POST- CONSTRUCTION STORMWATER MANAGEMENT PLAN

PORT WESTWARD INDUSTRIAL PARK
NEXT RENEWABLE FUELS FACILITY

Prepared for

NEXT RENEWABLE FUELS, OREGON, INC.

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The material and data in this plan were prepared under the supervision and direction of the undersigned.

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TABLES AND ILLUSTRATIONS

TABLES

ACRONYMS AND ABBREVIATIONS

cfs	cubic feet per second
County	Columbia County
BMP	Best Management Practices
DEQ	Oregon Department of Environmental Quality
East Rail Spur	rail spur located southeast of the Main Plant
Main Plant	the proposed NEXT Renewables renewable diesel production facility
Main Plant Rail Spur	portion of the rail yard south and southeast of the Main Plant
MFA	Maul Foster & Alongi, Inc.
NEXT Renewables	NEXT Renewable Fuels, Oregon, Inc.
NPDES	National Pollutant Discharge Elimination System
1200-Z Permit	NPDES Stormwater Discharge Permit No. 1200-Z issued by the DEQ
Pipeline/Maintenance Road	an aboveground pipeline and associated gravel maintenance road located northwest of Drainage Area 1
Port	Port of Columbia County
site	property located in Port Westward Industrial Park between Kallunki Road and Hermo Road, Clatskanie, Oregon
SECO	Columbia County's Stormwater and Erosion Control Ordinance
SLOPES	Standard Local Operating Procedures for Endangered Species
Waterways A - C	existing lateral ditches along Waterway D
Waterway D	an existing ditch located adjacent to the proposed pipeline and maintenance road
Waterway F	an existing ditch located on the west side of Drainage Area 3 and conveys runoff from the surrounding areas
Waterway G	an existing ditch located south of the proposed West Rail Spur area
West Rail Spur	a paved road, gravel laydown area, and rail yard located west of the Main Plant

1 PROJECT OVERVIEW

Maul Foster & Alongi, Inc. (MFA) has prepared this Post-Construction Stormwater Management Plan (SWMP) on behalf of NEXT Renewable Fuels, Oregon, Inc. (NEXT Renewables) to describe the post-construction stormwater management system and best management practices (BMPs) for the proposed NEXT Renewables facility at the Port of Columbia County (Port) Port Westward Industrial Park near Clatskanie, Oregon (the site).

1.1 Site Location

The site is located in the Port Westward Industrial Park between Kallunki Road and Hermo Road approximately 7 miles north of Clatskanie, Oregon (see Figure 1). The site is bounded by the Columbia River and Port properties on the north and by the McLean Slough on the south. The site is bordered to the west by undeveloped land and Hermo Road and to the east by undeveloped land followed by the Bradbury Slough.

1.2 Existing Site Conditions

The site currently is approximately 122.5 acres, which consists of primarily agricultural and open land and approximately 0.7 acres of gravel roads. A network of ditches (see Waterways in Figure 2) crosses the site and conveys stormwater to McLean Slough near the southwest corner of the site (see attached Drawings).

The site soils primarily consist of the Udipsamments and silt loam soils, which generally have the following drainage characteristics:

- Udipsamments: sandy, well-drained soils, hydrologic soil group A
- Wauna-Lacoda silt loam: loamy, poorly drained soils, hydrologic soil group C
- Wauna silt loam: loamy, poorly drained soils, hydrologic soil group C

The site-specific soil survey, including a soil map, is provided in Appendix A of this SWMP.

A geotechnical report was prepared in 2001 for a prior development opportunity at the site. The subsurface investigation located the groundwater between 2 feet to 4 feet belowground surface. Based on this finding, infiltration is not expected to be a feasible discharge option for the site runoff. The geotechnical report is provided in Appendix B of this SWMP.

1.3 Proposed Site Description

The proposed NEXT Renewables renewable fuel production facility (the Main Plant) will be used for renewable fuel refining, processing, and storage. The proposed development also includes construction of buildings, parking, utilities, concrete equipment pads, paved drive aisles, paved parking areas, aboveground pipe racks, fuel storage tanks and tank containment structures, paved and gravel roadways, rail spurs and gravel laydown areas. An overview of the site features, including the Main Plant layout and the stormwater discharge points is shown on Figure 2. A description of the proposed stormwater system is provided in the following sections and depicted on the attached Drawings.

The pre-development and post-development pervious and impervious areas are summarized in Table 1-1 below:

Table 1-1
Pre-Developed and Post-Developed Site Conditions

Area	Pre-Development		Post-Development	
	Pervious (acres)	Impervious (acres)	Pervious (acres)	Impervious (acres)
Drainage Area 1	107.8	0.7	44.3	64.2
Drainage Area 2	12.2	0.0	3.9	8.3
Drainage Area 3	0.8	0.0	0.7	0.1
Drainage Area 4	1.0	0.0	1.0	0.0

1.3.1 Drainage Area 1

Drainage Area 1 is approximately 108.5 acres and consists of the Main Plant and a portion of the rail yard south and southeast of the Main Plant (referred to as the Main Plant Rail Spur), located in the northeast portion of the site. 102 acres of the 108.5 acres in Drainage Area 1 will be disturbed during construction. Existing stormwater management systems will be maintained in the areas that will not be disturbed or altered.

Stormwater runoff from the Main Plant will be routed to the on-site wastewater treatment facility for treatment and discharged to the Port's outfall to the Columbia River. The treated wastewater discharges will be covered under the Port's National Pollutant Discharge Elimination System Wastewater Discharge Permit (NPDES Permit, DEQ File No.111746).

Runoff from remaining impervious surfaces within the Main Plant footprint and runoff from the Main Plant Rail Spur Area will be routed to an on-site treatment system prior to being pumped to Discharge Point 001 (see Figure 2). The design of stormwater treatment BMPs is discussed in Section 4 of this SWMP.

1.3.2 Drainage Area 2

Drainage Area 2 is approximately 12.2 acres and consists of two distinct areas: a paved road, gravel laydown area, and rail yard located west of the Main Plant (referred to as the West Rail Spur) and an aboveground pipeline and associated gravel maintenance road located northwest of Drainage Area 1 (referred to as the Pipeline/Maintenance Road). Stormwater runoff from the West Rail Spur is collected in a series of catch basins and conveyed via gravity piping into one of two proposed stormwater ponds located south of the proposed paved road (see Ponds 1 and 2, Figure 2). The ponds provide detention to meet the County's flow-control requirements, as well as treatment via sedimentation and biofiltration. Pond outlets have been equipped with a downturned elbow to trap floatables, including oil sheen, in the ponds. The pond outlets are routed to a manhole (see Manhole MH-DP002, Figure 2) that may be used to sample stormwater consistent with a future National Pollutant Discharge Elimination System (NPDES) Industrial Stormwater Discharge Permit No. 1200-Z (1200-Z Permit) that will be issued to cover the industrial stormwater discharges from the site.

An existing ditch (see Waterway G, Figure 2) located south of the proposed West Rail Spur area conveys off-site stormwater from the surrounding areas to McLean Slough. The existing Waterway G will remain in place to maintain existing drainage conditions for the areas outside of the site boundary.

Site runoff from the Pipeline/Maintenance Road area in the northwest portion of the site sheet flows into a pond (Pond 3) that runs parallel to the maintenance road and is conveyed via gravity pipe to MH-DP002, where it combines with the treated stormwater from the proposed Ponds 1 and 2 prior to discharging into the McLean Slough via Discharge Point 002 (see Figure 2). Pond 3 provides detention to meet the County's flow-control requirements, as well as treatment via sedimentation and biofiltration. The pond outlet has been equipped with a downturned elbow to trap floatables, including oil sheen, in the pond.

An existing ditch (see Waterway D, Figure 2) located adjacent to the proposed pipeline and maintenance road conveys off-site stormwater from the surrounding wetlands to McLean Slough via a culvert that crosses under the West Rail Spur and discharges downstream of MH-DP002. The existing Waterway D will remain in place and runoff from existing lateral ditches (Waterways A – C) will be routed into the ditch via culverts installed under the pipeline and maintenance road. The existing Waterway D will be maintained and isolated from site runoff generated in this area. The culvert will be sized during final design when more information about the wetland drainage conditions becomes available (wetland water levels will be monitored over the next year to evaluate seasonal fluctuations).

1.3.3 Drainage Area 3

Drainage Area 3 is approximately 0.8 acre and consists of a rail spur located southeast of the Main Plant (East Rail Spur). A gravel road in this area provides access to the adjacent property. Stormwater runoff from the East Rail Spur is collected in a catch basin and conveyed via gravity piping into a pond located along the southwest boundary of this drainage area (see Pond 4, Figure 2). This pond provides detention to meet the County's flow-control requirements, as well as treatment via sedimentation and biofiltration. The Pond 4 outlet consists of a grated catch basin (CB-DP003), equipped with a downturned elbow to trap floatables including oil sheen in the pond. The Pond 4 catch basin may be used to sample stormwater consistent with a future 1200-Z Permit that will be issued to cover the industrial stormwater discharges from the site.

An existing ditch (see Waterway F, Figure 2) runs south and then west through the property on the west side of Drainage Area 3 and conveys runoff from the surrounding areas. Runoff from this ditch will be conveyed via a new culvert under the proposed rail tracks to maintain the existing drainage. Treated industrial runoff from the proposed Pond 4 will discharge to the existing Waterway F via Discharge Point 003 (see Figure 2) and will then be conveyed west to McLean Slough.

The design criteria used to design the proposed stormwater treatment BMPs are included in Section 4 of this SWMP.

1.3.4 Drainage Area 4

Drainage Area 4 is approximately one acre and consists of a proposed aboveground pipeline located northwest of Hermo Road. An existing maintenance road runs parallel to the aboveground pipeline and will remain in place to facilitate maintenance access to the pipeline and other Port properties.

An existing ditch runs parallel to the proposed aboveground pipeline and conveys off-site runoff from the surrounding areas. Stormwater from this ditch discharges to Waterway D via Discharge Point 004 (see Figure 2). Impervious surfaces will not increase in Drainage Area 4 and stormwater runoff will continue to be managed through the existing ditches; therefore, post-construction stormwater management is not further discussed in this SWMP.

1.4 Receiving Waters

Stormwater and process wastewater generated at the Main Plant are conveyed to and treated via the on-site wastewater treatment system. The comingled stormwater and process wastewater streams are considered and regulated as wastewater and will discharge to the Bradbury Slough and the Columbia River via the Port's pump station and outfall (Discharge Point 001).

Ponds 1, 2, and 3 will discharge to McLean Slough via Discharge Point 002.

Pond 4 will discharge to the Waterway F and McLean Slough via Discharge Point 003.

The existing ditch in Drainage Area 4 will continue to discharge to Waterway D and McLean Slough via Discharge Point 004.

The latitude and longitude of the discharge points are as follows:

- Discharge Point 001: 46.168600°N and 123.161950°W
- Discharge Point 002: 46.164137°N and 123.162208°W
- Discharge Point 003: 46.164147°N and 123.152285°W
- Discharge Point 004 : 46.172119°N and 123.181221°W

2 STORMWATER MANAGEMENT STANDARDS

The development of the NEXT Renewables facility will include wetland fill and mitigation; therefore, the Joint Permit Application (No. 63077 RF) and the related design documents, including this SWMP, are subject to Standard Local Operating Procedures for Endangered Species (SLOPES) V regulations (USACE 2014). Sections 2.1 through 2.4 outline the applicable design standards for the project. The water quality and flow control measures were also designed consistent with the requirements of the Columbia County (the County) Stormwater and Erosion Control Ordinance No. 2001-10 adopted November 28, 2001 (SECO). If the SECO and SLOPES design standards differed, the more conservative criteria was used to design the proposed stormwater flow control and treatment facilities.

Additionally, the site will be required to meet the requirements of the 1200-Z Permit that will be issued by the DEQ for industrial stormwater discharges from the NEXT Renewables facility. The proposed site will be classified under Standard Industrial Code 2869 Industrial Organic Chemicals, Not Elsewhere Classified.

2.1 Water Quality Treatment

From the SECO:

- Section 1.C.18: "Water quality storm" means the rainfall from a six-month 24-hour storm. SECO defines this water quality storm as equal to approximately 64 percent of rainfall from the two-year 24-hour storm or 0.83 inches for the entire county.
- Section III.B.2.a.i: Stormwater and runoff from parking lots, driveways, and other exposed traffic areas shall be treated using one of the following treatment methods: biofiltration swales, vegetative filter strips, or alternative treatment methods.

From SLOPES V:

- **Section 36.e:** All stormwater quality treatment practices and facilities will be designed to accept and fully treat the volume of water equal to 50 percent of the cumulative rainfall from the two-year 24-hour storm for that site. The SLOPES V water quality storm depth for the site was calculated to be 1.4 inches, based on a two-year 24-hour storm depth of 2.8 inches obtained from Appendix E of the SECO using the rainfall depths for Clatskanie.
- **Section 36.f:** Use low impact development practices to infiltrate or evaporate runoff to the maximum extent feasible. For runoff that cannot be infiltrated or evaporated and therefore will discharge into surface or subsurface waters, apply one or more of the following specific primary treatment practices, supplemented with appropriate soil amendments:
    - Bioretention cell
    - Bioslope, also known as an "ecology embankment"
    - Bioswale
    - Constructed wetlands
    - Infiltration pond
    - Media filter devices with demonstrated effectiveness
  - Porous pavement, with no soil amendments and appropriate maintenance

From the *Post-Construction Stormwater Management Plan Submission Guidelines* (DEQ 2022):

- **Section E.1.1:** Multiply the two-year 24-hour precipitation by the appropriate water quality design storm factor: 0.5 for the rest of the state. If the results are less than 0.7 inch, use 0.7 inch. The DEQ SWMP water quality storm depth for the site was calculated to be 1.4 inches, based on a two-year 24-hour storm depth of 2.8 inches obtained from Appendix E of the SECO using the rainfall depths for Clatskanie.

2.2 Runoff Control and Water Quantity

From the SECO :

- **Section III.B.2.b.i:** Runoff from the development site shall be controlled such that the following criteria are met:
  - The peak flows for the ten and 100-year, 24-hour design storms after development does not exceed the respective predevelopment peak flows.
  - The peak flow for the two-year, 24-hr design storm after development does not exceed one-half the predevelopment peak flow for the two-year storm.

From SLOPES V:

- **Section 36.c.iii:** Water quantity treatment (retention or detention facilities), unless the outfall discharges directly into a major water body (e.g., mainstem Columbia River, Willamette River (downstream of Eugene), large lakes, reservoir, ocean, or estuary). Retention or detention facilities must limit discharge to match predeveloped discharge rates (i.e., the discharge rate of the site based on its natural groundcover and grade before any development occurred) using a continuous simulation for flows between 50 percent of the two-year event and the ten-year flow event (annual series).

2.3 Storm Conveyance Design

From the SECO:

- **Section II.E.1:** Conveyance systems shall be designed to carry runoff from the 25-year storm where the contributing drainage area is less than 40 acres and the 100-year storm where the contributing drainage area exceeds 40 acres.

From SLOPES V:

- **Section 36.g:** When conveyance is necessary to discharge treated stormwater directly into surface water or a wetland, the following requirements apply:
  - Maintain natural drainage patterns.
  - To the maximum extent feasible, ensure that water quality treatment for contributing impervious area runoff is completed before commingling with off-site runoff for conveyance.

- Prevent erosion of the flow path from the project to the receiving water and, if necessary, provide a discharge facility made entirely of manufactured elements (e.g., pipes, ditches, discharge facility protection) that extends at least to ordinary high water (OHW).

2.4 Design Storms

For water quality treatment, the SLOPES V and DEQ SWMP design storms are equivalent and exceed the SECO design storm. Therefore, the water quality design storm of 1.4 inches (over 24 hours) was used to size stormwater treatment BMPs using the rainfall depths for Clatskanie based on Appendix E of the SECO. The design storms are summarized in the following table.

Table 2-1: Design Storms

Storm Event	Water Quality	2-year, 24-hour	5-year, 24-hour	10-year, 24-hour	25-year, 24-hour	100-year, 24-hour
Rainfall Depth	1.4 inches	2.8 inches	3.4 inches	3.9 inches	4.5 inches	5.4 inches

Groundwater at the site is estimated to be between 2 and 4 feet below existing ground surface. High groundwater limits the infiltration capacity and the proposed stormwater facilities were designed with the assumption that infiltration is negligible. Proposed ponds were designed with a shallow depth to avoid the need for a liner and minimize groundwater intrusion into the ponds. Liners can negatively impact the pond vegetation, make maintenance more difficult and expensive and are subject to buoyancy; therefore, a liner is not recommended at this time. Groundwater elevations will be further studied, and the pond design may be refined during the final design phase to minimize groundwater intrusion, if needed.

2.5 Hydrologic Model

The hydrologic conditions were modeled using HydroCAD software 10.0 and utilized the Soil Conservation Service method and the Natural Resource Conservation Service Type IA, 24-hour storm hydrograph. The HydroCAD model output report is included in Appendix C.

2.5.1 Hydrologic Design Factors

The drainage areas contributing to Discharge Points 002 and 003 were calculated using a scaled Autodesk Civil3D site plan and proposed facility development provided by NEXT Renewables. The hydrologic curve numbers used to model the various surface covers proposed for the site are outlined in Table 2-2 below.

Table 2-2: Runoff Curve Numbers

Surface Coverage	Runoff Curve Number
Pavement and Building Roofs	98
Gravel Roads and Laydown Areas	92
Railroad Ballast and Tracks	78

Surface Coverage	Runoff Curve Number
Proposed Landscaping	78
Existing Grass or Vegetated Field	78
Stormwater Ponds	100

3 POTENTIAL POLLUTANTS OF CONCERN

Generally, potential pollutants in stormwater at the site are associated with vehicle traffic, material loading/unloading, and transport of biodiesel products via pipe rack and cargo train cars. The potential pollutants are listed below:

- Leaks or spills of biodiesel, motor oil, gasoline, diesel, antifreeze, and hydraulic fluids from equipment and vehicles are a potential source of oil sheen and oxygen demand in stormwater.
- Vehicle and equipment brake pads are a potential source of copper in stormwater.
- Vehicle and equipment tires are a potential source of zinc and 6PPD-quinone (6PPD-q) in stormwater.[1]
- Galvanized surfaces are a potential source of zinc in stormwater.
- Gravel areas are a potential source of suspended solids in stormwater.
- Decaying vegetation and soil erosion are potential sources of suspended solids and nutrients in stormwater.

4 STORMWATER TREATMENT

Runoff water quality treatment and flow (stormwater quantity) control will be provided via detention and settling/biofiltration ponds as outlined in this section.

4.1 Drainage Area 1

The design of the Drainage Area 1 stormwater conveyance, flow control and treatment system is outlined in detail in the *Wastewater-Storm Water Design Basis* document that is included in Appendix D of this SWMP. This design was completed by others, but the design is summarized in the following sections for the sake of completion.

[1] 6PPD-q is not currently regulated via stormwater discharge permits; however, it is considered to be an "emerging pollutant" and is addressed in this SWMP.

4.1.1 Stormwater Treatment

Stormwater runoff from the process areas of the Main Plant and adjacent Main Plant Rail Spur will be detained in the Process Wastewater System, combined with wastewater and routed to the wastewater treatment system. Stormwater from the non-process areas of the Main Plant will be detained in the Stormwater System and combined with pretreated wastewater and process area stormwater. The combined flow will be treated as process water and routed to a filtration system for final polishing prior to discharge.

The Main Plant stormwater conveyance and treatment system were designed to detain and treat the 100-year, 24-hour storm. The wastewater treatment system was designed to remove a wide range of pollutants, including but not limited to oils and greases, suspended solids, heavy metals, nutrients and 6PPD-q. Additional design information is included in Appendix D. The stormwater detention system will detain peak flows and provide treatment via sedimentation. Treated effluent will be discharged to the Port's outfall to the Columbia River via Discharge Point 001, consistent with the Port's NPDES permit.

In addition to stormwater treatment in Drainage Area 1, consistent with County requirements, a ten-foot wide tree buffer totaling 1.1 acres will be planted south of the proposed Main Plant Rail Spur along the southern boundary of the site and will gently slope towards the existing Waterway F.

4.1.2 Conveyance System

Conveyance piping was sized to convey the 100-year, 24-hour storm consistent with the SECO standards for drainage areas that exceed 40 acres.

4.1.3 Flow Control

Since the Main Plant will discharge to the Port's outfall to the Columbia River, and direct discharges to the Columbia River are exempt from flow control requirements. Flow control will be based on the available capacity in the Port's conveyance system, including the pump station and outfall. Flow control in Drainage Area 1 is achieved through detention and controlled discharge from the treatment system and is discussed in detail in the *Wastewater-Storm Water Design Basis* document that is included in Appendix D of this SWMP.

4.2 Drainage Areas 2 and 3

The following sections describe the design of stormwater treatment and detention facilities in Drainage Areas 2 and 3. The hydrologic model output report showing the design calculations is included in Appendix C. The treatment and detention facilities are depicted on the attached Drawings and Figure 2.

4.2.1 Stormwater Treatment

The proposed aboveground pipeline within Drainage Area 2 includes the construction of a compacted gravel roadway and concrete footings for the pipe rack. Runoff from the pipe rack and roadway will be routed into Pond 3 that will run parallel to the maintenance road and will then be conveyed via gravity flow to MH-DP002, located upstream of Discharge Point 002. The vegetated pond will treat stormwater via sedimentation and biofiltration.

Runoff from the paved access road, gravel laydown area, and rail areas west of the Main Plant (West Rail Spur) will sheet flow to a series of catch basins and will then be conveyed via gravity flow to Pond 1 that extends east from Hermo Road for approximately 2,684 feet. Each catch basin will be equipped with an oil trapping outlet and sump to trap oil sheen and sediment in the sump. Runoff from the Main Plant Rail Spur will sheet flow to a series of catch basins and will be conveyed via gravity flow to Pond 2 that extends from the Main Plant westward for approximately 1,064 feet. The vegetated ponds will provide sedimentation and biofiltration prior to discharging to MH-DP002, located within an earth berm between Ponds 1 and 2. Pond outlets will be equipped with downturned elbows to trap oil sheen and other floatables in the ponds. Absorbent socks or booms will be used to remove sheen, if any, from the water surface in the pond. Stormwater will discharge from the manhole to McLean Slough south of the site boundary.

Runoff from the rail area southeast of the Main Plant (East Rail Spur) will sheet flow to a catch basin and will then be conveyed via gravity flow to Pond 4 located in the southwest portion of Drainage Area 3 adjacent to the existing Waterway F. The catch basin will be equipped with an oil trapping outlet and sump to trap oil sheen and sediment in the sump. The vegetated pond will provide sedimentation and biofiltration. The catch basin will include a sump and oil trapping outlet to trap oil sheen and sediment in the sump. The pond outlet will be equipped with a downturned elbow to trap oil sheen and other floatables in the pond. Absorbent socks or booms will be used to remove sheen, if any, from the water surface in the pond.

The ponds will be planted with native vegetation suitable for water quality facilities. An example of the seed mix that may be used for the upper slopes of the ponds is the ProTime Seeds Mix 498 (Native Riparian Zone 2 Mix) suitable for riparian slopes of water quality facilities. The lower side slopes and pond bottom will be vegetated to enhance sedimentation with biofiltration. An example of the seed mix that may be used at the bottom and lower side slopes of the ponds is the ProTime Seed Mix 440 (Native Biofilter Mix).

These vegetation specifications are subject to change during the final design phase, as the vegetation may be customized to better match the existing native wetland vegetation in the surrounding areas or the vegetation in the proposed wetland mitigation areas. All proposed planting will utilize native species and be selected based on the level of inundation expected (upper side slope versus lower slope and bottom).

The site soils will be tested for cation exchange capacity and organic content and other parameters to determine whether they can support plant life and treat stormwater without soil amendments or use of imported soils.

Soils that meet the specifications of a high performance bioretention soil mix[2], as defined in the Washington State Department of Ecology (Ecology) Stormwater Management Manual for Western Washington, will be utilized in the stormwater ponds to enhance biofiltration and reduce concentrations of heavy metals, nutrients and 6PPD-q in stormwater discharged from the site. Bioretention soils have been shown to effectively remove these pollutants[3].

The ponds were sized to detain peak flow rates generated by storms up to the 100-year, 24-hour storm. Post-development flow rates were matched to the pre-development flows as outlined in Section 2. Due to the flow control requirements, the ponds will treat flows that include and significantly exceed the SLOPES water quality design flow. Live storage volumes in the ponds were calculated using the distance from the outlet elevations to the top of the ponds. Dead/sediment storage volumes in the ponds were calculated using the distance from the bottom of the ponds to the outlets. The following summarizes the pond dimensions:

- **Pond 1**
  - Total volume: 102,300 cubic ft (ft^3)
  - Live storage: 87,700 ft^3
  - Dead/sediment storage: 14,600 ft^3
- **Pond 2**
  - Total volume: 49,400 ft^3
  - Live storage: 42,400 ft^3
  - Dead/sediment storage: 7,000 ft^3
- **Pond 3**
  - Total volume: 22,400 ft^3
  - Live storage: 16,200 ft^3
  - Dead/sediment storage: 6,200 ft^3
- **Pond 4**
  - Total volume: 8,100 ft^3
  - Live storage: 4,600 ft^3
  - Dead/sediment storage: 3,500 ft^3

[2] Ecology. 2021. *Guidance on using new high performance bioretention soil mixes.* Washington Department of Ecology. Publication 21-10-023. May.

[3] Ecology. 2022. *Stormwater Treatment of Tire Contaminants Best Management Practices Effectiveness.* Washington Department of Ecology.

The existing Waterway G extends east through the center of the site beginning at Hermo Road and conveys stormwater to McLean Slough. Consistent with County requirements, this ditch will remain in place to maintain existing drainage conditions for the surrounding area. Additionally, a ten-foot wide tree buffer totaling 1.2 acres will be planted south of the proposed Ponds 1 and 2 along the southern boundary of the site and will gently slope towards the existing Waterway G.

4.2.2 Conveyance System

Conveyance piping was sized to convey the 100-year, 24-hour storm consistent with the SECO standards for drainage areas that exceed 40 acres. Consistent with the SLOPES requirements, existing drainage patterns and conveyance ditches were preserved to the extent practicable, industrial stormwater conveyance and treatment facilities were separated from off-site flows and receiving water bodies, and discharges to surface waters were protected from erosion using rip rap to dissipate energy.

The attached HydroCAD model includes conveyance piping; however, it should be noted that each pipe and catch basin was not modeled separately. Since many of the rail spur catch basins drain a similar size area, the largest area was modeled to size the pipe that will discharge to the vegetated ponds and the same pipe size was used for all catch basins in the rail spur. Pond outlet pipes were modeled as an outlet feature in the pond node (rather than a separate node). More detailed models of the conveyance system will be developed during the final design phase and will be designed consistent with the applicable SECO and SLOPES design standards.

4.2.3 Flow Control

Tables 4-1 and 4-2 below summarize the Drainage Area 2 and Drainage Area 3 pre- and post-development peak flow rates. Consistent with the SECO flow control standards, the maximum post-development peak flow rates do not exceed 50 percent of the 2-year storm, or the 10-year and the 100-year storm pre-development peak flow rates (see Appendix C for the HydroCAD output report showing pre- and post-development peak flow rates).

Table 4-1: Drainage Area 2 Flow Control Summary

Storm Event	Pre-development Peak Flow Rate (cfs)	Maximum Post-development Peak Flow Rate (cfs)
2-yr	2.07	0.86
10-yr	4.44	1.56
100-yr	8.16	2.62

Table 4-2: Drainage Area 3 Flow Control Summary

Storm Event	Pre-development Peak Flow Rate (cfs)	Maximum Post-development Peak Flow Rate (cfs)
2-yr	0.16	0.06
10-yr	0.33	0.14
100-yr	0.59	0.30

4.3 Drainage Area 4

Impervious surface areas will not increase in Drainage Area 4. The ground surface under the pipeline will be restored and remain vegetated and pervious to maintain existing drainage conditions. Therefore, additional stormwater flow control and treatment measures are not required.

5 OPERATIONS AND MAINTENANCE GUIDELINES

Maintenance of the proposed stormwater system will be the responsibility of NEXT Renewables. The stormwater system will be inspected monthly consistent with future 1200-Z Permit requirements to evaluate the need for maintenance. The following summarizes typical maintenance requirements:

- **Drainage Area 2 and 3 Ponds:** vegetation pruning, debris removal, sediment removal, sheen absorption using absorbent booms and boom removal/replacement, replanting dead vegetation, and irrigation during plant establishment period
- **Main Plant Stormwater Tanks:** debris removal, sediment removal, sheen absorption using absorbent booms and boom removal/replacement
- **Manholes:** periodic inspection and sediment/sheen removal
- **Catch Basins:** periodic inspection and sediment/sheen removal

The Operations and Maintenance (O&M) Manual for the Drainage Area 2 and Drainage Area 3 stormwater treatment measures is included in Appendix E. This O&M Manual will be updated and refined during the final design phase and updated as needed thereafter.

An O&M Manual for the Main Plant (Drainage Area 1) wastewater and stormwater treatment system will be developed during the final design phase and updated as needed thereafter.

LIMITATIONS

The services undertaken in completing this SWMP were performed consistent with generally accepted professional consulting principles and practices. No other warranty, express or implied, is made. These services were performed consistent with our agreement with our client. This SWMP is solely for the use and information of our client unless otherwise noted. Any reliance on this SWMP by a third party is at such party's sole risk.

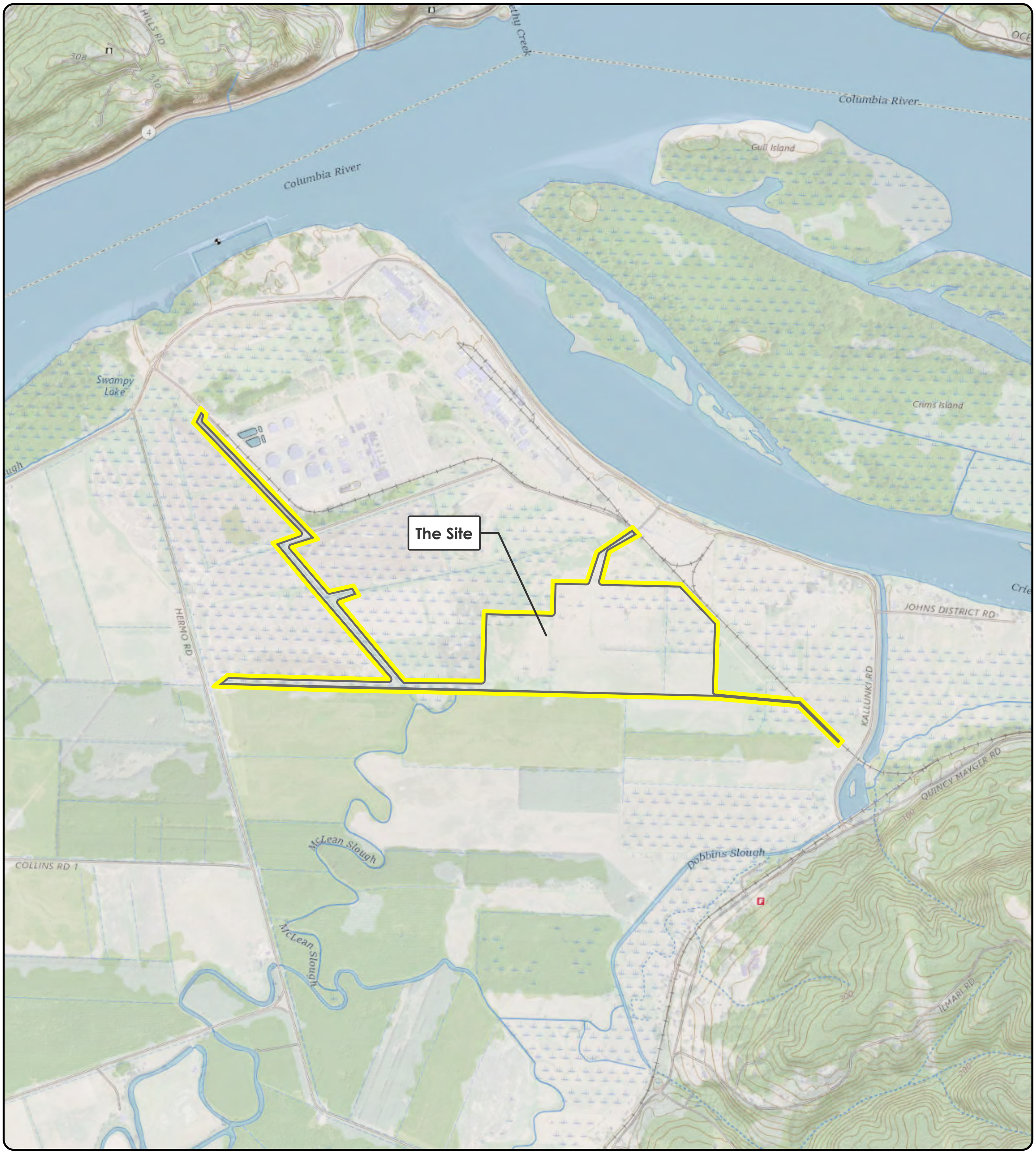
Opinions and recommendations contained in this report apply to conditions existing when services were performed and are intended only for the client, purposes, locations, time frames, and project parameters indicated. We are not responsible for the impacts of any changes in environmental standards, practices, or regulations subsequent to performance of services. We do not warrant the accuracy of information supplied by others, or the use of segregated portions of this SWMP.

REFERENCES

DEQ. 2022. *Section 401 Water Quality Certification Post-Construction Stormwater Management Plan Submission Guidelines*. Oregon Department of Environmental Quality: Portland, OR. October

USACE. 2014. William W. Stelle, Jr. National Oceanic and Atmospheric Administration National Marine Fisheries Services. *Reinitiation of the Endangered Species Act Section 7 Programmatic Conference and Biological Opinion and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Consultation for Revisions to Standard Local Operating Procedures for Endangered Species to Administer Maintenance or Improvement of Stormwater, Transportation or Utility Actions Authorized or Carried Out by the U.S. Army Corps of Engineers in Oregon (SLOPES for Stormwater, Transportation or Utilities)*. NWR-2013-10411. Letter to Shawn H. Zinszer and Joyce Casey, U.S. Army Corps of Engineers. March 14.

FIGURES



Notes
U.S. Geological Survey 7.5-minute topographic quadrangle (2021): Oak Point.
Township 8 north, range 4 west, sections 21-23.

Legend
Site Boundary

Figure 1
Site Location

NEXT Renewable Fuels, Inc.
Port Westward, OR

0 1,000 2,000
Feet

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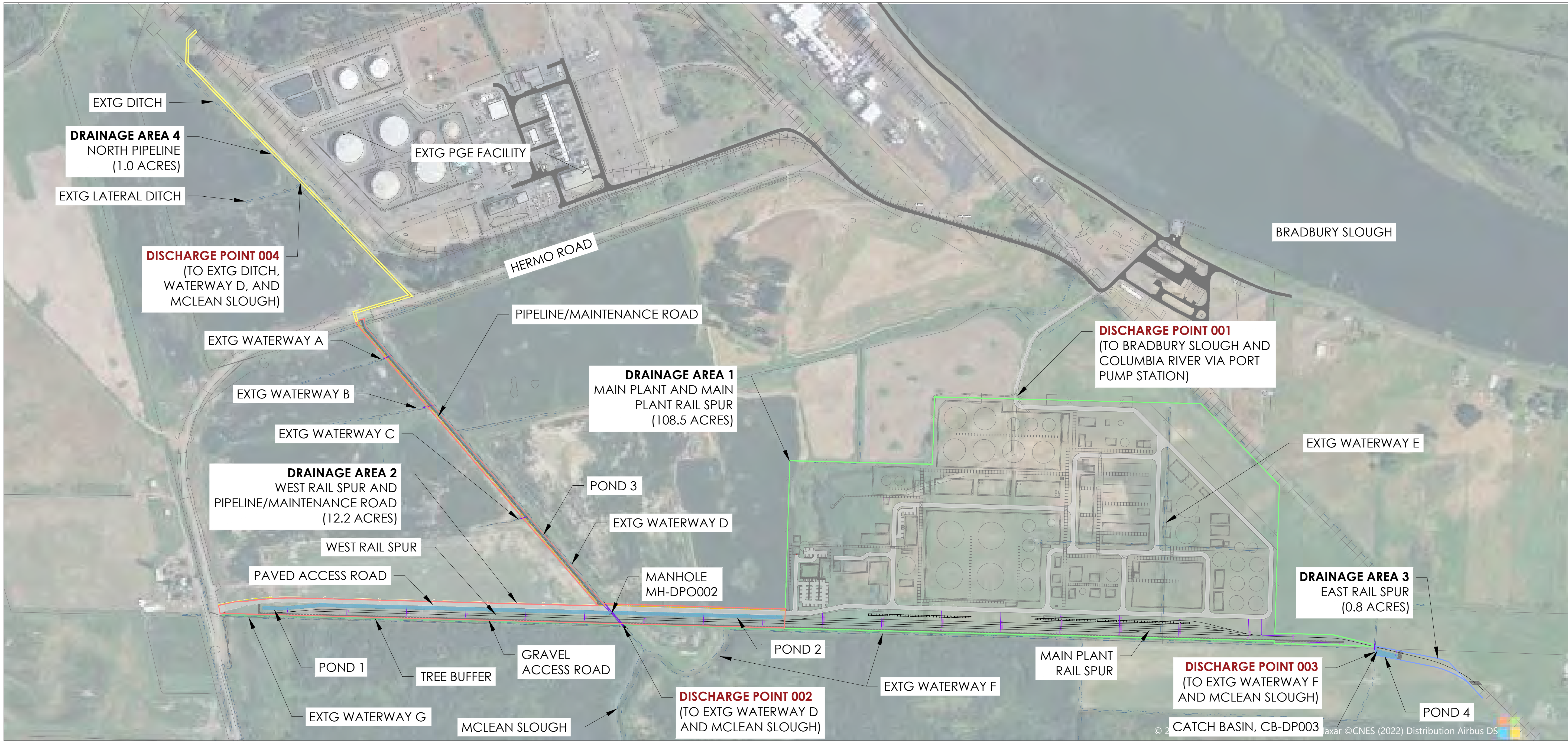
Project: M1724.01.004 Produced By: jroberts Reviewed By: apoliski Print Date: 1/19/2023 Path: X:\1724.01 CONFIDENTIAL - NEXTEnergy_04\Projects\Pro\M1724_01_004.aprx



LEGEND

- STORMWATER POND
- PAVED ROAD
- GRAVEL
- TREE BUFFER
- DRAINAGE AREA BOUNDARY
- RAIL SPUR
- PIPE RACK
- STORM PIPE
- CATCH BASIN
- EXISTING WATERWAY/DITCH

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NEXT Renewable Fuels, Inc.

SITE LAYOUT

NEXT RENEWABLE FUELS OREGON

NEXT RENEWABLE FUELS, INC.

PORT WESTWARD, OREGON

0 700' 1400'

NOTE: BAR IS ONE INCH ON ORIGINAL DRAWING. IF NOT ONE INCH ON THIS SHEET, ADJUST SCALE ACCORDINGLY.

FIGURE 2

DRAWINGS

NEXT RENEWABLE FUELS OREGON

PREPARED FOR:

NEXT RENEWABLE FUELS, INC.

LOCATED IN SEC. 16, T. 8 N., R. 4 W., W.M., COLUMBIA COUNTY, CLATSKANIE, OR

PROJECT CONTACTS

CLIENT
NEXT RENEWABLE FUELS, INC.
11767 KATY FREEWAY, SUITE 705
HOUSTON, TX 77079
P: 281-884-3680
CHRISTOPHER EFIRD
CHRIS@NEXTRENEWABLES.COM

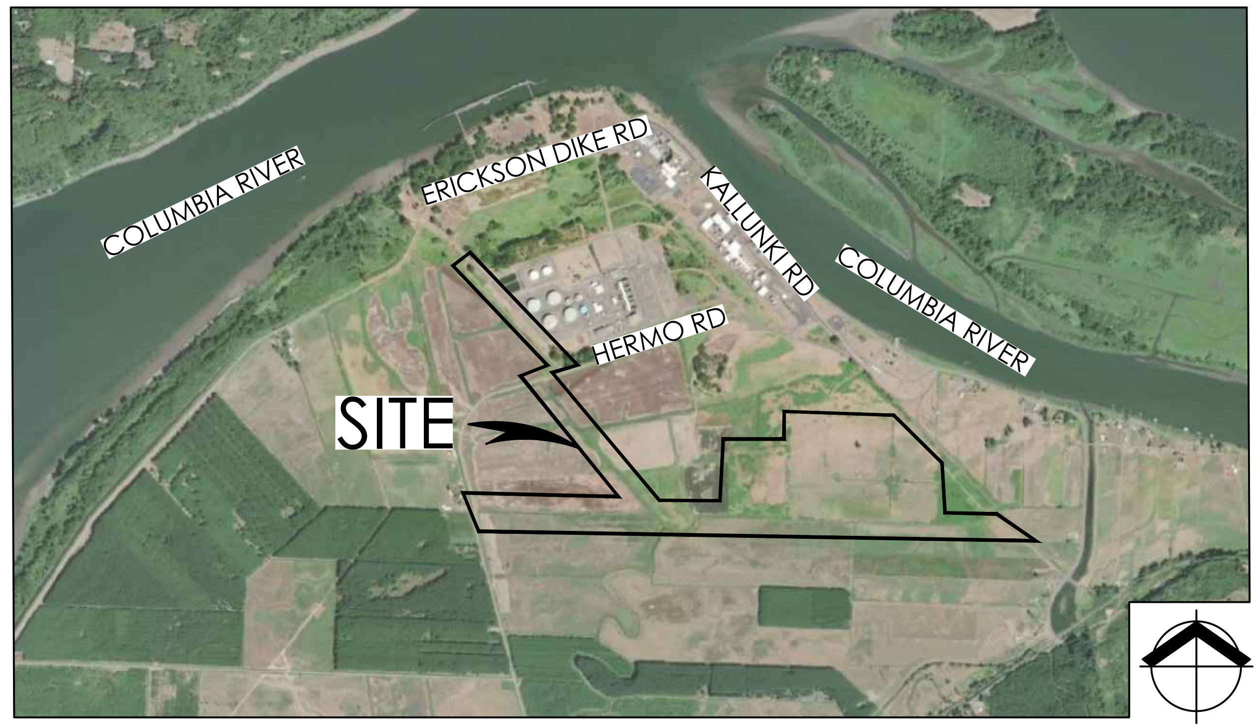
CIVIL ENGINEER
MAUL, FOSTER & ALONGI, INC.
3140 NE BROADWAY STREET
PORTLAND, OR 97232
P: 971-544-2139
BROOKE HARMON, PE
BHARMON@MAULFOSTER.COM

SURVEYOR
DAVE MILLS SURVEYING
BEAVERTON, OR 97008
P: 503-330-8646

PROJECT SUMMARY

SITE ADDRESS:
LOCATED IN THE PORT WESTWARD INDUSTRIAL PARK
BETWEEN KALLUNKI ROAD AND HERMO ROAD
COLUMBIA COUNTY
CLATSKANIE, OREGON

WORK DESCRIPTION:
NEXT RENEWABLE FUELS OREGON, LLC (NEXT) PROPOSES TO BUILD A RENEWABLE FUELS FACILITY TO SUPPLY RENEWABLE FUELS TO WEST COAST MARKETS.



VICINITY MAP

NOT TO SCALE

GENERAL NOTES

1. SURVEY PERFORMED BY DAVE MILLS SURVEYING IN 2020.
2. HORIZONTAL DATUM: OREGON STATE PLANE COORDINATE SYSTEM NORTH ZONE, NAD 83/91. ELEVATION DATUM: NGVD 29/47.

SHEET INDEX

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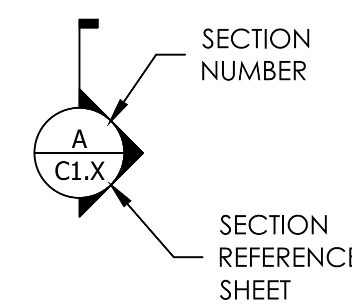
NEXT Renewable Fuels, Inc.

COVER SHEET

NEXT RENEWABLE FUELS OREGON
NEXT RENEWABLE FUELS, INC.
PORT WESTWARD, OREGON

SYMBOL EXIST.	PROP.	DESCRIPTION
		GAS METER
		GAS VALVE
		PAD-MOUNTED TRANSFORMER
P		POWER VAULT
		TRANSMISSION TOWER
		UTILITY POLE
		UTILITY POLE ANCHOR
		TELEPHONE RISER
T		TELEPHONE VAULT
		LIGHT POLE
		SAN. SEWER CLEAN OUT
	S	SAN. SEWER MANHOLE
CB		STORM DRAIN CATCH BASIN
		STORM DRAIN CULVERT
	D	STORM DRAIN MANHOLE
		DRY WELL
		AREA DRAIN
		STORM CLEANOUT
		STORM WATER FLOW ARROW
27		PROPOSED GRADE MAJOR CONTOUR (5.0' INTERVAL)
27		PROPOSED GRADE MINOR CONTOUR (1.0' INTERVAL)
		PROPOSED STORM DRAIN PIPE
		PROPOSED WATER PIPE
		PROPOSED SANITARY SEWER PIPE
		PROPOSED AC PAVEMENT
		PROPOSED CONCRETE SURFACING
		PROPOSED GRAVEL SURFACING
		PROPOSED BUILDING
X		PROPOSED FENCE LINE
		PROPOSED ROAD CENTERLINE
		PROPOSED RIGHT-OF-WAY
PL		PROPOSED PROPERTY LINE
SF		PROPOSED SEDIMENT FENCE
		PROPOSED ABOVE GROUND PIPE RACK
		PROPOSED TREE BUFFER
		PROPOSED STORMWATER POND

SYMBOL	DESCRIPTION
27	EXISTING GRADE MAJOR CONTOUR
27	EXISTING GRADE MINOR CONTOUR
SD_x	EXISTING STORM DRAIN PIPE
W_x	EXISTING WATER PIPE
SS_x	EXISTING SANITARY SEWER PIPE
	EXISTING AC PAVEMENT
	EXISTING CONCRETE SURFACING
	EXISTING GRAVEL SURFACING
	EXISTING BUILDING
	EXISTING WETLAND BOUDARY
	EXISTING FENCE LINE
	EXISTING ROAD CENTERLINE
	EXISTING RIGHT-OF-WAY
PL	EXISTING PROPERTY LINE
OHW	EXISTING ORDINARY HIGH WATER MARK
E_x	EXISTING UNDERGROUND POWER
T	EXISTING UNDERGROUND TELEPHONE
G	EXISTING UNDERGROUND GAS
	INLET PROTECTION
	CONSTRUCTION ENTRANCE



TYPICAL SECTION CALLOUT

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NEXT Renewable Fuels, Inc.

MASTER LEGEND

NEXT RENEWABLE FUELS OREGON

NEXT RENEWABLE FUELS, INC.
PORT WESTWARD, OREGON

EXHIBIT
C1.0

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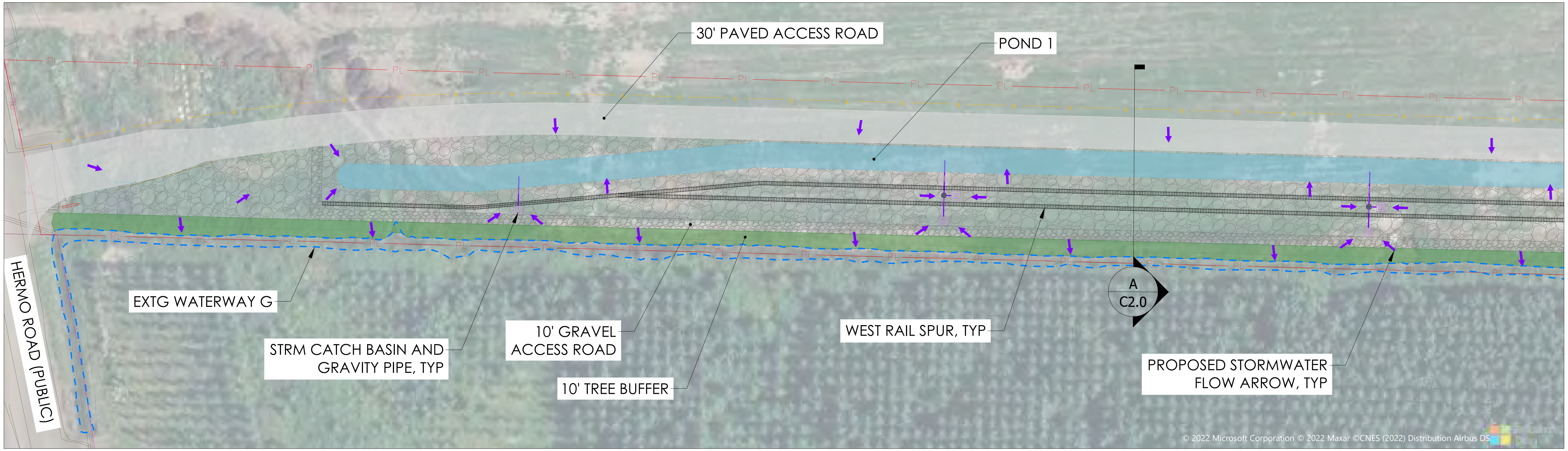

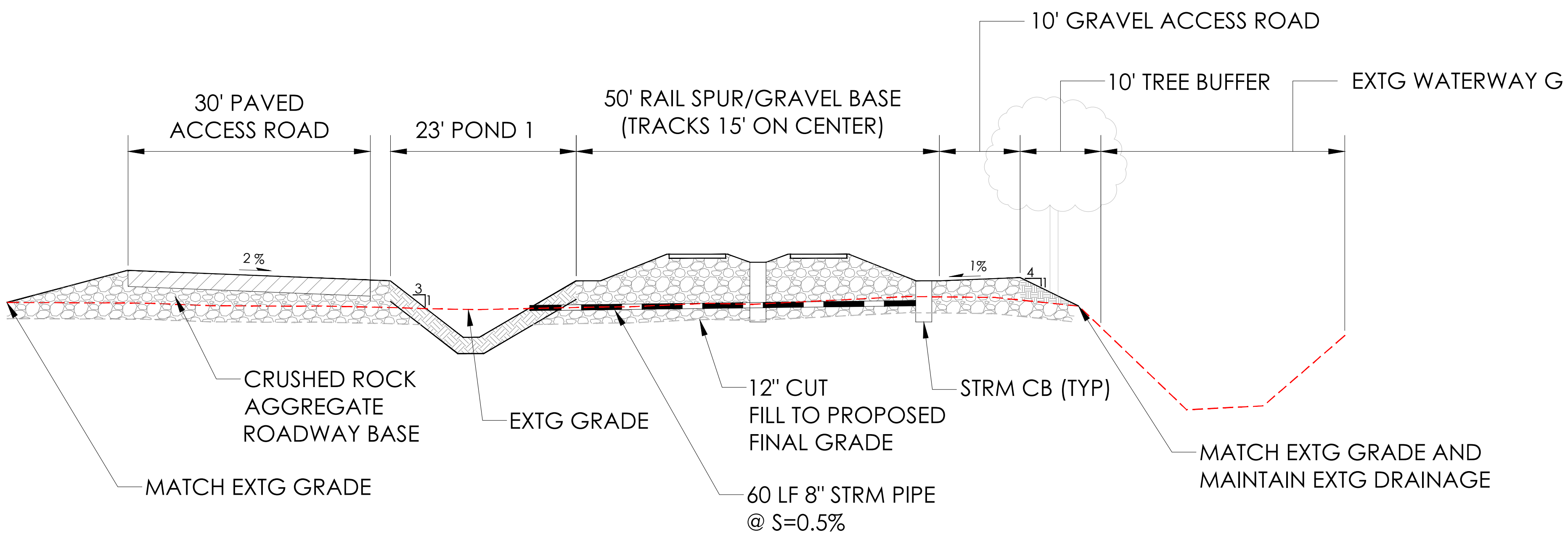

A WEST RAIL SPUR TYPICAL SECTION

NOT TO SCALE

SITE LOCATION KEY

PERMIT DOCUMENT

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NEXT Renewable Fuels, Inc.

WEST RAIL SPUR PLAN AND SECTION I

NEXT RENEWABLE FUELS OREGON

NEXT RENEWABLE FUELS, INC.

PORT WESTWARD, OREGON

0 100' 200'

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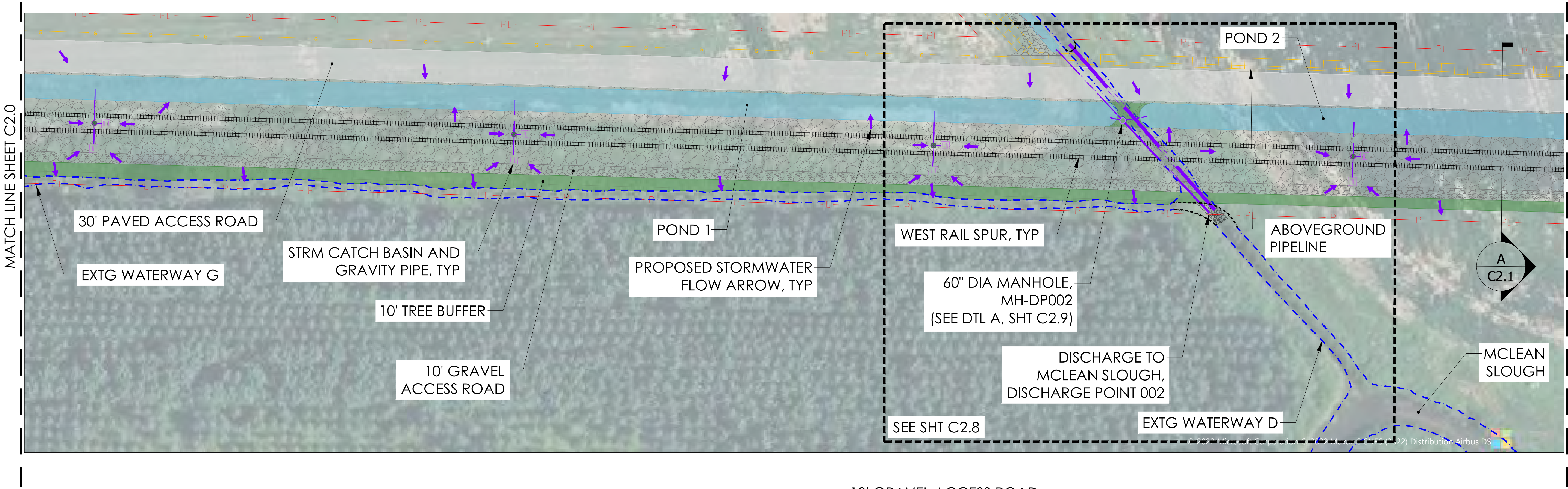

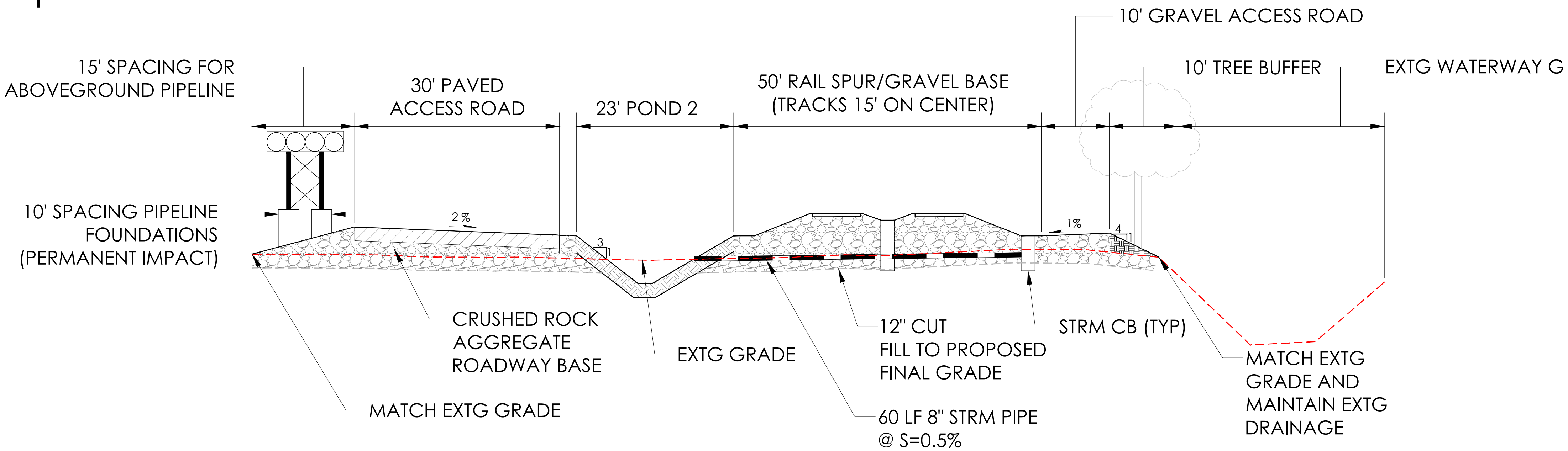

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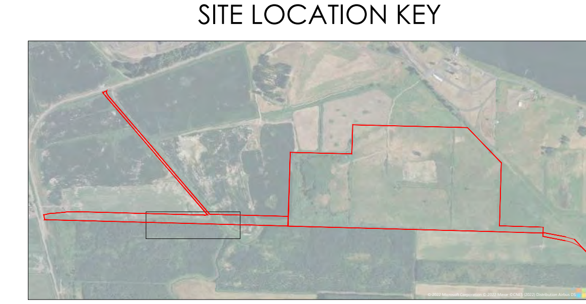

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NEXT Renewable Fuels, Inc.

WEST RAIL SPUR PLAN AND SECTION II

NEXT RENEWABLE FUELS OREGON

NEXT RENEWABLE FUELS, INC.
PORT WESTWARD, OREGON

0 100' 200'

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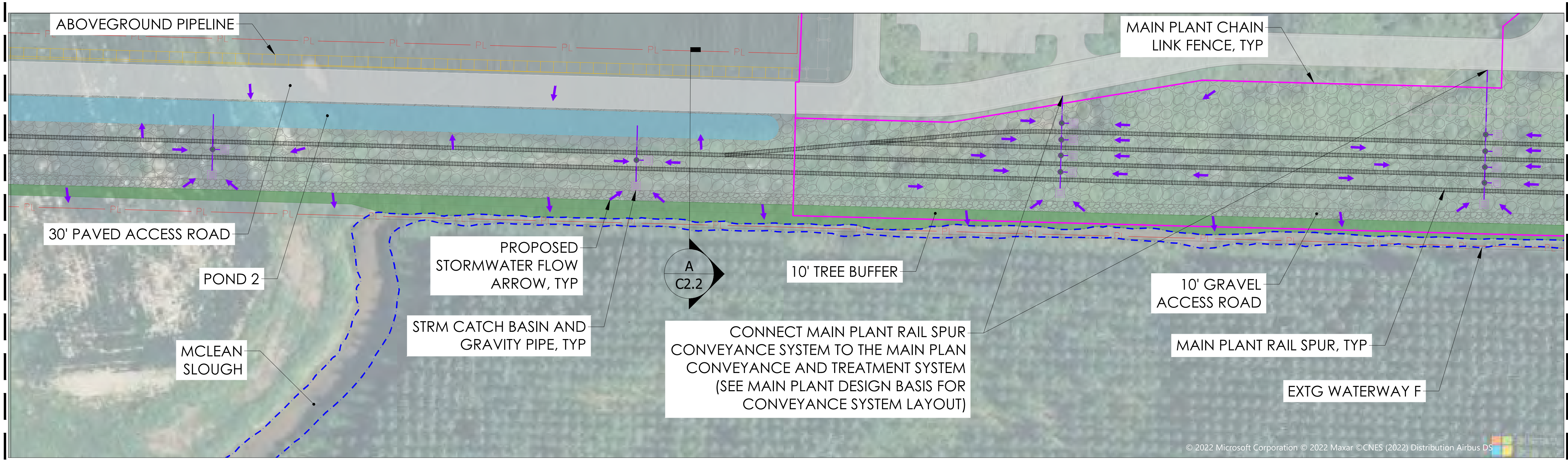

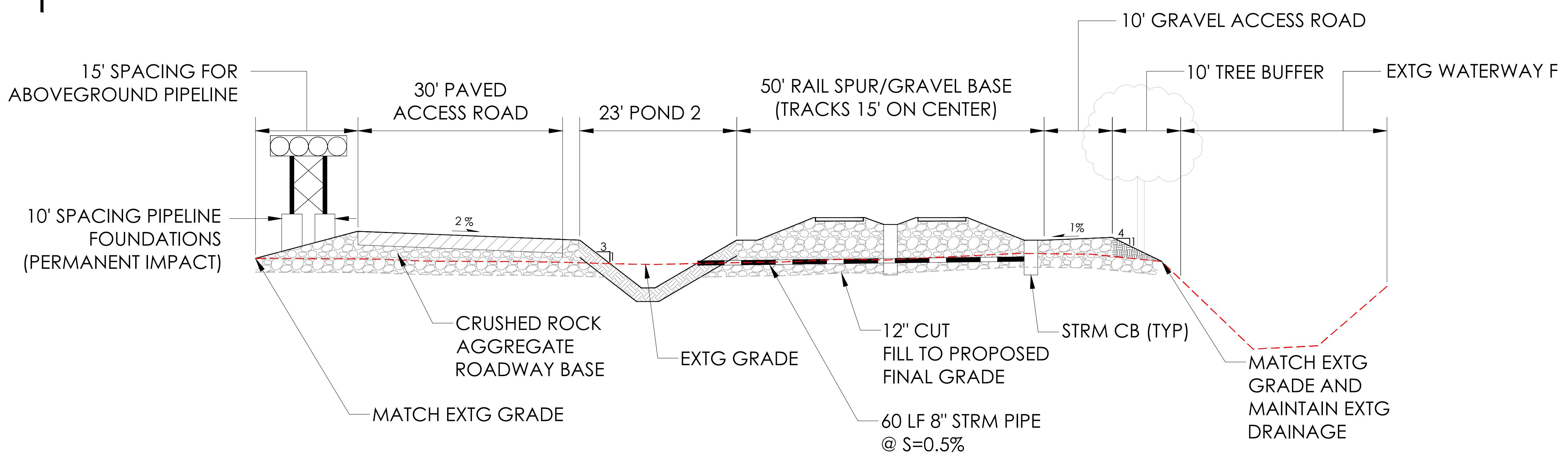

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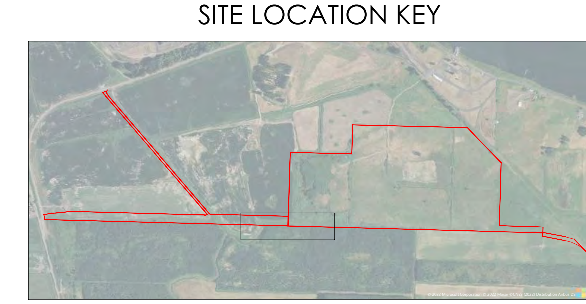

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NEXT Renewable Fuels, Inc.

WEST RAIL SPUR PLAN AND SECTION III

NEXT RENEWABLE FUELS OREGON

NEXT RENEWABLE FUELS, INC.
PORT WESTWARD, OREGON

0 100' 200'

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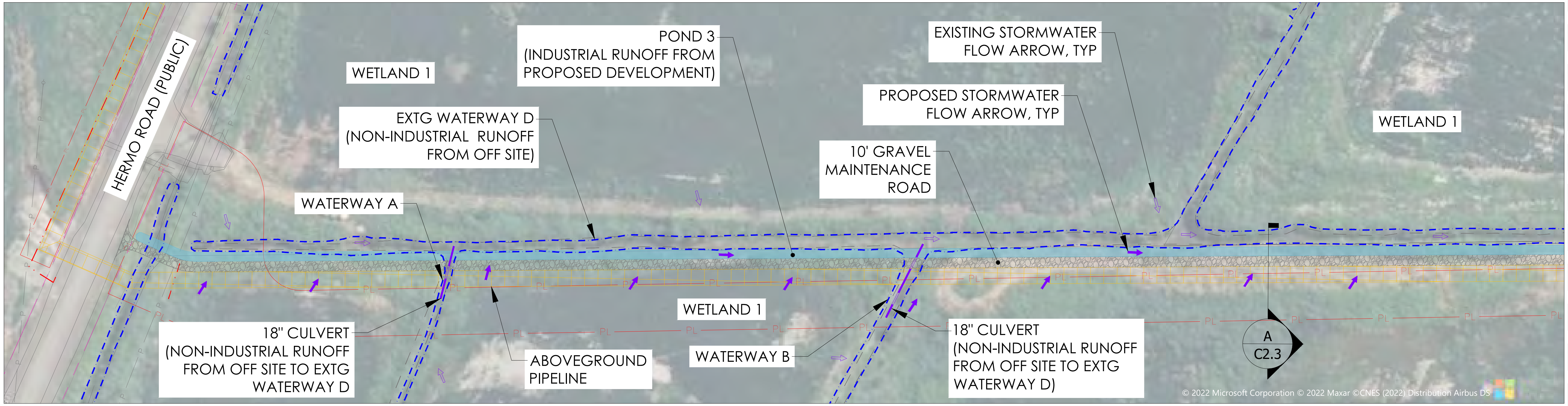

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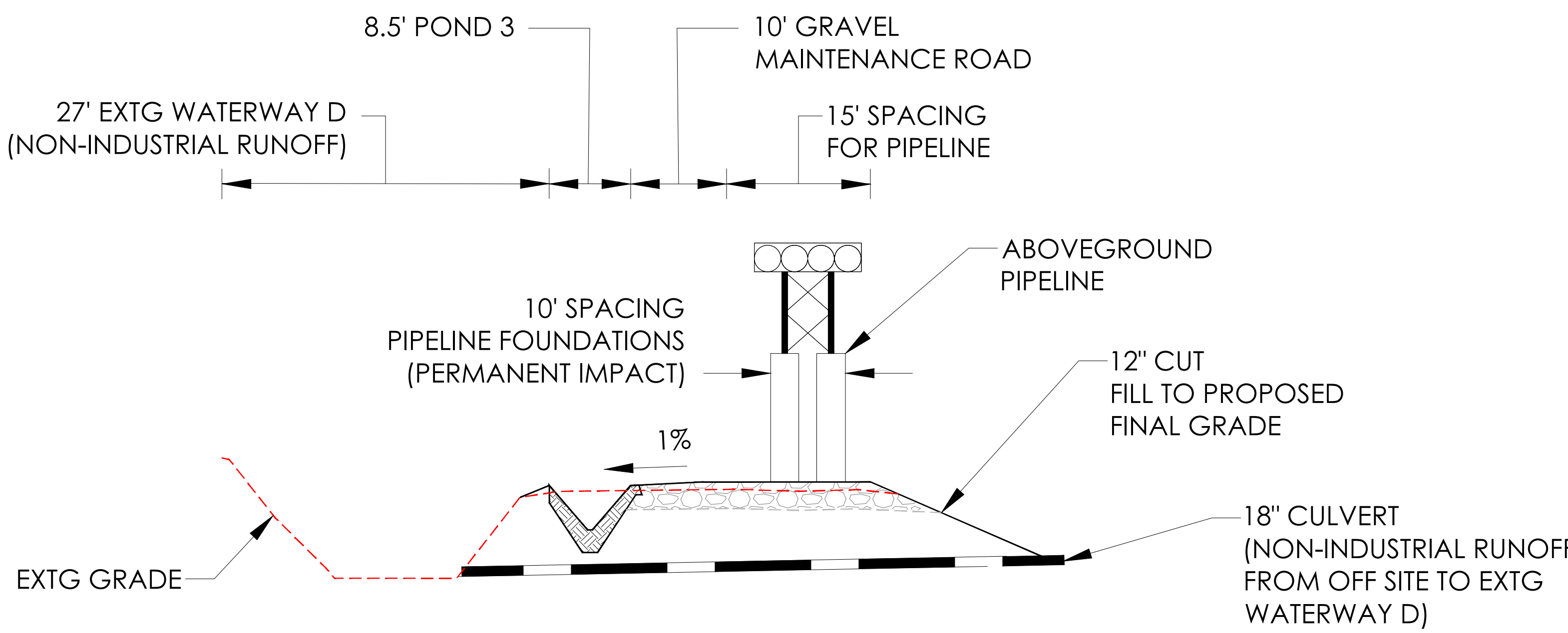

A PIPELINE/MAINTENANCE ROAD TYPICAL SECTION

NOT TO SCALE

SITE LOCATION KEY

PERMIT DOCUMENT

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NEXT Renewable Fuels, Inc.

PIPELINE/MAINTENANCE ROAD PLAN AND SECTION I

NEXT RENEWABLE FUELS OREGON

NEXT RENEWABLE FUELS, INC.

PORT WESTWARD, OREGON

0 100' 200'

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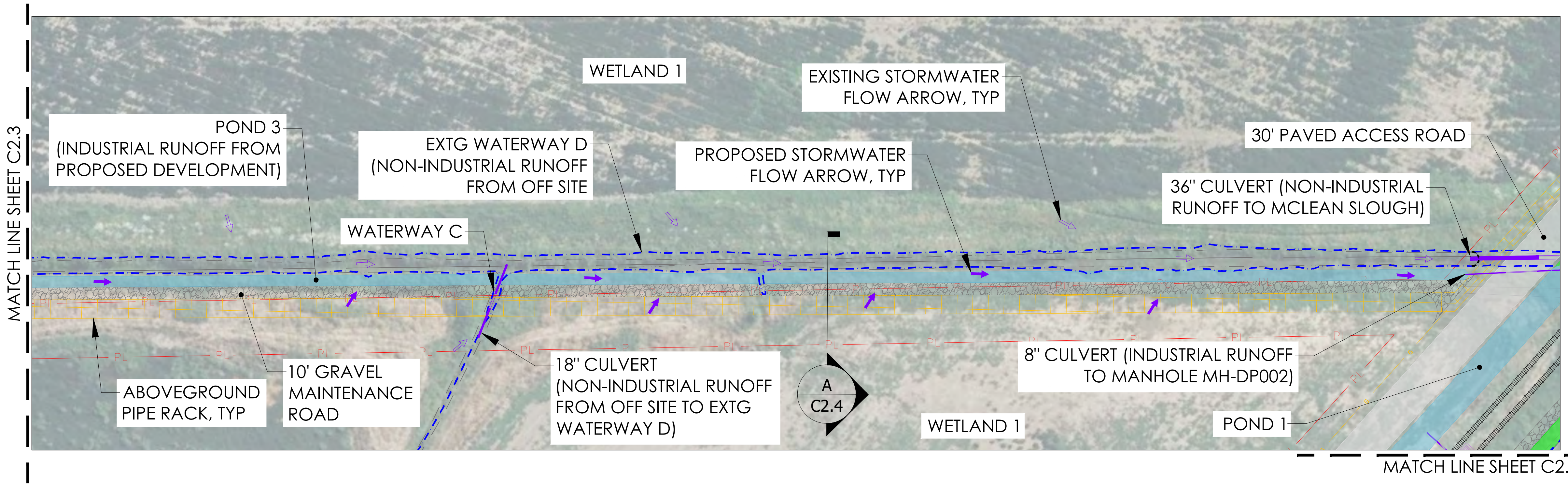

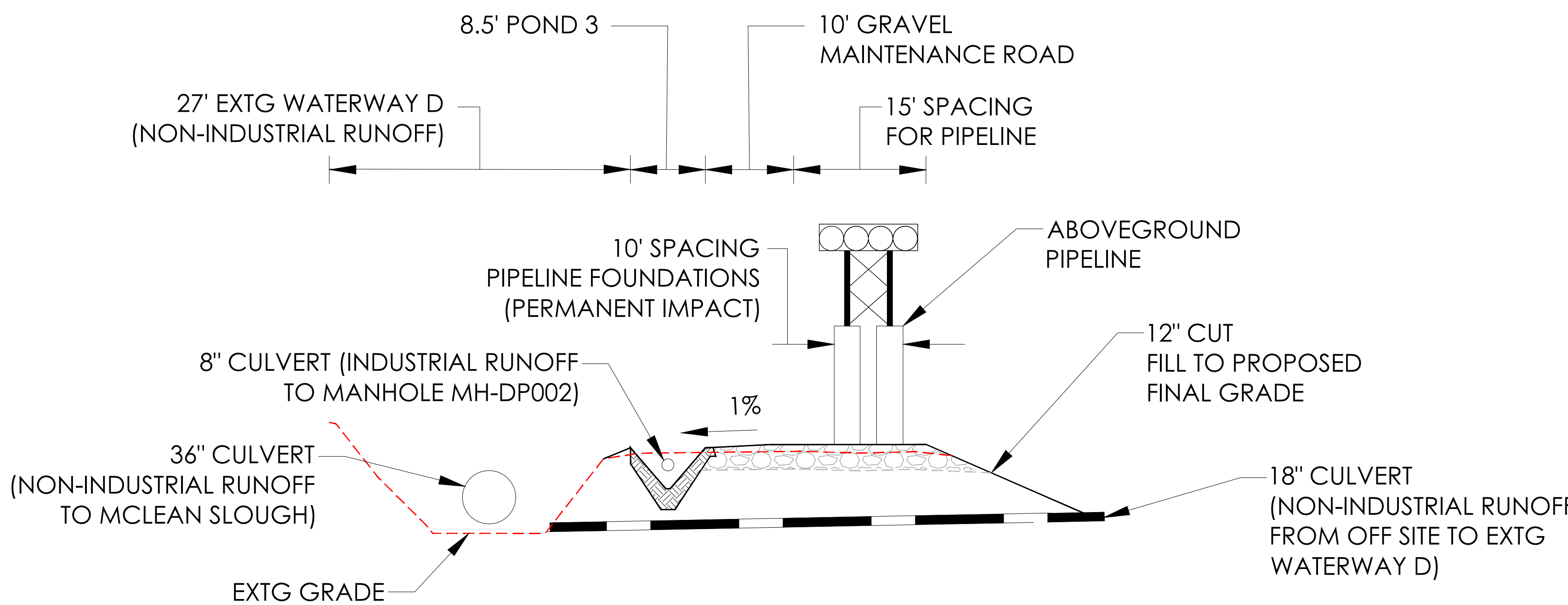

A PIPELINE/MAINTENANCE ROAD TYPICAL SECTION

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SITE LOCATION KEY

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NEXT Renewable Fuels, Inc.

PIPELINE/MAINTENANCE ROAD PLAN AND SECTION II

NEXT RENEWABLE FUELS OREGON

NEXT RENEWABLE FUELS, INC.
PORT WESTWARD, OREGON

0 100' 200'

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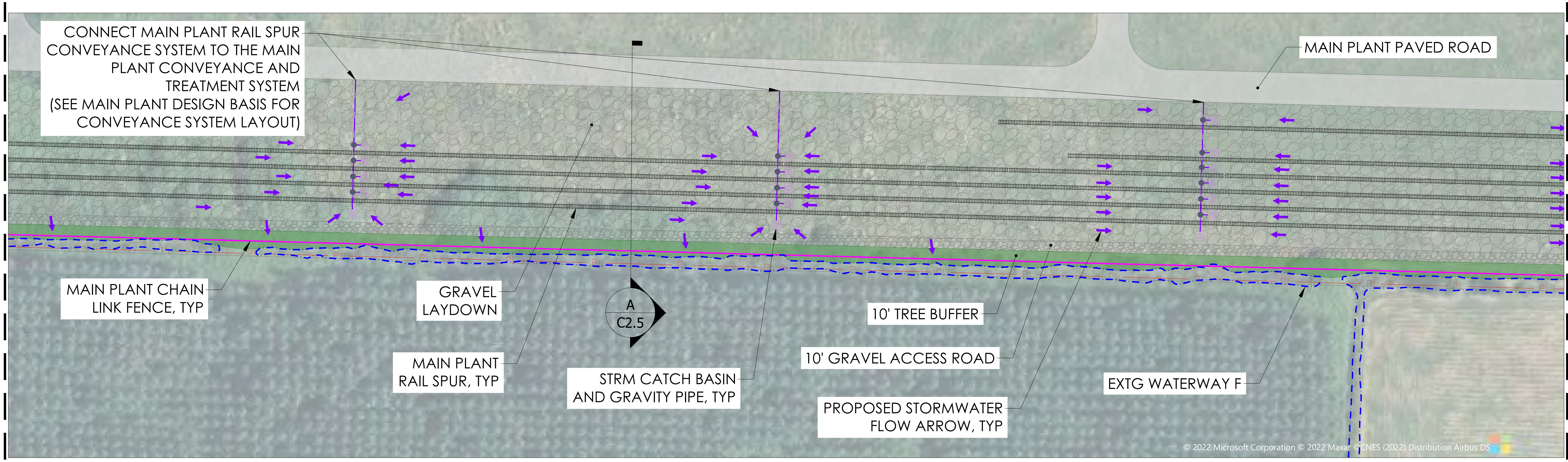

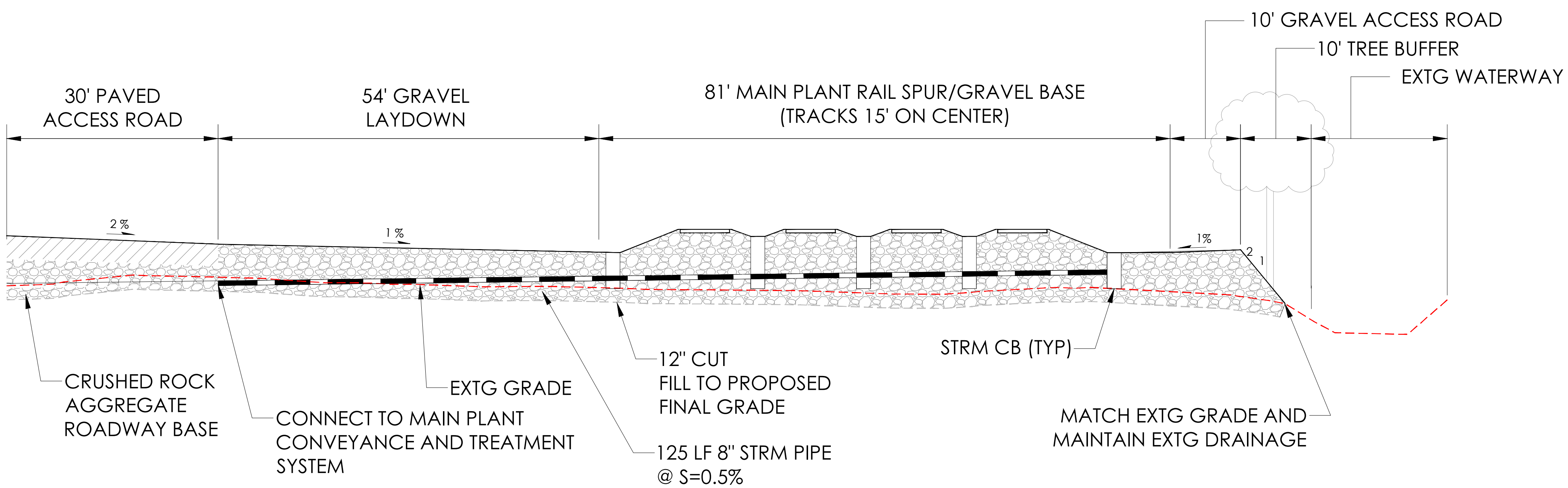

A **MAIN PLANT RAIL SPUR TYPICAL SECTION**

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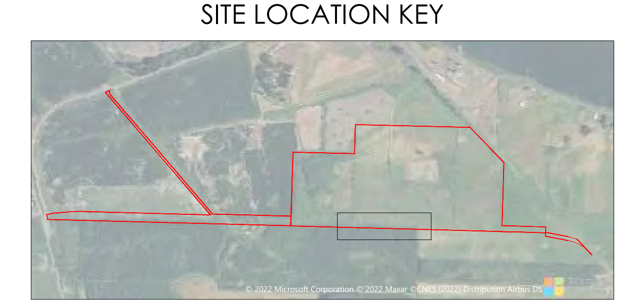

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NEXT Renewable Fuels, Inc.

MAIN PLANT RAIL SPUR PLAN AND SECTION I

NEXT RENEWABLE FUELS OREGON

NEXT RENEWABLE FUELS, INC.

PORT WESTWARD, OREGON

0 100' 200'

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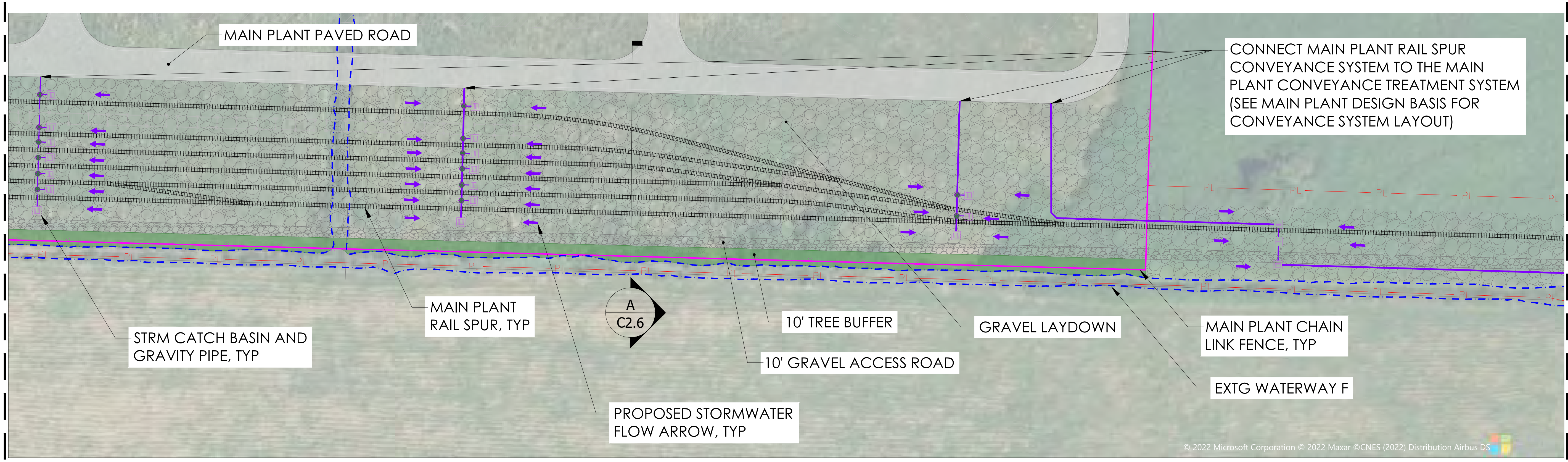

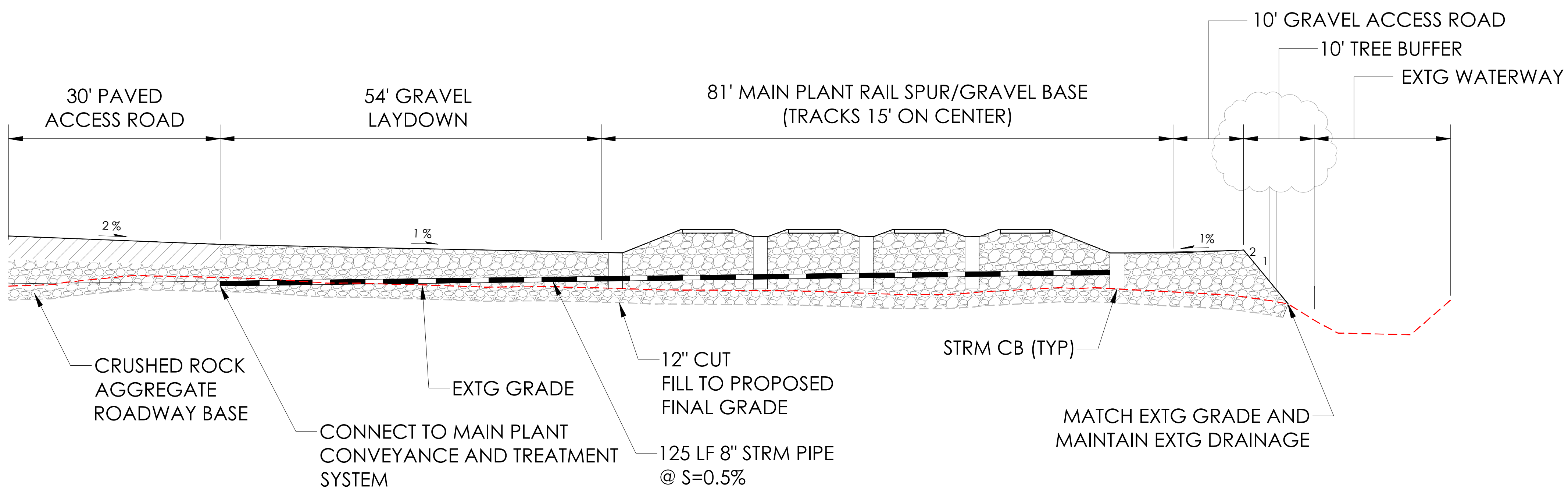

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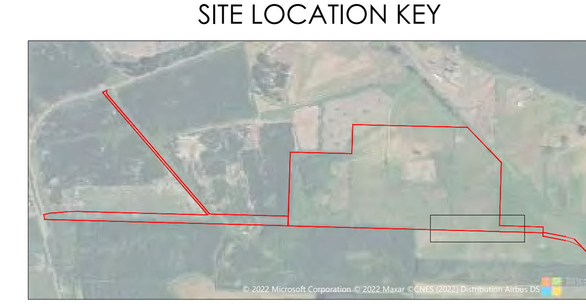
MAIN PLANT RAIL SPUR TYPICAL SECTION

NOT TO SCALE

SITE LOCATION KEY



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NEXT Renewable Fuels, Inc.

MAIN PLANT RAIL SPUR PLAN AND SECTION II

NEXT RENEWABLE FUELS OREGON

NEXT RENEWABLE FUELS, INC.
PORT WESTWARD, OREGON

0 100' 200'

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EXHIBIT
C2.6

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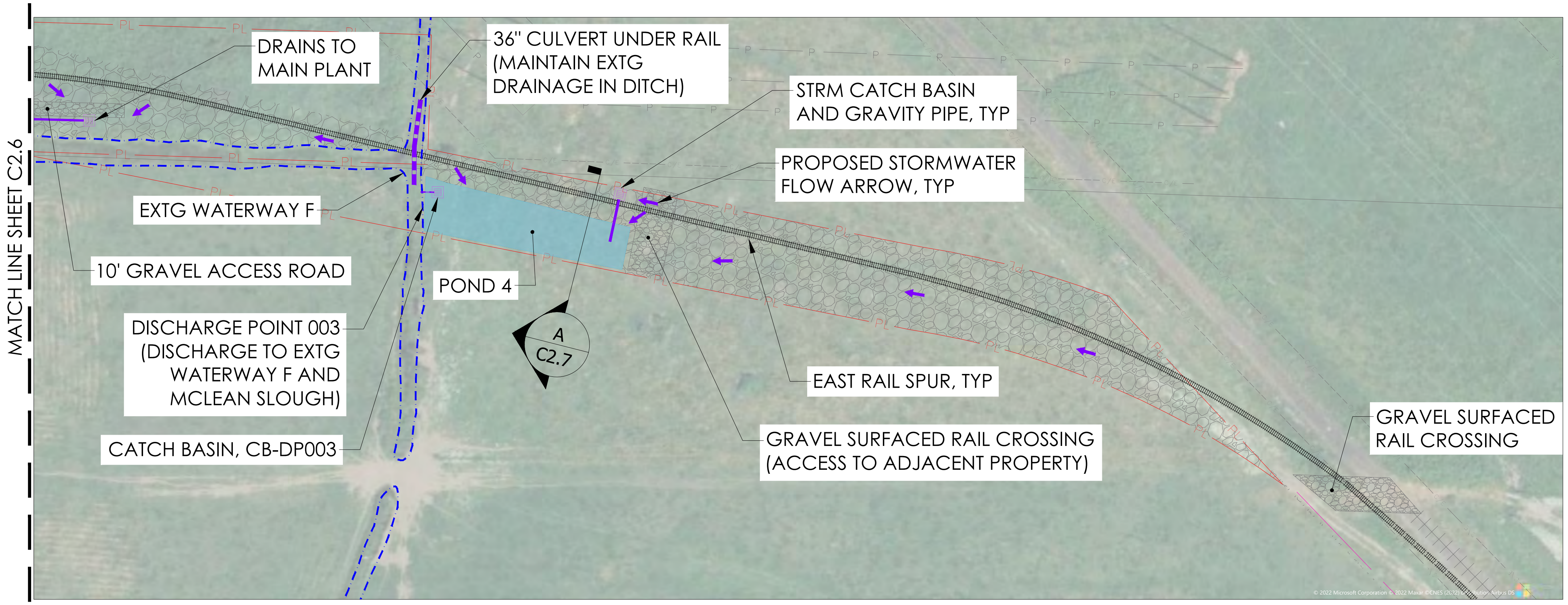

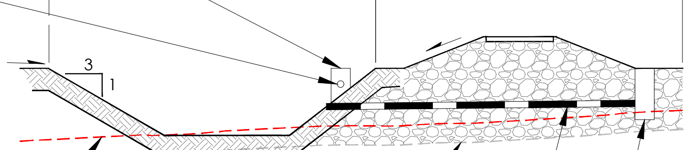

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EAST RAIL SPUR TYPICAL SECTION

NOT TO SCALE

SITE LOCATION KEY

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NEXT Renewable Fuels, Inc.

EAST RAIL SPUR PLAN AND SECTION

NEXT RENEWABLE FUELS OREGON

NEXT RENEWABLE FUELS, INC.
PORT WESTWARD, OREGON

0 100' 200'

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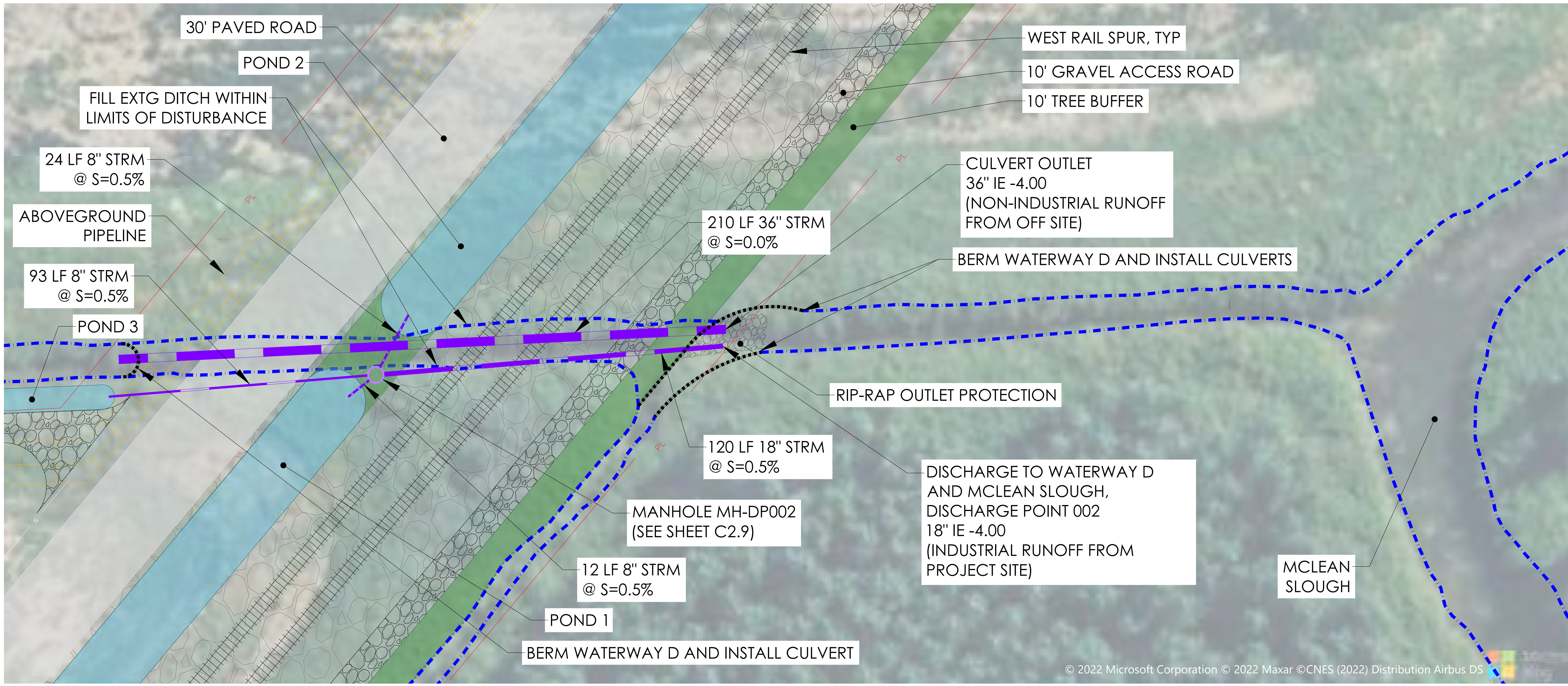

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NEXT Renewable Fuels, Inc.

DISCHARGE POINT 002 PLAN

NEXT RENEWABLE FUELS OREGON

NEXT RENEWABLE FUELS, INC.
PORT WESTWARD, OREGON

0 20' 40'

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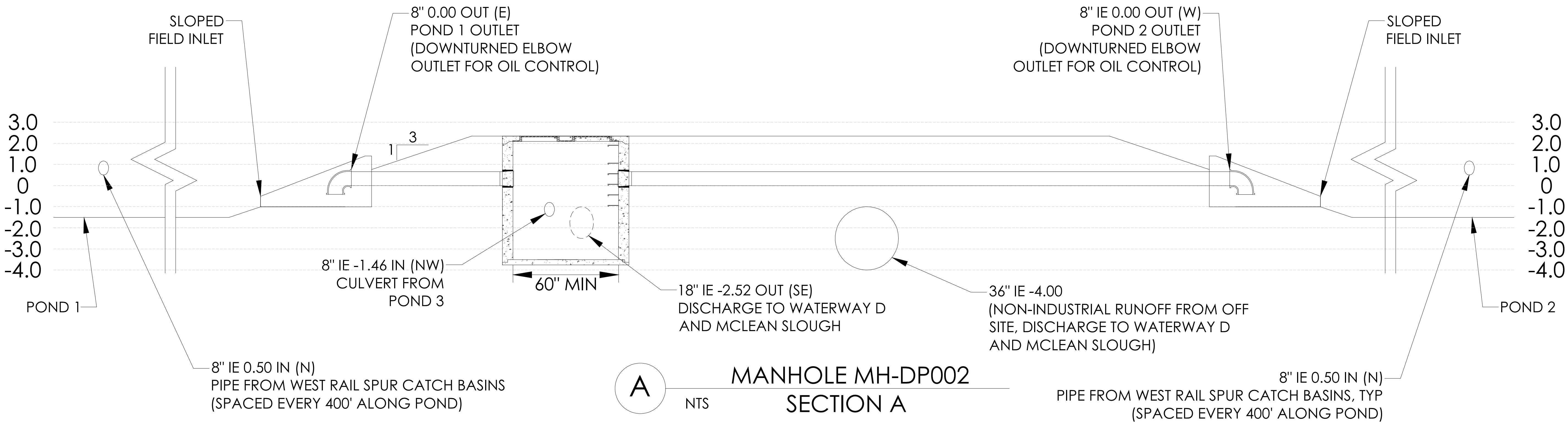

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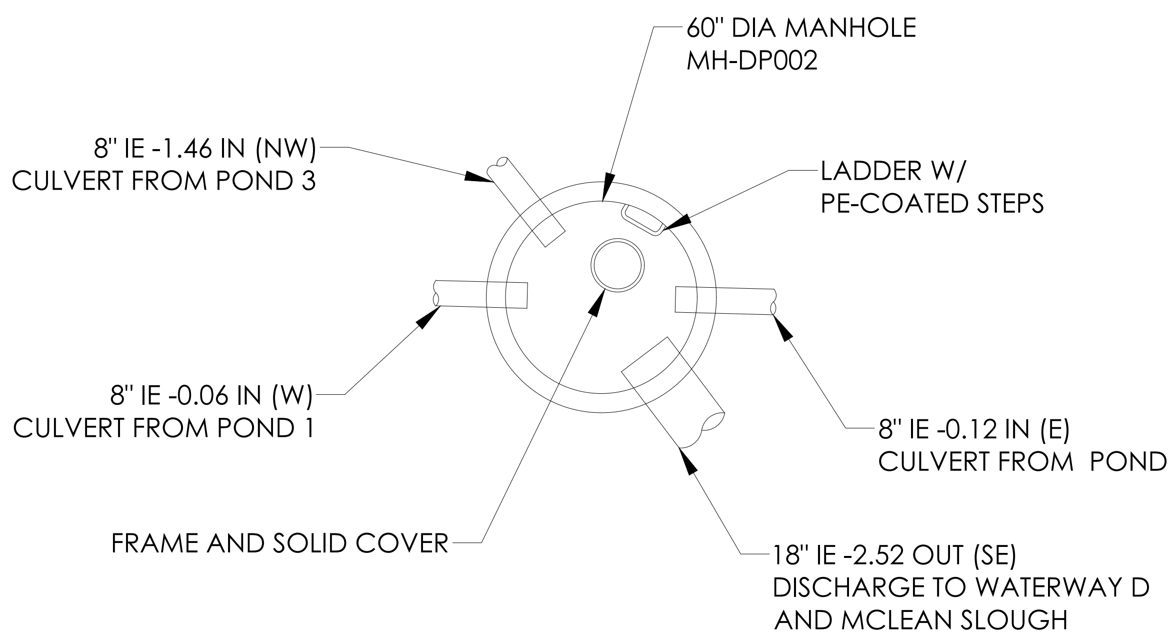
NTS SECTION A



B MANHOLE MH-DP002 ENLARGED PLAN
NTS

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ISSUE DATE: 12/09/2022
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DRAWN: L. DANIEL

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PORTLAND, OR 97232
PHONE: 971.544.2139
www.maulfoster.com

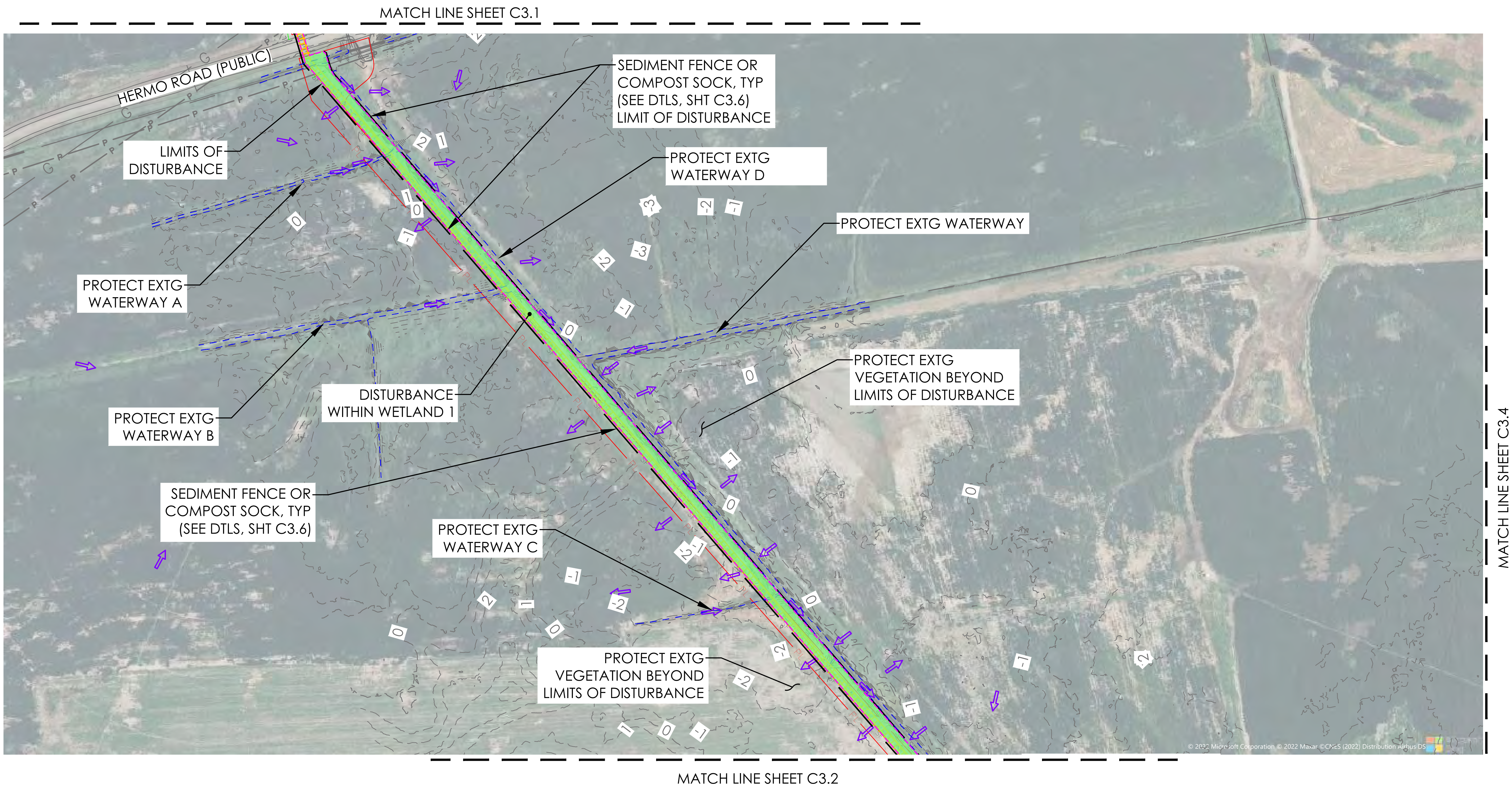
NEXT Renewable Fuels, Inc.

MANHOLE MH-DP002 DETAILS

NEXT RENEWABLE FUELS OREGON

NEXT RENEWABLE FUELS, INC.
PORT WESTWARD, OREGON

EXHIBIT
C2.9



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NEXT Renewable Fuels, Inc.

PIPELINE/MAINTENANCE RD ESCP I

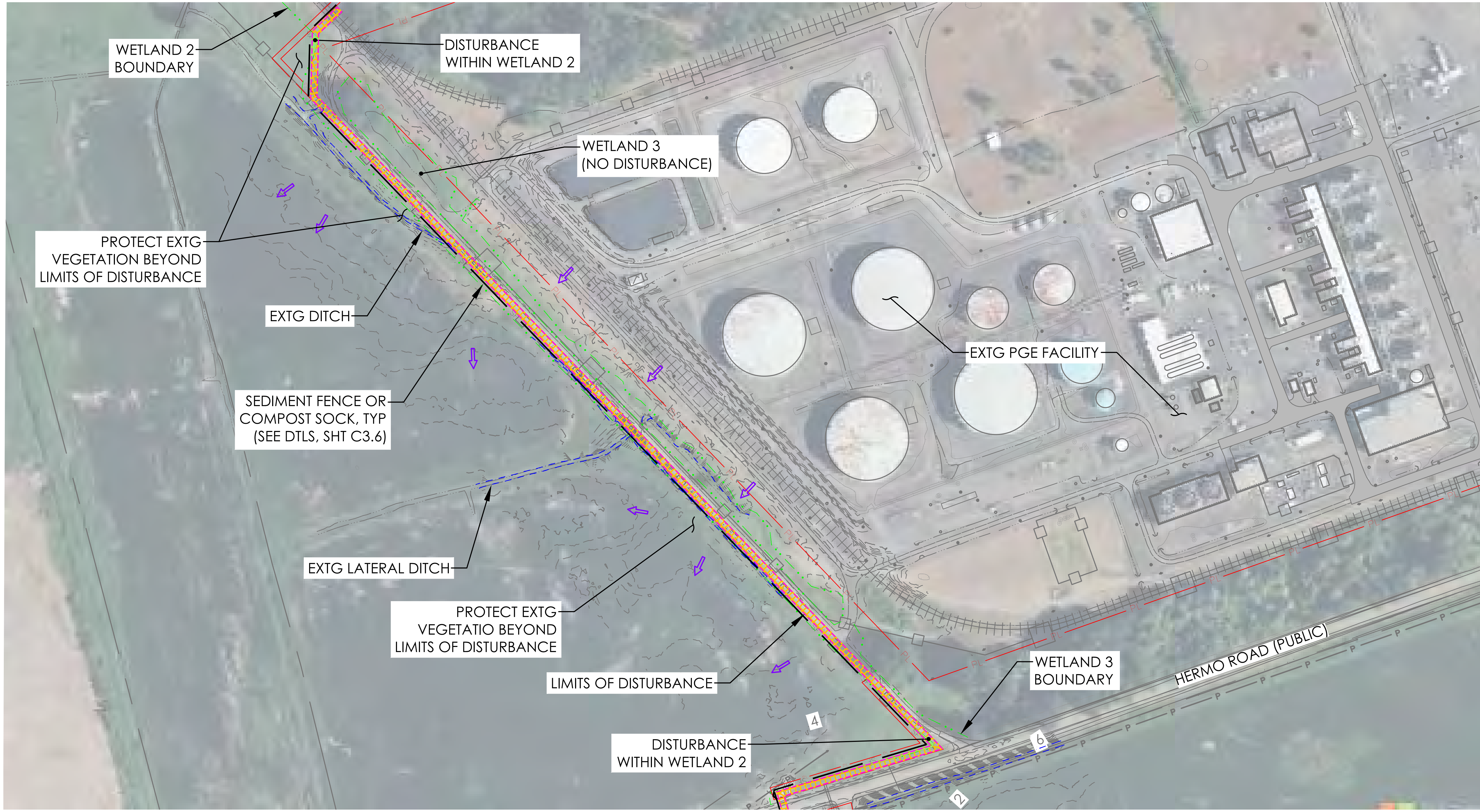
NEXT RENEWABLE FUELS OREGON

NEXT RENEWABLE FUELS, INC.
PORT WESTWARD, OREGON

0 250' 500'

NOTE: BAR IS ONE INCH ON ORIGINAL DRAWING. IF NOT ONE INCH ON THIS SHEET, ADJUST SCALE ACCORDINGLY.

EXHIBIT C3.0



MATCH LINE SHEET C3.0

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NEXT Renewable Fuels, Inc.

PIPELINE/MAINTENANCE RD ESCP II

NEXT RENEWABLE FUELS OREGON

NEXT RENEWABLE FUELS, INC.
PORT WESTWARD, OREGON

0 250' 500'

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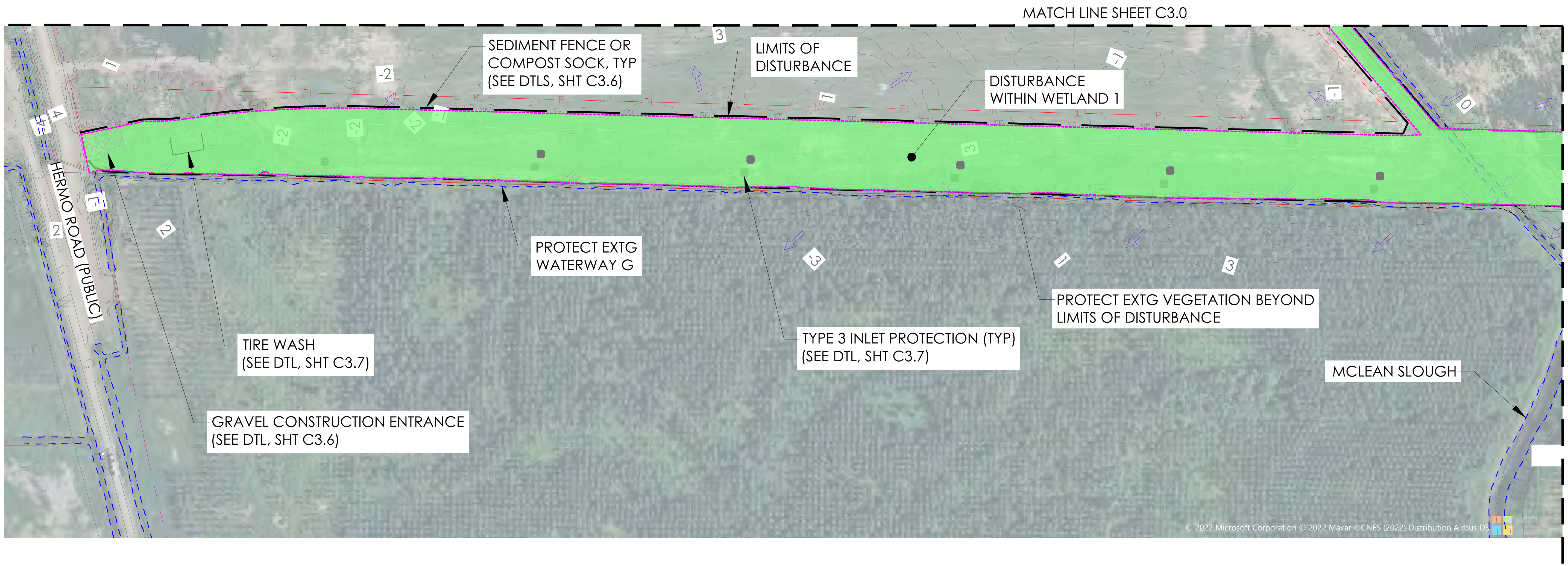
EXHIBIT C3.1



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NEXT Renewable Fuels, Inc.

WEST RAIL SPUR ESCP I

NEXT RENEWABLE FUELS OREGON

NEXT RENEWABLE FUELS, INC.
PORT WESTWARD, OREGON

0 200' 400'

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EXHIBIT
C3.2

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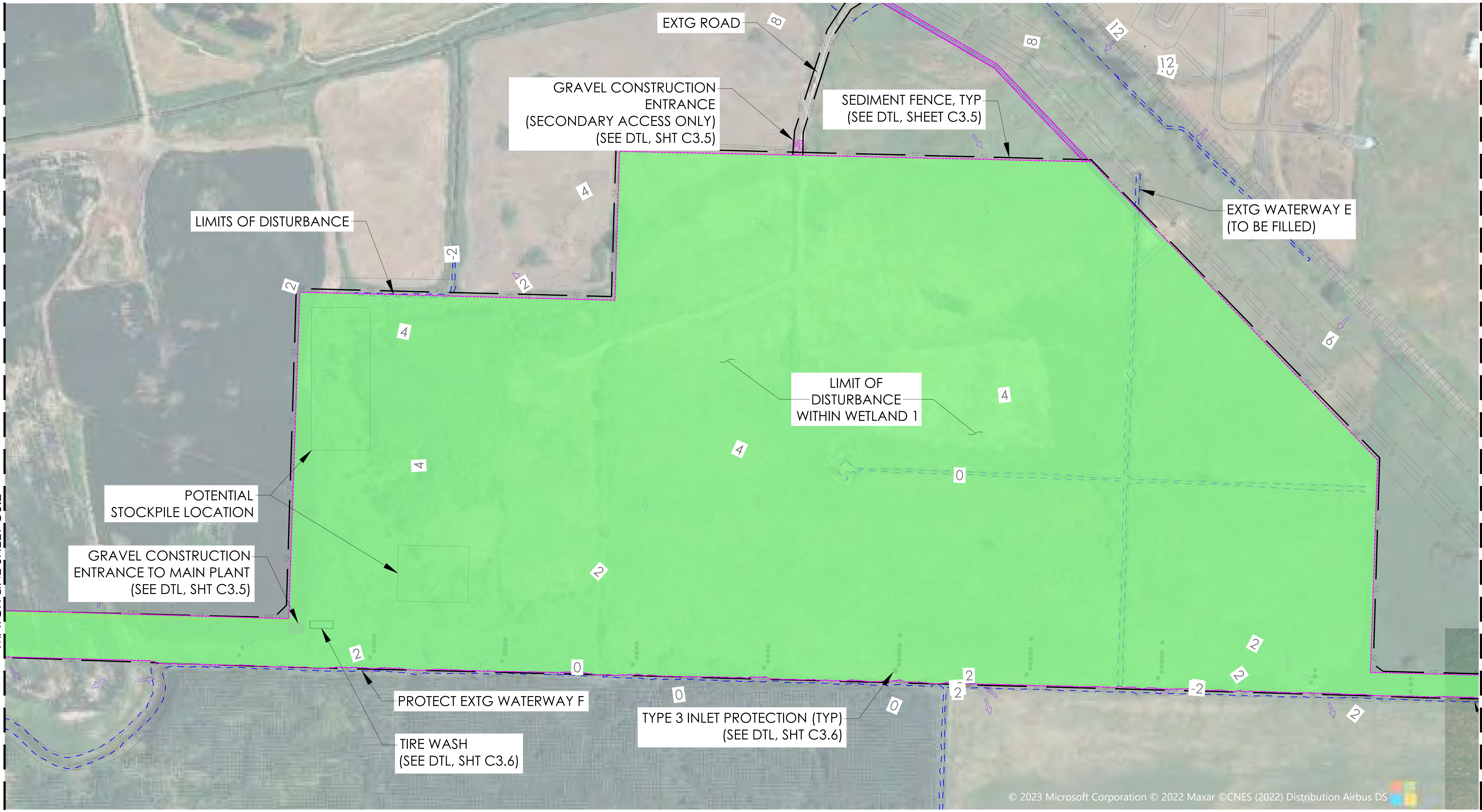
MATCH LINE SHEET C3.2



MATCH LINE SHEET C3.4

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Date: 1/19/2023 11:21:00 AM

NEXT Renewable Fuels, Inc.

MAIN PLANT ESCP

NEXT RENEWABLE FUELS OREGON

NEXT RENEWABLE FUELS, INC.

PORT WESTWARD, OREGON

0 250' 500'

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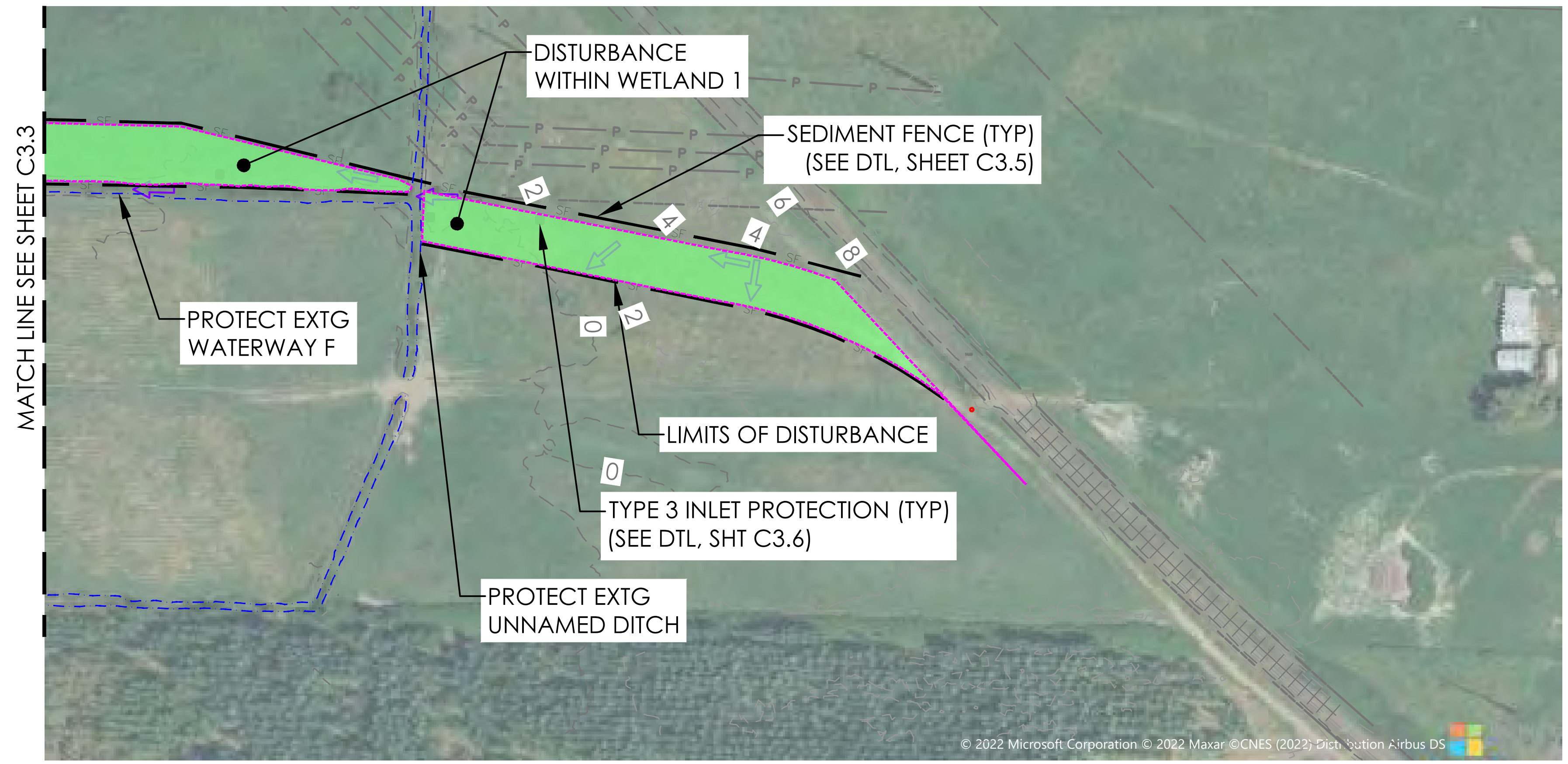
EXHIBIT C3.3



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NEXT Renewable Fuels, Inc.

EAST RAIL SPUR ESCP

NEXT RENEWABLE FUELS OREGON

NEXT RENEWABLE FUELS, INC.

PORT WESTWARD, OREGON

0 200' 400'

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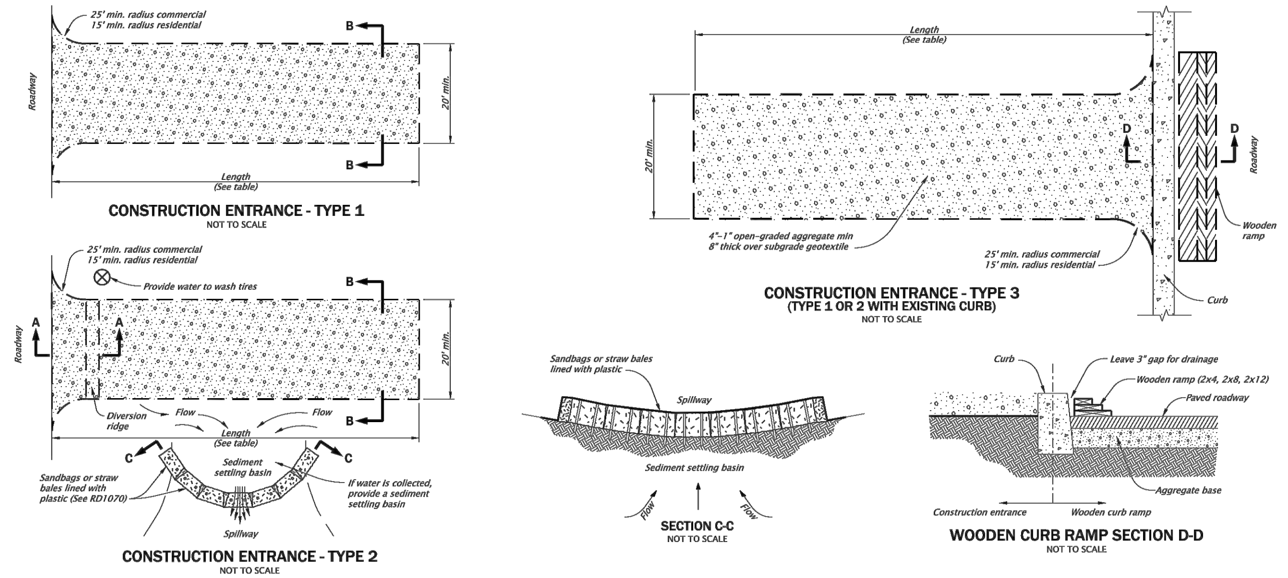
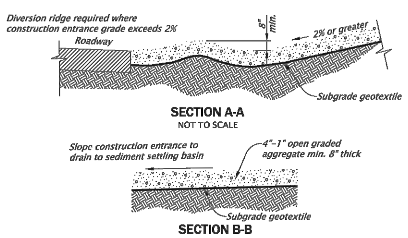
EXHIBIT C3.4





NOTES:
1. The Type 1 entrance is a simple entrance without a diversion ridge or settling basin.
2. The wooden ramp may be used on either Type 1 or Type 2 entrances in situations where there is curb and the curb is not removed for the construction entrance.

CONSTRUCTION ENTRANCE TABLE MINIMUM LENGTH

Length (FT)	Area Of Exposed Soil (Acre)
20	0.25
50	0.25 < A < 1.0
100	A > 1.0

CALC. BOOK NO. N/A — SDR DATE January, 2021

NOTE: All material and workmanship shall be in accordance with the current Oregon Standard Specifications

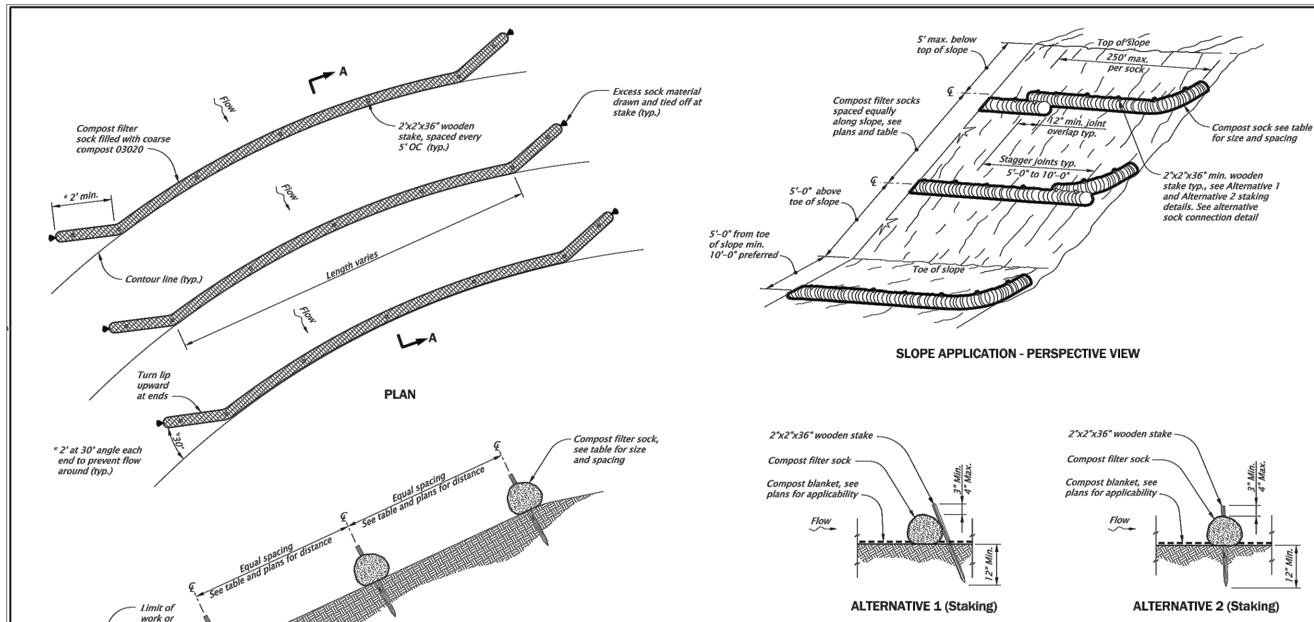
The selection and use of this Standard Drawing, while designed in accordance with generally accepted engineering principles and practices, is the sole responsibility of the user and should not be used without consulting a Registered Professional Engineer.

OREGON STANDARD DRAWINGS

CONSTRUCTION ENTRANCES

2021

DATE	REVISION DESCRIPTION
Jan 2021	Removed Calc book numbers



NOTE:
Fully biodegradable compost sock mesh is recommended for permanent installations. Where compost socks must be moved or removed, synthetic sock mesh should be used.

COMPOST FILTER SOCK DIAMETER AND SPACING BASED ON SLOPE

SLOPE	SPACING (ft)	DIAMETER (in)
<1:50	250	8
1:50 – 1:10	125	12
1:10 – 1:5	100	12
1:5 – 1:2	50	18
>1:2	25	18

COMPOST FILTER SOCK
NOT TO SCALE

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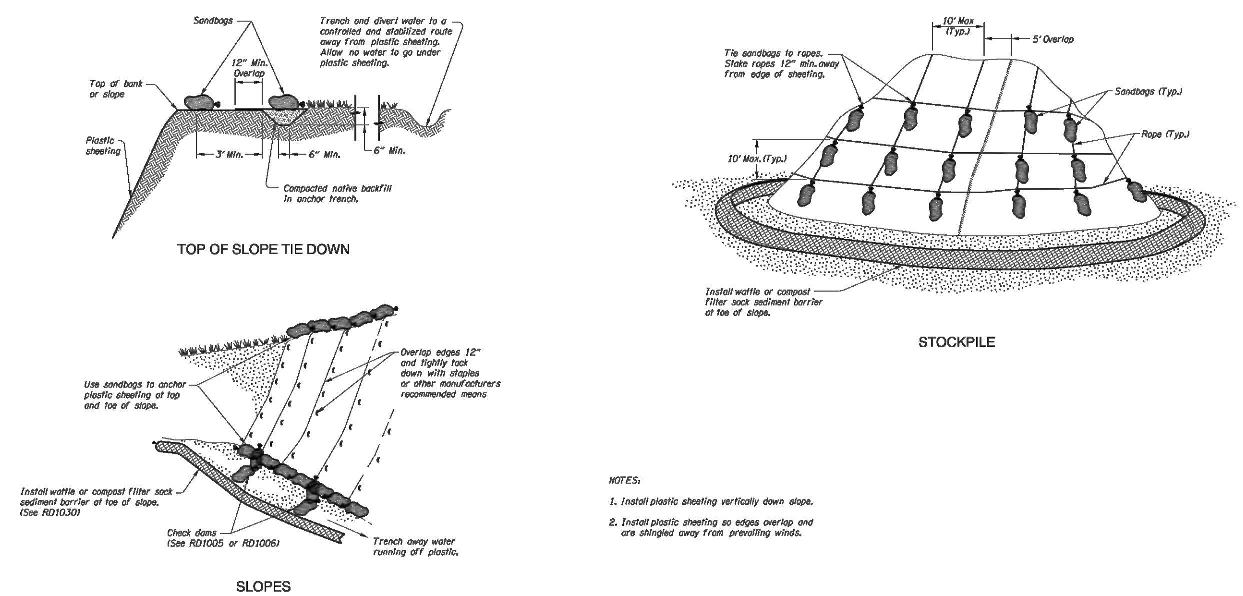
OREGON STANDARD DRAWINGS

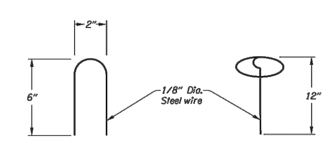
SEDIMENT BARRIER TYPE 8

2021

DATE	REVISION DESCRIPTION
Jan 2021	Removed Calc book numbers



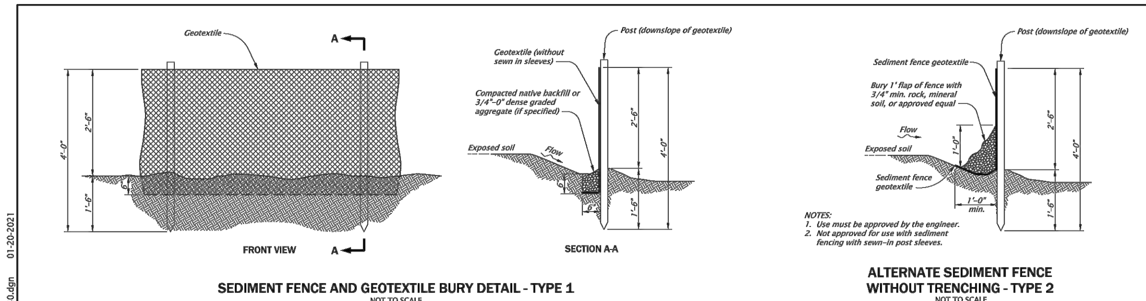
NOTES:
1. Install plastic sheeting vertically down slope.
2. Install plastic sheeting so edges overlap and are shingled away from prevailing winds.



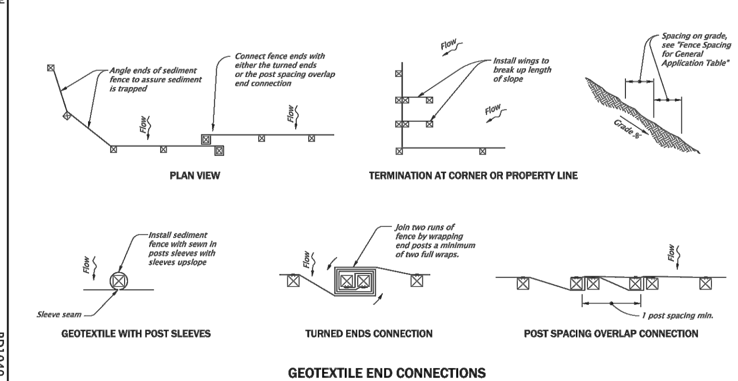
The selection and use of this detail, while designed in accordance with generally accepted engineering principles and practices, is the sole responsibility of the user and should not be used without consulting a Registered Professional Engineer.

OREGON DEPARTMENT OF TRANSPORTATION
TECHNICAL SERVICES
DETAILS

PLASTIC SHEETING — DETAIL NO. DET6001



NOTES:
1. Use must be approved by the engineer.
2. Not approved for use with sediment fencing with sewn-in post sleeves.



GENERAL NOTES:
1. Use 2"x2" wood fence posts.
2. Posts to be installed on downhill side of sediment fence geotextile. Position posts to prevent separation from geotextile.
3. Compact filter fabric trench backfill and soil on uphill side of fence.
4. Locate fence no closer than three feet to the toe of a slope.
5. Wing spacing shall comply with "Fence Spacing for General Application Table".

FENCE SPACING FOR GENERAL APPLICATION TABLE

INSTALL PARALLEL ALONG CONTOURS AS FOLLOWS

GRADE	MAXIMUM SPACING ON GRADE
Grade < 10%	300'
10% ≤ Grade < 15%	150'
15% ≤ Grade < 20%	100'
20% ≤ Grade < 30%	50'
30% ≤ Grade	25'

POST SPACING TABLE

6'	Sediment Fence with Geotextile elongation less than 50%
4'	Sediment Fence with Geotextile elongation 50% or more

CALC. BOOK NO. N/A — SDR DATE January, 2021

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OREGON STANDARD DRAWINGS

SEDIMENT FENCE

2021

DATE	REVISION DESCRIPTION
Jan 2021	Removed Calc book numbers

rd1040.dgn 01-20-2021

RD1040

Effective Date: June 1, 2022 - November 30, 2022 — RD1040

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MFA JOB #: M1724.01
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NEXT Renewable Fuels, Inc.

ESCP DETAILS I

NEXT RENEWABLE FUELS OREGON

NEXT RENEWABLE FUELS, INC.
PORT WESTWARD, OREGON

EXHIBIT
C3.5

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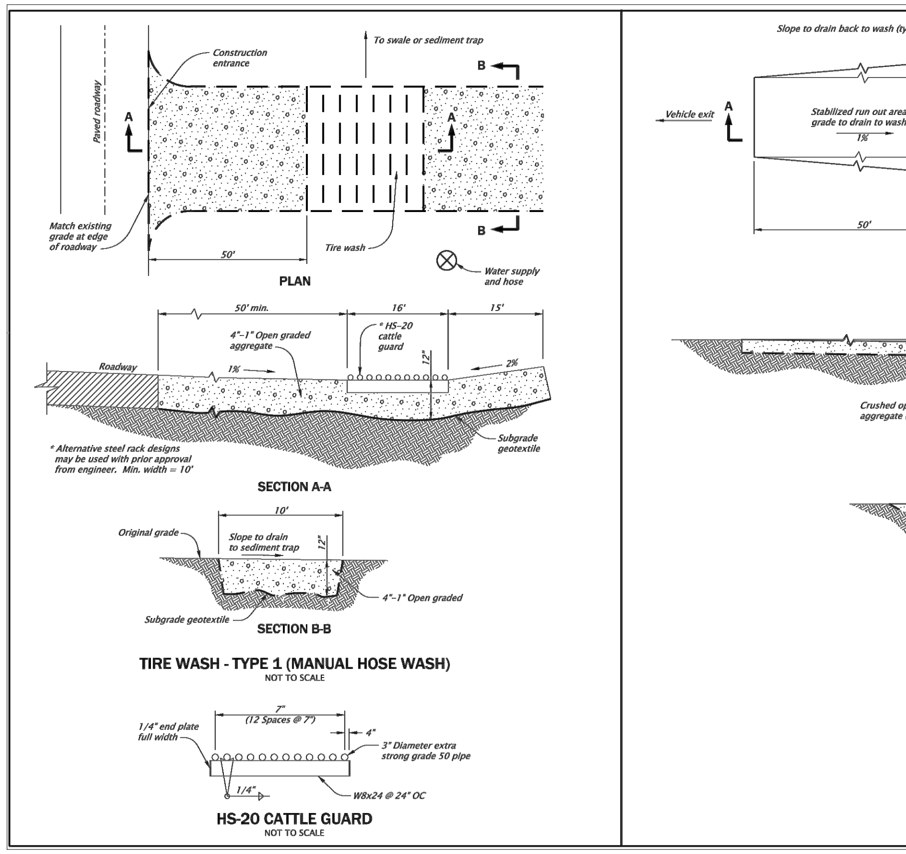

CALC. BOOK NO. N/A
SDR DATE January, 2021
NOTE: All material and workmanship shall be in accordance with the current Oregon Standard Specifications

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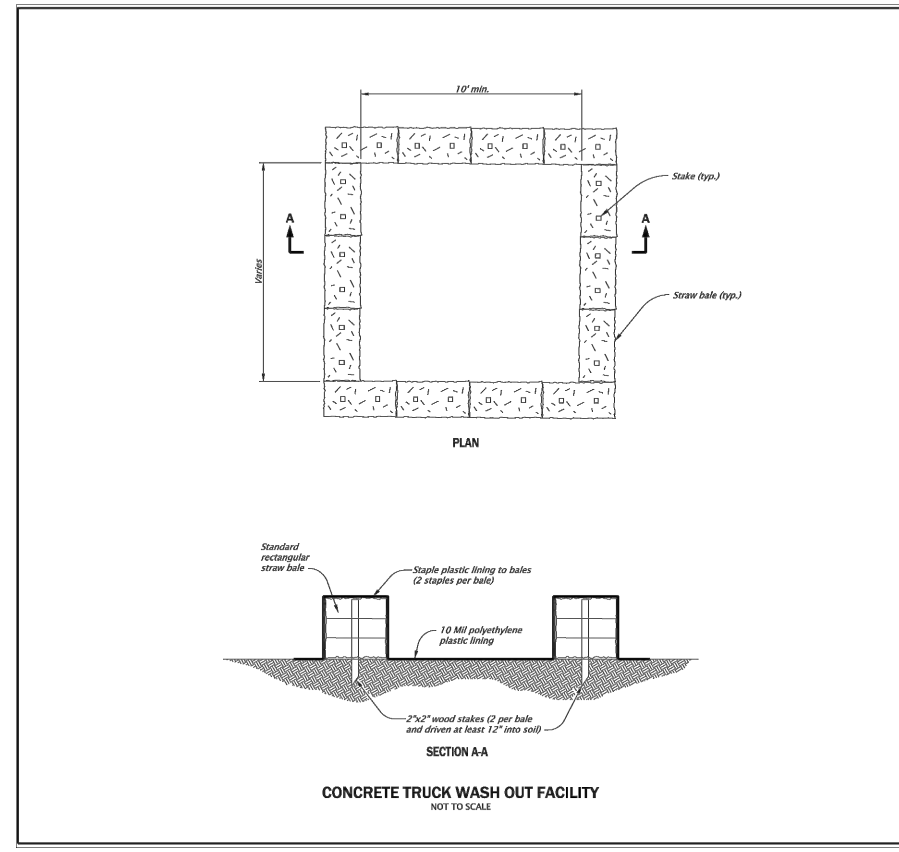
OREGON STANDARD DRAWINGS

TIRE WASH FACILITY TYPE 1 AND 2

2021

DATE	REVISION DESCRIPTION
Jan 2021	Removed Calc book numbers



CALC. BOOK NO. N/A
SDR DATE January, 2021
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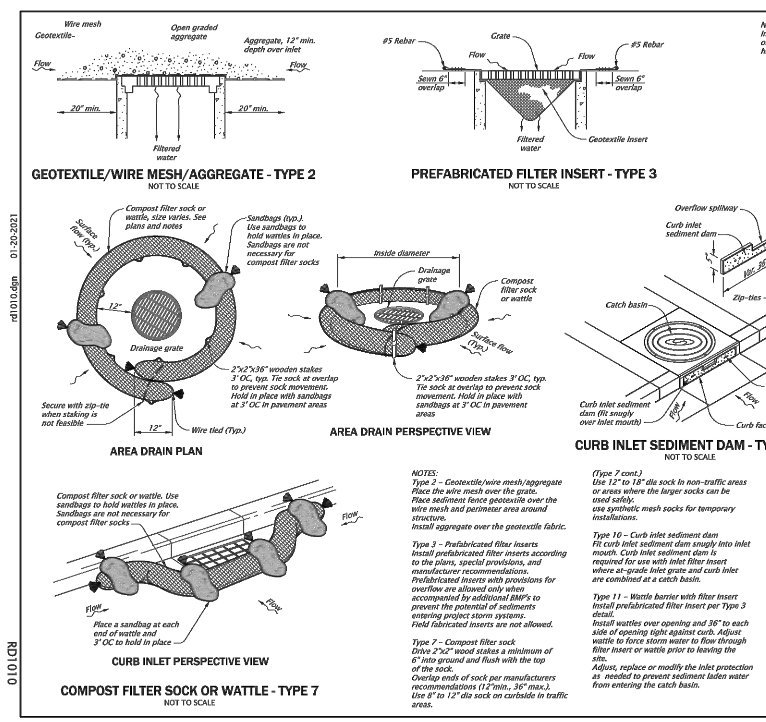
OREGON STANDARD DRAWINGS

CONCRETE TRUCK WASH OUT

2021

DATE	REVISION DESCRIPTION



CALC. BOOK NO. N/A
SDR DATE January, 2021

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OREGON STANDARD DRAWINGS

INLET PROTECTION TYPE 2, 3, 6, 7, 10 AND 11

2021

Effective Date: June 1, 2022 - November 30, 2022 RD1010

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NEXT Renewable Fuels, Inc.

ESCP DETAILS II

NEXT RENEWABLE FUELS OREGON

NEXT RENEWABLE FUELS, INC.
PORT WESTWARD, OREGON

EXHIBIT
C3.6

1. ONCE KNOWN, INCLUDE A LIST OF ALL CONTRACTORS THAT WILL ENGAGE IN CONSTRUCTION ACTIVITIES ON SITE, AND THE AREAS OF THE SITE WHERE THE CONTRACTOR(S) WILL ENGAGE IN CONSTRUCTION ACTIVITIES. REVISE THE LIST AS APPROPRIATE UNTIL PERMIT COVERAGE IS TERMINATED (SECTION 4.4.C.I). IN ADDITION, INCLUDE A LIST OF ALL PERSONNEL (BY NAME AND POSITION) THAT ARE RESPONSIBLE FOR THE DESIGN, INSTALLATION AND MAINTENANCE OF STORMWATER CONTROL MEASURES (E.G., ESCP DEVELOPER, BMP INSTALLER (SEE SECTION 4.10), AS WELL AS THEIR INDIVIDUAL RESPONSIBILITIES. (SECTION 4.4.C.II)
2. VISUAL MONITORING INSPECTION REPORTS MUST BE MADE IN ACCORDANCE WITH DEQ 1200-C PERMIT REQUIREMENTS (SECTION 6.5)
3. INSPECTION LOGS MUST BE KEPT IN ACCORDANCE WITH DEQ'S 1200-C PERMIT REQUIREMENTS. (SECTION 6.5.Q)
4. RETAIN A COPY OF THE ESCP AND ALL REVISIONS ON SITE AND MAKE IT AVAILABLE ON REQUEST TO DEQ, AGENT, OR THE LOCAL MUNICIPALITY (SECTION 4.7)
5. THE PERMIT REGISTRANTS MUST IMPLEMENT THE ESCP. FAILURE TO IMPLEMENT ANY OF THE CONTROL MEASURES OR PRACTICES DESCRIBED IN THE ESCP IS A VIOLATION OF THE PERMIT (SECTIONS 4 AND 4.11)
6. THE ESCP MUST BE ACCURATE AND REFLECT SITE CONDITIONS (SECTION 4.8)
7. SUBMISSION OF ALL ESCP REVISIONS IS NOT REQUIRED. SUBMITTAL OF THE ESCP REVISIONS IS ONLY UNDER SPECIFIC CONDITIONS. SUBMIT ALL NECESSARY REVISION TO DEQ OR AGENT WITHIN 10 DAYS (SECTION 4.9)
8. SEQUENCE CLEARING AND GRADING TO THE MAXIMUM EXTENT PRACTICAL TO PREVENT EXPOSED INACTIVE AREAS FROM BECOMING A SOURCE OF EROSION (SECTION 2.2.2)
9. CREATE SMOOTH SURFACES BETWEEN SOIL SURFACE AND EROSION AND SEDIMENT CONTROLS TO PREVENT STORMWATER FROM BYPASSING CONTROLS AND PONDING (SECTION 2.2.3)
10. IDENTIFY, MARK, AND PROTECT (BY CONSTRUCTION FENCING OR OTHER MEANS) CRITICAL RIPARIAN AREAS AND VEGETATION INCLUDING IMPORTANT TREES AND ASSOCIATED ROOTING ZONES, AND VEGETATION AREAS TO BE PRESERVED IDENTIFY VEGETATIVE BUFFER ZONES BETWEEN THE SITE AND SENSITIVE AREAS (E.G., WETLANDS), AND OTHER AREAS TO BE PRESERVED, ESPECIALLY IN PERIMETER AREAS (SECTION 2.2.1)
11. PRESERVE EXISTING VEGETATION WHEN PRACTICAL AND RE-VEGETATE OPEN AREAS. RE-VEGETATE OPEN AREAS WHEN PRACTICABLE BEFORE AND AFTER GRADING OR CONSTRUCTION. IDENTIFY THE TYPE OF VEGETATIVE SEED MIX USED (SECTION 2.2.5)
12. MAINTAIN AND DELINEATE ANY EXISTING NATURAL BUFFER WITHIN THE 50-FEET OF WATERS OF THE STATE (SECTION 2.2.4)
13. INSTALL PERIMETER SEDIMENT CONTROL, INCLUDING STORM DRAIN INLET PROTECTION AS WELL AS ALL SEDIMENT BASINS, TRAPS, AND BARRIERS PRIOR TO LAND DISTURBANCE (SECTION 2.1.3)
14. CONTROL BOTH PEAK FLOW RATES AND TOTAL STORMWATER VOLUME, TO MINIMIZE EROSION AT OUTLETS AND DOWNSTREAM CHANNELS AND STREAMBANKS (SECTIONS 2.1.1 AND 2.2.16)
15. CONTROL SEDIMENT AS NEEDED ALONG THE SITE PERIMETER AND AT ALL OPERATIONAL INTERNAL STORM DRAIN INLETS AT ALL TIMES DURING CONSTRUCTION, BOTH INTERNALLY AND AT THE SITE BOUNDARY (SECTIONS 2.2.6 AND 2.2.13)
16. ESTABLISH CONCRETE TRUCK AND OTHER CONCRETE EQUIPMENT WASHOUT AREAS BEFORE BEGINNING CONCRETE WORK (SECTION 2.2.14)
17. APPLY TEMPORARY AND/OR PERMANENT SOIL STABILIZATION MEASURES IMMEDIATELY ON ALL DISTURBED AREAS AS GRADING PROGRESSES. TEMPORARY OR PERMANENT STABILIZATIONS MEASURES ARE NOT REQUIRED FOR AREAS THAT ARE INTENDED TO BE LEFT UNVEGETATED, SUCH AS DIRT ACCESS ROADS OR UTILITY POLE PADS (SECTIONS 2.2.20 AND 2.2.21)
18. ESTABLISH MATERIAL AND WASTE STORAGE AREAS, AND OTHER NON-STORMWATER CONTROLS (SECTION 2.3.7)
19. KEEP WASTE CONTAINER LIDS CLOSED WHEN NOT IN USE AND CLOSE LIDS AT THE END OF THE BUSINESS DAY FOR THOSE CONTAINERS THAT ARE ACTIVELY USED THROUGHOUT THE DAY. FOR WASTE CONTAINERS THAT DO NOT HAVE LIDS, PROVIDE EITHER (1) COVER (E.G., A TARP, PLASTIC SHEETING, TEMPORARY ROOF) TO PREVENT EXPOSURE OF WASTES TO PRECIPITATION, OR (2) A SIMILARLY EFFECTIVE MEANS DESIGNED TO PREVENT THE DISCHARGE OF POLLUTANTS (E.G., SECONDARY CONTAINMENT) (SECTION 2.3.7)
20. PREVENT TRACKING OF SEDIMENT ONTO PUBLIC OR PRIVATE ROADS USING BMPS SUCH AS: CONSTRUCTION ENTRANCE, GRAVELED (OR PAVED) EXITS AND PARKING AREAS, GRAVEL ALL UNPAVED ROADS LOCATED ONSITE, OR USE AN EXIT TIRE WASH. THESE BMPS MUST BE IN PLACE PRIOR TO LAND-DISTURBING ACTIVITIES (SECTION 2.2.7)
21. WHEN TRUCKING SATURATED SOILS FROM THE SITE, EITHER USE WATER-TIGHT TRUCKS OR DRAIN LOADS ON SITE (SECTION 2.2.7.F)
22. CONTROL PROHIBITED DISCHARGES FROM LEAVING THE CONSTRUCTION SITE, I.E., CONCRETE WASH-OUT, WASTEWATER FROM CLEANOUT OF STUCCO, PAINT AND CURING COMPOUNDS (SECTIONS 1.5 AND 2.3.9)
23. ENSURE THAT STEEP SLOPE AREAS WHERE CONSTRUCTION ACTIVITIES ARE NOT OCCURRING ARE NOT DISTURBED (SECTION 2.2.10)
24. PREVENT SOIL COMPACTION IN AREAS WHERE POST-CONSTRUCTION INFILTRATION FACILITIES ARE TO BE INSTALLED (SECTION 2.2.12)
25. USE BMPS TO PREVENT OR MINIMIZE STORMWATER EXPOSURE TO POLLUTANTS FROM SPILLS; VEHICLE AND EQUIPMENT FUELING, MAINTENANCE, AND STORAGE; OTHER CLEANING AND MAINTENANCE ACTIVITIES; AND WASTE HANDLING ACTIVITIES. THESE POLLUTANTS INCLUDE FUEL, HYDRAULIC FLUID, AND OTHER OILS FROM VEHICLES AND MACHINERY, AS WELL AS DEBRIS, FERTILIZER, PESTICIDES AND HERBICIDES, PAINTS, SOLVENTS, CURING COMPOUNDS AND ADHESIVES FROM CONSTRUCTION OPERATIONS (SECTIONS 2.2.15 AND 2.3)
26. PROVIDE PLANS FOR SEDIMENTATION BASINS THAT HAVE BEEN DESIGNED PER SECTION 2.2.17 AND STAMPED BY AN OREGON PROFESSIONAL ENGINEER (SEE SECTION 2.2.17.A)
27. IF ENGINEERED SOILS ARE USED ON SITE, A SEDIMENTATION BASIN/IMPOUNDMENT MUST BE INSTALLED (SEE SECTIONS 2.2.17 AND 2.2.18)
28. PROVIDE A DEWATERING PLAN FOR ACCUMULATED WATER FROM PRECIPITATION AND UNCONTAMINATED GROUNDWATER SEEPAGE DUE TO SHALLOW EXCAVATION ACTIVITIES (SEE SECTION 2.4)
29. IMPLEMENT THE FOLLOWING BMPS WHEN APPLICABLE: WRITTEN SPILL PREVENTION AND RESPONSE PROCEDURES, EMPLOYEE TRAINING ON SPILL PREVENTION AND PROPER DISPOSAL PROCEDURES, SPILL KITS IN ALL VEHICLES, REGULAR MAINTENANCE SCHEDULE FOR VEHICLES AND MACHINERY, MATERIAL DELIVERY AND STORAGE CONTROLS, TRAINING AND SIGNAGE, AND COVERED STORAGE AREAS FOR WASTE AND SUPPLIES (SECTION 2.3)
30. USE WATER, SOIL-BINDING AGENT OR OTHER DUST CONTROL TECHNIQUE AS NEEDED TO AVOID WIND-BLOWN SOIL (SECTION 2.2.9)
31. THE APPLICATION RATE OF FERTILIZERS USED TO REESTABLISH VEGETATION MUST FOLLOW MANUFACTURER'S RECOMMENDATIONS TO MINIMIZE NUTRIENT RELEASES TO SURFACE WATERS. EXERCISE CAUTION WHEN USING TIME-RELEASE FERTILIZERS WITHIN ANY WATERWAY RIPARIAN ZONE (SECTION 2.3.5)
32. IF AN ACTIVE TREATMENT SYSTEM (FOR EXAMPLE, ELECTRO-COAGULATION, FLOCCULATION, FILTRATION, ETC.) FOR SEDIMENT OR OTHER POLLUTANT REMOVAL IS EMPLOYED, SUBMIT AN OPERATION AND MAINTENANCE PLAN (INCLUDING SYSTEM SCHEMATIC, LOCATION OF SYSTEM, LOCATION OF INLET, LOCATION OF DISCHARGE, DISCHARGE DISPERSION DEVICE DESIGN, AND A SAMPLING PLAN AND FREQUENCY) BEFORE OPERATING THE TREATMENT SYSTEM. OBTAIN ENVIRONMENTAL MANAGEMENT PLAN APPROVAL FROM DEQ BEFORE OPERATING THE TREATMENT SYSTEM. OPERATE AND MAINTAIN THE TREATMENT SYSTEM ACCORDING TO MANUFACTURER'S SPECIFICATIONS. (SECTION 1.2.9)
33. TEMPORARILY STABILIZE SOILS AT THE END OF THE SHIFT BEFORE HOLIDAYS AND WEEKENDS, IF NEEDED. THE REGISTRANT IS RESPONSIBLE FOR ENSURING THAT SOILS ARE STABLE DURING RAIN EVENTS AT ALL TIMES OF THE YEAR. (SECTION 2.2)
34. AS NEEDED BASED ON WEATHER CONDITIONS, AT THE END OF EACH WORKDAY SOIL STOCKPILES MUST BE STABILIZED OR COVERED, OR OTHER BMPS MUST BE IMPLEMENTED TO PREVENT DISCHARGES TO SURFACE WATERS OR CONVEYANCE SYSTEMS LEADING TO SURFACE WATERS. (SECTION 2.2.8)
35. SEDIMENT FENCE: REMOVE TRAPPED SEDIMENT BEFORE IT REACHES ONE THIRD OF THE ABOVE GROUND FENCE HEIGHT AND BEFORE FENCE REMOVAL (SECTION 2.1.5.B)
36. OTHER SEDIMENT BARRIERS (SUCH AS BIOBAGS): REMOVE SEDIMENT BEFORE IT REACHES TWO INCHES DEPTH ABOVE GROUND HEIGHT AND BEFORE BMP REMOVAL (SECTION 2.1.5.C)
37. CATCH BASINS: CLEAN BEFORE RETENTION CAPACITY HAS BEEN REDUCED BY FIFTY PERCENT. SEDIMENT BASINS AND SEDIMENT TRAPS: REMOVE TRAPPED SEDIMENTS BEFORE DESIGN CAPACITY HAS BEEN REDUCED BY FIFTY PERCENT AND AT COMPLETION OF PROJECT (SECTION 2.1.5.D)
38. WITHIN 24 HOURS, SIGNIFICANT SEDIMENT THAT HAS LEFT THE CONSTRUCTION SITE, MUST BE REMEDIATED. INVESTIGATE THE CAUSE OF THE SEDIMENT RELEASE AND IMPLEMENT STEPS TO PREVENT A RECURRENCE OF THE DISCHARGE WITHIN THE SAME 24 HOURS. ANY IN-STREAM CLEAN-UP OF SEDIMENT SHALL BE PERFORMED ACCORDING TO THE OREGON DIVISION OF STATE LANDS REQUIRED TIMEFRAME. (SECTION 2.2.19.A)
39. THE INTENTIONAL WASHING OF SEDIMENT INTO STORM SEWERS OR DRAINAGE WAYS MUST NOT OCCUR. VACUUMING OR DRY SWEEPING AND MATERIAL PICKUP MUST BE USED TO CLEANUP RELEASED SEDIMENTS. (SECTION 2.2.19)
40. DOCUMENT ANY PORTION(S) OF THE SITE WHERE LAND DISTURBING ACTIVITIES HAVE PERMANENTLY CEASED OR WILL BE TEMPORARILY INACTIVE FOR 14 OR MORE CALENDAR DAYS (SECTION 6.5.F)
41. PROVIDE TEMPORARY STABILIZATION FOR THAT PORTION OF THE SITE WHERE CONSTRUCTION ACTIVITIES CEASE FOR 14 DAYS OR MORE WITH A COVERING OF BLOWN STRAW AND A TACKIFIER, LOOSE STRAW, OR AN ADEQUATE COVERING OF COMPOST MULCH UNTIL WORK RESUMES ON THAT PORTION OF THE SITE. (SECTION 2.2.20)
42. DO NOT REMOVE TEMPORARY SEDIMENT CONTROL PRACTICES UNTIL PERMANENT VEGETATION OR OTHER COVER OF EXPOSED AREAS IS ESTABLISHED. ONCE CONSTRUCTION IS COMPLETE AND THE SITE IS STABILIZED, ALL TEMPORARY EROSION CONTROLS AND RETAINED SOILS MUST BE REMOVED AND DISPOSED OF PROPERLY, UNLESS NEEDED FOR LONG TERM USE FOLLOWING TERMINATION OF PERMIT COVERAGE (SECTION 2.2.21)
43. ALL FACILITIES TO BE USED FOR POST-CONSTRUCTION STORMWATER MANAGEMENT SHOULD BE DELINEATED ONCE CONSTRUCTED TO PREVENT TRAMPLING BY FOOT OR EQUIPMENT.
44. ONCE INSTALLED, INLET PROTECTION WILL BE IMPLEMENTED FOR EACH CATCH BASIN FOR THE DURATION OF CONSTRUCTION.

Filepath: G:\00_MFA Civil 3D\00_PROJECTS\1724.01 NEXT Renewable Fuels, Inc\PLANS\EROSION CONTROL\C3.7 ESCP NOTES.dwg
Printed by: Brian Tino
Date: 12/7/2022 9:58:22 PM

MFA JOB #:	M1724.01
ISSUE DATE:	12/09/2022
CHECKED:	A. BANASIK
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PHONE: 971.544.2139
www.maulfoster.com

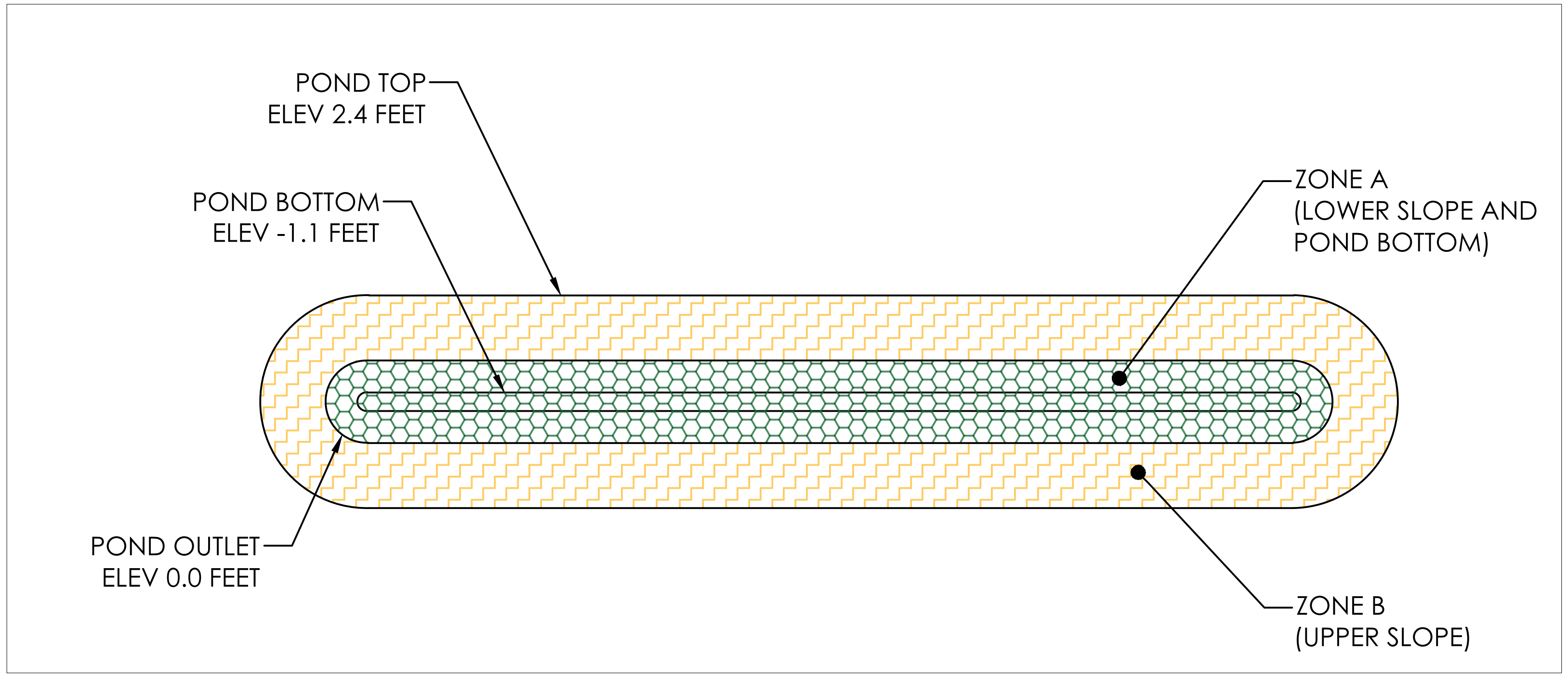
NEXT Renewable Fuels, Inc.

ESCP NOTES

NEXT RENEWABLE FUELS OREGON

NEXT RENEWABLE FUELS, INC.
PORT WESTWARD, OREGON

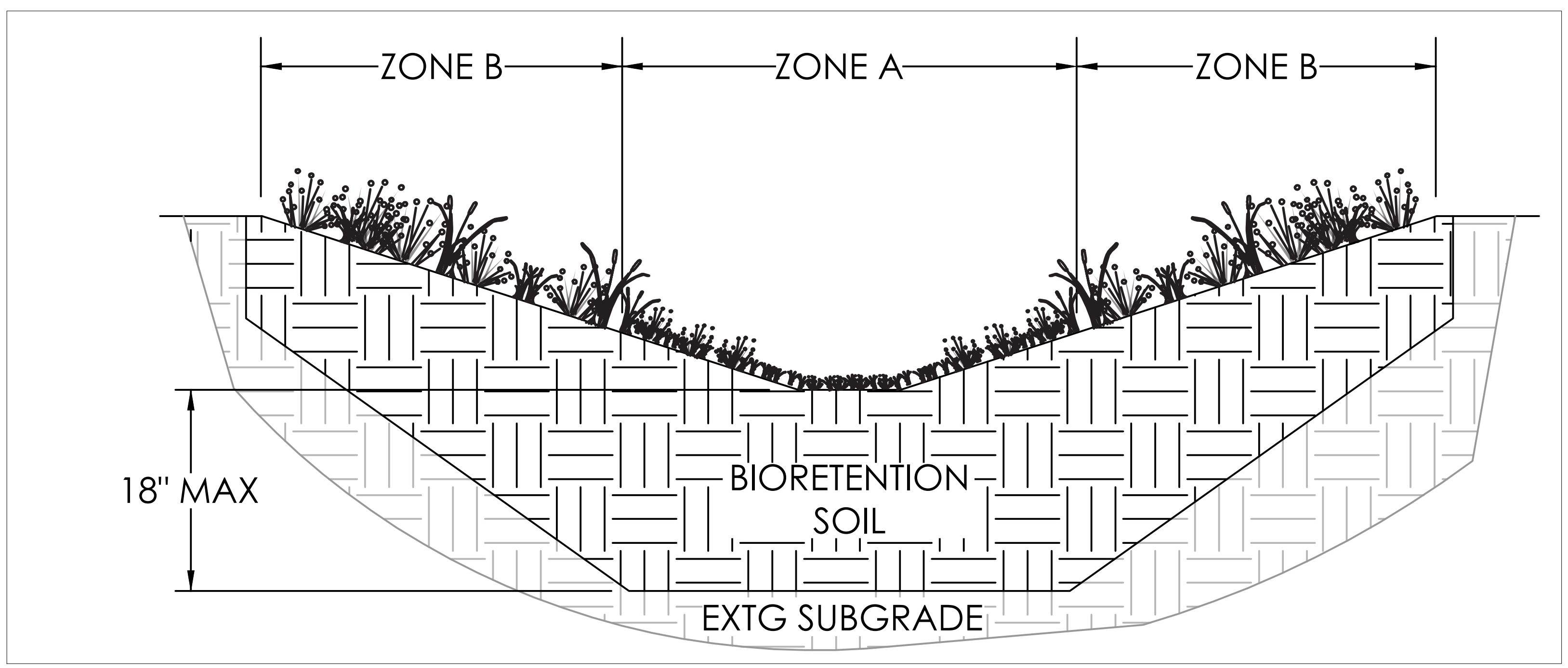
EXHIBIT C3.7



(A) STORMWATER POND PLANTING PLAN, TYP
NOT TO SCALE

SEED MIX

LOCATION	DESCRIPTION
ZONE A	PROTIME SEED MIX 440 (NATIVE BIOFILTER MIX): • MEADOW BARLEY (*HORDEUM BRACHYANTHERUM*) • BLUE WILDRYE (*ELYMUS GLAUCUS*) • TUFTED HAIRGRASS (*DESCHAMPSIA CESPITOSA*) • AMERICAN SLOUGHGRASS (*BECKMANNIA SYZIGACHNE*) • WESTERN MANNAGRASS (*GLYCERIA OCCIDENTALIS*)
ZONE B	PROTIME SEED MIX 498 NATIVE RIPARIAN MIX): • BLUE WILDRYE (*ELYMUS GLAUCUS*) • SPIKE BENTGRASS (*AGROSTIS EXARATA*) • SLENDER HAIRGRASS (*DESCHAMPSIA ELONGATA*) • LARGE LEAF LUPINE (*LUPINUS POLYPHYLLUS*)



(B) STORMWATER POND DETAIL
NOT TO SCALE

POND DETAILS

- USE MAXIMUM 18" SOILS THAT MEET THE SPECIFICATIONS OF A HIGH PERFORMANCE BIORETENTION SOIL MIX AS DEFINED IN THE WASHINGTON DEPARTMENT OF ECOLOGY STORMWATER MANAGEMENT MANUAL FOR WESTERN WASHINGTON
- 3:1 SIDE SLOPES
- DELINEATION BETWEEN ZONE A AND B IS SET AT THE OUTLET ELEVATION (0.0 FEET)

CONSTRUCTION CONSIDERATIONS

MARK THE LOCATION OF PROPOSED FACILITIES AND FENCE OR COVER FACILITY LOCATIONS AFTER EXCAVATION. LEAVE AT LEAST 6" OF NATIVE SOIL DURING THE INITIAL EXCAVATION TO LIMIT COMPACTION DURING CONSTRUCTION. DO NOT ALLOW VEHICULAR TRAFFIC, FOOT TRAFFIC, MATERIAL STORAGE, OR HEAVY EQUIPMENT WITHIN 10 FEET OF THE POND AREA EXCEPT AS NEEDED TO EXCAVATE, GRADE, AND CONSTRUCT THE FACILITY. DO NOT ALLOW ENTRY OF RUNOFF OR SEDIMENT DURING CONSTRUCTION

MFA JOB #:	M1724.01
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NEXT Renewable Fuels, Inc.

PLANTING PLAN AND POND DETAIL

NEXT RENEWABLE FUELS OREGON

NEXT RENEWABLE FUELS, INC.
PORT WESTWARD, OREGON

EXHIBIT
C3.8

APPENDIX A
SOIL SURVEY REPORT

United States Department of Agriculture

NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for

Columbia County, Oregon

NEXT Renewables

December 8, 2020

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

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Contents

How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

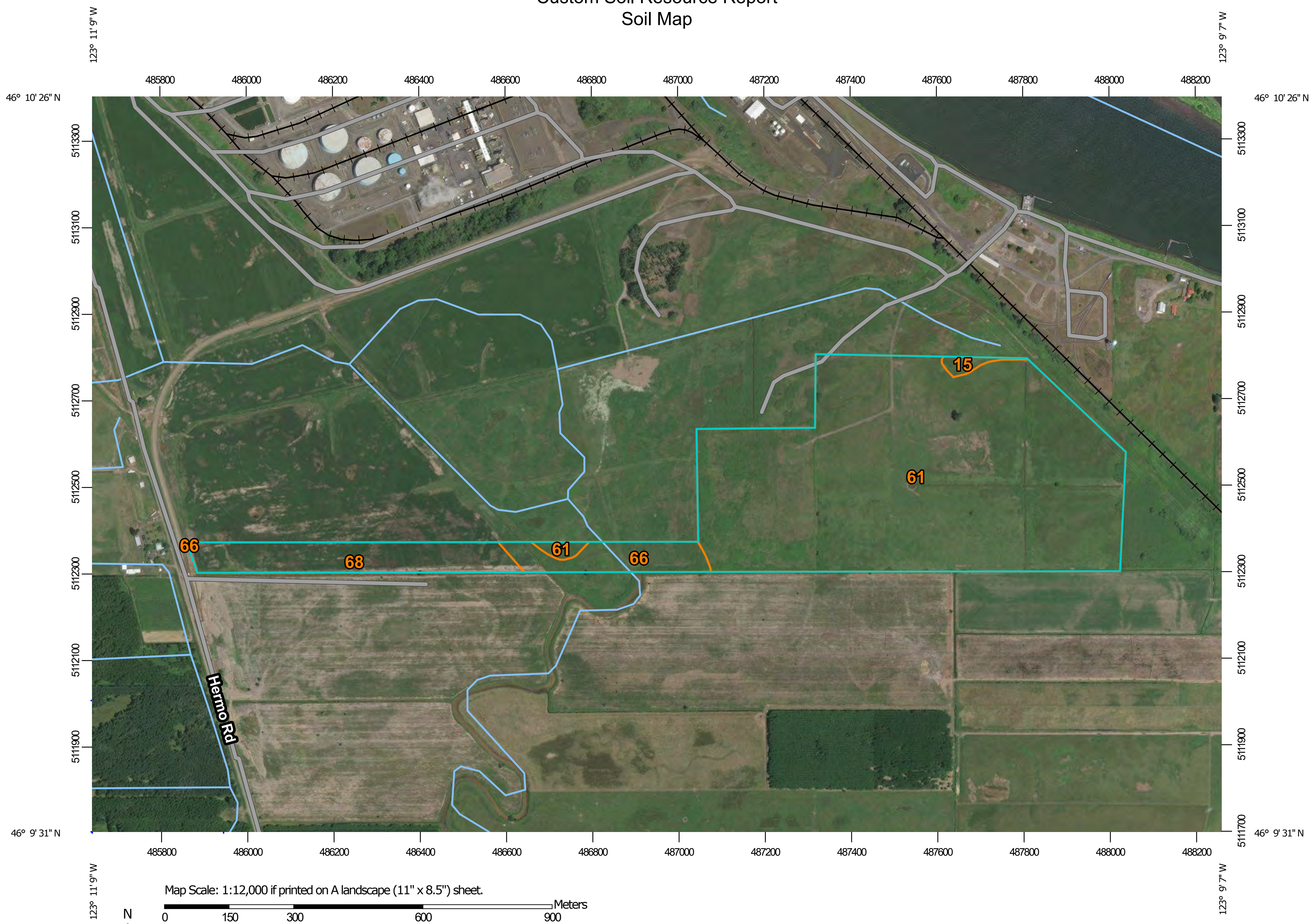
Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Soil Map



Map Scale: 1:12,000 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0, 150, 300, 600, 900

Feet: 0, 500, 1000, 2000, 3000

Map projection: Web Mercator   Corner coordinates: WGS84   Edge tics: UTM Zone 10N WGS84

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:20,000.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Columbia County, Oregon
Survey Area Data: Version 17, Jun 11, 2020

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Apr 16, 2015—Feb 12, 2017

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
15	Crims silt loam, protected	1.0	0.8%
61	Udipsamments, nearly level, protected	104.1	83.4%
66	Wauna silt loam, protected	7.0	5.6%
68	Wauna-Locoda silt loams, protected	12.9	10.3%
Totals for Area of Interest		**124.9**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Columbia County, Oregon

15—Crims silt loam, protected

Map Unit Setting

National map unit symbol: 21f3
Elevation: 0 to 20 feet
Mean annual precipitation: 50 to 80 inches
Mean annual air temperature: 50 to 54 degrees F
Frost-free period: 165 to 210 days
Farmland classification: Farmland of unique importance

Map Unit Composition

Crims, protected, and similar soils: 95 percent
Minor components: 4 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Crims, Protected

Setting

Landform: Flood plains
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Partially decomposed herbaceous plant material over silty alluvium

Typical profile

H1 - 0 to 9 inches: silt loam
Oe - 9 to 40 inches: mucky peat
H3 - 40 to 60 inches: silt loam

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Very poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: About 0 to 12 inches
Frequency of flooding: RareNone
Frequency of ponding: Frequent
Available water capacity: Very high (about 22.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3w
Hydrologic Soil Group: B/D
Hydric soil rating: Yes

Minor Components

Locoda, protected

Percent of map unit: 2 percent
Landform: Flood plains
Landform position (three-dimensional): Tread
Down-slope shape: Linear

Across-slope shape: Linear
Other vegetative classification: Very Poorly Drained (G001XY009OR)
Hydric soil rating: Yes

Wauna, protected

Percent of map unit: 2 percent
Landform: Flood plains
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Other vegetative classification: Poorly Drained (G001XY008OR)
Hydric soil rating: Yes

61—Udipsamments, nearly level, protected

Map Unit Setting

National map unit symbol: 21h4
Elevation: 0 to 40 feet
Mean annual precipitation: 50 to 80 inches
Mean annual air temperature: 50 to 54 degrees F
Frost-free period: 145 to 210 days
Farmland classification: Not prime farmland

Map Unit Composition

Udipsamments, protected, and similar soils: 85 percent
Minor components: 12 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Udipsamments, Protected

Setting

Landform: Flood plains
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Sandy dredge spoils

Typical profile

H1 - 0 to 4 inches: loamy sand
H2 - 4 to 60 inches: fine sand

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 99.90 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: RareNone
Frequency of ponding: None
Available water capacity: Low (about 3.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: A
Hydric soil rating: Yes

Minor Components

Wauna, protected

Percent of map unit: 4 percent
Landform: Flood plains
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Other vegetative classification: Poorly Drained (G001XY008OR)
Hydric soil rating: Yes

Locoda, protected

Percent of map unit: 4 percent
Landform: Flood plains
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Other vegetative classification: Very Poorly Drained (G001XY009OR)
Hydric soil rating: Yes

Crims, protected

Percent of map unit: 4 percent
Landform: Flood plains
Hydric soil rating: Yes

66—Wauna silt loam, protected

Map Unit Setting

National map unit symbol: 21h9
Elevation: 0 to 40 feet
Mean annual precipitation: 50 to 80 inches
Mean annual air temperature: 50 to 54 degrees F
Frost-free period: 145 to 210 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Wauna, protected, and similar soils: 90 percent
Minor components: 8 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Wauna, Protected

Setting

Landform: Flood plains

Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Silty alluvium derived from mixed sources

Typical profile

H1 - 0 to 8 inches: silt loam
H2 - 8 to 26 inches: silt loam
H3 - 26 to 60 inches: silt loam

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)
Depth to water table: About 24 to 60 inches
Frequency of flooding: NoneRare
Frequency of ponding: None
Available water capacity: Very high (about 12.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2w
Hydrologic Soil Group: C
Forage suitability group: Poorly Drained (G002XY006OR)
Other vegetative classification: Poorly Drained (G002XY006OR)
Hydric soil rating: Yes

Minor Components

Crims, protected

Percent of map unit: 3 percent
Landform: Flood plains
Hydric soil rating: Yes

Locoda, protected

Percent of map unit: 3 percent
Landform: Flood plains
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Other vegetative classification: Very Poorly Drained (G001XY009OR)
Hydric soil rating: Yes

Udipsamments, protected

Percent of map unit: 2 percent
Landform: Flood plains
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: Yes

68—Wauna-Locoda silt loams, protected

Map Unit Setting

National map unit symbol: 21hc
Elevation: 0 to 40 feet
Mean annual precipitation: 50 to 80 inches
Mean annual air temperature: 50 to 54 degrees F
Frost-free period: 145 to 210 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Wauna, protected, and similar soils: 45 percent
Locoda, protected, and similar soils: 35 percent
Minor components: 14 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Wauna, Protected

Setting

Landform: Flood plains
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Silty alluvium derived from mixed sources

Typical profile

H1 - 0 to 8 inches: silt loam
H2 - 8 to 26 inches: silt loam
H3 - 26 to 60 inches: silt loam

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)
Depth to water table: About 24 to 60 inches
Frequency of flooding: NoneRare
Frequency of ponding: None
Available water capacity: Very high (about 12.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2w
Hydrologic Soil Group: C
Forage suitability group: Poorly Drained (G002XY006OR)
Other vegetative classification: Poorly Drained (G002XY006OR)
Hydric soil rating: Yes

Description of Locoda, Protected

Setting

Landform: Flood plains
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Silty alluvium from mixed sources

Typical profile

H1 - 0 to 10 inches: silt loam
H2 - 10 to 60 inches: silty clay loam

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Very poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)
Depth to water table: About 0 to 12 inches
Frequency of flooding: RareNone
Frequency of ponding: Frequent
Available water capacity: Very high (about 12.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3w
Hydrologic Soil Group: C/D
Forage suitability group: Poorly Drained (G002XY006OR)
Other vegetative classification: Poorly Drained (G002XY006OR)
Hydric soil rating: Yes

Minor Components

Udipsamments, protected

Percent of map unit: 7 percent
Landform: Flood plains
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: Yes

Crims, protected

Percent of map unit: 7 percent
Landform: Flood plains
Hydric soil rating: Yes

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APPENDIX B

2001 GEOTECHNICAL ENGINEERING REPORT

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GEOTECHNICAL EVALUATION
SUMMIT/WESTWARD ENERGY PROJECT
CLATSKANIE, OREGON

May 2001

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GEOTECHNICAL EVALUATION
SUMMIT/WESTWARD ENERGY PROJECT
CLATSKANIE, OREGON

1.0 INTRODUCTION

This geotechnical evaluation report has been completed for the proposed Summit/Westward Energy Project, which includes a new natural gas-fired combined-cycle combustion turbine generation facility located near Clatskanie, Oregon. The project site is located on Port of St. Helens property located in Columbia County approximately seven miles northeast of Clatskanie, Oregon. The Vicinity Map, Figure 1, shows the location of the project site.

The purpose of this evaluation was to present findings regarding the geologic and seismic setting of the project site; assess the nature of the subsurface conditions and materials which underlie the project site including site specific seismic evaluation; develop preliminary conclusions concerning the key geotechnical aspects of the project, such as foundations for the turbines/generators and other settlement sensitive facilities; seismic design considerations; and related site geotechnical issues. This report also contains "site specific geological and soil stability assessment" information pertinent to site certificate application, Exhibit H, requirements by Oregon Department of Energy, Energy Facility Siting Council.

2.0 LIMITATIONS

The scope of the geotechnical evaluation presented herein is limited to the assessment of geologic site-specific conditions and evaluation of the subsurface conditions related to the proposed facilities for the Summit/Westward Energy Project near Clatskanie, Oregon. This report has been prepared to aid Harza Engineering Company, Milwaukee, Wisconsin and the project owner in the evaluation of the site and application for site certificate for the proposed facility in accordance with generally accepted engineering geologic and geotechnical engineering practices. No other warranty, based on the contents of this report is intended, and none shall be inferred from the statements or opinions expressed herein.

Our description of the project represents our understanding of the significant aspects of the project relevant to the general arrangement of the project and the proposed site layout provided by Harza Engineering. In the event that any changes in the proposed locations of the structures as outlined in this report are planned or occur, we recommend that a geotechnical review of the changes be made to affirm in writing the conclusions of this report.

The scope of our services reported herein included environmental field screening of the near surface soils to a depth of 15 feet below the current ground surface for the presence of certain soil contaminants. Any statement in this report or on the boring logs regarding odors noted or unusual or suspicious items or conditions observed are solely for the information of our client.

The analyses and conclusions represented in this report are based on the data obtained from the borings made at the locations indicated on the Boring Location Site Map, (Figure 2) and from other information discussed herein. This report is based on the assumption that the subsurface conditions across the site are not significantly different from those revealed by the borings. However, variations in soil conditions may exist between the borings locations. The nature and extent of the variations may not become evident until further investigations are made at the site during the design phase or during construction.

The exploratory activities, laboratory testing, and preliminary analysis are consistent with those normally used in conceptual or preliminary geotechnical evaluations and for site characterizations to develop budgets for future design and construction. When concepts have been better defined, additional explorations and analyses will be necessary to complete the geotechnical analysis and to provide design recommendations.

3.0 BACKGROUND INFORMATION

3.1 Topography

The site is located in the Oak Point 7½-minute quadrangle (U.S. Geological Survey, 1985). The proposed generation facilities site is a relatively flat, vegetation covered pasture land with shallow drainage ditches containing water generally to the south and east of the proposed main plant facilities. The greatest relief on the site is related to the existing drainage ditches, which are less than 10 feet deep with associated spoil piles from the ditch excavations. The ground surface on the site varies between elevations 5 and 10 feet, based on North American Vertical Datum (NAVD) 1988, according to the contours shown on Figure 2. The topography north of the site remains flat for a distance of approximately 2000 feet to a levee that bounds Bradbury Slough, a side channel of the Columbia River.

3.2 Project Description

The proposed project layout map is shown on Figure 2. Along the northeast border of the property are existing gas lines and power lines and a railroad spur. We understand that the generation facility will contain the following major components:

- Combustion Turbines and Generators;
- Heat Recovery Steam Generators (HRSGs);
- A Steam Turbine, Condenser and Generator;
- Main Power Transformers;
- Miscellaneous Buildings;
- Multi-cell Cooling Tower Complex;
- Water Storage Tanks;
- In-plant Substation and Switch Yard; and
- Pipes, Conduits, and Pipe Racks.

We understand there also will be numerous buried utilities and associated underground vaults constructed across the proposed plant site to depths up to 20 feet. Large diameter underground pipelines will be installed between the cooling tower and the steam generator. We understand the orientation of the structures shown on Figure 2 could change, but the general spacing or relative location will remain similar.

4.0 GEOLOGIC SETTING

The information in this section represents a summary of the geologic setting information presented in Appendix D.

4.1 Regional and Site Geology

The Summit/Westward Energy Project site and its related/supporting facilities are located on the Columbia River alluvial valley within the Coast Range physiographic province of northern Oregon and southern Washington. A physiographic province is a region of similar geologic history and composition. The Coast Range province is broadly upwarped, forming a low mountain range located between the Pacific Ocean and coastline on the west and Willamette Valley-Puget Sound Lowlands on the east. The general geology in the vicinity of the project area is shown in Appendix D, Geology Map, Figure H3 (Walsh and others, 1987 and Walker and MacLeod 1991). The region is underlained from oldest to youngest: basement rock of

Eocene epoch age volcanic sea floor basalt and island volcanic centers; a thick marine sedimentary sequence of younger Oligocene to Miocene; Miocene epoch Columbia River Basalt lava flows; and local younger alluvial deposits along the Columbia River, coastal rivers and bays. The Eocene volcanic rock basement is estimated to be about 20 miles thick under the Oregon Coast Range (Orr and Orr, 1996). The overlying marine sedimentary sequence is at least 5,000 feet thick and the Columbia River Basalt 1,400 feet thick in the northern Oregon Coast Range (Beaulieu, 1973). The alluvial sediments may be about 350 feet thick.

Following the cessation of Columbia River Basalt volcanism, the Coast Range began to uplift. Concurrently, the eastern and western margins began to subside and sedimentation resumed along the eastern and western margin of the uplift. As the uplift continued, the erosive power of the Columbia River was able to maintain its course through the growing mountain range.

During the Pleistocene (2 million years) (Orr and Orr, 1996), major continental glaciers periodically formed over much of Canada and Europe. At glacial maximums, vast quantity of water was locked up in glacial ice, which caused 300 to 450 feet lowering of sea level (Balwin, 1964). During these times, the Columbia River eroded a deep channel. The eroded Pleistocene Columbia River channel was probably greater than 350 feet deep at the project site.

During glacial maximums, glacial ice advance blocked the Clark Fork River in northern Idaho and northwestern Montana. Water backed up behind the ice-dam until the dam became unstable and failed, releasing a vast flood of water (Trimble, 1963). These floods are known as the Pleistocene floods or "Bretz Floods". These floods scoured and redeposited sands and gravels in the Pleistocene river channel. At the site, the Pleistocene channel at the time of the floods was probably greater than 350 feet below the present day ground surface. Consequently, the Pleistocene flood deposits are not exposed at the surface in the lower Columbia River valley but are probably present at depths below 300 feet.

At the end of each glacial period, including the latest, sea level rose rapidly as the glacial ice melted. This rise in sea level caused a general flooding and formation of an estuary environment in the lower Columbia River. The base level of the Columbia River rose concurrently, resulting in rapid sedimentation of alluvium along the river. This alluvium consists of sand deposit along the river channel and silt, clay, and organic soils in the overbank (flood plain) deposit.

The geologic structure within the vicinity of the project area is complex. Overall, the area is dominated by the broad north-south upwarp of the Coast Range. The amount of upwarping is uneven, with both the Tillamook highlands to the south and Willapa Hills to the north, uplifted higher than the area in between along the lower Columbia River. Geologic mapping shows the older rocks exposed in the core of the uplifted areas are extensively faulted (Walker and MacLeod, 1991 and Walsh and others, 1987). Faults are generally oriented northwest-southeast and northeast-southwest. Most of these faults, however, appear to be restricted to the older rocks suggesting that they are related to the older tectonism and were not active after the deposition of the younger sedimentary rocks. Therefore, they are not active now.

Superimposed on the broad uplift are numerous small secondary folds. In the vicinity of the project, these secondary folds are oriented northwest-southeast (Walker and MacLeod, 1991 and Walsh and others, 1987). The nearest mapped secondary fold is a syncline that trends through Quincy, beneath the project site and into the state of Washington.

4.2 Seismic Setting

The site is located in the seismic region known as the Cascadia Subduction Zone (CSZ), which extends from Northern California to British Columbia. A more in depth discussion of the CSZ is presented in Appendix D. In the CSZ, just off the coast of Oregon and Washington, the oceanic Juan de Fuca Plate is being forced under the North American Plate. Much of the Pacific Northwest's topographic relief, including the Coast Ranges and Cascade Mountains and the region's seismicity, can be attributed to the plate tectonics of the region. Three types of earthquakes are known to occur within the CSZ: shallow crustal, deeper subcrustal intraplate, and the large interface. The most seismically active area occurs in the Puget Sound region, 60 miles to north.

Earthquakes are sized using two fundamentally different scales: Modified Mercalli scale and magnitude scales. The following definitions are based on Rogers, Walsh, Kockelman, and Priest (1996) definitions. The Modified Mercalli scale was developed before the advent of mechanical means of measuring earthquakes. It is a subjective numerical index describing the severity of an earthquake in terms of its effects on the Earth's surface and on humans and their structures. The index scale spans from Roman Number I, felt by few, to XII, total destruction. Unless specifically stated, Modified Mercalli intensity is the maximum observed at the epicenter of an earthquake.

Magnitude scale is a measured number that characterizes the relative size of an earthquake. It is based on measurement of the maximum motion recorded by a seismograph corrected for attenuation to a standardized distance. Several magnitude scales have been defined, but the most commonly used are 1) local magnitude (M_L), commonly referred to as "Richter magnitude," 2) surface-wave magnitude (MS), 3) body-wave magnitude (m_b), and movement magnitude (M_W). The first three scales have limited range and applicability and do not satisfactorily measure the largest earthquakes. The moment magnitude (M_W) scale is based on the concept of seismic moment, and is uniformly applicable to all sizes of earthquakes. Conceptually, all magnitude scales can be cross-calibrated to yield the same value for any given earthquake. In practice, however, this has only been proved to be approximately true. For engineering purposes, the scales are similar enough that the differences are not significant. Historically, most of the earthquakes recorded in the Pacific Northwest were reported in local magnitude M_L scale. For this report, magnitudes are expressed as **M** without attempting to convert between the various scales.

Shallow crustal earthquakes take place typically between depths of 10 km and 20 km. Several earthquakes between estimated **M**4 and **M**5 have occurred within 31 miles (50 km) of the site over the past 150 years. The most significant event is the estimated **M**5.2, 1962 Portland-Vancouver earthquake located approximately 46 miles east-southeast of the site. Earthquake recurrence relationship suggests a magnitude **M**6.0 event with about a 500-year recurrence and a magnitude **M**6.5 event with about a 5000-year recurrence.

The second major type of earthquake that could affect the site is a deeper subcrustal intraplate earthquake occurring within the subducting Juan de Fuca Plate at depths between 40 km to 60 km. The 1949 Olympia and the 2001 Nisqually earthquakes were deep subcrustal events. An intraplate earthquake could potentially occur directly below the site (depth 50 km). The maximum expected magnitude for an intraplate earthquake is between **M**7.0 and **M**7.5. An earthquake recurrence relationship extrapolated to large magnitudes based on smaller magnitude subcrustal earthquakes suggests that an **M**7.0 event may occur in the region once in 1000 years. The distance that this possible event could have ranges between 0 to more than 30 miles (0 to 50 km). For hazard analysis purposes, a **M**7.0 occurring directly beneath the site (distance 0 km, depth 50 km) and a larger **M**7.5 event occurring at a distance of 30 miles (50 km) were considered.

The third major type of earthquake that potentially could affect the site is an interface, or subduction zone, earthquake, which could take place at the boundary of the Juan de Fuca and the North American plates. Although a subduction zone earthquake has not been historically recorded off the coast of Oregon or Washington, geologic data suggests that a **M9+** earthquake is possible from an interface event. The best estimate for the most likely size ranges between magnitudes **M8** to **M9** depending upon the length that ruptures. Recurrence for a subduction zone interface earthquake ranges from 350 to 600 years, with a mean recurrence of about 450 years. The last event occurred 300 years ago. The nearest approach of a CSZ interface earthquake would be about 30 miles (50 km) west of the site.

A literature review was also conducted to identify known geologically active or potentially active faults within 62 miles (100 km) of the site. The results are presented in Appendix D. Primary reference sources reviewed include Seismic Design Mapping: State of Oregon (Geomatrix Consultants, 1995), National Seismic Hazard Maps (Frankel, et al., 1996) and Wong and others (2000). The review shows that there are at least eleven geologic faults or fault zones with or suspected with greater than 50 percent probability of having Quaternary movement (movement within the last two million years). In addition, the CSZ is active and underlies the site at depth.

4.3 Geologic Hazards

Potential geologic hazards for the site were evaluated. The results are presented in Geologic and Soil Stability Assessment, Appendix D. Based on the geologic history, the alluvial soil is assumed to extend down to about 350 feet below sea level. Deep alluvial soils at the site strongly affect seismic ground response at the surface. The assessment identified the primary geologic and soil stability issues are associated with seismic hazards: primarily strong ground shaking, the potential for liquefaction of some of the subsurface materials, and seismically induced settlement. The analysis indicates that seismic waves would be significantly dampened and deamplified as they traverse up through the deep soil column. In addition, the analysis suggests that some of the loose sandy silt and sand strata may be susceptible to liquefaction during a subduction zone earthquake event. The occurrence of liquefaction could result in loss of foundation bearing capacity of the near surface soils and/or settlement. Consequently, heavy structures and structures sensitive to settlement probably will be founded on deep piles driven to below identified liquefiable zones to provide adequate support.

Other geologic hazards, in our current opinion, are not significant at the site. The site is flat and there are no landslide or slope stability issues. Also, there is little risk of fault displacement at the site. In addition, the site is located behind flood control levees that provide 100-year flood protection with 4.7 feet of freeboard. Since the site is level and over 2000 feet from Bradbury

Slough, the potential for lateral spreading is not considered a hazard. Also, the site is too far from the ocean to be affected by tsunami.

5.0 FIELD EXPLORATIONS AND LABORATORY TESTING

The subsurface conditions beneath the site were investigated with eight borings that were advanced between April 16 and April 25, 2001. Laboratory and field soil tests consisting, of among others, photoionization, soil classification, seismic compression and shear wave, and soil resistivity tests were performed. Presented in the following sections is a discussion of tests performed at the site during the field exploration and laboratory testing that were performed on the samples returned to our office.

5.1 Field Explorations

The locations of the borings, designated B-1 through B-8, are shown on the Borehole Location Map, Figure 2. The borings were advanced to between 80 and 150 feet from the ground surface using a combination of track and truck-mounted drill rigs owned and operated by Geo-Tech Explorations of Tualatin, Oregon. A total of 852 feet lineal feet was drilled, sampled, and logged.

During the drilling, disturbed samples were obtained at about every 2.5 feet in the upper 25 feet, and about 5 feet thereafter using the Standard Penetration Test (SPT) ASTM D1586. During the Standard Penetration Test, the N-value blow counts required to advance the sampler with a 140-pound weight dropped 30 inches was recorded. The N-value, expressed as blows per foot, is used to provide a measure of the relative density of granular soils such as sand, and the consistency of cohesive soils such as silt and clay. In addition, thin-wall Shelby tube samples of relatively undisturbed soil were obtained at selected depths.

Two piezometers, consisting of a slotted PVC pipe backfilled with clean free draining sand were installed in Borings B-4 and B-7 at the site to allow for future measurements of a ground water level. At the ground surface, each piezometer pipe was placed inside a flush mounted monument cover set in concrete. All the other borings were backfilled with bentonite up to the ground surface at the completion of drilling, except for B-3 that also contained the downhole testing PVC pipe, described below.

Presented in Appendix A is a description of the procedures used in making the borings, including the details of the piezometer installations and the techniques utilized in obtaining the various types of soil samples. Table A1 in Appendix A presents the terminology used to describe the soils. Presented on Figure A1 of Appendix A is information related to the symbols, soil and well material graphics, and soil property data presented on the boring logs. The logs of the borings are presented in figures A2 through A9.

5.2 Photoionization Testing

Environmental screening for the presence of volatile vapors in the upper 15 feet of each boring was analyzed by use of a Photoionization detector (PID). The PID measures vapors released from chemical volatilization of organic compounds in parts per million (ppm). For the purpose of environmental screening, a lower limit threshold was set to 10 ppm for this project based on typical industry standards, before further environmental analysis was considered necessary. Additional information on this testing is contained in Appendix A.

5.3 Laboratory Testing

Laboratory tests were performed on selected soils returned to our laboratory to evaluate the soil index properties and provide data related to the strength and settlement characteristics of the soil. The testing program adopted for this investigation includes soil visual examinations, moisture content, grain-size analyses, Atterberg limits, and unit weight measurements. In addition, two unconfined compressive strength and a soil consolidation test were also performed. Presented in Appendix B of this report is a description of the laboratory tests that were performed and the testing results.

5.4 Downhole Seismic Tests

A downhole seismic wave velocity survey for S and P waves was conducted at the project site in Boring B-3 on April 22, 2001. The test was performed by Northwest Geophysical Associates, Corvallis, Oregon, and the results are presented in Appendix C. In general, the test measures the time required for shear (S) and compression (P) waves propagation through soils over a range of distances from a surface energy source. By measuring the arrival time of shear waves at incremental depths in the borehole, a profile of shear wave velocity is developed. Changes in shear wave velocity with depth in the borehole were used to predict differences in soil types, soil properties and soil behavior. Shear wave velocity in the soils was used in the seismic analyses of the site and an evaluation of the range of the level of ground shaking during the controlling earthquake event.

5.5 Soil Resistivity

Soil resistivity measurements were made at the site on May 3, 2001 to determine the soil resistance to an electric current. We understand this information will be used to evaluate the grounding potential of the soils at the site. The resistivity of the soil was measured using the four-point Wenner method with tests performed by Northwest Geophysical Associates. The results of the test are presented in Appendix E.

6.0 DISCUSSION OF SUBSURFACE CONDITIONS

6.1 Soils

Figure 3 through Figure 5 present general geologic cross sections, which show in a generalized manner, the interpreted subsurface conditions disclosed by the borings at various locations at the site. The Cross Sections are designated A-A', B-B', and C-C' and their location and orientation are shown on the Site Plan, Figure 2. The geologic Cross Sections are interpretive in nature and the contacts between soil units may be gradational. Further, variations in soil conditions may exist between the locations of the borings.

As shown on the geologic Cross Sections, the subsurface materials encountered at the site can be divided into two general soil units within the depth of our explorations, based on their engineering characteristics and stratigraphic position. The subsections that follow present a description of the two soil units, including the subsurface conditions and materials present across the site. A more detailed description of the soils is described on the Boring Logs, Figures A2 through A9 (Appendix A).

6.1.1 Upper Fine-Grained Alluvium

An upper fine-grained alluvium unit was encountered in all the borings and consists generally of very soft silt with various minor amounts of fine sand. The upper alluvium was encountered up to depths between 25 to 60 feet from the ground surface. Blow counts or N-values, observed during the Standard Penetration Test (SPT) varied from 0 to 11 blows per foot. In general, the predominantly silt soils, which constituted a majority of the unit, had N-values between 0 and 2. Higher N-values between 5 and 11 were observed in the silt soils containing, in general, a higher percentage of sand. Organics, including isolated pieces of plant and wood fiber, were generally observed in estimated amounts between 5 to about 15 percent (based on volume) of the soil samples. The moisture content of the unit ranged between 40 to 70 percent. Some higher moisture contents were observed within the soils containing a larger percentage of organic matter.

The plasticity characteristics of the soil unit, as measured in Atterberg Limits Tests, indicate a Liquid Limit (LL) between 53 and 73 percent, and a Plastic Limit (PL) between 35 and 41 percent. These values are influenced, in our opinion, because of the presence of organic matter, as described previously. The Plasticity Index (PI) ranged between 0 percent (non-plastic) to 34 percent, with a majority of the test results below 15 percent. Locally within the unit, some minor amounts of clay were apparent, up to estimates of about 5 percent, by weight of the sample. Classification tests performed on the silt, including dry strength, dilatancy and toughness, performed in general accordance with ASTM D-2488, indicate a range of plasticity between non-plastic to medium plasticity, with a majority of the results ranging from non-plastic to low plasticity.

In general, as indicated by a majority of the "N"-values between 0 and 2, the silty soil was classified as either "very loose" or as "soft", depending upon its apparent plasticity. The condition of the silt, together with a high ground water level at the site, and the presence of organic matter, in our opinion, contributes to a moderate to high potential of settlement within the unit. A consolidation test was performed on a sample of the upper fine-grained alluvium with results discussed under Section 7.3.

Measurements of shear strength were performed on selected samples of the soil unit and consisted of unconfined compressive strength test, pocket penetrometer, and torvane strength tests. The results of the unconfined tests indicate undrained shear strength of between .18 and .25 ton per square foot (tsf), correlating to very soft. Pocket penetrometer tests and torvane tests performed on Shelby tube samples returned to our laboratory indicate a range of undrained shear strength between 0 and .25 tsf.

6.1.2 Lower Sandy Alluvium

Below the upper fine-grained alluvium, we encountered a lower sandy alluvium unit consisting mostly of fine-grained poorly graded sand with varying amounts of silt. All of the borings were terminated in this soil unit. N-values varied between 4 to 60 blows per foot, with most of the values between 20 to 35 blows per foot. The lower N-values within this unit were generally observed in the sand soils that contained a higher percentage of silt. The moisture content of the unit ranged between about 30 to 50 percent. Organics, although observed in this unit, were generally less abundant than observed in the upper fine-grained alluvium.

6.2 Ground Water

Ground water was measured at depths between 2 to 4 feet from the ground surface in Borings B-3, B-4 and B-5 during and immediately after drilling. A ground water level was not observed in the other borings and is in general, difficult to measure when a mud-rotary system is used. Based on our analyses and our experience, we believe that the ground water level at the site should be expected at elevations closely related to the surface water level in the Columbia River, located to the north of the site.

6.3 Photoionization Results

Photoionization results on soil samples in the upper 15 feet of each boring ranged from 0 to 8 ppm. Boring B-3 at 10 feet registered 8 ppm, while all other results in the other seven borings registered no more than 0.1 ppm. Since all results were below the minimum threshold, 10 ppm, previously described, no samples required additional analytical analysis.

7.0 PRELIMINARY CONCLUSIONS AND RECOMMENDATIONS

7.1 General Findings

The field explorations disclosed that deep soft alluvial sediments exist across the site. The conditions observed in the borings suggest that the upper 50 feet of soils is relatively loose to very soft, and potentially liquefiable during the design earthquake. In addition, ground water occurs at a relatively shallow depth. During periods of flooding, water level in the river is higher than the ground surface. High ground water is currently controlled by a drainage ditch system managed by the Beaver Drainage District. In our opinion, the upper relatively soft soils in their existing condition are not suitable for the support of settlement sensitive equipment, heavily loaded mat foundations, and building foundations. Pile supporting structures or ground modification techniques will be discussed in later sections.

7.2 Site Preparation/Earthwork/Ground Water Control

The following issues are considerations for future design and construction activities.

7.2.1 Clearing and Stripping

There are scattered trees that will need to be cleared and grubbed. The pasture land vegetation cover and topsoil should be stripped under settlement sensitive facilities and other areas where organics left in-place would be a detriment to long-term performance.

7.2.2 Well Abandonment

Regarding subsurface features, we became aware of an existing shallow water well that would need to be abandoned by a State of Oregon licensed water well driller. Similarly, the two soil borings containing the standpipe piezometers and the one boring containing the grouted pipe for the downhole seismic tests will need to abandoned according to Oregon Department of Water Resources regulations.

7.2.3 Working Pad (Site Fill)

Due to the relatively very loose and soft nature of the shallow subsurface materials and the high ground water levels, working pads or mats are advisable for the construction period. Typically, a pad constructed of imported granular material, preferably well-graded, free-draining crushed rock placed on a heavy non-woven geotextile would be used. The material specifications, thickness, and placement methods would depend on how the working pad would be incorporated into the design of the various foundation systems, roadway subgrade preparation, and buried piping. Based on discussions with the site grading consultant, we understand that site filling throughout most of the area will be less than 3 feet. The exception would be areas requiring special treatment. Since site filling would cause some settlement, we have assumed a site fill thickness of 3 feet in our analysis discussed in Section 7.4.

7.2.4 Drainage Ditches

There are at least two fairly deep drainage ditches that intersect the footprint of the plant facilities that will need to be dealt with during site preparation. We understand that these ditches are part of the Beaver Drainage District.

7.2.5 Softer Surface Areas

In the southwest portion of the site in the vicinity of the existing barn, we noticed that the ground surface was generally softer than the rest of the plant site area. Additional stripping or other treatment may be required if facilities area placed in this area.

7.2.6 Ground and Subsurface Modification

To decrease the long-term settlement of the deep, soft and loose subsurface materials for static and seismic loading conditions, various ground improvement methods may be needed as part of the overall site preparation. More discussion related to this is mentioned in sections below.

7.2.7 Earthwork and Ground Water Control

For the various earthwork activities, heavy earthwork equipment and loaded dump trucks most likely will have difficulty operating on the existing ground surface. During our explorations, truck-mounted soil exploration drill rigs were breaking through the vegetative cover and were stuck several times. For the excavations that extend below the shallow ground water, we anticipate that lowering ground water levels with positive control dewatering systems would be needed. Use of sump systems is generally not feasible for these types of soil. The use of excavated material from above and below the ground water levels for structural fill or backfill most likely is not feasible. Potential uses of the excavation spoils may be for landscaping or grading for surface drainage improvements. Grading this material with its high moisture content will be difficult.

7.2.8 Other Related Issues

There other site preparation issues adjacent to the site, such as construction of an access roadway embankment to change grade from the existing road on the levee adjacent to the slough, crossing of the raised grade railroad tracks, and preparation of subsurface for utilities coming into or leaving the site.

7.3 Soil Parameters for the Site

Soil parameters are provided for the project site to assist in the preliminary project site evaluation. Based on the subsurface conditions and the laboratory testing, the recommended soil parameters are presented in Table 1, below. Descriptions of the various parameters follow Table 1.

Table 1
Soil Parameters for the Site

Soil parameter	Very loose silt to sand	Very soft silt	Lower Sandy Alluvium
Poisson's ratio	0.2	0.3	0.25
Modulus of elasticity	100,000 psf	10,000 psf	250,000 psf
Shear modulus	300,000 psf	340,000 psf	900,000 psf
Subgrade modulus	30 pci	25 pci	100 pci
Moist unit weight	105 pcf	100 pcf	120 pcf

psf = pounds per square foot
pcf = pounds per cubic foot
pci = pounds per square inch per inch

7.3.1 Poisson's Ratio

Poisson's ratio, μ, is defined as the ratio of axial compression to lateral expansion strains. Poisson's ratio is both nonlinear and stress-dependent. The range of Poisson's ratio is relatively small for the same types of soil at the site; therefore, we estimated Poisson's ratio based on the soil classifications. The estimated Poisson's ratio values are presented on Table 1. The Poisson's ratio for the very soft silt is estimated for drained condition.

7.3.2 Modulus of Elasticity

The modulus of elasticity, E_0, is the initial slope of soil stress-strain curve. It is often estimated by correlation from field tests, such as the Standard Penetration Test (SPT) and Cone Penetration Test (CPT). For this project, we used the field SPT N-values and laboratory test results to estimate the Modulus of Elasticity for both the very loose silt to sand and very soft silt. The modulus of elasticity of the very soft silt is estimated for drained condition. The estimated modulus of elasticity values are shown in Table 1. Estimates of E_o were based on information from EPRI, 1990.

7.3.3 Shear Modulus

The shear modulus, G, is defined as the slope of the shear stress-strain curve. For soil seismic evaluation purposes, the shear modulus is often estimated by using shear wave velocity measurements, v_s. The relationship between shear modulus and shear wave velocity is: $G = \rho v_s^2$, where ρ is the mass density of the soil. The shear modulus estimated using the above method is a low-strain shear modulus. The shear modulus for the project site were estimated by using the measured shear wave velocity data obtained using a downhole technique in Boring B-3.

Appendix C provides additional background data related to the downhole shear wave velocity values. The estimated shear modulus values are shown in Table 1.

7.3.4 Subgrade Modulus

The subgrade modulus, k_{s1}, is defined as the ratio of stress to deformation for a 1-foot by 1-foot square plate or 1-foot wide beam resting on the subgrade. The subgrade modulus is generally dependent on the relative density of the native soil and the thickness of the compacted foundation structural fill above the native material. The estimated subgrade modulus for the native soils is shown in Table 1. The estimated subgrade modulus values in Table 1 are based on an assumption that footings directly are founded on the native soils. Therefore, in the final design phase, the subgrade modulus should be modified based on the thickness of the compacted working pad and foundation structural fill above the native soils.

7.3.5 Consolidation Settlement Parameters

A one-dimensional consolidation test was performed on a sample of the upper fine-grained alluvium layer, specifically from boring B-6, at a depth of 15 feet. The test sample was classified as soft silt (ML) with trace fine sand and scattered organics. An Atterberg Limits Test resulted LL = 53.6%, PL = 40.8 %, and PI = 13.9%.

The percent strain in the sample was plotted versus the applied test load. Since the interpreted apparent pre-consolidation pressure was slightly above the present overburden pressure, the sample was judged to be essentially normally consolidated. From the strained based consolidation test, soil was judged to normally consolidated based on a reconstructed curve to adjust for potential sample disturbance. The following parameters were estimated based on the results of the consolidation test and our experience:

$C_{c\varepsilon}$	=	0.12
$C_{r\varepsilon}$	=	0.0008
$C_{\alpha\varepsilon}$	=	0.002
Pre-consolidation pressure	=	1,700 psf
OCR	=	slightly over 1

where $C_{c\varepsilon} = \dfrac{C_c}{1 + e_o}$.

For definition of terms, we recommend referring to Holtz and Kovacs, 1981. In our experience with silty soil with organics along the Columbia River, we have seen C_{CE} values range from approximately 0.10 to 0.20, depending on the soil consistency and amount of organics.

7.3.6 Coefficient of Sliding Resistance

The lateral loads on the various power facilities, including lateral earth pressures, earthquakes, and wind can be resisted by sliding resistance of the foundation and partial soil passive pressure, which should be estimated in the final design. The coefficient of sliding resistance for concrete on granular materials generally ranges between 0.3 to 0.4. For this site, it is not feasible to place concrete foundations directly on the native soil.

7.3.7 CBR and Resilient Modulus

The native soil subgrade at the plant site is predominately very low strength non-plastic silt to sand with relatively high natural moisture content. For design of flexible pavement sections, we estimate a California Bearing Ratio (CBR) of 1 percent. Also, for use in design of flexible pavement sections, we estimate a resilient modulus (M_R) value of 1,500 psi. The CBR value was estimated by past experience on these types of soils, and use of the soil classification tests performed on the near surface soils. The M_R value was estimated by the commonly used expression (1500 x CBR) presented in AASHTO Guide for Design of Pavement Structures (1993).

7.3.8 Hydraulic Conductivity of Native Soil

Hydraulic conductivity tests have not been conducted on the native soils. However, based on visual soil classification, experience in similar soils along the Columbia River, and comparison to the consolidation test time rates, hydraulic conductivity is expected to be low. The upper silt and silty fine sand is estimated to have a hydraulic conductivity of about 10^{-5} to 10^{-3} cm/sec. The hydraulic conductivity of the underlying very soft silt is estimated to be in the range of 10^{-6} to 10^{-4} cm/sec.

7.3.9 Seismic Soil Profile Type

The seismic soil profile type represents the average condition of the upper 100 feet beneath the site. The Uniform Building Code, 1997 Edition (UBC-97) Soil Profile Type for the site is S_F because the soil is vulnerable to potential failure due to liquefaction occurring in the medium dense silty sand. The designation S_F means that a site-specific evaluation must be conducted.

From our site evaluation, the site is underlain by about 50 feet of loose sandy silt and medium dense silty sand that is susceptible to liquefaction and 20 to 30 feet of very soft silt (PI <20).

7.3.10 Site Response

Site response spectra for the site is presented in Appendix D. The site is classified as a seismically soft site with potential for soil liquefaction to occur above elevation -50 feet. The foundation support system should consider this risk.

7.4 Foundation Alternative Evaluation

To compare foundation support alternatives for the non-heavily loaded structures planned for the site, we have completed a preliminary evaluation of two different support alternatives using two site soil models. These consist of 1) shallow mat foundations, and 2) pile-supported deep foundations. The two different soil models and types of planned structures are:

- Main Plant Area – Typical water tanks planned for construction in the north central portion of the site.
- Cooling Tower Area – A series of multi-cell cooling towers planned near the southeast corner of the site.

Presented below is an estimate of static settlement and seismically induced post-liquefaction settlement for the shallow foundation system. With large amounts of settlements anticipated for these structures, piles for most of the structures may be warranted. A discussion of estimated pile capacities is presented in a later section. Also discussed are possible mitigation measures to reduce settlement.

We have assumed the heavily loaded structures such as turbines, generators, HRSGs, and other settlement sensitive structures would be placed on pile-supported foundations.

7.4.1 Shallow Foundations Main Plant Area

To analyze a typical shallow foundation support alternative, we have assumed a mat foundation with a plan area of 40 feet by 40 feet and a static dead and sustained live load of 500, 1000, 2000, and 3000 psf. A preliminary soil analytical model was developed for this area based on the interpreted subsurface soil conditions, and the results of laboratory tests. A detail of the soil model for the main plant area is presented in Figure 6. For these settlement estimates, the lower sandy alluvium is considered non-compressible.

For static dead load and sustained live loads, estimates of total settlement, including estimates of secondary settlement, are:

For 500 psf:	1 to 2 inches
For 1,000 psf:	3 to 6 inches
For 2,000 psf:	6 to 10 inches
For 3,000 psf:	10 to 15 inches

Settlement at the site may also occur due to earthquake induced post-liquefaction settlement. The extent and level of liquefaction in general, will depend on the severity of ground shaking at the site. Figure 6 shows approximated soil zones that would liquefy during the design level magnitude earthquake that was selected based on the site-specific earthquake and hazard analyses described in Appendix D. We estimate that between 10 and 15 inches of post-liquefaction induced settlement may occur.

Based on these estimates of static and seismic induced settlement, settlement mitigation will be necessary to prevent damage to the structures. For mitigation of static and seismically induced settlement, we suggest supporting the structures on piles. Preloading could mitigate excessive static settlement; however, in our opinion, typical schedule constraints for fast-track power plant projects cannot accommodate the time necessary for conventional preloading approaches. Based on our analysis and experience, we estimate that a preload fill without installing vertical drains in the subsurface should remain in place a minimum of 3 to 4 months to induce the consolidation settlement. Installing vertical wick drains could substantially speed up the time for settlement to occur. Since preloads generally cannot mitigate for seismically induced liquefaction settlement, ground modification construction techniques should be evaluated to densify the sandy liquefiable materials.

7.4.2 Shallow Foundations Cooling Tower Area

To analyze the shallow foundation support alternative for the cooling tower area, we have assumed a mat foundation with a plan area of 40 feet by 450 feet and a static dead load and sustained live load of 500, 1,000, 2,000, and 3,000 psf. A soil analytical model was developed for this area based on the interpreted subsurface soil conditions and the results of laboratory tests. A detail of the soil model for the cooling tower area is presented in Figure 7. For these settlement estimates, lower sandy alluvium is considered non-compressible.

For static dead load and sustained live loads, estimates of total settlement, including estimates of secondary settlement, are:

For 500 psf:	4 to 6 inches
For 1,000 psf:	8 to 12 inches
For 2,000 psf:	12 to 18 inches
For 3,000 psf:	18 to 24 inches

Figure 7 shows our estimate of the soil zones that would liquefy under the same seismic event described in Appendix D. We estimate that between 12 and 18 inches of soil liquefaction induced settlement may occur.

Settlement mitigation will again be necessary to prevent structural damage to the structures. The settlement mitigation measures described above also apply to this area.

7.4.3 Deep Foundations for the Site

As previously discussed, the preliminary analytical soil models presented on Figures 6 and 7 show a layer of very soft compressive silt, and layers of very loose to medium dense liquefiable sandy silt to sand up to a depth of 60 feet below the existing ground surface. Since this surface condition results in very large estimated settlements, pile-supported foundations should be considered for all the settlement sensitive plant facilities or the seismically designed facilities. We recommend that the minimum pile embedment be 80 feet which includes at least 20 feet below the bottom of the potentially liquefiable layers to account for variability of subsurface conditions at the site. We recommend additional subsurface explorations including use of the Cone Penetration Test (CPT) to better define the thickness of the compressible soil layers.

For preliminary evaluation, we analyzed piles consisting of 12¾-inch and 16-inch diameter driven closed-end, steel pipe piles. Pipe piles should conform to the requirements of ASTM A252, Specifications for Welded and Seamless Steel Pipe Piles. We assumed the pipe piles would be fitted with a welded flat plate.

The allowable compressive and uplift capacities of the driven closed-end, steel pipe piles were evaluated under both static and seismic conditions with capacity estimates in Table 2. For the static compression condition, a nominal soil shaft friction was used for the upper 60-foot compressible zone. The allowable compressive values have a factor of safety equal to or slightly greater than 3. For the seismic compression condition, the upper 60-foot compressible zone was assumed to provide no soil shaft friction resistance and apply no downdrag or negative skin friction to the pile. The allowable seismic compressive values have a factor of safety equal to or slightly above 2. For the allowable static uplift capacities shown in Table 3, the 60-foot compressible zone was treated in the same manner as for compression. The factor of safety for the static allowable uplift condition is equal to or greater than 3. The factor of safety for the seismic allowable condition is equal to or greater than 1.

Table 2
Allowable Compressive Pile Capacities

Pile Depth (ft)	12¾-inch Dia. (kips)		16-inch Diameter (kips)	
	Static	Seismic	Static	Seismic
70	80	65	120	100
80	100	85	150	130
90	125	110	190	170

Table 3
Allowable Uplift Pile Capacities

Pile Depth (ft)	12¾-inch Dia. (kips)		16-inch Diameter (kips)	
	Static	Seismic	Static	Seismic
70	50	30	75	55
80	65	45	95	75
90	85	65	120	100

The above compressive and uplift capacities with the pile embedment lengths shown should result in less than ½-inch settlement. The allowable capacities assume no reduction for group effects and that all piles are driven no closer than 3 pile diameters center-to-center. Also, to maintain spacing, we assume piles would be driven with a maximum deviation from vertical of not more than 3 percent (1.5 inches in 4 feet).

The proposed structures will be subject to lateral loads due to wind and earthquake forces. The lateral load capacities of these pipe piles were evaluated for both static and seismic loading conditions. The laterally loaded pipe pile analyses were performed with the aid of the computer program "LPILE". Two pile sections, PP12¾ X 0.375 and PP16 X 0.375, under a free-pile head condition were evaluated. For these values a reduction for group action was not considered and no lateral resistance was assumed form passive resistance from an embedded pile cap. Based upon our evaluation, the single pipe piles, PP12¾ X 0.375 and PP16 X 0.375, can provide 4 kips and 6 kips, allowable lateral capacities, respectively, under static loading condition and horizontal deflection of approximately ½-inch. Included is a factor of safety equal to about 2.0. Under seismic loading conditions, the allowable lateral capacities of the piles should be reduced to about 50 percent of the static condition. The results of the computer analyses showed an approximate depth to fixity below the top of the pile as follows:

PP12¾ X 0.375	25 feet
PP16 X 0.375	30 feet

7.4.4 Settlement Sensitive Pipes, Pipe Racks, and Conduits

We estimate that differential static settlement between pipe racks, utility conduits and pipelines (i.e., linear facilities) may occur between structures with different foundation support systems. In addition, seismic induced liquefaction settlement could have a significant impact on settlement sensitive linear facilities. If these facilities cannot tolerate the settlement magnitudes estimated, we suggest deep foundation be considered. If linear facilities are allowed to settle, we recommend evaluating special pipe joints and connections, sleeves, shorter pipe lengths, and other methods to help mitigate such settlement and possible infrastructure damage. Also, we recommend that settlement analyses based on the type, depth, and difference in settlement tolerance between the planned structures be completed to evaluate the impact on these type of structures.

7.4.5 Lateral Earth Pressure

Lateral earth pressure on retaining walls depend on the type of wall (i.e., yielding or non-yielding), the type and method of placement of backfill against the wall, the magnitude of surcharge during construction or permanent loads on the ground surface adjacent to the wall, the slope of the backfill, location of the ground water level, use of positive drainage systems behind wall, and the design criteria such as static or seismic condition, and combination loading conditions. Based on the nature of the native soil at the site, it is our opinion that the native soil should not be used for backfill, and backfill material should be imported. For retaining wall backfill, import material consisting of free-draining, crushed rock would be the most desirable.

7.4.6 Roadways

Construction staging areas, roadways, and parking areas constructed on these loose and soft subsurface materials will require special consideration for subgrade stabilization. The subgrade bearing values for the native materials are estimated to be extremely low; therefore the use of geotextile, geogrids, and free-draining imported crushed rock should be considered to develop an adequate zone of subbase strength. Also, the consideration of maintaining drained subbase base material should also be considered.

8.0 REFERENCES

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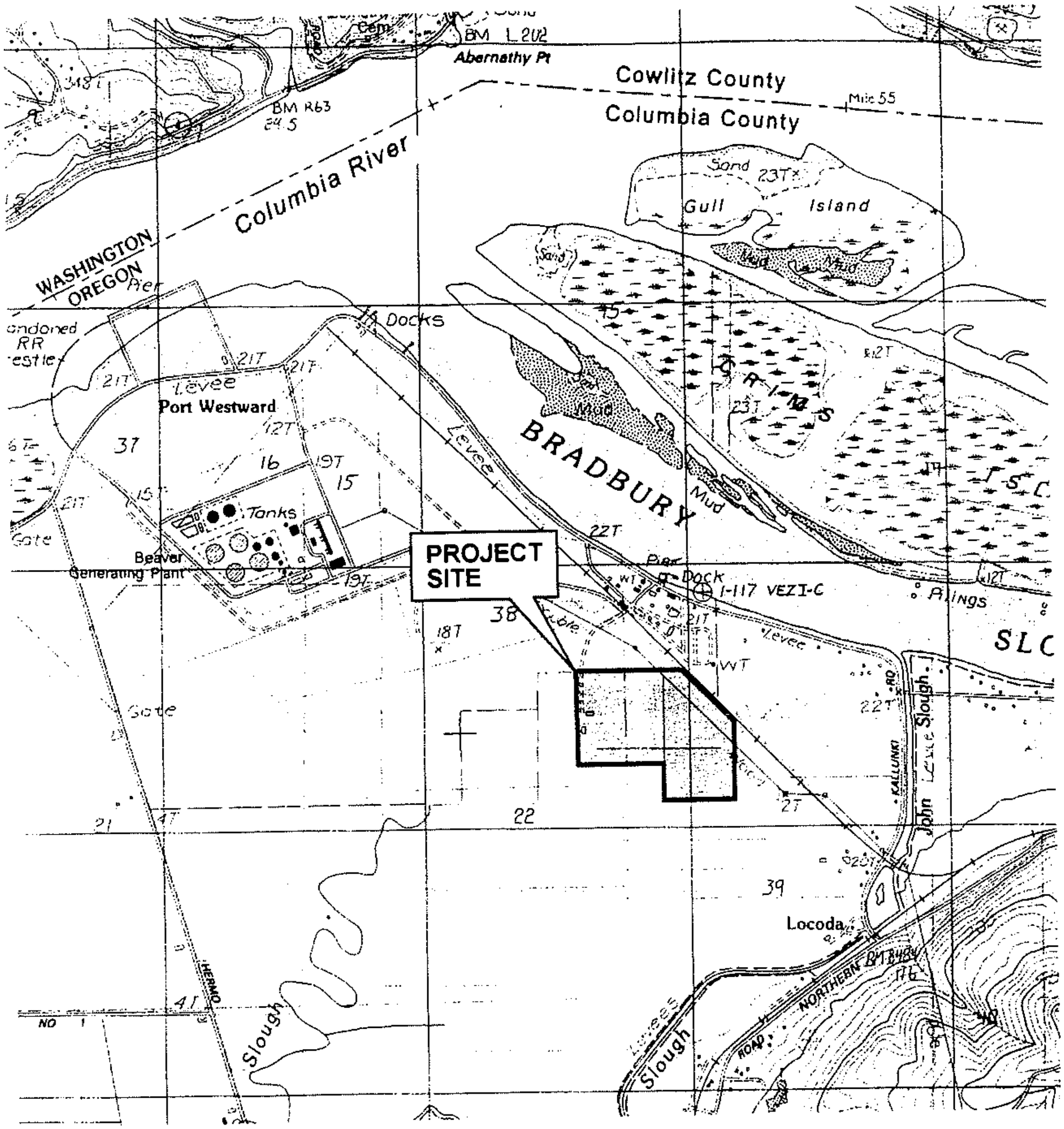
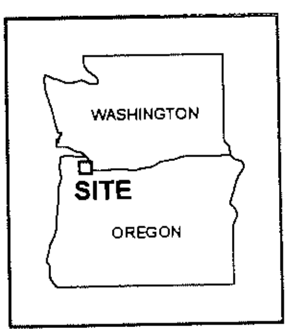
Note: A more comprehensive list of references for the Site Specific Geological and Soil Stability Assessment is contained in Appendix D.





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SCALE IN FEET

0 2000 4000

Source:
USGS 7.5 minute quadrangle map.
"OAK POINT, WASH,-OREG."

SUMMIT/WESTWARD ENERGY PROJECT
CLATSKANIE, OREGON

VICINITY MAP

SQUIER ASSOCIATES

FIGURE 1

NOTE: Features shown are for illustrative purposes only and are approximate.

Drawn by: GCD	Checked by:	Graphics Check: AHK	File: GRAPHICS\FIG1.FH8	Date: 4/24/01	Job. No. 201578

TABLE 2

DC Resistivity Models
Summit/Westward Energy Project
Clatskanie, Oregon

Models

Sounding	Layer 1 Resistivity (ohm-m)	Layer 1 Depth (Feet)	Layer 2 Resistivity (ohm-m)	Layer 2 Depth (Feet)	Layer 3 Resistivity (ohm-m)	Layer 3 Depth (Feet)	Layer 4 Resistivity (ohm-m)	Model Misfit % Error
R-1	204	1.5	105	15.4	18	40	52	3.1%
R-2	161	4.7	67	18.1	19	46	57	5.2%
R-3	122	2.9	98	14.3	18	39	57	1.9%
R-4	102	3.2	57	14.5	17	36	51	2.3%
R-5	148	1.5	87	7.3	35	32	49	0.7%
R-6	213	3.4	72	15.8	21	40	54	1.9%

TABLE 1

a-spacing (feet)	Apparent Resistivity (Ohm-m)	Apparent Resistivity (Ohm-ft)	V/I (Ohms)	Error	Current (mA)
Sounding R-5					
Boring B-6	E-W Sounding offset 20 feet north of B-6(new)				
3.0	111.3	319.9	1.70E+01	0.1%	100
4.0	99.2	285.1	1.13E+01	0.0%	100
5.0	91.0	261.5	8.32E+00	0.0%	100
7.0	79.8	229.2	5.21E+00	0.0%	100
10.0	67.2	193.2	3.08E+00	0.0%	100
15.0	52.6	151.0	1.60E+00	0.0%	100
20.0	45.0	129.2	1.03E+00	0.0%	100
25.0	42.8	123.0	7.83E-01	0.0%	100
30.0	42.0	120.8	6.41E-01	0.1%	100
40.0	41.4	119.0	4.74E-01	0.0%	100
50.0	42.3	121.5	3.87E-01	0.1%	100
70.0	43.3	124.4	2.83E-01	0.0%	100
100.0	45.3	130.1	2.07E-01	0.0%	100
130.0	46.6	134.0	1.64E-01	0.0%	100
160.0	47.4	136.3	1.36E-01	0.0%	100
Sounding R-6					
Boring B-4	E-W Sounding offset 10 feet north of B-4				
3.0	181.2	520.8	2.76E+01	0.0%	100
4.0	170.2	489.0	1.95E+01	0.0%	100
5.0	147.0	422.5	1.34E+01	0.0%	100
7.0	115.8	332.9	7.57E+00	0.1%	100
10.0	87.4	251.1	4.00E+00	0.0%	100
15.0	66.4	190.8	2.02E+00	0.0%	100
20.0	52.4	150.5	1.20E+00	0.0%	100
25.0	46.1	132.5	8.43E-01	0.1%	100
30.0	40.5	116.3	6.17E-01	0.0%	100
40.0	35.1	100.7	4.01E-01	0.1%	100
50.0	34.5	99.1	3.15E-01	0.1%	100
70.0	36.4	104.6	2.38E-01	0.0%	100
100.0	41.6	119.6	1.90E-01	0.0%	100
130.0	44.6	128.0	1.57E-01	0.0%	100
160.0	47.7	137.2	1.36E-01	0.6%	100
200.0	46.2	132.8	1.06E-01	0.0%	100

END

a-spacing (feet)	Apparent Resistivity (Ohm-m)	Apparent Resistivity (Ohm-ft)	V/I (Ohms)	Error	Current (mA)
Sounding R-3					
B-7 offset	E-W Sounding offset 100 feet east of B-7				
3.0	120.2	345.4	1.83E+01	0.3%	100
4.0	113.3	325.6	1.30E+01	0.0%	100
5.0	107.3	308.3	9.81E+00	0.0%	100
7.0	98.2	282.3	6.42E+00	0.0%	100
10.0	91.4	262.7	4.18E+00	0.0%	100
15.0	77.2	221.8	2.35E+00	0.1%	100
20.0	60.8	174.6	1.39E+00	0.0%	100
25.0	48.4	139.1	8.86E-01	0.0%	100
30.0	41.9	120.3	6.38E-01	0.0%	100
40.0	33.9	97.4	3.88E-01	0.0%	100
50.0	32.6	93.6	2.98E-01	0.0%	100
70.0	35.5	101.9	2.32E-01	0.0%	100
100.0	40.1	115.2	1.83E-01	0.0%	100
130.0	43.6	125.2	1.53E-01	0.0%	100
160.0	45.4	130.5	1.30E-01	0.2%	100
Sounding R-4					
	E-W Sounding offset 300 feet east of B-7				
3.0	92.0	264.4	1.40E+01	0.0%	100
4.0	86.3	248.0	9.87E+00	0.0%	100
5.0	82.8	238.0	7.57E+00	0.0%	100
7.0	69.5	199.8	4.54E+00	0.0%	100
10.0	58.8	169.0	2.69E+00	0.0%	100
15.0	48.7	139.9	1.48E+00	0.0%	100
20.0	40.5	116.3	9.26E-01	0.1%	100
25.0	35.8	103.0	6.55E-01	0.0%	100
30.0	31.9	91.7	4.87E-01	0.0%	100
40.0	28.5	81.9	3.26E-01	0.0%	100
50.0	31.7	91.2	2.90E-01	0.1%	100
70.0	32.3	93.0	2.11E-01	0.0%	100
100.0	37.5	107.8	1.72E-01	0.0%	100
130.0	41.3	118.8	1.45E-01	0.0%	100
160.0	42.0	120.7	1.20E-01	0.0%	100

TABLE 1

DC Resistivity Soundings

Wenner Array
Summit/Westward Energy Project
Clatskanie, Oregon

a-spacing (feet)	Apparent Resistivity (Ohm-m)	Apparent Resistivity (Ohm-ft)	V/I (Ohms)	Error	Current (mA)
Sounding R-1					
Boring B-5	N-S Sounding offset 10 feet west of B-5				
3.0	138.2	397.1	2.11E+01	0.0%	20
4.0	135.7	389.8	1.55E+01	0.0%	20
5.0	112.9	324.4	1.03E+01	0.0%	20
7.0	103.5	297.4	6.76E+00	0.0%	20
10.0	96.2	276.3	4.40E+00	0.0%	20
15.0	84.6	243.0	2.58E+00	0.0%	20
20.0	69.1	198.5	1.58E+00	0.0%	20
25.0	54.3	156.1	9.94E-01	0.0%	20
30.0	44.5	127.9	6.79E-01	0.0%	50
40.0	35.5	102.1	4.06E-01	0.0%	50
50.0	33.4	96.0	3.06E-01	0.3%	50
70.0	34.4	98.8	2.25E-01	0.0%	50
100.0	38.0	109.3	1.74E-01	0.0%	100
150.0	42.2	121.3	1.29E-01	0.0%	100
Sounding R-2					
Boring B-3	N-S Sounding offset 10 feet east of B-3				
3.0	139.4	400.7	2.13E+01	0.7%	100
4.0	136.0	390.7	1.55E+01	0.8%	100
5.0	146.6	421.2	1.34E+01	1.0%	100
7.0	113.3	325.5	7.40E+00	0.2%	100
10.0	84.7	243.5	3.87E+00	0.1%	100
15.0	70.6	203.0	2.15E+00	0.1%	100
20.0	59.0	169.4	1.35E+00	0.0%	100
25.0	47.2	135.5	8.63E-01	0.2%	100
30.0	41.0	117.8	6.25E-01	0.0%	100
40.0	34.2	98.2	3.91E-01	0.1%	100
50.0	33.0	95.0	3.02E-01	0.0%	100
70.0	34.5	99.3	2.26E-01	0.0%	100
100.0	39.5	113.5	1.81E-01	0.1%	100
130.0	42.7	122.6	1.50E-01	0.2%	100
160.0	44.6	128.2	1.28E-01	0.0%	100

Geophysical Services
Environmental • Groundwater • Geotechnical

D.C. Resisitivity

INTRODUCTION

D.C. resistivity (electrical resistivity) techniques measure earth resistivity by driving a direct current (D.C.) signal into the ground and measuring the resulting potentials (voltages) created in the earth. From the data the electrical properties of the earth (the geoelectric section) can be derived. In turn, from those electrical properties we can infer geologic properties of the earth.

In geophysical and geotechnical literature, the terms "electrical resistivity" and "D.C. resistivity" are used synonymously. The term "vertical electric sounding" (VES) is also used to refer to soundings using the D.C resistivity method. The terms "resistivity" or "electrical" are often used to refer to the same methods or techniques, although "electrical" is sometimes used to encompass a broader range of techniques including the electromagnetic methods.

APPLICATIONS

Electrical resistivity of soils and rocks correlates with other soil/rock properties which are of interest to the geologist, hydrogeologist, geotechnical engineer and/or quarry operator. Several geologic parameters which affect earth resistivity (and its reciprocal, conductivity) include:

- clay content,
- groundwater conductivity,
- soil or formation porosity, and
- degree of water saturation.

D.C. resistivity techniques may be used in the profiling mode (dipole-dipole surveys) to map lateral changes and identify near-vertical features (e.g., fracture zones), or they may be used in the sounding mode (e.g., Schlumberger soundings) to determine depths to geoelectric horizons (e.g., depth to saline groundwater).

Common applications of the D.C. resistivity method include:

- delineation of aggregate deposits for quarry operations
- measuring earth impedance or resistance for electrical grounding circuits or for cathodic protection,
- estimating depth to bedrock, to the water table, or to other geoelectric boundaries, and
- mapping and/or detecting other geologic features.

D.C. resistivity and electromagnetic (EM) techniques both measure electrical properties of the earth, and hence both are used for many of the same applications. Conductivity, which is often reported by EM instruments, is the reciprocal of resistivity.

THEORY OF OPERATION

Figure 2 is a schematic diagram showing the basic principle of D.C. resistivity measurements. Two short metallic stakes (electrodes) are driven about 1 foot into the earth to apply the current to the ground. Two additional electrodes are used to measure the earth voltage (or electrical potential) generated by the current.

Depth of investigation is a function of the electrode spacing. The greater the spacing between the outer current electrodes, the deeper the electrical currents will flow in the earth, hence the greater the depth of exploration. The depth of investigation is generally 20% to 40% of the outer electrode spacing, depending on the earth resistivity structure.

(Continued Next Page)

Figure 1 - D.C. Resistivity Crew In Operation In The Willamette Valley of Oregon

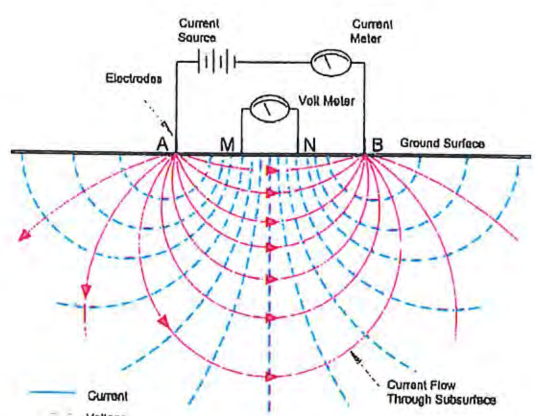


Figure 2 - Schematic Illustrating Basic Concept Of Electrical Resistivity Measurement

:hwest Geophysical Associates, Inc.
. ., Box 1063, Corvallis, OR 97339-1063
(541) 757-7231 Fax: (541) 757-7331
www.nga.com info@nga.com

ATA ANALYSIS & INTERPRETATION

Apparent Resistivity:
Instrument readings (current and voltage) are generally reduced to "apparent resistivity" values. The apparent resistivity is the resistivity of the homogeneous half-space which would produce the observed instrument response for a given electrode spacing. Apparent resistivity is a weighted average of soil resistivities over the depth of investigation.

For soundings a log-log plot of apparent resistivity versus electrode separation is obtained. This is sometimes referred to as the "sounding curve."

Modeling:
Resistivity data is generally interpreted using the "modeling" process: A hypothetical model of the earth and its resistivity structure (geoelectric sections) is generated. The theoretical electrical resistivity response over that model is then calculated. The theoretical response is then compared with the observed field response and differences between observed and calculated are noted. The hypothetical earth model is then adjusted to create a response which more nearly fits the observed data. When this iterative process is automated it is referred to as "iterative inversion" or "optimization."

iqueness
esistivity models are generally not unique; i.e., a large number of earth models can produce the same observed data or sounding curve. In general, resistivity methods determine the "conductance" of a given stratigraphic layer or unit. The conductance is the product of the resistivity and the thickness of a unit. Hence that layer could be thinner and more conductive or thicker and less conductive, and produce essentially the same results. Hence constraints on the model, from borehole data or assumed unit resistivities, can greatly enhance the interpretation.

Deliverables
The end product from a D.C. resistivity survey is generally a "geoelectric" cross section showing thicknesses and resistivities of all the geoelectric units or layers. If borehole data or a conceptual geologic model is available, then a geologic identity can be assigned to the geoelectric units.

A two-dimensional geoelectric section may be made up of a series of one-dimensional soundings joined together to form a two-dimensional section, or it may be a continual two-dimensional cross section. The type of section produced depends on the acquisition parameters and the type of processing applied to the data.

Figure 3 is a two dimensional geoelectric section from a dipole-dipole survey in Alaska. The resistivity survey, part of a water resources investigation, was conducted in order to identify fracture zones with increased porosity. The geophysical objective was to locate conductive fracture zones in the more resistive bedrock. The zone with lower resistivities (1500 to 2000 ohm-meters), which is seen in Figure 3 between 90m and 100m, is indicative of increased water content due to higher fracture porosity in that region.

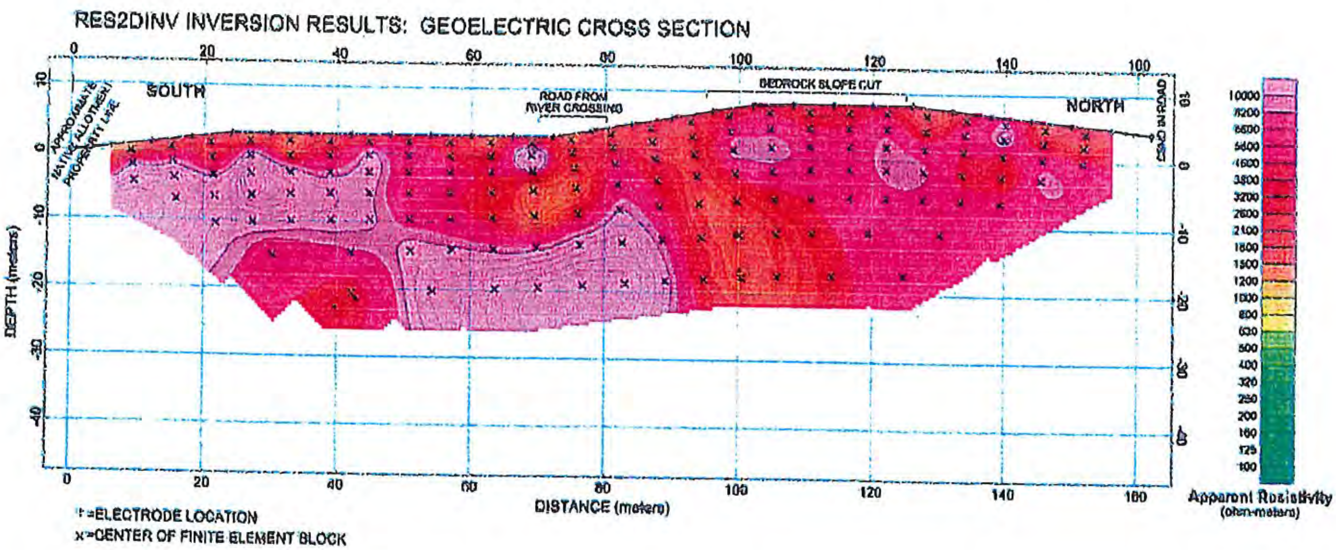
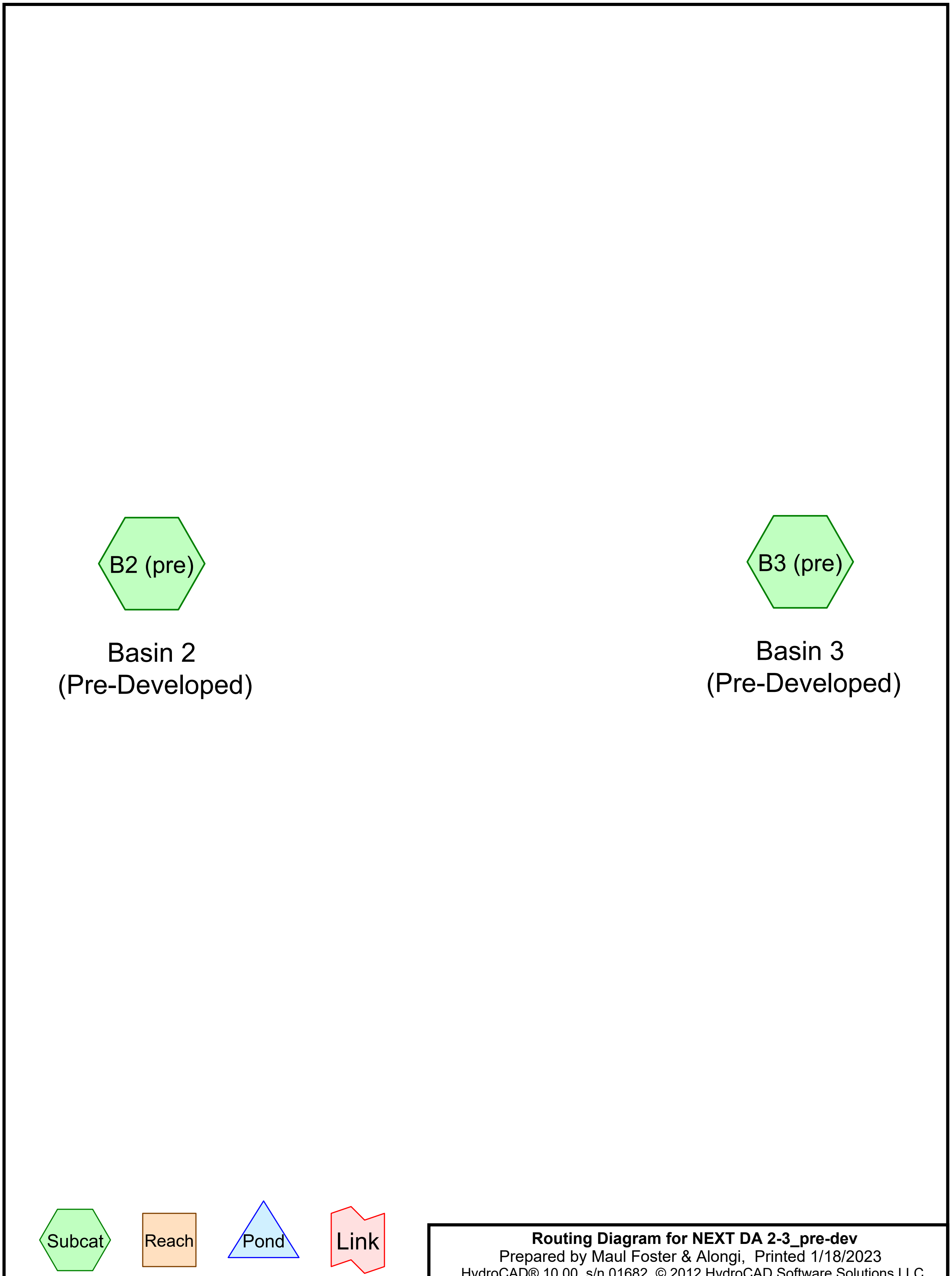


Figure 3 - Geoelectric Model From Dipole-Dipole Resistivity Survey

APPENDIX C

PRE-DEVELOPED AND DEVELOPED HYDROLOGY AND CONVEYANCE CALCULATIONS



Routing Diagram for NEXT DA 2-3_pre-dev
Prepared by Maul Foster & Alongi, Printed 1/18/2023

Area Listing (all nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
565,844	78	Existing Grass or Vegetated Field (B2 (pre), B3 (pre))
565,844	**78**	**TOTAL AREA**

Summary for Subcatchment B2 (pre): Basin 2 (Pre-Developed)

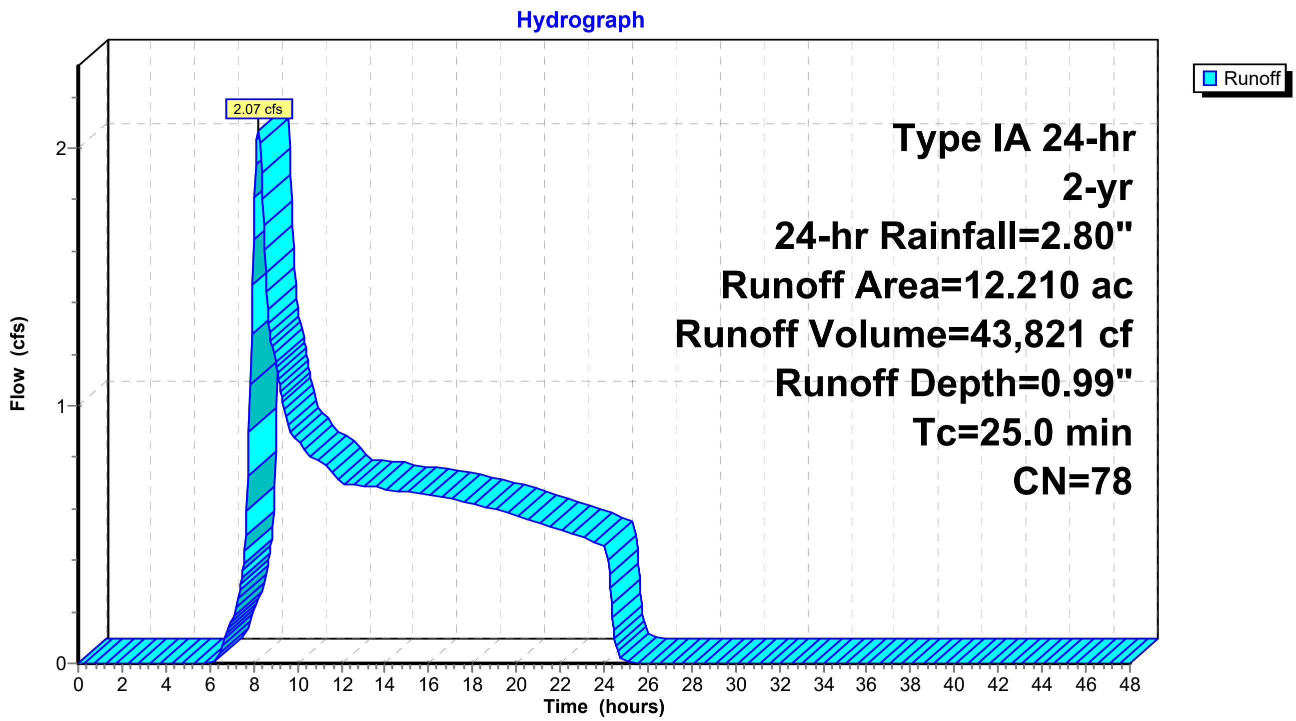
Runoff = 2.07 cfs @ 8.21 hrs, Volume= 43,821 cf, Depth= 0.99"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type IA 24-hr 2-yr, 24-hr Rainfall=2.80"

	Area (ac)	CN	Description
*	12.210	78	Existing Grass or Vegetated Field
	12.210		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
25.0					**Direct Entry, TR-55 Minimum**

Subcatchment B2 (pre): Basin 2 (Pre-Developed)



Summary for Subcatchment B3 (pre): Basin 3 (Pre-Developed)

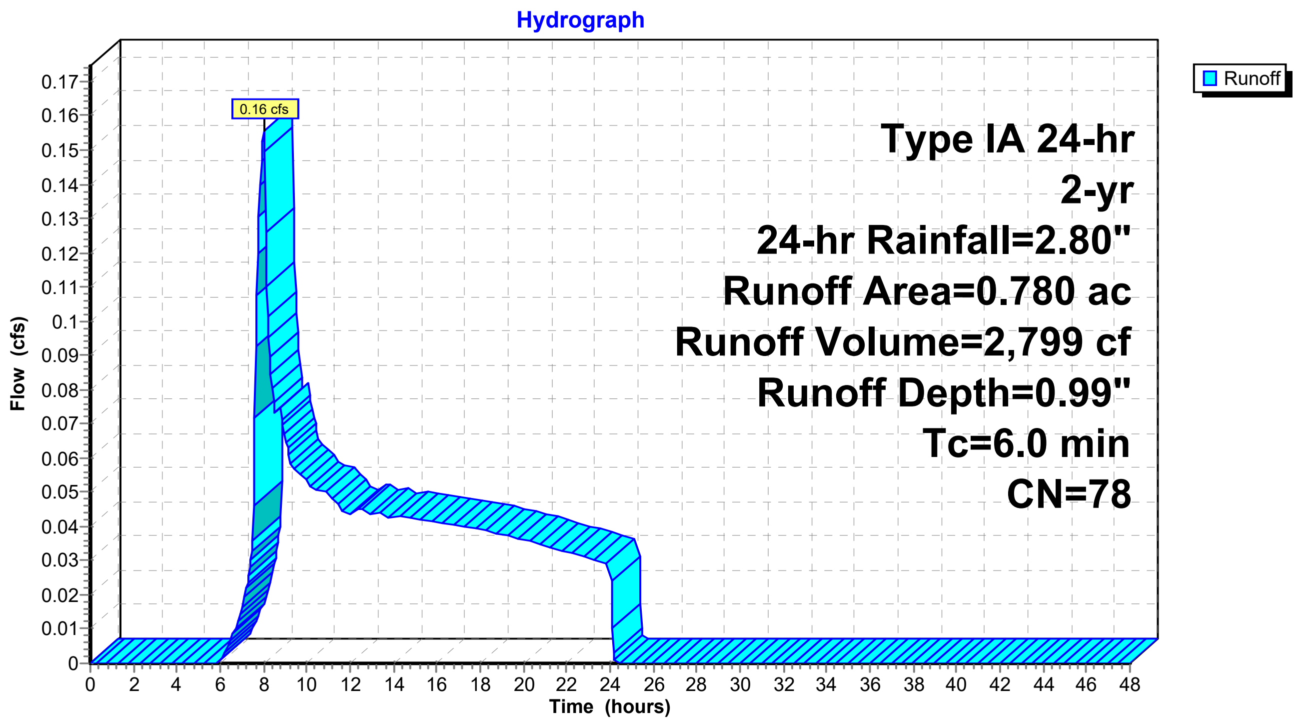
Runoff = 0.16 cfs @ 7.99 hrs, Volume= 2,799 cf, Depth= 0.99"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type IA 24-hr 2-yr, 24-hr Rainfall=2.80"

	Area (ac)	CN	Description
*	0.780	78	Existing Grass or Vegetated Field
	0.780		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, TR-55 Minimum**

Subcatchment B3 (pre): Basin 3 (Pre-Developed)



Summary for Subcatchment B2 (pre): Basin 2 (Pre-Developed)

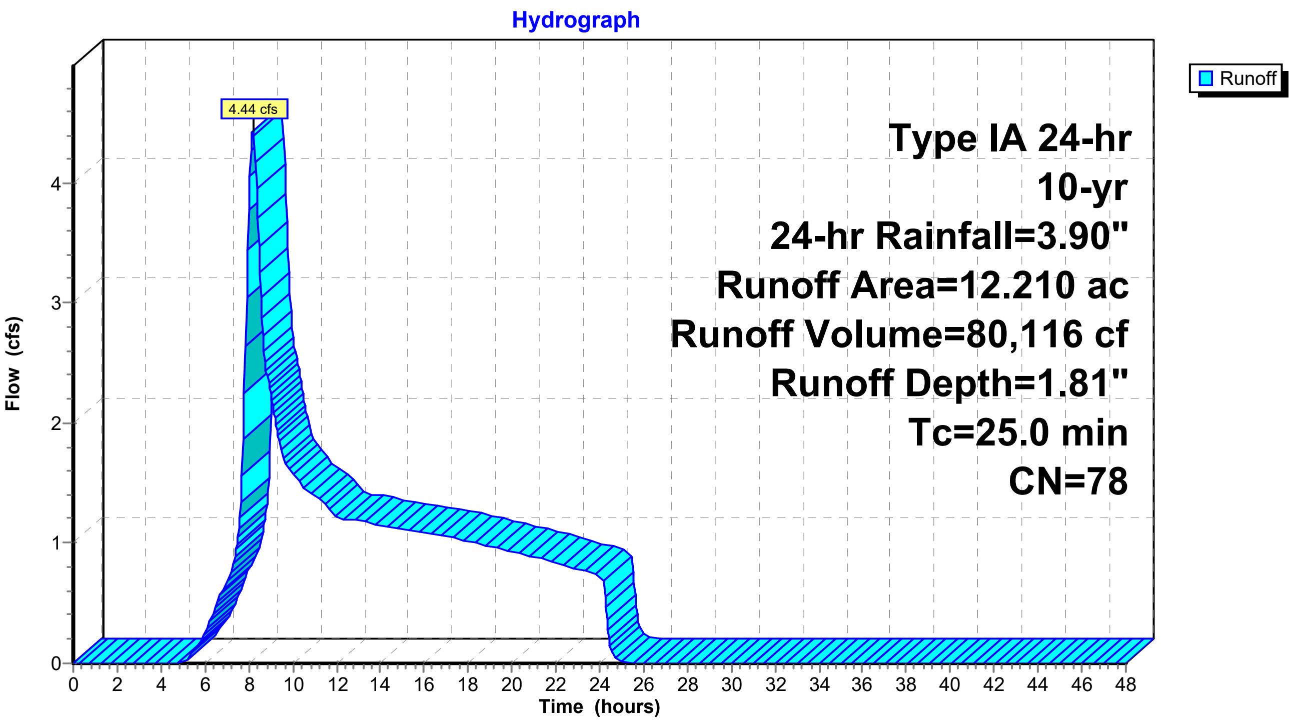
Runoff = 4.44 cfs @ 8.18 hrs, Volume= 80,116 cf, Depth= 1.81"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type IA 24-hr 10-yr, 24-hr Rainfall=3.90"

	Area (ac)	CN	Description
*	12.210	78	Existing Grass or Vegetated Field
	12.210		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
25.0					**Direct Entry, TR-55 Minimum**

Subcatchment B2 (pre): Basin 2 (Pre-Developed)



Summary for Subcatchment B3 (pre): Basin 3 (Pre-Developed)

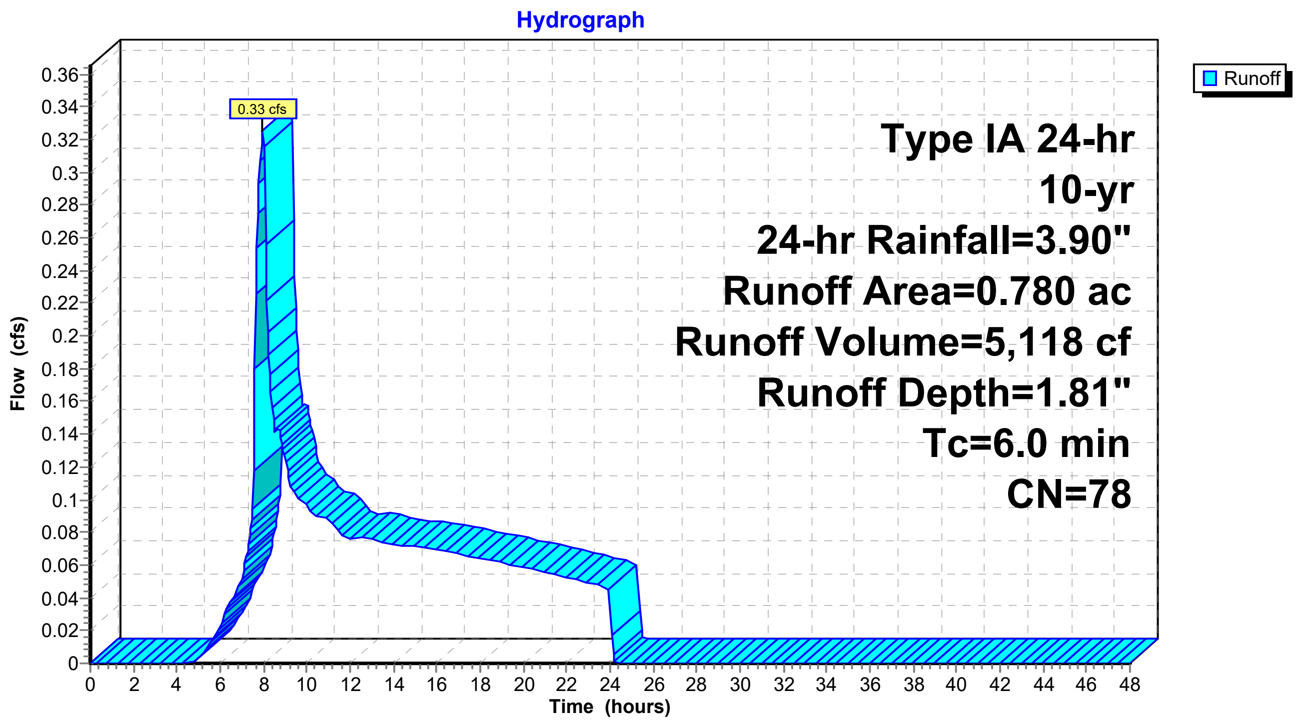
Runoff = 0.33 cfs @ 7.98 hrs, Volume= 5,118 cf, Depth= 1.81"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type IA 24-hr 10-yr, 24-hr Rainfall=3.90"

	Area (ac)	CN	Description
*	0.780	78	Existing Grass or Vegetated Field
	0.780		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, TR-55 Minimum**

Subcatchment B3 (pre): Basin 3 (Pre-Developed)



Summary for Subcatchment B2 (pre): Basin 2 (Pre-Developed)

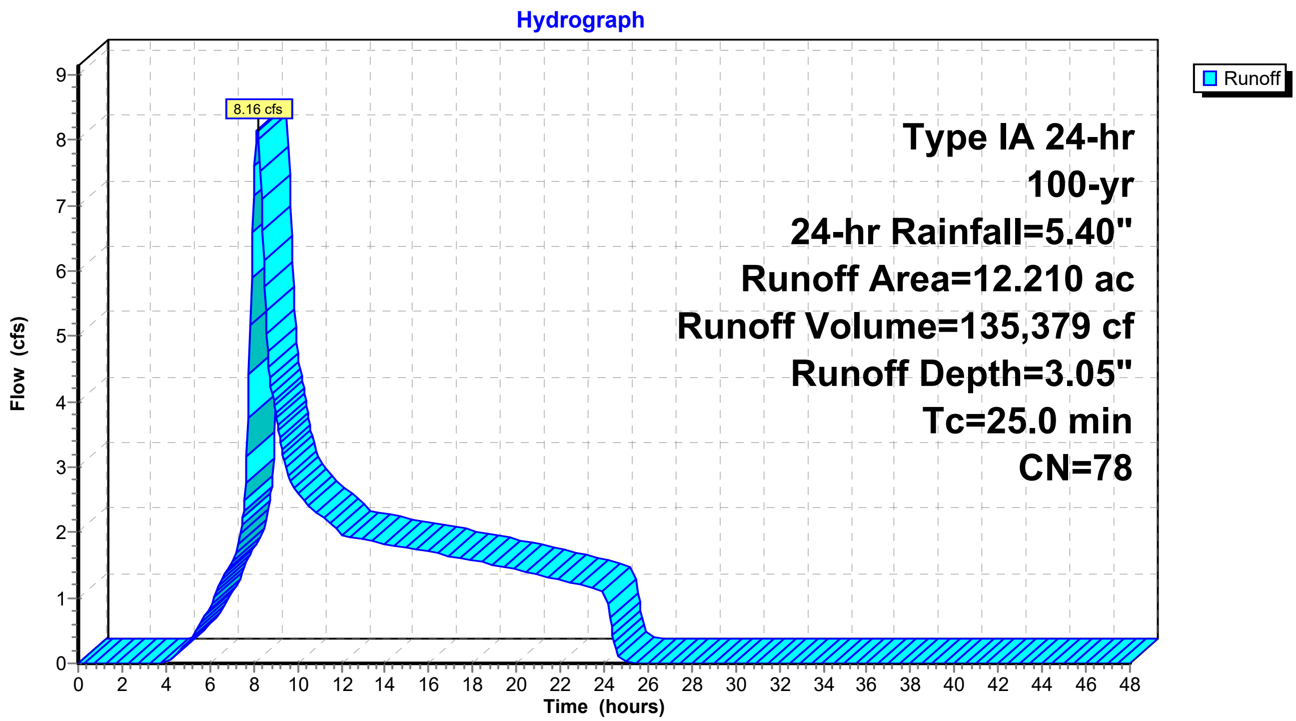
Runoff = 8.16 cfs @ 8.17 hrs, Volume= 135,379 cf, Depth= 3.05"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type IA 24-hr 100-yr, 24-hr Rainfall=5.40"

	Area (ac)	CN	Description
*	12.210	78	Existing Grass or Vegetated Field
	12.210		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
25.0					**Direct Entry, TR-55 Minimum**

Subcatchment B2 (pre): Basin 2 (Pre-Developed)



Summary for Subcatchment B3 (pre): Basin 3 (Pre-Developed)

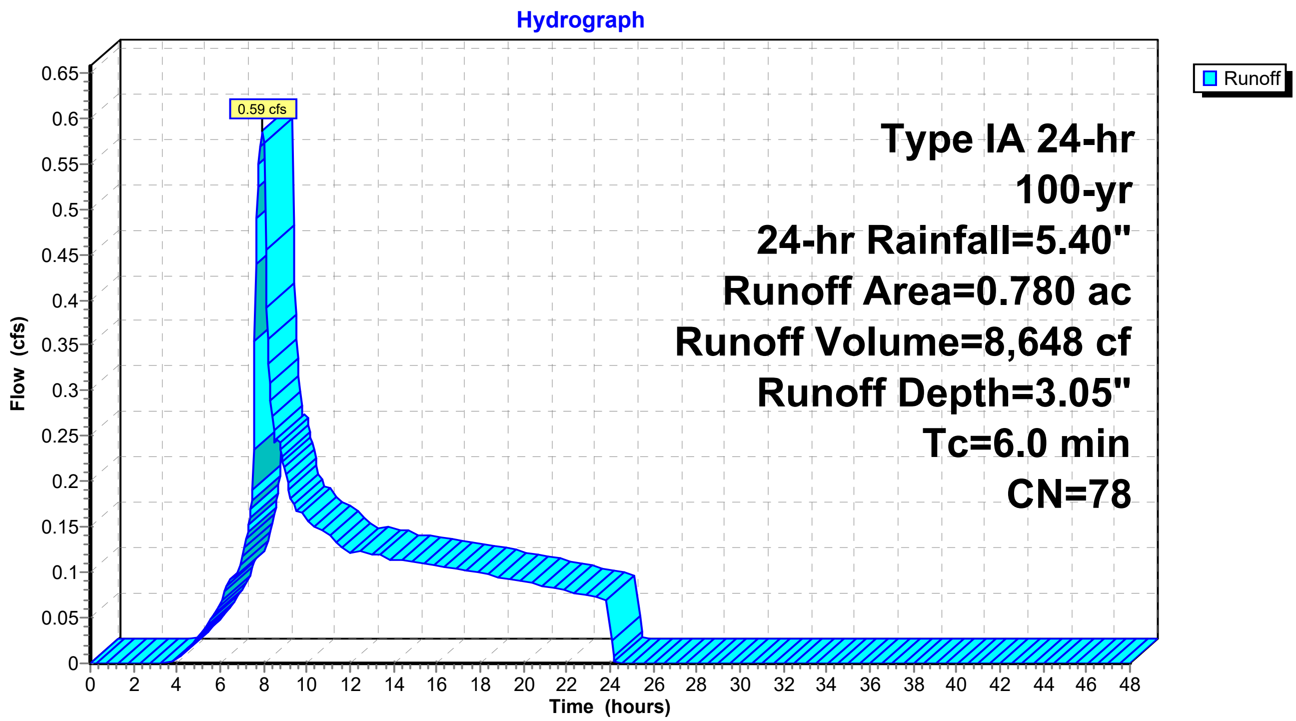
Runoff = 0.59 cfs @ 7.96 hrs, Volume= 8,648 cf, Depth= 3.05"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type IA 24-hr 100-yr, 24-hr Rainfall=5.40"

	Area (ac)	CN	Description
*	0.780	78	Existing Grass or Vegetated Field
	0.780		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, TR-55 Minimum**

Subcatchment B3 (pre): Basin 3 (Pre-Developed)



Summary for Subcatchment B2 (pre): Basin 2 (Pre-Developed)

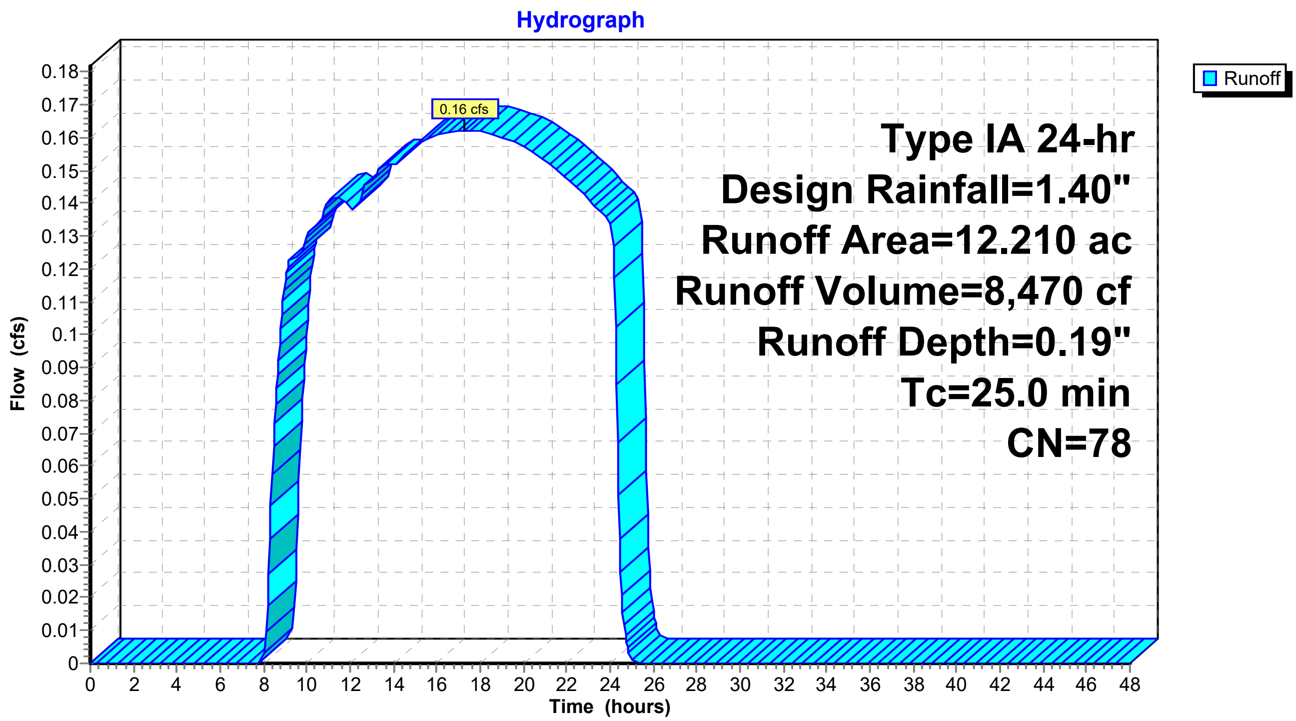
Runoff = 0.16 cfs @ 17.29 hrs, Volume= 8,470 cf, Depth= 0.19"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type IA 24-hr Design Rainfall=1.40"

	Area (ac)	CN	Description
*	12.210	78	Existing Grass or Vegetated Field
	12.210		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
25.0					**Direct Entry, TR-55 Minimum**

Subcatchment B2 (pre): Basin 2 (Pre-Developed)



Summary for Subcatchment B3 (pre): Basin 3 (Pre-Developed)

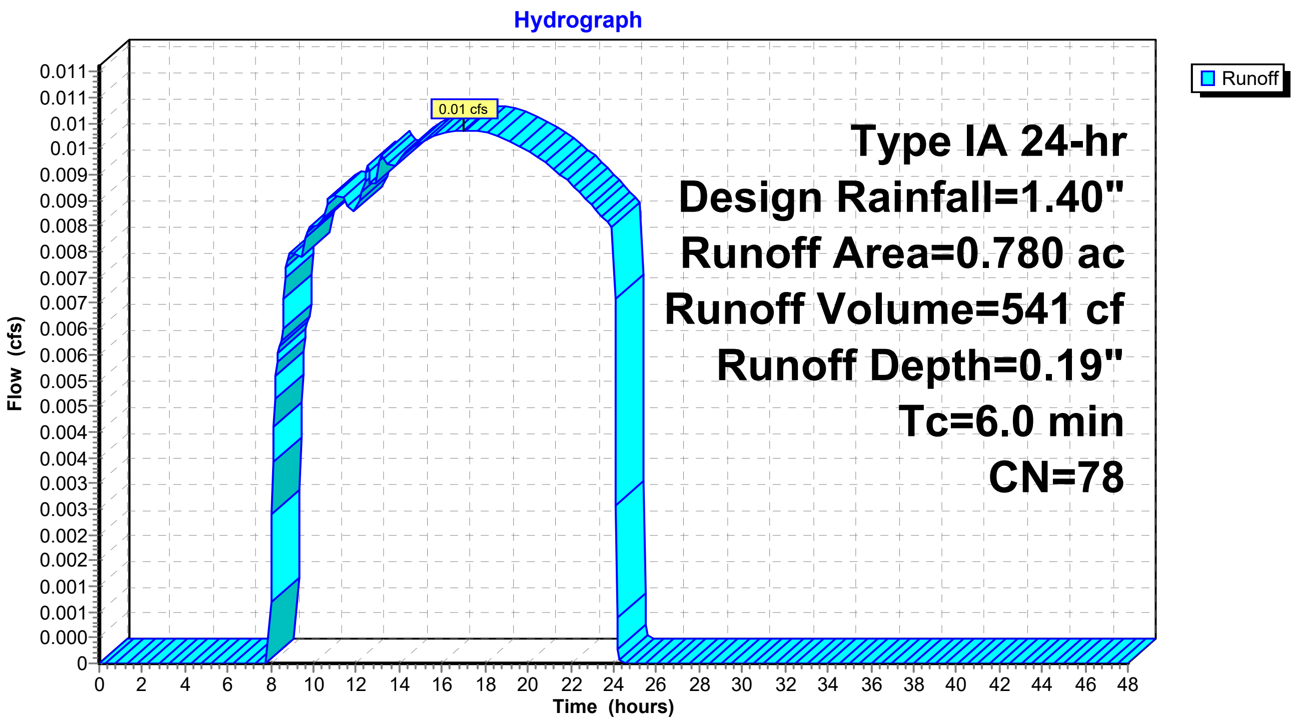
Runoff = 0.01 cfs @ 17.01 hrs, Volume= 541 cf, Depth= 0.19"

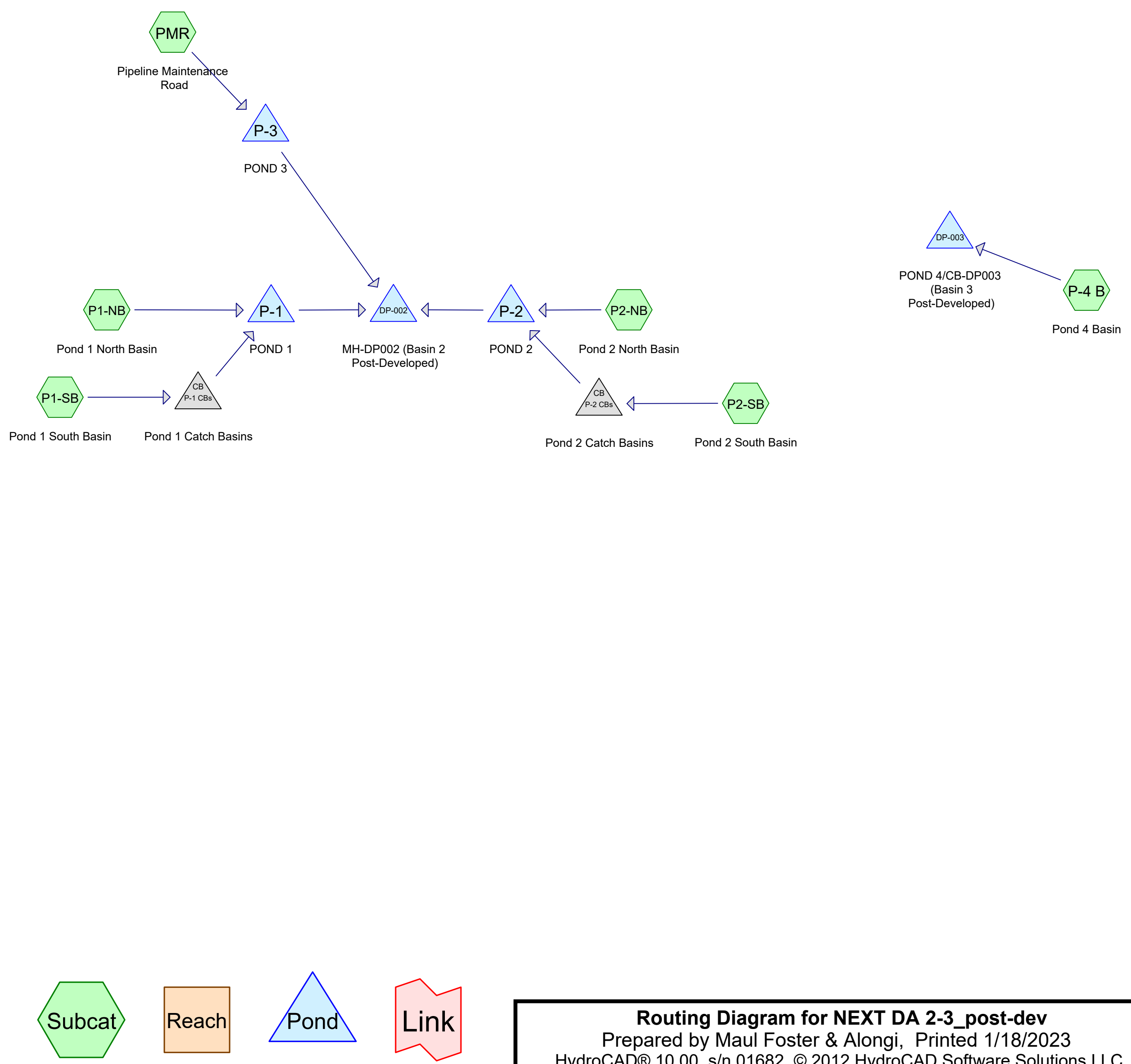
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type IA 24-hr Design Rainfall=1.40"

	Area (ac)	CN	Description
*	0.780	78	Existing Grass or Vegetated Field
	0.780		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, TR-55 Minimum**

Subcatchment B3 (pre): Basin 3 (Pre-Developed)





Routing Diagram for NEXT DA 2-3_post-dev
Prepared by Maul Foster & Alongi, Printed 1/18/2023
HydroCAD® 10.00 s/n 01682 © 2012 HydroCAD Software Solutions LLC

Area Listing (all nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
36,155	92	Gravel Access Road (P1-SB, P2-SB)
27,443	92	Gravel Laydown (P1-NB, P2-NB)
25,265	92	Maintenance Road (PMR)
82,328	98	Paved Road (P1-NB)
34,848	100	Paved Road (P2-NB)
54,450	80	Pipeline (P1-NB, P2-NB, PMR)
54,014	100	Pond 1 (P1-NB)
26,136	100	Pond 2 (P2-NB)
21,344	100	Pond 3 (PMR)
5,227	100	Pond 4 (P-4 B)
199,505	78	Rail/Gravel Base (P-4 B, P1-SB, P2-SB)
566,716	**89**	**TOTAL AREA**

Summary for Subcatchment P-4 B: Pond 4 Basin

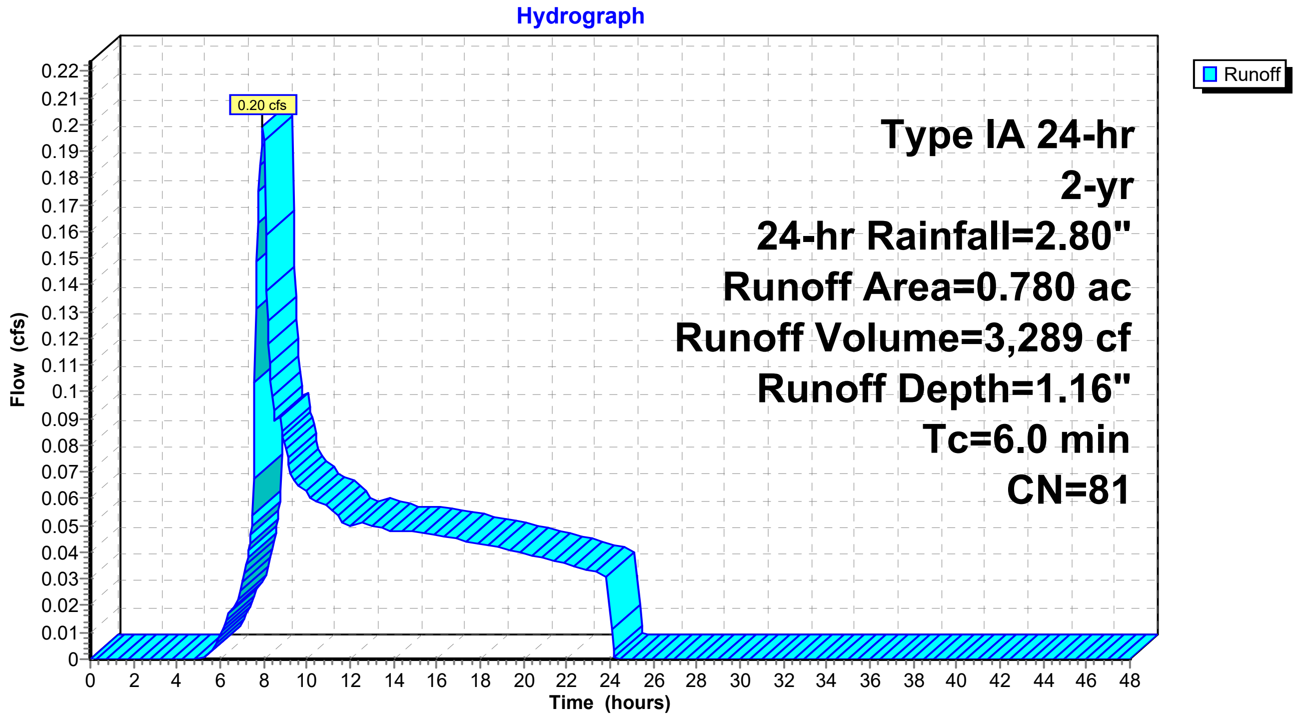
Runoff = 0.20 cfs @ 7.98 hrs, Volume= 3,289 cf, Depth= 1.16"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type IA 24-hr 2-yr, 24-hr Rainfall=2.80"

	Area (ac)	CN	Description
*	0.660	78	Rail/Gravel Base
*	0.120	100	Pond 4
	0.780	81	Weighted Average
	0.660		84.62% Pervious Area
	0.120		15.38% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, TR-55 Minimum**

Subcatchment P-4 B: Pond 4 Basin



Summary for Subcatchment P1-NB: Pond 1 North Basin

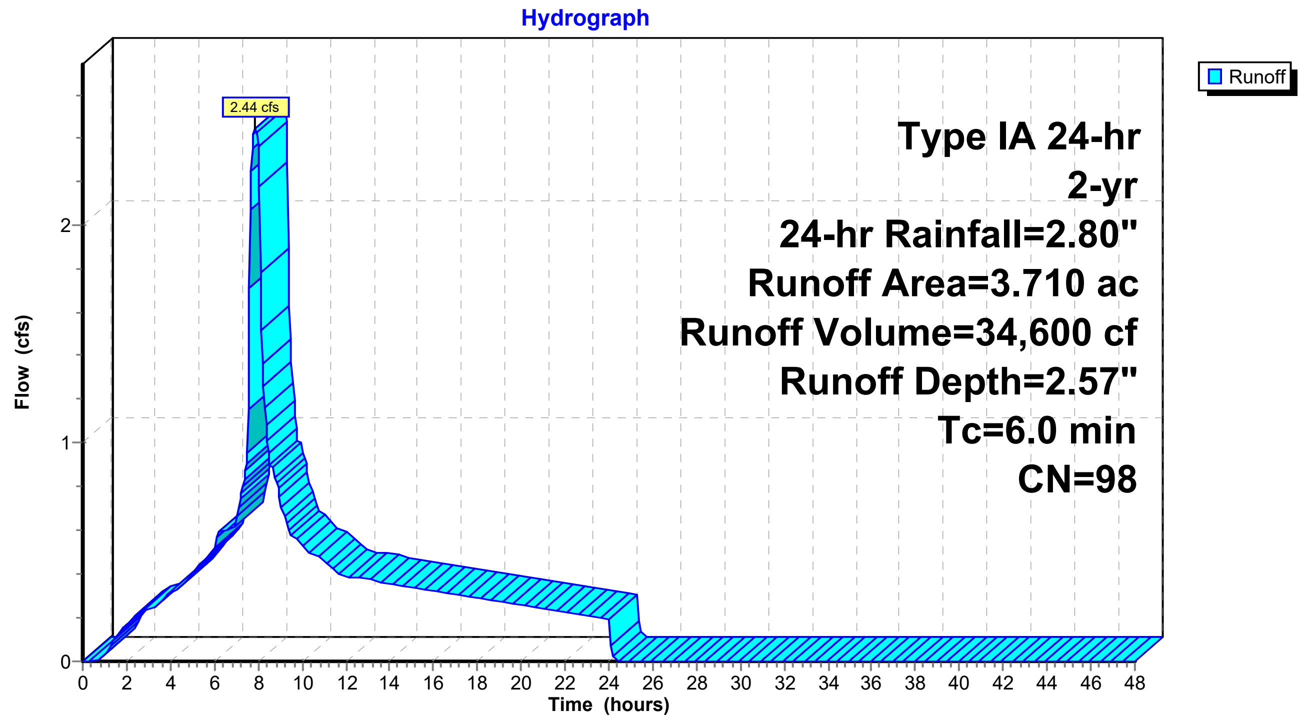
Runoff = 2.44 cfs @ 7.87 hrs, Volume= 34,600 cf, Depth= 2.57"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type IA 24-hr 2-yr, 24-hr Rainfall=2.80"

	Area (ac)	CN	Description
*	1.890	98	Paved Road
*	0.550	92	Gravel Laydown
*	1.240	100	Pond 1
*	0.030	80	Pipeline
	3.710	98	Weighted Average
	0.580		15.63% Pervious Area
	3.130		84.37% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, TR-55 Minimum**

Subcatchment P1-NB: Pond 1 North Basin



Summary for Subcatchment P1-SB: Pond 1 South Basin

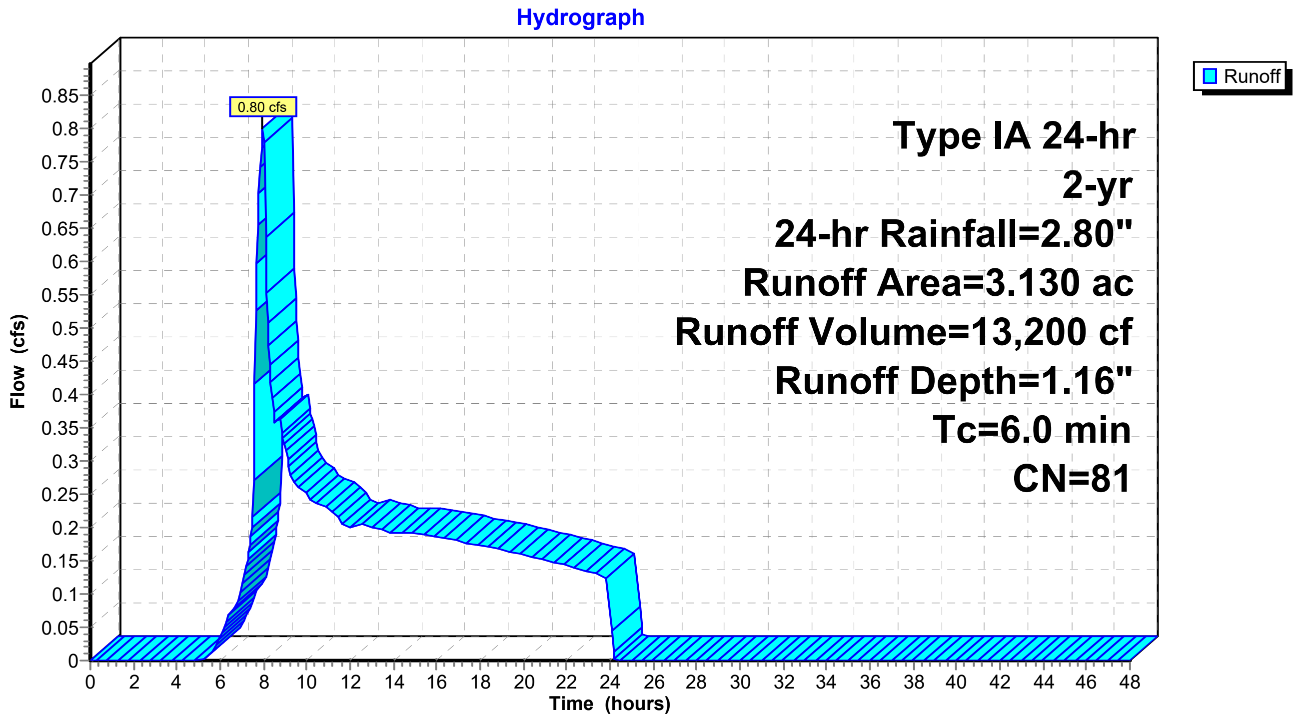
Runoff = 0.80 cfs @ 7.98 hrs, Volume= 13,200 cf, Depth= 1.16"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type IA 24-hr 2-yr, 24-hr Rainfall=2.80"

	Area (ac)	CN	Description
*	2.570	78	Rail/Gravel Base
*	0.560	92	Gravel Access Road
	3.130	81	Weighted Average
	3.130		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, TR-55 Minimum**

Subcatchment P1-SB: Pond 1 South Basin



Summary for Subcatchment P2-NB: Pond 2 North Basin

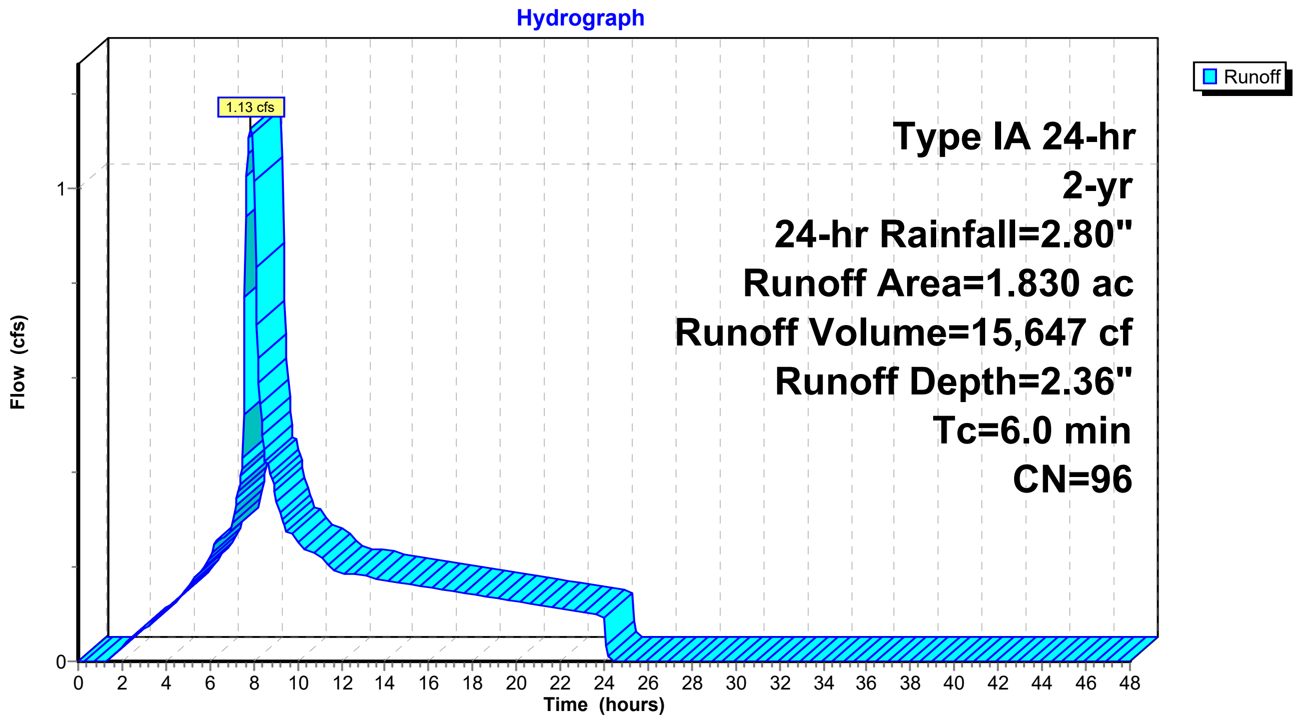
Runoff = 1.13 cfs @ 7.89 hrs, Volume= 15,647 cf, Depth= 2.36"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type IA 24-hr 2-yr, 24-hr Rainfall=2.80"

	Area (ac)	CN	Description
*	0.350	80	Pipeline
*	0.800	100	Paved Road
*	0.080	92	Gravel Laydown
*	0.600	100	Pond 2
	1.830	96	Weighted Average
	0.430		23.50% Pervious Area
	1.400		76.50% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, TR-55 Minimum**

Subcatchment P2-NB: Pond 2 North Basin



Summary for Subcatchment P2-SB: Pond 2 South Basin

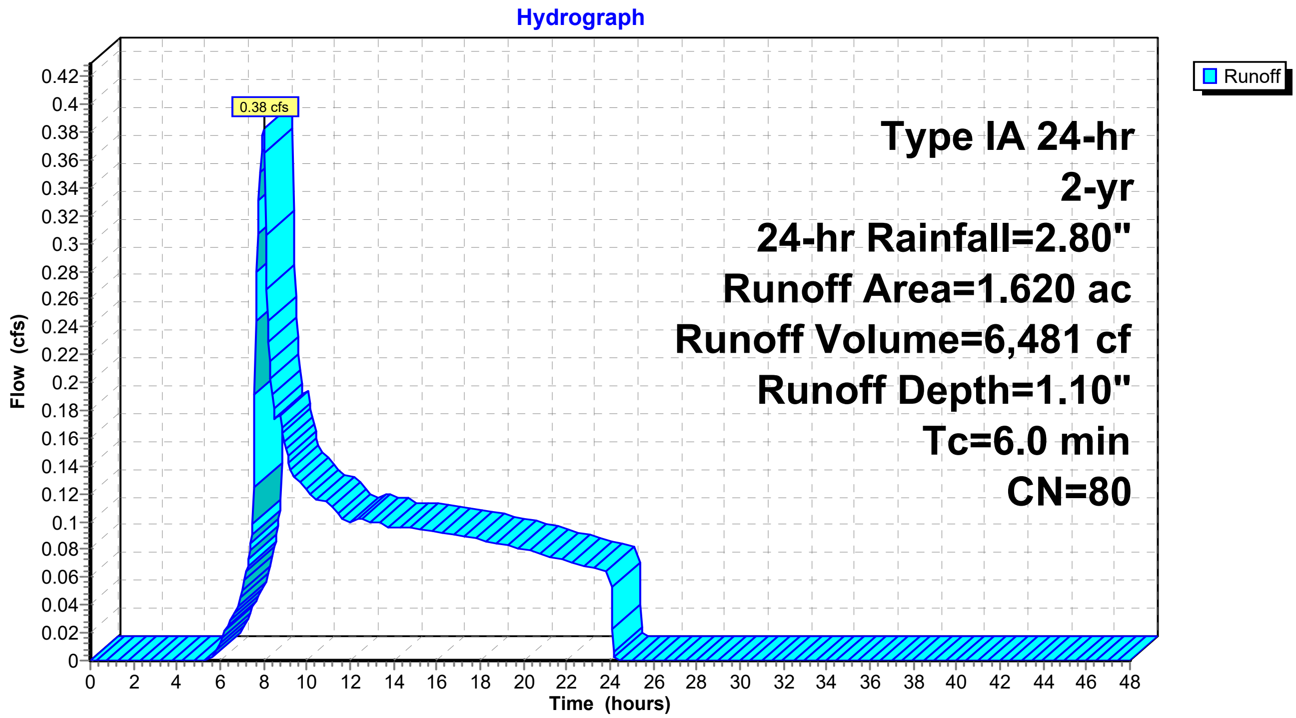
Runoff = 0.38 cfs @ 7.99 hrs, Volume= 6,481 cf, Depth= 1.10"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type IA 24-hr 2-yr, 24-hr Rainfall=2.80"

	Area (ac)	CN	Description
*	1.350	78	Rail/Gravel Base
*	0.270	92	Gravel Access Road
	1.620	80	Weighted Average
	1.620		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, TR-55 Minimum**

Subcatchment P2-SB: Pond 2 South Basin



Summary for Subcatchment PMR: Pipeline Maintenance Road

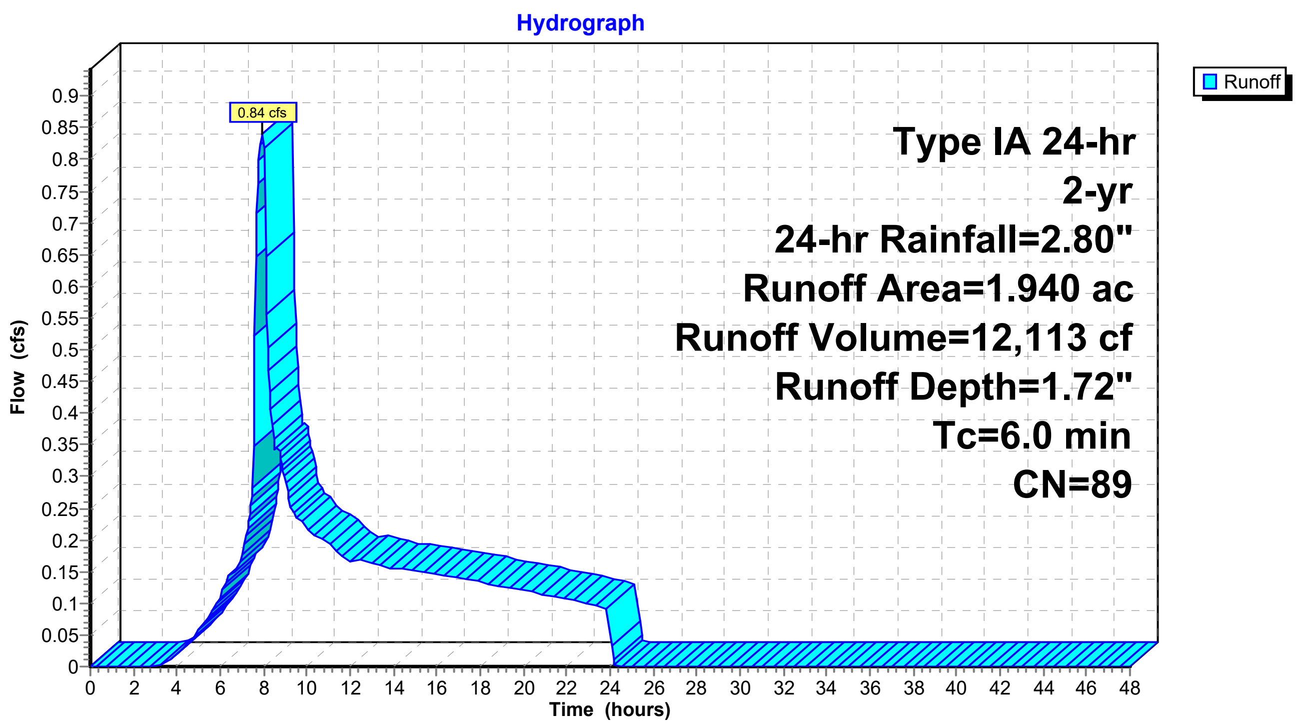
Runoff = 0.84 cfs @ 7.94 hrs, Volume= 12,113 cf, Depth= 1.72"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type IA 24-hr 2-yr, 24-hr Rainfall=2.80"

	Area (ac)	CN	Description
*	0.580	92	Maintenance Road
*	0.490	100	Pond 3
*	0.870	80	Pipeline
	1.940	89	Weighted Average
	1.450		74.74% Pervious Area
	0.490		25.26% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, TR-55 Minimum**

Subcatchment PMR: Pipeline Maintenance Road



Summary for Pond DP-002: MH-DP002 (Basin 2 Post-Developed)

Inflow Area = 532,739 sf, 41.05% Impervious, Inflow Depth > 1.25" for 2-yr, 24-hr event
Inflow = 0.86 cfs @ 16.32 hrs, Volume= 55,284 cf
Outflow = 0.86 cfs @ 16.32 hrs, Volume= 55,282 cf, Atten= 0%, Lag= 0.1 min
Primary = 0.86 cfs @ 16.32 hrs, Volume= 55,282 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs / 2
Starting Elev= -2.52' Surf.Area= 20 sf Storage= 30 cf
Peak Elev= -2.05' @ 16.32 hrs Surf.Area= 20 sf Storage= 39 cf (9 cf above start)

Plug-Flow detention time= 1.7 min calculated for 55,195 cf (100% of inflow)
Center-of-Mass det. time= 0.2 min (1,202.0 - 1,201.8)

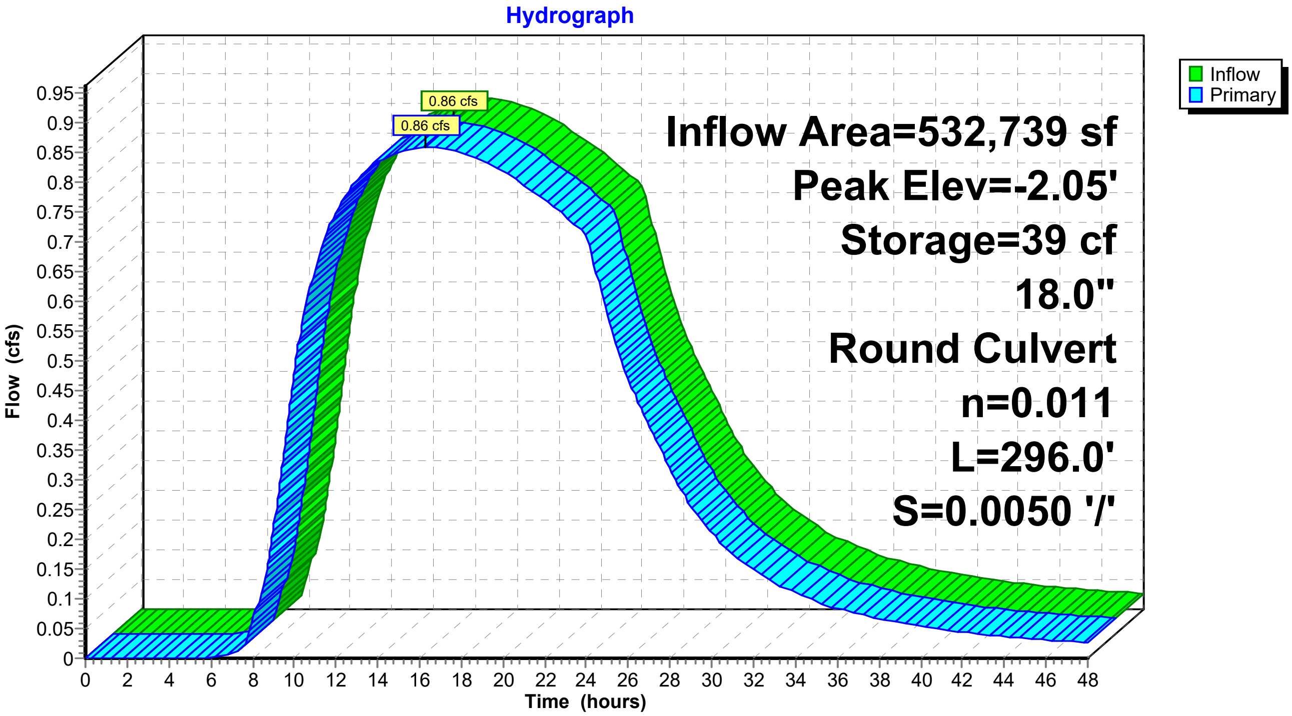
Volume	Invert	Avail.Storage	Storage Description
#1	-4.00'	140 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
-4.00	20	0	0
3.00	20	140	140

Device	Routing	Invert	Outlet Devices
#1	Primary	-2.52'	**18.0" Round Pipe to McLean Slough** L= 296.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= -2.52' / -4.00' S= 0.0050 '/' Cc= 0.900 n= 0.011, Flow Area= 1.77 sf

Primary OutFlow Max=0.86 cfs @ 16.32 hrs HW=-2.05' (Free Discharge)
└─**1=Pipe to McLean Slough** (Inlet Controls 0.86 cfs @ 1.83 fps)

Pond DP-002: MH-DP002 (Basin 2 Post-Developed)



Summary for Pond DP-003: POND 4/CB-DP003 (Basin 3 Post-Developed)

Inflow Area = 33,977 sf, 15.38% Impervious, Inflow Depth = 1.16" for 2-yr, 24-hr event
Inflow = 0.20 cfs @ 7.98 hrs, Volume= 3,289 cf
Outflow = 0.06 cfs @ 10.98 hrs, Volume= 3,201 cf, Atten= 71%, Lag= 180.1 min
Primary = 0.06 cfs @ 10.98 hrs, Volume= 3,201 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs / 2
Starting Elev= 2.00' Surf.Area= 0 sf Storage= 3,518 cf
Peak Elev= 2.16' @ 10.98 hrs Surf.Area= 0 sf Storage= 4,233 cf (715 cf above start)
Flood Elev= 3.00' Surf.Area= 0 sf Storage= 8,061 cf (4,543 cf above start)

Plug-Flow detention time= (not calculated: initial storage excedes outflow)
Center-of-Mass det. time= 226.8 min (1,055.8 - 829.0)

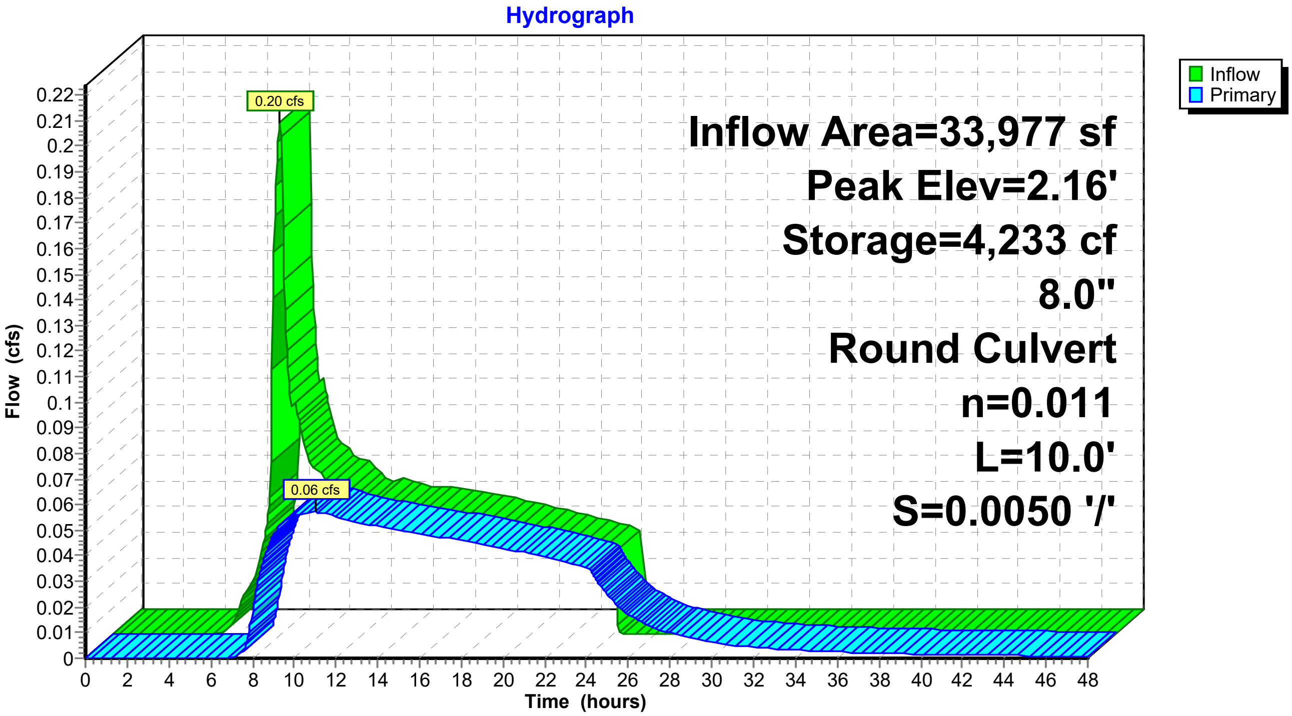
Volume	Invert	Avail.Storage	Storage Description
#1	1.00'	8,061 cf	**Custom Stage Data** Listed below

Elevation (feet)	Cum.Store (cubic-feet)
1.00	0
2.00	3,518
3.00	8,061

Device	Routing	Invert	Outlet Devices
#1	Primary	2.00'	**8.0" Round Pipe to CB-DP-003** L= 10.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 2.00' / 1.95' S= 0.0050 '/' Cc= 0.900 n= 0.011, Flow Area= 0.35 sf

Primary OutFlow Max=0.06 cfs @ 10.98 hrs HW=2.16' (Free Discharge)
↑—**1=Pipe to CB-DP-003** (Barrel Controls 0.06 cfs @ 1.37 fps)

Pond DP-003: POND 4/CB-DP003 (Basin 3 Post-Developed)



Summary for Pond P-1: POND 1

Inflow Area = 297,950 sf, 45.76% Impervious, Inflow Depth = 1.93" for 2-yr, 24-hr event
Inflow = 3.21 cfs @ 7.91 hrs, Volume= 47,799 cf
Outflow = 0.45 cfs @ 18.59 hrs, Volume= 30,061 cf, Atten= 86%, Lag= 640.4 min
Primary = 0.45 cfs @ 18.59 hrs, Volume= 30,061 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 0.50' @ 18.59 hrs Surf.Area= 0 sf Storage= 27,509 cf
Flood Elev= 2.35' Surf.Area= 0 sf Storage= 102,326 cf

Plug-Flow detention time= 761.7 min calculated for 30,030 cf (63% of inflow)
Center-of-Mass det. time= 543.5 min (1,256.9 - 713.4)

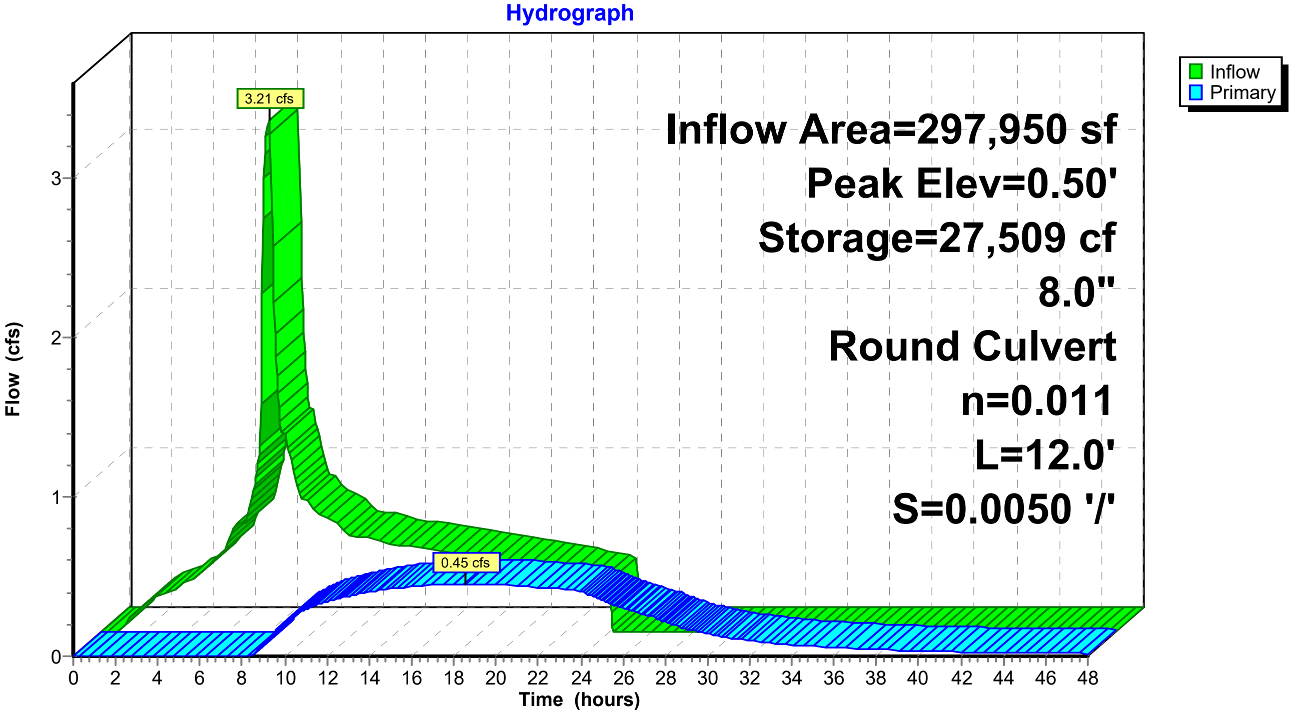
Volume	Invert	Avail.Storage	Storage Description
#1	-1.15'	102,326 cf	**Custom Stage Data**Listed below

Elevation (feet)	Cum.Store (cubic-feet)
-1.15	0
-0.65	4,073
0.35	22,730
1.35	55,457
2.35	102,326

Device	Routing	Invert	Outlet Devices
#1	Primary	0.00'	**8.0" Round Pipe to MH-DP002** L= 12.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 0.00' / -0.06' S= 0.0050 '/' Cc= 0.900 n= 0.011, Flow Area= 0.35 sf

Primary OutFlow Max=0.45 cfs @ 18.59 hrs HW=0.50' TW=-2.06' (Dynamic Tailwater)
↑—**1=Pipe to MH-DP002** (Barrel Controls 0.45 cfs @ 2.26 fps)

Pond P-1: POND 1



Summary for Pond P-1 CBs: Pond 1 Catch Basins

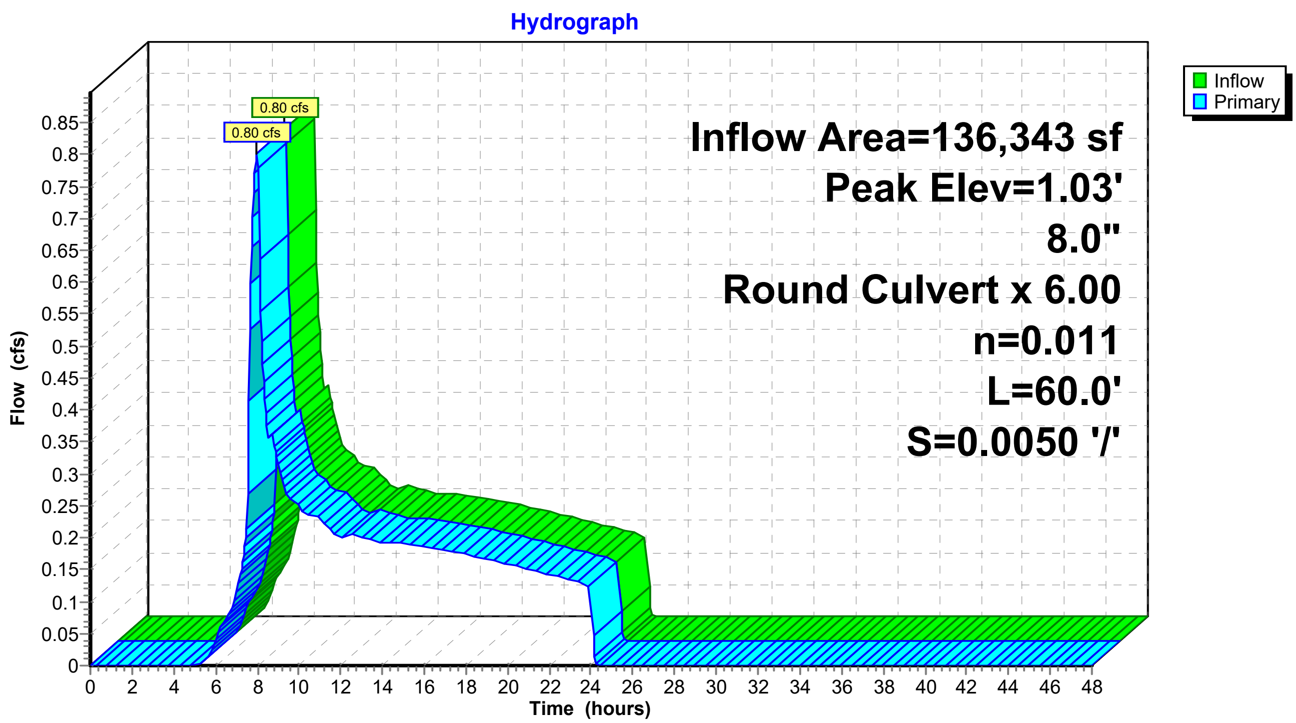
Inflow Area = 136,343 sf, 0.00% Impervious, Inflow Depth = 1.16" for 2-yr, 24-hr event
Inflow = 0.80 cfs @ 7.98 hrs, Volume= 13,200 cf
Outflow = 0.80 cfs @ 7.98 hrs, Volume= 13,200 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.80 cfs @ 7.98 hrs, Volume= 13,200 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 1.03' @ 7.98 hrs
Flood Elev= 2.35'

Device	Routing	Invert	Outlet Devices
#1	Primary	0.80'	**8.0" Round Storm Pipe Under Tracks to Pond X 6.00** L= 60.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 0.80' / 0.50' S= 0.0050 '/' Cc= 0.900 n= 0.011, Flow Area= 0.35 sf

Primary OutFlow Max=0.80 cfs @ 7.98 hrs HW=1.03' TW=-0.13' (Dynamic Tailwater)
1=Storm Pipe Under Tracks to Pond(Barrel Controls 0.80 cfs @ 1.88 fps)

Pond P-1 CBs: Pond 1 Catch Basins



Summary for Pond P-2: POND 2

Inflow Area = 150,282 sf, 40.58% Impervious, Inflow Depth = 1.77" for 2-yr, 24-hr event
Inflow = 1.50 cfs @ 7.93 hrs, Volume= 22,128 cf
Outflow = 0.26 cfs @ 14.50 hrs, Volume= 13,985 cf, Atten= 82%, Lag= 394.5 min
Primary = 0.26 cfs @ 14.50 hrs, Volume= 13,985 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 0.35' @ 14.50 hrs Surf.Area= 0 sf Storage= 10,934 cf
Flood Elev= 2.35' Surf.Area= 0 sf Storage= 49,476 cf

Plug-Flow detention time= 601.1 min calculated for 13,985 cf (63% of inflow)
Center-of-Mass det. time= 386.7 min (1,124.3 - 737.6)

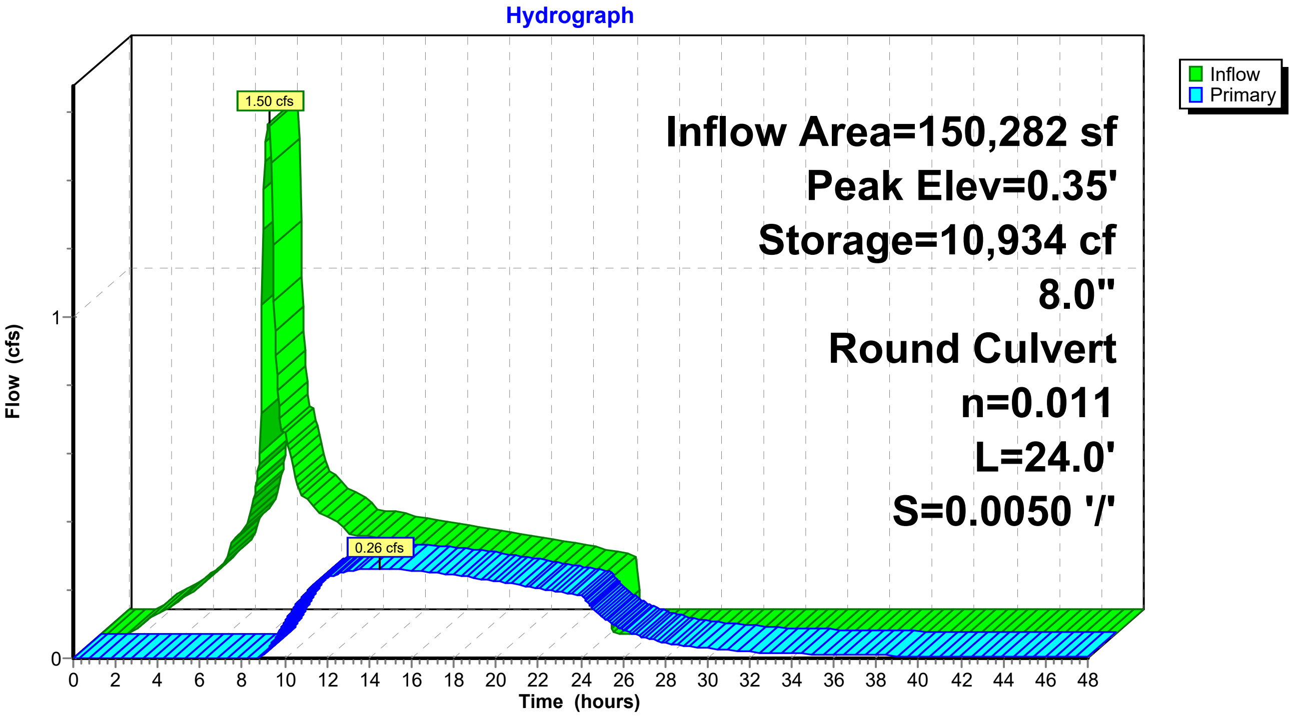
Volume	Invert	Avail.Storage	Storage Description
#1	-1.15'	49,476 cf	**Custom Stage Data** Listed below

Elevation (feet)	Cum.Store (cubic-feet)
-1.15	0
-0.65	1,959
0.35	10,959
1.35	26,767
2.35	49,476

Device	Routing	Invert	Outlet Devices
#1	Primary	0.00'	**8.0" Round Pipe to MH-DP002** L= 24.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 0.00' / -0.12' S= 0.0050 '/' Cc= 0.900 n= 0.011, Flow Area= 0.35 sf

Primary OutFlow Max=0.26 cfs @ 14.50 hrs HW=0.35' TW=-2.06' (Dynamic Tailwater)
└─**1=Pipe to MH-DP002** (Barrel Controls 0.26 cfs @ 2.08 fps)

Pond P-2: POND 2



Summary for Pond P-2 CBs: Pond 2 Catch Basins

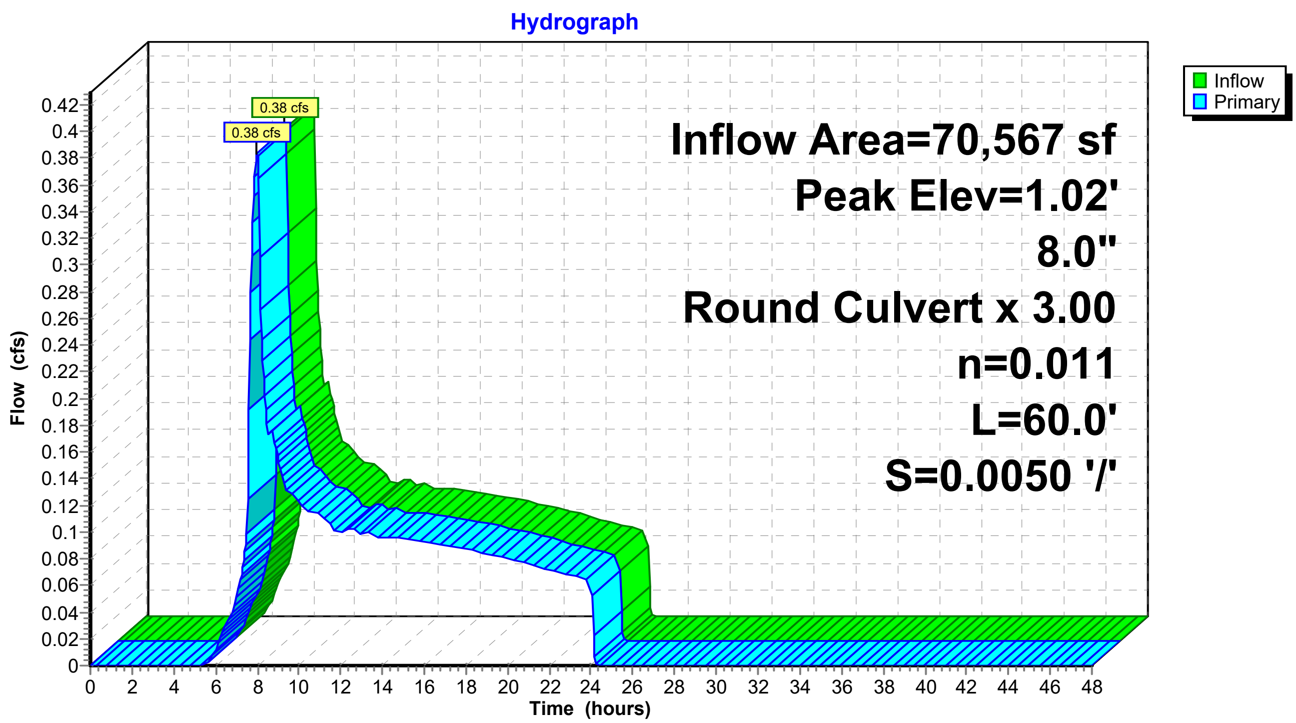
Inflow Area =	70,567 sf,	0.00% Impervious,	Inflow Depth = 1.10"	for 2-yr, 24-hr event
Inflow =	0.38 cfs @	7.99 hrs, Volume=	6,481 cf	
Outflow =	0.38 cfs @	7.99 hrs, Volume=	6,481 cf, Atten= 0%, Lag= 0.0 min	
Primary =	0.38 cfs @	7.99 hrs, Volume=	6,481 cf	

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 1.02' @ 7.99 hrs
Flood Elev= 2.35'

Device	Routing	Invert	Outlet Devices
#1	Primary	0.80'	**8.0" Round Storm Pipe Under Tracks to Pond 2 X 3.00** L= 60.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 0.80' / 0.50' S= 0.0050 '/' Cc= 0.900 n= 0.011, Flow Area= 0.35 sf

Primary OutFlow Max=0.38 cfs @ 7.99 hrs HW=1.02' TW=-0.24' (Dynamic Tailwater)
└─**1=Storm Pipe Under Tracks to Pond 2**(Barrel Controls 0.38 cfs @ 1.86 fps)

Pond P-2 CBs: Pond 2 Catch Basins



Summary for Pond P-3: POND 3

Inflow Area = 84,506 sf, 25.26% Impervious, Inflow Depth = 1.72" for 2-yr, 24-hr event
Inflow = 0.84 cfs @ 7.94 hrs, Volume= 12,113 cf
Outflow = 0.17 cfs @ 11.72 hrs, Volume= 11,237 cf, Atten= 80%, Lag= 226.8 min
Primary = 0.17 cfs @ 11.72 hrs, Volume= 11,237 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs / 2
Starting Elev= -1.00' Surf.Area= 0 sf Storage= 6,229 cf
Peak Elev= -0.74' @ 11.72 hrs Surf.Area= 0 sf Storage= 10,407 cf (4,178 cf above start)

Plug-Flow detention time= 1,100.2 min calculated for 5,003 cf (41% of inflow)
Center-of-Mass det. time= 384.9 min (1,151.1 - 766.1)

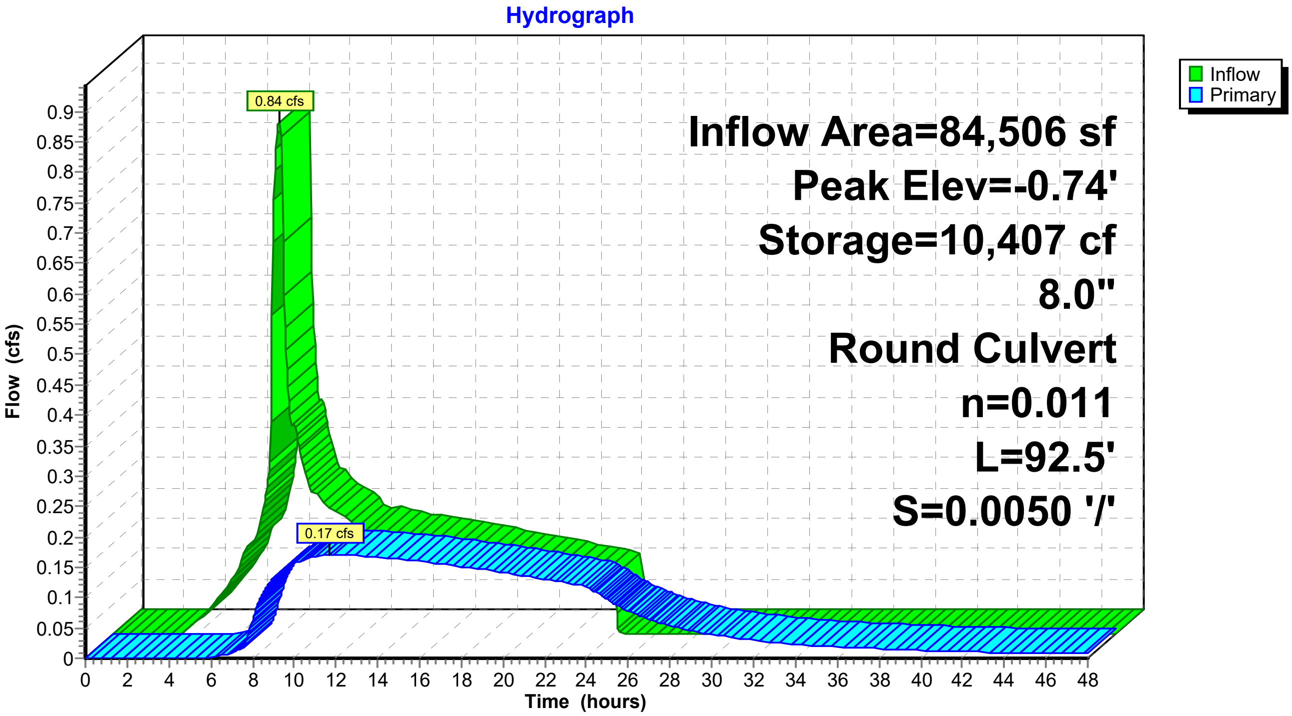
Volume	Invert	Avail.Storage	Storage Description
#1	-2.00'	22,444 cf	**Custom Stage Data** Listed below

Elevation (feet)	Cum.Store (cubic-feet)
-2.00	0
-1.00	6,229
0.00	22,444

Device	Routing	Invert	Outlet Devices
#1	Primary	-1.00'	**8.0" Round Pipe to MH-DP002** L= 92.5' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= -1.00' / -1.46' S= 0.0050 '/' Cc= 0.900 n= 0.011, Flow Area= 0.35 sf

Primary OutFlow Max=0.17 cfs @ 11.72 hrs HW=-0.74' TW=-2.09' (Dynamic Tailwater)
└─**1=Pipe to MH-DP002** (Inlet Controls 0.17 cfs @ 1.36 fps)

Pond P-3: POND 3



Summary for Subcatchment P-4 B: Pond 4 Basin

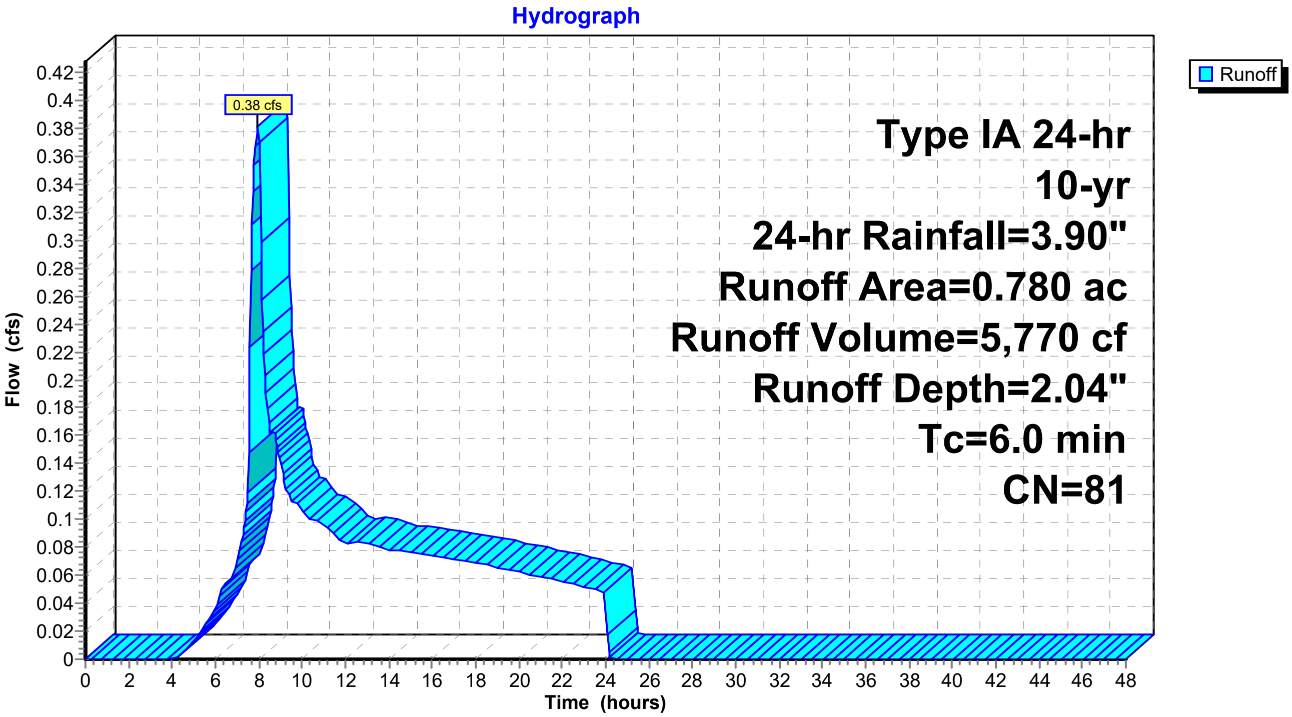
Runoff = 0.38 cfs @ 7.97 hrs, Volume= 5,770 cf, Depth= 2.04"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type IA 24-hr 10-yr, 24-hr Rainfall=3.90"

	Area (ac)	CN	Description
*	0.660	78	Rail/Gravel Base
*	0.120	100	Pond 4
	0.780	81	Weighted Average
	0.660		84.62% Pervious Area
	0.120		15.38% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, TR-55 Minimum**

Subcatchment P-4 B: Pond 4 Basin



Summary for Subcatchment P1-NB: Pond 1 North Basin

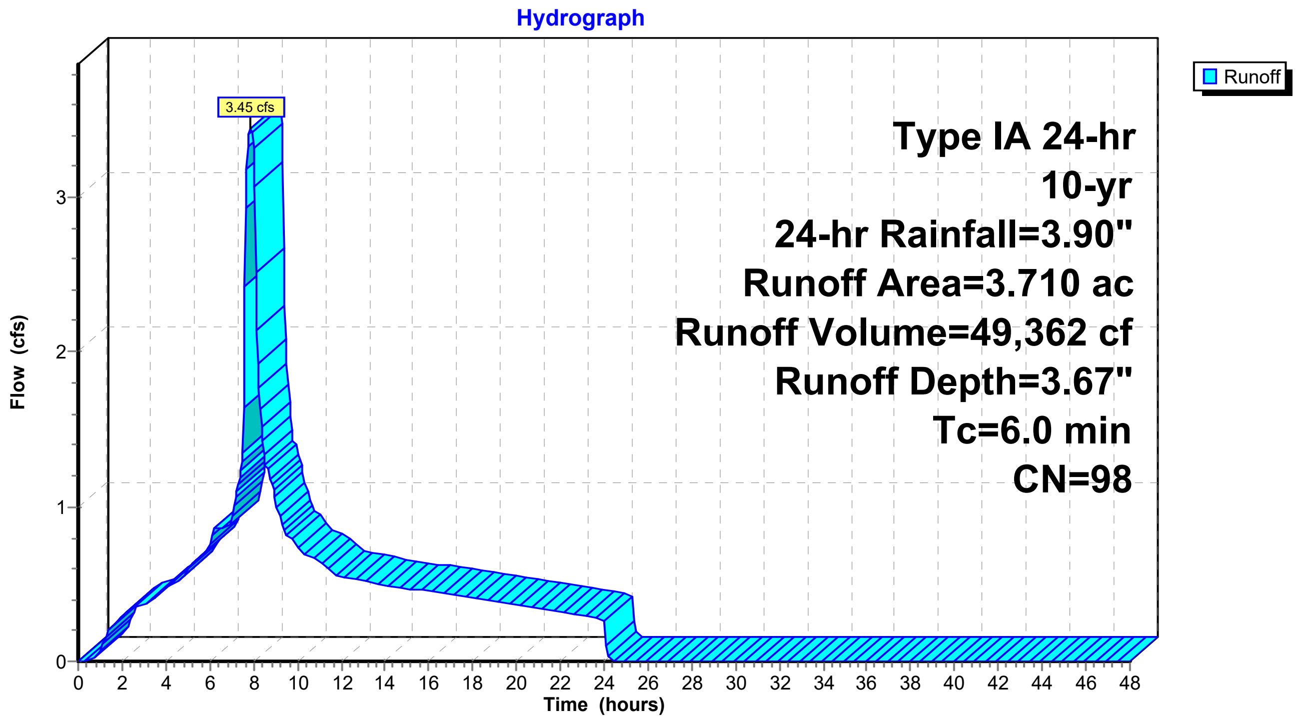
Runoff = 3.45 cfs @ 7.87 hrs, Volume= 49,362 cf, Depth= 3.67"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type IA 24-hr 10-yr, 24-hr Rainfall=3.90"

	Area (ac)	CN	Description
*	1.890	98	Paved Road
*	0.550	92	Gravel Laydown
*	1.240	100	Pond 1
*	0.030	80	Pipeline
	3.710	98	Weighted Average
	0.580		15.63% Pervious Area
	3.130		84.37% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, TR-55 Minimum**

Subcatchment P1-NB: Pond 1 North Basin



Summary for Subcatchment P1-SB: Pond 1 South Basin

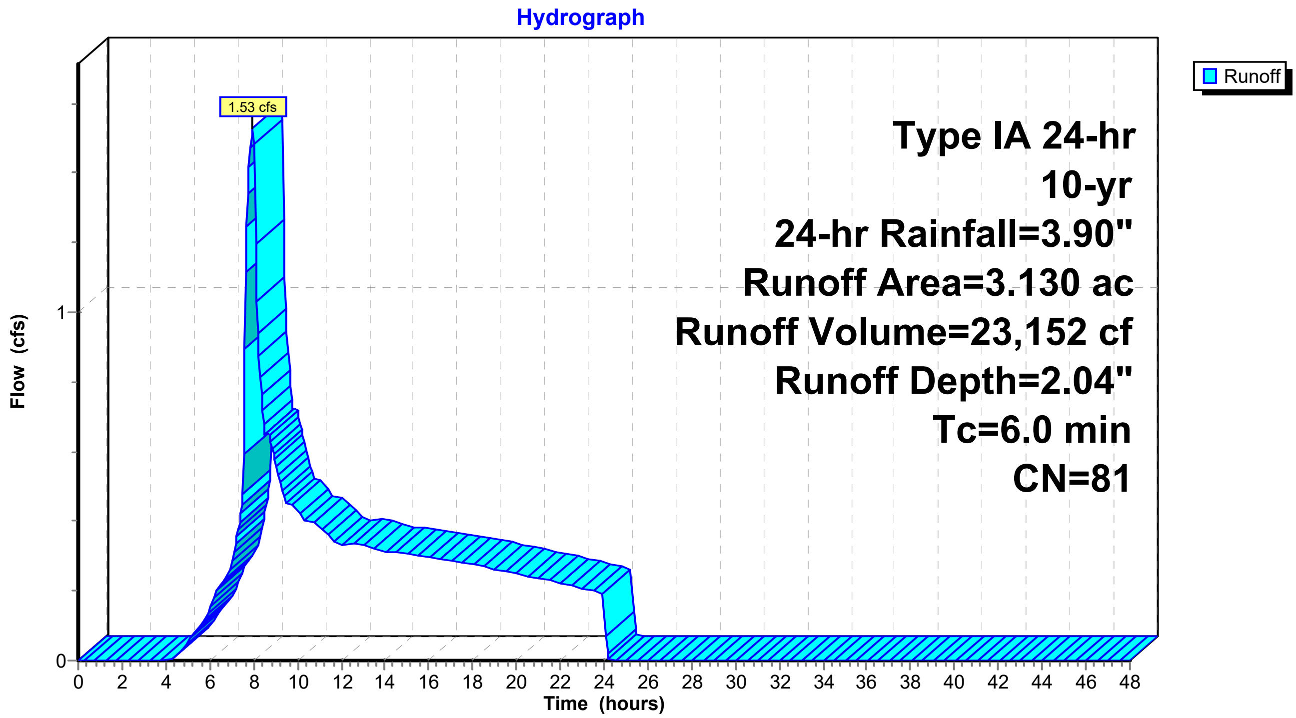
Runoff = 1.53 cfs @ 7.97 hrs, Volume= 23,152 cf, Depth= 2.04"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type IA 24-hr 10-yr, 24-hr Rainfall=3.90"

	Area (ac)	CN	Description
*	2.570	78	Rail/Gravel Base
*	0.560	92	Gravel Access Road
	3.130	81	Weighted Average
	3.130		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, TR-55 Minimum**

Subcatchment P1-SB: Pond 1 South Basin



Summary for Subcatchment P2-NB: Pond 2 North Basin

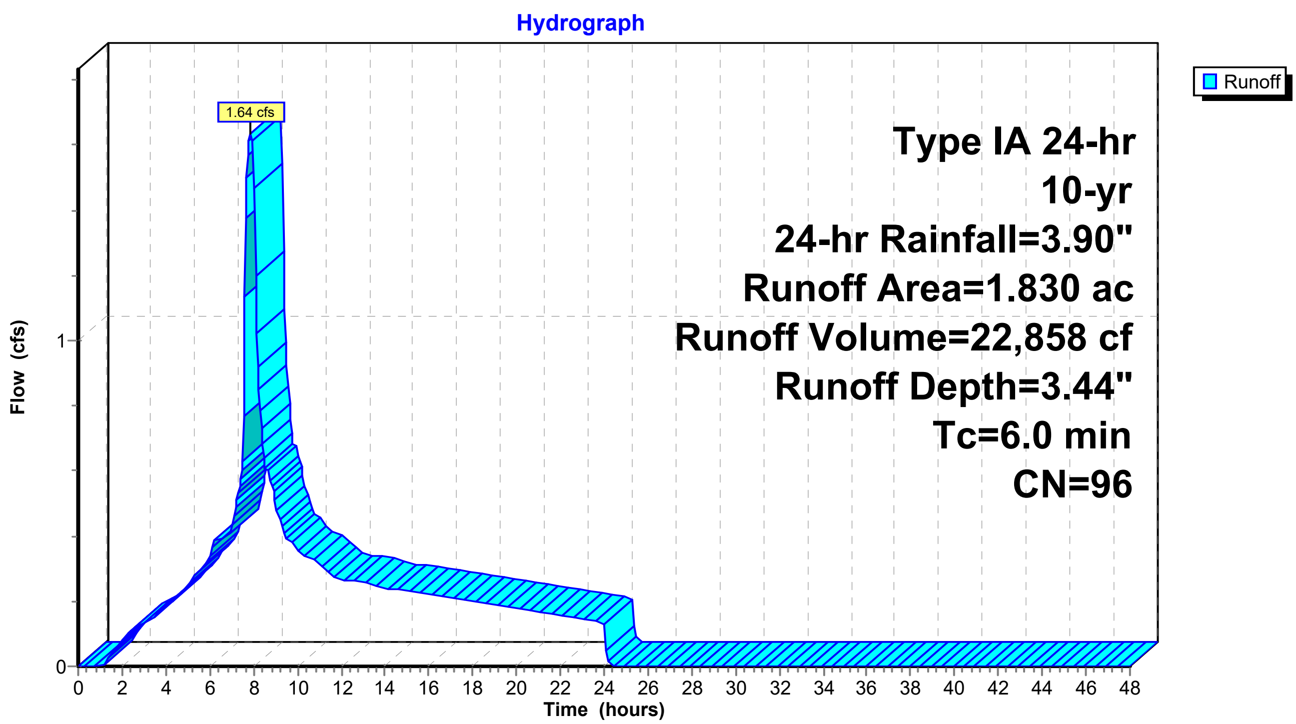
Runoff = 1.64 cfs @ 7.88 hrs, Volume= 22,858 cf, Depth= 3.44"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type IA 24-hr 10-yr, 24-hr Rainfall=3.90"

	Area (ac)	CN	Description
*	0.350	80	Pipeline
*	0.800	100	Paved Road
*	0.080	92	Gravel Laydown
*	0.600	100	Pond 2
	1.830	96	Weighted Average
	0.430		23.50% Pervious Area
	1.400		76.50% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, TR-55 Minimum**

Subcatchment P2-NB: Pond 2 North Basin



Summary for Subcatchment P2-SB: Pond 2 South Basin

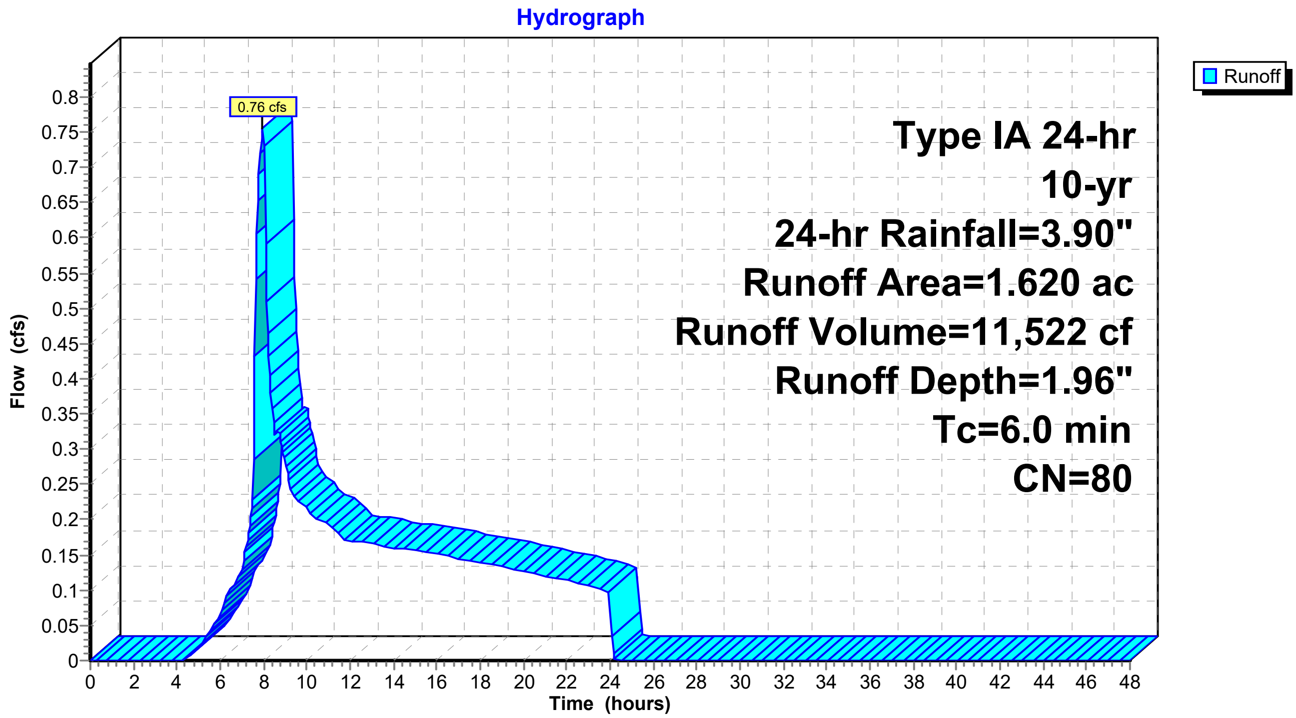
Runoff = 0.76 cfs @ 7.98 hrs, Volume= 11,522 cf, Depth= 1.96"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type IA 24-hr 10-yr, 24-hr Rainfall=3.90"

	Area (ac)	CN	Description
*	1.350	78	Rail/Gravel Base
*	0.270	92	Gravel Access Road
	1.620	80	Weighted Average
	1.620		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, TR-55 Minimum**

Subcatchment P2-SB: Pond 2 South Basin



Summary for Subcatchment PMR: Pipeline Maintenance Road

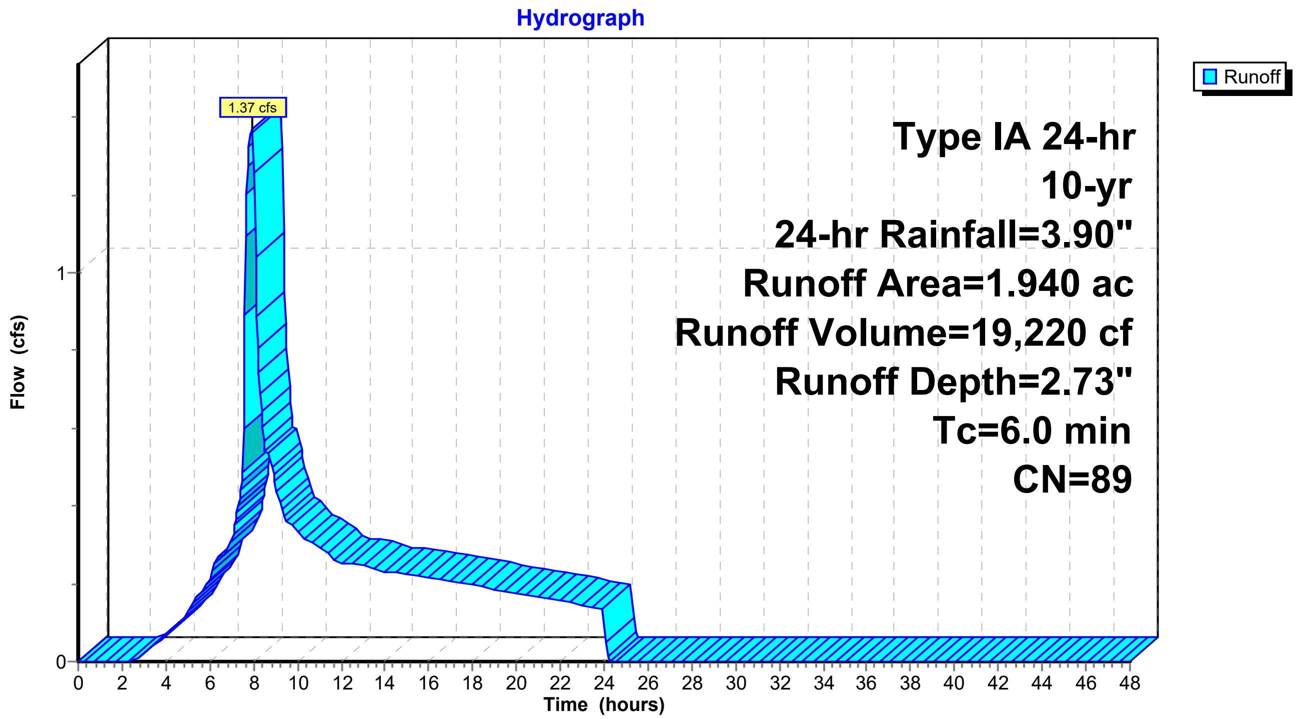
Runoff = 1.37 cfs @ 7.92 hrs, Volume= 19,220 cf, Depth= 2.73"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type IA 24-hr 10-yr, 24-hr Rainfall=3.90"

	Area (ac)	CN	Description
*	0.580	92	Maintenance Road
*	0.490	100	Pond 3
*	0.870	80	Pipeline
	1.940	89	Weighted Average
	1.450		74.74% Pervious Area
	0.490		25.26% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, TR-55 Minimum**

Subcatchment PMR: Pipeline Maintenance Road



Summary for Pond DP-002: MH-DP002 (Basin 2 Post-Developed)

Inflow Area = 532,739 sf, 41.05% Impervious, Inflow Depth > 2.23" for 10-yr, 24-hr event
Inflow = 1.56 cfs @ 11.56 hrs, Volume= 99,134 cf
Outflow = 1.56 cfs @ 11.56 hrs, Volume= 99,132 cf, Atten= 0%, Lag= 0.1 min
Primary = 1.56 cfs @ 11.56 hrs, Volume= 99,132 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs / 2
Starting Elev= -2.52' Surf.Area= 20 sf Storage= 30 cf
Peak Elev= -1.88' @ 11.56 hrs Surf.Area= 20 sf Storage= 42 cf (13 cf above start)

Plug-Flow detention time= 1.1 min calculated for 98,999 cf (100% of inflow)
Center-of-Mass det. time= 0.1 min (1,112.2 - 1,112.1)

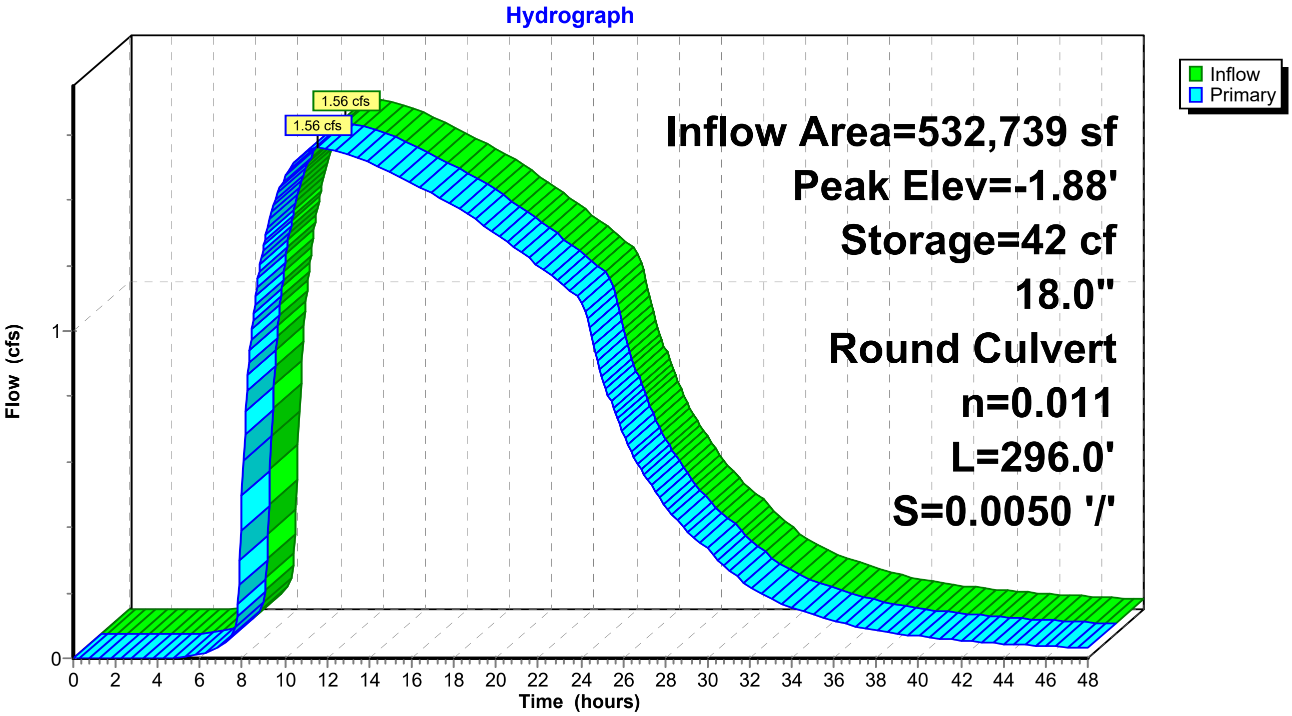
Volume	Invert	Avail.Storage	Storage Description
#1	-4.00'	140 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
-4.00	20	0	0
3.00	20	140	140

Device	Routing	Invert	Outlet Devices
#1	Primary	-2.52'	**18.0" Round Pipe to McLean Slough** L= 296.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= -2.52' / -4.00' S= 0.0050 '/' Cc= 0.900 n= 0.011, Flow Area= 1.77 sf

Primary OutFlow Max=1.56 cfs @ 11.56 hrs HW=-1.88' (Free Discharge)
└─**1=Pipe to McLean Slough** (Inlet Controls 1.56 cfs @ 2.16 fps)

Pond DP-002: MH-DP002 (Basin 2 Post-Developed)



Summary for Pond DP-003: POND 4/CB-DP003 (Basin 3 Post-Developed)

Inflow Area = 33,977 sf, 15.38% Impervious, Inflow Depth = 2.04" for 10-yr, 24-hr event
Inflow = 0.38 cfs @ 7.97 hrs, Volume= 5,770 cf
Outflow = 0.14 cfs @ 9.04 hrs, Volume= 5,679 cf, Atten= 64%, Lag= 64.4 min
Primary = 0.14 cfs @ 9.04 hrs, Volume= 5,679 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs / 2
Starting Elev= 2.00' Surf.Area= 0 sf Storage= 3,518 cf
Peak Elev= 2.25' @ 9.04 hrs Surf.Area= 0 sf Storage= 4,666 cf (1,148 cf above start)
Flood Elev= 3.00' Surf.Area= 0 sf Storage= 8,061 cf (4,543 cf above start)

Plug-Flow detention time= 887.6 min calculated for 2,159 cf (37% of inflow)
Center-of-Mass det. time= 177.0 min (970.9 - 793.9)

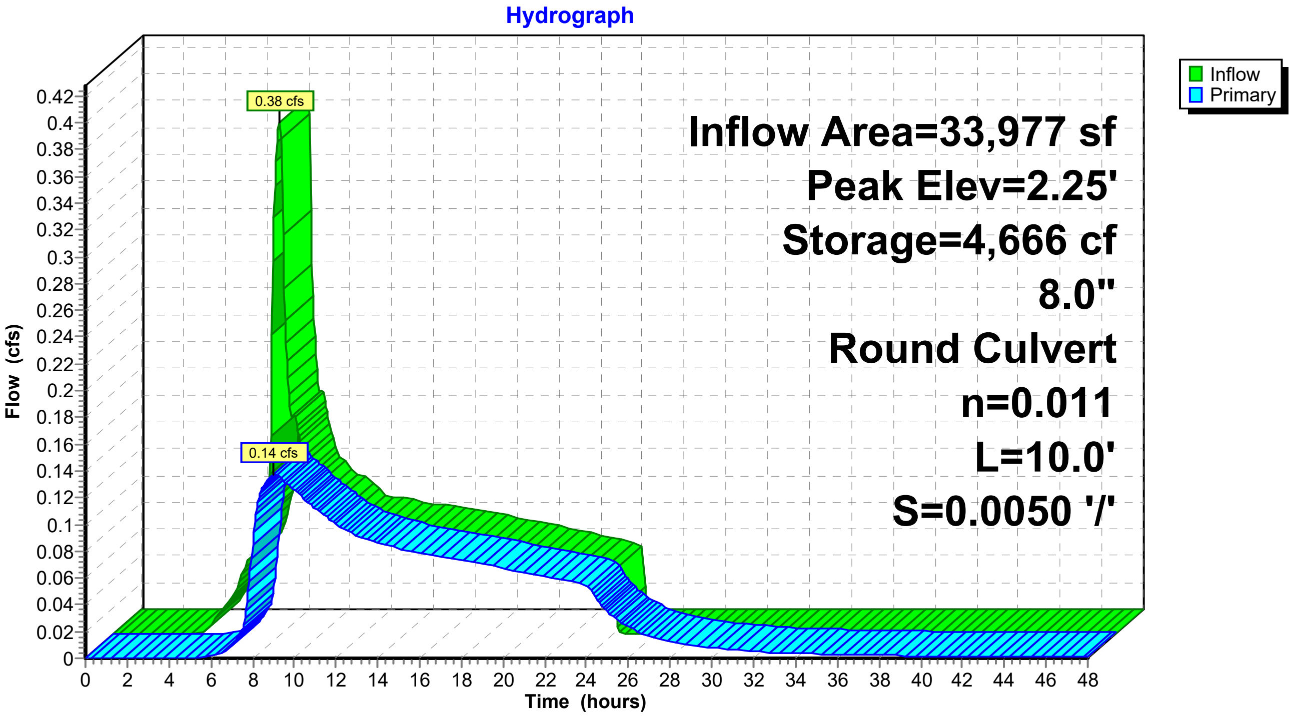
Volume	Invert	Avail.Storage	Storage Description
#1	1.00'	8,061 cf	**Custom Stage Data**Listed below

Elevation (feet)	Cum.Store (cubic-feet)
1.00	0
2.00	3,518
3.00	8,061

Device	Routing	Invert	Outlet Devices
#1	Primary	2.00'	**8.0" Round Pipe to CB-DP-003** L= 10.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 2.00' / 1.95' S= 0.0050 '/' Cc= 0.900 n= 0.011, Flow Area= 0.35 sf

Primary OutFlow Max=0.14 cfs @ 9.04 hrs HW=2.25' (Free Discharge)
└─**1=Pipe to CB-DP-003** (Barrel Controls 0.14 cfs @ 1.68 fps)

Pond DP-003: POND 4/CB-DP003 (Basin 3 Post-Developed)



Summary for Pond P-1: POND 1

Inflow Area = 297,950 sf, 45.76% Impervious, Inflow Depth = 2.92" for 10-yr, 24-hr event
Inflow = 4.95 cfs @ 7.91 hrs, Volume= 72,514 cf
Outflow = 0.78 cfs @ 14.91 hrs, Volume= 54,604 cf, Atten= 84%, Lag= 420.4 min
Primary = 0.78 cfs @ 14.91 hrs, Volume= 54,604 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 0.71' @ 14.91 hrs Surf.Area= 0 sf Storage= 34,660 cf
Flood Elev= 2.35' Surf.Area= 0 sf Storage= 102,326 cf

Plug-Flow detention time= 625.4 min calculated for 54,547 cf (75% of inflow)
Center-of-Mass det. time= 469.6 min (1,172.6 - 703.0)

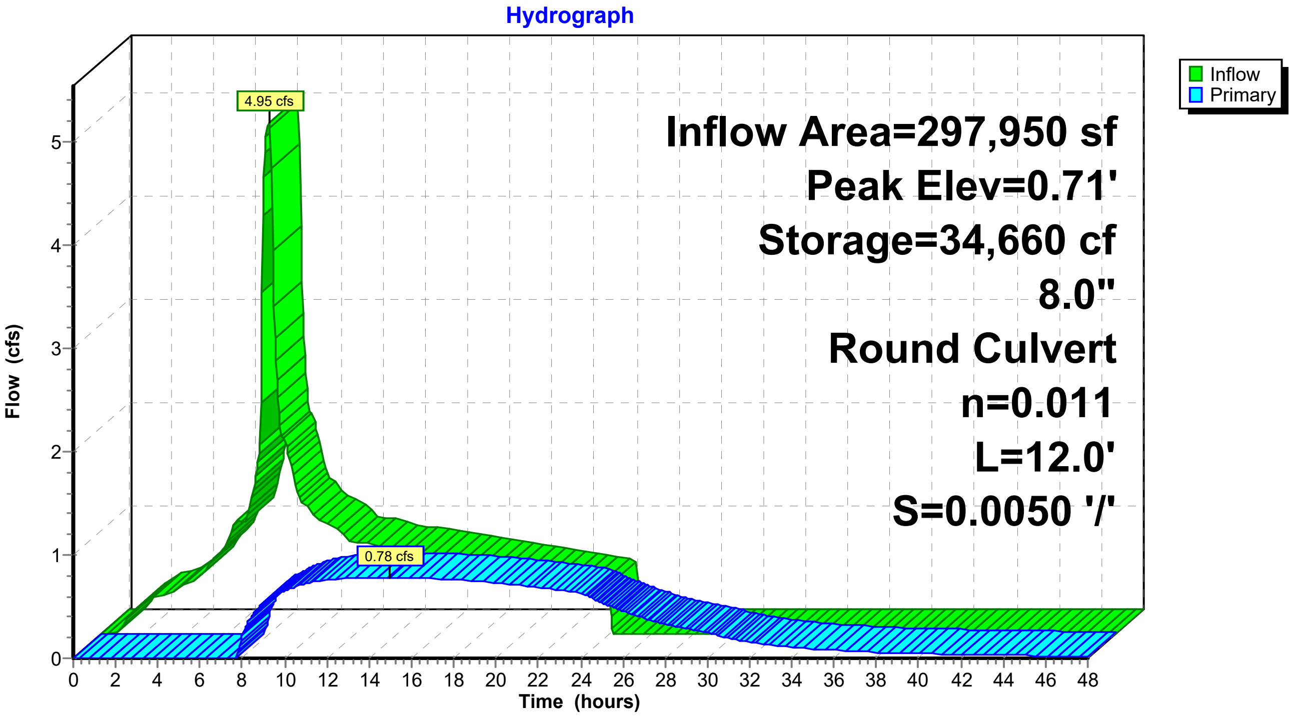
Volume	Invert	Avail.Storage	Storage Description
#1	-1.15'	102,326 cf	**Custom Stage Data**Listed below

Elevation (feet)	Cum.Store (cubic-feet)
-1.15	0
-0.65	4,073
0.35	22,730
1.35	55,457
2.35	102,326

Device	Routing	Invert	Outlet Devices
#1	Primary	0.00'	**8.0" Round Pipe to MH-DP002** L= 12.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 0.00' / -0.06' S= 0.0050 '/' Cc= 0.900 n= 0.011, Flow Area= 0.35 sf

Primary OutFlow Max=0.78 cfs @ 14.91 hrs HW=0.71' TW=-1.89' (Dynamic Tailwater)
└─**1=Pipe to MH-DP002** (Barrel Controls 0.78 cfs @ 2.61 fps)

Pond P-1: POND 1



Summary for Pond P-1 CBs: Pond 1 Catch Basins

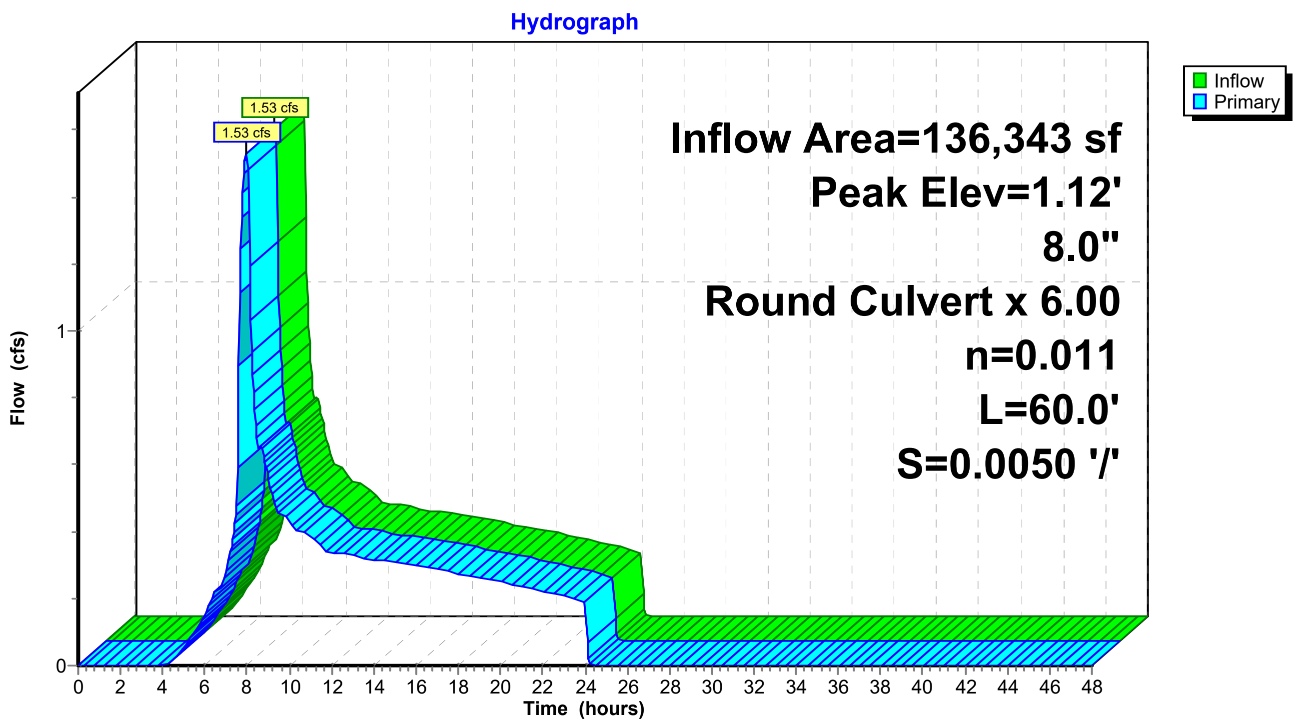
Inflow Area =	136,343 sf,	0.00% Impervious,	Inflow Depth = 2.04"	for 10-yr, 24-hr event
Inflow =	1.53 cfs @	7.97 hrs, Volume=	23,152 cf	
Outflow =	1.53 cfs @	7.97 hrs, Volume=	23,152 cf,	Atten= 0%, Lag= 0.0 min
Primary =	1.53 cfs @	7.97 hrs, Volume=	23,152 cf	

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 1.12' @ 7.97 hrs
Flood Elev= 2.35'

Device	Routing	Invert	Outlet Devices
#1	Primary	0.80'	**8.0" Round Storm Pipe Under Tracks to Pond X 6.00** L= 60.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 0.80' / 0.50' S= 0.0050 '/' Cc= 0.900 n= 0.011, Flow Area= 0.35 sf

Primary OutFlow Max=1.53 cfs @ 7.97 hrs HW=1.12' TW=0.29' (Dynamic Tailwater)
└─**1=Storm Pipe Under Tracks to Pond** (Barrel Controls 1.53 cfs @ 2.21 fps)

Pond P-1 CBs: Pond 1 Catch Basins



Summary for Pond P-2: POND 2

Inflow Area = 150,282 sf, 40.58% Impervious, Inflow Depth = 2.75" for 10-yr, 24-hr event
Inflow = 2.38 cfs @ 7.91 hrs, Volume= 34,380 cf
Outflow = 0.50 cfs @ 11.11 hrs, Volume= 26,226 cf, Atten= 79%, Lag= 191.8 min
Primary = 0.50 cfs @ 11.11 hrs, Volume= 26,226 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 0.51' @ 11.11 hrs Surf.Area= 0 sf Storage= 13,474 cf
Flood Elev= 2.35' Surf.Area= 0 sf Storage= 49,476 cf

Plug-Flow detention time= 446.9 min calculated for 26,226 cf (76% of inflow)
Center-of-Mass det. time= 297.9 min (1,019.8 - 721.9)

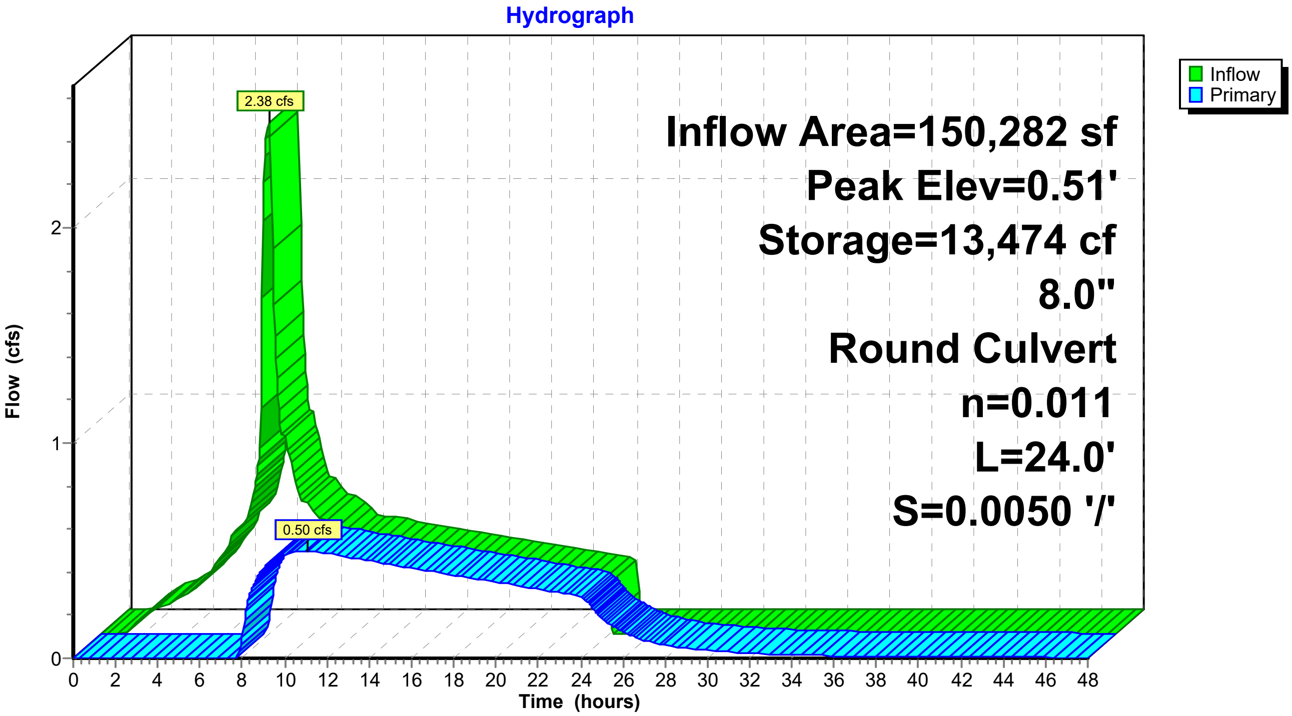
Volume	Invert	Avail.Storage	Storage Description
#1	-1.15'	49,476 cf	**Custom Stage Data** Listed below

Elevation (feet)	Cum.Store (cubic-feet)
-1.15	0
-0.65	1,959
0.35	10,959
1.35	26,767
2.35	49,476

Device	Routing	Invert	Outlet Devices
#1	Primary	0.00'	**8.0" Round Pipe to MH-DP002** L= 24.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 0.00' / -0.12' S= 0.0050 '/' Cc= 0.900 n= 0.011, Flow Area= 0.35 sf

Primary OutFlow Max=0.50 cfs @ 11.11 hrs HW=0.51' TW=-1.88' (Dynamic Tailwater)
└─**1=Pipe to MH-DP002** (Barrel Controls 0.50 cfs @ 2.41 fps)

Pond P-2: POND 2



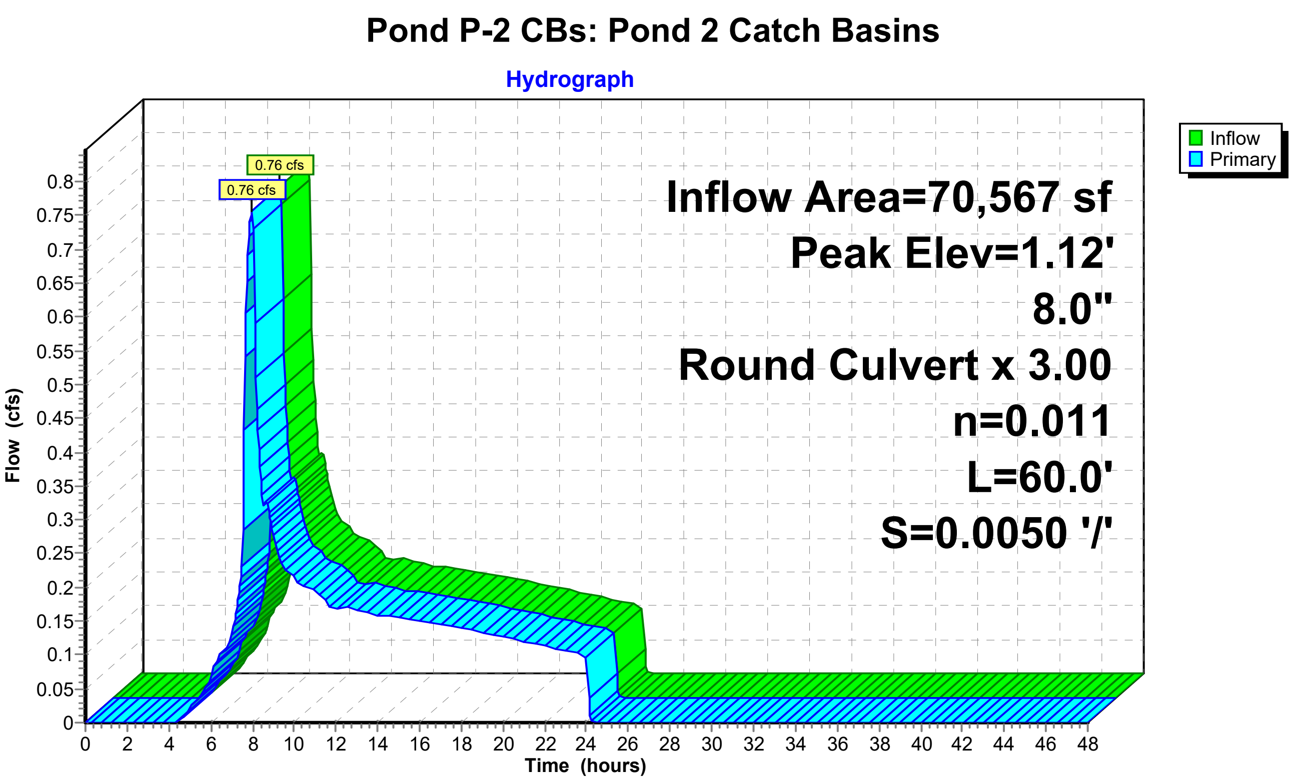
Summary for Pond P-2 CBs: Pond 2 Catch Basins

Inflow Area = 70,567 sf, 0.00% Impervious, Inflow Depth = 1.96" for 10-yr, 24-hr event
Inflow = 0.76 cfs @ 7.98 hrs, Volume= 11,522 cf
Outflow = 0.76 cfs @ 7.98 hrs, Volume= 11,522 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.76 cfs @ 7.98 hrs, Volume= 11,522 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 1.12' @ 7.98 hrs
Flood Elev= 2.35'

Device	Routing	Invert	Outlet Devices
#1	Primary	0.80'	**8.0" Round Storm Pipe Under Tracks to Pond 2 X 3.00** L= 60.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 0.80' / 0.50' S= 0.0050 '/' Cc= 0.900 n= 0.011, Flow Area= 0.35 sf

Primary OutFlow Max=0.75 cfs @ 7.98 hrs HW=1.12' TW=0.18' (Dynamic Tailwater)
└─**1=Storm Pipe Under Tracks to Pond 2**(Barrel Controls 0.75 cfs @ 2.20 fps)



Summary for Pond P-3: POND 3

Inflow Area = 84,506 sf, 25.26% Impervious, Inflow Depth = 2.73" for 10-yr, 24-hr event
Inflow = 1.37 cfs @ 7.92 hrs, Volume= 19,220 cf
Outflow = 0.33 cfs @ 10.09 hrs, Volume= 18,304 cf, Atten= 76%, Lag= 130.2 min
Primary = 0.33 cfs @ 10.09 hrs, Volume= 18,304 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs / 2
Starting Elev= -1.00' Surf.Area= 0 sf Storage= 6,229 cf
Peak Elev= -0.63' @ 10.09 hrs Surf.Area= 0 sf Storage= 12,283 cf (6,054 cf above start)

Plug-Flow detention time= 760.0 min calculated for 12,063 cf (63% of inflow)
Center-of-Mass det. time= 323.1 min (1,063.9 - 740.7)

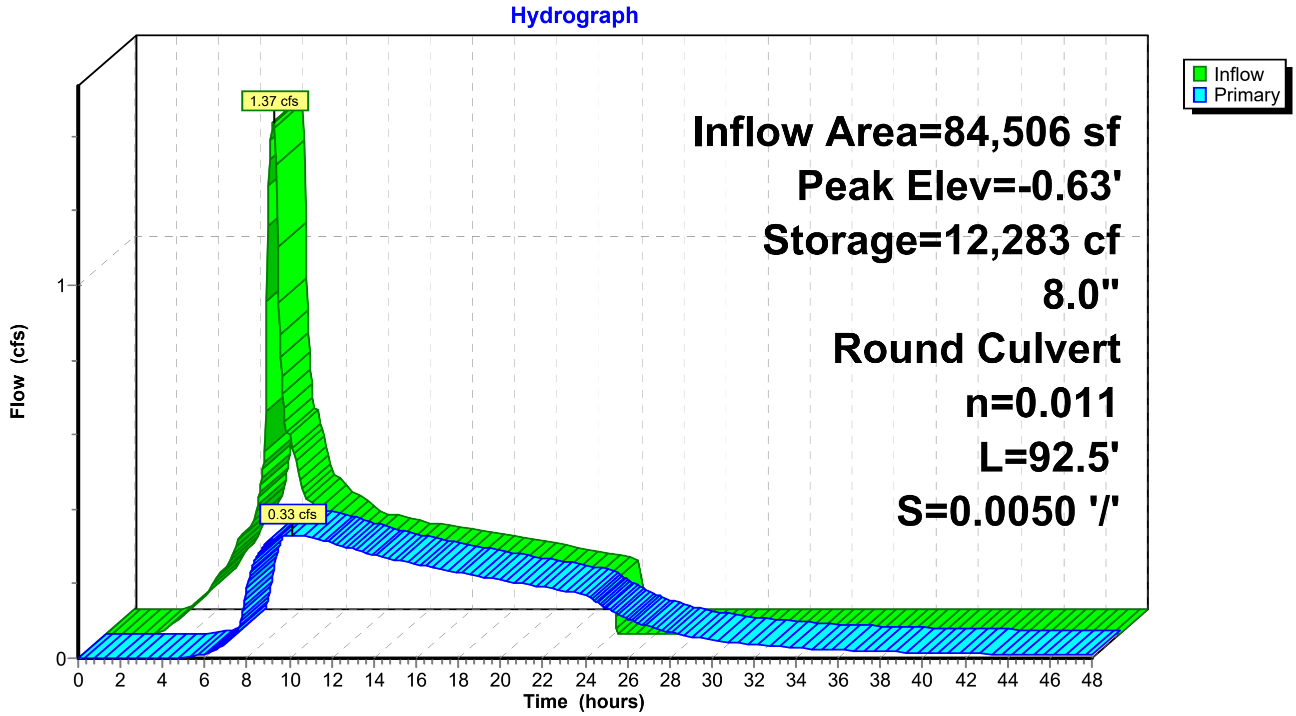
Volume	Invert	Avail.Storage	Storage Description
#1	-2.00'	22,444 cf	**Custom Stage Data**Listed below

Elevation (feet)	Cum.Store (cubic-feet)
-2.00	0
-1.00	6,229
0.00	22,444

Device	Routing	Invert	Outlet Devices
#1	Primary	-1.00'	**8.0" Round Pipe to MH-DP002** L= 92.5' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= -1.00' / -1.46' S= 0.0050 '/' Cc= 0.900 n= 0.011, Flow Area= 0.35 sf

Primary OutFlow Max=0.33 cfs @ 10.09 hrs HW=-0.63' TW=-1.90' (Dynamic Tailwater)
↑—**1=Pipe to MH-DP002** (Inlet Controls 0.33 cfs @ 1.64 fps)

Pond P-3: POND 3



Summary for Subcatchment P-4 B: Pond 4 Basin

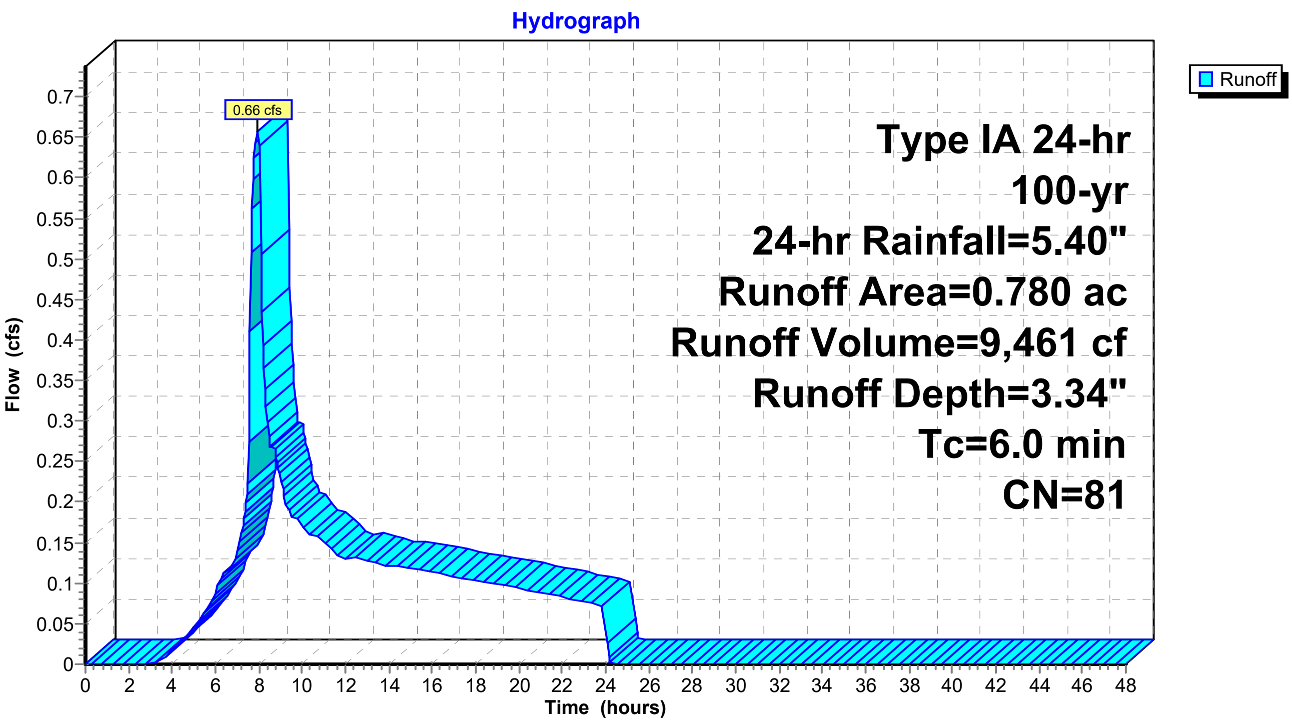
Runoff = 0.66 cfs @ 7.94 hrs, Volume= 9,461 cf, Depth= 3.34"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type IA 24-hr 100-yr, 24-hr Rainfall=5.40"

	Area (ac)	CN	Description
*	0.660	78	Rail/Gravel Base
*	0.120	100	Pond 4
	0.780	81	Weighted Average
	0.660		84.62% Pervious Area
	0.120		15.38% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, TR-55 Minimum**

Subcatchment P-4 B: Pond 4 Basin



Summary for Subcatchment P1-NB: Pond 1 North Basin

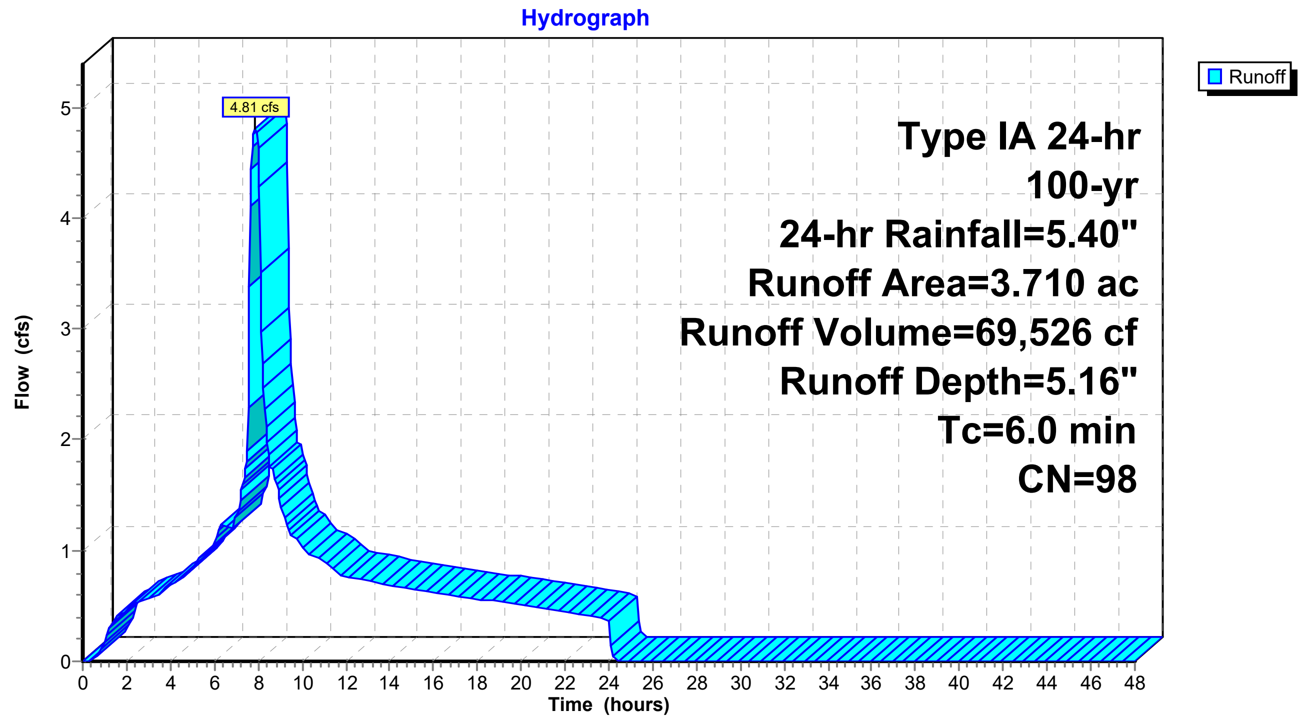
Runoff = 4.81 cfs @ 7.87 hrs, Volume= 69,526 cf, Depth= 5.16"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type IA 24-hr 100-yr, 24-hr Rainfall=5.40"

	Area (ac)	CN	Description
*	1.890	98	Paved Road
*	0.550	92	Gravel Laydown
*	1.240	100	Pond 1
*	0.030	80	Pipeline
	3.710	98	Weighted Average
	0.580		15.63% Pervious Area
	3.130		84.37% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, TR-55 Minimum**

Subcatchment P1-NB: Pond 1 North Basin



Summary for Subcatchment P1-SB: Pond 1 South Basin

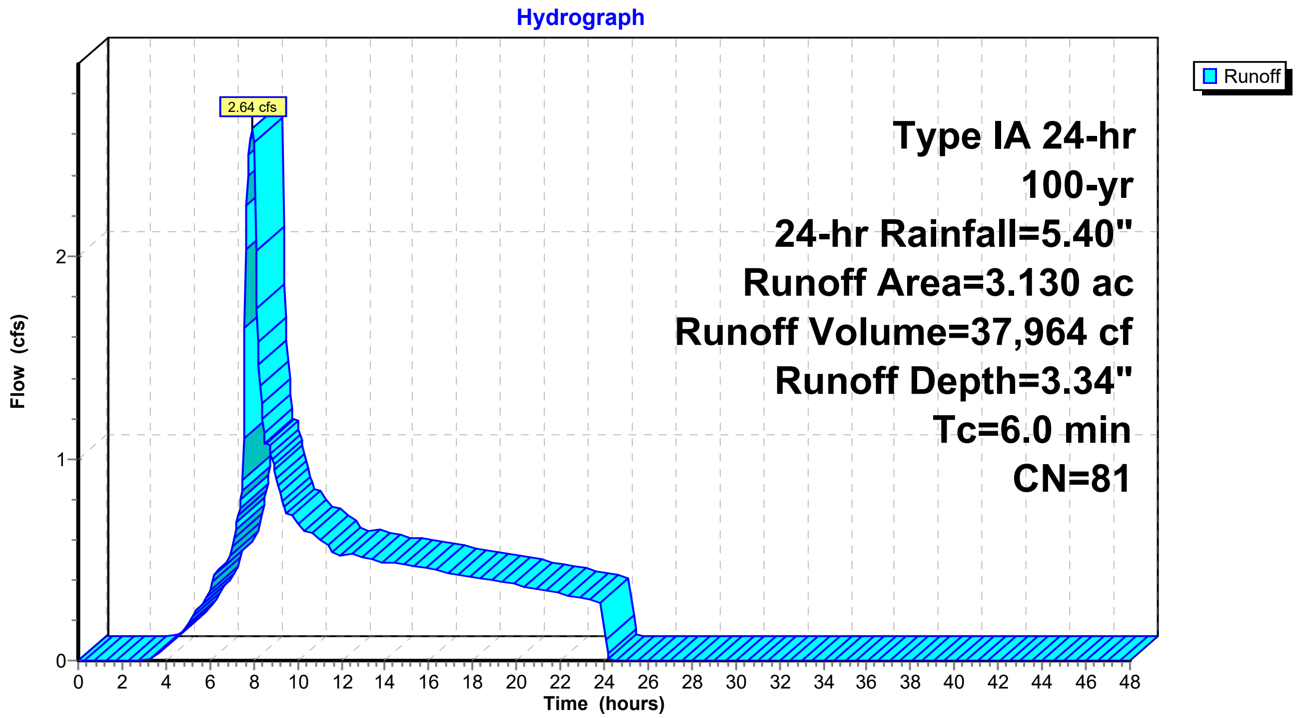
Runoff = 2.64 cfs @ 7.94 hrs, Volume= 37,964 cf, Depth= 3.34"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type IA 24-hr 100-yr, 24-hr Rainfall=5.40"

	Area (ac)	CN	Description
*	2.570	78	Rail/Gravel Base
*	0.560	92	Gravel Access Road
	3.130	81	Weighted Average
	3.130		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, TR-55 Minimum**

Subcatchment P1-SB: Pond 1 South Basin



Summary for Subcatchment P2-NB: Pond 2 North Basin

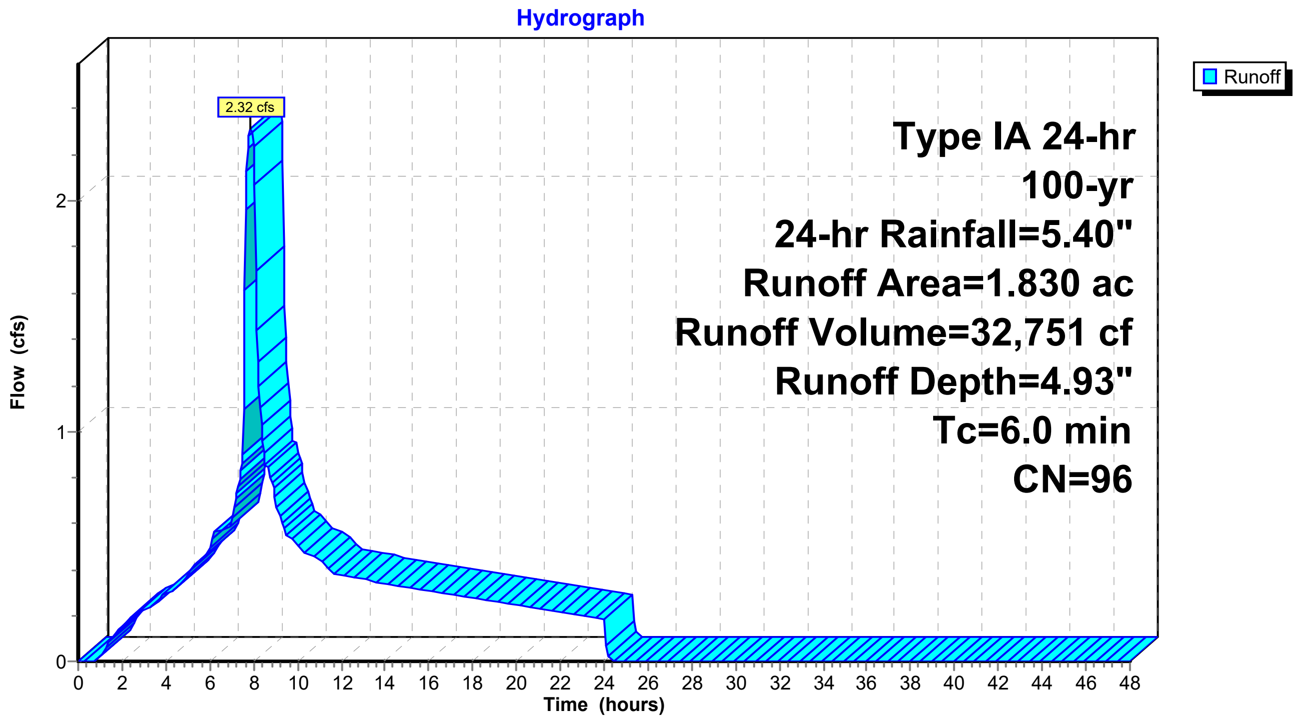
Runoff = 2.32 cfs @ 7.87 hrs, Volume= 32,751 cf, Depth= 4.93"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type IA 24-hr 100-yr, 24-hr Rainfall=5.40"

	Area (ac)	CN	Description
*	0.350	80	Pipeline
*	0.800	100	Paved Road
*	0.080	92	Gravel Laydown
*	0.600	100	Pond 2
	1.830	96	Weighted Average
	0.430		23.50% Pervious Area
	1.400		76.50% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, TR-55 Minimum**

Subcatchment P2-NB: Pond 2 North Basin



Summary for Subcatchment P2-SB: Pond 2 South Basin

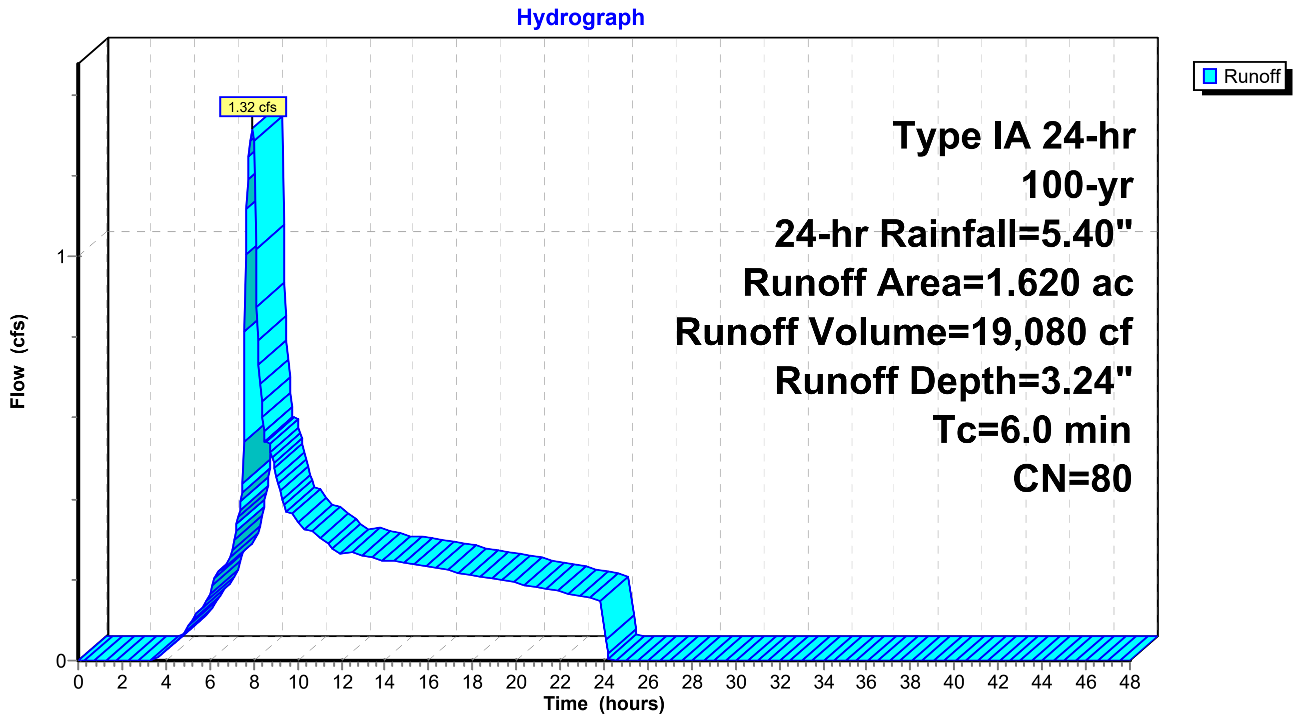
Runoff = 1.32 cfs @ 7.95 hrs, Volume= 19,080 cf, Depth= 3.24"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type IA 24-hr 100-yr, 24-hr Rainfall=5.40"

	Area (ac)	CN	Description
*	1.350	78	Rail/Gravel Base
*	0.270	92	Gravel Access Road
	1.620	80	Weighted Average
	1.620		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, TR-55 Minimum**

Subcatchment P2-SB: Pond 2 South Basin



Summary for Subcatchment PMR: Pipeline Maintenance Road

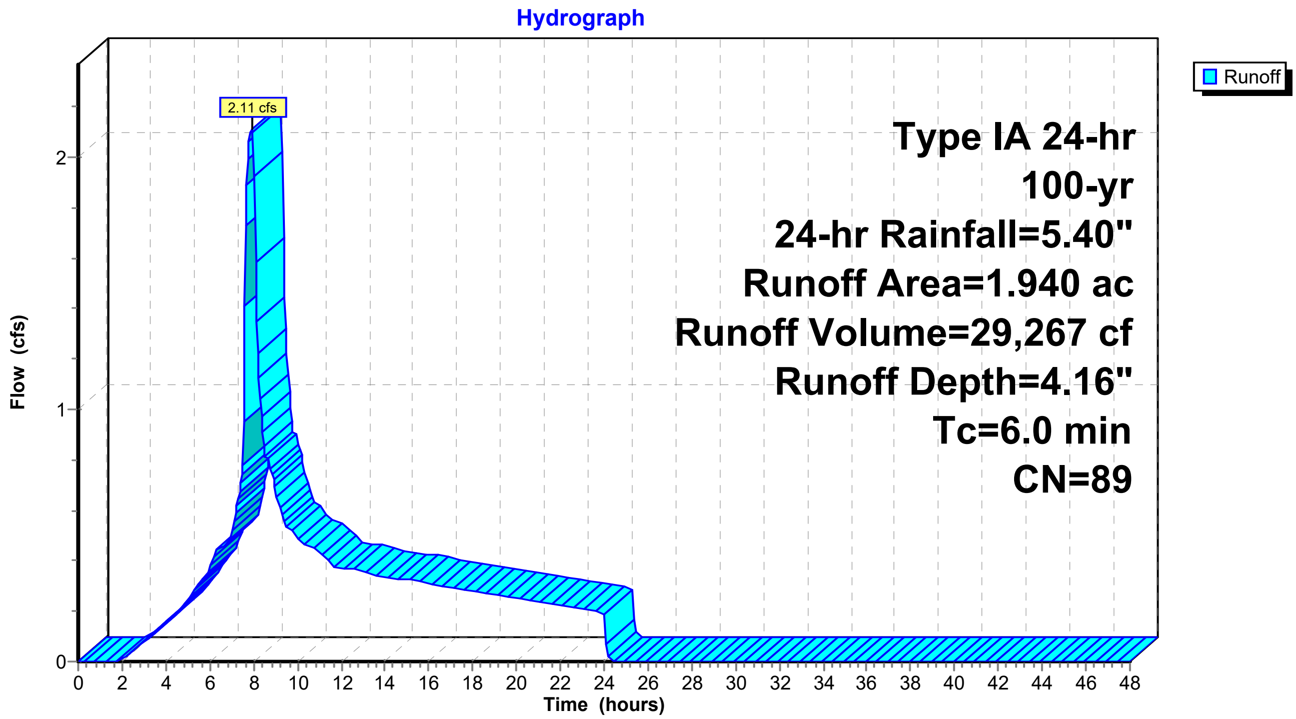
Runoff = 2.11 cfs @ 7.90 hrs, Volume= 29,267 cf, Depth= 4.16"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type IA 24-hr 100-yr, 24-hr Rainfall=5.40"

	Area (ac)	CN	Description
*	0.580	92	Maintenance Road
*	0.490	100	Pond 3
*	0.870	80	Pipeline
	1.940	89	Weighted Average
	1.450		74.74% Pervious Area
	0.490		25.26% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, TR-55 Minimum**

Subcatchment PMR: Pipeline Maintenance Road



Summary for Pond DP-002: MH-DP002 (Basin 2 Post-Developed)

Inflow Area = 532,739 sf, 41.05% Impervious, Inflow Depth > 3.63" for 100-yr, 24-hr event
Inflow = 2.62 cfs @ 10.07 hrs, Volume= 161,276 cf
Outflow = 2.62 cfs @ 10.08 hrs, Volume= 161,274 cf, Atten= 0%, Lag= 0.5 min
Primary = 2.62 cfs @ 10.08 hrs, Volume= 161,274 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs / 2
Starting Elev= -2.52' Surf.Area= 20 sf Storage= 30 cf
Peak Elev= -1.66' @ 10.08 hrs Surf.Area= 20 sf Storage= 47 cf (17 cf above start)

Plug-Flow detention time= 0.8 min calculated for 161,245 cf (100% of inflow)
Center-of-Mass det. time= 0.1 min (1,082.2 - 1,082.1)

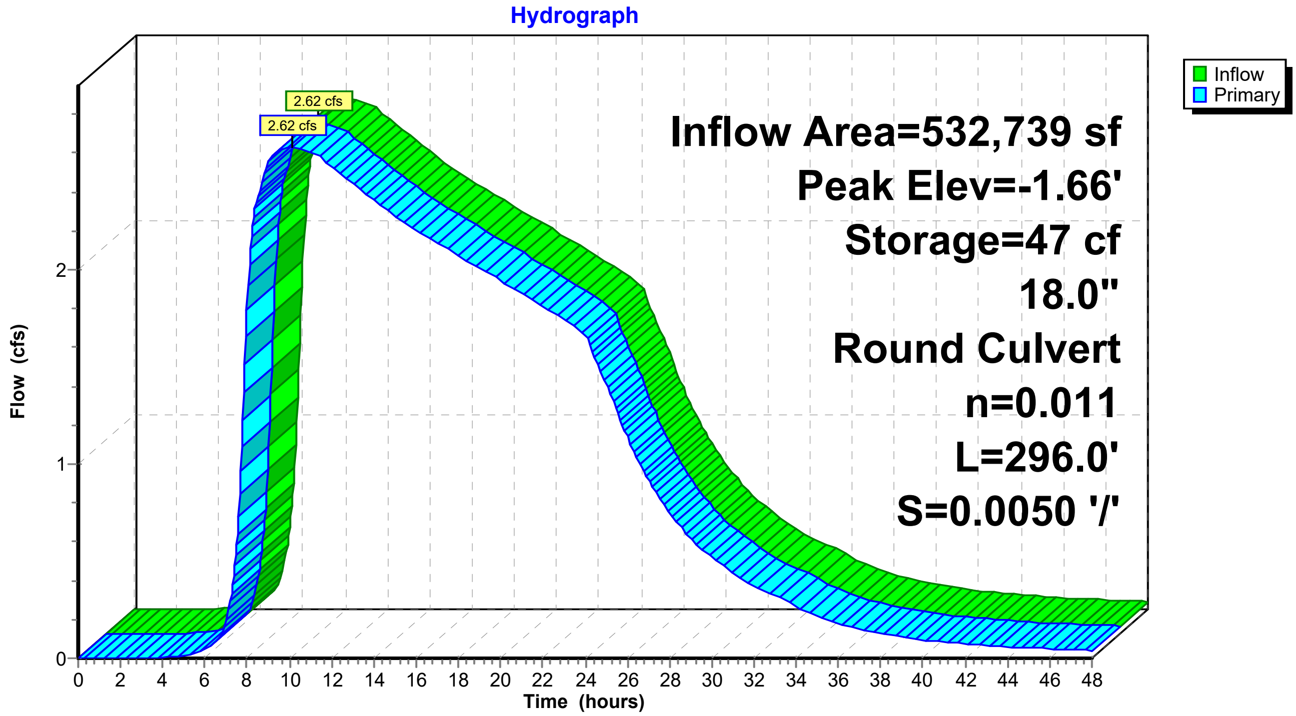
Volume	Invert	Avail.Storage	Storage Description
#1	-4.00'	140 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
-4.00	20	0	0
3.00	20	140	140

Device	Routing	Invert	Outlet Devices
#1	Primary	-2.52'	**18.0" Round Pipe to McLean Slough** L= 296.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= -2.52' / -4.00' S= 0.0050 '/' Cc= 0.900 n= 0.011, Flow Area= 1.77 sf

Primary OutFlow Max=2.62 cfs @ 10.08 hrs HW=-1.66' (Free Discharge)
└─**1=Pipe to McLean Slough** (Inlet Controls 2.62 cfs @ 2.50 fps)

Pond DP-002: MH-DP002 (Basin 2 Post-Developed)



Summary for Pond DP-003: POND 4/CB-DP003 (Basin 3 Post-Developed)

Inflow Area = 33,977 sf, 15.38% Impervious, Inflow Depth = 3.34" for 100-yr, 24-hr event
Inflow = 0.66 cfs @ 7.94 hrs, Volume= 9,461 cf
Outflow = 0.30 cfs @ 8.41 hrs, Volume= 9,368 cf, Atten= 55%, Lag= 27.9 min
Primary = 0.30 cfs @ 8.41 hrs, Volume= 9,368 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs / 2
Starting Elev= 2.00' Surf.Area= 0 sf Storage= 3,518 cf
Peak Elev= 2.39' @ 8.41 hrs Surf.Area= 0 sf Storage= 5,289 cf (1,771 cf above start)
Flood Elev= 3.00' Surf.Area= 0 sf Storage= 8,061 cf (4,543 cf above start)

Plug-Flow detention time= 566.7 min calculated for 5,844 cf (62% of inflow)
Center-of-Mass det. time= 142.9 min (907.7 - 764.8)

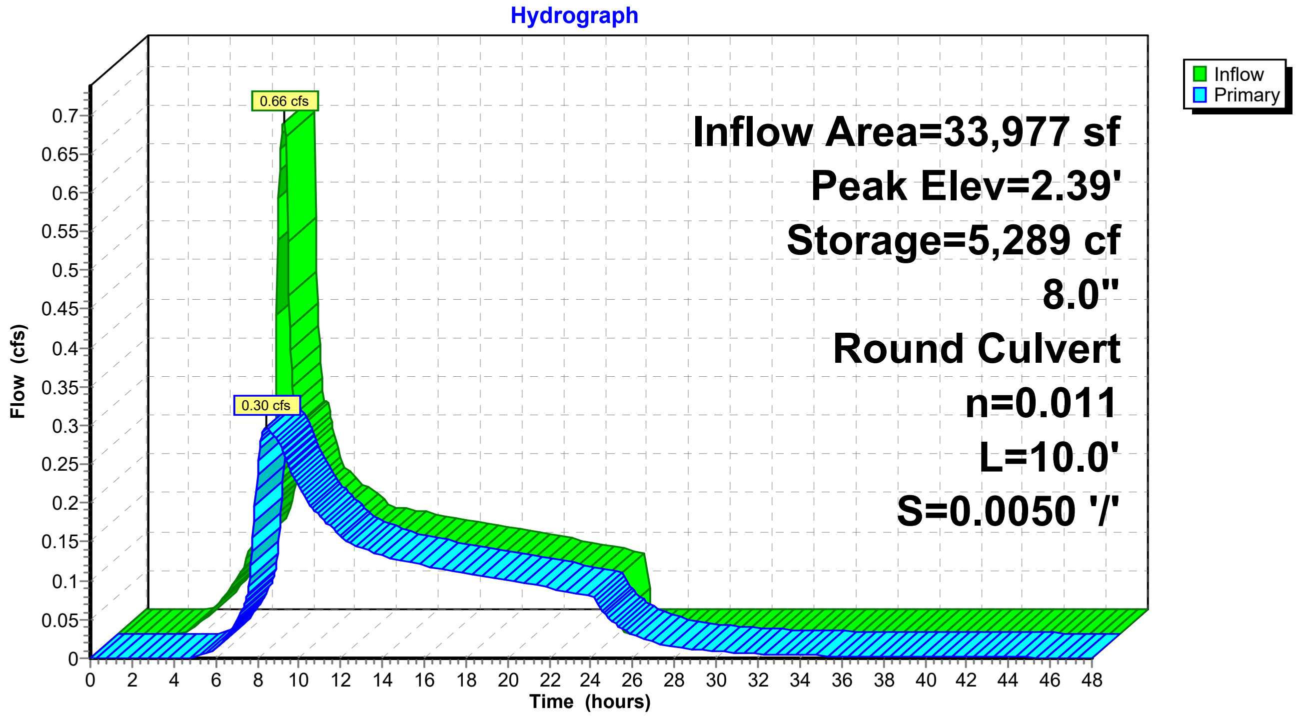
Volume	Invert	Avail.Storage	Storage Description
#1	1.00'	8,061 cf	**Custom Stage Data**Listed below

Elevation (feet)	Cum.Store (cubic-feet)
1.00	0
2.00	3,518
3.00	8,061

Device	Routing	Invert	Outlet Devices
#1	Primary	2.00'	**8.0" Round Pipe to CB-DP-003** L= 10.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 2.00' / 1.95' S= 0.0050 '/' Cc= 0.900 n= 0.011, Flow Area= 0.35 sf

Primary OutFlow Max=0.30 cfs @ 8.41 hrs HW=2.39' (Free Discharge)
↑—**1=Pipe to CB-DP-003** (Barrel Controls 0.30 cfs @ 2.02 fps)

Pond DP-003: POND 4/CB-DP003 (Basin 3 Post-Developed)



Summary for Pond P-1: POND 1

Inflow Area = 297,950 sf, 45.76% Impervious, Inflow Depth = 4.33" for 100-yr, 24-hr event
Inflow = 7.43 cfs @ 7.90 hrs, Volume= 107,490 cf
Outflow = 1.19 cfs @ 13.61 hrs, Volume= 89,298 cf, Atten= 84%, Lag= 342.7 min
Primary = 1.19 cfs @ 13.61 hrs, Volume= 89,298 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 1.14' @ 13.61 hrs Surf.Area= 0 sf Storage= 48,496 cf
Flood Elev= 2.35' Surf.Area= 0 sf Storage= 102,326 cf

Plug-Flow detention time= 586.3 min calculated for 89,298 cf (83% of inflow)
Center-of-Mass det. time= 472.9 min (1,165.7 - 692.8)

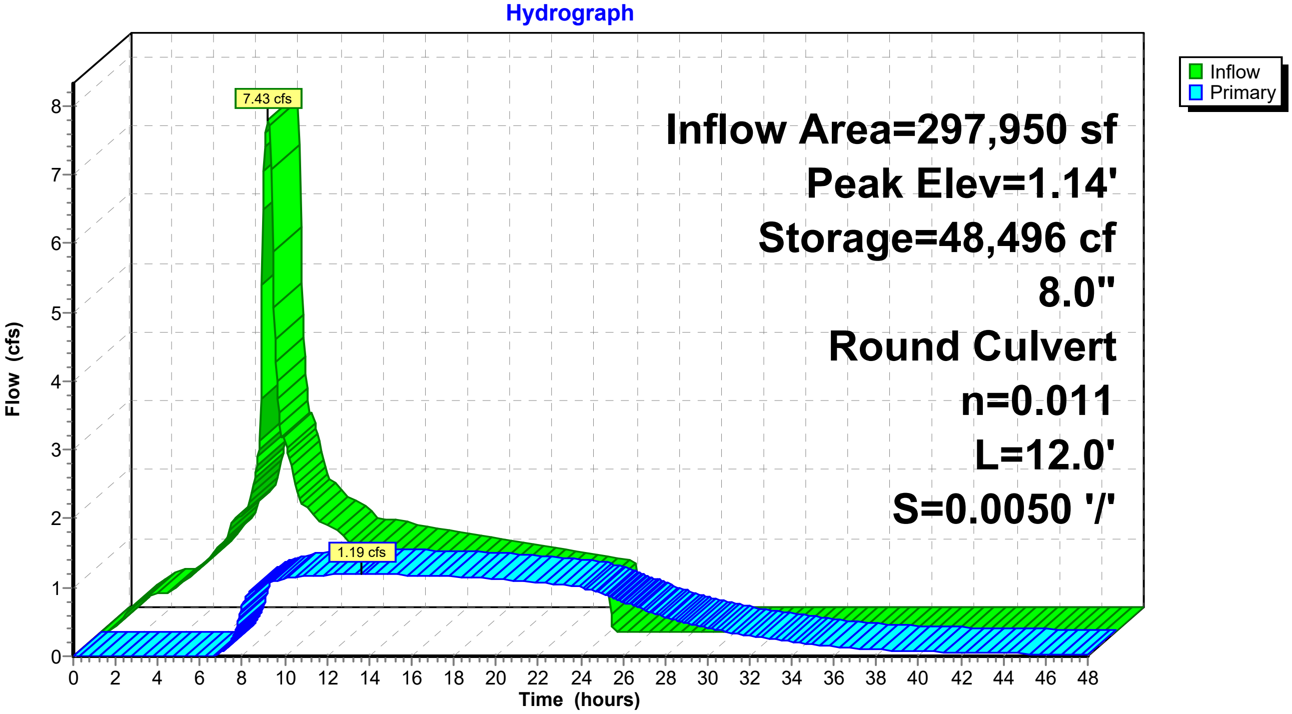
Volume	Invert	Avail.Storage	Storage Description
#1	-1.15'	102,326 cf	**Custom Stage Data**Listed below

Elevation (feet)	Cum.Store (cubic-feet)
-1.15	0
-0.65	4,073
0.35	22,730
1.35	55,457
2.35	102,326

Device	Routing	Invert	Outlet Devices
#1	Primary	0.00'	**8.0" Round Pipe to MH-DP002** L= 12.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 0.00' / -0.06' S= 0.0050 '/' Cc= 0.900 n= 0.011, Flow Area= 0.35 sf

Primary OutFlow Max=1.19 cfs @ 13.61 hrs HW=1.14' TW=-1.70' (Dynamic Tailwater)
↑—**1=Pipe to MH-DP002** (Inlet Controls 1.19 cfs @ 3.41 fps)

Pond P-1: POND 1



Summary for Pond P-1 CBs: Pond 1 Catch Basins

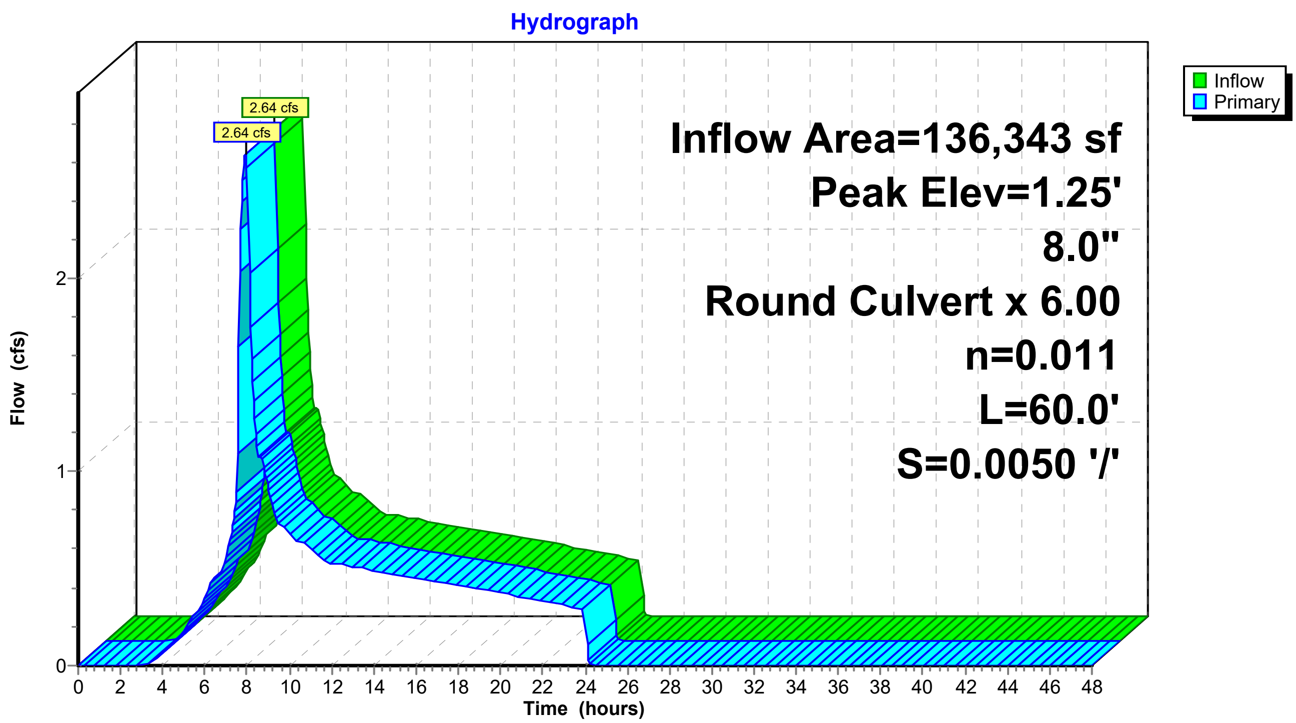
Inflow Area = 136,343 sf, 0.00% Impervious, Inflow Depth = 3.34" for 100-yr, 24-hr event
Inflow = 2.64 cfs @ 7.94 hrs, Volume= 37,964 cf
Outflow = 2.64 cfs @ 7.94 hrs, Volume= 37,964 cf, Atten= 0%, Lag= 0.0 min
Primary = 2.64 cfs @ 7.94 hrs, Volume= 37,964 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 1.25' @ 7.94 hrs
Flood Elev= 2.35'

Device	Routing	Invert	Outlet Devices
#1	Primary	0.80'	**8.0" Round Storm Pipe Under Tracks to Pond X 6.00** L= 60.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 0.80' / 0.50' S= 0.0050 '/' Cc= 0.900 n= 0.011, Flow Area= 0.35 sf

Primary OutFlow Max=2.64 cfs @ 7.94 hrs HW=1.25' TW=0.63' (Dynamic Tailwater)
↑—1=Storm Pipe Under Tracks to Pond(Barrel Controls 2.64 cfs @ 2.51 fps)

Pond P-1 CBs: Pond 1 Catch Basins



Summary for Pond P-2: POND 2

Inflow Area = 150,282 sf, 40.58% Impervious, Inflow Depth = 4.14" for 100-yr, 24-hr event
Inflow = 3.62 cfs @ 7.90 hrs, Volume= 51,832 cf
Outflow = 0.92 cfs @ 9.51 hrs, Volume= 43,663 cf, Atten= 75%, Lag= 96.5 min
Primary = 0.92 cfs @ 9.51 hrs, Volume= 43,663 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 0.81' @ 9.51 hrs Surf.Area= 0 sf Storage= 18,257 cf
Flood Elev= 2.35' Surf.Area= 0 sf Storage= 49,476 cf

Plug-Flow detention time= 361.6 min calculated for 43,617 cf (84% of inflow)
Center-of-Mass det. time= 258.3 min (965.8 - 707.5)

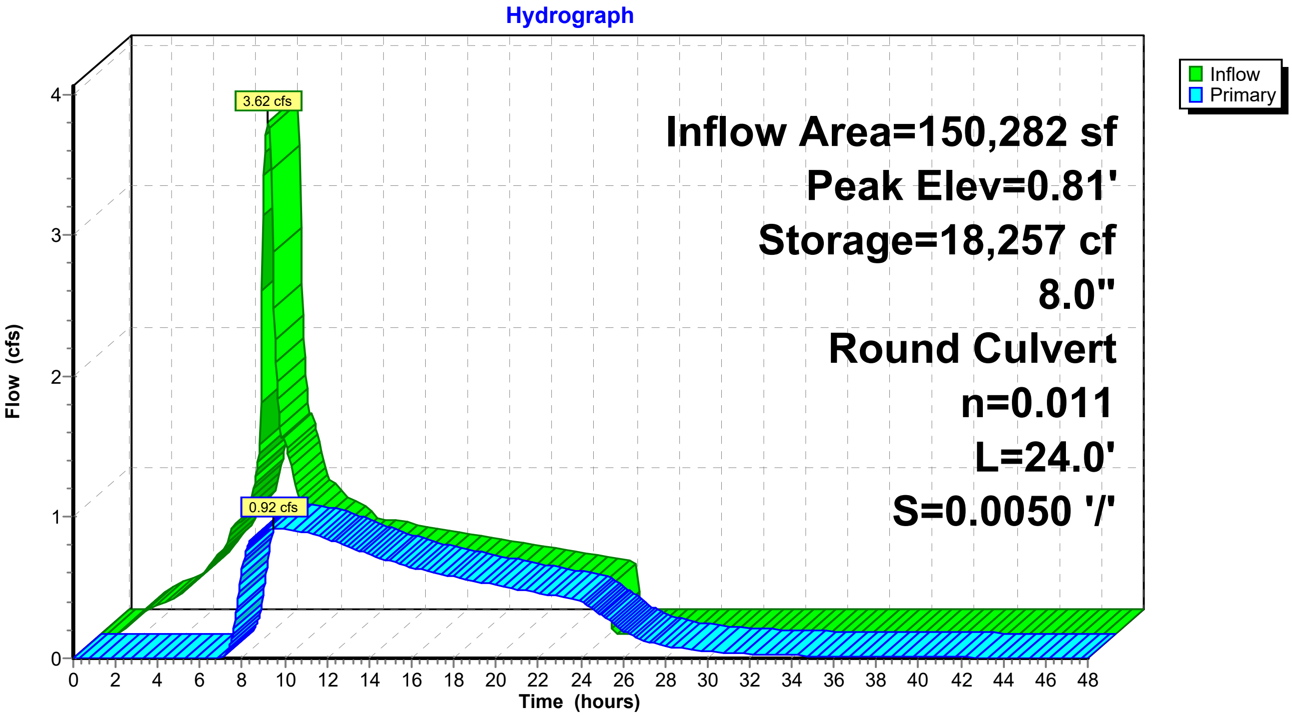
Volume	Invert	Avail.Storage	Storage Description
#1	-1.15'	49,476 cf	**Custom Stage Data**Listed below

Elevation (feet)	Cum.Store (cubic-feet)
-1.15	0
-0.65	1,959
0.35	10,959
1.35	26,767
2.35	49,476

Device	Routing	Invert	Outlet Devices
#1	Primary	0.00'	**8.0" Round Pipe to MH-DP002** L= 24.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 0.00' / -0.12' S= 0.0050 '/' Cc= 0.900 n= 0.011, Flow Area= 0.35 sf

Primary OutFlow Max=0.92 cfs @ 9.51 hrs HW=0.81' TW=-1.66' (Dynamic Tailwater)
↑—**1=Pipe to MH-DP002** (Inlet Controls 0.92 cfs @ 2.63 fps)

Pond P-2: POND 2



Summary for Pond P-2 CBs: Pond 2 Catch Basins

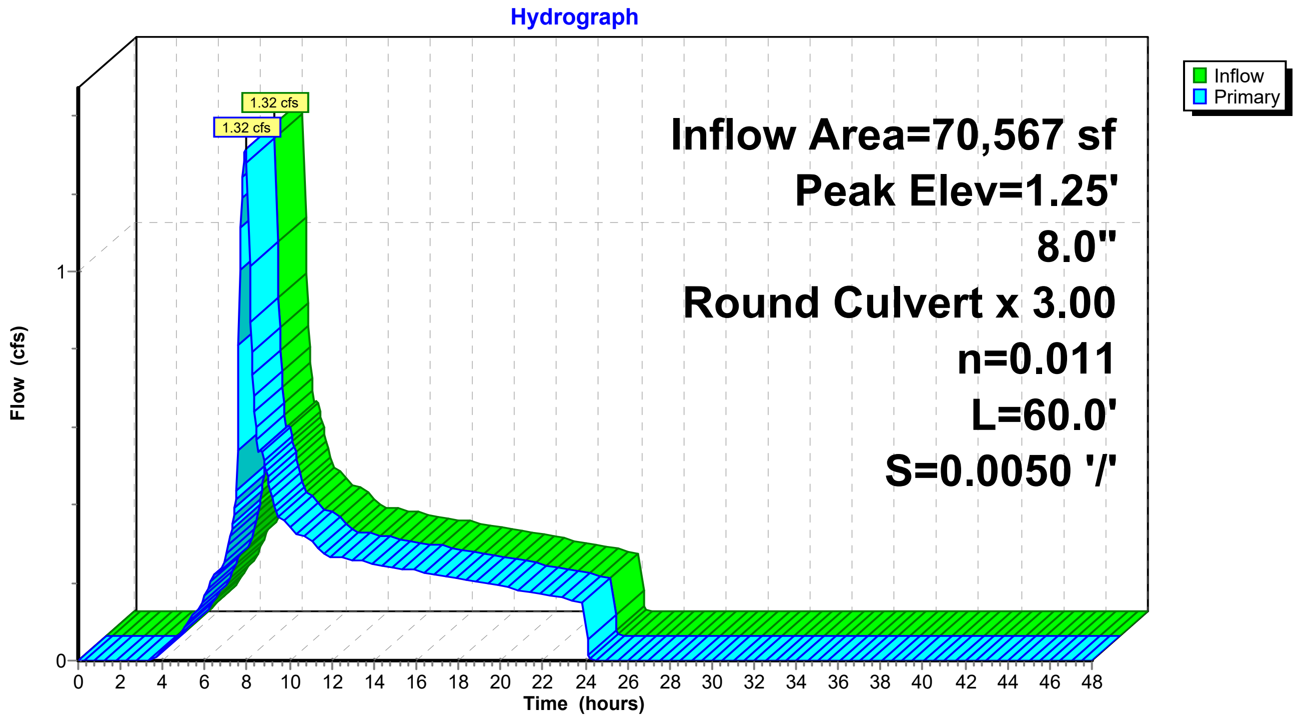
Inflow Area =	70,567 sf,	0.00% Impervious,	Inflow Depth = 3.24"	for 100-yr, 24-hr event	
Inflow =	1.32 cfs @	7.95 hrs,	Volume=	19,080 cf	
Outflow =	1.32 cfs @	7.95 hrs,	Volume=	19,080 cf,	Atten= 0%, Lag= 0.0 min
Primary =	1.32 cfs @	7.95 hrs,	Volume=	19,080 cf	

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 1.25' @ 7.95 hrs
Flood Elev= 2.35'

Device	Routing	Invert	Outlet Devices
#1	Primary	0.80'	**8.0" Round Storm Pipe Under Tracks to Pond 2 X 3.00** L= 60.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 0.80' / 0.50' S= 0.0050 '/' Cc= 0.900 n= 0.011, Flow Area= 0.35 sf

Primary OutFlow Max=1.32 cfs @ 7.95 hrs HW=1.25' TW=0.56' (Dynamic Tailwater)
└─**1=Storm Pipe Under Tracks to Pond 2**(Barrel Controls 1.32 cfs @ 2.51 fps)

Pond P-2 CBs: Pond 2 Catch Basins



Summary for Pond P-3: POND 3

Inflow Area = 84,506 sf, 25.26% Impervious, Inflow Depth = 4.16" for 100-yr, 24-hr event
Inflow = 2.11 cfs @ 7.90 hrs, Volume= 29,267 cf
Outflow = 0.60 cfs @ 9.22 hrs, Volume= 28,316 cf, Atten= 72%, Lag= 78.9 min
Primary = 0.60 cfs @ 9.22 hrs, Volume= 28,316 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs / 2
Starting Elev= -1.00' Surf.Area= 0 sf Storage= 6,229 cf
Peak Elev= -0.46' @ 9.22 hrs Surf.Area= 0 sf Storage= 14,983 cf (8,754 cf above start)

Plug-Flow detention time= 561.1 min calculated for 22,064 cf (75% of inflow)
Center-of-Mass det. time= 277.8 min (997.4 - 719.6)

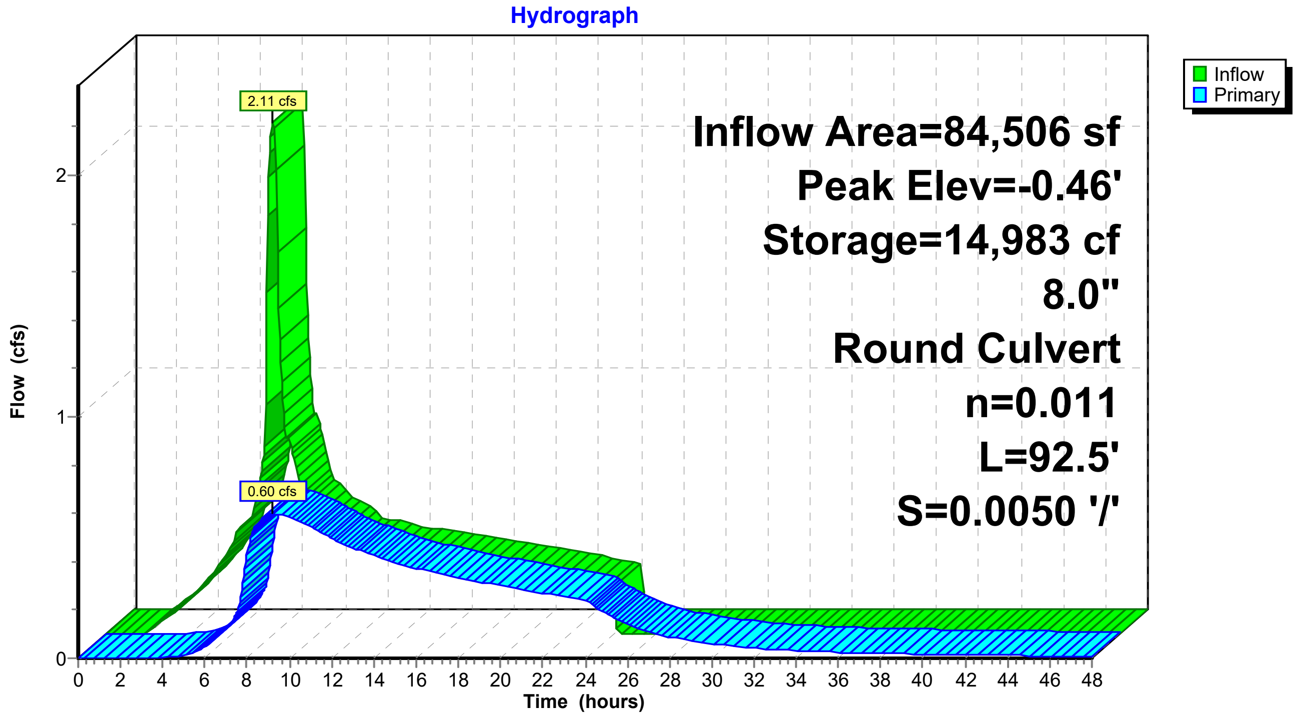
Volume	Invert	Avail.Storage	Storage Description
#1	-2.00'	22,444 cf	**Custom Stage Data**Listed below

Elevation (feet)	Cum.Store (cubic-feet)
-2.00	0
-1.00	6,229
0.00	22,444

Device	Routing	Invert	Outlet Devices
#1	Primary	-1.00'	**8.0" Round Pipe to MH-DP002** L= 92.5' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= -1.00' / -1.46' S= 0.0050 '/' Cc= 0.900 n= 0.011, Flow Area= 0.35 sf

Primary OutFlow Max=0.60 cfs @ 9.22 hrs HW=-0.46' TW=-1.67' (Dynamic Tailwater)
↑—**1=Pipe to MH-DP002** (Inlet Controls 0.60 cfs @ 1.97 fps)

Pond P-3: POND 3



Summary for Subcatchment P-4 B: Pond 4 Basin

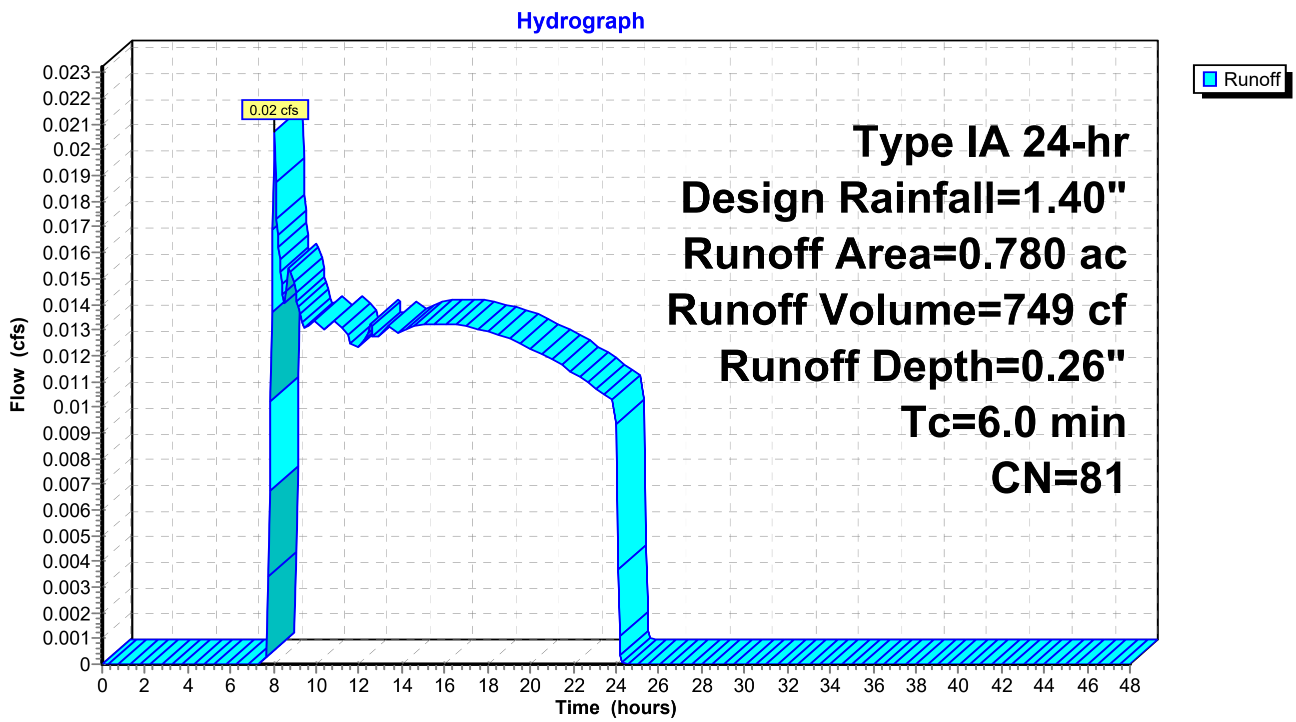
Runoff = 0.02 cfs @ 8.04 hrs, Volume= 749 cf, Depth= 0.26"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type IA 24-hr Design Rainfall=1.40"

	Area (ac)	CN	Description
*	0.660	78	Rail/Gravel Base
*	0.120	100	Pond 4
	0.780	81	Weighted Average
	0.660		84.62% Pervious Area
	0.120		15.38% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, TR-55 Minimum**

Subcatchment P-4 B: Pond 4 Basin



Summary for Subcatchment P1-NB: Pond 1 North Basin

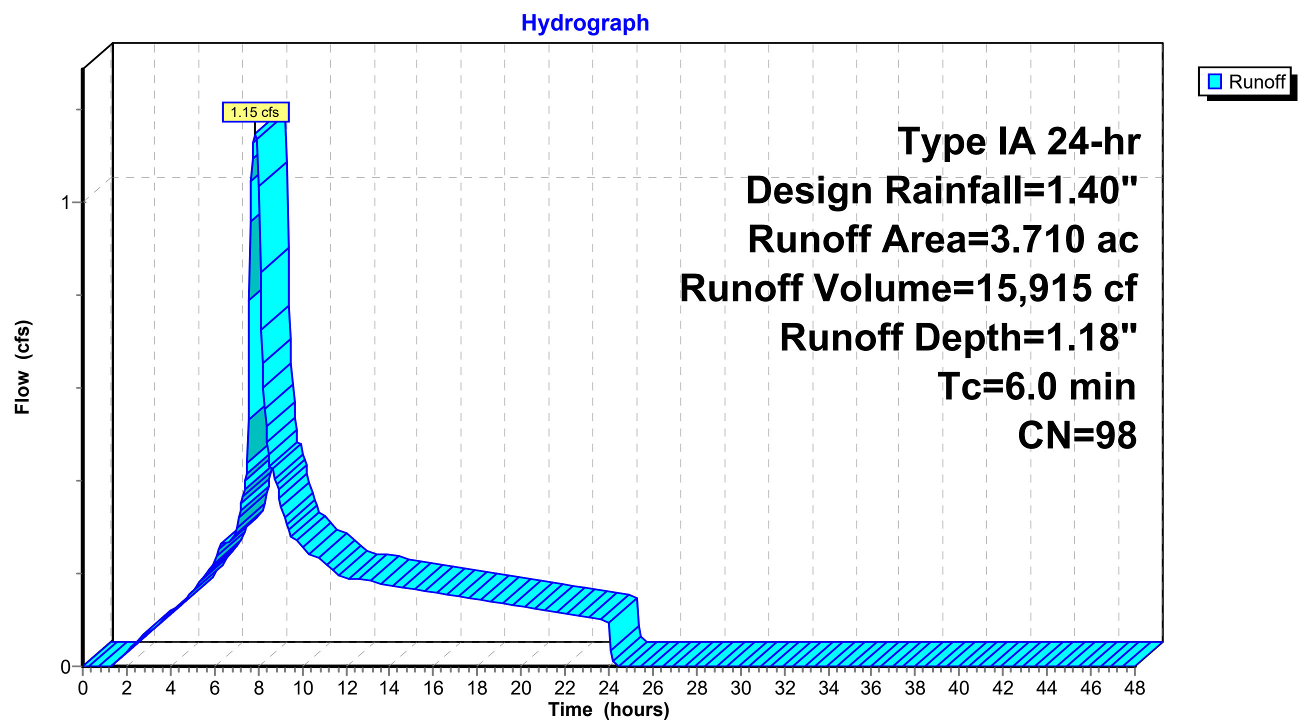
Runoff = 1.15 cfs @ 7.89 hrs, Volume= 15,915 cf, Depth= 1.18"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type IA 24-hr Design Rainfall=1.40"

	Area (ac)	CN	Description
*	1.890	98	Paved Road
*	0.550	92	Gravel Laydown
*	1.240	100	Pond 1
*	0.030	80	Pipeline
	3.710	98	Weighted Average
	0.580		15.63% Pervious Area
	3.130		84.37% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, TR-55 Minimum**

Subcatchment P1-NB: Pond 1 North Basin



Summary for Subcatchment P1-SB: Pond 1 South Basin

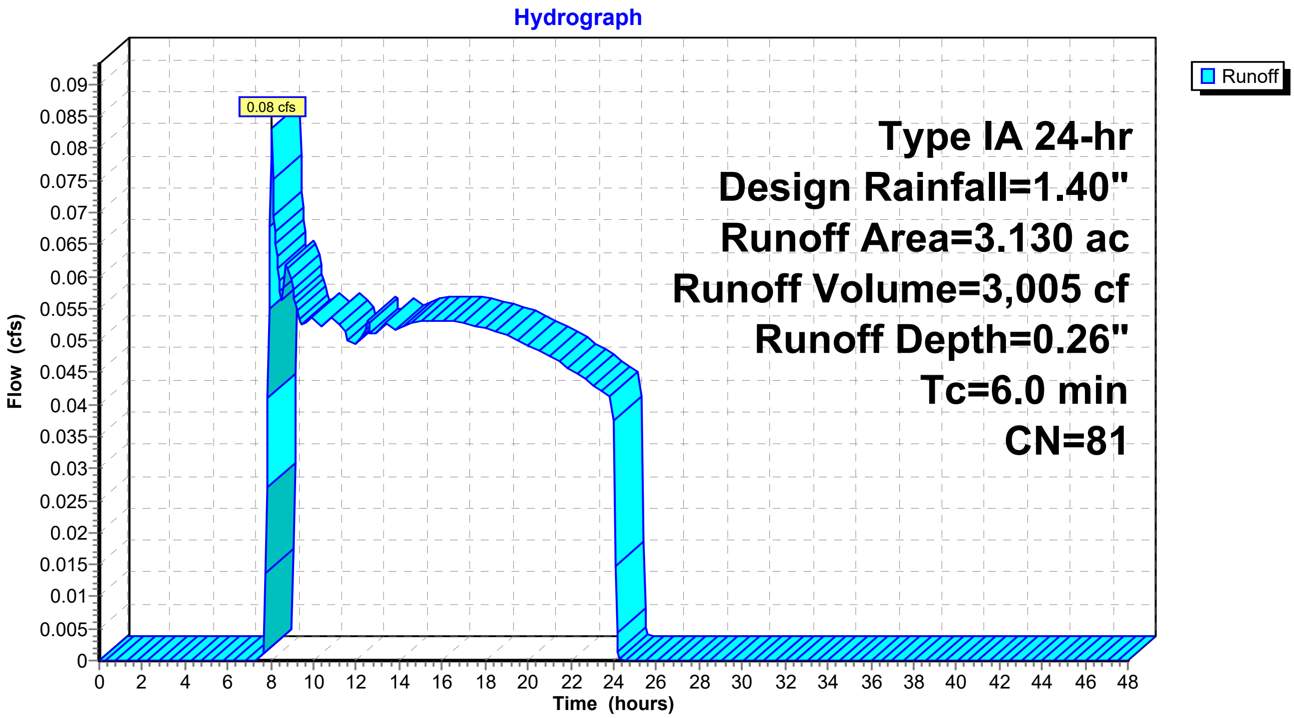
Runoff = 0.08 cfs @ 8.04 hrs, Volume= 3,005 cf, Depth= 0.26"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type IA 24-hr Design Rainfall=1.40"

	Area (ac)	CN	Description
*	2.570	78	Rail/Gravel Base
*	0.560	92	Gravel Access Road
	3.130	81	Weighted Average
	3.130		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, TR-55 Minimum**

Subcatchment P1-SB: Pond 1 South Basin



Summary for Subcatchment P2-NB: Pond 2 North Basin

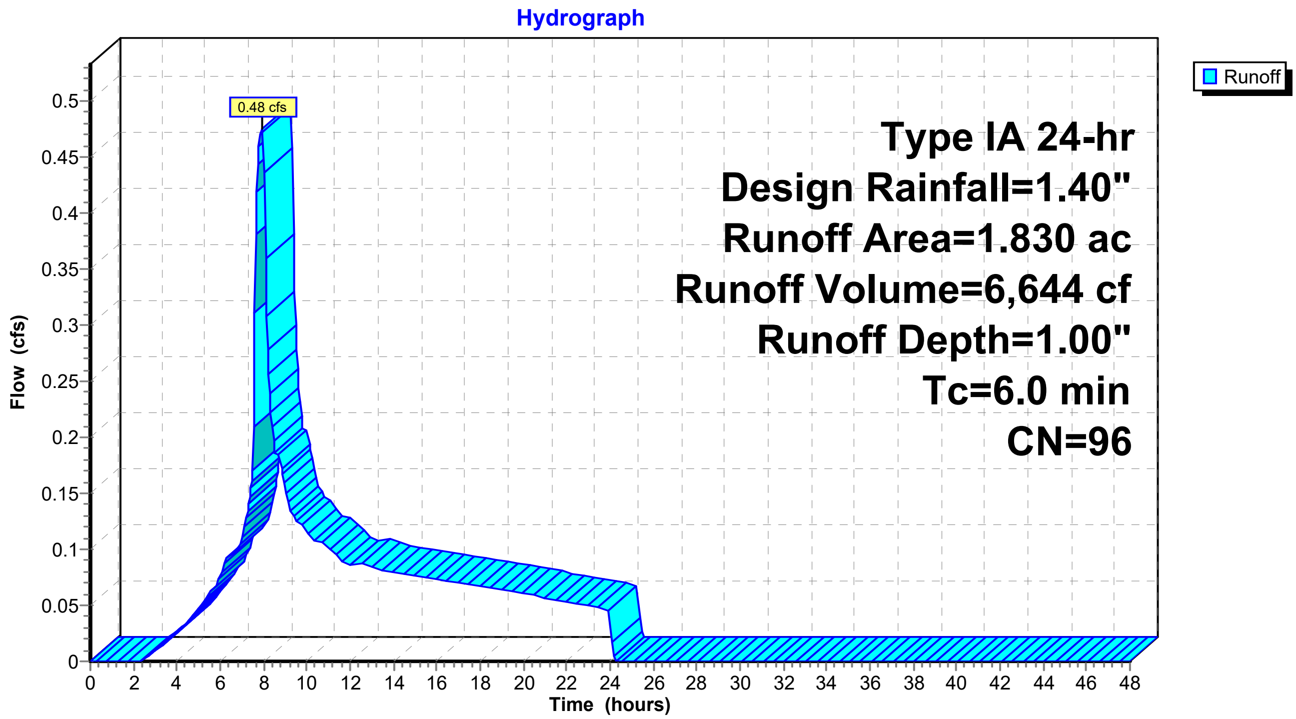
Runoff = 0.48 cfs @ 7.92 hrs, Volume= 6,644 cf, Depth= 1.00"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type IA 24-hr Design Rainfall=1.40"

	Area (ac)	CN	Description
*	0.350	80	Pipeline
*	0.800	100	Paved Road
*	0.080	92	Gravel Laydown
*	0.600	100	Pond 2
	1.830	96	Weighted Average
	0.430		23.50% Pervious Area
	1.400		76.50% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, TR-55 Minimum**

Subcatchment P2-NB: Pond 2 North Basin



Summary for Subcatchment P2-SB: Pond 2 South Basin

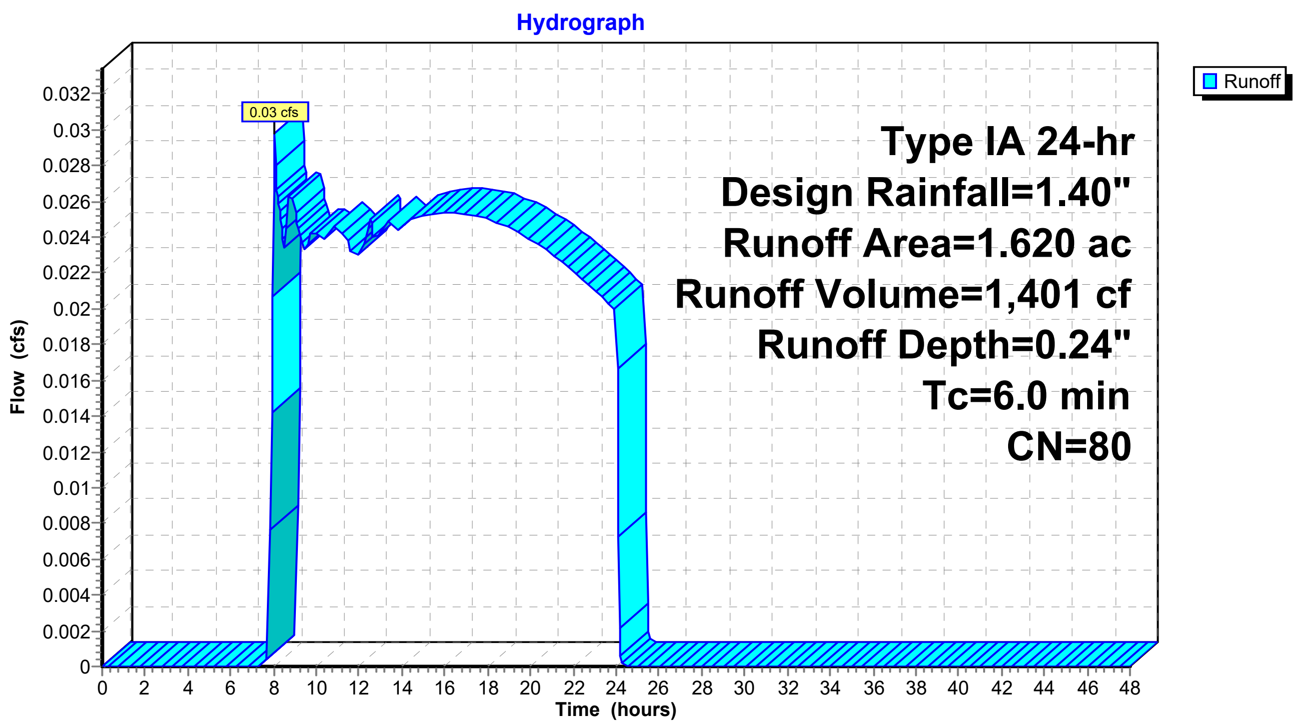
Runoff = 0.03 cfs @ 8.06 hrs, Volume= 1,401 cf, Depth= 0.24"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type IA 24-hr Design Rainfall=1.40"

	Area (ac)	CN	Description
*	1.350	78	Rail/Gravel Base
*	0.270	92	Gravel Access Road
	1.620	80	Weighted Average
	1.620		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, TR-55 Minimum**

Subcatchment P2-SB: Pond 2 South Basin



Summary for Subcatchment PMR: Pipeline Maintenance Road

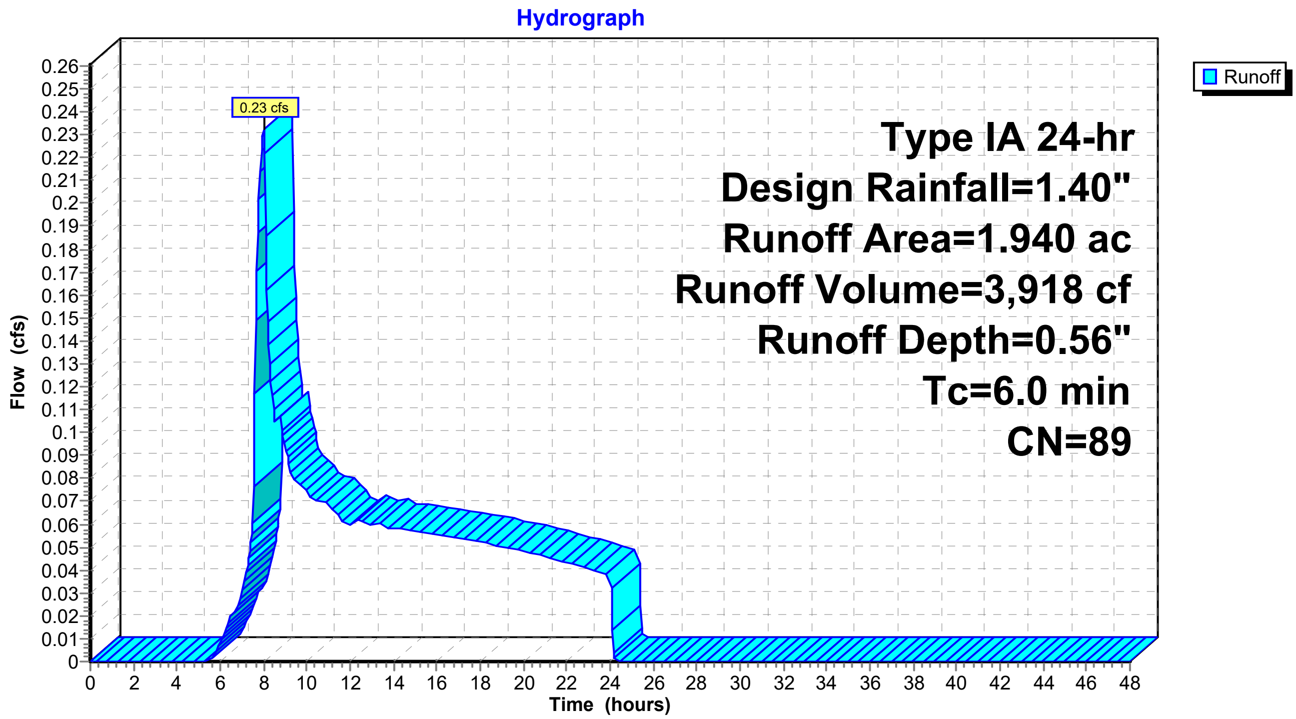
Runoff = 0.23 cfs @ 7.99 hrs, Volume= 3,918 cf, Depth= 0.56"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type IA 24-hr Design Rainfall=1.40"

	Area (ac)	CN	Description
*	0.580	92	Maintenance Road
*	0.490	100	Pond 3
*	0.870	80	Pipeline
	1.940	89	Weighted Average
	1.450		74.74% Pervious Area
	0.490		25.26% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, TR-55 Minimum**

Subcatchment PMR: Pipeline Maintenance Road



Summary for Pond DP-002: MH-DP002 (Basin 2 Post-Developed)

Inflow Area = 532,739 sf, 41.05% Impervious, Inflow Depth > 0.11" for Design event
Inflow = 0.09 cfs @ 24.10 hrs, Volume= 4,970 cf
Outflow = 0.09 cfs @ 24.10 hrs, Volume= 4,969 cf, Atten= 0%, Lag= 0.3 min
Primary = 0.09 cfs @ 24.10 hrs, Volume= 4,969 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs / 2
Starting Elev= -2.52' Surf.Area= 20 sf Storage= 30 cf
Peak Elev= -2.38' @ 24.10 hrs Surf.Area= 20 sf Storage= 32 cf (3 cf above start)

Plug-Flow detention time= 15.1 min calculated for 4,934 cf (99% of inflow)
Center-of-Mass det. time= 0.6 min (1,584.4 - 1,583.9)

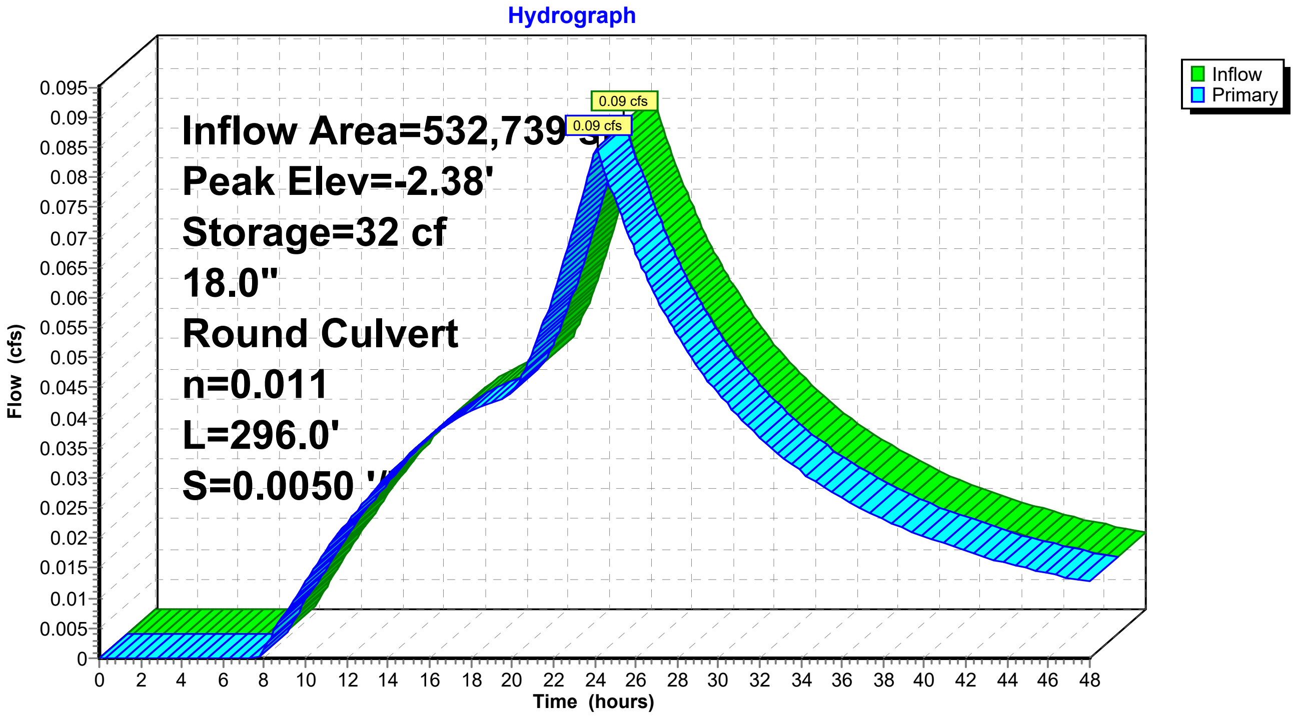
Volume	Invert	Avail.Storage	Storage Description
#1	-4.00'	140 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
-4.00	20	0	0
3.00	20	140	140

Device	Routing	Invert	Outlet Devices
#1	Primary	-2.52'	**18.0" Round Pipe to McLean Slough** L= 296.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= -2.52' / -4.00' S= 0.0050 '/' Cc= 0.900 n= 0.011, Flow Area= 1.77 sf

Primary OutFlow Max=0.09 cfs @ 24.10 hrs HW=-2.38' (Free Discharge)
↑—**1=Pipe to McLean Slough** (Inlet Controls 0.09 cfs @ 1.01 fps)

Pond DP-002: MH-DP002 (Basin 2 Post-Developed)



Summary for Pond DP-003: POND 4/CB-DP003 (Basin 3 Post-Developed)

Inflow Area = 33,977 sf, 15.38% Impervious, Inflow Depth = 0.26" for Design event
Inflow = 0.02 cfs @ 8.04 hrs, Volume= 749 cf
Outflow = 0.01 cfs @ 21.52 hrs, Volume= 670 cf, Atten= 44%, Lag= 808.6 min
Primary = 0.01 cfs @ 21.52 hrs, Volume= 670 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs / 2
Starting Elev= 2.00' Surf.Area= 0 sf Storage= 3,518 cf
Peak Elev= 2.07' @ 21.52 hrs Surf.Area= 0 sf Storage= 3,834 cf (316 cf above start)
Flood Elev= 3.00' Surf.Area= 0 sf Storage= 8,061 cf (4,543 cf above start)

Plug-Flow detention time= (not calculated: initial storage excedes outflow)
Center-of-Mass det. time= 424.5 min (1,359.3 - 934.8)

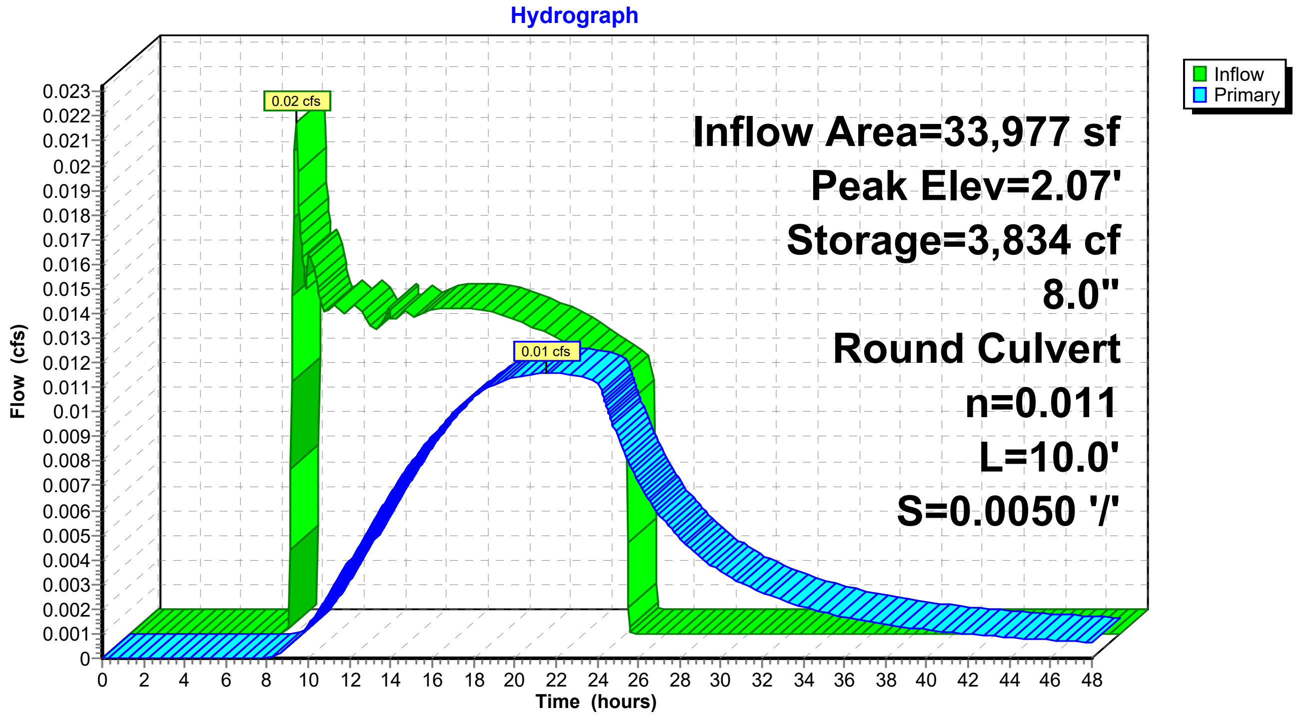
Volume	Invert	Avail.Storage	Storage Description
#1	1.00'	8,061 cf	**Custom Stage Data** Listed below

Elevation (feet)	Cum.Store (cubic-feet)
1.00	0
2.00	3,518
3.00	8,061

Device	Routing	Invert	Outlet Devices
#1	Primary	2.00'	**8.0" Round Pipe to CB-DP-003** L= 10.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 2.00' / 1.95' S= 0.0050 '/' Cc= 0.900 n= 0.011, Flow Area= 0.35 sf

Primary OutFlow Max=0.01 cfs @ 21.52 hrs HW=2.07' (Free Discharge)
↑—**1=Pipe to CB-DP-003** (Barrel Controls 0.01 cfs @ 0.92 fps)

Pond DP-003: POND 4/CB-DP003 (Basin 3 Post-Developed)



Summary for Pond P-1: POND 1

Inflow Area = 297,950 sf, 45.76% Impervious, Inflow Depth = 0.76" for Design event
Inflow = 1.21 cfs @ 7.93 hrs, Volume= 18,920 cf
Outflow = 0.04 cfs @ 24.12 hrs, Volume= 1,725 cf, Atten= 97%, Lag= 970.9 min
Primary = 0.04 cfs @ 24.12 hrs, Volume= 1,725 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 0.13' @ 24.12 hrs Surf.Area= 0 sf Storage= 18,639 cf
Flood Elev= 2.35' Surf.Area= 0 sf Storage= 102,326 cf

Plug-Flow detention time= 1,595.8 min calculated for 1,725 cf (9% of inflow)
Center-of-Mass det. time= 1,128.3 min (1,861.9 - 733.6)

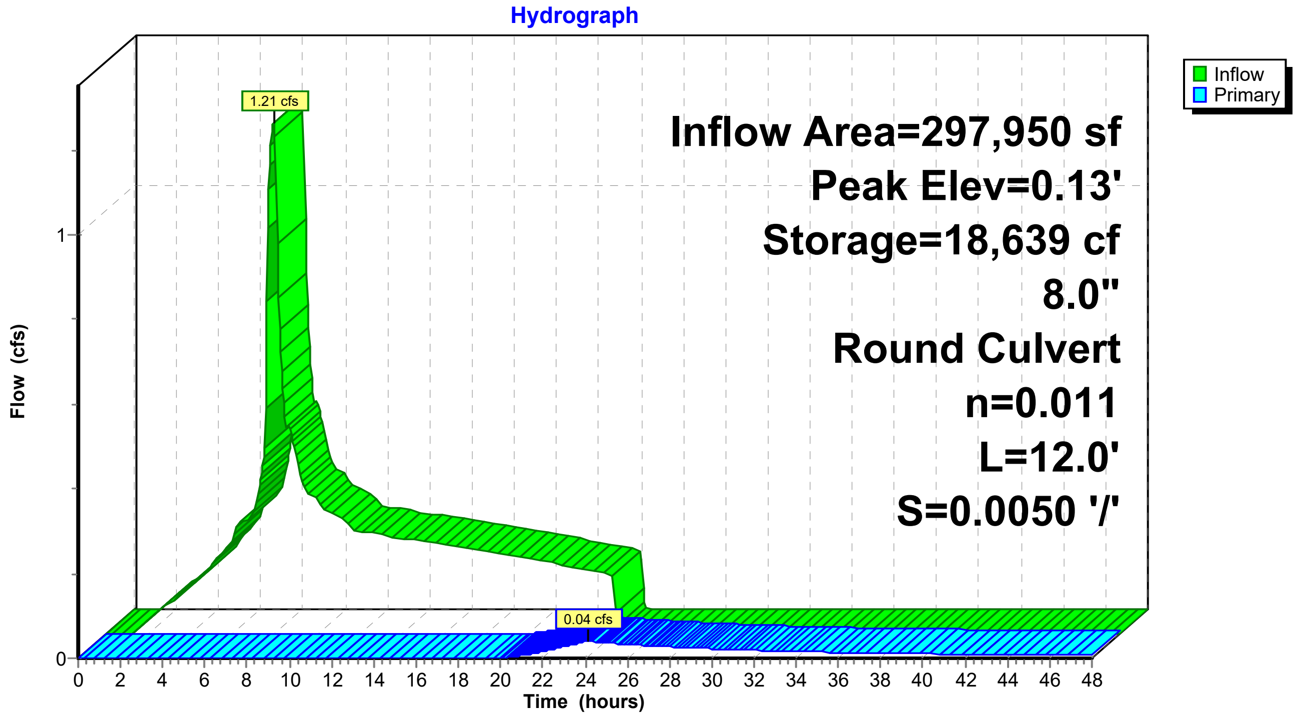
Volume	Invert	Avail.Storage	Storage Description
#1	-1.15'	102,326 cf	**Custom Stage Data**Listed below

Elevation (feet)	Cum.Store (cubic-feet)
-1.15	0
-0.65	4,073
0.35	22,730
1.35	55,457
2.35	102,326

Device	Routing	Invert	Outlet Devices
#1	Primary	0.00'	**8.0" Round Pipe to MH-DP002** L= 12.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 0.00' / -0.06' S= 0.0050 '/' Cc= 0.900 n= 0.011, Flow Area= 0.35 sf

Primary OutFlow Max=0.04 cfs @ 24.12 hrs HW=0.13' TW=-2.38' (Dynamic Tailwater)
└─**1=Pipe to MH-DP002** (Barrel Controls 0.04 cfs @ 1.27 fps)

Pond P-1: POND 1



Summary for Pond P-1 CBs: Pond 1 Catch Basins

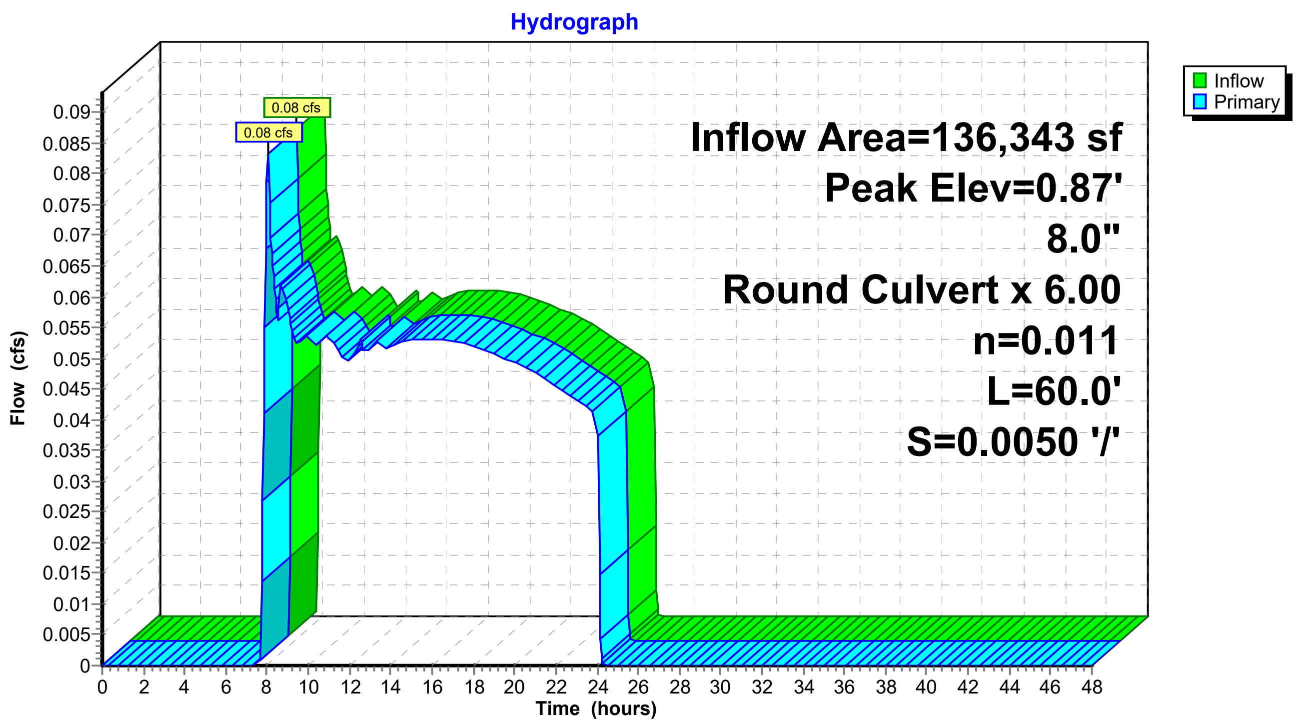
Inflow Area =	136,343 sf,	0.00% Impervious,	Inflow Depth = 0.26"	for Design event
Inflow =	0.08 cfs @	8.04 hrs, Volume=	3,005 cf	
Outflow =	0.08 cfs @	8.04 hrs, Volume=	3,005 cf,	Atten= 0%, Lag= 0.0 min
Primary =	0.08 cfs @	8.04 hrs, Volume=	3,005 cf	

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 0.87' @ 8.04 hrs
Flood Elev= 2.35'

Device	Routing	Invert	Outlet Devices
#1	Primary	0.80'	**8.0" Round Storm Pipe Under Tracks to Pond X 6.00** L= 60.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 0.80' / 0.50' S= 0.0050 '/' Cc= 0.900 n= 0.011, Flow Area= 0.35 sf

Primary OutFlow Max=0.08 cfs @ 8.04 hrs HW=0.87' TW=-0.58' (Dynamic Tailwater)
└─**1=Storm Pipe Under Tracks to Pond** (Barrel Controls 0.08 cfs @ 1.01 fps)

Pond P-1 CBs: Pond 1 Catch Basins



Summary for Pond P-2: POND 2

Inflow Area = 150,282 sf, 40.58% Impervious, Inflow Depth = 0.64" for Design event
Inflow = 0.50 cfs @ 7.97 hrs, Volume= 8,045 cf
Outflow = 0.00 cfs @ 24.22 hrs, Volume= 84 cf, Atten= 100%, Lag= 975.2 min
Primary = 0.00 cfs @ 24.22 hrs, Volume= 84 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 0.03' @ 24.22 hrs Surf.Area= 0 sf Storage= 8,042 cf
Flood Elev= 2.35' Surf.Area= 0 sf Storage= 49,476 cf

Plug-Flow detention time= 1,827.8 min calculated for 84 cf (1% of inflow)
Center-of-Mass det. time= 1,266.9 min (2,040.3 - 773.3)

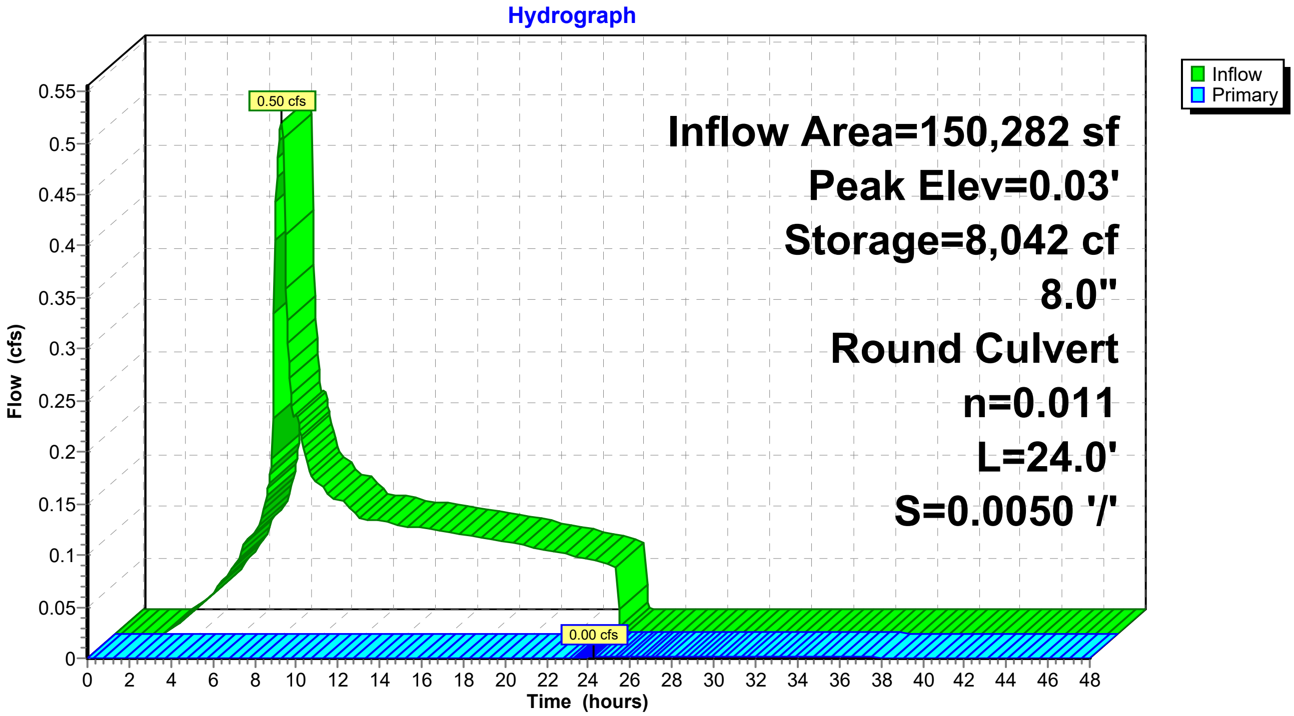
Volume	Invert	Avail.Storage	Storage Description
#1	-1.15'	49,476 cf	**Custom Stage Data** Listed below

Elevation (feet)	Cum.Store (cubic-feet)
-1.15	0
-0.65	1,959
0.35	10,959
1.35	26,767
2.35	49,476

Device	Routing	Invert	Outlet Devices
#1	Primary	0.00'	**8.0" Round Pipe to MH-DP002** L= 24.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 0.00' / -0.12' S= 0.0050 '/' Cc= 0.900 n= 0.011, Flow Area= 0.35 sf

Primary OutFlow Max=0.00 cfs @ 24.22 hrs HW=0.03' TW=-2.38' (Dynamic Tailwater)
└─**1=Pipe to MH-DP002** (Barrel Controls 0.00 cfs @ 0.52 fps)

Pond P-2: POND 2



Summary for Pond P-2 CBs: Pond 2 Catch Basins

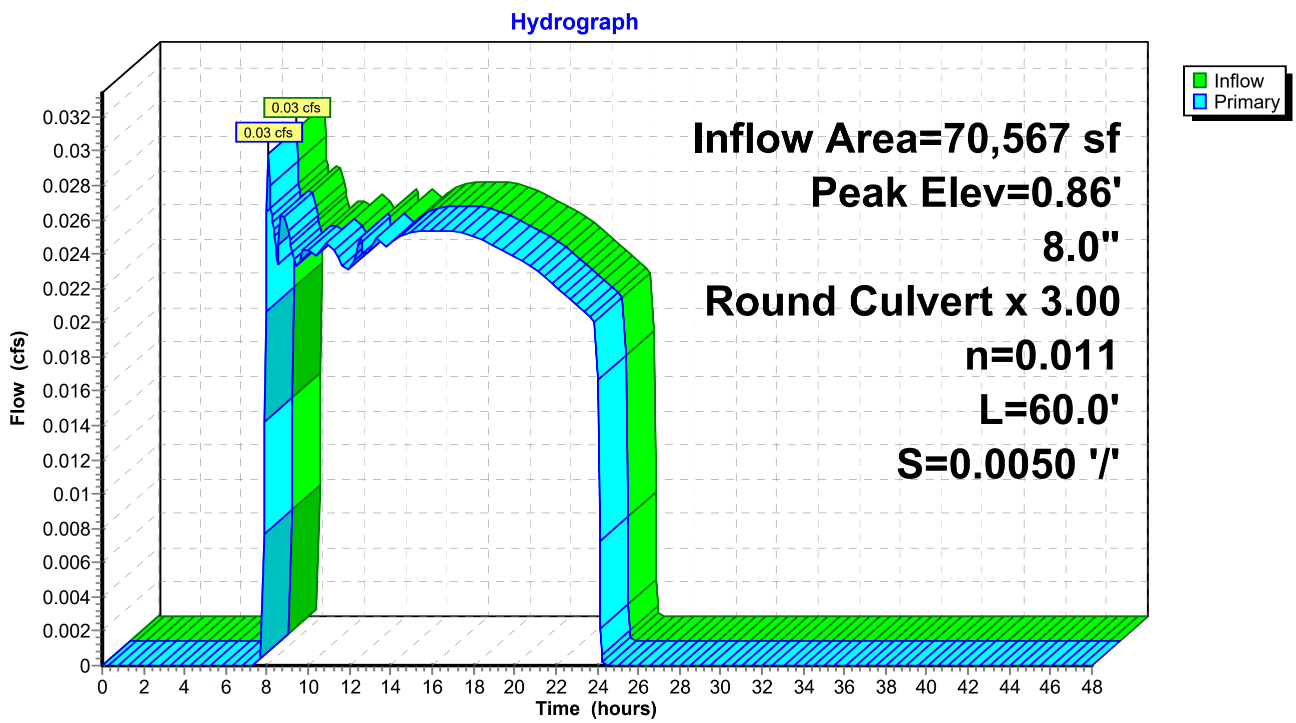
Inflow Area =	70,567 sf,	0.00% Impervious,	Inflow Depth = 0.24"	for Design event	
Inflow =	0.03 cfs @	8.06 hrs, Volume=	1,401 cf		
Outflow =	0.03 cfs @	8.06 hrs, Volume=	1,401 cf,	Atten= 0%,	Lag= 0.0 min
Primary =	0.03 cfs @	8.06 hrs, Volume=	1,401 cf		

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 0.86' @ 8.06 hrs
Flood Elev= 2.35'

Device	Routing	Invert	Outlet Devices
#1	Primary	0.80'	**8.0" Round Storm Pipe Under Tracks to Pond 2 X 3.00** L= 60.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 0.80' / 0.50' S= 0.0050 '/' Cc= 0.900 n= 0.011, Flow Area= 0.35 sf

Primary OutFlow Max=0.03 cfs @ 8.06 hrs HW=0.86' TW=-0.68' (Dynamic Tailwater)
└─**1=Storm Pipe Under Tracks to Pond 2**(Barrel Controls 0.03 cfs @ 0.91 fps)

Pond P-2 CBs: Pond 2 Catch Basins



Summary for Pond P-3: POND 3

Inflow Area = 84,506 sf, 25.26% Impervious, Inflow Depth = 0.56" for Design event
Inflow = 0.23 cfs @ 7.99 hrs, Volume= 3,918 cf
Outflow = 0.04 cfs @ 21.66 hrs, Volume= 3,161 cf, Atten= 81%, Lag= 820.2 min
Primary = 0.04 cfs @ 21.66 hrs, Volume= 3,161 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs / 2
Starting Elev= -1.00' Surf.Area= 0 sf Storage= 6,229 cf
Peak Elev= -0.87' @ 21.66 hrs Surf.Area= 0 sf Storage= 8,316 cf (2,087 cf above start)

Plug-Flow detention time= (not calculated: initial storage excedes outflow)
Center-of-Mass det. time= 584.7 min (1,419.9 - 835.2)

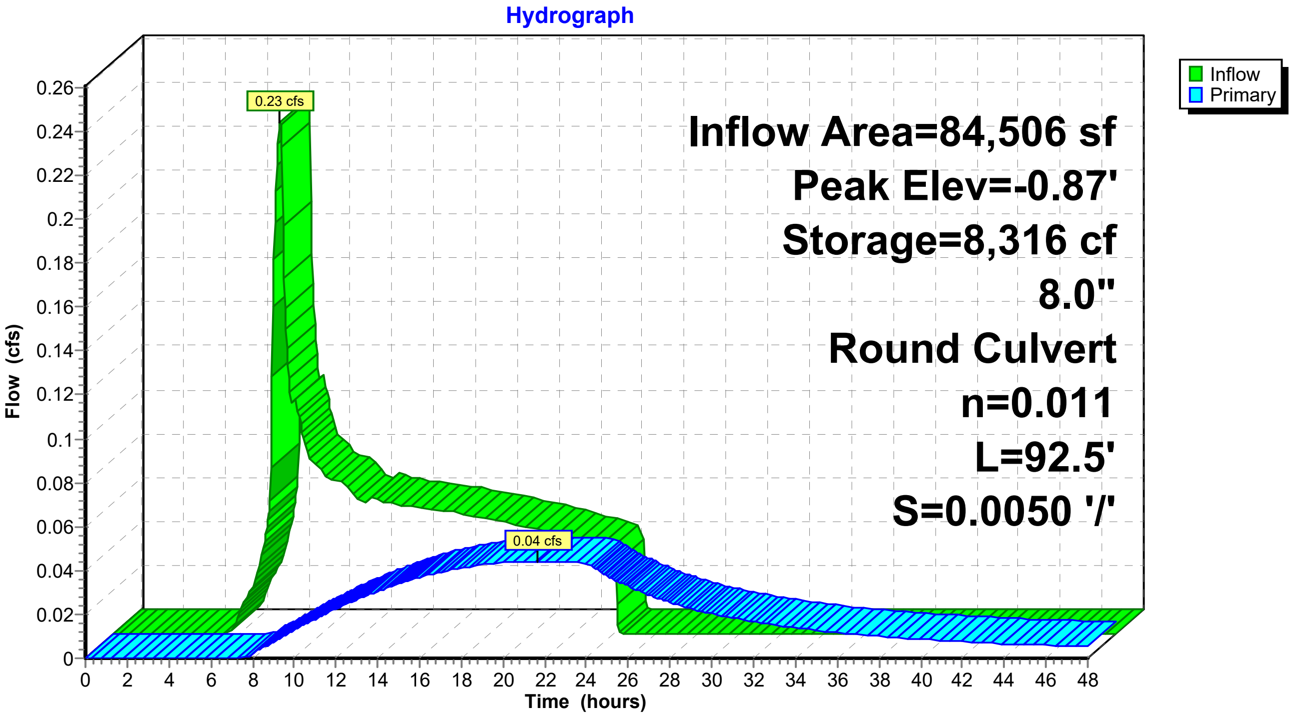
Volume	Invert	Avail.Storage	Storage Description
#1	-2.00'	22,444 cf	**Custom Stage Data**Listed below

Elevation (feet)	Cum.Store (cubic-feet)
-2.00	0
-1.00	6,229
0.00	22,444

Device	Routing	Invert	Outlet Devices
#1	Primary	-1.00'	**8.0" Round Pipe to MH-DP002** L= 92.5' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= -1.00' / -1.46' S= 0.0050 '/' Cc= 0.900 n= 0.011, Flow Area= 0.35 sf

Primary OutFlow Max=0.04 cfs @ 21.66 hrs HW=-0.87' TW=-2.40' (Dynamic Tailwater)
└—**1=Pipe to MH-DP002** (Barrel Controls 0.04 cfs @ 1.41 fps)

Pond P-3: POND 3



APPENDIX D

WASTEWATER TREATMENT PLANT DESIGN INFORMATION

NEXT Renewable Fuels, Oregon LLC

WASTEWATER-STORM WATER DESIGN BASIS

April 15, 2021
Revised January 23, 2023
Rev 1

I. INTRODUCTION

NEXT Renewable Fuels, Oregon LLC (NEXT) is a private company focused on producing and delivering clean transportation fuels. NEXT plans to build a Renewable Fuels facility at Port Westward, Oregon.

Details regarding the Facility and the renewable fuels manufacturing process are outlined in the NEXT Project Design Basis in Attachment 1.

As part of the Renewable Fuels project, NEXT will install a wastewater and stormwater management facilities within the Main Plant (referred to as Drainage Area 1 on Figure 1). The wastewater and stormwater at the Main Plant are commingled and treated as wastewater. Once the two streams are commingled and treated, the two streams are referred to as "Process Wastewater" and discharge consistent with Port Westward's individual National Pollutant Discharge Elimination System (NPDES) Waste Discharge Permit (DEQ File No. 111746) to the Port wastewater system.

The stormwater management system for runoff generated in Drainage Areas 2 and 3, which include proposed roads, pipe rack, and rail areas (see Figure 1), are outlined in the Post Construction Stormwater Management Plan (SWMP).

II. OVERVIEW

The NEXT Renewable Fuels facility Wastewater Treatment facility is designed to treat wastewater produced from processing vegetable oil (VO) and animal fats (AF) to produce 50,000 barrels per day (BPD) of Renewable Diesel, as well as stormwater that comes into contact with the oil-handling process equipment at the Main Plant.

A process flow diagram showing the Wastewater / Stormwater Treatment facilities is included in Attachment 2.

The NEXT treated Process Wastewater effluent will discharge to the existing Port Westward outfall to the Columbia River. The effluent quality will be required to comply with the Port Westward NPDES Waste Discharge Permit (see Attachment 3). To ensure compliance with the Port's NPDES permit, the NEXT Wastewater Treatment (WWT) effluent design specifications, shown in Table 1, are more stringent than the Port's effluent limits. These specifications will be adjusted if the Port's effluent limitations change when the Waste Discharge Permit is renewed.

Table 1: NEXT WWT/SW Effluent Specifications

WWT Specifications	Spec	Comment
Temperature DT:	**0 °F**	Temp delta is influent raw water - WWT effluent
COD:	**N/A**	
BOD5:	**≤ 20 mg/L**	
FOG:	**≤ 20 mg/L**	
TSS:	**≤ 10 mg/L**	
Total Nitrogen:	**≤ 50 mg/L**	
Phosphorus-P:	**≤ 5 mg/L**	
Alkalinity:	**≥ 50 mg/L**	
pH:	**6.6 – 8.5**	
Free Chlorine:	**≤ 0.15 mg/L**	

Wastewater Treatment

As Attachment 2 highlights, the WWT flow scheme has been designed to segregate and optimize the treating of the various streams and contaminants.

The VO/AF pretreatment facility will produce two wastewater streams, High and Low Strength. The high strength wastewater will contain a high chemical oxygen demand (COD) load from the degumming section and the low strength will be a lower COD stream made up of several wastewater sources. These streams will be segregated and processed differently. The low strength COD stream will be comingled with the normal process wastewater stream and processed through the dissolved air floatation (DAF) facility to separate of oily float, solids, and water. The high strength COD stream will be comingled with the DAF float and processed in the Anerobic Digestion system.

The treated products from the DAF and the Anerobic Digester will flow to the Equalization Tank where they will be comingled with low COD water from several sources, RO Reject, Boiler Blowdown, Stripped Sour Water (SSW), and Cooling Tower (CT) Blowdown and stormwater from the process area of the Main Plant. These waters will be mixed and discharged to the Aerobic Sequential Batch Bioreactors (SBRs) for further treatment.

The water from the SBRs will flow to the Post Equalization Tank for further oxidation and clarification before being sent to Tertiary Filtration to substantially reduce solids content. Stormwater from non-process areas of the facility will be comingled with the Post Equalization water and be treated through the Tertiary Filters.

The final step in processing is cooling of the streams to ensure compliance with the Port's NPDES Waster Discharge Permit temperature effluent limit. A heat exchanger will be used to cool the Process Wastewater effluent against incoming plant raw water.

Refer to the tables in Section IV for pretreatment and effluent parameters in the wastewater treatment system mentioned above.

Main Plant Stormwater System

The Main Plant stormwater system will be designed to collect and process stormwater generated during a 100-year, 24-hour storm event. The design storms used for the project are based on Appendix E of the Columbia County's Stormwater and Erosion Control Ordinance No. 2001-10 adopted November 28, 2001, using the rainfall depths for Clatskanie as shown in Table 2.

Table 2: Columbia County Design Storm Rainfall Depths

Storm Event	Water Quality (SLOPES V)	2-yr 24-hr	5-yr 24-hr	10-yr 24-hr	25-yr 24-hr	100-yr 24-hr
Rainfall Depth	1.40"	2.8"	3.4"	3.9"	4.5"	5.4"

Stormwater treatment facilities were designed with the assumption that infiltration is negligible. The runoff curve numbers for thesite surfaces are selected to reflect the low permeability soil conditions, as follows.

Table 3: Runoff Curve Numbers

Surface Coverage	Runoff Curve Number
Paved Roadway, Building Roof, and Sidewalks	98
Gravel Surfacing and Roadways	92
Proposed Landscaping	78
Existing Grass or Vegetated Field	78

Stormwater within the Main Plant boundary will come from several different areas and will consist of both uncontaminated and potentially contaminated runoff. The Main Plant stormwater will be segregated into two separate drainage systems. These include:

- Uncontaminated stormwater from outside the process unpaved areas (Stormwater System).
- Potentially contaminated stormwater from process and utility areas (Process Wastewater System).

The various areas and their proposed drainage:

- **Process & Utility Areas**
  These areas of the Main Plant are subject to biodiesel processing activities and stormwater from these areas is considered potentially contaminated and will be routed to the Process Wastewater System (PWS).

- **Paved Areas other than Process & Utility Areas**
  These areas are considered uncontaminated and will be routed to the Stormwater System (SW). This includes paved roads as well as parking areas.

- **Unpaved Areas**
  These areas are considered uncontaminated and will be routed to SW or will continue to follow existing drainage conditions.

- **Inside Tank Dikes**
  The area inside the dikes is normally considered uncontaminated. Stormwater will be contained inside the dike and allowed to evaporate. If a diked area needs to be drained the water will be visually inspected for a sheen prior to draining. If contaminated, the water will be collected with vacuum trucks or other methods and transported to be comingled with the Post Equalization water and be processed through the Tertiary Filters.

<u>Process Wastewater System (PWS):</u>

The PWS system is a single contained system for collecting stormwater and water wash-downs from the paved process unit and utility areas of the Main Plant.This water is considered to be potentially contaminated and requires treatment. The PWS system will include:

- PWS Basin, Capacity of 12,825 barrels (bbl)
- PWS Tank #1, Capacity of 65,000 bbl
- Equalization Tank, Capacity of 65,000 bbl reserved for stormwater
- Three (3) PWS Basin Sump Pumps and one (1) small pump
- PWS transfer pumps

Runoff from the various process areas is collected through a network of underground pipes and gravity flows to lift stations. Stormwater from smaller pump manifolds, flare drum areas, and loading/unloading areas, which are remote from the process areas will be collected in a similar manner and routed to one or more lift stations to be pumped to the PWS Tank. Water is pumped from the lift stations to the PWS Tank and is then pumped at a controlled rate (750 gallons per minute (gpm)) to the WWT system.

Treated effluent from the WWT will meet the effluent specifications outlined in Table 1.

Refer to attached Figure 2 for the extent of the PWS system.

<u>Stormwater (SW) System</u>:

In the SW (Stormwater) system, the uncontaminated runoff from outside the process areas is conveyed to the Stormwater Tank (SW Tank). Runoff from the paved roads is collected through a network of underground pipes that gravity flow to stormwater collection sumps that pump stormwater to the SW Tank (see Figure 2). The SW system will include:

- SW Basin, Capacity of 12,825 barrels (bbl)
- SW Tank, Capacity of 125,000 bbl
- Three (3) SW Basin Sump Pumps and one (1) small pump
- SW transfer pumps

Stormwater from the SW Tank will be tested and if it complies with effluent specifications in Table

1, it will be released gradually over a period of 10 days at a controlled flow rate of 750 gpm to the Tertiary Filters before discharging to the Port Outfall.

Refer to the attached Figure 2 that depicts the extent of the SW system.

Table 4 summarizes the acreage attributed to each stormwater drainage area.

Table 4: NEXT Main Plant Stormwater Basins

NEXT Main Plant Stormwater Basin Acreage	
	Acres
Process Wastewater System (PWS) Area	33
Stormwater (SW) System Area	42
Tank Dike Areas	21
Other Pervious Surface Areas[1]	14
Total Surface Area	110

[1] Pervious surface areas are expected to evaporate or follow existing drainage conditions.

III. DESIGN BASIS / CONSIDERATIONS

Storage Capacity

During extreme storm events (i..e., the100-year, 24-hour storm of 5.4 in.), the stormwater system will need to contain ~230,000 barrels (bbl) of process and stormwater. The water will be contained in various tanks within the PWS and SW systems and pumped through the treatment facility over a 2-week period.

The pump out rate from each system (PWS and SW) is based on a 100-year, 24-hour storm (5.40 inches).The pump out rate for the PWS and SW systems will be provided by three pumps at 3,750 GPM each. An additional small pump is provided at 500 gpm to handle pumping small daily rain episodes. Table 5 shows the current design's water storage capacity and pump rates.

Table 5: Stormwater Tankage

Source	Basins		Tanks				
	Basin Volume (bbl)	Minimum Basin Pump Rate (GPM)	PWS Tank 1 (bbl)	Equalization Tank (bbl)	SW Tank 2(bbl)	Tank Pump Rate (GPM)	Total (bbl)
PWS	12,825	6,610	65,000	65,000	-	750	132,825
SW	12,825	7,800	-	-	125,000	750	137,825
Total Water Storage							270,650

The HydroCAD model output report is included in Attachment 4.

IV. WWT INFLUENT WATER SPECIFICATIONS

The tables below depict the potential WWT effluent monitoring parameters and pretreatment standards that the Port may apply to discharges from the wastewater treatment system.

Pretreat Unit Summary Table		without high COD stream to WWTP		high-COD stream only		If all streams combined
Flow Rate	GPM	118		53		171
Flow Rate	pph	58962		26233		85194
COD (estimated)	ppm	19824		282697		100767
BOD5	ppm	11498		163965		58445
Lyso-Phospholipids	ppm	335		28631		9048
Phospholipids	ppm	0		0		0
Fats & Oils	ppm	9058		52771		22518
Inorganic Chlorides	ppm	15		655		212
Citric Acid	ppm	0		9772		3009
Phosphorus	ppm	43		1661		542
TSS (insoluble impurities + Fats & Oils entrained with insoluble impurities)	ppm	0		93814		28887
TDS (not considering TDS of process water provided by client)	ppm	102		3099		1025
Sulfur (rough estimate)	ppm	51		807		284
Nitrogen (rough estimate	ppm	130		2039		717

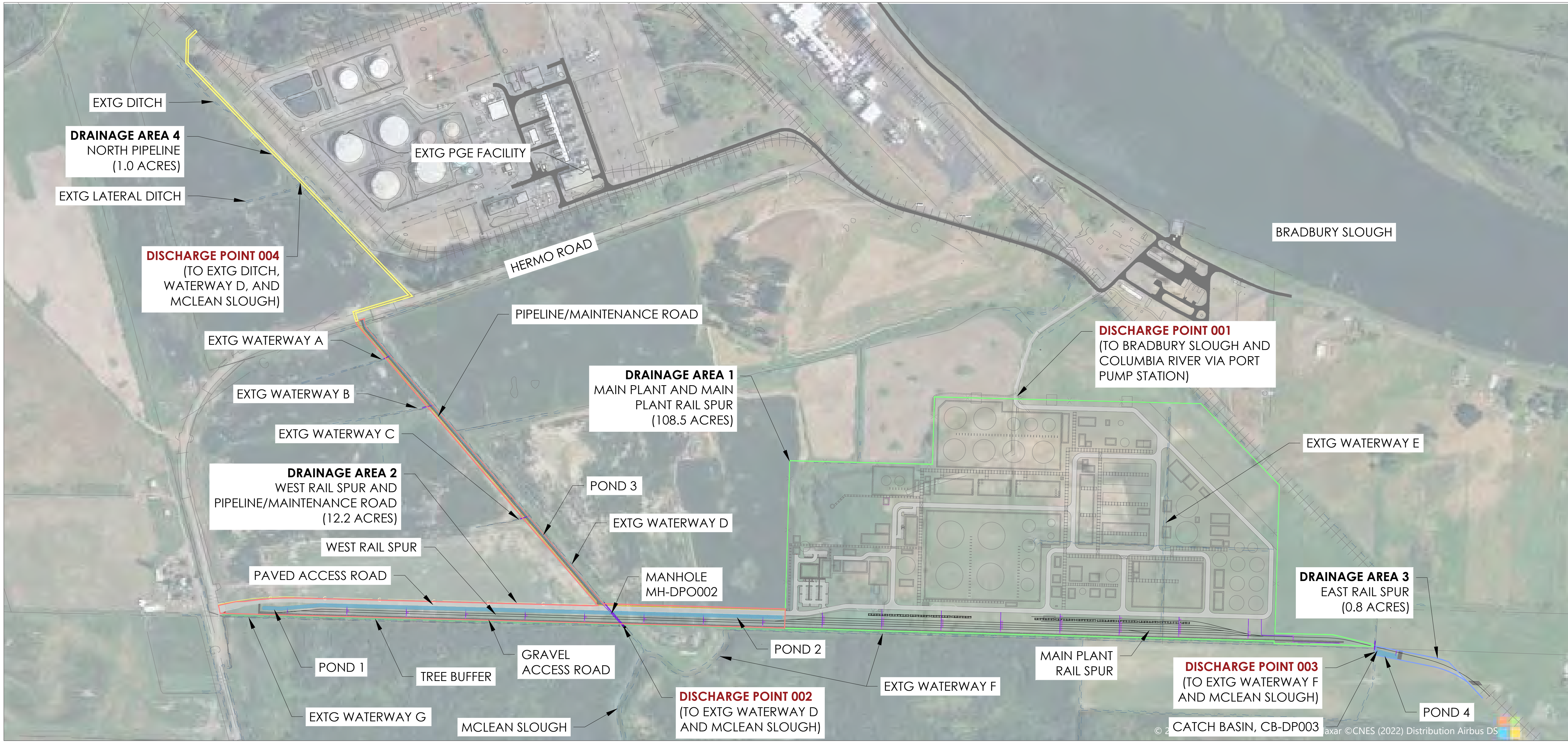
	Cooling Tower Blowdown	RO Reject
Dissolved Oxygen, ppm O2		
pH	7.5-8.0	
Total Hardness as CACO3, ppm	345	590
Alkalinity – Bicarbonate, ppm	266.5	506
Total Iron, ppm FE	0.21	0
Total Copper, ppm Cu	0.0035	
Total Dissolved Solids, ppm	450	850
Total Suspended Solids, ppm	73.5	127
Silica ppm as SiO2	63	117
Conductivity, microohms/cm at 68F	725	1250
Turbidity	-	
Chloride	23.5	
Fluoride	0.5	
Nitrate as N	2.5	
Sulfate	48.5	
Calcium	79.5	
Magnesium, Total	23	
Potassium, Total	6	
Sodium, Total	33	
Temp	70-120 F	70-90 F

Typical Boiler Blowdown Properties		
Boiler pressure	psig	600 - 750
Iron Concentration	*(ppm)*	0.025
Copper Concentration	*(ppm)*	0.02
Hardness $CaCO_3$	*(ppm)*	0.2
Silica Concentration	*(ppm)*	30
Alkalinity $CaCO_3$	*(ppm)*	400
Total Dissolved Solids	*(ppm)*	1000
Specific Conductivity	*(µS/cm)* *	4000
Temp		400-450 F

Sour Water Effluent Stream	
Ammonia ppm	50
H2S ppm	<5
Phenol ppm	30
BOD ppm	120
COD ppm	514
TOC ppm	160
pH	5-7

Oily Water Effluent		
pH		6-9
COD, ppm		750
BOD, ppm		300
TSS, ppm		250
TOC, ppm		150
Alkalinity, ppm		125
Ammonia, ppm		0
Temp		100 F

FIGURES



LEGEND

- STORMWATER POND
- PAVED ROAD
- GRAVEL
- TREE BUFFER
- DRAINAGE AREA BOUNDARY
- RAIL SPUR
- PIPE RACK
- STORM PIPE
- CATCH BASIN
- EXISTING WATERWAY/DITCH

MFA JOB #:	M1724.01
ISSUE DATE:	1/19/2023
CHECKED:	A. AGUIRRE
DRAWN:	L. DANIEL

MAUL FOSTER ALONGI
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PORTLAND, OR 97232
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NEXT Renewable Fuels, Inc.

SITE LAYOUT

NEXT RENEWABLE FUELS OREGON

NEXT RENEWABLE FUELS, INC.
PORT WESTWARD, OREGON

0 700' 1400'

NOTE: BAR IS ONE INCH ON ORIGINAL DRAWING. IF NOT ONE INCH ON THIS SHEET, ADJUST SCALE ACCORDINGLY.

FIGURE 1

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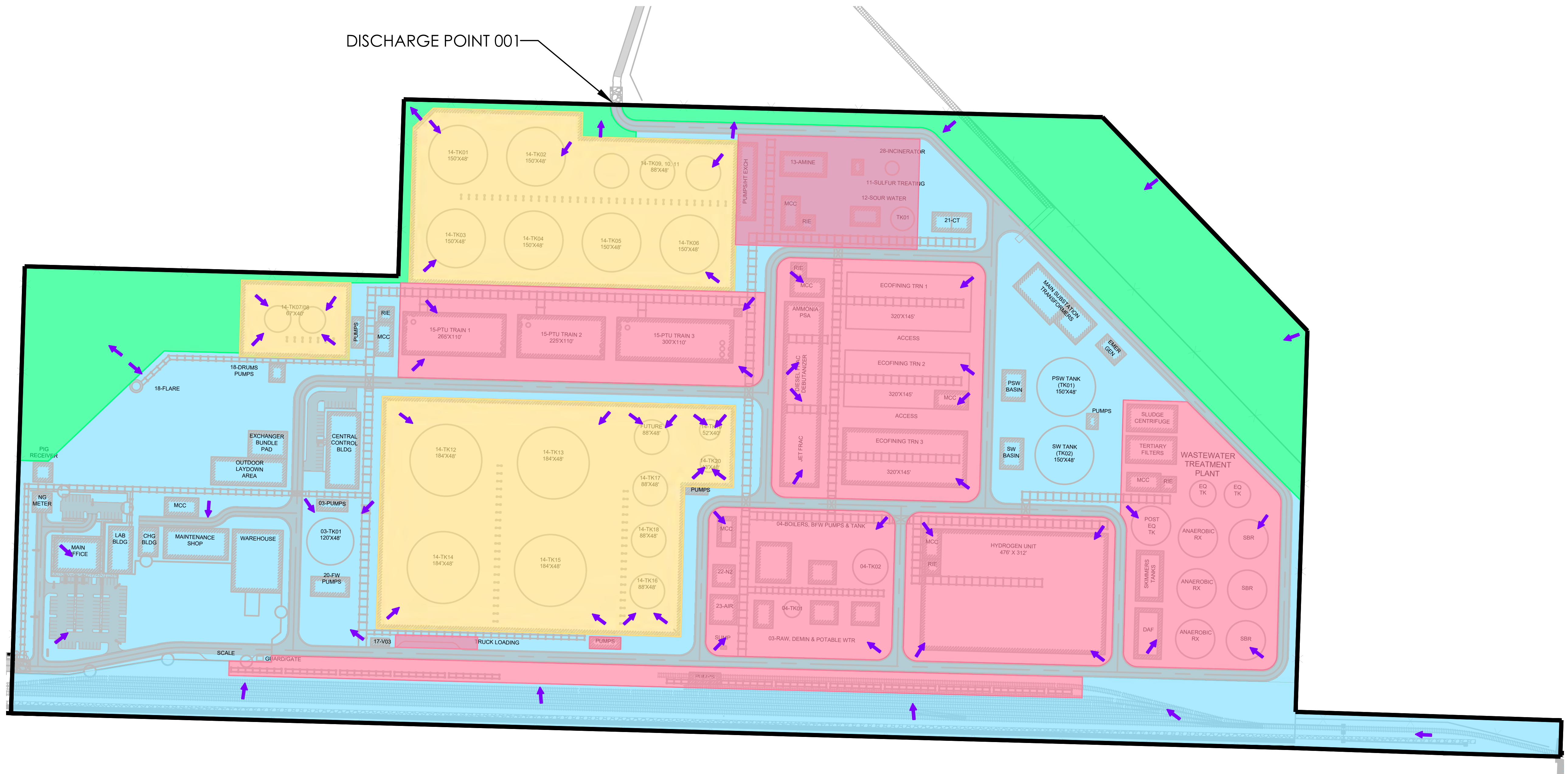

LEGEND

- PROCESS WASTEWATER AREAS (33-ACRES)
- STORMWATER AREAS (40-ACRES)
- TANK DIKE AREAS (21-ACRES)
- OTHER PERVIOUS AREAS (15-ACRES)
- DRAINAGE FLOW DIRECTION

PERMIT

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Date: 11/29/2022 6:24:10 AM

MFA JOB #:	M1724.01
ISSUE DATE:	1/23/2023
CHECKED:	B. TINO
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NEXT Renewable Fuels, Inc.

MAIN PLANT DRAINAGE AREAS

NEXT RENEWABLE FUELS OREGON

NEXT RENEWABLE FUELS, INC.

PORT WESTWARD, OREGON

0 300' 600'

NOTE: BAR IS ONE INCH ON ORIGINAL DRAWING. IF NOT ONE INCH ON THIS SHEET, ADJUST SCALE ACCORDINGLY.

FIGURE 2

ATTACHMENT 1

PROJECT DESIGN BASIS – 50,000 BPD

NEXT Renewable Fuels, Oregon LLC.

PROJECT DESIGN BASIS

50,000 BPD
RENEWABLE DIESEL PROJECT

Revision B
May 7, 2021

Table of Contents

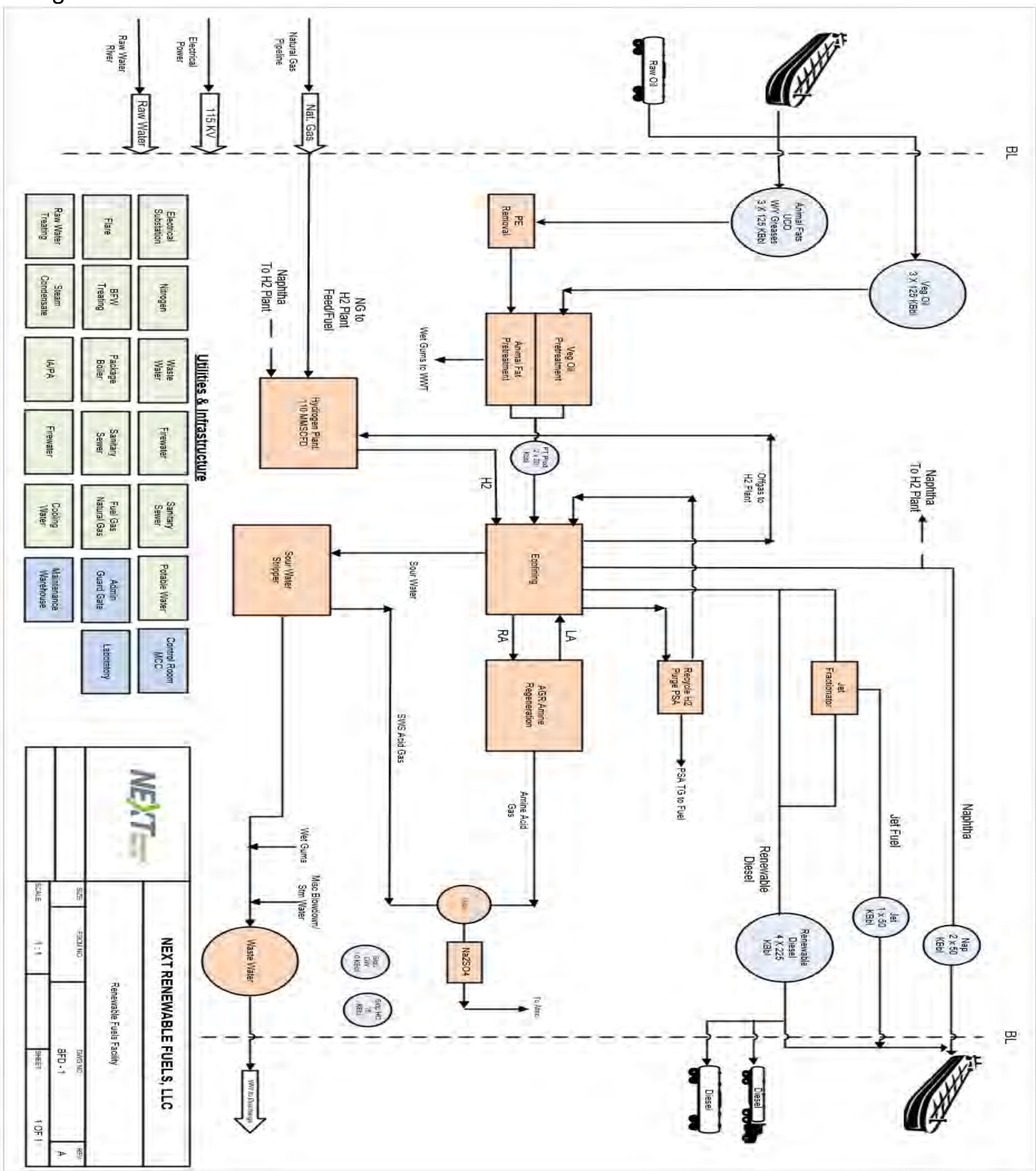
1. Introduction

NEXT Renewable Fuels, LLC is a private company focused on producing and delivering clean transportation fuels. NEXT Renewable Fuels plans to build a flexible Green Diesel facility utilizing the Honeywell UOP Ecofining™ Green Diesel technology. This design basis was prepared for NEXT Renewable Fuels based on constructing a facility that can produce 50,000 BPD of renewable fuels utilizing the Honeywell UOP Ecofining™ Green Diesel technology. The facility would be located in the Pacific Northwest with access to West Coast markets.

The Ecofining™ process is a versatile solution for producing renewable diesel from a range of sustainable feedstocks such as used cooking oil, animal fats, and various vegetable oils. Renewable diesel produced in the Ecofining process is a drop-in fuel which can directly replace up to 100% petroleum-based diesels complying with ASTM975 diesel specification.

The Renewable Diesel facility will be designed to process a variety of used cooking oils, animal fats, vegetable oils, and choice white and yellow greases. The facility will process 51,500 BPD of raw vegetable oils, tallows and animal fats to produce ~50,000 BPD of renewable products. Outlined in Figure 1 is the general block flow for the overall NEXT Green Diesel facility.

Figure 1: NEXT Renewable Diesel BFD



Due to the capacity of the Renewable Diesel facility, the Raw Oil Pretreat and Ecofining™ Units will be multi-train.

A preliminary plot plan, Figure 2, has been developed for the NEXT Renewable Fuels site.

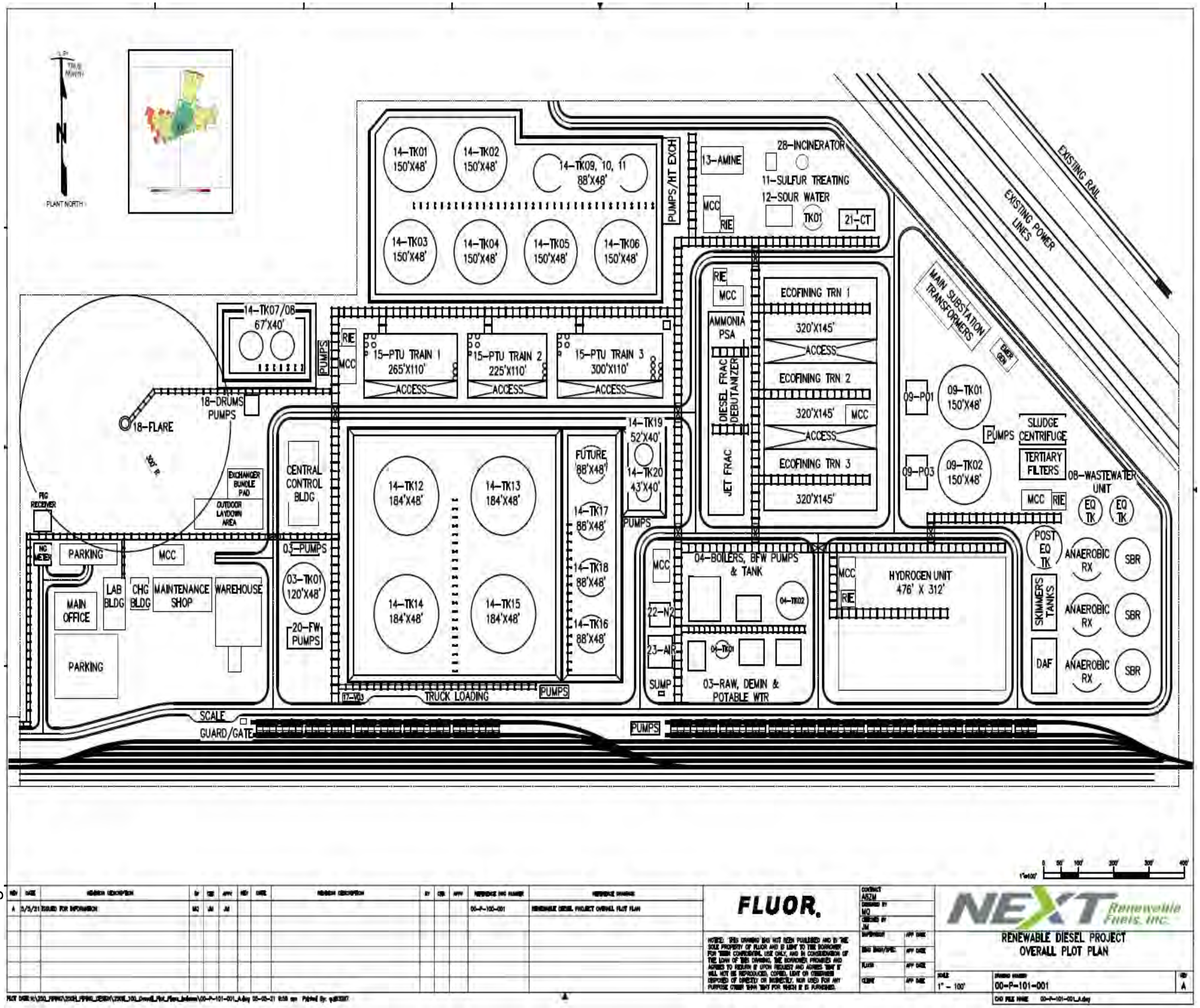


Figure 2: NEXT Renewable Plot Plan

NEXT Renewable Fuels, Inc.

2. Overall Design Basis

NEXT Renewable Fuels is planning to construct a UOP Green Diesel facilitylocated in the pacific northwest. .The design of the facility will be based on processing vegetable oils, animal fats or reclaimed oil / greases (Soybean, DCO, Used Cooking Oil, Beef Tallow, Choice White Grease and Yellow Grease). The planned distribution is listed below.

Raw Oil Feedstock	Oil	Wt%
Soybean Oil	Veg Oil	30
Distillers Corn Oil	Veg Oil	15
Used Cooking Oil	Veg Oil	15
Beef Tallow	Animal Fat	20
Choice White Grease (Pork Oil)	Animal Fat	10
Yellow Grease	Animal Fat	10

The Raw Oil Pretreatment System will be designed to process a total of 51,500 BPSD of raw oils. The pretreament unit will be three (3) trains of equal hydraulic capacity but each unit configuration will be have different features to provide flexibility in processing vegatable oils, tallows/greases and used cooking oils.

The general steps included in each train are:

- Train 1: Enzymatic Degumming/Special Degumming and Adsorption
- Train 2: Acid Washing/Special Degumming and Adsorption
- Train 3: Polyethylene Removal, Acid Washing/Special Degumming and Adsorption

Train (1) one will utilize enzymatic degumming to process phospholipids in the vegetable oils. Train (3) three will have a PE removal system ahead of the Degumming and Adsorption facilities.

The goal is to remove feed gums, metals, soaps, color, and phospholipids with minimal loss of free fatty acids. A deodorizing step is not needed with these feeds.

The Ecofining™ Units will process the treated raw oils from the Raw Oil Pretreat facilities. The facility will be designed to process 50,000 BPD treated oil feedstock.

The Ecofining™ Unit equipment will be designed to bracket a range of feedstocks and operating modes.

- Max Diesel - 100% Beef Tallow
- 25 vol% Jet Fuel - 100% Camelina Vegetable Oil
- Max Diesel - design feedstock blend
- 25 vol% Jet Fuel - design feedstock blend

3. Feed and Product Specifications

Feedstock Specifications

The Base design feedstock to the Ecofining™ Unit will be a combination of Vegetable Oils and Animal Fats. Listed below are chemical and physical properties for the base raw oil feedstocks.

Raw Oils / Fats General Properties	Unit	Soybean (VO)	Corn Oil Distillers (VO)	Used Coooking Oil (UCO)	Tallow (AF)	Choice White Greases (AF)	Yellow Greases (AF)
Feed Comp	**wt%**	**30**	**15**	**15**	**20**	**10**	**10**
Density	SG	0.92	0.92	0.89	0.92	0.92	0.92
Kinematic Viscosity	mm2/s 40°C	28.9	30.8	27	45.34	41	132.1
Unsponifiables	wt%	0.4	1.3	0.1	0.4	0.5	0.4
Phospholipids	wt%	1.5-2.5	0.7-2.0*	-	-	-	-
Sponification Value	mgKOH/g	195	183	199	198	202	198
Phosphorous	ppmw	200	500*	27	271	42.5	132.1
Ca+Na+Mg+K	ppmw	0.5*	1*	1	100*	1	38.9
Fe	ppmw	2-6	-	-	-	-	-
Sulfur	ppmw	0.8	10.5	3.4	25.2	7.7	30.7
Nitrogen	ppmw	*	*	*	*	*	*
Moisture	wt%	0.03	0.15	0.24	0.05	0.22	0.49
FAC Color			33	11B	11A	<13	11B
Chlorides	ppmw	*	*	*	*	*	*
MIU	wt%	0.77	2.36	0.85	0.8	1	0.8
FFA	wt%	0.3-0.7	12.22	2.72	1.61	0.5-2.5	7-15
Fatty Acid Composition							
C12:0	Lauric	0.1	--	0.3	0.2	0.2	0.1
C14:0	Myristic	0.1	--	0.7	2.4	1.4	0.7
C15:0	entadecano	--	--	--	--	0.1	0.2
C16:0	Palmitic	11.4	11.8	17.3	24.4	21.3	15
C16:1	Palmitoleic	0.2	0.1	3.6	2.7	3.3	2
C18:0	Stearic	4.1	2.1	7.3	20	9.5	9.1
C18:1	Oleic	23.5	27.4	44.3	41.7	43.4	49
C18:2	Linoleic	53.5	57.7	22.8	5.9	17.4	21.3
C18:3	Linolenic	6.6	0.6	2	0.7	1.9	2
C20:0	Arachidic	0.3	0.3	0.4	0.4	0.1	0.5
C20:1	Eicosenoic	0.2	0.3	0.6	0.5	0.8	--
C22:0	Behenic	0.3	--	0.4	--	--	0.3
C22:1	Erucic	--	--	0.15	0.1	0.1	--
C24:0	Lignoceric	--	0.14	0.3	0.27	0.43	--

The raw oil feedstock specifications are:

NEXT Renewable Inc Pretreat Unit Feed / Product Specs					
Property	**Unit**	**Feed Blend**		**Max Any Feedstock**	**Product Spec**
Moisture	%	1	max	2	No Free Water
Insoluables	wt%	0.2	max	1.00	<0.05
FFA	wt%	10	max	20	N/A
Unsaponafiables	wt%	1	max	2	N/A
Total Metals (Ca+Mg+Na+K+Fe+Si+Al)	ppmw	500	max	750	<10
Ca+Mg	ppmw	50		100	TotMtl Spec
Na+K	ppmw	150		300	<2
Fe	ppmw	10		25	TotMtl Spec
Si	ppmw	5		10	TotMtl Spec
Phosphorous	ppmw	200	max	1000	<3
Polyethylene	ppmw	150 (Note 3)	Max	50	<10
Total Chlorides (Organic + Inorganic)	ppmw	+25 over Inorganic	Max	100 over inorganic	N/A
Inorganic Chlorides (Salt)	ppmw	100	Max	200	<5
Sulfur	ppmw	20	max	250	N/A
Nitrogen	ppmw	350	max	500	N/A
Temperature	F	120	min		120

Note 3: PE Train only, other trains 50 ppmw

The crude vegatable oil and animal fat pretreat product specifications are required to meet UOP's Ecofining fresh feed specifications:

UOP Property Specifications	Contaminant Limit (Note 3)	Test Method
Free Fatty Acid (FFA), %	< 20 (Note 1)	AOCS Ca 5a-40
Total Metals (Si, Fe, Al, K, Na, Mg, Ca, P), wppm	< 10	UOP 391 or UOP 389
Including these separate maximums:		UOP 391 or UOP 389
Sodium, wppm	< 2	UOP 391 or UOP 389
Phosphorous, wppm	< 3	UOP 391 or UOP 389
Sulfur, wppm	< 20	ASTM D 1552 or ASTM D 4294
Nitrogen, wppm	< 30 (Note 2)	ASTM D 4629
Chloride, wppm	< 50	UOP 7359
Water, wppm	no free water	ASTM D 2709
Unsaponifiables, wt-%	<1.0	AOCS Ca 6a-40
Insoluble impurities, wt-%	0.05 max	AOCS Ca 3a-46
Polyethylene, wppm	<50	AOCS Ca 16-75

Make up hydrogen will be PSA quality:

Property	Unit	Contaminant Limit
Hydrogen Purity	mol%	>99.9
Methane	mol%	<0.1
Nitrogen	vppm	<150
CO+CO2	vppm	<20

Product specifications

The products generated from the UOP Ecofining™ Process will be:

- C5+ Naphtha
- Renewable Jet Fuel
- Renewable Distillate

The product specifications for the evaluation are:

- C5+ Naphtha
  - RVP 7.0-7.5 psia Target
- Renewable Jet Fuel (Meet ASTM D7566 specification)
  - Sulfur <0.3 wt%
  - Copper Strip Corrosion 1.0 max
  - Distillation
    - T10 / FBP 205 °C max / 300 °C max
  - Flash Point 38 °C min
  - Smoke Point 25 mm min
  - Existent Gum 7 mg/100ml max
- Renewable Diesel (Meet ASTM D975 specification)
  - Sulfur <10 ppmw
  - Cetane Number Report
  - Cloud Point
    - Summer -7 °C
    - Winter -10 °C
  - Pour Point Report
  - Flash Point >135 °F
  - CFPP Report

4. Facility Components

This design basis has been developed with the understanding that all facility components will be required to meet environmental permitting requirements set by the governing agencies located in the Pacific Northwest. Final design of all components will be modified, if necessary, in order to meet the requirements of the location where the project is permitted.

The overall basis for the project is defined below:

- Overall plant vegetable oil and animal fat input 51,500 BPD
- Overall plant input 50,000 BPD feed to Ecofiner
- Three (3) Alfa Laval Pretreat units
- Three (3) UOP Ecofiner units
- All Ecofiner heaters will utilize SCR Technology. Specification of 5 ppm NOx / 20 ppm CO
- 110 MMSCFD SMR Hydrogen Plant. SMR furnace will have SCR 5 ppm NOx / 10 ppm CO
- Jet Fractionation designed to process mid-distillate product from 2 Ecofiner trains at 25 vol% jet yield.
- Jet Fractionator heater will require SCR controls 5 ppm NOx / 20 ppm CO
- 225 gpm Sour Water Stripper
- MDEA Amine system
- Incinerator for Treated Sour Water Offgas and Amine Regenerator Offgas. Incinerator will require SCR 9 ppm NOx / 20 ppm CO / 75 ppm SO2
- HP and LP flare system for overall plant capacity
- Access to a two-ship berth operation with the following capacity:
    - Berth 1 - Vessel size –19,000 - 80,000 DWT
        - Diesel Export - 20 KBPH
        - Veg Oils / Animal Fats Import – 10 KBPH
    - Berth 2 - Vessel/Barge size - 5,000 - 35,000 DWT
        - Veg Oils / Animal Fats Import – 10 KBPH
- Rail
    - 22,500 LF Track
    - 10 spot unloading bleaching earth — 80 cars/month
    - 30 spot unloading feedstock oils — 930 cars/month
    - 10 spot loading renewable diesel — 240 cars/month
- Truck
    - 1 spot loading renewable diesel — 60 trucks/month

- Process Tankage:

Service	# Tanks	Design Volume (BBLS)	Type of Roof	Seals	Heated Y/N	Approx. Dimen ft
Raw Oil Feedstock	6	125,000	Fixed	N/A	Y	150x48
Treated Oil	3	50,000	Fixed	N/A	Y	88x48
Renewable Diesel	3	225,000	Fixed	N/A	N	184x48
Renewable Jet	1	225,000	IFR	Dual	N	184x48
Naphtha/Jet	3	50,000	IFR	Dual	N	88x48
HC Slop	1	15,000	IFR	Dual	Y	52x40
OWS Slop	1	10,000	IFR	Dual	Y	43x40
PT Prod Day TK	2	25,000	Fixed	N/A	Y	67X40
Sour Water Tank	1	10,000	IFR	Dual	N	43X48

- Utilities
  - 1880 gpm raw water treatment facilities
  - 2 - 50 KPPH 600 psig steam boiler. Boiler will have SCR 5 ppm NOx / 20 ppm CO / 10 ppm NH3
  - 20,000 gpm 2 cell Cooling Tower
  - 750 gpm wastewater treatment facility
  - Process and Storm water collection / containment system
  - 115 KV electrical supply – estimated power demand 40-50 MW
  - Natural Gas – 8” pipeline / normal demand 15-25 MMSCFD
  - Nitrogen – VSA

- Infrastructure
  - Buildings
    - Administration – 20,000 ft^2 (2 story)
    - Guard Shack – 250 ft^2
    - Maintenance Facility – 13,500 ft^2
    - Warehouse – 20,000 ft^2
    - Fire Station – 5,000 ft^2
    - DCS Control Room – 8,000 ft^2
    - Local Operator Shelters – 4 x 400ft^2
    - Change Room – 5,000 ft^2
    - Laboratory – 7,500 ft^2
    - Raw water treatment/RO – TBD
    - Instrument Air/Plant Air – TBD

5. Process Units

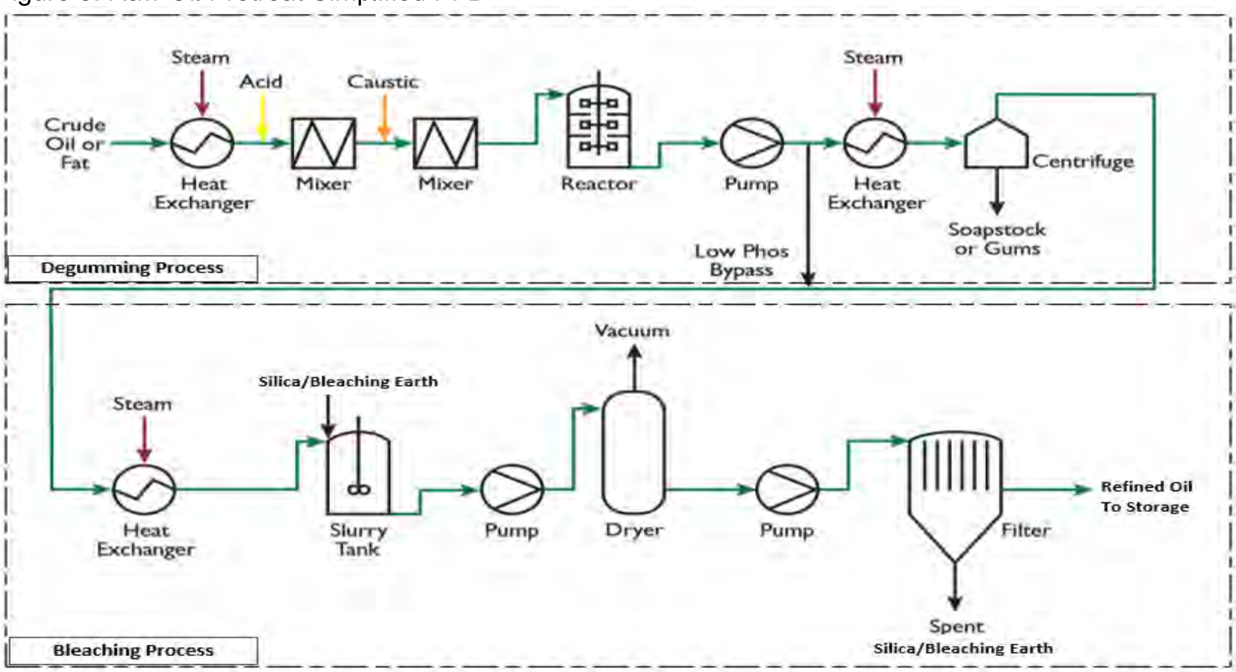
The ISBL Process facilities consist of following units:

- Raw Oil Pretreatment Units
- UOP Ecofining™ Units

5.1 Raw Oil Pretreatment Unit

The Raw Oil Pretreatment (ROP) System will be designed to produce a total of 50,000 BPSD of feed oils to the Ecofining™ units. The Pretreat process facility will consist of three (3) Pretreat Units. All the Pretreat Units will include a two-stage refining system which consists of degumming and bleaching units, Figure 3.

Figure 3: Raw Oil Pretreat Simplified PFD



Additional or modified processes from the base degumming/bleaching are outlined below.

Vegetable Oil – Trains 1 will be designed to process high phospholipid vegetable oils. The degumming process will incorporate enzymatic degumming to allow processing of the gums in the wastewater and to maximize FFA yields.

Animal Fats – Trains 3 will be designed to process high PE animal fats. A polyethylene removal (PE) system has been incorporated into Train 3 due to contamination of animal fats, mainly tallows. Polyethylene finds its way into the rendering plant as meat wrappers mixed in with the raw material. Most of the polyethylene wrappers used by the meat industry are of low-density type that will melt at lower temperatures and stay soluble in the tallow. At present the only feasible means of removing PE from tallow is to filter the tallow at low temperature using special filter aids.

Outlined below are the processing steps incorporated into each train:

Pretreat Unit Configuration Process Steps	Soy/DCO Train 1	DCO/UCO YG Train 2	Tallow Greases Train 3
PE / Solids Removal			X
Enzymatic	X		
Special Degumming	X	X	X
Hot Wash	X	X	X
Adsorption/Bleaching	X	X	X

The majority of the Pretreat Train processing equipment will be indoors in separate buildings. Bulk acid, caustic, filter silo's and area sump will be located outside.

5.2 UOP Ecofining^{TM} Units

The UOP Ecofining^{TM} Units will be designed to process a total of 50,000 BPSD of treated feed oils. There will be 3 reactor trains with integrated fractionation.

The Ecofining^{TM} Unit equipment will be designed by UOP to bracket a range of feedstocks and operating modes. The following feedstock and operating options will be incorporated into the Ecofining equipment design to provide flexability and capacity.

Design Feedstock Blend	Oil	Wt%
Soybean Oil	Veg Oil	30
Distillers Corn Oil	Veg Oil	15
Used Cooking Oil	Veg Oil	15
Beef Tallow	Animal Fat	20
Choice White Grease (Pork Oil)	Animal Fat	10
Yellow Grease	Animal Fat	10

- Max Diesel - 100% Beef Tallow
- 25 vol% Jet Fuel - 100% Camelina Vegetable Oil
- Max Diesel - design feedstock blend
- 25 vol% Jet Fuel - design feedstock blend

The Ecofiner Fractionation system will consist of the following:

- Jet Fractionator/Stripper for 2 trains
- Diesel Stripper/Dryer for 1 train

- Debutanizer common to all 3 trains.
- Make up Hydrogen specified as PSA quality hydrogen, 99.9% H2.
- Fired Heater
  - o SCR technology with Low NOx burners will be installed on all Ecofiner heaters.
  - o The charge and isom heater flue gas stacks will be combined into a single exhaust stack.
  - o Stack testing ports – 2- 4” ports
  - o Heater fuel gas piping will be upgraded to stainless steel.
  - o A coalescer filter will be installed inline in the new fuel gas piping.
  - o Piping downstream of the coalescer/filter will be steam traced and insulated.
  - o A BMS, instruments, and controls will be required.
- All rotating equipment will be motor driven
- No LPG will be recovered as liquid product. All the LPG produced will be recovered as a gas product and routed to the Hydrogen Plant.
- The offgas from the Ecofining™ units routed to the Hydrogen plant as feed.
- The DMDS tank and injection system will be designed for 15 days inventory at 100% of sulfur demand.
- Fractionation will consist of a common jet fuel fraction section designed to recovery 25 vol% jet fuel from two Ecofiner trains and a diesel stripper on a single Ecofiner train.
- A single recycle gas purge PSA for all three Ecofiner trains will be installed.

6. Auxiliary Support Units

The NEXT Renewable Diesel facility is a grassroots facility and consequently requires all process support and utility infrastructure systems. Outlined below are the significant systems required which are further described in the sections below:

Process Support

- Hydrogen Supply
- Offgas Sulfur Management / H_2S Treaters and Incineration
- Acid Gas Regeneration Units (AGR)
- Sour Water Stripper
- Feed, Product, and Intermediate Storage
- Logistic Facilities Dock/Rail/Truck
- Flare System
- Pipelines

Utilities

- Steam and Condensate
- Raw water and boiler feed water treating facilities
- Electrical supply and distribution

- Natural gas
- Fuel gas
- Cooling water
- Fire Water
- Potable Water
- Sanitary Sewer
- Plant and Instrument Air
- Wastewater Treatment
- Storm Water Treatment
- Nitrogen
- DCS/SIS Systems
- Communications

Infrastructure

- Buildings

6.0 AUXILARY SUPPORT DESIGN CRITERIA:

6.1 Hydrogen Supply

The Hydrogen Production and Compression facility to support the Ecofiner™ hydrogen requirements are planned to be a combination of stick-built and module fabrication. The facility will include a hydrogen production unit with a design capacity of 110 MMSCFD. The SMR design will combine standard SMR technology with an HTER reformer to provide the required hydrogen capacity.

Additional considerations for the hydrogen plant are defined below:

- The permitted SMR furnace duty is limited to 700 MMBTU/hr HHV.
- Hydrogen plant design should incorporate processing all the Ecofiner offgas as supplement hydrogen plant feed.
- Hydrogen plant design should incorporate processing up to 3500 BPD of renewable naphtha as supplemental hydrogen plant feed.
- The Hydrogen purity to be no less than 99.9% and hydrogen recovery 85% minimum.
- Plant Hydrogen header pressure 350 psig.
- Natural gas supply pressure 400 psig.
- Natural gas compressor is anticipated to be required. The design of the compressor is for 100% of the required feed with a 100% spare,
- On-line stream factor for the facility is to be a minimum of 98%.
- All drivers shall be electric motors.
- The Hydrogen Plant shall be designed with a minimum catalyst life of four (4) years for feed gas pre-reforming, steam reforming, and temperature shift converter systems.

- Any Sulfur guard system shall be designed with two beds in series and such that either bed can be switched to the lead bed or by-passed. Each bed shall be designed for an on-stream operation of 6 (six) months.
- The burners in the steam reforming furnace shall be based on Low NOx type.
- SMR furnace is utilize SCR for NOx.
- CEMS stack gas analyzers will be installed.
- SMR heater stack emissions requirements are:
  - NOx 5 ppm
  - CO 10 ppm
  - NH_3 Slip 10 ppmv @ 3% O2
- CO_2 recovery is not required.

6.2 AGR Amine Regeneration System

The AGR Amine Systems is the regeneration section for the following Ecofiner™ amine systems:

- High pressure lean offgas
- Recycle Hydrogen purge gas
- DeC4 offgas

The amine system will include

- Amine absorbers (2x50%)
- Amine Regeneration tower and required exchanges, pumps and vessels
- Amine flash drum with acid gas stripper
- Amine storage tank and amine sump
- Amine cartridge filter and carbon filter
- Lean Amine storage tank

The acid gas produced off the regeneration system will be routed the offgas sulfur incineration / treating system.

6.3 Sour Water Stripper

A sour water stripper will be required to process sour water from the Ecofiner™ units. The Sour Water Stripper will be designed for up to 225 GPM sour water. The SWS stripper will be a single tower design. H_2S/NH_3 Acid Gas from the SWS Stripper will be routed to the H2S scavenger system then to the Incinerator.

The stripped water specification is NH_3 <50 ppmw and H_2S <10 ppmw. Stripped sour water will be routed to wastewater treatment.

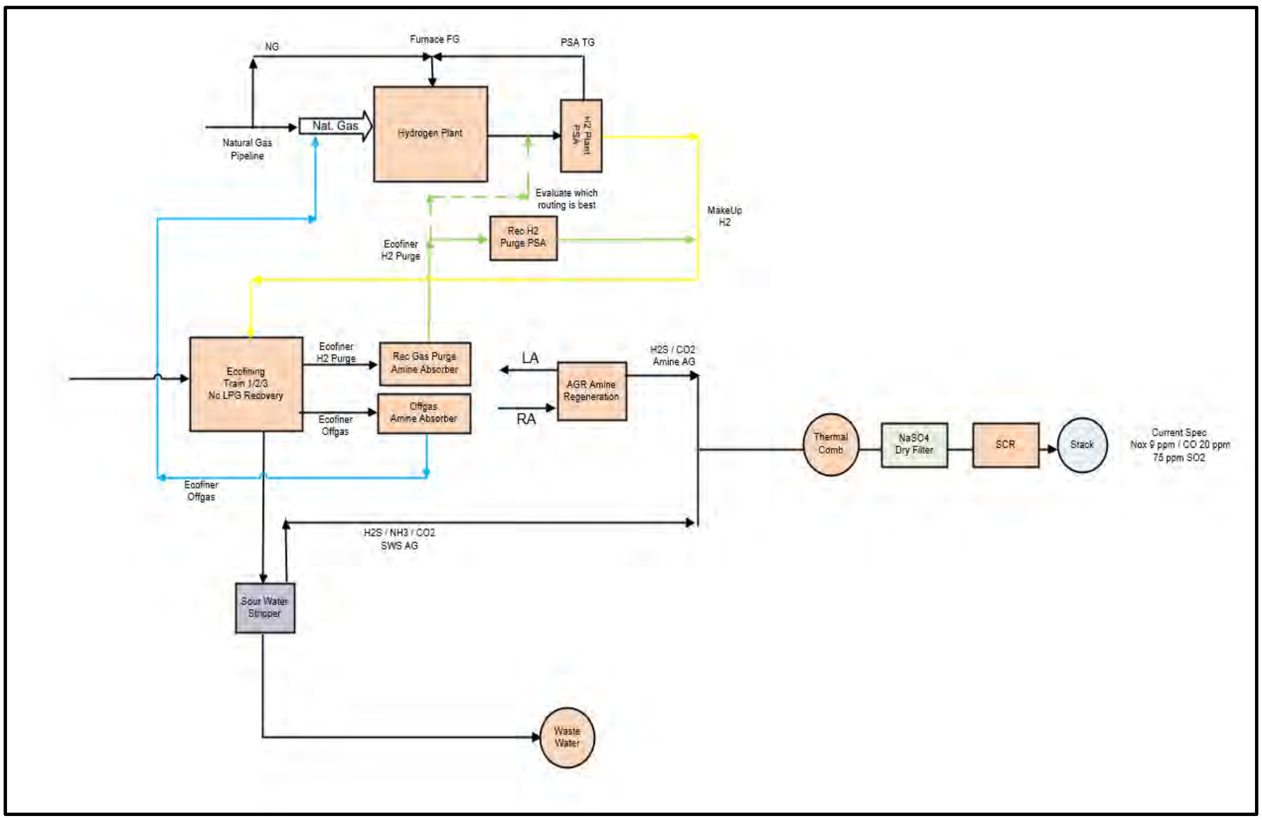
The Sour Water Stripper(s) will consist of the following:

- SWS towers and required exchangers, pumps and vessels
- Pumparound cooling with no overhead system
- Reboilers with condensate recovery
- NH_3 offgas water wash system
- Sour water feed multiphase flash drum
- Sour water storage tank designed for 3 days sour water capacity.
- Sour water tank will require an IFR with dual seals and floating suction system.

6.4 Offgas Sulfur Incineration / Treating System

A sour water offgas H_2S capture system needs to be installed to remove H_2S from the sour water stripper and amine acid gas streams.

A UOP nViro Eco acid gas Incineration system will be installed on the SWS and Amine Acid Gas systems. The nViro Eco system will recover the sulfur as Na2SO4 which potentially can be sold as a product versus disposed. The nViro Eco system will include incineration, Na2SO4 removal and a flue gas stack with SCR technology.



6.5 Feed, Product, and Intermediate Tankage

The Renewable Diesel facility tankage that is required in hydrocarbon service is listed below.

Service	# Tanks	Tank Volume (BBLS)	Type of Roof	Seals	Heated Y/N	Approx Dimen ft
Raw Oil Feedstock	6	125,000	Fixed	N/A	Y	150x48
Treated Oil	3	50,000	Fixed	N/A	Y	88x48
Renewable Diesel	3	225,000	Fixed	N/A	N	184x48
Renewable Jet/Diesel	1	225,000	IFR	Dual	N	184x48
Naphtha/Jet	3	50,000	IFR	Dual	N	88x48
HC Slop	1	15,000	IFR	Dual	Y	52x40
OWS Slop	1	10,000	IFR	Dual	Y	43x40
PT Prod Day TK	2	25,000	Fixed	N/A	Y	67X40
Sour Water Tank	1	10,000	IFR	Dual	N	43X48

All tanks that require heating will be a pumped system through an external heat exchange. MP or LP steam will be the heating medium. The pump systems will return tangentially into the tank to ensure good mixing.

Product tanks used in intermittent service will be installed with one pump with a warehouse spare. Raw Oil, Treated Oil, and Slop tanks in continuous service will have spare pump installed.

6.6 Logistic Loading and Unloading Systems

Ship Dock Services	Unload/ Load	Production[1] BPD	Avg[2] MMBbl/ Mth	VCU Required
Raw Oil – Ship/Barge Train	U	52,000[1]	1.61	No
Diesel* Ship Train Truck	 L L L	50,000[1]	1.55	No

Jet* - Ship	L	6,425[1]	0.20	No

Production[1]- Peak production for either Max Diesel or Jet Modes.
Avg[2] – based on 31 day/month
*** Future**

Raw Oil Unloading

- Ship / Barge Unloading – **1-2 ships per month / 10-11 barges per month**
  - Access to unloading facilities at a dock with two berths able to handle the necessary capacity is required.
  - The raw vegetable oils, used cooking oils, and animal fats/greases will be discharged from a dock facility at both berth 1 and 2.
  - One berth will need to have the capacity to discharge larger ships 150,000-200,000 bbls.
  - The second berth will need to have the capacity to discharge barge and smaller ships 50,000-150,000 bbls
  - The ship/barge unloading rate will be designed to offload a ship in less than 24 hours.
  - One berth at the loading facility will require a single 10,000 BPH unloading booster pump to achieve unloading capacity. Raw oil has a high pour point and will require capability to heat ship/barge cargoes prior to discharge. This capability will be provided by the ship and is not a design requirement for the dock facilities.
  - All raw oil unloading facilities will require insulation and heat tracing.
  - No vapor combustion is required.

- Rail Unloading – **930 railcars per month**
  - Raw Oil rail unloading will be 2 - 15 bottom unloading spots with individual unloading arms
  - All loading arms will be capable of unloading at the same time
  - Two discharge lines will be provided, one dedicated to vegetable oil and the other to animal fats
  - Two pumps with a common spare will be provided
  - All rail cars should be unloaded in less than 5 hours
  - No vapor combustion is required

Diesel Loading

- Ship Loading – **4-6 ships per month**
  - Diesel ship loading rate will be designed to load a 320,000 bbl. ship in less than 24 hours.

- One berth at the loading facility will require a single 20,000 BPH loading pump to achieve loading capacity.
- Vapor combustion is not required.

- Rail Loading – **240 rail cars per month**
  - Diesel rail loading will be a 10 spot rack with individual loading arms
  - All rail loading spot will be capable of filling rail cars at the same time
  - All rail cars should be loaded in less than 12 hours
  - Vapor combustion is required.
  - Combine Rail and Truck loading VCU.

- Truck Loading – **60 trucks per month**
  - A single (1) spot truck loading facility should be located adjacent to the diesel rail loading facilities.
  - The rail and truck loading pumps (500 gpm) and lines should be common
  - The truck should be loaded in less than 1 hour
  - Vapor combustion is required.

Jet Loading - Future

- Jet product will only be transported by ship.
- Ship Loading – **2-5 ships per month (Depends on operating mode)**
  - Jet assumed to loaded on diesel ships in segregated compartment.
  - Ship loading rate will be designed to load an 80,000 bbl. ship volume in less than 24 hours.
  - One berth at the loading facility will require a Jet loading 7,500 BPH single pump to achieve loading capacity
  - Separate Jet loading line from tankage to the dock will be required.

Bleaching Earth Unloading

- Bleaching earth and filter aid will be imported by rail for use in the Pretreatment Unit
- Rail Unloading – **80 rail cars per month**
  - A 10 spot rack with pneumatic unloading system for bleaching earth and filter aid.
  - Rail cars will be used as temporary bulk storage and unloaded as required.
  - Rail cars will be pneumatically unloaded to unit silo's.
  - Design pneumatic system to unload 1 rail car in 2-3 hours.

Rail Car Storage Siding

- Rail siding will be installed to support the storage of railcars on-site.

- The rail siding linear feet is ~22,500 ft. and will consist of 5 lines.
- Two (2) rail siding lines will be dedicated to feedstock and will extend through the plant down the plant entrance access. Each line will be ~6,500 LF.

6.8 Flare System

- A flare system will be required.
- An elevated flare is preferred. Vendor to advise type of elevated flare, derrick vs guy wire.
- Flare height will be determined based on radiant heat impacts at grade. Target 500-1500 BTU/hr/ft2.
- Design will incorporate a high pressure (HP) and low pressure (LP) header design.
- A common flare knock out drum and pumps are required.

6.10 Pipelines

- An 8” Natural Gas pipeline will be designed to run down the main plant entrance road where it will need to have access to tie into an existing natural gas supply. A custody meter will be required.

- Wastewater and Stormwater will be required to be routed to an existing permitted outfall via pipeline and lift station. If there is no currently permitted outfall at the permitted facility site, NEXT will be required to obtain a NPDES permit for wastewater discharge and build a discharge outfall facility.

- Raw Water will be required via an existing water intake system.

- Pipelines to and from the plant/dock are:

    - Raw Oil – 18” electric traced and insulated
    - Diesel – 20”
    - Jet Fuel - 12”

- Routing of the Raw Oil, Diesel, and Jet Fuel lines is shown on the overall location plot plan.

- Raw Oil line will require backup electric supply to support electric tracing in case of loss of power.

7.0 UTILITIES

All utility balances and process support capacities are assumed to be preliminary and will require verification as overall plant balances are completed. Following are design criteria for the NEXT Renewable Diesel Project.

7.1 Steam/Condensate/Boiler Feed Water Systems

- The steam, condensate and BFW systems consist of:
  - Two (2) 50,000 PPH Package 600 psi steam boilers, to support Hydrogen plant startup requirements
  - An SCR is required on the Boiler.
  - Deaerator – capacity 550-600 KPPH BFW
  - 3 boiler feed water pumps, 3 – 75%, with at least one turbine drive
  - Treated Water tank
  - 2 deaerator feed pumps, 2 – 100%
  - LP Condensate flash drum
  - Desuperheater

7.2 Raw Water/BFW Treatment Systems

- A water intake system will be required. The raw water will flow through an ultrafiltration system and prior to the Raw Water storage tank. The raw water storage tank supplies water for utility water, potable water, fire water, cooling water and boiler feed water systems. The raw water makeup is estimated to be ~1850 gpm.

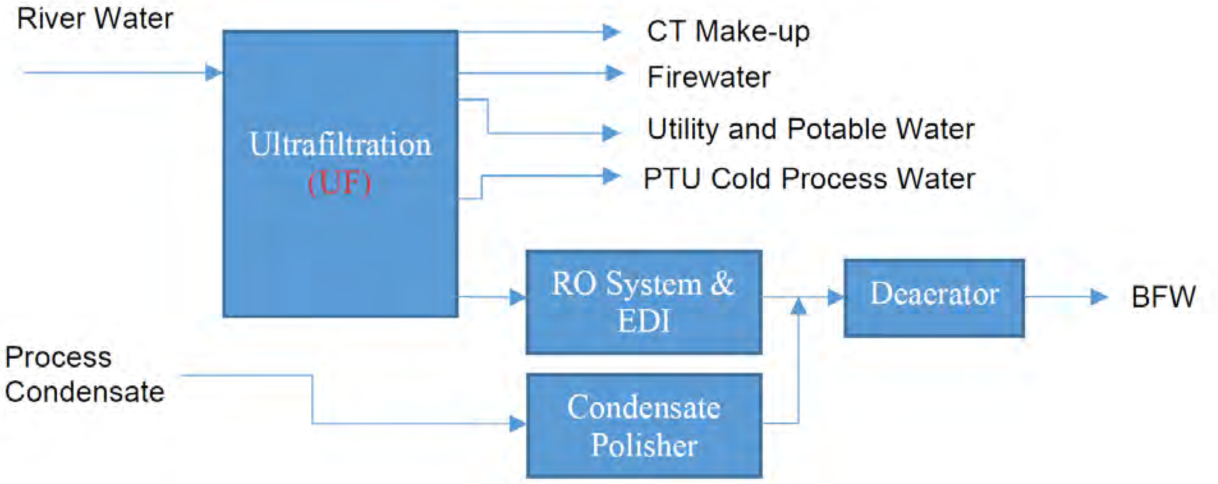
- The raw water treatment will require the following:

  - Ultra filtration systems
  - Chemical injection system, chlorination/sulfite etc.

- The Raw Water and Fire Water storage volume will be combined into one common tank – 1.2 MMgal. The tank will be a cone roof design. The basis for the tank volume is:

  - Raw Water – 1 day supply
  - Fire Water – 4 hour fire water supply at 5,000 gpm

- The boiler feed water (BFW) system will treat filtered raw water to produce 600# steam. The water treatment design is ~600 gpm input to produce ~550,000 PPH BFW. The plant condensate be processed through a condensate polisher system before being deaerated to produce BFW.



7.3 Electrical Supply

- Main power feed will need to be supplied via the specific Power Authority system that supplies the permitted location of the facility. The preliminary base load required is ~40-50 MW.
- Main sub will have 2-100% 115 to 13.8 KVA transformers.
- Internal unit subs will have dual feed and double ended design. The subs will require 4160 and 480 V step down transformers.
- Two 1500 HP emergency backup diesel generators will be required.

7.4 Natural Gas

- Natural gas supply pressure required to the facility is ~400 psig.
- Gas will need to be supplied already treated to an H2S concentration less than 0.25 grain/100 ft^3 and total sulfur less than 0.75 grain/100 ft^3.
- Natural gas will be used for heater & boiler pilots, flare pilots, building heating, Incinerator, other start-up services such as startup gas.
- A custody metering skid with analyzers will be required.
- The system will consist of a natural gas knock drum / coalescer and OSBL distribution headers.

7.5 Fuel Gas

- Gas produced at the Ecofining™ Units will be amine treated to an H2S concentration of <20 ppmv and routed normally to hydrogen plant as feed but could also be routed to the fuel system as backup.
- Natural gas / fuel gas will be used as the primary fuel source for all applications unless natural gas is specifically required.

- The fuel gas system will consist of a fuel gas knock out drum / coalescer and OSBL distribution headers.

7.6 Cooling Water

- The cooling tower circulation design is ~20,000 gpm with a duty of ~206 MMBTU/hr. The tower will be induced draft, counter flow equipped with drift eliminators.
- 3x50% recirculation pumps are required; 2 operating / one spare. A letdown steam turbine should be considered for one (1) cooling tower recirculation pump driver.
- Tower drift will be controlled with enhanced drift eliminators with an estimated efficiency of 0.00050%. Target PM_{10} limit of <0.2 ton/year.
- An in-line hydrocarbon monitor in the return cooling water line to the cooling tower is required to detect hydrocarbon leaks.
- Chemical injections systems will be required.

7.7 Fire Water

- Three fire water pumps will be supplied with autostart on low fire water header pressure. Two of the pumps will be diesel driven. A jockey pump is required ~100 gpm.
- Preliminary fire water demand is 5,000 gpm.
- Firefighting equipment, deluge systems and firewater tank size will be designed to comply with NFPA requirements.
- A foam firefighting system will be required.
- Firewater and raw water will be stored in the same tank with different suction locations to ensure firewater supply.

7.8 Potable Water/Sanitary Sewer

- A potable water treatment system will be provided.
- The potable water system will be designed for ~150 people at 5 gph per person. The potable water tank will be designed for one (1) day storage.
- The sanitary grey and black water sewer systems will be segregated. Black water will be collected in a tank with vacuum truck disposal. Grey water disposal is to be routed to the wastewater treatment for final disposal.

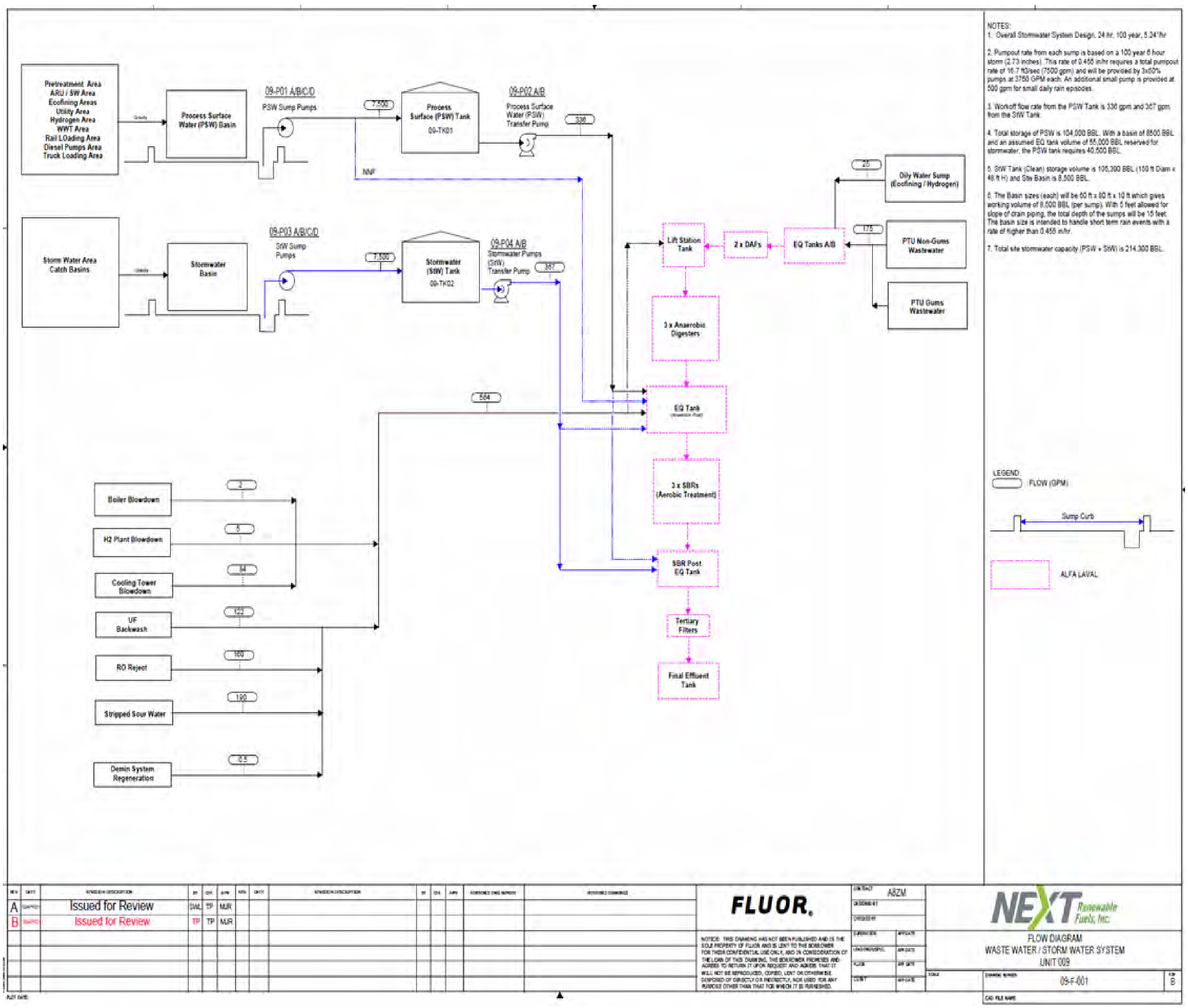
7.9 Plant / Instrument Air

- A combined plant & instrument air compressor and drier system will be provided to reduce the dew point to -40ºF. Three (3) 50% instrument/plant air systems will be installed. Both instrument and plant air will be dried.
- A plant air receiver will be installed designed for 5 min surge.

- A design margin of 115% will be built into all equipment within the Plant/Instrument Air system.

7.10 Waste Water Treatment / Water Drainage Systems

All waste water systems must meet 40 CFR 60 Subpart QQQ, Standards of Performance for VOC Emissions from Petroleum Refinery Wastewater Systems requirements. The inputs to the water treatment system is oily sewer, pretreat water, stripped sour water, cooling tower blowdown, boiler blowdown, storm water and RO reject water.



The NEXT wastewater / stormwater effluent will be comingled and require discharge to an outfall. The effluent qualities will be required to comply with any existing NPDES permit for wastewater discharge at the permitted facility site. To ensure compliance with any NPDES permit, the NEXT WWT effluent design specifications will more stringent than required by current NPDES permits. If necessary NEXT will obtain an individual NPDES permit.

Wastewater Treatment

The Renewable Diesel facility provides some unique waste treatment challenges. As the figure above highlights, the WWT flow scheme has been designed to segregate and optimize the treating of the various stream contaminants.

The WWT system will consist of the following:

- Oil/Water Separator DAF
- Equalization Tanks
- Anerobic Digestors
- Aerobic Digestors
- Post Equalization Tank
- Sludge Decanter and Dewatering Centrifuge
- Tertiary Filtration

Storm Water System

The storm water system will be designed to collect and process water for a 24-hour 100 year rain event. The design will be based on the county ordinances, utilizing the rainfall depth, of the permitted facility location.

The facility storm water's will be segregated and provided with several different types of drainage systems. These include:

- Systems for disposal of uncontaminated storm water from outside the process unit paved areas.
- Systems for collection and transfer for treatment of storm water from process and utility areas.
- An oily water system for drains from the Ecofiner equipment and vessels.

7.11 Nitrogen

Nitrogen is required in the Pretreat adsorption system. A leased liquid nitrogen tank/vaporization or VSA system will be used for normal operations. The system will be designed to supply gaseous nitrogen. Nitrogen for reactor inerting will be supplied by a pumper truck and rental trailer with an evaporation system.

7.12 DCS/SIS/UPS

A general control systems philosophy will be required. The scope of the control system philosophy should include, minimum, the following:

- Basic process control system
- Packaged equipment control system
- Safety instrument system
- Fire and gas system
- UPS and emergency power system
- Information management / Report tool system
- Redundancy and security philosophy
- Hardware and software recommendations
- Control system implementation plan.

7.13 Communications

Includes requirements for:

- Security System
- Site Radio System
- Phone, data network, and public address system
- Fiber optic communication line to facility.
- Plant data historian system

8.0 INFRASTRUCTURE DESIGN CRITERIA

8.1 Buildings

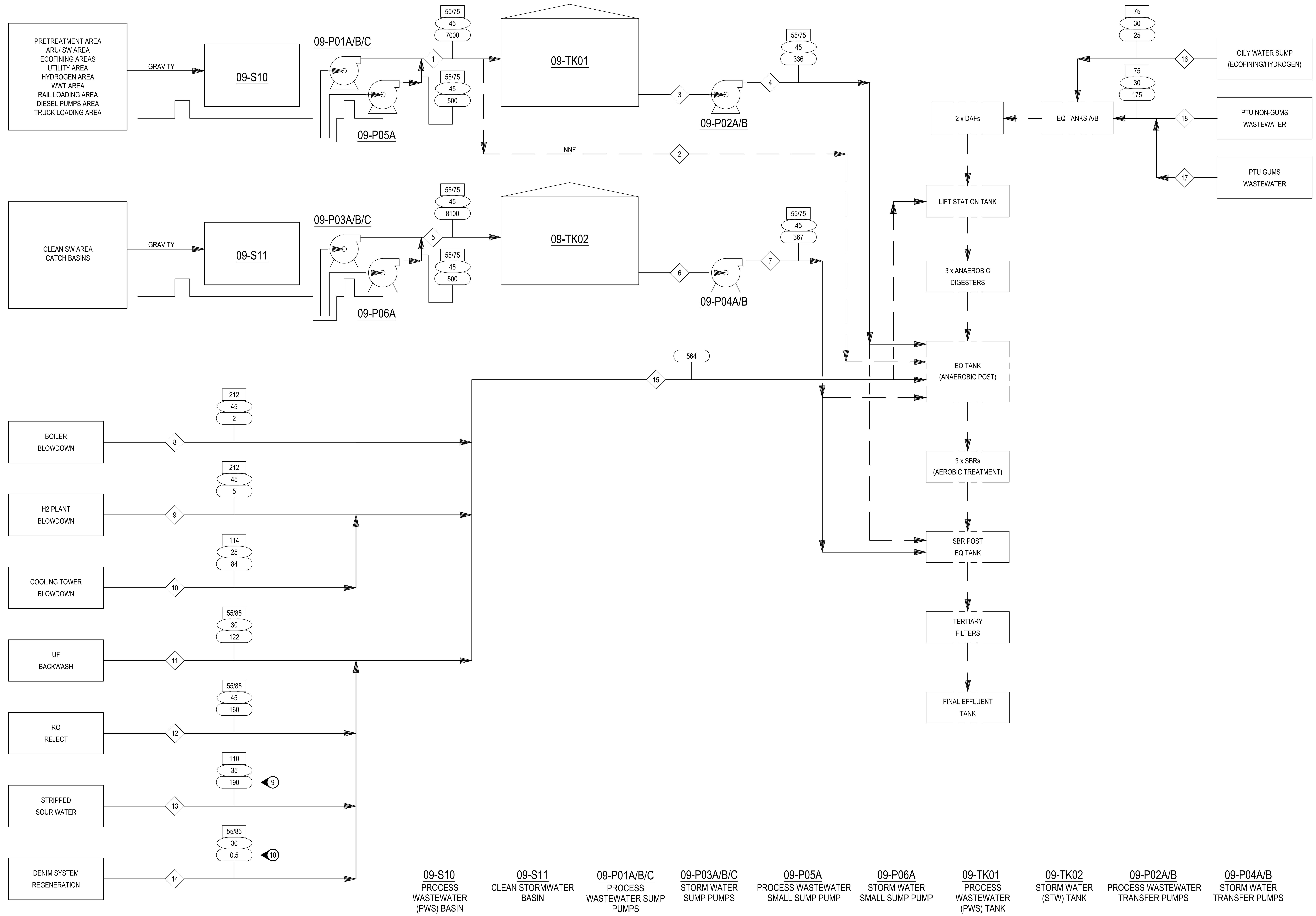
- Primary facility buildings include the following
  - Administration – 20,000 ft^2 (2 story)
  - Guard Shack – 250 ft^2
  - Maintenance Facility – 13,500 ft^2
  - Warehouse – 20,000 ft^2
  - Fire Station – 5,000 ft^2
  - DCS Control Room – 8,000 ft^2
  - Local Operator Shelters – 4 x 400ft^2
  - Change Room – 5,000 ft^2
  - Laboratory – 7,500 ft^2
  - Raw Water / RO Shelter – TBD

  - Instrument Air/Plant Air Shelter - TBD

- All buildings sizes and contents to be confirmed.
- All building overpressure design to be confirmed with blast study
- Substation buildings will be combination of MCC shelters and RIE rooms. The MCC buildings will be integral to the local operator shelters.

ATTACHMENT 2

PROCESS FLOW DIAGRAM



NOTES:

1.STORMWATER SYSTEM WAS DESIGNED TO TREAT RUNOFF GENERATED BY 100-YEAR, 24-HOUR STORM (5.4IN/HR).

2.STORMWATER SYSTEM DESIGN IS BASED ON THE FOLLOWING SITE AREACALCULATIONS: PROCESS WASTEWATER (PWS) CALCULATED TO BE 33 ACRES, CLEAN STORMWATER AREAS IS APPROXIMATELY 40 ACRES, AND TANK DIKE AREAS 21 ACRES, AND OTHER AREAS WHERE RUNOFF WILL FLOW OFFSITE IS 15 ACRES, TOTAL IS 109 ACRES.

3.THE PUMPOUT RATE FROM EACH SYSTEM (PWS AND SW) IS BASED ON A 100-YEAR, 24-HOUR (5.4 IN/HR). THE PUMP OUR RATE FOR THE PWS AND SW SYSTEMS WILL BE 3 PUMPS AT 3750 GPM PER SYSTEM. AN ADDITIONAL SMALL PUMP AT 500 GPM IS PROVED TO HANDLE SMALL DAILY RAIN EVENTS.

4.FLOW RATE FROM THE PWS TANK IS 336 GPM AND 367 GPM FROM THE SW TANK

5. THE TOTAL STORAGE OF PWS IS 133,000 BBL. WITH A BASIN OF 12,825 BBL AND ASSUMED EQ TANK VOLUME OF 65,000 BBL RESERVED FOR STORMWATER, THE PWS TANK REQUIRES 65,000 BBL

6. SW TANK STORAGE VOLUME IS 125,000 BBL. AND THE BASIS IS 12,825 BBL.

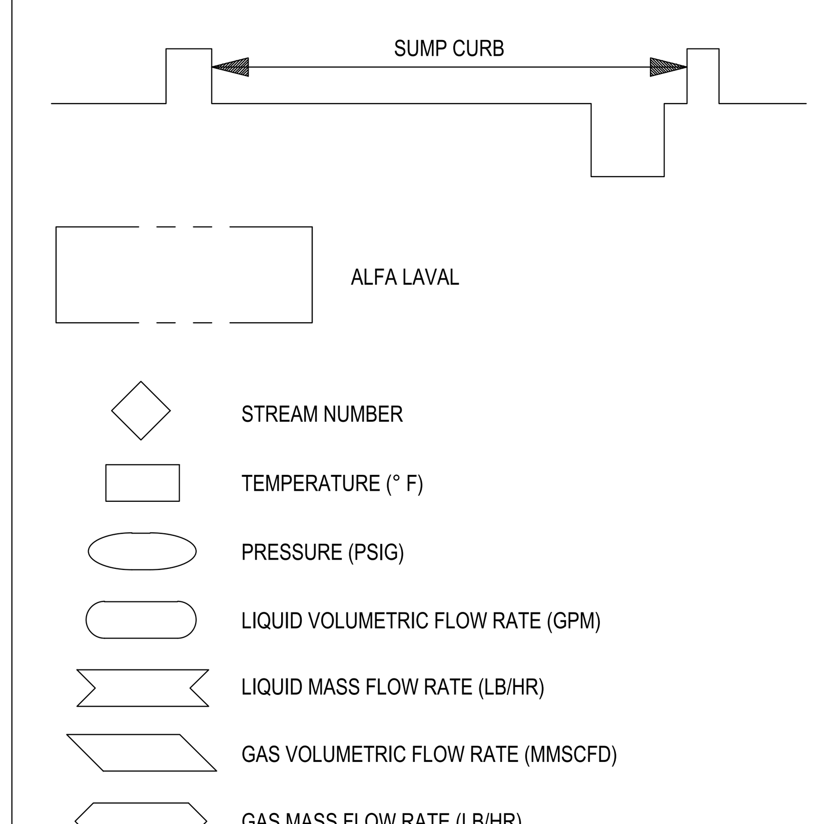
7. THE BASIN SIZES (EACH) WILL BE 60' X 100' X 15' FOR A WORKING VOLUME OF 12,825 BBL. (PER SUMP). WITH 5' ALLOWED FOR SLOPE OF DRAIN PIPING, THE TOTAL DEPTH OF THE SUMP WILL BE 15'. THE BASIN SIZE IS INTEDED TO HANDLE SHORT TERM RAIN EVENTS WITH A RATE OF HIGHER THAN 0.455 IN/HR.

8. TOTAL SIZE OF STORWATER CAPACITY (PWS+SW) IS 271,000 BBL.

9. MAX STRIPPED SOUR WATER IS 216 GPM

10. MAXIMUM INSTANTEOUS FLOW ONCE PER WEEK IS 15 GPM.

LEGEND



REV	DATE	REVISION DESCRIPTION	BY	CHK	APPV
A	04/02/21	ISSUED FOR REVIEW	SWL	TP	MJR
B	05/06/21	ISSUED FOR REVIEW	TP	TP	MJR
C	05/06/21	ISSUED FOR INFORMATION	TP	TP	MJR
0	06/14/21	ISSUED FOR DESIGN	TP	TP	MJR

REV	DATE	REVISION DESCRIPTION	BY	CHK	APPV	REFERENCE DWG NUMBER	REFERENCE DRAWINGS

FLUOR

CONTRACT ABZM
DESIGNED BY
CHECKED BY
SUPERVISOR | APP DATE
LEAD ENGR/SPEC. | APP DATE
FLUOR | APP DATE
CLIENT | APP DATE

NEXT Renewable Fuels, Inc.

PROCESS FLOW DIAGRAM

PROCESS WASTEWATER AND STORMWATER SYSTEM

SCALE NONE
DRAWING NUMBER 09-F-001 GC
REV 0
CAD FILE NAME 09-F-001.dwg

PLOT DATE: \\fdnet.com\HO_Projects\HO_ABZM\CAD\226_PROCESS_GRAPHICS\Drawings\09-F-001.dwg 05-20-21 7:08 pm Printed By: sco57212

ATTACHMENT 3
NPDES PERMIT

PW ENV 11-6 NPDES

G,

Oregon

Theodore Kulongoski, Governor

Department of Environmental Quality
Northwest Region Portland Office
2020 SW 4th Avenue, Suite 400
Portland, OR 97201-4987
(503) 229-5263
FAX (503) 229-6957
TTY (503) 229-5471

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

February 10, 2003
7001 1140 0002 3345 6188

Paul Langner
Marine Industrial Manager
Port of St. Helens
PO Box 598
St. Helens OR 97051

Re: NPDES Permit
File No. 111746
Port of St. Helens, Port Westward
Columbia County

We have completed our review of your permit application and the comments received regarding the preliminary draft permit, and have issued the enclosed National Pollutant Discharge Elimination System Permit.

This permit will be considered the final action on permit application number 986433.

If you are dissatisfied with the conditions or limitations of this permit, you have 20 days to request a hearing before the Environmental Quality Commission or its authorized representative. Any such request shall be made in writing to the Director and shall clearly state the grounds for the request.

You are urged to carefully read the permit and take all possible steps to comply with conditions established.

Should you have any questions regarding this permit, please contact Elliot Zais at 503/229-5292.

Sincerely,

Robert P. Baumgartner, Manager
Water Quality Source Control
Northwest Region

Enclosure: NPDES permit
cc: File

RECEIVED
BY ENGRG
FEB 20 2003

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NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM

WASTE DISCHARGE PERMIT

Department of Environmental Quality
Northwest Region Office
2020 Southwest Fourth Avenue, Portland, OR 97201-4987
Telephone: (503) 229-5263

Issued pursuant to ORS 468B.050 and The Federal Clean Water Act

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ISSUED TO:

Port of St. Helens
PO Box 598
St. Helens, Oregon

SOURCES COVERED BY THIS PERMIT:

Type of Waste	Outfall Number	Outfall Location
Process Wastewater	001	RK 85 (RM 53)

PLANT TYPE AND LOCATION:

Wastewater Collection System
Port Westward Industrial Site
Clatskanie, Oregon

RECEIVING STREAM INFORMATION:

Basin: North Coast/Lower Columbia
Sub-Basin: Lower Columbia/Clatskanie
Stream: Columbia River
Hydro-code: 10=-COLU 53 D
County: Columbia

EPA REFERENCE NUMBER: OR 004085-1

Issued in response to Application No. 986433 received 26 February 2002

Robert P. Baumgartner, Manager
Water Quality Source Control, Northwest Region

Date: 2/10/2003

PERMITTED ACTIVITIES

Until this permit expires or is modified or revoked, the permittee is authorized to construct, install, modify or operate a waste water collection, treatment, control and disposal system and discharge to public waters adequately treated waste waters only from the authorized discharge point or points established in Schedule A and only in conformance with all the requirements, limitations, and conditions set forth in the attached schedules as follows:

Unless specifically authorized by this permit, by another NPDES or WPCF permit, or by Oregon Administrative Rule, any other direct or indirect discharge to waters of the state is prohibited, including discharge to an underground injection control system.

SCHEDULE A

1. Waste Discharge Limitations not to be Exceeded After Permit Issuance Date

a. Outfall 001: Wastewater Discharge to Columbia River

Parameter	7-Day Moving Average	30-Day Moving Average	Peak (2 hour average)
Excess Heat Load[1] 1 June – 15 October	4.46 MW	3.58 MW	----
pH	Must not be outside the range of 6.5 – 8.5	Must not be outside the range of 6.5 – 8.5	Must not be outside the range of 6.5 – 8.5
Temperature[2] 1 June – 15 October	27 °C	26 °C	32 °C

[1] Excess heat load is heat loads above the applicable criteria (68 °F (20 °C)) which shall be calculated as follows.

Heat transfer per unit time equals density of water times flow rate times specific heat times temperature difference. Heat transfer is in units of megawatts (MW) or megajoules/second (MJ/s).

H = $(1000\ kg/m^3)(Q\ m^3/s)(4182\ J/(kg\ ^\circ C))(\Delta T)(1\ W/(1\ J/s))(1\ MJ/1000\ J)$, where ΔT = effluent temperature (expressed as the 7-day or 30-day moving average temperature, as applicable) – 20 °C. If ΔT is less than or equal to zero, the excess heat load will be reported as zero for that period.

For example, the projected excess heat load at full buildout using a 7-day average temperature of 29.67 °C and an average flowrate of 5.23 cfs or 0.148097 m^3/s will be:

$$H = (1000\ kg/m^3)(0.148097\ m^3/s)(4182\ J/(kg\ ^\circ C))(9.67\ ^\circ C)(1\ W/(1\ J/s))(1\ MJ/10^6 J) = 5.99\ MW$$

[2] Daily average temperature is the arithmetic average of temperatures taken every 30 minutes throughout a 24-hour day. The 7-day moving average temperature is the average of 7 consecutive daily averages. If there is no flow on a given day, that day is to be skipped for the averaging. The 30-day moving average is calculated similarly.

b. The Permittee shall require all dischargers that are subject to 40 CFR Part 423 (steam electric power generators) to comply with the following conditions as applicable to their discharges upstream of the point of discharge into the Permittee's system.

i) Once Through cooling water

Parameter	Monthly Average	Daily Maximum
Total Residual Chlorine[3]	0.15 mg/L	0.38 mg/L

[3]Chlorine must not be discharged for more than two hours on any day. The permittee shall prohibit dischargers to its system from discharging cooling tower blowdown during chlorination.

ii) Cooling Tower Blowdown prior to mixing with other waste streams

Parameter	Monthly Average	Daily Maximum

Free Available Chlorine	0.15 mg/L	0.38 mg/L
Total Chromium	0.2 mg/L	0.2 mg/L
Total Zinc	1.0 mg/L	1.0 mg/L

iii) Low Volume Waste Sources[3].

Parameter	Monthly Average	Daily Maximum
Total Suspended Solids	30 mg/L	100 mg/L
Oil & Grease	15 mg/L	20 mg/L

[3] Low volume waste sources means, taken collectively as if from one source, wastewater from all sources except those for which specific limitations are otherwise established in this part. Low volume waste sources include, but are not limited to: wastewater from wet scrubber air pollution control system, ion exchange water treatment system, water treatment evaporator blowdown, floor drains, cooling tower basin cleaning wastes, and re-circulating house service water systems. Sanitary and air conditioning wastes are not included.

There must be no addition of polychlorinated biphenyl compounds to process wastewater.

2. Notwithstanding the effluent limitations established by this permit, no wastes shall be discharged and no activities shall be conducted which will violate Water Quality Standards as adopted in OAR 340-041-0202 through -0215 except in the following defined mixing zone:

The size of the mixing zone is:

30 meters horizontally in any flow direction from the diffuser.

The size of the zone of initial dilution (ZID) is:

3.5 meters horizontally in any flow direction from the diffuser.

3. Temperature Management Plan

a. The effluent limitations and other conditions in this permit related to temperature shall constitute the surface water temperature management plan (temperature management plan) required by OAR 340-041-0026(3)(a)(D) and 340-041-0120 (11)(e)(C)applicable to the permittee. Provided that the permittee complies with this temperature management plan, the permittee shall be deemed to be in compliance with the state temperature water quality standard and not be deemed to be causing or contributing to a violation of the water quality standards for temperature.

b. The permittee shall install (or require dischargers to the permittee's system to install) one or more influent/effluent heat exchangers to reduce the temperature of waste water before it is discharged. The permittee will operate (or require dischargers to the permittee's system to operate) the influent/effluent heat exchangers June 1 through October 15 each year commencing the first year that wastewater is discharged under this permit.

c. The permittee shall comply with the mitigation requirements set forth in condition D.1. Once approved by DEQ, the Mitigation Plan and Mitigation Agreement described in Condition D.1.b.B shall become part this Temperature Management Plan.

SCHEDULE B
Minimum Monitoring and Reporting Requirements (unless otherwise approved in writing by the Department)

1. Outfall Number 001

Item or Parameter	Minimum Frequency	Type of Sample
Chlorine	Continuous	Monitor
Temperature*	Continuous	Monitor
pH	Continuous	Monitor
Heat Load	Continuous	Calculated
Flow rate**	Continuous	Meter

*Half-hourly readings will be used for calculating average temperatures and heat loads as described above.

**Flow will be totalized daily. The daily flowrate will be the totatlized flow divided by the total flow time within a 24-hour period from midnight to the following midnight.

2. Discharges to Permittee's System

The Permittee will require discharges subject to Condition A.1.b to monitor and report to the Permittee the following parameters for the wastewater streams described in Condition A.1.b, as applicable:

Item or Parameter	Minimum Frequency	Type of Sample
Chlorine	Continuous	Monitor
Total Chromium	Annually	Grab
Total Zinc	Annually	Grab
Total Suspended Solids	Monthly	Grab
Oil and Grease	Monthly	Grab

The Permittee shall include the monitoring results submitted by dischargers in its monitoring reports to the Department.

SCHEDULE D
Special Conditions

1. Mitigation Conditions

a. Duty to Mitigate

During the first three years of this Permit, the Permittee shall evaluate the performance of influent/effluent heat exchangers to reduce the discharge of excess heat load. If the use of the heat exchangers is shown to be successful in reducing or eliminating excess heat load discharged to the Columbia River, the permittee can propose permit modifications with new wasteload allocations. If by December 31, 2005, the permittee demonstrates that no excess heat load will be discharged under this permit and requests in writing that the Department modify this permit to include effluent limitations that do not allow the discharge of excess heat, then the requirements of these mitigation conditions shall no longer apply. Otherwise, the Permittee shall implement a heat load mitigation project in accordance with the schedule and requirements set forth in these mitigation conditions.

b. Schedule

The permittee shall:

A. By December 31, 2005, identify a specific riparian vegetation restoration project within the watershed (Columbia River watershed within Oregon) and submit to DEQ for review a draft Mitigation Plan (as defined in Condition D.1.c), Mitigation Agreement (as defined in Condition D.1.d) and request for modification of the heat load effluent limits in this permit , consistent with the mitigation standard set forth in Condition D.1.e.

B. Develop a final Mitigation Plan and Mitigation Agreement and submit them to DEQ for approval within 30 days of receiving Department comments on the plan. Upon approval by DEQ these documents shall become part of an updated Temperature Management Plan (TMP).

C. Enter into the approved Mitigation Agreement and fully fund the mitigation project within 180 days of DEQ approval of the Mitigation Plan and Mitigation Agreement. Once the permittee has entered into the approved Mitigation Agreement and fully funded its obligations under the Mitigation Agreement, its mitigation obligations shall be fully satisfied under this permit. The Mitigation Agreement also shall satisfy any mitigation requirements in subsequent renewals of this permit for as long as the mitigation project is maintained. In the event of any changes to the discharge that increase excess heat load above the levels mitigated under these special conditions, additional mitigation shall be required by the Department only with respect to the increased heat load.

c. Mitigation Plan

The Mitigation Plan shall include the following components:

A. Description of the location of the riparian restoration project by water body, river mile and legal description.

B. A planting plan, including vicinity map, plan view drawing, cross section drawing, and plant list. Specifications for construction/installation of the riparian vegetation

C. The schedule for initial planting and riparian restoration tasks.

D. Calculations demonstrating that the mitigation standards identified below in Condition D.1.e. will be met by the mitigation project.

E. A maintenance plan describing how the plants will be maintained and providing for replacement of plants if survival rate is not as great as the survival rate assumed in the calculations described in Condition D.1.c.D above.

F. Monitoring to confirm implementation of the Mitigation Plan in accordance with its terms. The plan will specify the parameters to be monitored, which shall include a biologist's assessment of plant growth rate and survival. The initial monitoring shall be conducted in the first year following completion of the initial planting and shall be repeated in years 2, 3, 5, 8, and 10 and every 10th year thereafter through the life of the mitigation project. A monitoring report will be submitted to the Department by December 31 in each year monitoring is required. The monitoring report will describe the results of the monitoring and any planting, maintenance or plant replacement conducted since the last monitoring report.

G. Description of the mechanism by which the mitigation site will be protected from uses not consistent with the intent of the mitigation, until the mitigation requirements are met.

H. A description of the real property rights that have been or will be acquired to provide access to the mitigation site, including easements, equitable servitudes, fee title or other rights.

d. Mitigation Agreement.

The permittee shall enter into a Mitigation Agreement with a reputable land or water conservation organization or governmental entity (the "Conservation Entity") to implement the Mitigation Plan. The Mitigation Agreement shall include at least the following terms:

A. A commitment by the Conservation Entity to fully implement the Mitigation Plan in accordance with its terms, including the initial planting and long-term maintenance, monitoring and reporting.

B. A provision that the Mitigation Agreement is enforceable by the Permittee and the Department and any successor agency. A breach of the Mitigation Agreement by the Conservation Entity shall not be deemed a violation of this permit by the permittee.

C. Terms describing the total amount of funding necessary for the mitigation project and the schedule and payment terms for how the permittee will provide that funding.

D. A commitment by the Conservation Entity to hold in trust the project funding and the necessary real property rights for the mitigation site for the benefit of the Department, the public and the permittee for at least the term of the mitigation project.

E. A requirement that the Conservation Entity will cause to be recorded in the county real property records a memorandum describing the Mitigation Agreement.

e. Mitigation Standards

The intent of the mitigation project is to offset the estimated aggregate excess heat load that the permittee will discharge during the water quality limited period of the Columbia River at the discharge (July, August, and September) over 40 years, which is the estimated life of the projects that initially will be discharging wastewater to the permittee for discharge under this permit.

A. The Estimated Aggregate Excess Heat Load under this permit shall be calculated as the 40-year sum of the average excess heat load over the 20°C standard projected for the temperature water quality limited season. The estimate shall be based on the temperature and heat load discharged over the first three years of this permit, adjusted to reflect projections for future operations of the sources generating (or projected to generate) the effluent discharged under this permit and long-term meteorological data. The Estimated Aggregate Excess Heat Load shall include any excess heat load actually discharged prior to date this projection is made.

B. The Projected Heat Load Reduction to the water body at the mitigation site shall be calculated as the amount of solar radiation blocked by shade trees from the surface area of the project stream over a 40-

year period. The mitigation value of the mitigation project shall be the sum of the Projected Heat Load Reduction over the 40-year life of the mitigation project, taking into consideration the time necessary for plants to mature to the point of providing the projected levels of shading.

C. The Projected Heat Load Reduction over the life of the mitigation project shall be at least as great as the 40-year Estimated Aggregate Excess Heat Load of the discharge described in paragraph D.1.e.A above.

D. Upon approval of the Mitigation Plan, the Department will modify this permit to revise the temperature and excess heat load limits set forth in Condition A.1.a consistent with the Estimated Aggregate Excess Heat Load, which modification may include the addition of a limit on aggregate excess heat load for each temperature water quality limited season.

Additional Conditions

2. An adequate contingency plan for prevention and handling of spills and unplanned discharges shall be in force at all times. A continuing program of employee orientation and education shall be maintained to ensure awareness of the necessity of good in plant control and quick and proper action in the event of a spill or accident

3. An environmental supervisor shall be designated to coordinate and carry out all necessary functions related to maintenance and operation of the collection and treatment system. This person must have access to all information pertaining to entire system, including all data generated.

4. Reopening of Permit. This permit may be reopened and modified or reissued to incorporate one or more waste load allocations (WLAs) resulting from a Total Maximum Daily Load (TMDL) for any of the parameters associated with the permittee's discharge. Nothing in this condition shall limit reopening of this permit for reasons specified in Schedule F, General Conditions. Nothing in this condition shall abridge the public process associated with permit modification or reissuance.

SCHEDULE F
NPDES GENERAL CONDITIONS

SECTION A. STANDARD CONDITIONS

1. Duty to Comply

The permittee must comply with all conditions of this permit. Any permit noncompliance constitutes a violation of Oregon Revised Statutes (ORS) 468B.025 and is grounds for enforcement action; for permit termination, suspension, or modification; or for denial of a permit renewal application.

2. Penalties for Water Pollution and Permit Condition Violations

Oregon Law (ORS 468.140) allows the Director to impose civil penalties up to $10,000 per day for violation of a term, condition, or requirement of a permit.

In addition, a person who unlawfully pollutes water as specified in ORS 468.943 or ORS 468.946 is subject to criminal prosecution.

3. Duty to Mitigate

The permittee shall take all reasonable steps to minimize or prevent any discharge or sludge use or disposal in violation of this permit which has a reasonable likelihood of adversely affecting human health or the environment. In addition, upon request of the Department, the permittee shall correct any adverse impact on the environment or human health resulting from noncompliance with this permit, including such accelerated or additional monitoring as necessary to determine the nature and impact of the noncomplying discharge.

4. Duty to Reapply

If the permittee wishes to continue an activity regulated by this permit after the expiration date of this permit, the permittee must apply for and have the permit renewed. The application shall be submitted at least 180 days before the expiration date of this permit.

The Director may grant permission to submit an application less than 180 days in advance but no later than the permit expiration date.

5. Permit Actions

This permit may be modified, suspended, revoked and reissued, or terminated for cause including, but not limited to, the following:

a. Violation of any term, condition, or requirement of this permit, a rule, or a statute;

b. Obtaining this permit by misrepresentation or failure to disclose fully all material facts; or

c. A change in any condition that requires either a temporary or permanent reduction or elimination of the authorized discharge.

The filing of a request by the permittee for a permit modification or a notification of planned changes or anticipated noncompliance, does not stay any permit condition.

6. Toxic Pollutants

The permittee shall comply with any applicable effluent standards or prohibitions established under Section 307(a) of the Clean Water Act for toxic pollutants within the time provided in the regulations that establish those standards or prohibitions, even if the permit has not yet been modified to incorporate the requirement.

7. Property Rights

The issuance of this permit does not convey any property rights of any sort, or any exclusive privilege.

8. Permit References

Except for effluent standards or prohibitions established under Section 307(a) of the Clean Water Act for toxic pollutants and standards for sewage sludge use or disposal established under Section 405(d) of the Clean Water Act, all rules and statutes referred to in this permit are those in effect on the date this permit is issued.

SECTION B. OPERATION AND MAINTENANCE OF POLLUTION CONTROLS

1. Proper Operation and Maintenance

The permittee shall at all times properly operate and maintain all facilities and systems of treatment and control (and related appurtenances) which are installed or used by the permittee to achieve compliance with the conditions of this permit. Proper operation and maintenance also includes adequate laboratory controls, and appropriate quality assurance procedures. This provision requires the operation of back-up or auxiliary facilities or similar systems which are installed by a permittee only when the operation is necessary to achieve compliance with the conditions of the permit.

2. Duty to Halt or Reduce Activity

For industrial or commercial facilities, upon reduction, loss, or failure of the treatment facility, the permittee shall, to the extent necessary to maintain compliance with its permit, control production or all discharges or both until the facility is restored or an alternative method of treatment is provided. This requirement applies, for example, when the primary source of power of the treatment facility fails or is reduced or lost. It shall not be a defense for a permittee in an enforcement action that it would have been necessary to halt or reduce the permitted activity in order to maintain compliance with the conditions of this permit.

3. Bypass of Treatment Facilities

a. Definitions

(1) "Bypass" means intentional diversion of waste streams from any portion of the treatment facility. The term "bypass" does not include nonuse of singular or multiple units or processes of a treatment works when the nonuse is insignificant to the quality and/or quantity of the effluent produced by the treatment works. The term "bypass" does not apply if the diversion does not cause effluent limitations to be exceeded, provided the diversion is to allow essential maintenance to assure efficient operation.

(2) "Severe property damage" means substantial physical damage to property, damage to the treatment facilities or treatment processes which causes them to become inoperable, or substantial and permanent loss of natural resources which can reasonably be expected to occur in the absence of a bypass. Severe property damage does not mean economic loss caused by delays in production.

b. Prohibition of bypass.

(1) Bypass is prohibited unless:

(a) Bypass was necessary to prevent loss of life, personal injury, or severe property damage;

(b) There were no feasible alternatives to the bypass, such as the use of auxiliary treatment facilities, retention of untreated wastes, or maintenance during normal periods of equipment downtime. This condition is not satisfied if adequate backup equipment should have been installed in the exercise of reasonable engineering judgement to prevent a bypass which occurred during normal periods of equipment downtime or preventative maintenance; and

(c) The permittee submitted notices and requests as required under General Condition B.3.c.

(2) The Director may approve an anticipated bypass, after considering its adverse effects and any alternatives to bypassing, when the Director determines that it will meet the three conditions listed above in General Condition B.3.b.(1).

c. Notice and request for bypass.

(1) Anticipated bypass. If the permittee knows in advance of the need for a bypass, it shall submit prior written notice, if possible at least ten days before the date of the bypass.

(2) Unanticipated bypass. The permittee shall submit notice of an unanticipated bypass as required in General Condition D.5.

4. Upset

a. Definition. "Upset" means an exceptional incident in which there is unintentional and temporary noncompliance with technology based permit effluent limitations because of factors beyond the reasonable control of the permittee. An upset does not include noncompliance to the extent caused by operation error, improperly designed treatment facilities, inadequate treatment facilities, lack of preventative maintenance, or careless or improper operation.

b. Effect of an upset. An upset constitutes an affirmative defense to an action brought for noncompliance with such technology based permit effluent limitations if the requirements of General Condition B.4.c are met. No determination made during administrative review of claims that noncompliance was caused by upset, and before an action for noncompliance, is final administrative action subject to judicial review.

c. Conditions necessary for a demonstration of upset. A permittee who wishes to establish the affirmative defense of upset shall demonstrate, through properly signed, contemporaneous operating logs, or other relevant evidence that:

(1) An upset occurred and that the permittee can identify the causes(s) of the upset;

(2) The permitted facility was at the time being properly operated;

(3) The permittee submitted notice of the upset as required in General Condition D.5, hereof (24-hour notice); and

(4) The permittee complied with any remedial measures required under General Condition A.3 hereof.

d. Burden of proof. In any enforcement proceeding the permittee seeking to establish the occurrence of an upset has the burden of proof.

5. Treatment of Single Operational Event

For purposes of this permit, A Single Operational Event which leads to simultaneous violations of more than one pollutant parameter shall be treated as a single violation. A single operational event is an exceptional incident which causes simultaneous, unintentional, unknowing (not the result of a knowing act or omission), temporary noncompliance with more than one Clean Water Act effluent discharge pollutant parameter. A single operational event does not include Clean Water Act violations involving discharge without a NPDES permit or noncompliance to the extent caused by improperly designed or inadequate treatment facilities. Each day of a single operational event is a violation.

6. Overflows from Wastewater Conveyance Systems and Associated Pump Stations

a. Definitions

(1) "Overflow" means the diversion and discharge of waste streams from any portion of the wastewater conveyance system including pump stations, through a designed overflow device or structure, other than discharges to the wastewater treatment facility.

(2) "Severe property damage" means substantial physical damage to property, damage to the conveyance system or pump station which causes them to become inoperable, or substantial and permanent loss of natural resources which can reasonably be expected to occur in the absence of an overflow.

(3) "Uncontrolled overflow" means the diversion of waste streams other than through a designed overflow device or structure, for example to overflowing manholes or overflowing into residences, commercial establishments, or industries that may be connected to a conveyance system.

b. Prohibition of overflows. Overflows are prohibited unless:

(1) Overflows were unavoidable to prevent an uncontrolled overflow, loss of life, personal injury, or severe property damage;

(2) There were no feasible alternatives to the overflows, such as the use of auxiliary pumping or conveyance systems, or maximization of conveyance system storage; and

(3) The overflows are the result of an upset as defined in General Condition B.4. and meeting all requirements of this condition.

c. Uncontrolled overflows are prohibited where wastewater is likely to escape or be carried into the waters of the State by any means.

d. Reporting required. Unless otherwise specified in writing by the Department, all overflows and uncontrolled overflows must be reported orally to the Department within 24 hours from the time the permittee becomes aware of the overflow. Reporting procedures are described in more detail in General Condition D.5.

7. Public Notification of Effluent Violation or Overflow

If effluent limitations specified in this permit are exceeded or an overflow occurs, upon request by the Department, the permittee shall take such steps as are necessary to alert the public about the extent and nature of the discharge. Such steps may include, but are not limited to, posting of the river at access points and other places, news releases, and paid announcements on radio and television.

8. Removed Substances

Solids, sludges, filter backwash, or other pollutants removed in the course of treatment or control of wastewaters shall be disposed of in such a manner as to prevent any pollutant from such materials from entering public waters, causing nuisance conditions, or creating a public health hazard.

SECTION C. MONITORING AND RECORDS

1. Representative Sampling

Sampling and measurements taken as required herein shall be representative of the volume and nature of the monitored discharge. All samples shall be taken at the monitoring points specified in this permit and shall be taken, unless otherwise specified, before the effluent joins or is diluted by any other waste stream, body of water, or substance. Monitoring points shall not be changed without notification to and the approval of the Director.

2. Flow Measurements

Appropriate flow measurement devices and methods consistent with accepted scientific practices shall be selected and used to ensure the accuracy and reliability of measurements of the volume of monitored discharges. The devices shall be installed, calibrated and maintained to insure that the accuracy of the measurements is consistent with the accepted capability of that type of device. Devices selected shall be capable of measuring flows with a maximum deviation of less than ± 10 percent from true discharge rates throughout the range of expected discharge volumes.

3. Monitoring Procedures

Monitoring must be conducted according to test procedures approved under 40 CFR Part 136, unless other test procedures have been specified in this permit.

4. Penalties of Tampering

The Clean Water Act provides that any person who falsifies, tampers with, or knowingly renders inaccurate, any monitoring device or method required to be maintained under this permit shall, upon conviction, be punished by a fine of not more than $10,000 per violation, or by imprisonment for not more than two years, or by both. If a conviction of a person is for a violation committed after a first conviction of such person, punishment is a fine not more than $20,000 per day of violation, or by imprisonment of not more than four years or both.

5. Reporting of Monitoring Results

Monitoring results shall be summarized each month on a Discharge Monitoring Report form approved by the Department. The reports shall be submitted monthly and are to be mailed, delivered or otherwise transmitted by the 15th day of the following month unless specifically approved otherwise in Schedule B of this permit.

6. Additional Monitoring by the Permittee

If the permittee monitors any pollutant more frequently than required by this permit, using test procedures approved under 40 CFR 136 or as specified in this permit, the results of this monitoring shall be included in the calculation and reporting of the data submitted in the Discharge Monitoring Report. Such increased frequency shall also be indicated. For a pollutant parameter that may be sampled more than once per day (e.g., Total Chlorine Residual), only the average daily value shall be recorded unless otherwise specified in this permit.

7. Averaging of Measurements

Calculations for all limitations which require averaging of measurements shall utilize an arithmetic mean, except for bacteria which shall be averaged as specified in this permit.

8. Retention of Records

Except for records of monitoring information required by this permit related to the permittee's sewage sludge use and disposal activities, which shall be retained for a period of at least five years (or longer as required by 40 CFR part 503), the permittee shall retain records of all monitoring information, including all calibration and maintenance records of all original strip chart recordings for continuous monitoring instrumentation, copies of all reports required by this permit, and records of all data used to complete the application for this permit, for a period of at least 3 years from the date of the sample, measurement, report or application. This period may be extended by request of the Director at any time.

9. Records Contents

Records of monitoring information shall include:

a. The date, exact place, time and methods of sampling or measurements;

b. The individual(s) who performed the sampling or measurements;

c. The date(s) analyses were performed;

d. The individual(s) who performed the analyses;

e. The analytical techniques or methods used; and

f. The results of such analyses.

10. Inspection and Entry

The permittee shall allow the Director, or an authorized representative upon the presentation of credentials to:

a. Enter upon the permittee's premises where a regulated facility or activity is located or conducted, or where records must be kept under the conditions of this permit;

b. Have access to and copy, at reasonable times, any records that must be kept under the conditions of this permit;

c. Inspect at reasonable times any facilities, equipment (including monitoring and control equipment), practices, or operations regulated or required under this permit, and

d. Sample or monitor at reasonable times, for the purpose of assuring permit compliance or as otherwise authorized by state law, any substances or parameters at any location.

SECTION D. REPORTING REQUIREMENTS

1. Planned Changes

The permittee shall comply with Oregon Administrative Rules (OAR) 340, Division 52, "Review of Plans and Specifications". Except where exempted under OAR 340-52, no construction, installation, or modification involving disposal systems, treatment works, sewerage systems, or common sewers shall be commenced until the plans and specifications are submitted to and approved by the Department. The permittee shall give notice to the Department as soon as possible of any planned physical alternations or additions to the permitted facility.

2. Anticipated Noncompliance

The permittee shall give advance notice to the Director of any planned changes in the permitted facility or activity which may result in noncompliance with permit requirements.

3. Transfers

This permit may be transferred to a new permittee provided the transferee acquires a property interest in the permitted activity and agrees in writing to fully comply with all the terms and conditions of the permit and the rules of the Commission. No permit shall be transferred to a third party without prior written approval from the Director. The permittee shall notify the Department when a transfer of property interest takes place.

4. Compliance Schedule

Reports of compliance or noncompliance with, or any progress reports on interim and final requirements contained in any compliance schedule of this permit shall be submitted no later than 14 days following each schedule date. Any reports of noncompliance shall include the cause of noncompliance, any remedial actions taken, and the probability of meeting the next scheduled requirements.

5. Twenty-Four Hour Reporting

The permittee shall report any noncompliance which may endanger health or the environment. Any information shall be provided orally (by telephone) within 24 hours, unless otherwise specified in this permit, from the time the permittee becomes aware of the circumstances. During normal business hours, the Department's Regional office shall be called. Outside of normal business hours, the Department shall be contacted at 1-800-452-0311 (Oregon Emergency Response System).

A written submission shall also be provided within 5 days of the time the permittee becomes aware of the circumstances. If the permittee is establishing an affirmative defense of upset or bypass to any offense under ORS 468.922 to 468.946, and in which case if the original reporting notice was oral, delivered written notice must be made to the Department or other agency with regulatory jurisdiction within 4 (four) calendar days. The written submission shall contain:

a. A description of the noncompliance and its cause;

b. The period of noncompliance, including exact dates and times;

c. The estimated time noncompliance is expected to continue if it has not been corrected;

d. Steps taken or planned to reduce, eliminate, and prevent reoccurrence of the noncompliance; and

e. Public notification steps taken, pursuant to General Condition B.7.

The following shall be included as information which must be reported within 24 hours under this paragraph:

a. Any unanticipated bypass which exceeds any effluent limitation in this permit.

b. Any upset which exceeds any effluent limitation in this permit.

c. Violation of maximum daily discharge limitation for any of the pollutants listed by the Director in this permit.

The Department may waive the written report on a case-by-case basis if the oral report has been received within 24 hours.

6. Other Noncompliance

The permittee shall report all instances of noncompliance not reported under General Condition D.4 or D.5, at the time monitoring reports are submitted. The reports shall contain:

a. A description of the noncompliance and its cause;

b. The period of noncompliance, including exact dates and times;

c. The estimated time noncompliance is expected to continue if it has not been corrected; and

d. Steps taken or planned to reduce, eliminate, and prevent reoccurrence of the noncompliance.

7. Duty to Provide Information

The permittee shall furnish to the Department, within a reasonable time, any information which the Department may request to determine compliance with this permit. The permittee shall also furnish to the Department, upon request, copies of records required to be kept by this permit.

Other Information: When the permittee becomes aware that it failed to submit any relevant facts in a permit application, or submitted incorrect information in a permit application or any report to the Department, it shall promptly submit such facts or information.

8. Signatory Requirements

All applications, reports or information submitted to the Department shall be signed and certified in accordance with 40 CFR 122.22.

9. Falsification of Information

A person who supplies the Department with false information, or omits material or required information, as specified in ORS 468.953 is subject to criminal prosecution.

10. Changes to Indirect Dischargers - **[Applicable to Publicly Owned Treatment Works (POTW) only]**

The permittee must provide adequate notice to the Department of the following:

a. Any new introduction of pollutants into the POTW from an indirect discharger which would be subject to section 301 or 306 of the Clean Water Act if it were directly discharging those pollutants and;

b. Any substantial change in the volume or character of pollutants being introduced into the POTW by a source introducing pollutants into the POTW at the time of issuance of the permit.

c. For the purposes of this paragraph, adequate notice shall include information on (i) the quality and quantity of effluent introduced into the POTW, and (ii) any anticipated impact of the change on the quantity or quality of effluent to be discharged from the POTW.

11. Changes to Discharges of Toxic Pollutant - **[Applicable to existing manufacturing, commercial, mining, and silvicultural dischargers only]**

The permittee must notify the Department as soon as they know or have reason to believe of the following:

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) One hundred micrograms per liter (100 μg/l);

    (2) Two hundred micrograms per liter (200 μg/l) for acrolein and acrylonitrile; five hundred micrograms per liter (500 μg/l) for 2,4-dinitrophenol and for 2-methyl-4,6-dinitrophenol; and one milligram per liter (1 mg/l) for antimony;

    (3) Five (5) times the maximum concentration value reported for that pollutant in the permit application in accordance with 40 CFR 122.21(g)(7); or

    (4) The level established by the Department in accordance with 40 CFR 122.44(f).

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

    (1) Five hundred micrograms per liter (500 μg/l);

(2) One milligram per liter (1 mg/l) for antimony;

(3) Ten (10) times the maximum concentration value reported for that pollutant in the permit application in accordance with 40 CFR 122.21(g)(7); or

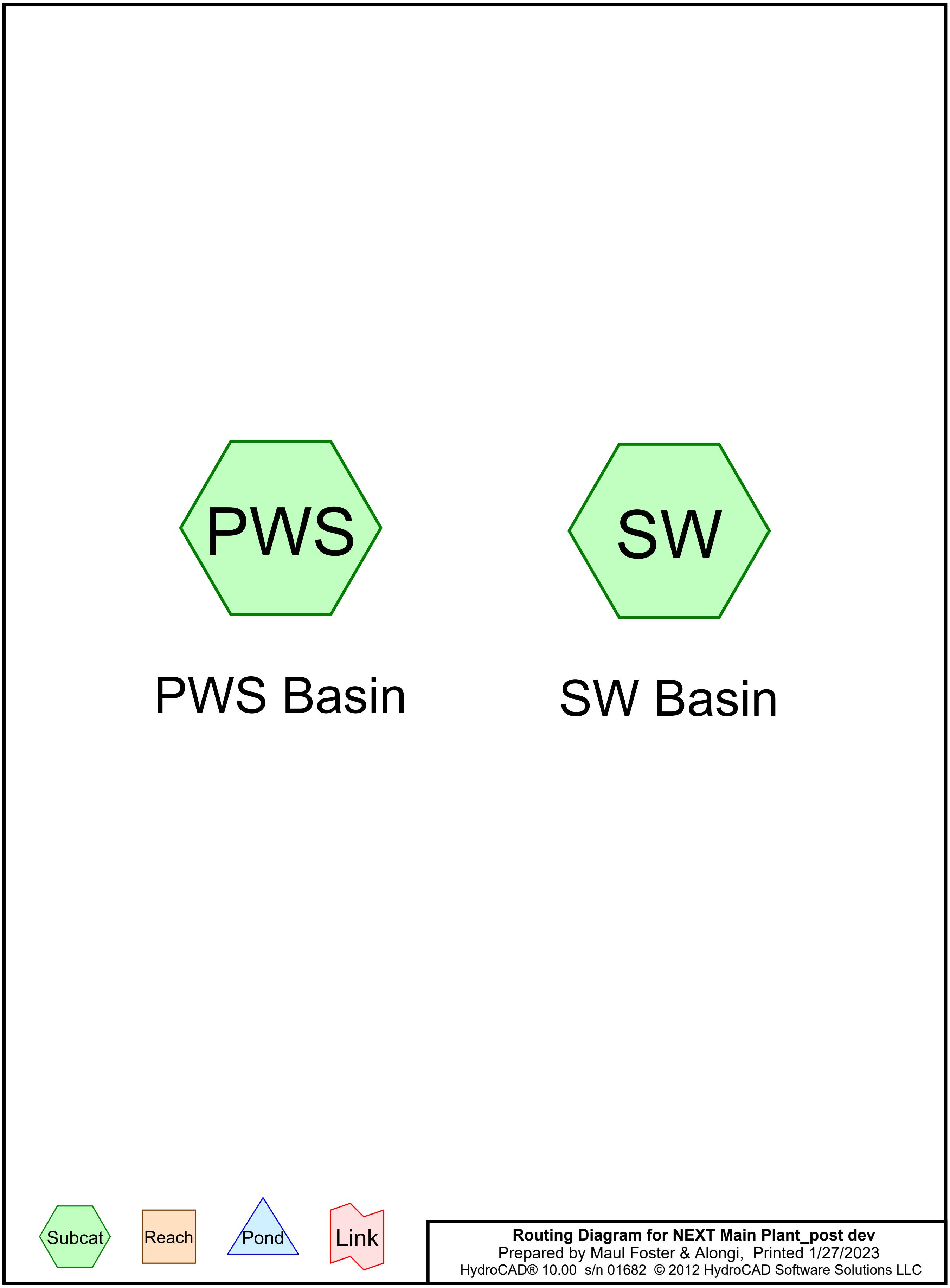
(4) The level established by the Department in accordance with 40 CFR 122.44(f).

SECTION E. DEFINITIONS

1. BOD means five-day biochemical oxygen demand.
2. TSS means total suspended solids.
3. mg/l means milligrams per liter.
4. kg means kilograms.
5. m^3/d means cubic meters per day.
6. MGD means million gallons per day.
7. Composite sample means a sample formed by collecting and mixing discrete samples taken periodically and based on time or flow.
8. FC means fecal coliform bacteria.
9. Technology based permit effluent limitations means technology-based treatment requirements as defined in 40 CFR 125.3, and concentration and mass load effluent limitations that are based on minimum design criteria specified in OAR 340-41.
10. CBOD means five day carbonaceous biochemical oxygen demand.
11. Grab sample means an individual discrete sample collected over a period of time not to exceed 15 minutes.
12. Quarter means January through March, April through June, July through September, or October through December.
13. Month means calendar month.
14. Week means a calendar week of Sunday through Saturday.
15. Total residual chlorine means combined chlorine forms plus free residual chlorine.
16. The term "bacteria" includes but is not limited to fecal coliform bacteria, total coliform bacteria, and E. coli bacteria.
17. POTW means a publicly owned treatment works.

ATTACHMENT 4

HYDROCAD MODEL OUTPUT REPORT



Routing Diagram for NEXT Main Plant_post dev
Prepared by Maul Foster & Alongi, Printed 1/27/2023
HydroCAD® 10.00 s/n 01682 © 2012 HydroCAD Software Solutions LLC

Area Listing (all nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
1,355,152	98	Impervious (SW)
1,437,480	98	Impervious areas (PWS)
375,052	78	Rail/Gravel Base (SW)
3,167,683	**96**	**TOTAL AREA**

Summary for Subcatchment PWS: PWS Basin

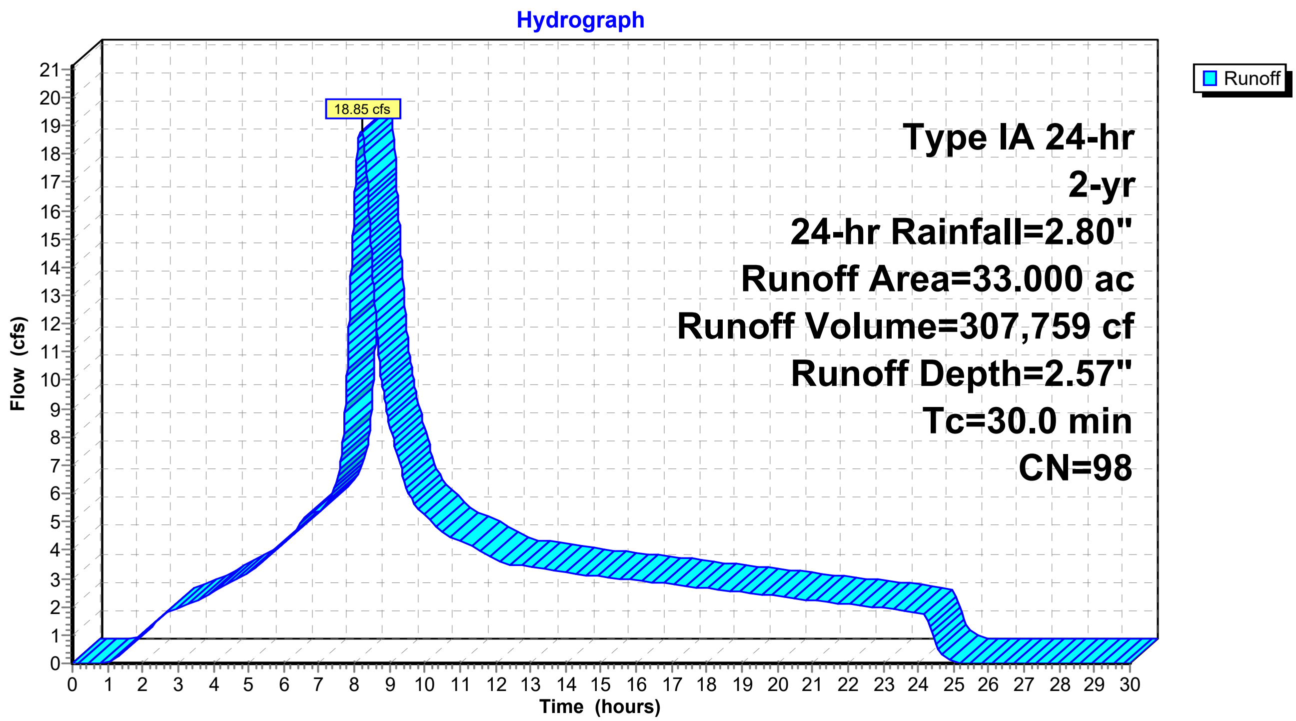
Runoff = 18.85 cfs @ 8.20 hrs, Volume= 307,759 cf, Depth= 2.57"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type IA 24-hr 2-yr, 24-hr Rainfall=2.80"

	Area (ac)	CN	Description
*	33.000	98	Impervious areas
	33.000		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
30.0					**Direct Entry,**

Subcatchment PWS: PWS Basin



Summary for Subcatchment SW: SW Basin

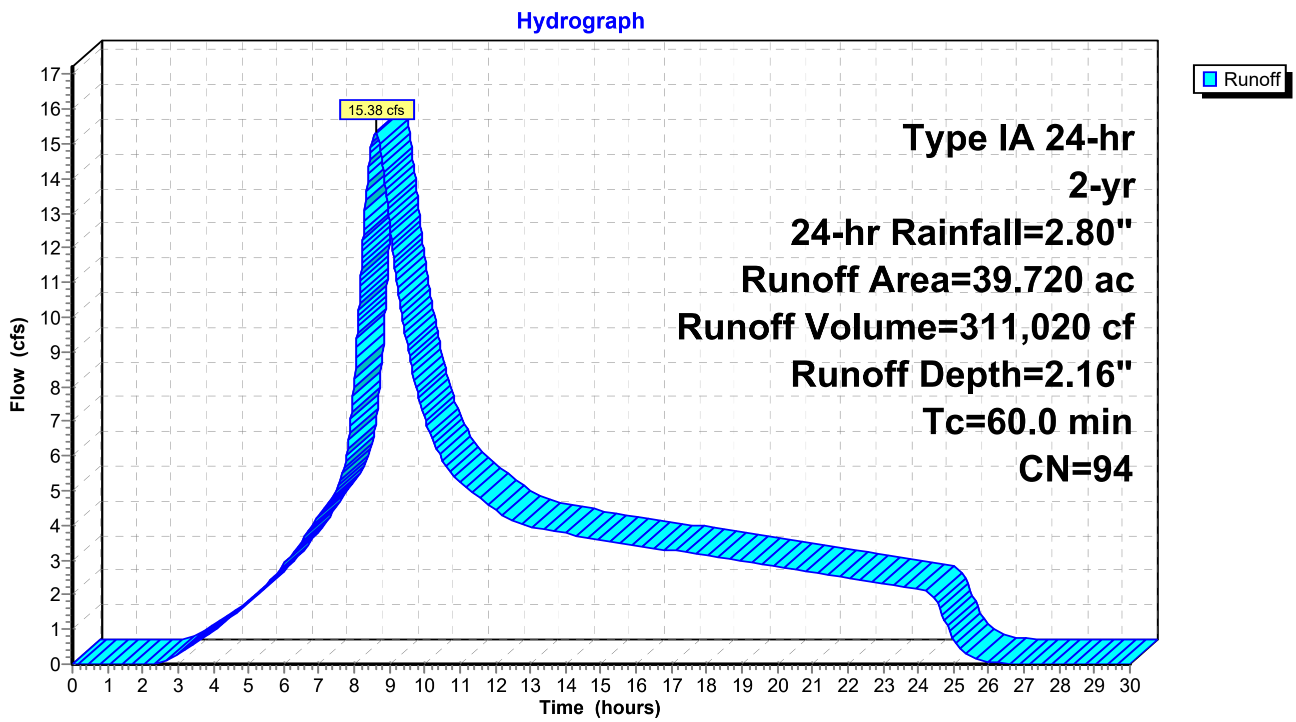
Runoff = 15.38 cfs @ 8.60 hrs, Volume= 311,020 cf, Depth= 2.16"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type IA 24-hr 2-yr, 24-hr Rainfall=2.80"

	Area (ac)	CN	Description
*	31.110	98	Impervious
*	8.610	78	Rail/Gravel Base
	39.720	94	Weighted Average
	8.610		21.68% Pervious Area
	31.110		78.32% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
60.0					**Direct Entry,**

Subcatchment SW: SW Basin



Summary for Subcatchment PWS: PWS Basin

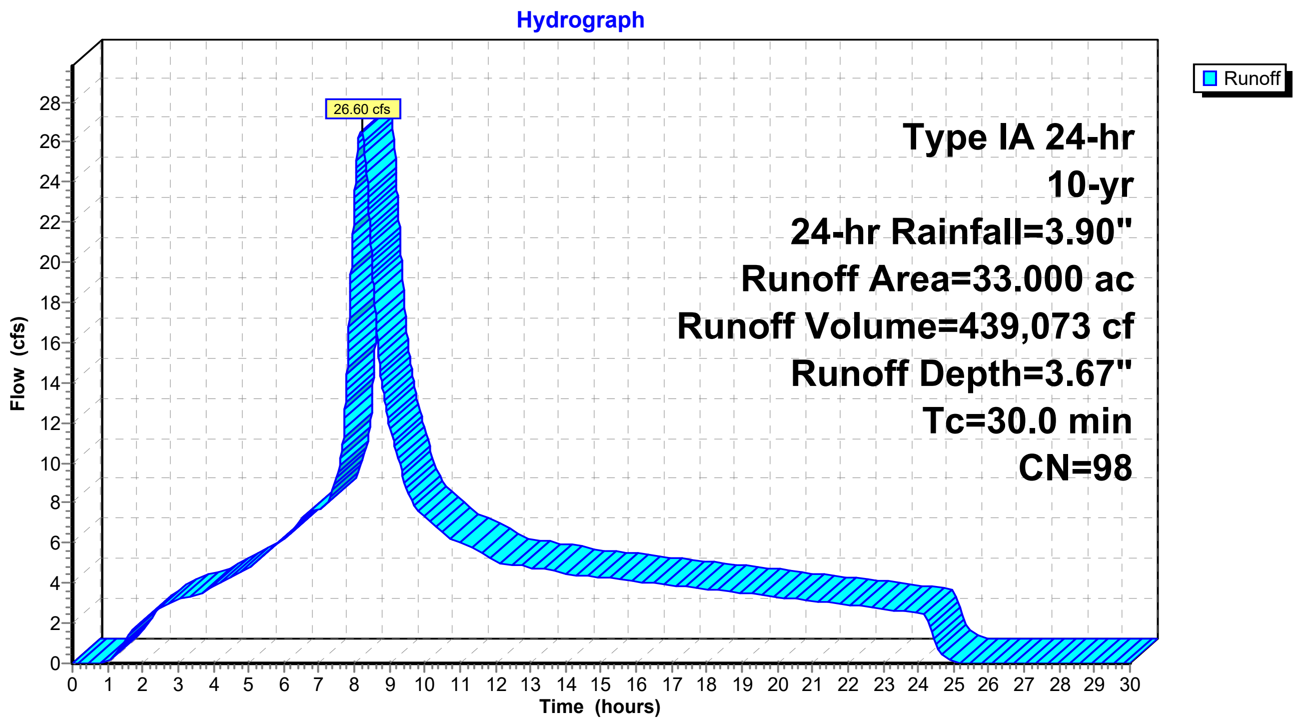
Runoff = 26.60 cfs @ 8.20 hrs, Volume= 439,073 cf, Depth= 3.67"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type IA 24-hr 10-yr, 24-hr Rainfall=3.90"

	Area (ac)	CN	Description
*	33.000	98	Impervious areas
	33.000		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
30.0					**Direct Entry,**

Subcatchment PWS: PWS Basin



Summary for Subcatchment SW: SW Basin

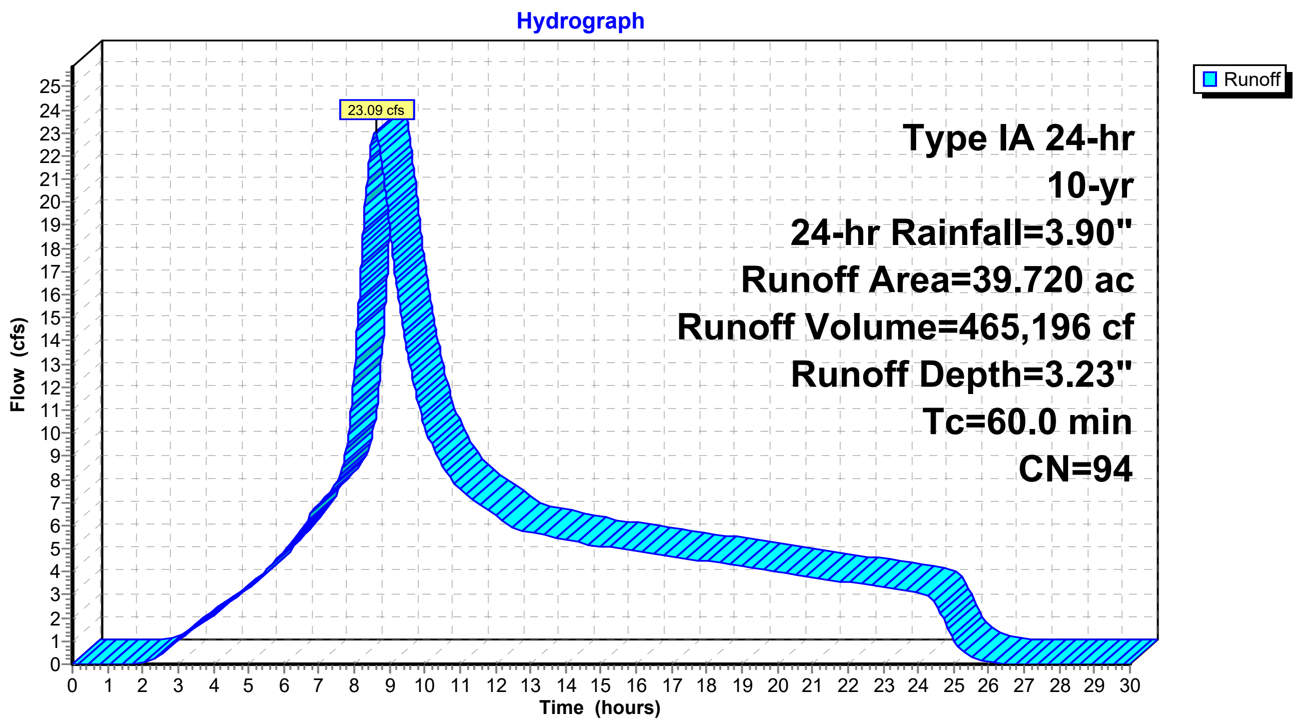
Runoff = 23.09 cfs @ 8.60 hrs, Volume= 465,196 cf, Depth= 3.23"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type IA 24-hr 10-yr, 24-hr Rainfall=3.90"

	Area (ac)	CN	Description
*	31.110	98	Impervious
*	8.610	78	Rail/Gravel Base
	39.720	94	Weighted Average
	8.610		21.68% Pervious Area
	31.110		78.32% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
60.0					**Direct Entry,**

Subcatchment SW: SW Basin



Summary for Subcatchment PWS: PWS Basin

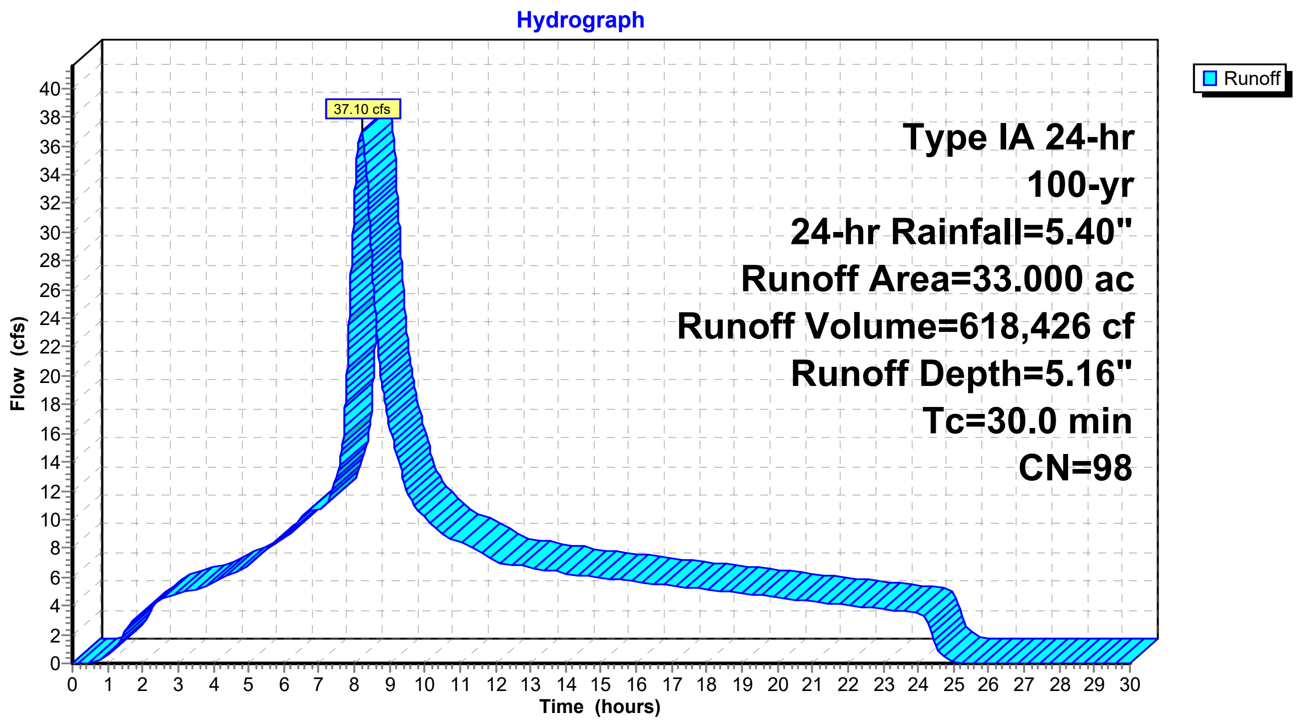
Runoff = 37.10 cfs @ 8.20 hrs, Volume= 618,426 cf, Depth= 5.16"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type IA 24-hr 100-yr, 24-hr Rainfall=5.40"

	Area (ac)	CN	Description
*	33.000	98	Impervious areas
	33.000		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
30.0					**Direct Entry,**

Subcatchment PWS: PWS Basin



Summary for Subcatchment SW: SW Basin

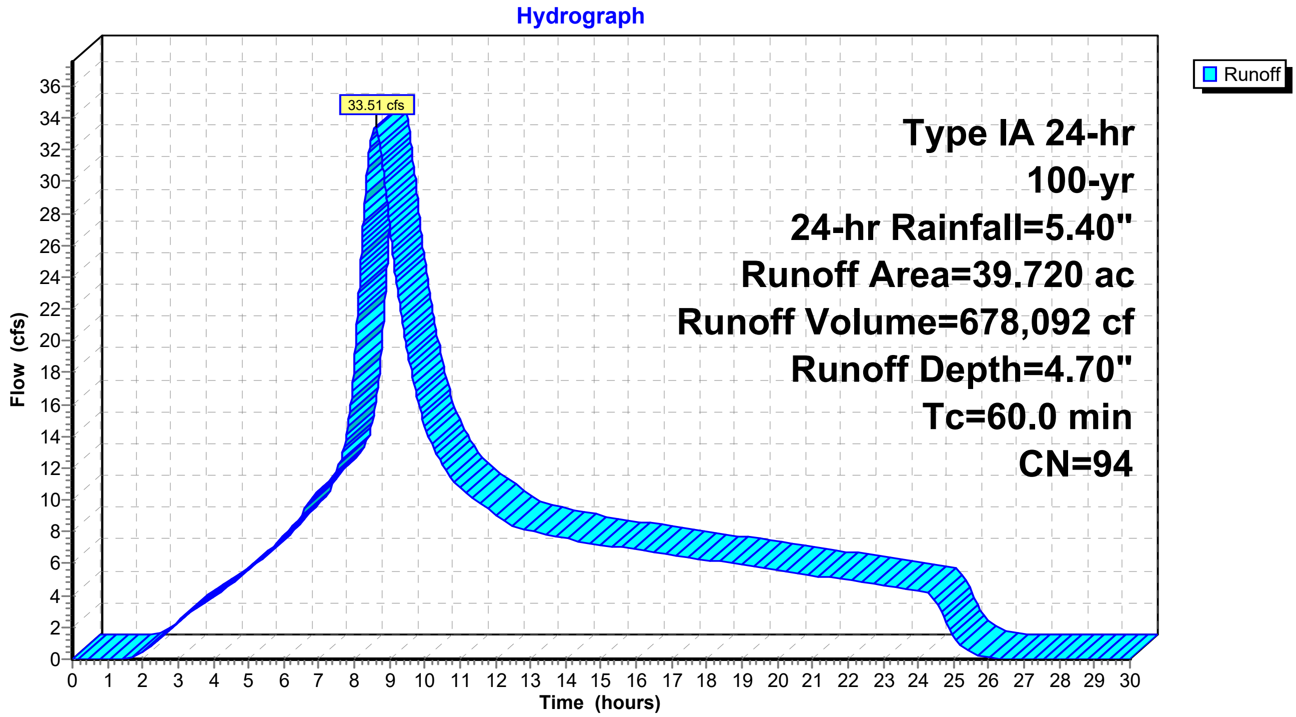
Runoff = 33.51 cfs @ 8.60 hrs, Volume= 678,092 cf, Depth= 4.70"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type IA 24-hr 100-yr, 24-hr Rainfall=5.40"

	Area (ac)	CN	Description
*	31.110	98	Impervious
*	8.610	78	Rail/Gravel Base
	39.720	94	Weighted Average
	8.610		21.68% Pervious Area
	31.110		78.32% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
60.0					**Direct Entry,**

Subcatchment SW: SW Basin



Summary for Subcatchment PWS: PWS Basin

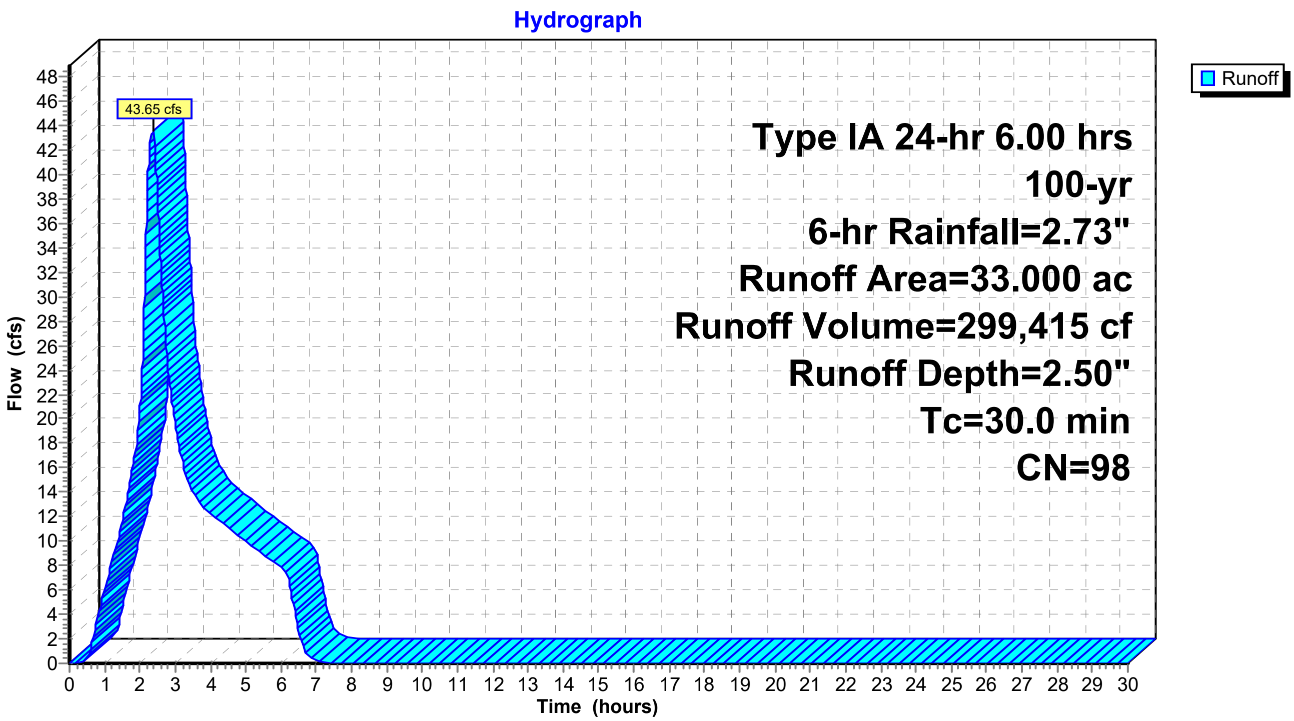
Runoff = 43.65 cfs @ 2.36 hrs, Volume= 299,415 cf, Depth= 2.50"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type IA 24-hr 6.00 hrs 100-yr, 6-hr Rainfall=2.73"

	Area (ac)	CN	Description
*	33.000	98	Impervious areas
	33.000		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
30.0					**Direct Entry,**

Subcatchment PWS: PWS Basin



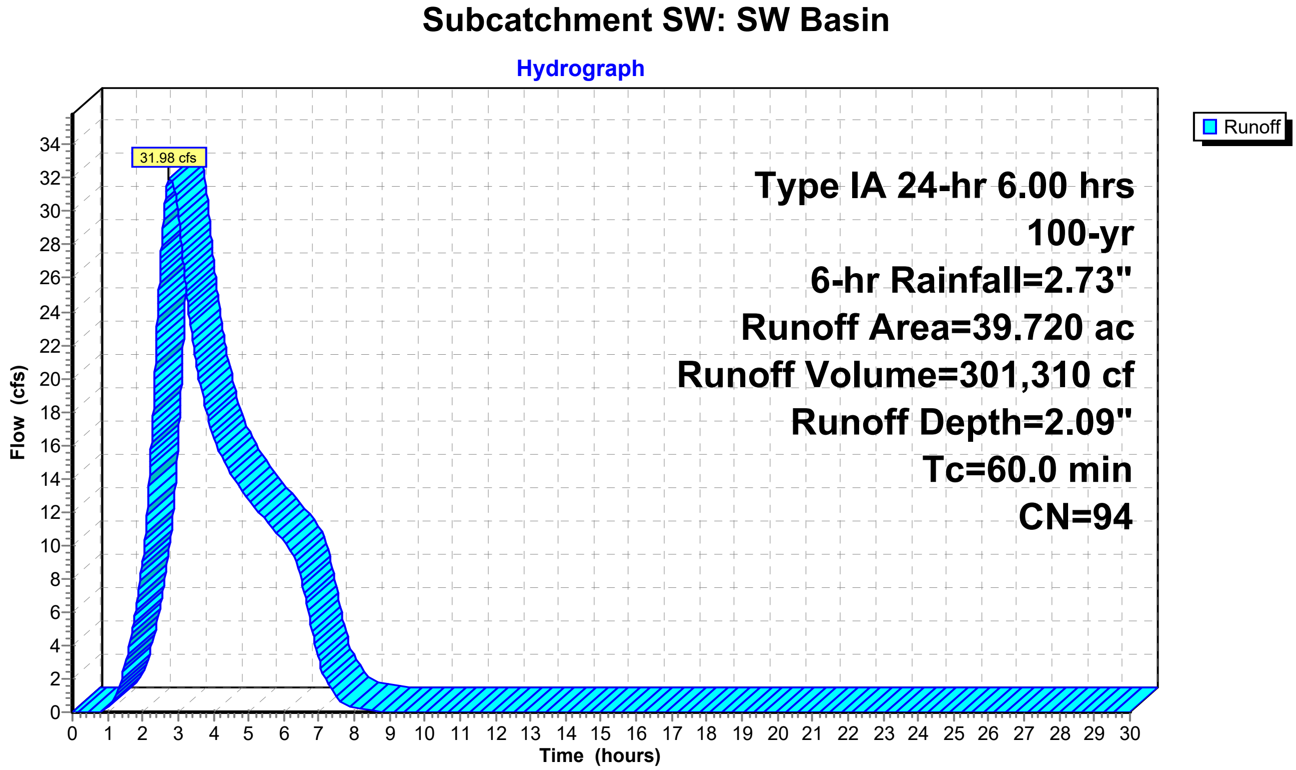
Summary for Subcatchment SW: SW Basin

Runoff = 31.98 cfs @ 2.74 hrs, Volume= 301,310 cf, Depth= 2.09"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type IA 24-hr 6.00 hrs 100-yr, 6-hr Rainfall=2.73"

	Area (ac)	CN	Description
*	31.110	98	Impervious
*	8.610	78	Rail/Gravel Base
	39.720	94	Weighted Average
	8.610		21.68% Pervious Area
	31.110		78.32% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
60.0					**Direct Entry,**



Summary for Subcatchment PWS: PWS Basin

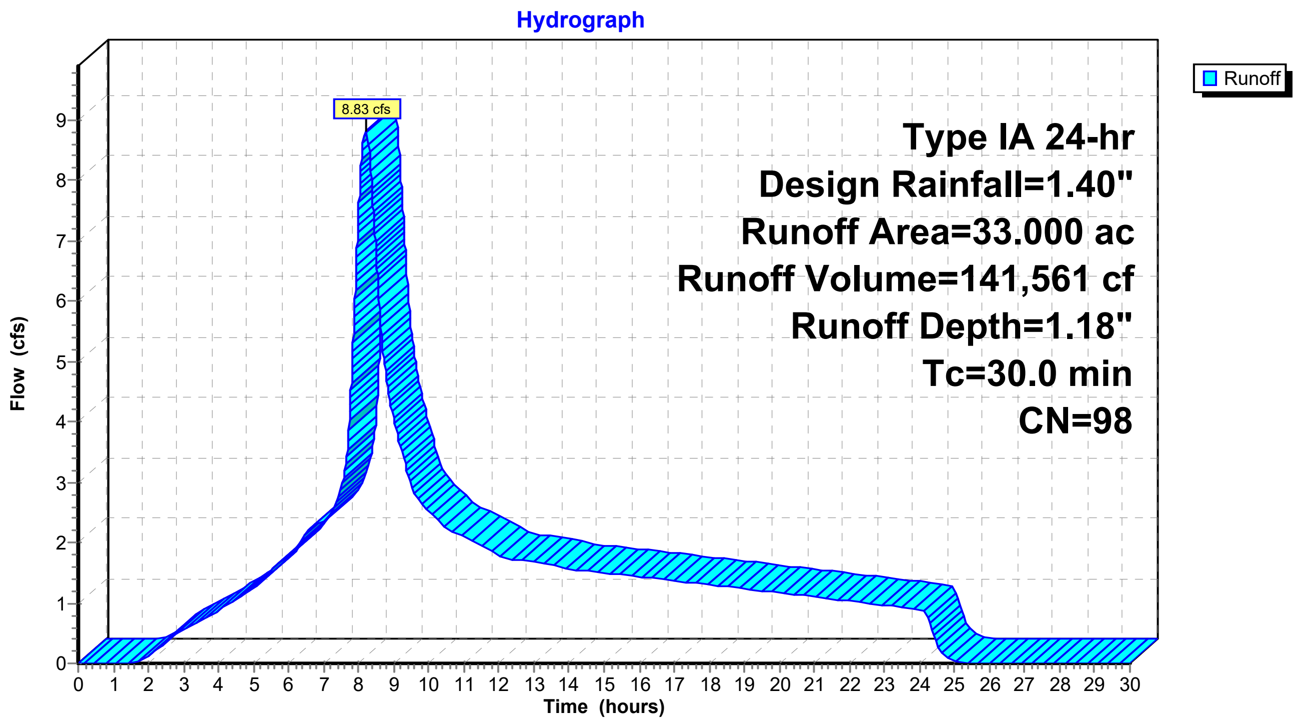
Runoff = 8.83 cfs @ 8.20 hrs, Volume= 141,561 cf, Depth= 1.18"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type IA 24-hr Design Rainfall=1.40"

	Area (ac)	CN	Description
*	33.000	98	Impervious areas
	33.000		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
30.0					**Direct Entry,**

Subcatchment PWS: PWS Basin



Summary for Subcatchment SW: SW Basin

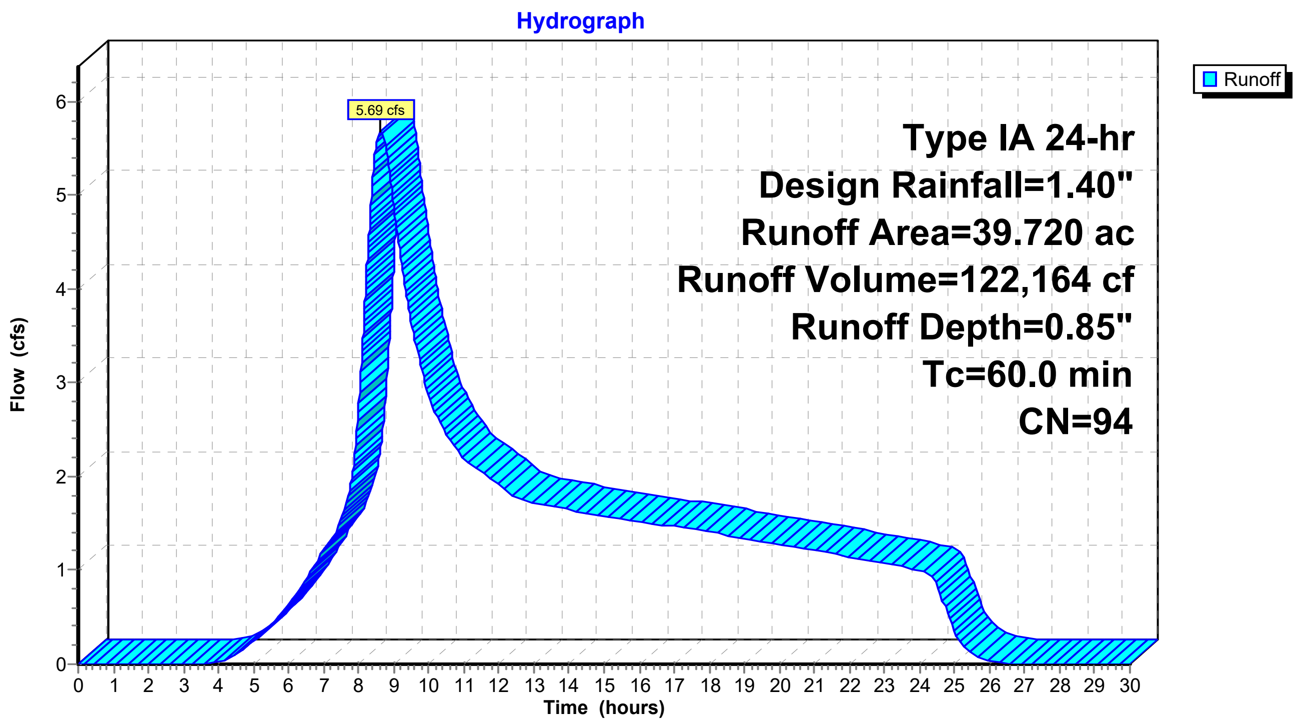
Runoff = 5.69 cfs @ 8.60 hrs, Volume= 122,164 cf, Depth= 0.85"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type IA 24-hr Design Rainfall=1.40"

	Area (ac)	CN	Description
*	31.110	98	Impervious
*	8.610	78	Rail/Gravel Base
	39.720	94	Weighted Average
	8.610		21.68% Pervious Area
	31.110		78.32% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
60.0					**Direct Entry,**

Subcatchment SW: SW Basin



APPENDIX E

OPERATIONS AND MAINTENANCE MANUAL

OPERATIONS AND MAINTENANCE MANUAL

NEXT RENEWABLE FUELS, OREGON, INC.

Prepared for

NEXT RENEWABLE FUELS, OREGON, INC.

January 30, 2023
Project No. M1724.01.004

Prepared by
Maul Foster & Alongi, Inc.
2001 NW 19th Avenue, Suite 200, Portland OR 97209

MAUL
FOSTER
ALONGI

CONTENTS

ACRONYMS AND ABBREVIATIONS

Main Plant	the proposed NEXT Renewables renewable diesel production facility
NEXT Renewables	Next Renewable Fuels, Oregon, Inc.
O&M Manual	Operations & Maintenance Manual
1200-Z Permit	Industrial Stormwater Discharge Permit No. 1200-Z issued by the DEQ
site	property located in Port Westward Industrial Park between Kallunki Road and Hermo Road, Clatskanie, Oregon
SWMP	Post-Construction Stormwater Management Plan for Port Westward Renewable Fuels Facility
SWPCP	Stormwater Pollution Control Plan
Waterway F	an existing ditch located on the west side of Drainage Area 3 and conveys runoff from the surrounding areas

1 INTRODUCTION

Maul Foster & Alongi, Inc., has prepared this Operations and Maintenance (O&M) Manual on behalf of NEXT Renewable Fuels, Oregon, Inc. (NEXT Renewables), as part of the *Post-Construction Stormwater Management Plan for Port Westward Industrial Park NEXT Renewable Fuels Facility* (SWMP) associated with the Joint Permit Application (No. 63077 RF) and comments on the application provided by the Oregon Department of Environmental Quality. This O&M Manual addresses the anticipated O&M procedures and schedules for the stormwater conveyance system and vegetated ponds in the drainage basins referred to in the SWMP as Drainage Area 2 and Drainage Area 3. This O&M Manual may be updated during the final design phase to reflect design changes, if any, or following the construction of the facilities.

1.1 Site Description

The proposed NEXT Renewables facility will be located in the Port Westward Industrial Park between Kallunki Road and Hermo Road near Clatskanie, Oregon (site, see Figure 1). The site comprises approximately 122.5 acres and is currently undeveloped, vegetated and surrounded by wetlands and agricultural land. The development will include the construction of industrial and processing areas, as well as buildings, parking, utilities, roadways, and rail spurs to support biofuels production, storage and shipping. The general layout of the proposed site is shown on Figure 2.

Drainage Area 2 is approximately 12.2 acres located outside the proposed renewable diesel production facility (the Main Plant) and consists of a paved road, gravel laydown area, and rail yard located west of the Main Plant, as well as an aboveground pipeline and associated gravel maintenance road located northwest of the Main Plant. Drainage Area 3 is approximately 0.8 acre and consists of a rail spur located southeast of the Main Plant. Industrial activities in these areas will include vehicle and rail traffic, material loading/unloading, and transport of biodiesel products via an aboveground pipeline or cargo train cars.

1.2 Stormwater Treatment Facilities

Stormwater runoff from the rail yard and roadways in Drainage Area 2 is collected in a series of catch basins and conveyed via gravity piping into one of two proposed ponds located along the southern site boundary (see Ponds 1 and 2, Figure 2).

Industrial stormwater from the aboveground pipeline and maintenance road in the northwest portion of the site sheet flows into a pond that runs parallel to the maintenance road and is conveyed via gravity pipe to MH-DP002 (Pond 3).

The vegetated ponds provide detention, sedimentation and biofiltration. The pond outlet pipes are equipped with downturned elbows to trap oil sheen and floatables in the ponds. Absorbent booms are used to absorb sheen, if observed. Treated effluent from Ponds 1, 2, and 3 is conveyed via gravity pipes to a manhole (MH-DP002, Figure 2) prior to discharging into McLean Slough (see Discharge Point 002, Figure 2).

Stormwater runoff from the rail yard in Drainage Area 3 is collected in a catch basin and conveyed via gravity piping into a pond located along the southwest boundary of this drainage area (see Pond 4, Figure 2). The vegetated pond provides detention, sedimentation and biofiltration. The Pond 4 outlet consists of a grated catch basin (CB-DP003) equipped with a downturned elbow to trap floatables including oil sheen in the pond. Absorbent booms are used to absorb sheen, if observed.

An existing ditch (see Waterway F, Figure 2) crosses through the property on the west boundary of Drainage Area 3 and will be conveyed via a new culvert under the proposed rail to maintain the existing drainage for the surrounding area. Treated industrial runoff from the proposed Pond 4 will discharge to the existing Waterway F via Discharge Point 003 (see Figure 2).

2 OPERATION AND MAINTENANCE RESPONSIBILITIES

NEXT Renewables assumes financial responsibility for the operation and maintenance of the stormwater conveyance system and ponds and will incorporate the costs of operating and maintaining these systems into its annual budget. The maintenance tasks and schedules will be incorporated into the site-specific Stormwater Pollution Control Plan (SWPCP) and discussed during the annual stormwater training. Inspection and maintenance activities will be performed by trained NEXT Renewables staff and/or contracted maintenance service providers (e.g., landscaping contractors, vacuum truck services, pavement sweepers).

3 STORMWATER SYSTEM OPERATION

The operation of the stormwater conveyance and treatment systems in Drainage Areas 2 and 3 is described in detail in the following sections.

3.1 Conveyance System

The stormwater conveyance system in Drainage Areas 2 and 3 consists of a network of catch basins, manholes and gravity piping. Runoff from Drainage Areas 2 will be collected in a series of catch basins connected to underground piping that will convey stormwater by gravity to Ponds 1 and 2. Each catch basin will be equipped with an oil trapping outlet and sump to trap oil sheen and sediment in the sump. Runoff from Drainage 3 will be collected in a single catch basin and conveyed via gravity flow to Pond 4.

A sampling manhole MH-DP002 is located between Ponds 1 and 2. Stormwater from Ponds 1, 2, and 3 discharges into and comingles inside this manhole prior to discharging via gravity pipe to McLean

Slough via Discharge Point 002. The manhole includes a sump to facilitate collection of stormwater samples.

3.2 Detention and Treatment Ponds

The stormwater detention and treatment ponds are shown on Figure 2. Runoff from the paved access road, gravel laydown area, and rail areas southwest of the Main Plant (Drainage Area 2) will be treated in two a vegetated ponds that extends east from Hermo Road toward the Main Plant (Ponds 1 and 2).

Industrial stormwater from the aboveground pipeline and maintenance road in the northwest pipeline and maintenance road will be treated in Pond 3 that runs parallel to the maintenance road. Treated runoff from the ponds is conveyed via gravity pipes to MH-DP002, located upstream of Discharge Point 002.

Runoff from the rail area southeast of the Main Plant (Drainage Area 3) will be treated in a vegetated Pond 4 located in the southwest portion of Drainage Area 3 adjacent to the existing Waterway F.

The ponds are long and narrow. Ponds 1 and 2 have a total depth of 3.5 feet, which includes 1.5 foot for sediment storage and 2 feet for live storage (detention) and freeboard. Ponds 3 and 4 have a total depth of 2 feet, which includes 1 foot for sediment storage, 1 foot for detention and freeboard. Each pond outlet has been equipped with a downturned elbow to trap floatables, including oil sheen, in the pond and allow for use of absorbent booms to absorb the sheen.

The pond planting plan will be refined during the final design phase, in conjunction with the design of wetland mitigation facilities. Sections of the ponds adjacent to inlet pipes may be segregated using weir walls, earth berms or rock check dams to allow for frequent sediment removal without the need to replace vegetation. The lower side slopes and pond bottom will be vegetated to enhance sedimentation with biofiltration. An example of the seed mix that may be used at the bottom and lower side slopes of the ponds is the ProTime Seed Mix 440 (Native Biofilter Mix). The ProTime Seeds Mix 498 (Native Riparian Zone 2 Mix), more suitable for riparian slopes of water quality facilities, or a similar mix may be used to vegetate the upper pond side slopes. These vegetation specifications are subject to change during the final design phase, as the vegetation may be customized to better match the existing native wetland vegetation in the surrounding areas or the vegetation in the proposed wetland mitigation areas. All proposed planting will utilize native species and be selected based on the level of inundation expected (upper side slope versus lower slope and bottom).

4 INSPECTIONS AND MAINTENANCE

The stormwater management system will be inspected monthly, consistent with the inspection requirements in the Industrial Stormwater Discharge Permit No. 1200-Z (1200-Z Permit) and maintained consistent with the inspection findings and the procedures outlined in the following section.

4.1 Pond Maintenance

Maintenance Component	Defect	Conditions When Maintenance Is Needed	Results Expected When Maintenance Is Performed
General	Trash and debris	Any trash and debris that exceeds 5 cubic feet (equal to the amount of trash it would take to fill up one standard garbage can). If less than the threshold, all trash and debris will be removed as part of next scheduled maintenance.	Trash and debris cleared from pond.
	Oil sheen	Oil sheen observed on the water surface of the ponds will be removed using absorbents (e.g., oil absorbent booms or socks).	No oil sheen observed.
Side Slopes of Pond	Erosion	Eroded damage over two inches deep where cause of damage is still present or where there is potential for continued erosion should be repaired (filled and stabilized) as soon as practicable.	Slopes should be stabilized using appropriate erosion control measure(s); e.g., rock reinforcement, sediment-control booms, plantings.
Sediment Storage Areas	Excessive Sediment Accumulation	Excessive levels of accumulated sediment (one foot or more in depth) require removal.	Sediment cleaned out to designed pond shape and depth; pond replanted, if necessary to control erosion.
Piping	Clogged inlets or outlets	Accumulated sediment that affects inlet or outlet pipe condition and impedes flow requires sediment removal and may require jet cleaning of the pipe.	Remove sediment and debris from pond areas adjacent to the inlet and outlet pipes to maintain conveyance capacity.

Maintenance Component	Defect	Conditions When Maintenance Is Needed	Results Expected When Maintenance Is Performed
Vegetation	Nuisance vegetation and noxious weeds	Nuisance vegetation that may constitute a hazard to maintenance personnel or increase the risk of fire, as well as noxious weeds and non-native invasive species should be removed by trained staff or contractors.	Vegetation that generally complies with the planting plan or of other native vegetation. Complete eradication of noxious weeds may not be possible. Nuisance vegetation must be removed via mechanical measures. Herbicide use will be avoided; however, if needed herbicides will be applied in accordance with Standard Local Operating Procedures for Endangered Species (SLOPES) V regulations[1].
	Dead or strained vegetation or trees	Dead vegetation should be removed and replaced, weather permitting, to maintain vegetative cover and control erosion where soils are exposed.	Vegetation that generally complies with the planting plan or of other native vegetation. Irrigate as needed. Mulch banks as needed.
	Tall grass and vegetation	Tall grass and vegetation blocking sight lines/foot traffic or blocking inlet/outlets to convey stormwater should be mowed or pruned.	Vegetation that does not impede traffic or sight lines.

4.2 Conveyance System Maintenance

Catch basins and the manhole should be inspected monthly consistent with the 1200-Z Permit. Remove sediment, oil, and debris from catch basins when the sump is 1/3 full or when the sediment layer is within 6 inches of the outlet pipe. The manhole is not anticipated to drain stormwater with significant levels of oil sheen, sediment or debris, since it is downstream of the treatment ponds. If sheen is observed in the manhole, it will be removed using absorbent boom or socks as soon as practicable to minimize the potential of discharging stormwater impacted with sheen to McLean Slough. Debris or trash will also be removed from the manhole as soon as practicable. Sediment will be removed if the depth of sediment exceeds three inches. If sediment removal is required, the catch basin or manhole should be pressure-washed and the solids/washwater vacuumed out and disposed at an off-site permitted disposal facility or the on-site wastewater and industrial process stormwater treatment system. The washwater and solids should not be discharged into the stormwater system.

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[1] USACE. 2014. William W. Stelle, Jr. National Oceanic and Atmospheric Administration National Marine Fisheries Services. Reinitiation of the Endangered Species Act Section 7 Programmatic Conference and Biological Opinion and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Consultation for Revisions to Standard Local Operating Procedures for Endangered Species to Administer Maintenance or Improvement of Stormwater, Transportation or Utility Actions Authorized or Carried Out by the U.S. Army Corps of Engineers in Oregon (SLOPES for Stormwater, Transportation or Utilities). NWR-2013-10411. Letter to Shawn H. Zinszer and Joyce Casey, U.S. Army Corps of Engineers. March 14.

Significant sediment accumulation in the gravity piping network is not expected; however, the piping network will include cleanouts to facilitate jet cleaning of the pipes, if needed.

4.3 Maintenance Schedule

Annual maintenance schedule:

- Summer: Make any necessary structural repairs. Clear inlet and outlet pipes. Remove sediment, debris or trash from catch basins, ponds and manhole. Irrigate new (less than two years old) vegetation.
- Fall: Remove dead plants, nuisance plants and noxious or invasive species. Replace dead plants. Replace absorbent booms in ponds, as needed. Remove floating debris or trash from ponds.
- Winter: Replace absorbent booms in ponds, as needed. Remove floating debris or trash from ponds.
- Spring: Remove dead plants, nuisance plants and noxious or invasive species. Replace dead plants. Replace absorbent booms in ponds, as needed. Remove floating debris or trash from ponds.

4.4 Best Management Practices

The following best management practices should be followed to reduce pollution at the source:

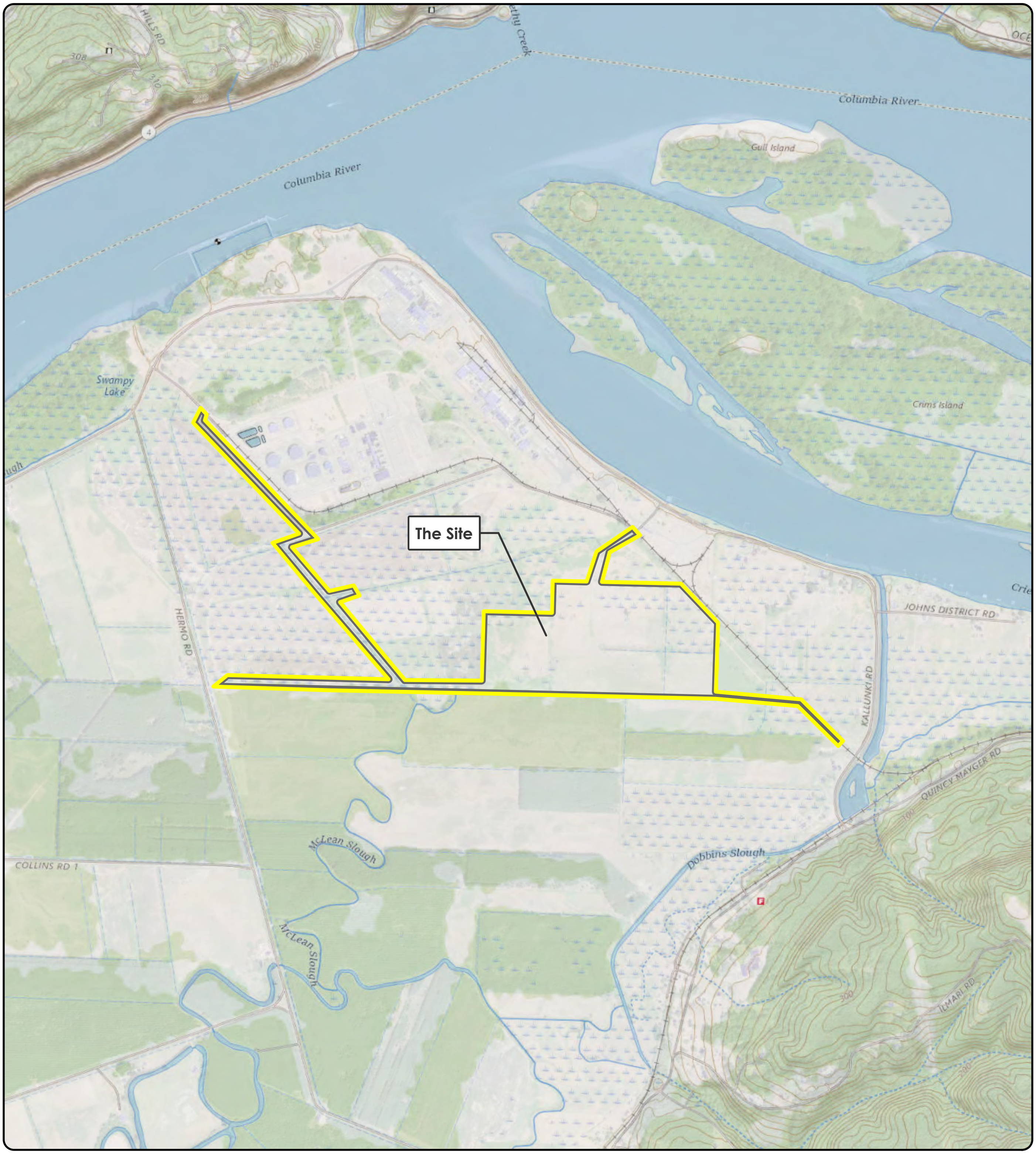
- Fertilizers, pesticides, and herbicides: Their use is strongly discouraged because of the potential for damage to downstream systems. If pesticides or herbicides are required, use products approved for aquatic use and contract with a licensed applicator.
- Vectors (mosquitoes and rats): Stormwater facilities must not harbor mosquito larvae or rodents that pose a threat to public health or that undermine facility structures. Monitor vector activity and implement vector abatement when needed. Do not use pesticides in the ponds.
- Spill Prevention and Response: Spill prevention and response measures will be outlined in a SWPCP and all employees that work in areas that are potentially subject to leaks or spills of significant materials will be trained to prevent spill and respond to them promptly and safely. Biodiesel storage will be subject to a Spill Prevention, Control and Countermeasure Plan and all employees that work in the Main Plant will be trained in the contents of this plan.
- SWPCP: Industrial stormwater BMPs, including but not limited to measures that minimize exposure of stormwater to potential pollutants, oil control measures, erosion, sediment and debris control, stormwater treatment measures, inspections and preventative maintenance, will be outlined in a SWPCP that will be updated as needed. Employees that work in areas where stormwater can be exposed to significant materials and potential pollutants will be trained on the contents of the SWPCP.

LIMITATIONS

The services undertaken in completing this manual were performed consistent with generally accepted professional consulting principles and practices. No other warranty, express or implied, is made. These services were performed consistent with our agreement with our client. This manual is solely for the use and information of our client unless otherwise noted. Any reliance on this manual by a third party is at such party's sole risk.

Opinions and recommendations contained in this manual apply to conditions existing when services were performed and are intended only for the client, purposes, locations, time frames, and project parameters indicated. We are not responsible for the impacts of any changes in environmental standards, practices, or regulations subsequent to performance of services. We do not warrant the accuracy of information supplied by others, or the use of segregated portions of this manual.

FIGURES



Notes
U.S. Geological Survey 7.5-minute topographic quadrangle (2021): Oak Point.
Township 8 north, range 4 west, sections 21-23.

Legend

Site Boundary

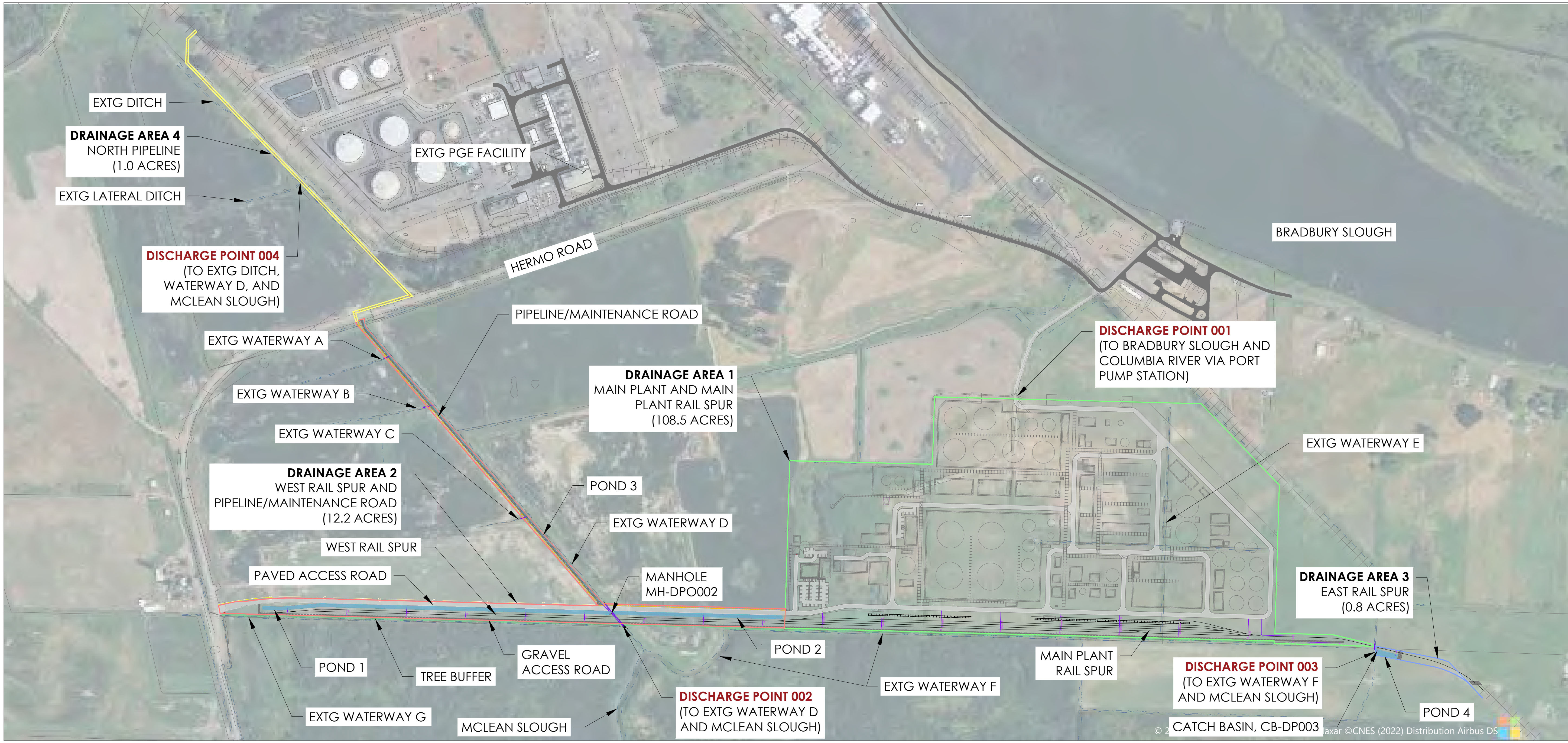
Figure 1
Site Location

NEXT Renewable Fuels, Inc.
Port Westward, OR

MAUL FOSTER ALONGI
p. 971 544 2139 | www.maulfoster.com

0 1,000 2,000
Feet

Path: X:\1724.01 CONFIDENTIAL - NEXTEnergy_04\Projects\Pro\M1724_01_004.aprx
Print Date: 1/19/2023
Reviewed By: apoliski
Produced By: jroberts
Project: M1724.01.004



Filepath: G:\00_MFA Civil 3D\00_PROJECTS\1724.01 NEXT Renewable Fuels, Inc\EXHIBIT\Figure 2_SWMP.dwg

Printed by: Brian Tino

LEGEND

- STORMWATER POND
- PAVED ROAD
- GRAVEL
- TREE BUFFER
- DRAINAGE AREA BOUNDARY
- RAIL SPUR
- PIPE RACK
- STORM PIPE
- CATCH BASIN
- EXISTING WATERWAY/DITCH

Date: 1/19/2023 10:35:25 AM

MFA JOB #:	M1724.01
ISSUE DATE:	1/19/2023
CHECKED:	A. AGUIRRE
DRAWN:	L. DANIEL

MAUL FOSTER ALONGI
3140 NE BROADWAY STREET
PORTLAND, OR 97232
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NEXT Renewable Fuels, Inc.

SITE LAYOUT

NEXT RENEWABLE FUELS OREGON

NEXT RENEWABLE FUELS, INC.
PORT WESTWARD, OREGON

0 700' 1400'

NOTE: BAR IS ONE INCH ON ORIGINAL DRAWING. IF NOT ONE INCH ON THIS SHEET, ADJUST SCALE ACCORDINGLY.

FIGURE 2