside #1 21,933 cf Overall x 0.0% Voids
		108,149 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
5.00	821	125.0	0	0	821
6.00	13,779	527.0	5,988	5,988	21,681
7.00	24,116	636.0	18,708	24,696	31,786
8.00	28,696	711.0	26,373	51,069	39,853
9.00	30,086	703.0	29,388	80,457	40,998
10.00	31,498	718.0	30,789	111,246	42,837
10.59	32,352	730.0	18,835	130,081	44,284

Pond 6P: Tank Yard 6



Summary for Pond 7P: Tank Yard 7

Inflow Area = 40,096 sf,100.00% Impervious, Inflow Depth = 7.69" for 100-yr event
Inflow = 7.21 cfs @ 12.07 hrs, Volume= 25,696 cf
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Atten= 100%, Lag= 0.0 min

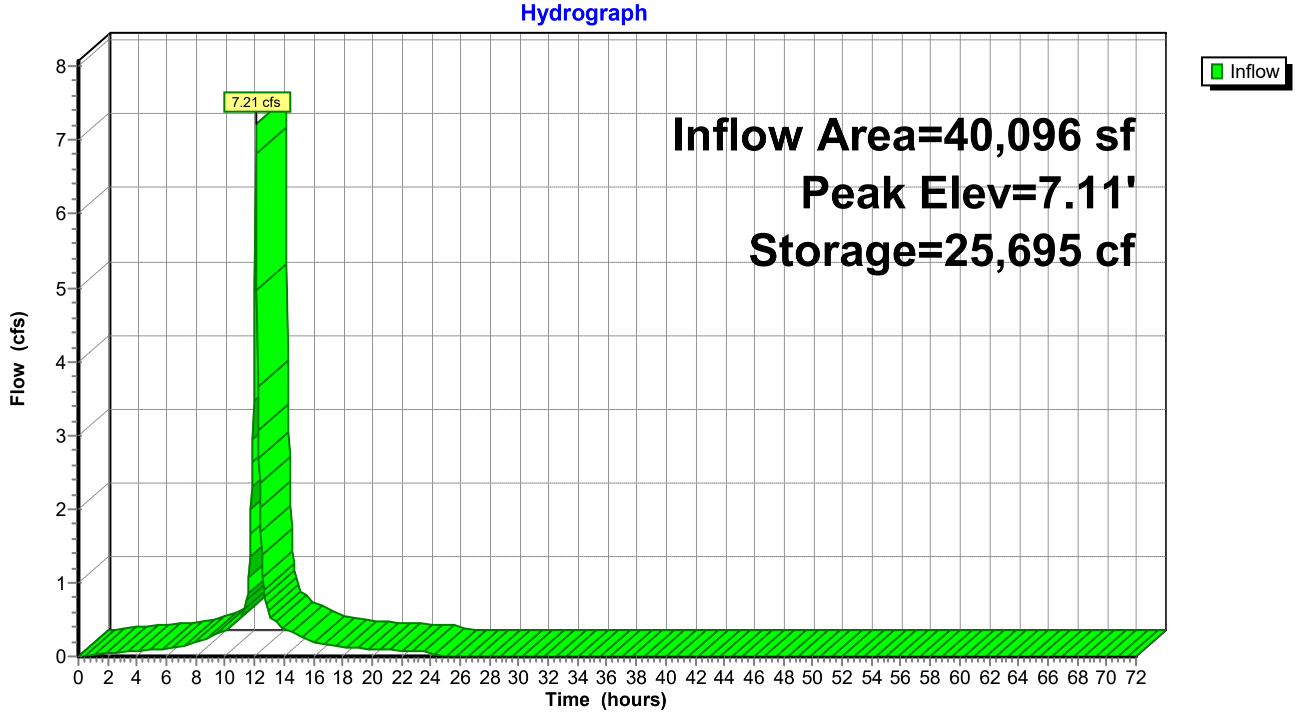
Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 7.11' @ 24.35 hrs Surf.Area= 26,291 sf Storage= 25,695 cf

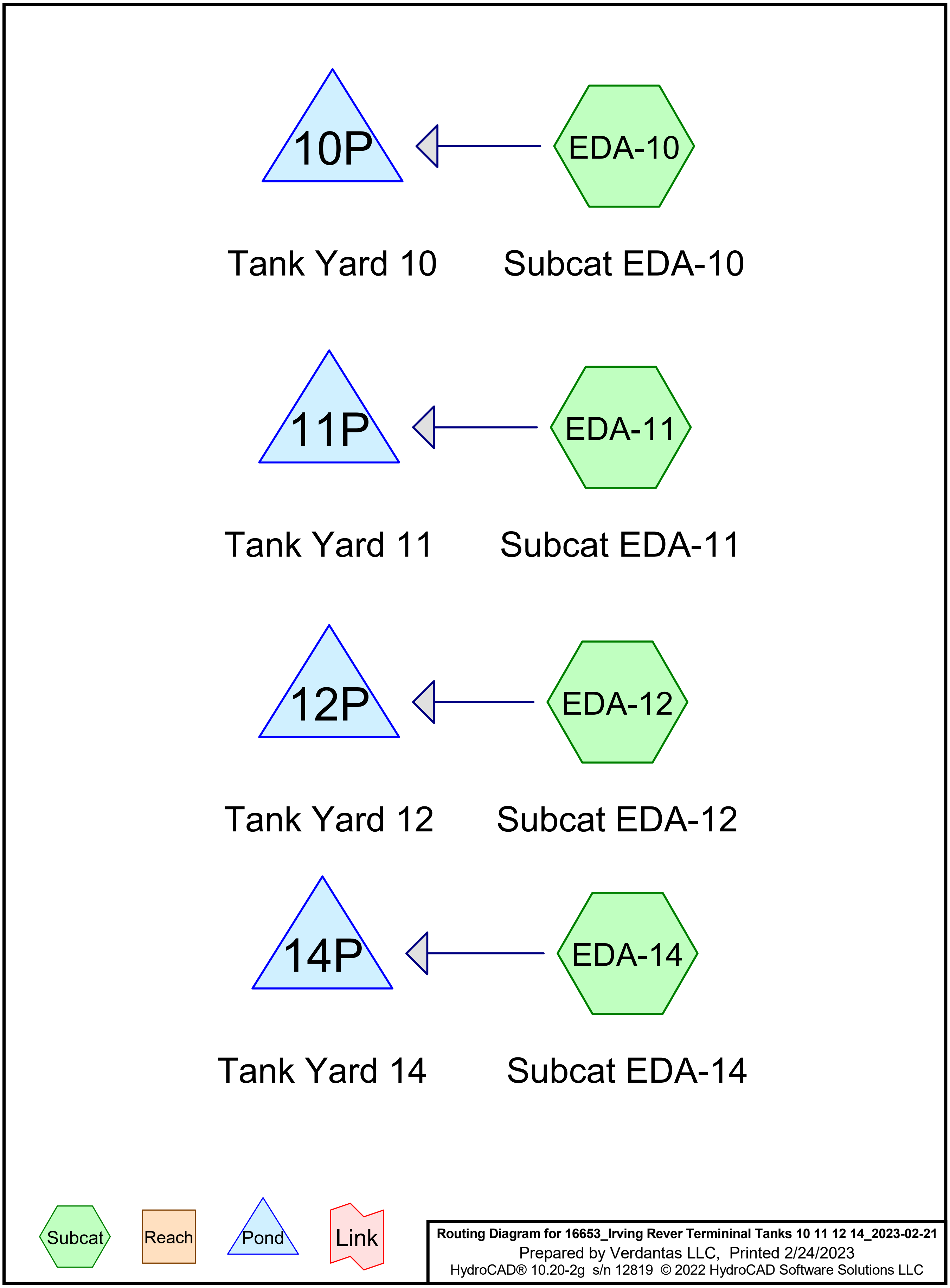
Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= (not calculated: no outflow)

Volume	Invert	Avail.Storage	Storage Description
#1	5.00'	75,892 cf	**Custom Stage Data (Irregular)** Listed below (Recalc) 93,524 cf Overall - 17,632 cf Embedded = 75,892 cf
#2	5.50'	0 cf	**78.00'D x 3.69'H Vertical Cone/Cylinder** Inside #1 17,632 cf Overall x 0.0% Voids
		75,892 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
5.00	1,422	280.0	0	0	1,422
6.00	18,440	541.0	8,328	8,328	18,479
7.00	25,949	648.0	22,088	30,415	28,620
8.00	29,011	690.0	27,466	57,881	33,142
9.00	30,595	703.0	29,799	87,681	34,743
9.19	30,913	714.0	5,843	93,524	35,990

Pond 7P: Tank Yard 7





Routing Diagram for 16653_Irving Rever Termininal Tanks 10 11 12 14_2023-02-21
Prepared by Verdantas LLC, Printed 2/24/2023
HydroCAD® 10.20-2g s/n 12819 © 2022 HydroCAD Software Solutions LLC

Rainfall Events Listing (selected events)

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	25-yr	Type III 24-hr		Default	24.00	1	6.16	2
2	100-yr	Type III 24-hr		Default	24.00	1	7.93	2

Area Listing (all nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
397,822	98	Impervious Cover, HSG D (EDA-10, EDA-11, EDA-12, EDA-14)

Summary for Subcatchment EDA-10: Subcat EDA-10

[49] Hint: Tc<2dt may require smaller dt

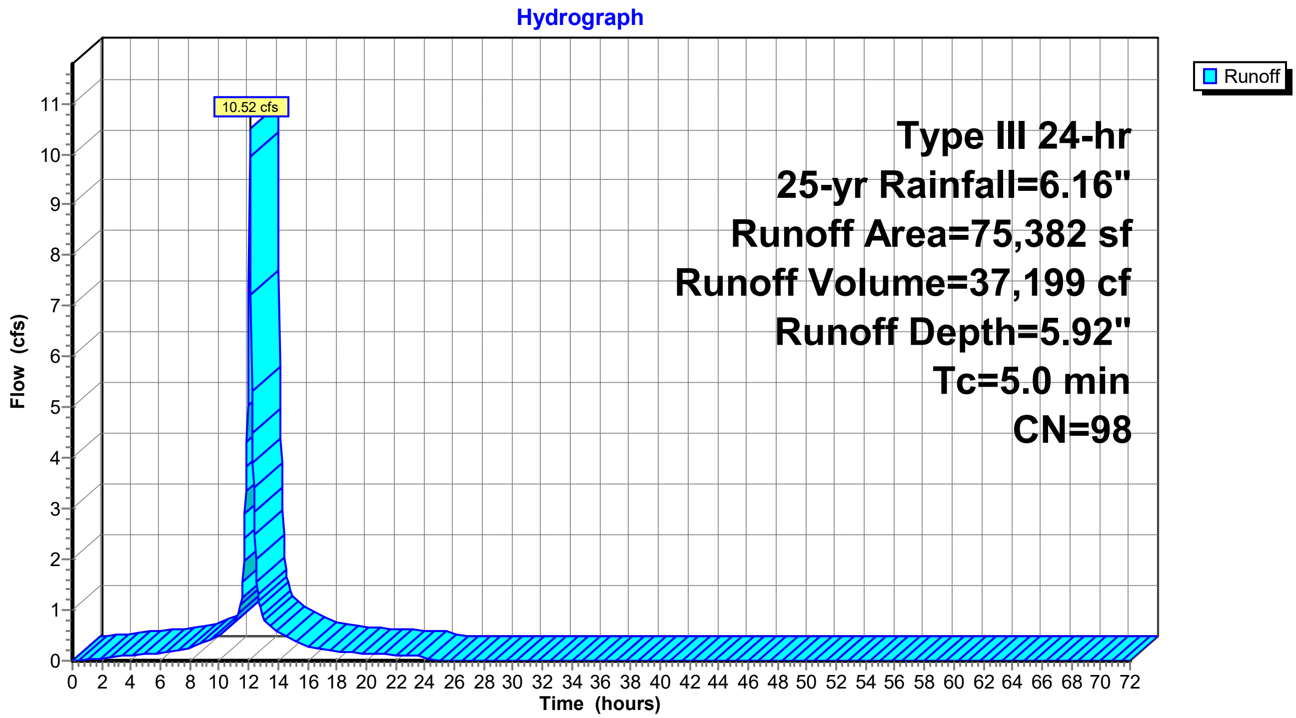
Runoff = 10.52 cfs @ 12.07 hrs, Volume= 37,199 cf, Depth= 5.92"
Routed to Pond 10P : Tank Yard 10

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-yr Rainfall=6.16"

Area (sf)	CN	Description
75,382	98	Impervious Cover, HSG D
75,382		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, Minimum TC**

Subcatchment EDA-10: Subcat EDA-10



Summary for Subcatchment EDA-11: Subcat EDA-11

[49] Hint: Tc<2dt may require smaller dt

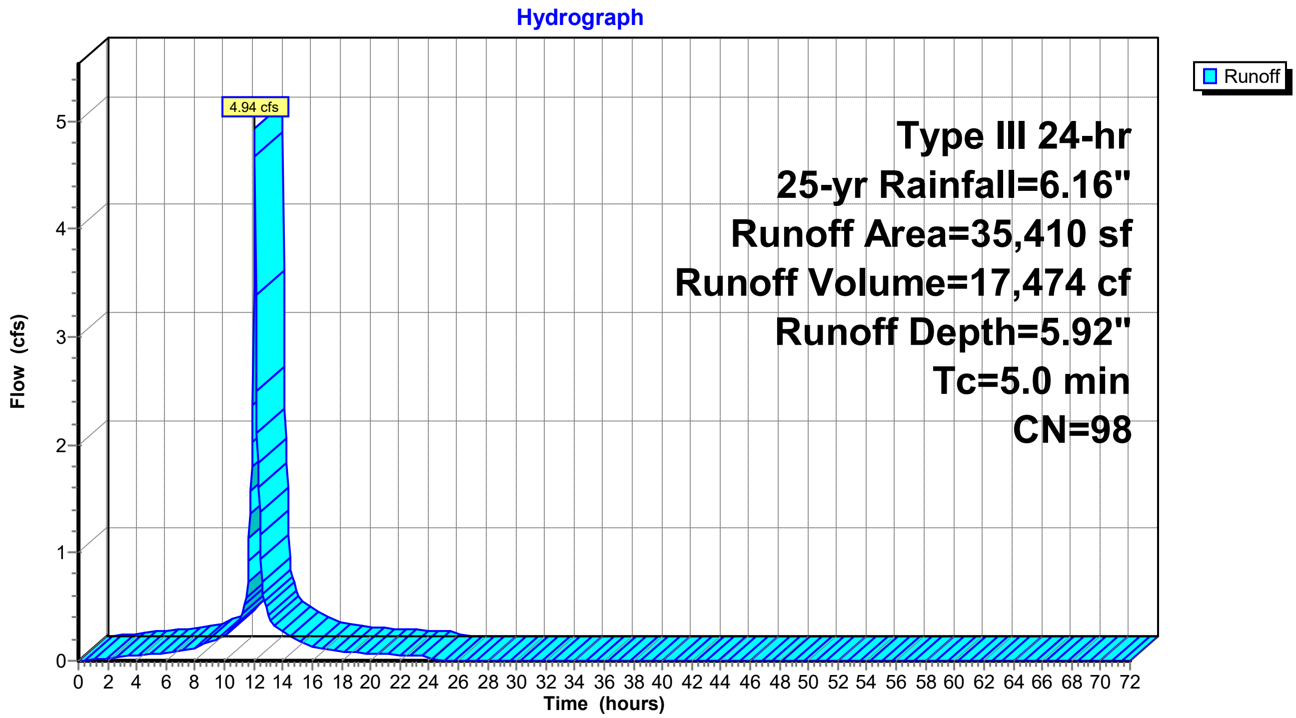
Runoff = 4.94 cfs @ 12.07 hrs, Volume= 17,474 cf, Depth= 5.92"
Routed to Pond 11P : Tank Yard 11

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-yr Rainfall=6.16"

Area (sf)	CN	Description
35,410	98	Impervious Cover, HSG D
35,410		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, Minimum TC**

Subcatchment EDA-11: Subcat EDA-11



Summary for Subcatchment EDA-12: Subcat EDA-12

[49] Hint: Tc<2dt may require smaller dt

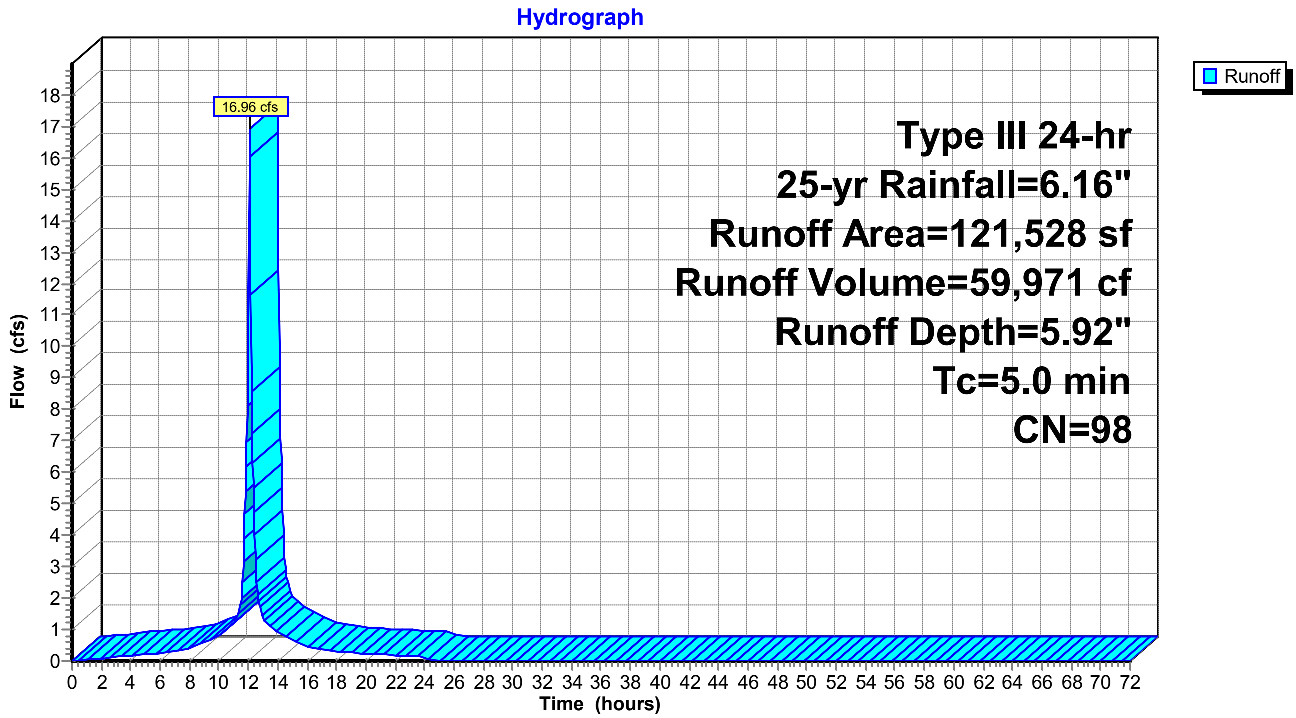
Runoff = 16.96 cfs @ 12.07 hrs, Volume= 59,971 cf, Depth= 5.92"
Routed to Pond 12P : Tank Yard 12

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-yr Rainfall=6.16"

Area (sf)	CN	Description
121,528	98	Impervious Cover, HSG D
121,528		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, Minimum TC**

Subcatchment EDA-12: Subcat EDA-12



Summary for Subcatchment EDA-14: Subcat EDA-14

[49] Hint: Tc<2dt may require smaller dt

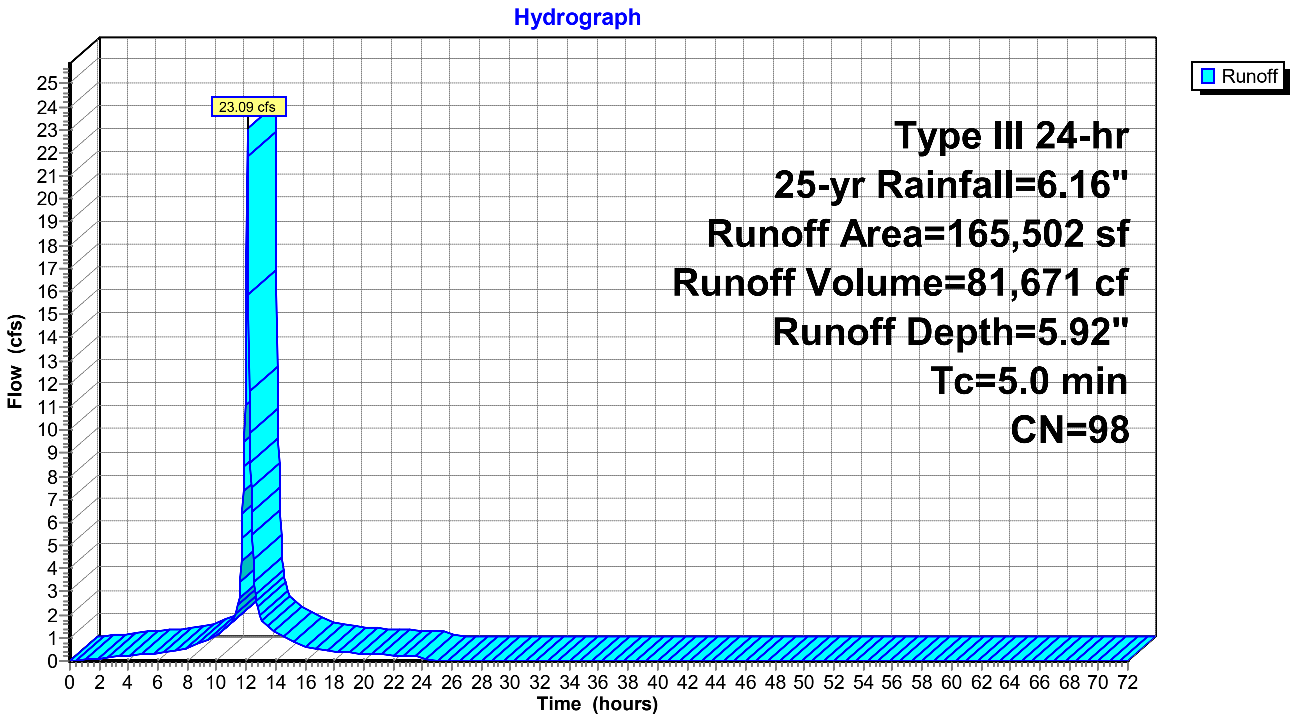
Runoff = 23.09 cfs @ 12.07 hrs, Volume= 81,671 cf, Depth= 5.92"
Routed to Pond 14P : Tank Yard 14

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-yr Rainfall=6.16"

Area (sf)	CN	Description
165,502	98	Impervious Cover, HSG D
165,502		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, Minimum TC**

Subcatchment EDA-14: Subcat EDA-14



Summary for Pond 10P: Tank Yard 10

Inflow Area = 75,382 sf,100.00% Impervious, Inflow Depth = 5.92" for 25-yr event
Inflow = 10.52 cfs @ 12.07 hrs, Volume= 37,199 cf
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Atten= 100%, Lag= 0.0 min

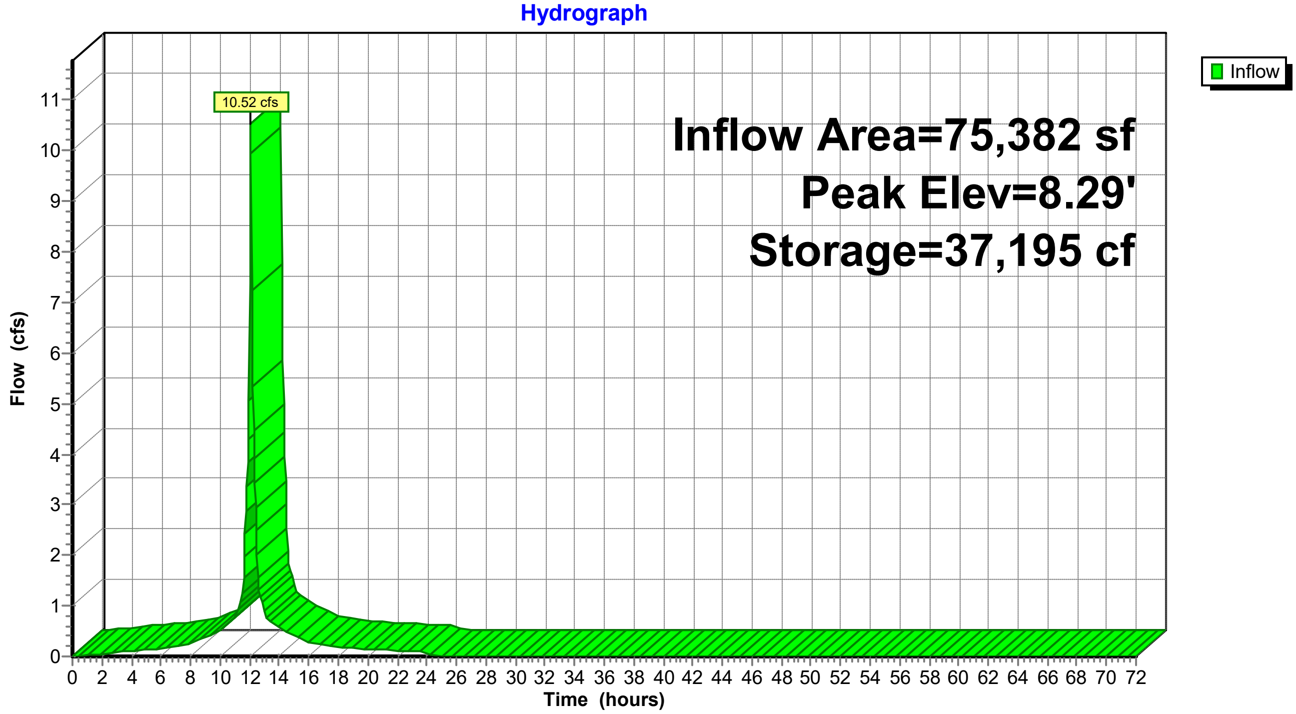
Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 8.29' @ 24.35 hrs Surf.Area= 51,413 sf Storage= 37,195 cf

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= (not calculated: no outflow)

Volume	Invert	Avail.Storage	Storage Description
#1	6.00'	307,640 cf	**Custom Stage Data (Irregular)** Listed below (Recalc) 377,760 cf Overall - 70,120 cf Embedded = 307,640 cf
#2	7.50'	0 cf	**120.00'D x 6.20'H Vertical Cone/Cylinder** Inside #1 70,120 cf Overall x 0.0% Voids
		307,640 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
6.00	805	148.0	0	0	805
7.00	9,790	1,056.0	4,467	4,467	87,804
8.00	49,303	994.0	27,021	31,488	97,970
9.00	56,740	947.0	52,978	84,466	105,294
10.00	59,600	963.0	58,164	142,631	107,907
11.00	61,735	977.0	60,664	203,295	110,276
12.00	63,877	994.0	62,803	266,098	113,118
13.00	66,031	1,009.0	64,951	331,049	115,711
13.70	67,433	1,024.0	46,712	377,760	118,239

Pond 10P: Tank Yard 10



Summary for Pond 11P: Tank Yard 11

Inflow Area = 35,410 sf,100.00% Impervious, Inflow Depth = 5.92" for 25-yr event
Inflow = 4.94 cfs @ 12.07 hrs, Volume= 17,474 cf
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Atten= 100%, Lag= 0.0 min

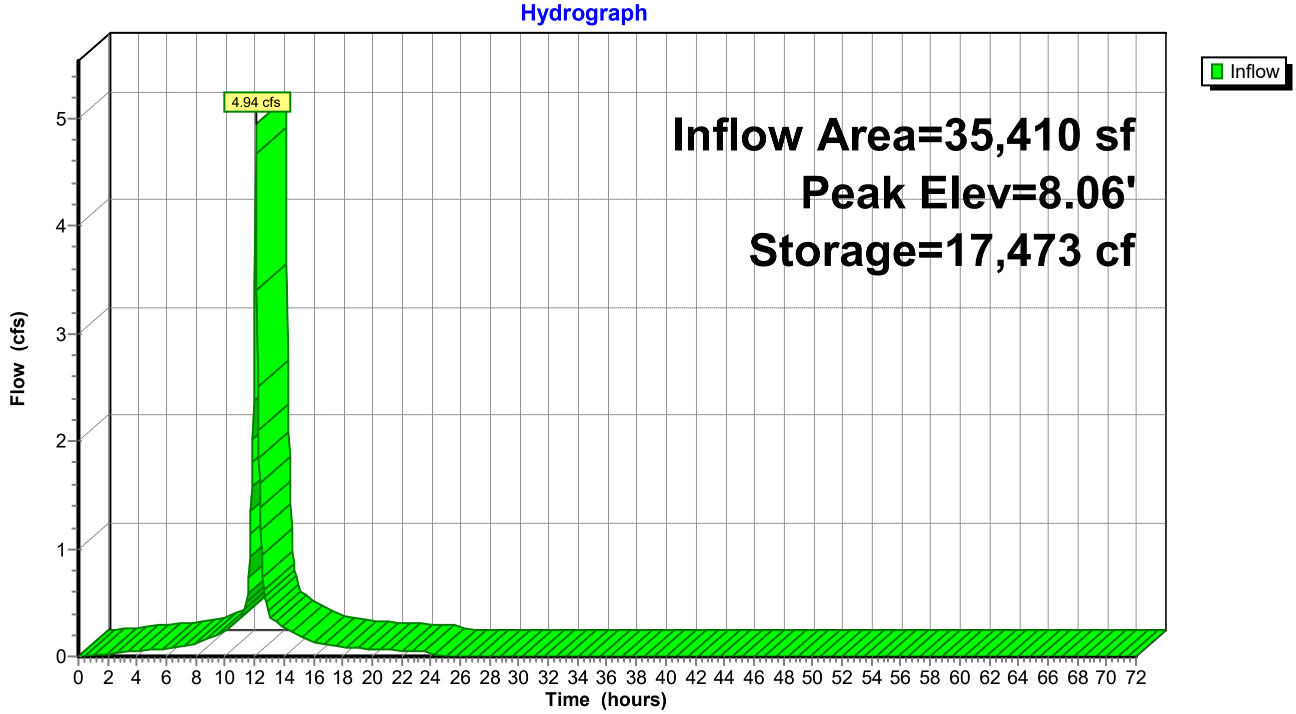
Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 8.06' @ 24.35 hrs Surf.Area= 21,649 sf Storage= 17,473 cf

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= (not calculated: no outflow)

Volume	Invert	Avail.Storage	Storage Description
#1	6.00'	133,216 cf	**Custom Stage Data (Irregular)** Listed below (Recalc) 159,115 cf Overall - 25,899 cf Embedded = 133,216 cf
#2	8.00'	0 cf	**78.00'D x 5.42'H Vertical Cone/Cylinder** Inside #1 25,899 cf Overall x 0.0% Voids
		133,216 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
6.00	512	136.0	0	0	512
7.00	6,792	809.0	3,056	3,056	51,124
8.00	21,506	728.0	13,461	16,518	61,061
9.00	24,099	601.0	22,790	39,308	74,509
10.00	25,443	617.0	24,768	64,076	76,175
11.00	26,806	633.0	26,122	90,197	77,885
12.00	28,185	649.0	27,493	117,690	79,639
13.00	29,585	665.0	28,882	146,572	81,436
13.42	30,144	680.0	12,543	159,115	83,066

Pond 11P: Tank Yard 11



Summary for Pond 12P: Tank Yard 12

Inflow Area = 121,528 sf,100.00% Impervious, Inflow Depth = 5.92" for 25-yr event
Inflow = 16.96 cfs @ 12.07 hrs, Volume= 59,971 cf
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Atten= 100%, Lag= 0.0 min

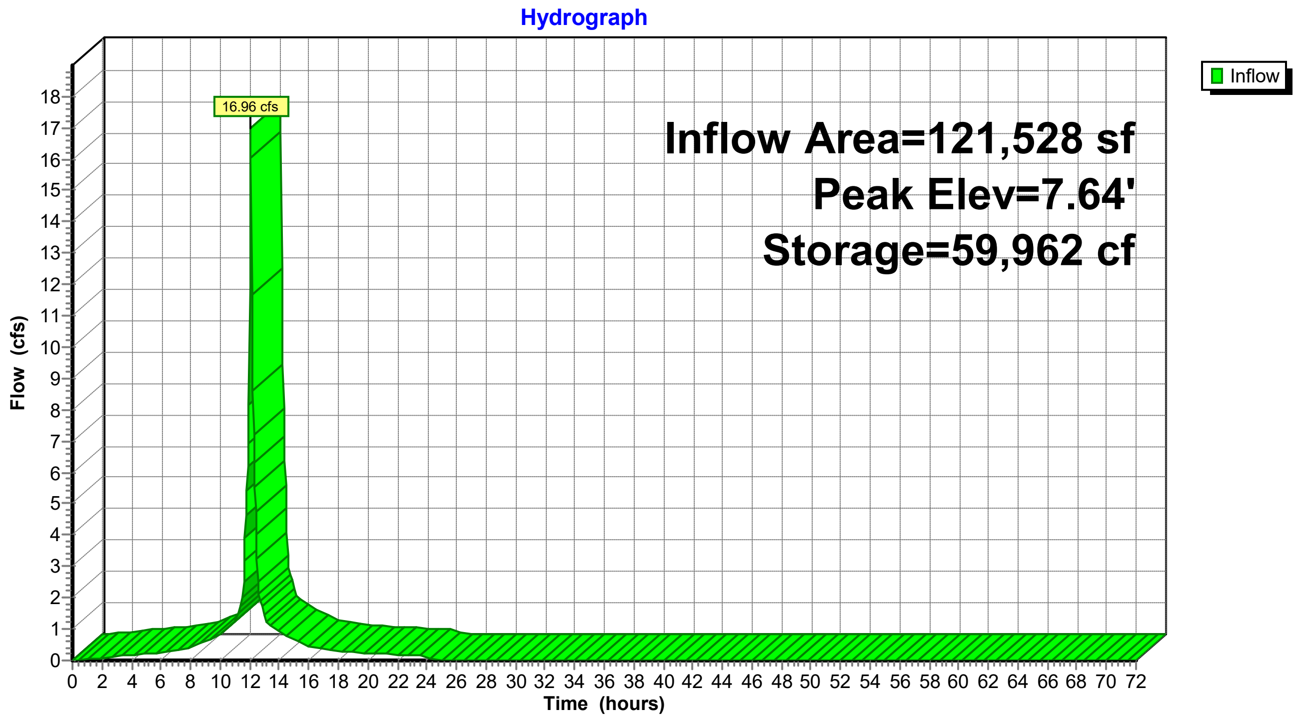
Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 7.64' @ 24.35 hrs Surf.Area= 80,199 sf Storage= 59,962 cf

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= (not calculated: no outflow)

Volume	Invert	Avail.Storage	Storage Description
#1	6.00'	375,293 cf	**Custom Stage Data (Irregular)** Listed below (Recalc) 451,030 cf Overall - 75,738 cf Embedded = 375,293 cf
#2	6.50'	0 cf	**140.00'D x 4.92'H Vertical Cone/Cylinder** Inside #1 75,738 cf Overall x 0.0% Voids
		375,293 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
6.00	9,578	1,201.0	0	0	9,578
7.00	62,058	1,016.0	32,005	32,005	42,235
8.00	91,328	1,305.0	76,223	108,229	95,626
9.00	98,495	1,244.0	94,889	203,118	108,065
10.00	101,774	1,269.0	100,130	303,248	113,220
11.00	105,031	1,293.0	103,398	406,646	118,278
11.42	106,325	1,304.0	44,384	451,030	120,615

Pond 12P: Tank Yard 12



Summary for Pond 14P: Tank Yard 14

Inflow Area = 165,502 sf,100.00% Impervious, Inflow Depth = 5.92" for 25-yr event
Inflow = 23.09 cfs @ 12.07 hrs, Volume= 81,671 cf
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Atten= 100%, Lag= 0.0 min

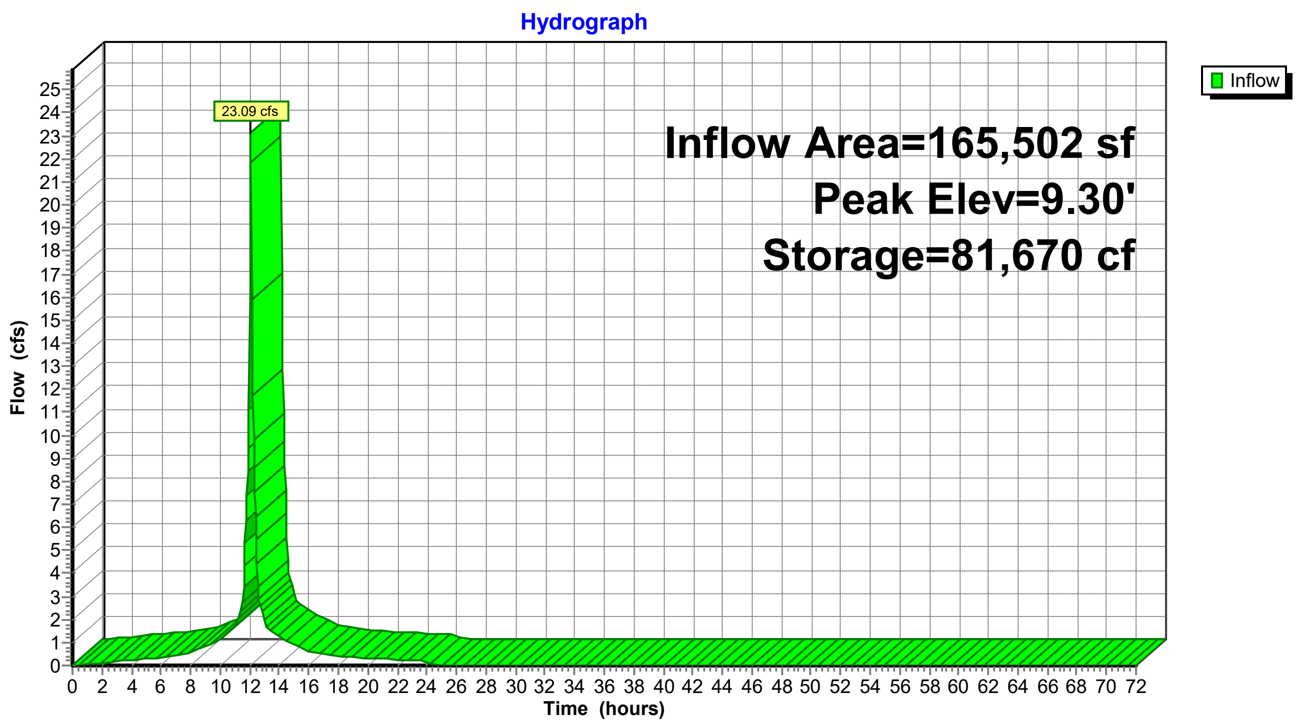
Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 9.30' @ 24.35 hrs Surf.Area= 89,463 sf Storage= 81,670 cf

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= (not calculated: no outflow)

Volume	Invert	Avail.Storage	Storage Description
#1	7.00'	185,020 cf	**Custom Stage Data (Irregular)** Listed below (Recalc) 258,107 cf Overall - 73,088 cf Embedded = 185,020 cf
#2	7.50'	0 cf	**170.00'D x 3.22'H Vertical Cone/Cylinder** Inside #1 73,088 cf Overall x 0.0% Voids
		185,020 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
7.00	2,824	359.0	0	0	2,824
8.00	57,694	970.0	24,427	24,427	67,446
9.00	86,389	1,238.0	71,560	95,988	114,548
10.00	96,758	1,255.0	91,525	187,512	118,144
10.72	99,344	1,404.0	70,595	258,107	149,686

Pond 14P: Tank Yard 14



Summary for Subcatchment EDA-10: Subcat EDA-10

[49] Hint: Tc<2dt may require smaller dt

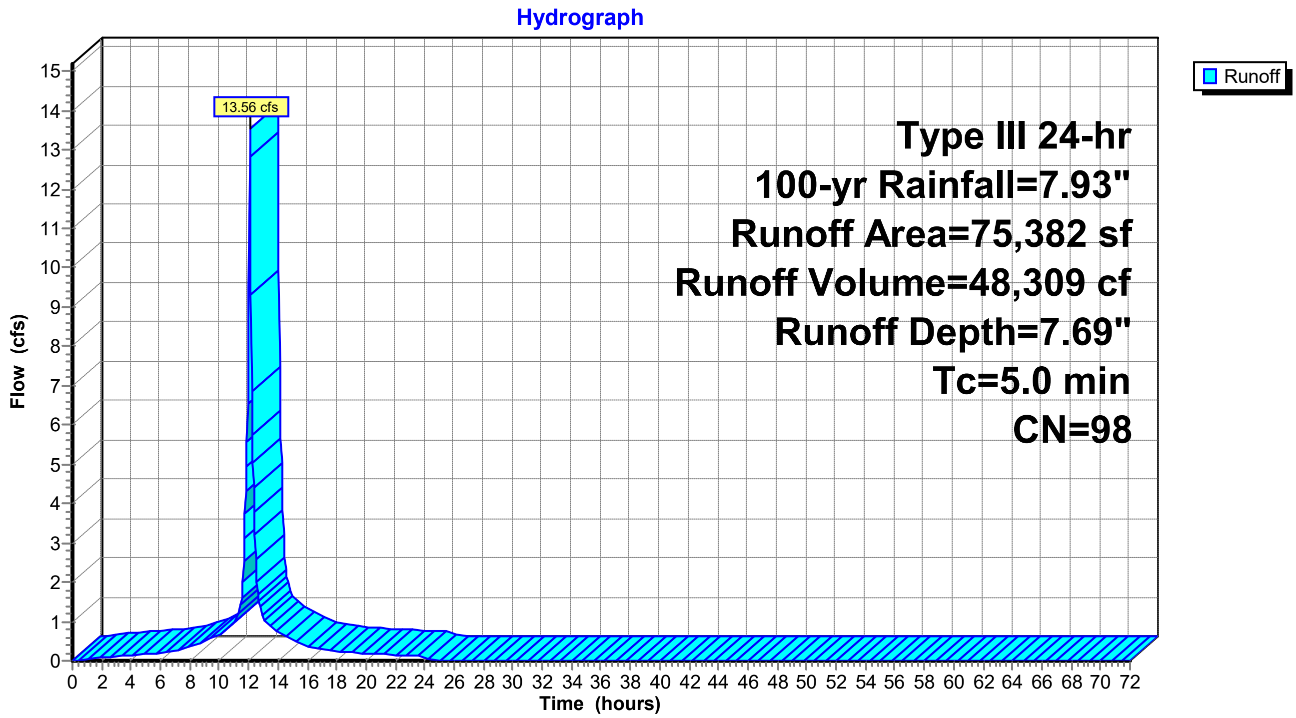
Runoff = 13.56 cfs @ 12.07 hrs, Volume= 48,309 cf, Depth= 7.69"
Routed to Pond 10P : Tank Yard 10

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-yr Rainfall=7.93"

Area (sf)	CN	Description
75,382	98	Impervious Cover, HSG D
75,382		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, Minimum TC**

Subcatchment EDA-10: Subcat EDA-10



Summary for Subcatchment EDA-11: Subcat EDA-11

[49] Hint: Tc<2dt may require smaller dt

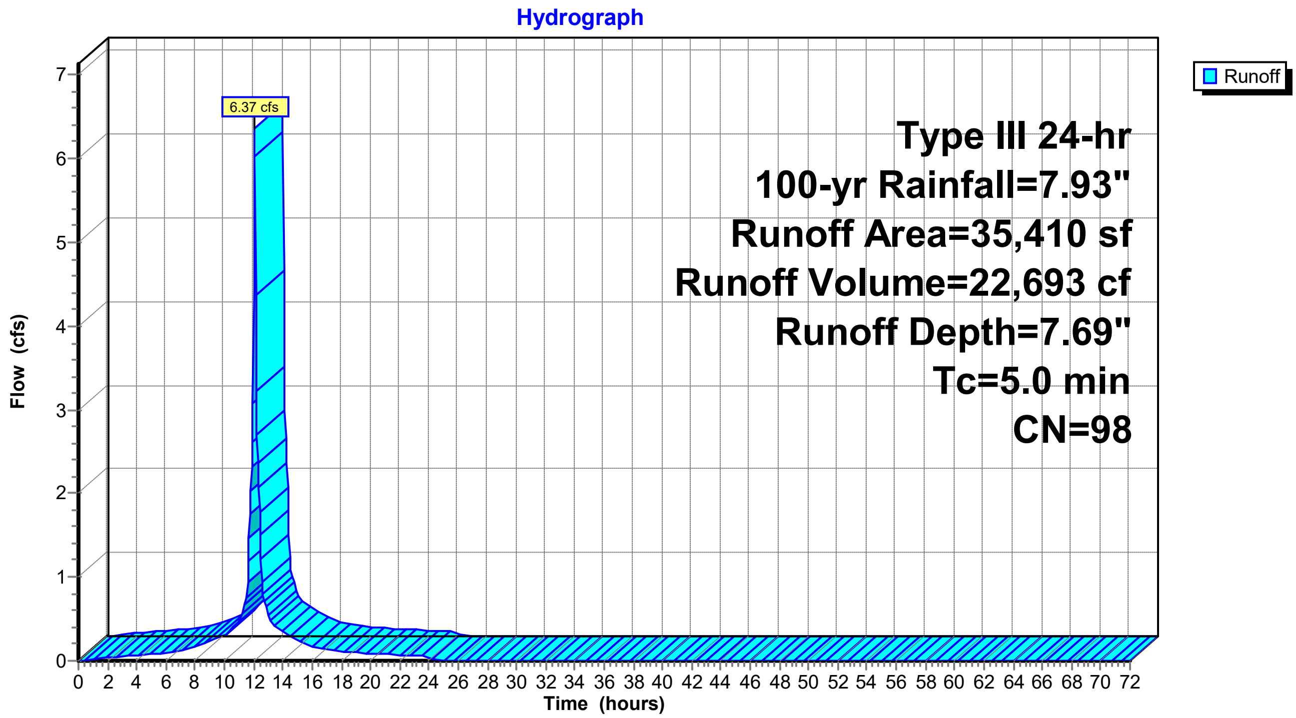
Runoff = 6.37 cfs @ 12.07 hrs, Volume= 22,693 cf, Depth= 7.69"
Routed to Pond 11P : Tank Yard 11

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-yr Rainfall=7.93"

Area (sf)	CN	Description
35,410	98	Impervious Cover, HSG D
35,410		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, Minimum TC**

Subcatchment EDA-11: Subcat EDA-11



Summary for Subcatchment EDA-12: Subcat EDA-12

[49] Hint: Tc<2dt may require smaller dt

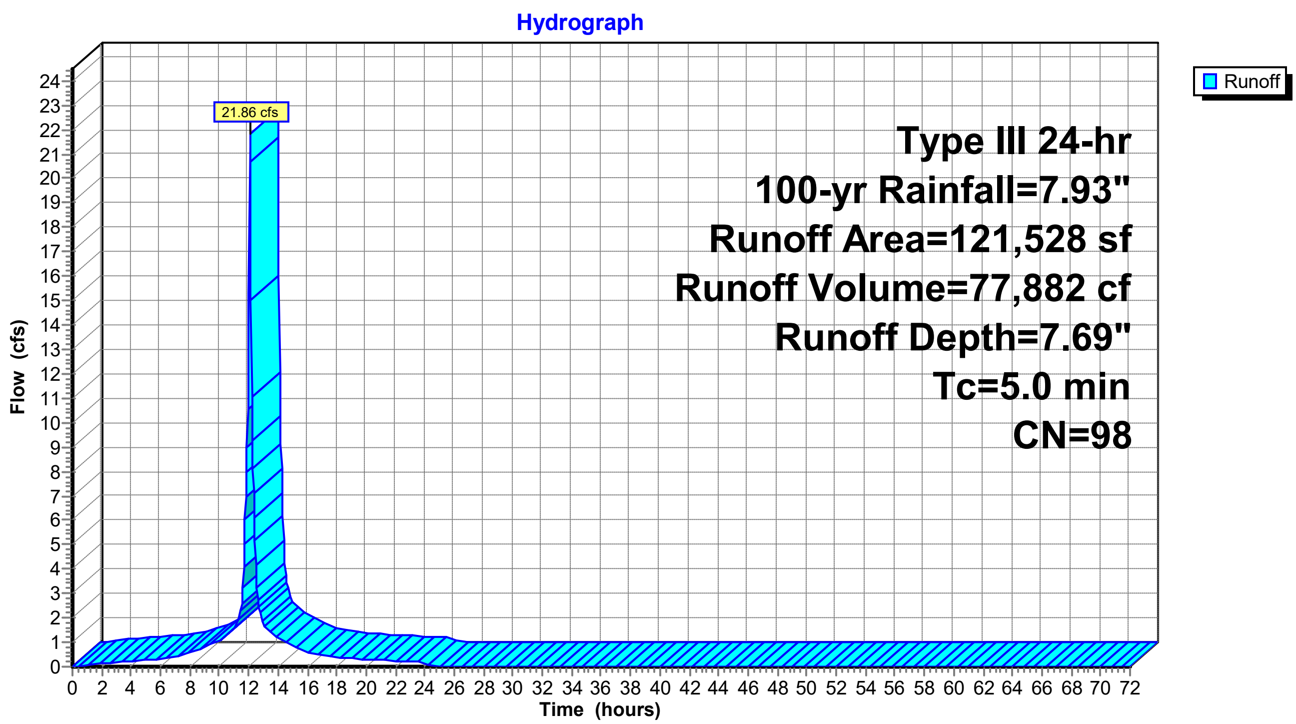
Runoff = 21.86 cfs @ 12.07 hrs, Volume= 77,882 cf, Depth= 7.69"
Routed to Pond 12P : Tank Yard 12

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-yr Rainfall=7.93"

Area (sf)	CN	Description
121,528	98	Impervious Cover, HSG D
121,528		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, Minimum TC**

Subcatchment EDA-12: Subcat EDA-12



Summary for Subcatchment EDA-14: Subcat EDA-14

[49] Hint: Tc<2dt may require smaller dt

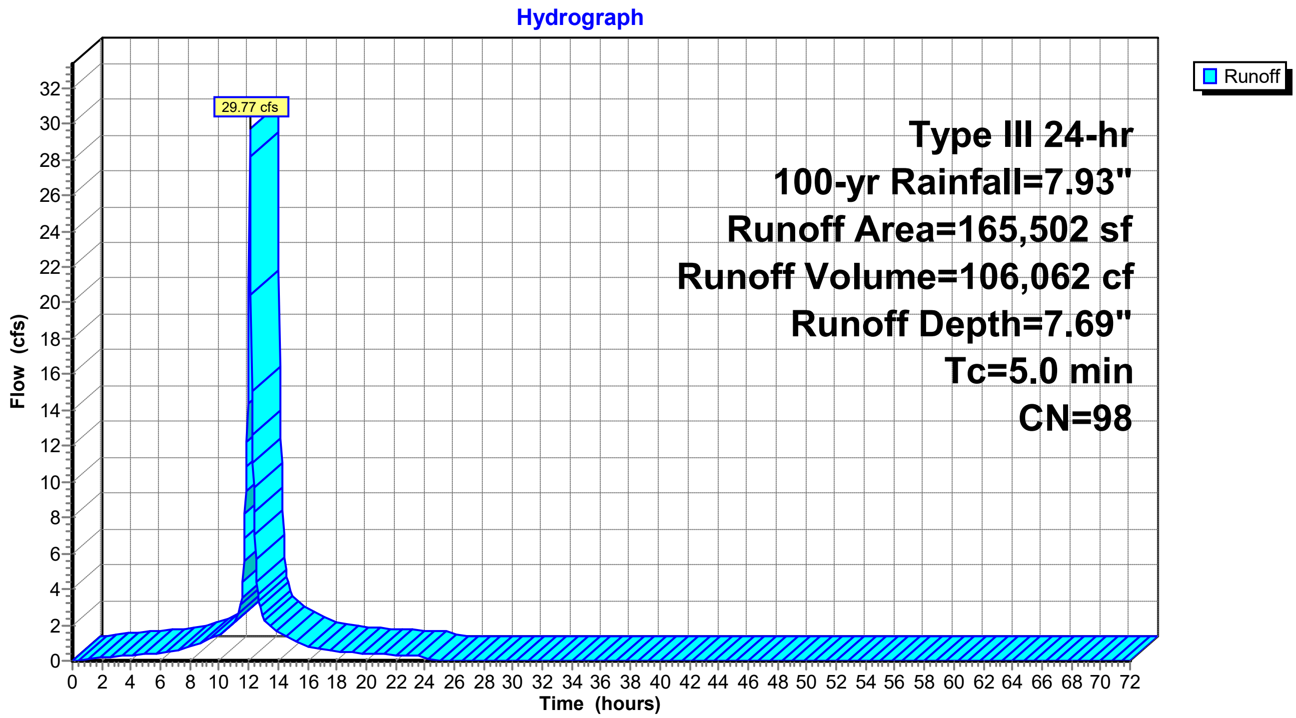
Runoff = 29.77 cfs @ 12.07 hrs, Volume= 106,062 cf, Depth= 7.69"
Routed to Pond 14P : Tank Yard 14

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-yr Rainfall=7.93"

Area (sf)	CN	Description
165,502	98	Impervious Cover, HSG D
165,502		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, Minimum TC**

Subcatchment EDA-14: Subcat EDA-14



Summary for Pond 10P: Tank Yard 10

Inflow Area = 75,382 sf,100.00% Impervious, Inflow Depth = 7.69" for 100-yr event
Inflow = 13.56 cfs @ 12.07 hrs, Volume= 48,309 cf
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Atten= 100%, Lag= 0.0 min

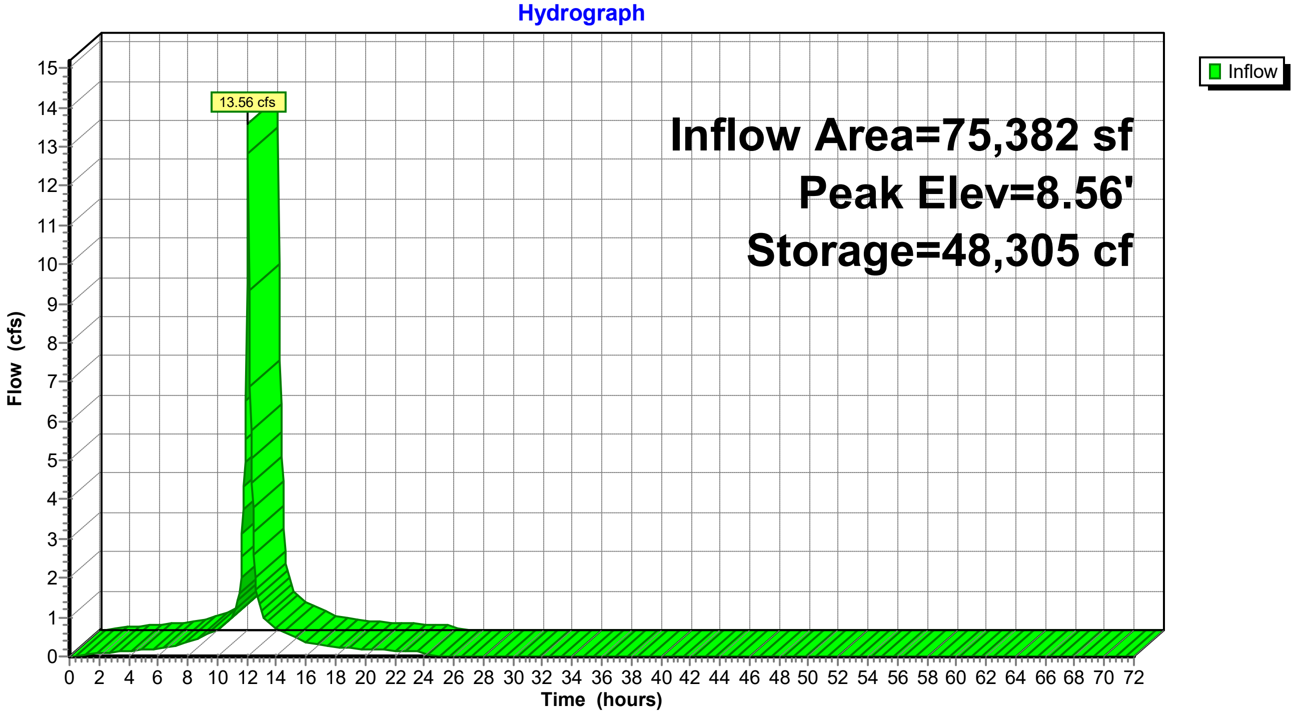
Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 8.56' @ 24.35 hrs Surf.Area= 53,413 sf Storage= 48,305 cf

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= (not calculated: no outflow)

Volume	Invert	Avail.Storage	Storage Description
#1	6.00'	307,640 cf	**Custom Stage Data (Irregular)** Listed below (Recalc) 377,760 cf Overall - 70,120 cf Embedded = 307,640 cf
#2	7.50'	0 cf	**120.00'D x 6.20'H Vertical Cone/Cylinder** Inside #1 70,120 cf Overall x 0.0% Voids
		307,640 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
6.00	805	148.0	0	0	805
7.00	9,790	1,056.0	4,467	4,467	87,804
8.00	49,303	994.0	27,021	31,488	97,970
9.00	56,740	947.0	52,978	84,466	105,294
10.00	59,600	963.0	58,164	142,631	107,907
11.00	61,735	977.0	60,664	203,295	110,276
12.00	63,877	994.0	62,803	266,098	113,118
13.00	66,031	1,009.0	64,951	331,049	115,711
13.70	67,433	1,024.0	46,712	377,760	118,239

Pond 10P: Tank Yard 10



Summary for Pond 11P: Tank Yard 11

Inflow Area = 35,410 sf,100.00% Impervious, Inflow Depth = 7.69" for 100-yr event
Inflow = 6.37 cfs @ 12.07 hrs, Volume= 22,693 cf
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Atten= 100%, Lag= 0.0 min

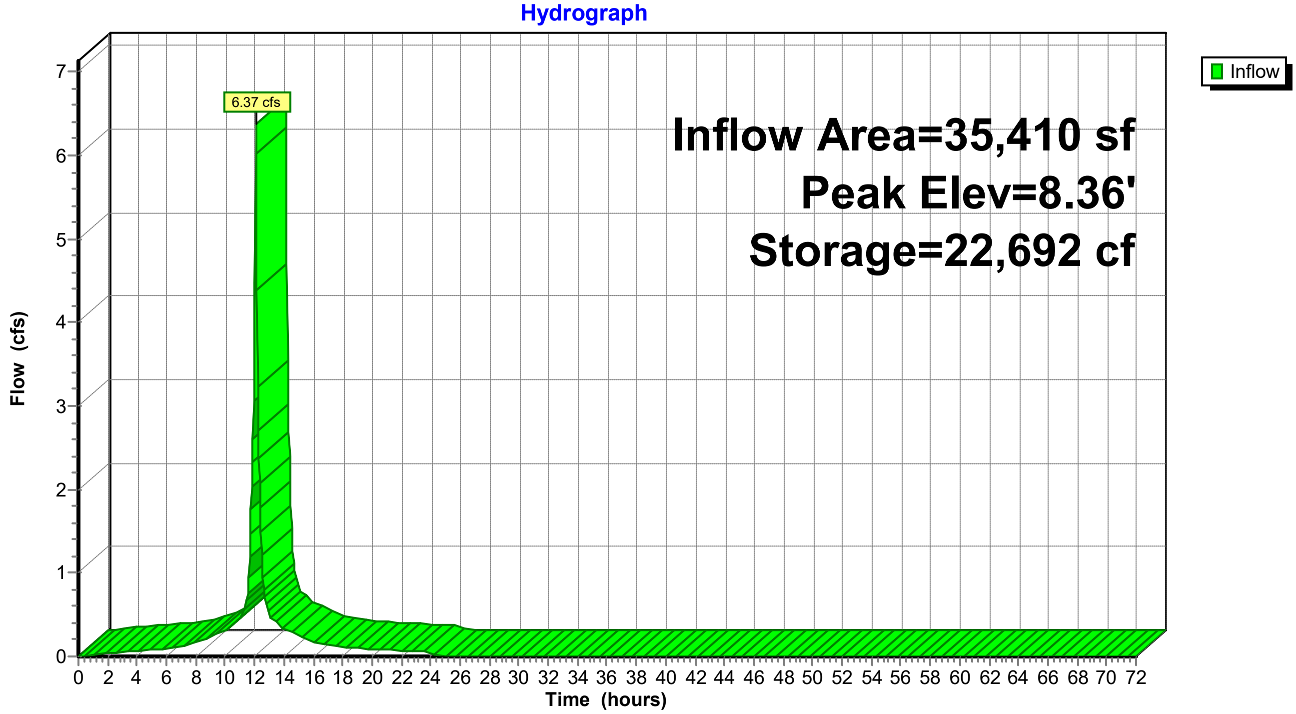
Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 8.36' @ 24.35 hrs Surf.Area= 22,421 sf Storage= 22,692 cf

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= (not calculated: no outflow)

Volume	Invert	Avail.Storage	Storage Description
#1	6.00'	133,216 cf	**Custom Stage Data (Irregular)** Listed below (Recalc) 159,115 cf Overall - 25,899 cf Embedded = 133,216 cf
#2	8.00'	0 cf	**78.00'D x 5.42'H Vertical Cone/Cylinder** Inside #1 25,899 cf Overall x 0.0% Voids
		133,216 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
6.00	512	136.0	0	0	512
7.00	6,792	809.0	3,056	3,056	51,124
8.00	21,506	728.0	13,461	16,518	61,061
9.00	24,099	601.0	22,790	39,308	74,509
10.00	25,443	617.0	24,768	64,076	76,175
11.00	26,806	633.0	26,122	90,197	77,885
12.00	28,185	649.0	27,493	117,690	79,639
13.00	29,585	665.0	28,882	146,572	81,436
13.42	30,144	680.0	12,543	159,115	83,066

Pond 11P: Tank Yard 11



Summary for Pond 12P: Tank Yard 12

Inflow Area = 121,528 sf,100.00% Impervious, Inflow Depth = 7.69" for 100-yr event
Inflow = 21.86 cfs @ 12.07 hrs, Volume= 77,882 cf
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Atten= 100%, Lag= 0.0 min

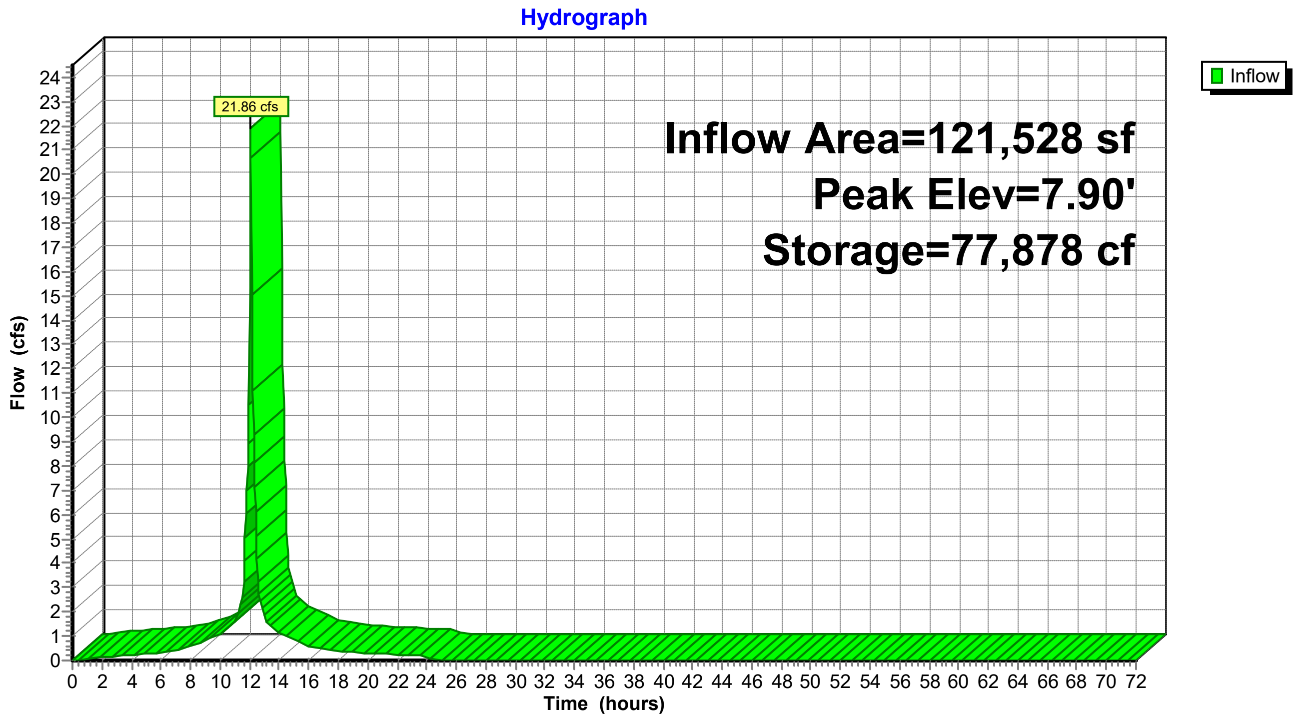
Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 7.90' @ 24.35 hrs Surf.Area= 88,222 sf Storage= 77,878 cf

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= (not calculated: no outflow)

Volume	Invert	Avail.Storage	Storage Description
#1	6.00'	375,293 cf	**Custom Stage Data (Irregular)** Listed below (Recalc) 451,030 cf Overall - 75,738 cf Embedded = 375,293 cf
#2	6.50'	0 cf	**140.00'D x 4.92'H Vertical Cone/Cylinder** Inside #1 75,738 cf Overall x 0.0% Voids
		375,293 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
6.00	9,578	1,201.0	0	0	9,578
7.00	62,058	1,016.0	32,005	32,005	42,235
8.00	91,328	1,305.0	76,223	108,229	95,626
9.00	98,495	1,244.0	94,889	203,118	108,065
10.00	101,774	1,269.0	100,130	303,248	113,220
11.00	105,031	1,293.0	103,398	406,646	118,278
11.42	106,325	1,304.0	44,384	451,030	120,615

Pond 12P: Tank Yard 12



Summary for Pond 14P: Tank Yard 14

Inflow Area = 165,502 sf,100.00% Impervious, Inflow Depth = 7.69" for 100-yr event
Inflow = 29.77 cfs @ 12.07 hrs, Volume= 106,062 cf
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Atten= 100%, Lag= 0.0 min

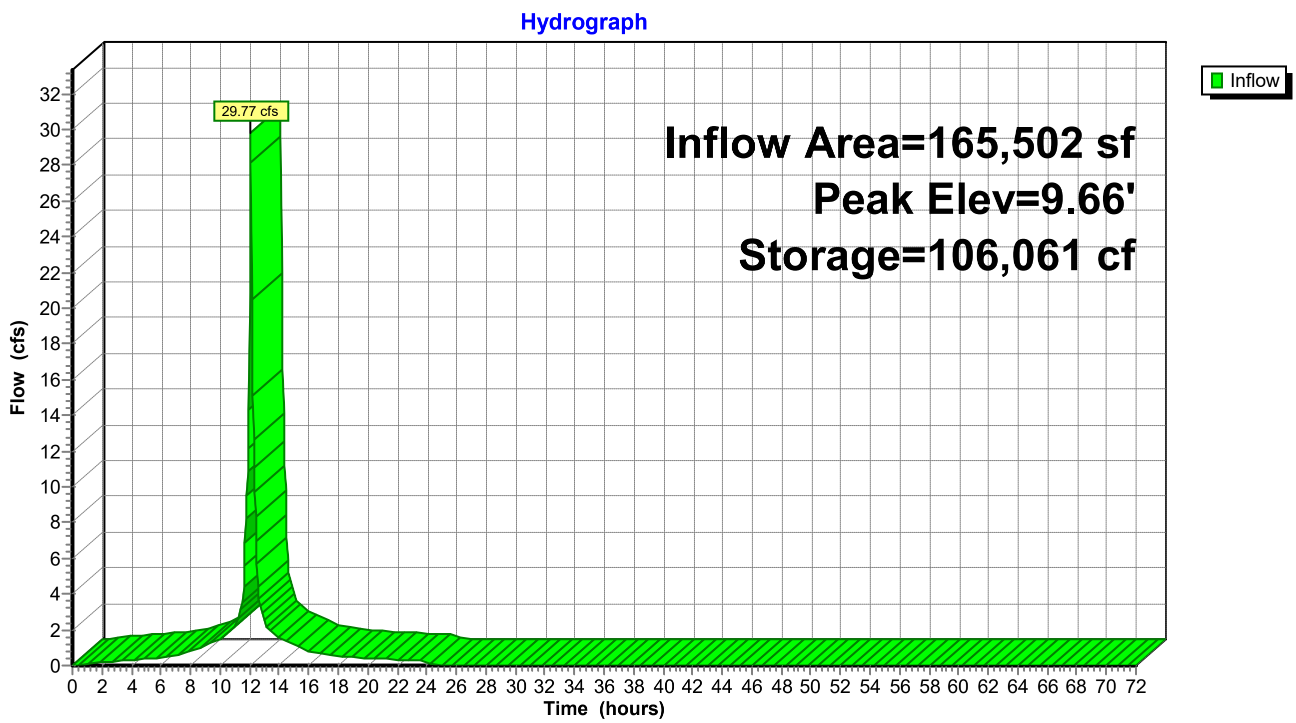
Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 9.66' @ 24.35 hrs Surf.Area= 93,146 sf Storage= 106,061 cf

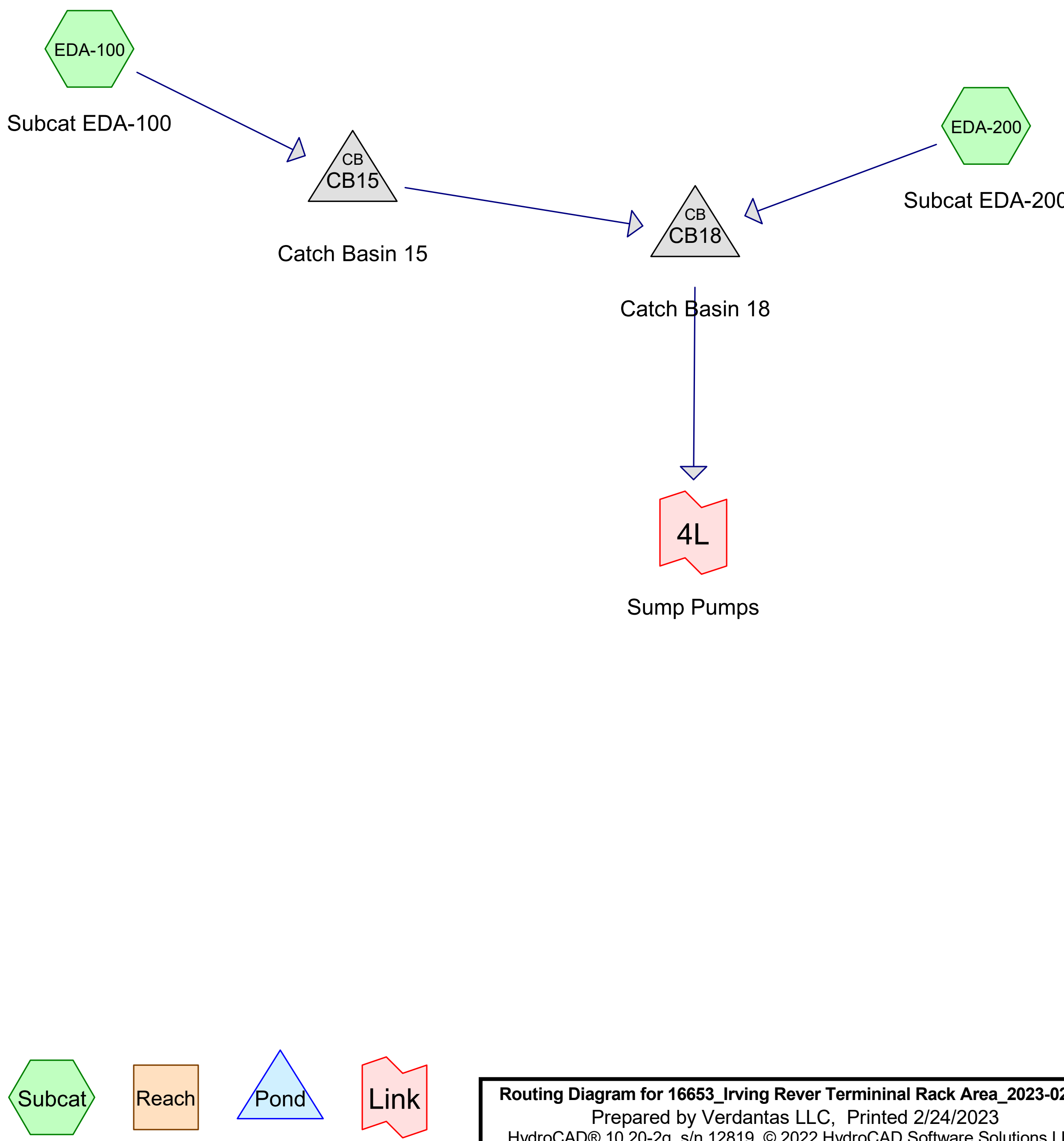
Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= (not calculated: no outflow)

Volume	Invert	Avail.Storage	Storage Description
#1	7.00'	185,020 cf	**Custom Stage Data (Irregular)** Listed below (Recalc) 258,107 cf Overall - 73,088 cf Embedded = 185,020 cf
#2	7.50'	0 cf	**170.00'D x 3.22'H Vertical Cone/Cylinder** Inside #1 73,088 cf Overall x 0.0% Voids
		185,020 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
7.00	2,824	359.0	0	0	2,824
8.00	57,694	970.0	24,427	24,427	67,446
9.00	86,389	1,238.0	71,560	95,988	114,548
10.00	96,758	1,255.0	91,525	187,512	118,144
10.72	99,344	1,404.0	70,595	258,107	149,686

Pond 14P: Tank Yard 14




EDA-100
Subcat EDA-100
CB
CB15
Catch Basin 15
CB
CB18
Catch Basin 18
EDA-200
Subcat EDA-200
4L
Sump Pumps
Subcat
Reach
Pond
Link

Rainfall Events Listing (selected events)

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	25-yr	Type III 24-hr		Default	24.00	1	6.16	2
2	100-yr	Type III 24-hr		Default	24.00	1	7.93	2

Area Listing (all nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
260,279	98	Paved roads w/curbs & sewers, HSG D (EDA-100, EDA-200)

Summary for Subcatchment EDA-100: Subcat EDA-100

[49] Hint: Tc<2dt may require smaller dt

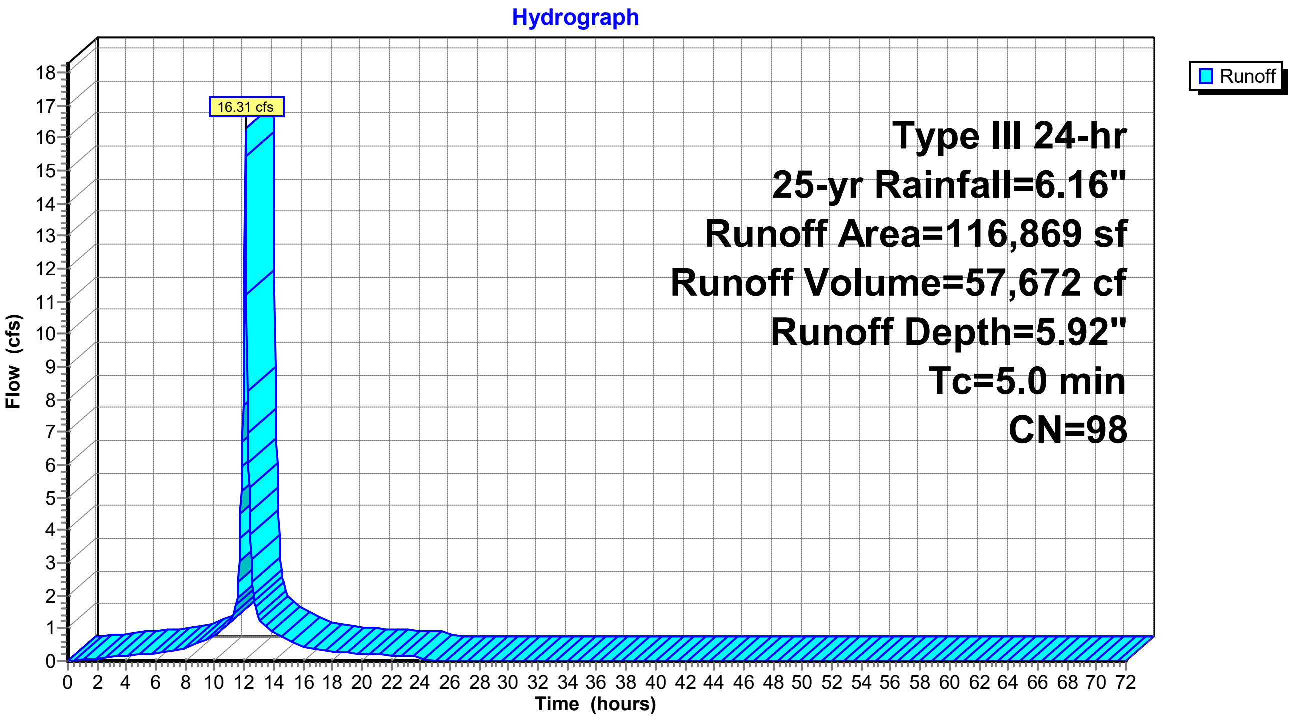
Runoff = 16.31 cfs @ 12.07 hrs, Volume= 57,672 cf, Depth= 5.92"
Routed to Pond CB15 : Catch Basin 15

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-yr Rainfall=6.16"

Area (sf)	CN	Description
116,869	98	Paved roads w/curbs & sewers, HSG D
116,869		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, Minimum TC**

Subcatchment EDA-100: Subcat EDA-100



Summary for Subcatchment EDA-200: Subcat EDA-200

[49] Hint: Tc<2dt may require smaller dt

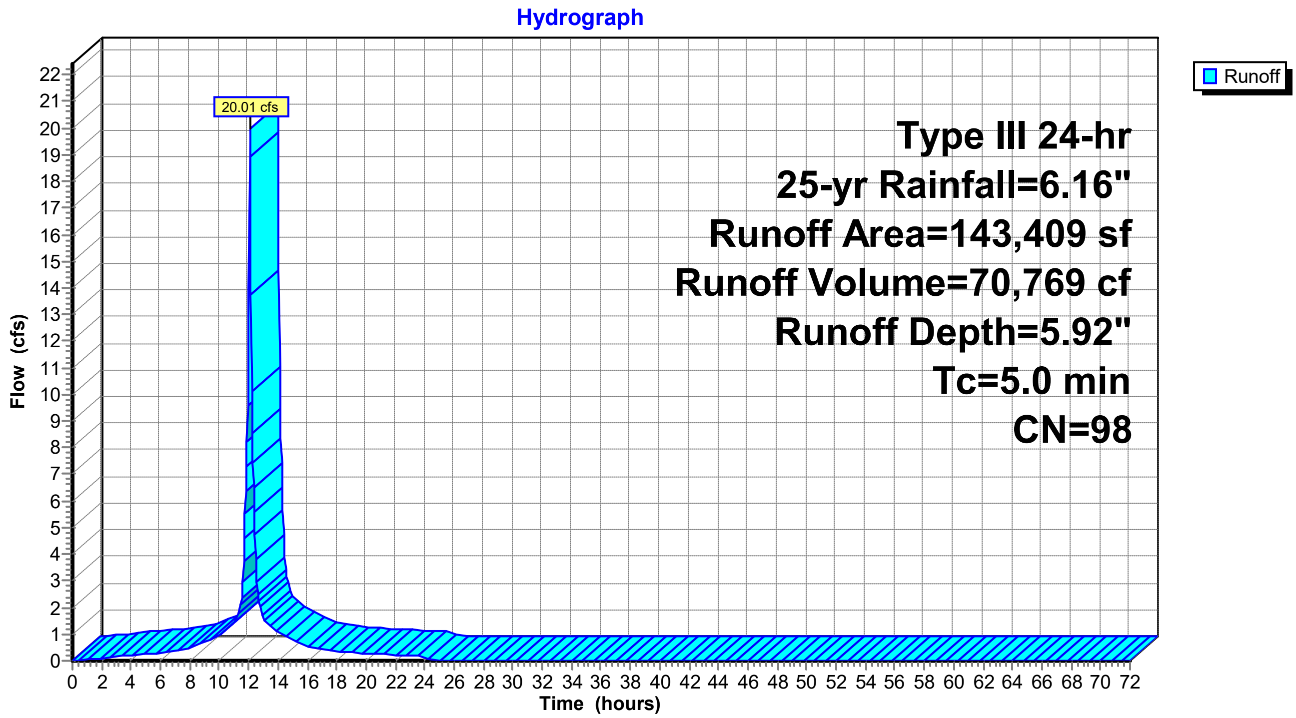
Runoff = 20.01 cfs @ 12.07 hrs, Volume= 70,769 cf, Depth= 5.92"
Routed to Pond CB18 : Catch Basin 18

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-yr Rainfall=6.16"

Area (sf)	CN	Description
143,409	98	Paved roads w/curbs & sewers, HSG D
143,409		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, Minimum TC**

Subcatchment EDA-200: Subcat EDA-200



Summary for Pond CB15: Catch Basin 15

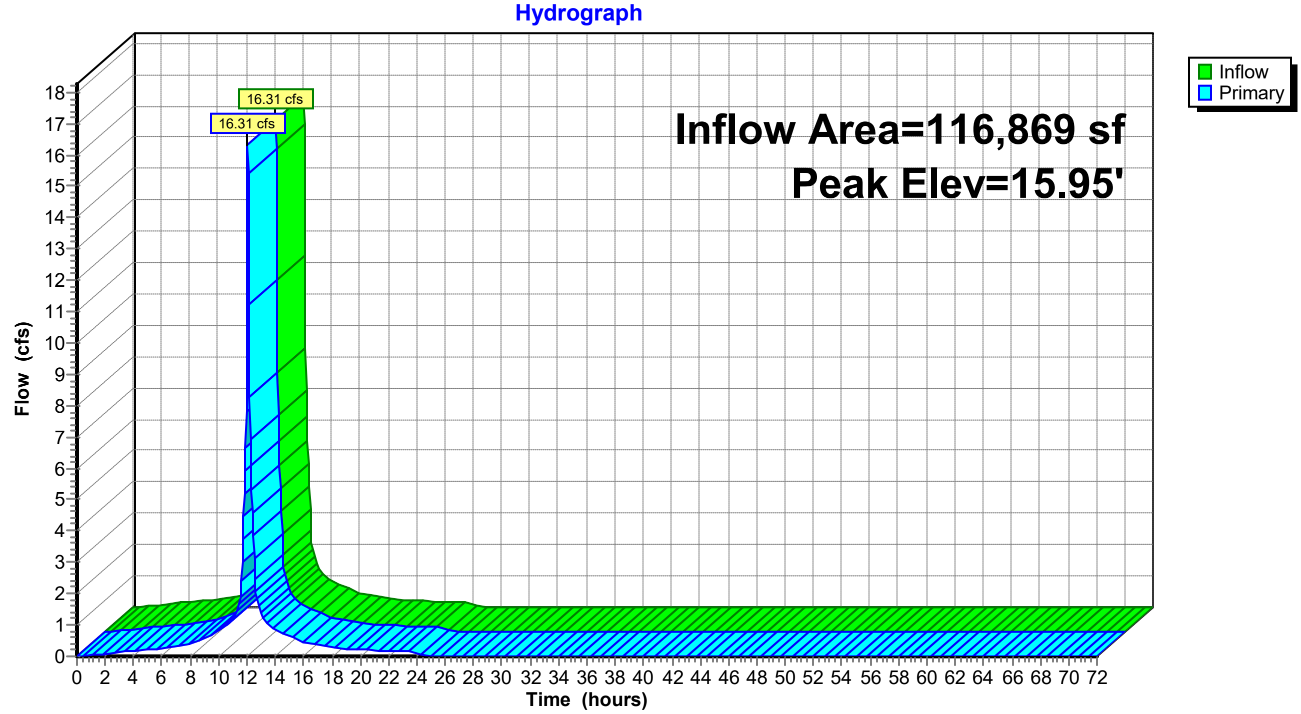
[58] Hint: Peaked 7.27' above defined flood level

Inflow Area = 116,869 sf,100.00% Impervious, Inflow Depth = 5.92" for 25-yr event
Inflow = 16.31 cfs @ 12.07 hrs, Volume= 57,672 cf
Outflow = 16.31 cfs @ 12.07 hrs, Volume= 57,672 cf, Atten= 0%, Lag= 0.0 min
Primary = 16.31 cfs @ 12.07 hrs, Volume= 57,672 cf
Routed to Pond CB18 : Catch Basin 18

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 15.95' @ 12.09 hrs
Flood Elev= 8.68'

Device	Routing	Invert	Outlet Devices
#1	Primary	4.23'	**15.0" Vert. Outlet Pipe** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=14.01 cfs @ 12.07 hrs HW=14.59' TW=8.97' (Dynamic Tailwater)
1=Outlet Pipe (Orifice Controls 14.01 cfs @ 11.41 fps)



Summary for Pond CB18: Catch Basin 18

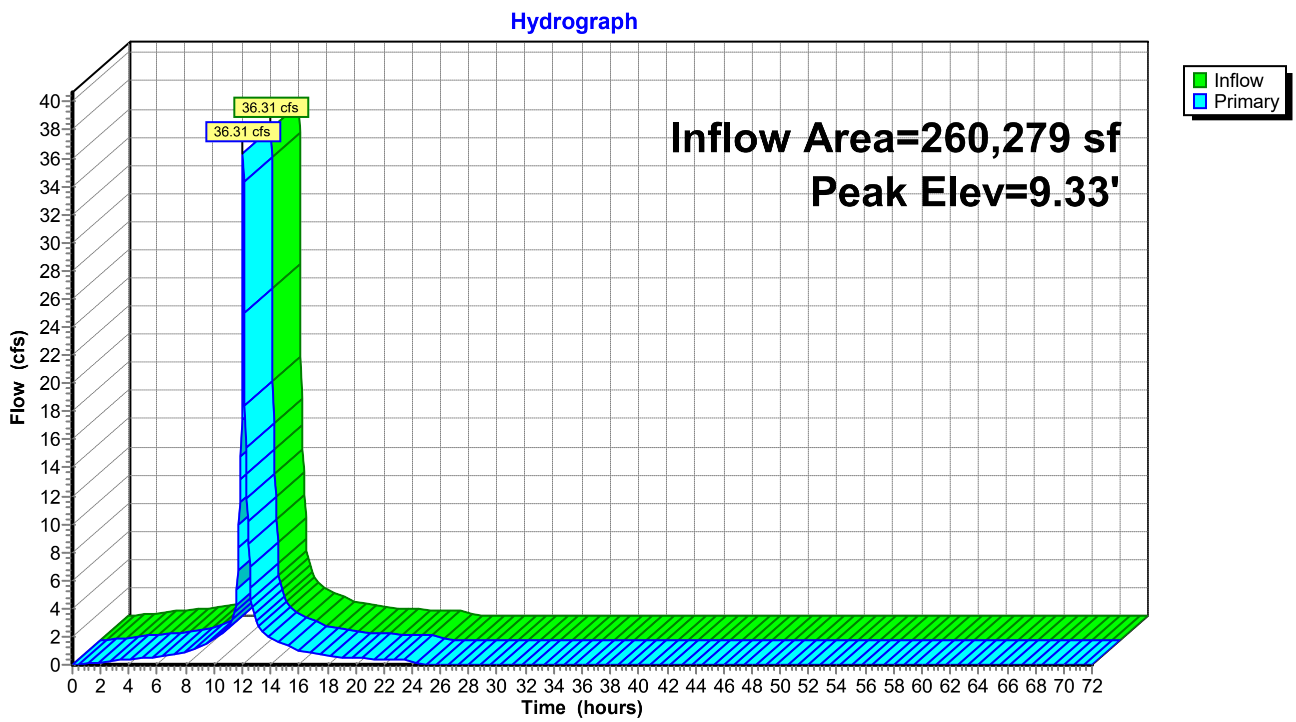
Inflow Area = 260,279 sf,100.00% Impervious, Inflow Depth = 5.92" for 25-yr event
Inflow = 36.31 cfs @ 12.07 hrs, Volume= 128,441 cf
Outflow = 36.31 cfs @ 12.07 hrs, Volume= 128,441 cf, Atten= 0%, Lag= 0.0 min
Primary = 36.31 cfs @ 12.07 hrs, Volume= 128,441 cf
Routed to Link 4L : Sump Pumps

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 9.33' @ 12.07 hrs
Flood Elev= 9.67'

Device	Routing	Invert	Outlet Devices
#1	Primary	2.62'	**24.0" Vert. Outlet Pipe** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=34.99 cfs @ 12.07 hrs HW=8.97' TW=0.00' (Dynamic Tailwater)
└─**1=Outlet Pipe** (Orifice Controls 34.99 cfs @ 11.14 fps)

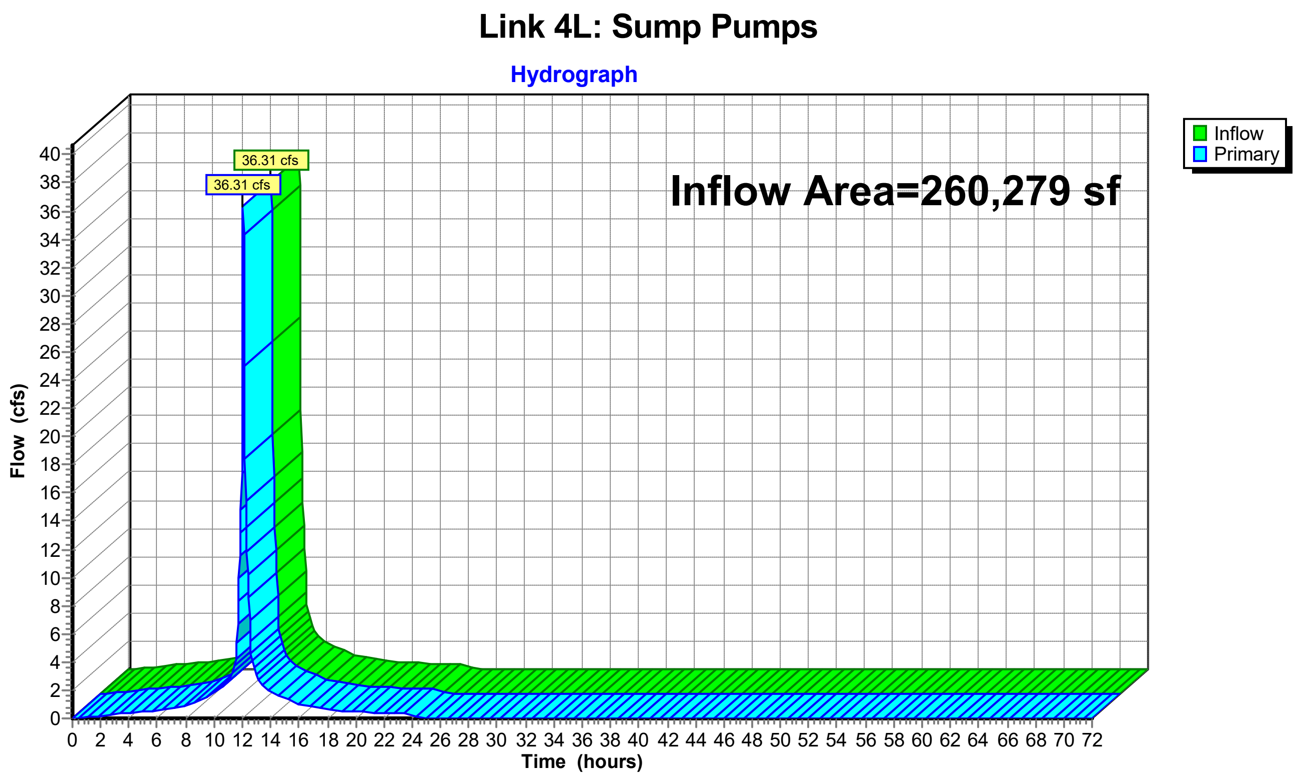
Pond CB18: Catch Basin 18



Summary for Link 4L: Sump Pumps

Inflow Area = 260,279 sf,100.00% Impervious, Inflow Depth = 5.92" for 25-yr event
Inflow = 36.31 cfs @ 12.07 hrs, Volume= 128,441 cf
Primary = 36.31 cfs @ 12.07 hrs, Volume= 128,441 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs



Summary for Subcatchment EDA-100: Subcat EDA-100

[49] Hint: Tc<2dt may require smaller dt

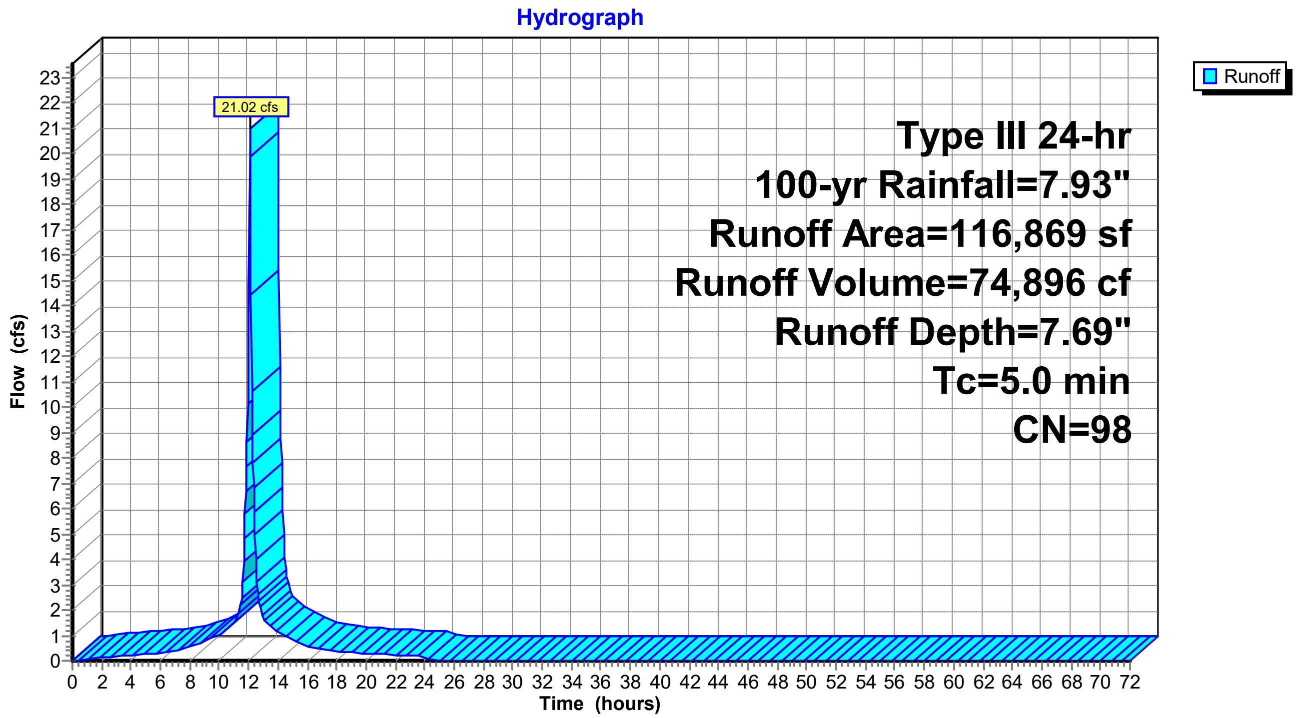
Runoff = 21.02 cfs @ 12.07 hrs, Volume= 74,896 cf, Depth= 7.69"
Routed to Pond CB15 : Catch Basin 15

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-yr Rainfall=7.93"

Area (sf)	CN	Description
116,869	98	Paved roads w/curbs & sewers, HSG D
116,869		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, Minimum TC**

Subcatchment EDA-100: Subcat EDA-100



Summary for Subcatchment EDA-200: Subcat EDA-200

[49] Hint: Tc<2dt may require smaller dt

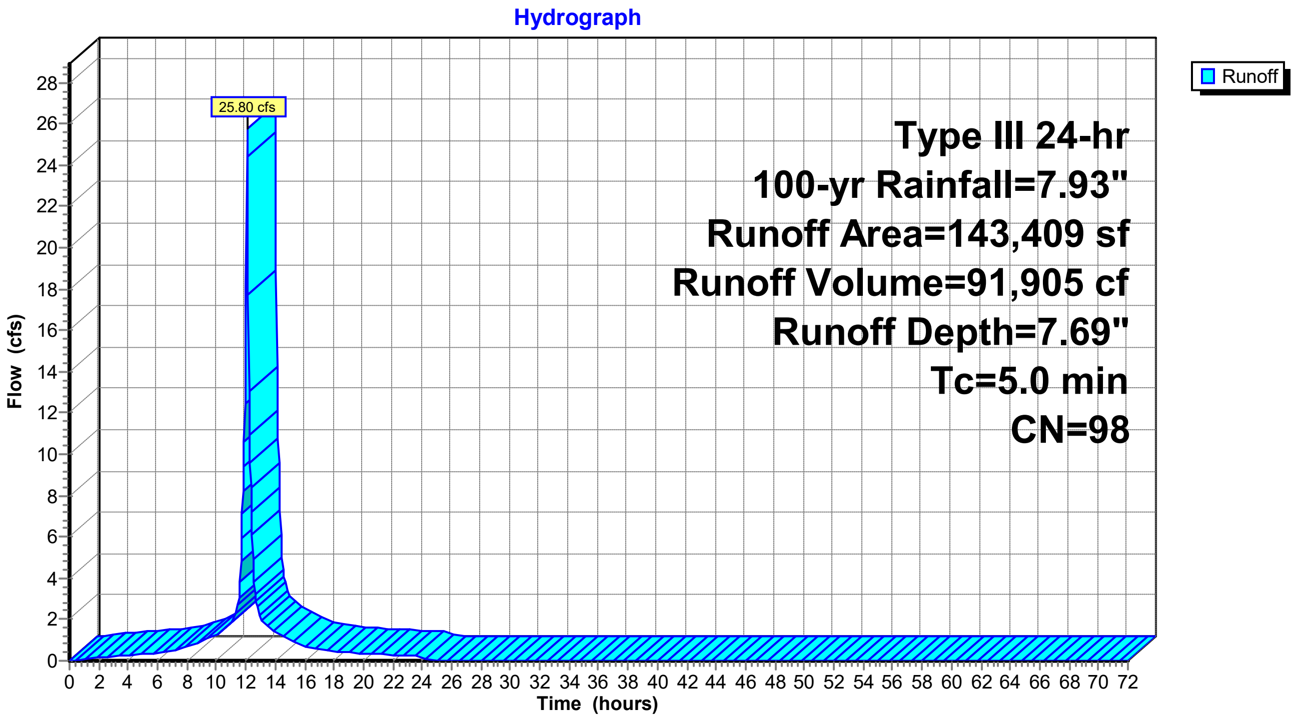
Runoff = 25.80 cfs @ 12.07 hrs, Volume= 91,905 cf, Depth= 7.69"
Routed to Pond CB18 : Catch Basin 18

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-yr Rainfall=7.93"

Area (sf)	CN	Description
143,409	98	Paved roads w/curbs & sewers, HSG D
143,409		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, Minimum TC**

Subcatchment EDA-200: Subcat EDA-200



Summary for Pond CB15: Catch Basin 15

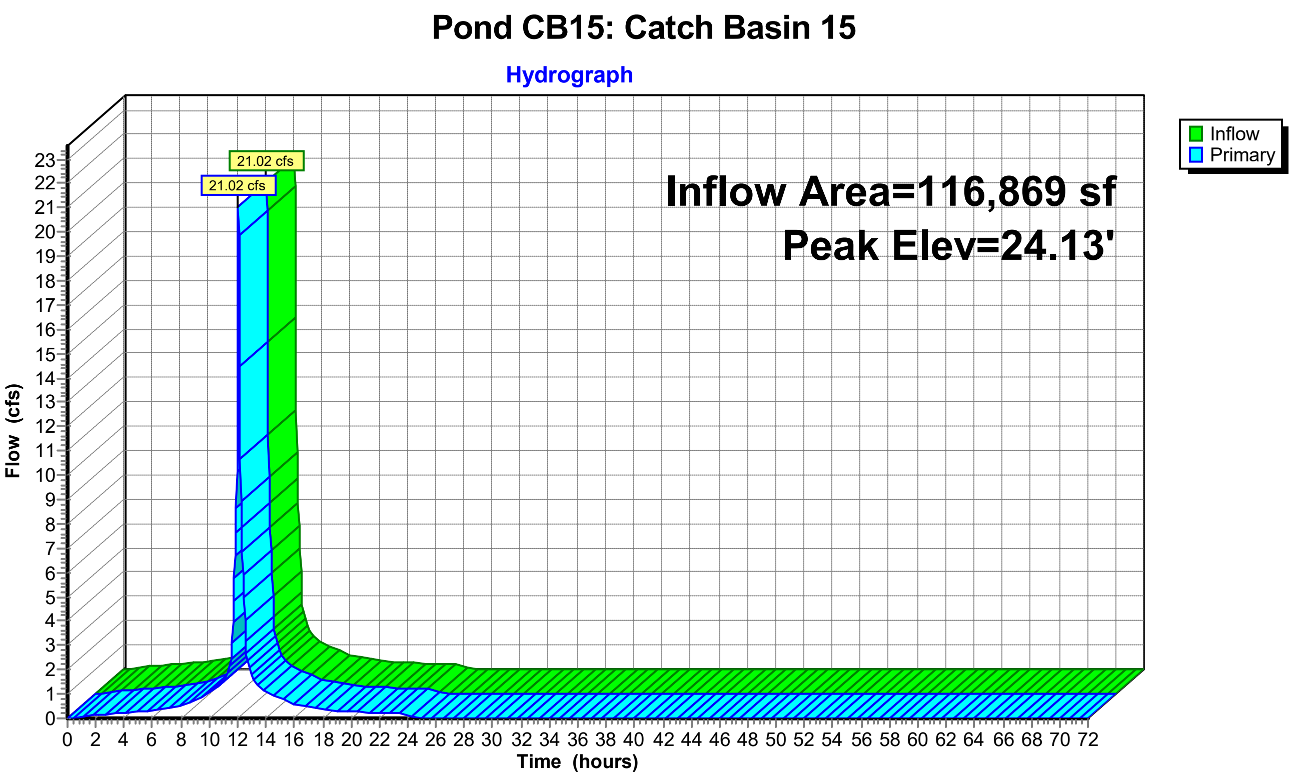
[58] Hint: Peaked 15.45' above defined flood level

Inflow Area = 116,869 sf,100.00% Impervious, Inflow Depth = 7.69" for 100-yr event
Inflow = 21.02 cfs @ 12.07 hrs, Volume= 74,896 cf
Outflow = 21.02 cfs @ 12.07 hrs, Volume= 74,896 cf, Atten= 0%, Lag= 0.0 min
Primary = 21.02 cfs @ 12.07 hrs, Volume= 74,896 cf
Routed to Pond CB18 : Catch Basin 18

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 24.13' @ 12.09 hrs
Flood Elev= 8.68'

Device	Routing	Invert	Outlet Devices
#1	Primary	4.23'	**15.0" Vert. Outlet Pipe** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=18.06 cfs @ 12.07 hrs HW=21.86' TW=12.51' (Dynamic Tailwater)
1=Outlet Pipe (Orifice Controls 18.06 cfs @ 14.72 fps)



Summary for Pond CB18: Catch Basin 18

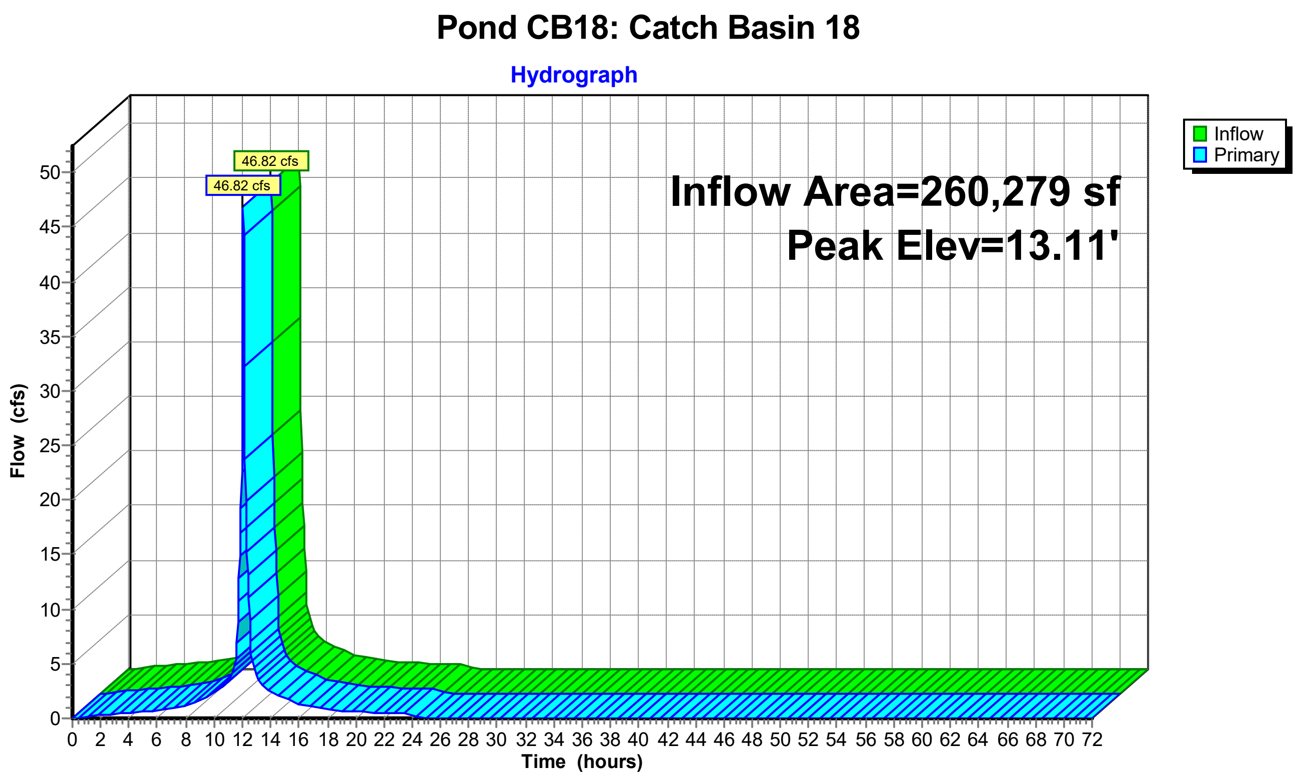
[58] Hint: Peaked 3.44' above defined flood level

Inflow Area = 260,279 sf,100.00% Impervious, Inflow Depth = 7.69" for 100-yr event
Inflow = 46.82 cfs @ 12.07 hrs, Volume= 166,801 cf
Outflow = 46.82 cfs @ 12.07 hrs, Volume= 166,801 cf, Atten= 0%, Lag= 0.0 min
Primary = 46.82 cfs @ 12.07 hrs, Volume= 166,801 cf
Routed to Link 4L : Sump Pumps

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 13.11' @ 12.07 hrs
Flood Elev= 9.67'

Device	Routing	Invert	Outlet Devices
#1	Primary	2.62'	**24.0" Vert. Outlet Pipe** C= 0.600 Limited to weir flow at low heads

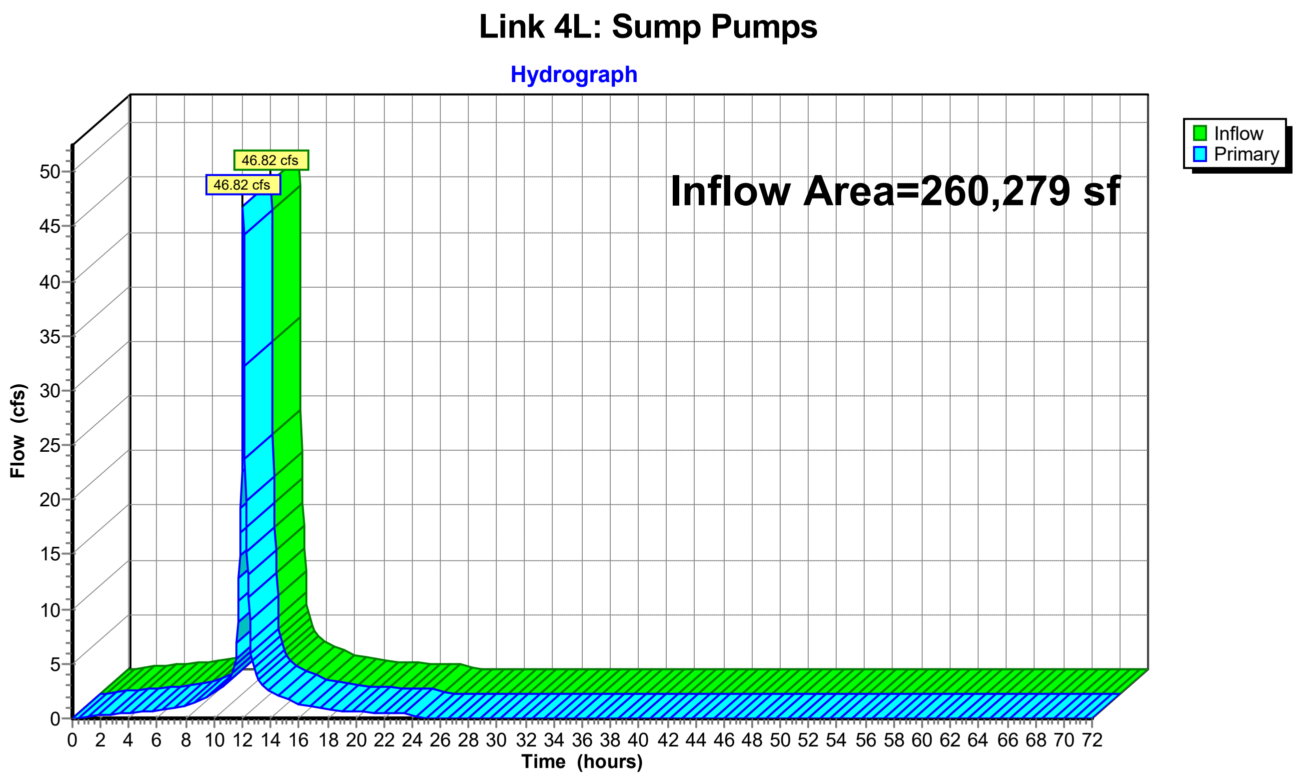
Primary OutFlow Max=45.11 cfs @ 12.07 hrs HW=12.51' TW=0.00' (Dynamic Tailwater)
1=Outlet Pipe (Orifice Controls 45.11 cfs @ 14.36 fps)



Summary for Link 4L: Sump Pumps

Inflow Area = 260,279 sf,100.00% Impervious, Inflow Depth = 7.69" for 100-yr event
Inflow = 46.82 cfs @ 12.07 hrs, Volume= 166,801 cf
Primary = 46.82 cfs @ 12.07 hrs, Volume= 166,801 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs



Flood Risk Assessment

Attachment 4 – FIRMette Mapping

National Flood Hazard Layer FIRMette

FEMA

71°0'51"W 42°24'1"N

71°0'13"W 42°23'34"N

Feet 0 250 500 1,000 1,500 2,000

1:6,000

Basemap: USGS National Map: Orthoimagery: Data refreshed October, 2020

Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS		Without Base Flood Elevation (BFE) *Zone A, V, A99*
		With BFE or Depth *Zone AE, AO, AH, VE, AR*
		Regulatory Floodway
OTHER AREAS OF FLOOD HAZARD		0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
		Future Conditions 1% Annual Chance Flood Hazard *Zone X*
		Area with Reduced Flood Risk due to Levee. See Notes. *Zone X*
		Area with Flood Risk due to Levee *Zone D*
OTHER AREAS	NO SCREEN	Area of Minimal Flood Hazard *Zone X*
		Effective LOMRs
		Area of Undetermined Flood Hazard *Zone D*
GENERAL STRUCTURES		Channel, Culvert, or Storm Sewer
		Levee, Dike, or Floodwall
OTHER FEATURES	B 20.2 17.5	Cross Sections with 1% Annual Chance Water Surface Elevation
	8	Coastal Transect
	513	Base Flood Elevation Line (BFE)
		Limit of Study
		Jurisdiction Boundary
		Coastal Transect Baseline
		Profile Baseline
		Hydrographic Feature
MAP PANELS		Digital Data Available
		No Digital Data Available
		Unmapped

N

The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 2/24/2023 at 10:23 AM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.

Flood Risk Assessment

Attachment 5 – Drainage Area Peak Flow Rate Summary

			25-Year Storm Event				100-Year Storm Event			
ID	Drainage Area (SF)	Description	Peak Runoff (CFS)	Volume (CF)	Peak Elevation (FT)	Spillover Elevation (FT)	Peak Runoff (CFS)	Volume (CF)	Peak Elevation (FT)	Spillover Elevation (FT)
EDA-1	83,722	Tank 1	11.68	41,315	6.72	10.17	15.06	53,653	7.00	10.17
EDA-2	86,412	Tank 2	12.06	42,642	6.39	10.54	15.54	55,378	6.65	10.54
EDA-3	79,598	Tank 3	11.11	39,280	6.45	9.28	14.32	51,011	6.7	9.28
EDA-4	81,970	Tank 4	11.44	40,450	6.24	9.77	14.75	52,531	6.45	9.77
EDA-5	47,265	Tank 5	6.59	23,324	6.75	10.58	8.50	30,290	7.05	10.58
EDA-6	37,562	Tank 6	5.24	18,536	6.93	10.59	6.76	24,072	7.21	10.59
EDA-7	40,096	Tank 7	5.59	19,786	6.83	9.19	7.21	25,696	7.11	9.19
EDA-10	75,382	Tank 10	10.52	37,199	8.29	13.7	13.56	48,306	8.56	13.7
EDA-11	35,410	Tank 11	4.94	17,474	8.06	13.42	6.37	22,693	8.36	13.42
EDA-12	121,528	Tank 12	16.96	59,971	7.64	11.42	21.68	77,822	7.9	11.42
EDA-14	165,502	Tank 14	23.09	81,671	9.3	10.72	29.77	106,062	9.66	10.72
EDA-100	116,869	Northern portion of the rack area	16.31	57,672	NA	NA	20.01	74,896	NA	NA
EDA-200	143,409	Southern portion of the rack area	21.02	70,769	NA	NA	25.8	91,905	NA	NA

APPENDIX J

STORMWATER SYSTEM OPERATION AND MAINTENANCE PLAN

APPENDIX J
STORMWATER OPERATIONS & MAINTENANCE PLAN

IRVING OIL TERMINALS INC.
41 LEE BURBANK HIGHWAY
SUFFOLK COUNTY, REVERE, MA 02151
NPDES PERMIT NO. MA0001929

MARCH 1, 2023

Prepared For:

Irving Oil Terminals Inc.
190 Commerce Way
Portsmouth, New Hampshire 03801
Tel: 603-559-8736

Prepared By:

Verdantas LLC
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Pawtucket, Rhode Island 02860
Tel: 401-648-8675

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FIGURES (SEE SWPPP)

ATTACHMENTS

1.0 INTRODUCTION

Verdantas LLC (Verdantas) prepared the following Operations and Maintenance (O&M) Plan, in reference to the Massachusetts Stormwater Handbook, for Irving Oil Terminals Inc. (the Owner) for the subject property terminal located at 41 Lee Burbank Highway, Revere, MA 02151 (the Terminal). The O&M Plan will be used by the Owner as a supplemental document to the Stormwater Pollution Prevention Plan (SWPPP), detailing maintenance procedures to maintain the existing stormwater infrastructure located within the Terminal.

This O&M includes a description of the facility (Section 1), drainage areas (Section 2), and maintenance activities (Section 3). This document will be updated based upon observations made and changing conditions over time and deviations or revisions to the O&M plan will be documented and referenced within Appendix A of this document. Appendix B includes an inventory of the existing stormwater system structures and a summary of available information related to sediment accumulation. Appendix C includes documentation forms to record maintenance events on a monthly, quarterly, and annual frequency. Appendix D is a maintenance form for oil/water separator 1 (OWS 1).

1.1 FACILITY DESCRIPTION

The Terminal, located on approximately 25 acres on the east bank of the Chelsea River, bisected by Lee Burbank Highway and approximately two and one-half miles northeast of the confluence of the Mystic and Chelsea Rivers, is a petroleum product bulk storage terminal (refer to Figure 1 for a Terminal Locus and Figure 2 for a Terminal Site Plan / Facility Layout). Stormwater monitoring is performed at the Meter Well, downgradient of OWS1, located at Latitude 42° 23’ 48” N, Longitude -71° 00’ 44” W. The final discharge point to the Chelsea Creek is located on the west side of Lee Burbank Highway, adjacent to the dock area, and is designated as “Outfall 001.”

Operations began at the Terminal in 1935 and Irving purchased the Terminal in August 1998. The dock area is located to the west of the highway (referred to as the “Dock Side” area) and the main Terminal is to the east of the highway (referred to as the “Terminal Side” area).

The area surrounding the Terminal includes industrial, residential, and commercial activities. Products received, stored, and distributed at the Terminal include gasoline, gasoline and diesel fuel additives, No. 2 heating oil, low sulfur diesel, and ethanol. The products managed at the Terminal are described in further detail in Section 5.6. Bulk petroleum products are received either by barge, ship, truck, or transfer pipeline, while additives (e.g., dye) are delivered by truck in bulk and/or 55-gallon drums. Product is distributed from the Terminal via truck or can be transferred to a neighboring terminal (Global Petroleum) via common dock lines.

An office building and several outbuildings are located on the eastern or Terminal Side of the Terminal. On the Dock Side of the Terminal, there is a main building leased from

Irving by a car rental company for offices and fleet vehicle maintenance, and an outbuilding used by Irving.

2.0 SITE DRAINAGE

2.1 SITE DRAINAGE DESCRIPTION

Stormwater is collected at the Terminal from the paved Terminal Yard and the earthen berm secondary containment areas of the Tank Farm. The Tank Farm and Terminal Yard are located on the east side of Lee Burbank Highway which have their own stormwater collection and treatment system, including OWS 1. A property leased from Irving by a car rental agency, located on the west side of the highway, has its own stormwater collection and treatment system, which includes oil-water separator 2 (OWS 2). The final discharge point from all areas of the Terminal occurs via Outfall 001 into the Chelsea River.

2.1.1 Vessel Dock Drainage

Petroleum product drips/spills that are captured during offloading operations at the marine vessel dock are containerized and disposed of offsite by a licensed waste disposal contractor. Stormwater contacting the marine vessel dock is not directed to either of the OWS devices.

2.1.2 Tank Farm Drainage

Secondary containment for the tank farm consists of an earthen perimeter dike surrounding the Tank Farm and a series of intermediate (interior) earthen dikes forming separate containment areas for each bulk AST. The dikes and floor of the Tank Farm are sufficiently impervious to contain oil. The secondary containment is sized to hold between 110 to 130 percent of the largest tank's storage capacity plus an added volume to hold accumulated fire-extinguishing agents, water and/or precipitation. The berms are used to help prevent potential petroleum releases from migrating from one secondary containment area to another or into surrounding waterways. There is a valve located within each secondary containment area that can be manually opened to allow the stormwater to drain into the stormwater collection system. When the valve is closed, stormwater is retained within the tanks' secondary containment area. Secondary containment stormwater valves are normally kept closed.

Stormwater accumulating within the dike areas evaporates or can be directed to low elevation catch basins. Terminal personnel are scheduled to visually inspect accumulated stormwater and if a sheen is not visible, the valve is opened, thereby allowing the stormwater to drain by gravity into the central diked area surrounding Tank 3.

The stormwater which accumulates in the secondary containment area around Tank 3 includes stormwater from the Tank Farm and Terminal Yard, and the truck loading rack canopy gutters. The stormwater accumulated within Tank 3's secondary containment flows into a concrete sump located adjacent to OWS 1. The sump is equipped with two pumps, a primary and a back-up, each with a reported pumping capacity of approximately 375 gallons per minute (gpm). When one of the two pumps is activated, the stormwater within the concrete sump is pumped to OWS 1 for treatment.

2.1.3 Truck Loading Rack Drainage

At the truck loading rack, the roof directs stormwater away from the truck rack equipment and loading operations to perimeter drains and individual catch basins. Stormwater from this portion of the Terminal yard is directed to an underground holding tank that automatically (i.e., via level controller) pumps the water into the secondary containment area surrounding Tank 3, whenever the water in the tank reaches a set level.

Runoff entering the drains located beneath the roof (the Trench Drains) of the truck loading racks flows into a concrete holding tank located northwest of the rack. This holding tank acts as a small OWS for petroleum products that might have spilled into the drains during truck loading operations. Stormwater from the holding tank flows into a nearby lift station, leaving accumulated petroleum product remaining on the surface. A 250-gpm pump conveys the stormwater from the lift station to OWS 1. Accumulated petroleum products in the holding tank would be removed by the Facility’s waste vendor for disposal off site.

2.1.4 Hydrostatic Test Water

The aboveground storage tanks (ASTs) for the products are subject to annual external inspections (502 CMR 5.00) and their integrity is certified annually by a licensed tank inspector. Internal inspections and testing of the ASTs are conducted in accordance with the American Petroleum Institute (API) 653 Standard. In addition, repairs are occasionally made at the Terminal to tanks and piping used for the storage and conveyance of petroleum products and additives. The storage tanks and/or pipe networks are rigorously cleaned (e.g., “Poly-Brushed”, “Squeegee-Pigged”) and certified as being product-free prior to conducting maintenance work.

After completing certain maintenance work, the vessels and/or pipe networks may be hydrostatically tested for leaks. Hydrostatic testing involves filling the vessel or pipe with water under pressure and monitoring pressure drops over time. If the system maintains a constant pressure, there are no leaks. River water or potable water may be used as a source of hydrostatic test water. Thus, hydrostatic test water discharge may contain minimal amounts of foreign matter, trace amounts of hydrocarbons, background material found in the river, or residual chlorine. Hydrostatic test water is tested prior to discharge as outlined in the Terminal’s SWPPP and is treated through the stormwater treatment system prior to being discharged to Outfall 001.

2.1.5 Oil-Water Separator 1 (OWS 1)

OWS 1 is located southeast of the administrative building near the vapor recovery unit (VRU) and does not involve groundwater extraction or discharge. The separator is an in-ground baffle/weir type unit with a storage capacity of approximately 25,000 gallons. The Terminal installed an orifice plate into the discharge line that reduces the size of the opening in the pipe from 8 inches to 2 inches. The discharge from OWS 1 flows by gravity via pipe underneath Lee Burbank Highway to Outfall 001, located on the eastern bank of the Chelsea River.

Flow rates through OWS device do not exceed the design capacity of the separator (thereby minimizing the potential for pollutants to be entrained to the waterway). The Terminal controls the flow rate through OWS 1 through two mechanisms. First, the flow rate of stormwater from the Tank Farm area and a portion of the Terminal yard (i.e., water conveyed through the sump located nearby Tank 3) is limited through use of an electrical interlock system. The interlock system prevents both pumps in the sump from operating at the same time, thereby limiting the flow rate from this portion of the Terminal into OWS 1 to approximately 375 gpm. Secondly, a flow restriction device (i.e., orifice plate) installed in the line conveying runoff from beneath the truck loading rack to OWS 1 reduces the flow into the separator to approximately 180 gpm. With the controls provided by both of these mechanisms, the stormwater entering OWS 1 is limited to less than the design flow capacity of 615 gpm.

2.1.6 Septic System

Domestic sanitary sewage from the tank farm side of the Terminal is discharged to an on-site septic system located immediately east of the office building. Industrial wastewater discharges do not enter the septic system. Domestic sanitary sewage from the maintenance building leased by the car rental agency, on the west side of the highway, is discharged to a second septic system located between the maintenance building and the Chelsea River. The floor drains within the maintenance building have been sealed in place except for those in the wash bay, so there are no industrial wastewater discharges to the septic system. Wash bay floor drains are connected to a self-contained water recycling system. The septic system maintenance is not covered within this O&M plan.

2.2 DRAINAGE COMPONENTS

The following is a compiled table of the drainage components and structures to be inspected, maintained, and recorded on a bi-annual basis, as outlined in Section 3, Maintenance, included herein:

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Table: Drainage Components

Structure ID	Location
MH3	Post Discharge from Overflow Stop Valve
Overflow Valve Box	Southwest from OWS 1; along Berm Embankment
Overflow Weir Pit	Southwest from OWS 1; along Berm Embankment
PS1	Concrete Holding Tank Pump Station; Tank 3
DMH2	West of Tank 3
CB7	East of Tank 7
CB26	Northwest of Tank 7
CB7A	Southeast of Tank 5
CB6	Southwest of Tank 6
CB3	Northwest of Tank 3
CB1B	Southwest of Tank 1; Northwest of CB25
CB25	Southwest of Tank 1; Discharge to CB1
CB11A	Southeast of Tank 14; Discharge to CB11
CB10	West of Tank 12; Discharge to CB11
CB11	West of Tank 14; Discharge to CB13
CB13	Southeast of Tank 3; Discharges to PS1
10" Steel Drainpipe	South of Tank 10
CB8	Northwest of Tank 11; Discharges to CB9
CB9	Southwest of Tank 10
CB17	East side of paved area; North of Loading Rack
CB15	Center of Paved Area; Northwest of Bol House
CB14	North of Paved Area; East of Exit Gate
CB16	Center of Paved Area; East of Bol House
CB18	South of the Loading Rack; East of Foam Building
CB19	South of the Loading Rack; Southeast of Foam Building
CB20	South of the Loading Rack; North of the Office Building
CB21	Northeast of the Office Building
CB22	Southeast of the Office Building
CB23	South of the Office Building; Northwest of the Yard Pump
CB24	Northeast of the Loading Rack; West of Tank 6 Berm
PS2	1,000 gal. Lift Station to the Northwest of the Loading Rack
Rack Sump 1	Located at the Northwest Corner of the Loading Rack
Rack Sump 2	Located at the Southwest Corner of the Loading Rack
PS3	3,000 gal. Pump Station (yard pump); Discharge to Tank 3
OWS 1	26,000 gal. main Oil-Water Separator; West of Tank 14
CB13A	Directly North of PS1

3.0 MAINTENANCE

To maintain proper operation and reduce the potential impact of pollutant migration through the Site and existing stormwater infrastructure, the Owner shall employ the following procedures and practices. It will be the responsibility of the Owner to employ such programs and recordkeeping at the frequency described herein. Deviations or revisions to the O&M plan shall be documented and referenced within Appendix A of this document.

3.1 SITE MAINTENANCE

Existing trash, liter, sediment, and other accumulated debris will be removed from the stormwater system structures (including catch basins, manholes, inlet and outlet structures) and is currently scheduled for 2023 as conditions allow. On-going monitoring will include annual monitoring of the system, and removal of sediment and debris as needed, based upon inspection observations. The system will be cleaned routinely, with a frequency established after initial survey and cleaning, to ensure the stormwater system features remain free of obstructions.

The parking lot and drives will be swept by the Owner as early as possible every spring and once in the fall to remove sediments, with frequency to increase depending on the observed site conditions. Sediments removed shall be disposed of at approved and permitted locations. The cleaning and maintenance of drainage systems BMP's shall be the responsibility of the Owner.

3.2 TRUCK LOADING RACK AREA MAINTENANCE

The Owner shall conduct a monthly inspection of the slotted trench drain conveyance system, and concrete catch basins encompassing the truck loading rack area for evidence of sheen, or separate phase product. If a sheen or product is observed, the Owner will deploy an oil-absorbent boom to allow for direct contact with the product. In addition, the Owner will remove visible debris and trash from within or around the loading rack conveyance system.

The loading rack area pump station (denoted as PS2 on Figure 3) shall be inspected for proper operation and potential deficiencies or evidence of pollutant migration (i.e., staining, leaks, sediment, etc.) will be documented.

The Monthly - Maintenance Documentation Form in Appendix C will be used to document the date and description of maintenance activities.

3.3 TANK YARD MAINTENANCE

The Owner shall coordinate a quarterly inspection of the tank yard in its entirety to identify excessive erosion and staining that could be contributing to increased sediment loading or pollutant migration into the stormwater conveyance system. Each identified area of concern shall be labeled on the existing stormwater system map (Figure 3) and given a condition priority ranking (High, Medium, Low). Prioritization ranking shall be established by Verdantas on completion of initial sediment survey.

Following receipt and review of the inspection and ranking information, the Owner shall review, prioritize, and act on the inspection information to help remediate and prevent significant further erosion or contaminate migration. The summary report may include but not be limited to: adding or increasing the size of stone cover along the dike walls; relocation or installation of catch basins; installation catch basin inserts; replacement of sediment traps; and, or regrading of the tank yard (while maintaining the required containment capacity volume).

Medium and low priority areas shall be monitored by the Owner each quarter to ensure that further erosion or contaminant migration does not progress to a point where it becomes a high priority action item.

The Quarterly - Maintenance Documentation Form in Appendix C will be used to document the date and description of the maintenance activities.

3.4 CATCH BASIN MAINTENANCE

Catch basins typically include a sump at the bottom of the structure below the outflow pipe. This permanent water storage volume is intended to trap sediments, debris, and other particles that can settle out of the accumulated stormwater, thus preventing clogging of downstream pipes and washing of the solids into receiving waters.

3.4.1 Sediment Survey and Removal

To help alleviate excessive sediment intrusion and accumulation within the stormwater system structures, the Owner will perform an initial cleanout event of the stormwater system. After the initial clean out, the Owner will perform annual inspections to monitor sediment accumulation in the stormwater system.

The Owner initiated the first annual sediment inspection in January 2023, which will be continued during seasonal dry conditions, later in 2023. Preliminary information is summarized in Appendix B - Preliminary Stormwater System Drainage Structure List and Conditions Summary. The Owner will continue the sediment inspections with Verdantas support and use the information to plan stormwater system maintenance activities. The sediment survey procedures are as follows:

- Sediment thicknesses are measured at each stormwater structure using a rod with marking delineated to the hundredths of a foot. In addition, the inspector will describe the type of sediment in each structure to the best extent possible (i.e., sand, silt, cobbles, etc.) and the condition of storm drain inlet protection (if any).

Best Management Practices (BMPs) indicate that in the event the sediment accumulation exceeds 60 percent of the sump depth, as measured from the bottom of the basin to the invert elevation of the lowest pipe out of the structure, then the sump should be cleaned by way of a tow-behind vacuum trailer, or equivalent methodology.

Upon review of the annual sediment survey records, the Owner will coordinate proper sediment removal from applicable stormwater structures with sediment thicknesses above the action level. Sediment removal will occur with the following, or comparable, procedures and methods. Sediment shall be dewatered and segregated into potentially petroleum impacted sediments and non-petroleum impacted material. The segregation shall be stockpiled on-site, on and under 0.60 mil polyethylene sheeting and encompassed by biodegradable compost filter socks (straw wattle).

The Owner will be responsible for coordinating sample collection from the stockpiles for waste characterization as needed. A material disposal request package shall be prepared and submitted for approval by a certified waste disposal facility.

The continued sediment survey results will be documented on the sediment survey record form included as Appendix B - Preliminary Stormwater System Drainage Structure List and Conditions Summary.

3.4.2 Drop Inlet Protection

Due to the consistent flow of stormwater and potential migration of sediment throughout the Tank Yard and truck loading rack area, the catch basins in these areas will be evaluated for installation of storm drain drop inlet protection (sediment trap) devices and existing drop inlet protection devices will be inspected for proper installation and maintenance.

The protection device consists of a fabric of porous materials that creates a filter and acts as a barrier against sediment entering the grate of the structure and allows water to flow through the fabric.

The inlet protection devices will be periodically inspected following significant rain events (greater than 2-inches) and maintained by performing the following:

- Removing accumulated sediment from atop the drop inlet protection when thickness exceeds 2-inches;
- Removing sediment from the settling area or unclogging weep holes if the control does not drain within 48 hours; or
- Immediately replacing tears in fabric controls or internal filtering controls. This may require replacing the entire control depending on the amount of damage.

The Quarterly - Maintenance Documentation Form in Appendix C will be used to document the date and description of the maintenance activities.

3.5 OIL-WATER SEPARATOR (OWS)

The Owner shall be responsible for conducting a cursory visual inspection of the OWS on a quarterly basis. Observations shall be documented on the Oil Water Separator Inspection Checklist form included within Appendix D. Note that OWS 1 is inspected daily using SWPPP Appendix F Daily Facility Inspection Form (Tank Farm Area; Item #9). Use Appendix D - Oil/Water Separator (OWS 1) Inspection and Maintenance Checklist to document maintenance activities for OWS 1.

Cleaning of the Oil-Water Separator (OWS) shall occur at a minimum frequency of once per year. This includes removing accumulated sediment from the bottom of the separator, and power washing the coalescer packs in place. The Owner shall be responsible for documenting and recording the following information:

- The personnel, date, and weather conditions at the time of the cleaning effort;
- Reason(s) for the cleaning effort (if outside the periodic yearly cleaning);
- Total amount of free-phase removed from the OWS;
- Total amount of sediment removed from the OWS.

The Annual - Maintenance Documentation Form in Appendix C will be used to document the date and description of the maintenance activities.

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APPENDIX A

OPERATIONS & MAINTENANCE PLAN AMENDMENT LOG

Amendment Log

TO BE FILLED OUT BY THE OWNER

Describe amendment(s) to be made to the Operations & Maintenance (O&M) Plan, the date, and the person/title making the amendment.

#	Date	Description of Amendment	Amended by: Person/Title	Site Owner Must Initial
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				

APPENDIX B

PRELIMINARY STORMWATER SYSTEM DRAINAGE STRUCTURE LIST AND CONDITIONS SUMMARY

PRELIMINARY STORMWATER SYSTEM
DRAINAGE STRUCTURE LIST AND CONDITIONS SUMMARY
IRVING TERMINAL, REVERE, MASSACHUSETTS
(EFFECTIVE MARCH 1, 2023)

DATE OF SURVEY: ___Initial Survey - January 18 and 31, 2023_(to be completed in 2023)______________________
OBSERVATIONS BY: _____Verdantas______________________________

CB/MH ID	#	Location	Size and Shape of Structure	Depth to Bottom (from rim)	Rim Elevation	Invert Elevation	Invert Elevation	Invert Distance (ft)	Invert Elevation	Invert Elevation	Sediment Thickness (inches)	Description (Pipe Composition, Hood Present, In Need of Repair, Etc.)
TERMINAL TANK FARM AREA												
CB8	16	Northwest of Tank 11; Discharges to CB9	4-ft round	3.38	6.18	5.24					14 fines	6-inch PVC
CB9	17	Southwest of Tank 10	4-ft round	2	6.84	4.42					41 fines	6-inch PVC
CB11A	11	Southeast of Tank 14; Discharge to CB13		--	6.89	6.89						Under water at time of survey
CB11	13	West of Tank 14; Discharge to CB13		--	6.55	6.55						
CB10	12	West of Tank 12; Discharge to CB11		3.95	7.2	7.2					13 fines	Under water at time of survey
CB13	14	Southeast of Tank 3; Discharges to PS1		8.03	5.02	5.02						
CB3	8	Northwest of Tank 3		--	--							Under water at time of survey
CB6	7	Southweast of Tank 6		--	4.03	4.03						Under water at time of survey
CB26	5	Northwest of Tank 7		--	--							Under water at time of survey
CB7	4	East of Tank 7		--	--							Under water at time of survey
CB7A	6	Southeast of Tank 5		--	--							Under water at time of survey
CB25	10	Southwest of Tank 1; Discharge to CB1		--	8.85	8.85						Under water at time of survey
CB1B	9	Southwest of Tank 1; Northwest of CB25		--	3.71	3.71						Under water at time of survey
PS1	2	Concrete Holding Tank Pump Station; Tank 3		--	6.3							
DMH2	3	West of Tank 3		--	4.84							Under water at time of survey
10" Steel Drain Pipe	15	South of Tank 10		--	--	--	--	--	--		--	
TERMINAL YARD AND LOADING RACK AREA												
CB17	18	East side of paved area; North of Loading Rack	3.5-ft round	3.98	8.22	5.6	6.28				2-6 fines/stone	2-inch PVC (out); 6-inch PVC (in)
CB16	21	Center of Paved Area; East of Bol House	3.5-ft round	5.41	8.82	5.17	5.22				1 fines	12-inch (in), 18-inch (out)
CB15	19	Center of Paved Area; Northwest of Bol House	3.5-ft round	5.95	8.8	4.35	4.35	4.45	4.35		3 fines	16-inch, 18-inch, 24-inch; all same elevation
CB14	20	North of Paved Area; East of Exit Gate	3.5-ft round	4.62	4.02	0.81					12 stone/fines	16-inch
CB18	22	South of the Loading Rack; East of Foam Building	4-ft round	7	9.39	2.84	2.44	3.7	5.69	5.69	4 fines	8-inch (in), 16-inch (in), 24-inch (in), 24-inch (out)
CB19	23	South of the Loading Rack; Southeast of Foam Building	3-ft round	6							8 fines	16-inch
CB20	24	South of the Loading Rack; North of the Office Building	4-ft round	6.21	8.79	2.58					4 fines	24-inch; cut open pipe at bottom with concrete
CB21	25	Northeast of the Office Building	4-ft round	6.22	8.65	2.37	2.59	5.84	2.81		trace	4-inch (in), 24-inch (in), 32-inch (out)
CB22	26	Southeast of the Office Building	--	--	--	--	--	--	--		--	Unable to locate - indicated as directly below site parking
CB23	27	South of the Office Building; Northwest of the Yard Pump	4-ft round	6.35	8.22	2.06	2.38				6 fines	24-inch (in), 32-inch (out)
CB24	28	Northeast of the Loading Rack; West of Tank 6 Berm	3.5-ft round	7.81	9.86	7.47					trace	6-inch
PS3	32	3,000 gal. Pump Station (yard pump); Discharge to Tank 3		--	8.46							
Rack Sump 1	30	Located at the Northwest Corner of the Loading Rack	2x2 square	2.82	9.89	7.09					trace	8-inch
Rack Sump 2	31	Located at the Southwest Corner of the Loading Rack	2x2 square	3.4	10.17	6.79					0-4 fines	6-inch
PS2	29	1,000 gal. Lift Station to the Northwest of the Loading Rack	--	--	--	--	--	--	--		--	
MH-1	35	Northwest of Tank 4	4-ft round	5.74	6.25	--	--	--	--		--	Under water at time of survey
OWS 1	33	26,000 gal. main Oil-Water Separator; West of Tank 14	26,000 gallon reservoir	--	18.09							
Overflow Weir Pit	1	Southwest from OWS 1; along Berm Embankment	4-ft round	5.71	17.26	13.31						

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APPENDIX C

MAINTENANCE DOCUMENTATION FORMS

Appendix C

MONTHLY- Maintenance Documentation Form

Stormwater System – Irving Oil Terminal, Revere, MA

Location: Irving Revere Terminal **Inspected By: ____________________**

Date: ____________________________Terminal Location: ______________________

Weather at time of Inspection: ____

TRUCK LOADING AREA TRENCH DRAIN MAINTENANCE

Monthly inspection of the slotted trench drain conveyance system, and concrete catch basins encompassing the truck loading rack area for evidence of sheen, or separate phase product. (Section 3.2 of the O&M Plan). Note the Terminal Rack area is inspected daily using SWPPP Appendix F Daily Facility Inspection Form (Truck Loading Rack; Item #7). USE THIS FORM to document maintenance activities to clear the drain for proper flow.

DATE OF MAINTENANCE EVENT:____

DESCRIBE MAINTENANCE EVENT TO DOCUMENT COMPLETION:

____

____

____

PS-2 - LOADING RACK PUMP STATION MAINTENANCE

The loading rack area pump station (denoted as PS2 on Figure 3) will be inspected for proper operation and potential deficiencies or evidence of pollutant migration (i.e., staining, leaks, sediment, etc.) will be documented. Note the Terminal Rack area is inspected daily using SWPPP Appendix F Daily Facility Inspection Form (Truck Loading Rack; Item #11). USE THIS FORM to document maintenance activities for PS-2.

DATE OF MAINTENANCE EVENT:____

DESCRIBE MAINTENANCE EVENT TO DOCUMENT COMPLETION:

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Appendix C

QUARTERLY- Maintenance Documentation Form

Stormwater System – Irving Oil Terminal, Revere, MA

Location: Irving Revere Terminal **Inspected By:** ____________________

Date: ___________________________**Terminal Location:** ______________________

OWS 1: INSPECTION

Complete Separate Form for OWS 1 in Appendix D. Note that OWS 1 is inspected daily using SWPPP Appendix F Daily Facility Inspection Form (Tank Farm Area; Item #9).
USE Appendix D - Oil/Water Separator (OWS 1) Inspection and Maintenance Checklist to document maintenance activities for OWS 1.

TANK YARD INSPECTION FOR EROSION AND STAINING

The Owner shall coordinate quarterly inspection of the tank yard in its entirety to identify excessive erosion and staining that could be contributing to increased sediment loading or pollutant migration to the stormwater conveyance system. Attach Figure 3 with locations marked and dated.

Q1: Date: _______________	**Inspection Completed by:** ________________________
Area Noted on Map (Y/N)	**Priority Ranking** (High, Medium, Low)
Q2: Date: _______________	**Inspection Completed by:** ________________________
Area Noted on Map (Y/N)	**Priority Ranking** (High, Medium, Low)
Q3: Date: _______________	**Inspection Completed by:** ________________________
Area Noted on Map (Y/N)	**Priority Ranking** (High, Medium, Low)
Q4: Date: _______________	**Inspection Completed by:** ________________________
Area Noted on Map (Y/N)	**Priority Ranking** (High, Medium, Low)

PERIODIC: CONTROL DEVICE INSPECTION/REPLACEMENT/REPAIR

The inlet protection devises shall be periodically inspected following significant rain events (greater than 2-inches) and maintained by performing the following:

- Removing accumulated sediment from atop the drop inlet protection when thickness exceeds 2-inches;
- Removing sediment from the settling area or unclogging weep holes if the control does not drain within 48 hours; or
- Immediately replacing tears in fabric controls or internal filtering controls. This may require replacing the entire control depending on the amount of damage.

USE the second page of this form to record observations and maintenance during the year and observed during normal inspections schedules.

CONTROL DEVICE INSPECTION/REPLACEMENT/REPAIR

CB ID	Inspection Date	Maintenance Required (Y/N)	Date Maintenance Performed	Description of Maintenance
TANK YARD				
CB1B				
CB3				
CB7A				
CB6				
CB7				
CB8				
CB9				
CB10				
CB11				
CB11A				
CB13				
CB13A				
CB25				
CB26				
TERMINAL YARD AND RACK AREAS				
CB14				
CB15				
CB16				
CB17				
CB18				
CB19				
CB20				
CB21				
CB22				
CB23				
CB24				

Appendix C

ANNUAL- Maintenance Documentation Form

Stormwater System – Irving Oil Terminal, Revere, MA

Location: Irving Revere Terminal **Inspected By: ____________________**

Date: ___________________________Terminal Location: _____________________

Weather at time of Inspection: ____

COMPREHENSIVE INSPECTION OF STORMWATER SYSTEM

Inspection for sediment accumulation (Section 3.1 of the O&M Plan).
A preliminary inspection was started in January 2023, that will be continued in dry weather conditions in 2023 (see Appendix B). Based upon the results of the sediment accumulation evaluation, a maintenance event will be planned to removed sediment. Use this form to document the maintenance event. Attach list of components addressed and volumes of media removed.

DATE OF MAINTENANCE EVENT:____

DESCRIBE MAINTENANCE EVENT TO DOCUMENT COMPLETION:

____

____

____

CONTROL DEVICE CLEANING: OWS 1

Cleaning of the Oil-Water Separator (OWS) (Section 3.5 of O&M Plan).

DATE OF MAINTENANCE EVENT:____

DESCRIBE MAINTENANCE EVENT TO DOCUMENT COMPLETION:

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APPENDIX D

OIL/WATER SEPARATOR (OWS 1) INSPECTION AND MAINTENANCE CHECKLIST

Appendix D

Oil/Water Separator (OWS 1)

QUARTERLY - Inspection and Maintenance Checklist

Facility: ________________________________ **Inspected By:** __________________________

Separator ID#: __________________________ **Date:** _________________________________

Separator Location: ____

Weather at time of Inspection: ____

	Inspection Items		
Oil/Water Separator	Distance from the rim of the access cover to the bottom of the structure	________	(depth)
	Distance from the rim of the access cover to the top of the sediment/sludge	________	(measured depth)
	Depth of accumulated sediment	________	(total)
	Distance from the rim of the access cover to the oil/water interface	________	(measured depth)
	Distance from the rim of the access cover to the top of the liquid surface	________	(reference depth)
	Depth of accumulated oil	________	(total)

	Inspection Items	Yes	No	Comments
Action to be Taken	Is Oil/water separator cleaning required?			
	If Yes, please indicate the following: - Who cleaned the separator: ____ - The date the separator was cleaned: ____________________________________ - The volume of liquid pumped: ____ - The volume of sludge removed: _______________________________________ - The method of disposal: ____			

Comments/Notes: ____

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