DESIGN REPORT - SITE, GRADING, STORMWATER & EROSION PLAN
IN & OUT PAINTING OVERFLOW PARKING LOT

For

RPP0441011000IA
401 Piehl Road
Ponderay, Idaho 83852

Figure 1: Project Vicinity Map

AUGUST 20

7B ENGINEERING
Authored by: Ian Ehrsam and Dan Larson

PROFESSIONAL ENGINEER
REGISTERED
10086
STATE OF IDAHO
DANIEL W. LARSON

Digitally signed by Daniel W. Larson, P.E.
DN: C=US, E=Dan@7BEngineering.com, O=D2G INC, OU=7B Engineering, CN="Daniel W. Larson, P.E."
Location: Sandpoint, ID
Reason: I am approving this document
Contact Info: Dan@7BEngineering.com
Date: 2025.08.20 15:30:13-07'00'

414 Church St., Ste 203
Sandpoint, ID 83864
(208) 263-0623
info@7BEngineering.com

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Introduction

This report has been prepared to address design considerations for a site plan application for In & Out Painting. More specifically, this Site, Stormwater, and Erosion Control Plan addresses site changes to construct a new overflow parking lot as well as provide stormwater controls for improvements planned for the site at this time.

This report, calculations, and drawings are for review by the City of Ponderay and shall become the property of the Owner when approved for construction. All other requirements for any future building permits must be met by the Owner. This report addresses design decisions and calculations that will aid the City, the Contractor, and the Owner in the review of this proposal.

Project Location

The site is located off Piehl Road in Ponderay Idaho.

Property Identification Number: ***RPP0441011000IA***
Site Address: 401 Piehl Road, City of Ponderay, Bonner County, Idaho.

Property owner:	**Location:**	**Size of Lot:**
Geiger, Steven R	Section 2, T57N, R2W	2.669 Acres

Geotechnical

The USDA NRCS Web Soil Survey was used to categorize the soil characteristics at this site. A site visit confirmed the findings of the NRCS and the soils appeared to be consistent with the Survey. In general, the site consists of Odenson silt loams, soils in Hydrologic group B/D. These soils have a low infiltration rate (high runoff potential), are very deep and very poorly drained. These consist chiefly of volcanic ash and loess.

Soil amendment and underdrains (where feasible) are recommended for any infiltration treatment design. All required testing and inspections will be coordinated by the Owner and Contractor and/or his representative and will be submitted to the Engineer if required at the completion of construction.

Water System

The Northside Water supplies water to the site.

Sewer System

The site is currently served by the Kootenai-Ponderay Sewer District.

Road Specifications

Piehl Road is a public and maintained road.

Stormwater Facility Calculations

In general, this project disturbs land sloping less than 2 percent. The stormwater design concept presented here meets the requirements of Ponderay City Code. The first ½" of runoff is captured and treated through grassed infiltration areas and wet ponds (volume-based treatment) and runoff rates are mitigated below pre-developed levels prior to discharge into the existing road ditch along Piehl Road. To protect the drainage and downstream properties from hazardous runoff flooding, the NRCS TR-20 method was used for stormwater calculations.

The Idaho Department of Environmental Quality (IDEQ) requires an Idaho Pollutant Discharge Elimination System (IPDES) storm water permit for all construction activities that disturb more than one acre of land (or is part of a larger common development area that will disturb more than one acre). If development is less than 5 acres a Low Erosivity Waiver (LEW) could be applied for, if the operator of the construction site wants or requires permit coverage and the project could be constructed in a reasonable time. This Project disturbs 0.78 acres which is less than an acre IPDES permit coverage is not a requirement.

Treatment Systems Selected

All new impervious surface areas are required to be treated per the standards of Ponderay Idaho. The Idaho Catalog of Storm Water Best Management Practices manual allows for a variety of treatment methods to be considered.

To treat the increased impervious runoff area from the development, Bioretention Basins (BMP 18) are proposed. Per the Manual, this method is a volume-based treatment designed to treat the first ½" of runoff for all impervious surface areas.

Hydrology and Hydraulics

To protect the drainage and downstream properties from hazardous runoff flooding, the NRCS TR-20 method was used for stormwater calculations. Existing drainage basins contributing runoff to the site were determined by site visit and analysis of the available maps. Calculations were made using the Type II, 25-Year, 24-Hour Unit Hydrograph. Rainfall amounts were taken from the NOAA Isopluvial precipitation maps for Idaho.

HydroCAD Version 10.10-7a was used to model the hydrology and hydraulics of the proposed stormwater system. The modeling procedures are based on methods developed by the Soil Conservation Service (SCS) and are fully integrated in HydroCAD to perform interactive hydrologic and hydraulic (H&H) analysis.

The stormwater model evaluates the proposed development, existing offsite drainage from the undeveloped land north of the site. The pre-developed condition assumes pasture grass over Hydrologic Soil Group D soils across the site, with all runoff managed by the existing swale that center the development. The post-development uses new detention ponds and a 12" stormwater network.

The model includes five distinct sub-catchments (basins):

- **Basin A** – North side of the proposed parking lot.
- **Basin B** – South side of the proposed parking lot.
- **Basin C** – Northwest undeveloped area north of the parking lot
- **Basin EXA**: Predeveloped Parking Lot Area (North side)
- **Basin EXB**: Predeveloped Parking Lot Area (South side)
- **Basin EXC**: Predeveloped area north of the parking lot

Note Basin C and (EXC) have matching flow characteristics as they are the same basin.

Each basin is routed to a corresponding pond in the model:

- **Pond A** – A proposed bioretention swale treating and detaining runoff from Basin A and Basin C (the undeveloped land north of the lot). Controlled by Catch Basin 1, Pond A discharges through a 12" stormwater pipe into the adjacent road ditch, sized to convey pre-development flows. Future upstream development should reduce post-development discharge rates to pre-development levels before tying into this pipe.
- **Pond B** – A proposed bioretention swale treating and detaining runoff from Basin B. This swale discharges toward Piehl Road via a 12" pipe network connected to Pond A. Outflow is controlled by a catch basin set to the treatment elevation.
- **Pond C**: The existing swale after improvements, discharging via a control berm with a broad-crested weir into Pond A. This swale collects Basin C.
- **Pond EXP**- The existing swale prior to improvements, collecting pre-developed basins.
- **CB2:** The outlet for the stormwater network, collecting overflow drainage from Pond A, Pond B.

The swales provide water quality treatment for the proposed development and attenuate flows to below pre-development conditions. The existing swale (pond c) will now be controlled by the new outflow structure, which will result in higher water levels within the existing drainage system during storm events. The stormwater network and swales are designed to convey and treat runoff from both the 25-year and 50-year, 24-hour storm events. Calculations for both events are included in the attached documentation. The existing dwelling and shop are not included in this stormwater report, as they are already served by separate, existing stormwater facilities.

The stormwater model was designed to treat the 25-year, 24-hour storm event. Results of the analysis are summarized in the following tables.

Table 1: 25 yr Stormwater Summary

Section 1 Stormwater Summary 25-Year, 24 Hr Storm								
		Predeveloped			Post Developed			
Basin/Pond	Area (AC)	Tc (min)	CN	Peak Flow (CFS)	CN	Tc (min)	Peak Inflow (CFS)	Peak Outflow (CFS)
A	0.35	31.1	89	0.57	90	5.0	1.26	1.08
B	0.43	31.1	89	0.68	90	5.0	1.51	1.45
C	1.23	31.1	89	1.98	89	31.1	1.98	0.75
Discharge Point	2.01			**3.07**			2.50	**2.50**

The predeveloped table summarizes the stormwater performance of the post-developed ponds, predeveloped ponds, and associated discharge structures for the 25-year, 24-hour storm event.

Pond A receives inflow from Basin A (north side of the parking lot, ~0.803 acres) and from Pond c, which collects Basin C (offsite drainage from the undeveloped area north of the site). Pond A discharges through a 24" catch basin (CB1) into a 12" stormwater network.

Pond B receives and treats runoff from Basin B (south side of the parking lot). Treated flow from Pond B is discharged through Catch Basin 2 (CB2), which also receives flow from Pond A via CB1, providing combined outflow control for the site.

The stormwater calculations are provided at the end of this report. The outflow from network is less than the existing pre-development swale outflow, demonstrating that the system meets the City's stormwater requirements.

A minor flow loss of approximately 0.03 cfs occurs between Pond A and Catch Basin 2 due to friction losses within the connecting pipe network.

Treatment Calculations

In general, more treatment volume is provided in the design than is required for the improvements as shown in the table below. The treatment design calculations for the required first ½ inch of runoff from new impervious surface areas created by the project as the proposed system uses volume treatment.

The treatment volumes were found using the following calculations:

- **Treatment Volume** was calculated with the following equation:

$$(V_{treatment}\ cf) = (A_{impervious}\ sf) \times \left[\left(\frac{1}{2} in \text{ of runoff}\right) \times \left(\frac{1ft}{12in}\right)\right]$$

- **Infiltration Disposal Rate** was calculated with the following equation:

$$(Q_{infiltrate}\ CFS) = (A_{treatment}\ sf) \times (f_s\ \frac{in}{hr}) \times \left(\frac{1\ ft}{12\ in}\right) \times \left(\frac{1\ hr}{360\ sec}\right)$$

where f_s is the Infiltration Rate assumed or proposed for a given soil and sand (~2 in/hr).

- **Manning's Equations**:

$$Q = VA \qquad V = \frac{k}{n}\left(\frac{A}{P}\right)^{2/3} S^{1/2}$$

Where:

k is a unit conversion factor:
k=1.49 for English units (feet and seconds).
k=1.0 for SI units (meters and seconds).
A = Flow area of the pipe, culvert, or channel.
P = Wetted perimeter (the portion of the circumference that is in contact with water).
Q = Discharge (flow rate).
S = Downward (longitudinal) slope of the culvert, pipe, or channel.
V = Average velocity in the pipe, culvert, or channel.

- **Conveyance Method**:
  By substitution the Manning and simplification (Lingedburg, 1992), these equations can be written as:

$$k = \frac{Q}{S^{1/2}}$$

Table 2: Stormwater Treatment Summary

Treatment Stormwater Summary			
Basin	**Impervious Area (sf)**	**Required Volume (CF)**	**Proposed Volume (CF)**
Basin A	6,872	286	735
Basin B	7,315	305	513
Totals	**14,187**	**591**	**1248**

Stormwater Facility Construction and Maintenance

Constructions considerations

BMP 18: Bioretention Basin

Landscaped areas that are generally flat and combine grasses, vegetation, and soils remove storm water pollutants through filtration, soil sorption, and plant uptake. They require little or no maintenance (unless obvious failure occurs) but are more expensive to construct. Storm water flows greater than the design flow overflow to the natural drainage channels or facilities shown on the plans. This takes advantage of existing natural surface depressions. Bioinfiltration is suitable on soils with infiltration rates of 0.5 to 2.4 inches/hour. Higher soil infiltration rates will require additional mitigation to slow transmissivity.

1) Scarify or till native soil at subgrade. If shrubs and trees are to be incorporated and soil amendments are needed place 18-inches of sand at the bottom of the facility.
2) Topsoil should be less than 25% clay, 8-9% organic material, and at least 60% sand 2 ft to 4 ft thick.
3) Place a 3-inch layer of mulch over the topsoil and till to 8-inch depth to line the facility before planting.

4) A mixture of trees, shrubs, and grass is preferred.
5) Water-loving plantings should be chosen (Alder, Willow, Ash, Dogwood, Sedges, etc.) or ponding depth should be limited to 6 inches.
6) Grass or sod may be used but should be a species adapted to permeable soils. Avoid grass intended for clay soils or sod grown on clay.
7) If a grass species for mowing is chosen, grass height should be kept at 3 inches to 9 inches and all grass clippings removed.
8) Infiltration rates should not exceed 9 inches per hour. Undesirable ponding may occur on some native soils and soil amendments or underdrains may be required.

BMP 31: Topsoiling

Topsoiling places material suitable for vegetative growth over disturbed lands (2:1 slopes or less) and in areas not planned for landscaping and may include native seeds and propagules in the plant growth mix. Soils from off site may be imported but reusing the existing topsoil that has been stripped and stockpiled during earlier site development activities is preferred.

Topsoiling adds biofiltration capacity; increases storm water retention and, through a more established root zone, results in less watering, fertilizing, and pesticide applications.

1) Protect topsoil stockpiles from erosion (BMP 44).
2) Topsoil should not be applied over a subsoil of contrasting permeability or when subsoil is frozen or saturated.
3) Topsoil that has been stockpiled should be amended prior to placement.
4) Place topsoil at a compacted depth of 4 inches on slopes 3:1 or steeper. Place 8 inches or deeper on flatter slopes.
5) Topsoil placed should be free of debris, sticks, large roots, weeds, and stones larger than 1.5 inches.
6) Before placing, it is recommended to have a lab sample the topsoil. A pH of 6.0 – 7.5 is recommended and an organic content of not less than 1.5% by weight. Apply lime or gypsum to raise pH and loosen high clay content soils. Do not use soils with soluble salt content over 500 ppm.
7) For topsoil pH 6.0 or below, consider landscaping with woody species instead of grasses.
8) Scarify the subgrade 4-inches deep prior to placement. On slopes, track a bulldozer vertically over the slope to create slots for bonding of subgrade to topsoil.
9) Stabilize topsoil with landscaping (BMP 32), mulching (BMP 52), matting (BMP 54) or using soil binders (BMP 55).

BMP 32: Landscaping

Establish vegetative cover over all disturbed areas by following the landscaping plans. Methods include seeding, sodding, planting perennial grasses, legumes, native shrubs, wild flowers, bushes, and trees. Native vegetation is strongly encouraged for all landscaping efforts. See Bonner County Title 12; Appendix B: Native Plant List for additional information and guidance.

Maintenance Requirements
Before landscape and stormwater facility sites are fully constructed and established, inspect topsoil periodically and after major storm events for signs of erosion (rills or gullies).

Repair damaged areas with additional topsoil, add additional erosion control measures, and reseed as needed.

After construction, monitor soil stability and vegetation. Adjust the soil with amendments, enhancements, microbial inoculants, irrigation, fertilizers, pesticides, and herbicides as needed. Replanting may be required during the first 2 years.

If non-native plants are used in the final landscape plantings, carefully monitor turn, shrubs, and perennial plantings. Add irrigation to water throughout the lifecycle of non-native species not accustomed to drought.

Native species require less maintenance, minimal watering after establishment, and need little or no chemical fertilizers or pesticides.

Grow plantings into dense groupings to reduce or eliminate unwanted weeds and invasive species. Mulch landscape areas with clean straw, bark chips, or wood shavings to preserve soils moisture and block weeds. Cut weeds or use herbicides to prevent damage to landscape plantings from pulling.

Inspect facilities monthly and after large storm events for the first two years. Clear outlets and pipes of sediment and debris. Once the facilities are functioning as designed and no sediment problems exist, reduce inspections to semiannually and after large storm events. Check for functional inlets, erosion, vegetation health, ponding, debris, and general conformance with the design.

Sediment should be removed after construction and before planting. Prevent pre-silting of facilities during construction by practicing good erosion control measures. Avoid over-compacting soils during construction. Remove sediment from landscape areas in early spring if it begins to inhibit the growth of grass. Avoid over irrigation (don't saturate the soils).

Erosion and Sediment Control BMP's

To properly construct this project, 0.78 acre of the site will be disturbed, including:

- Tree and brush removal
- Stripping and stockpiling of topsoil
- Driveway grading
- Fine grading of landscape and stormwater facilities
- Landscaping and planting

All disturbed exposed areas will be covered with suitable topsoil, mulched, and either landscaped or re-vegetated on slopes 2:1 or less. Slopes steeper than 2:1 will be stabilized with stone mulch, riprap or boulders.

Temporary Erosion and Sediment Controls

All temporary erosion control features shall be installed and maintained as detailed and shall prevent stormwater runoff or sediment migration off-site. Barriers shall be placed perpendicular to the direction of flow and shall be deployed before construction begins. Leave all temporary stormwater and erosion control measures in place until vegetation has been re-established. Construct fiber rolls as shown on plans or where overland flow may allow runoff to leave the construction site or enter the neighboring properties. Mulching

of disturbed, final graded areas can be done with hay, straw, or grass clippings (8-10 pounds per 100 sf).

BMP 36: Constructing Timing

Construction activities for this site grading can proceed as follows:

Construction Schedule	Timing
Install Temporary Erosion Controls	Sep-25
Excavation and grading	Sep-25
Rough grade landscape areas and bioswales	Oct-25
Stormwater Sewer Construction	Oct-25
Parking Lot Construction	Oct-25
Utility Construction- Light etc.	Nov-25
Finish grade landscape areas	Nov-25
Reseed slopes and distrubed areas	Nov-25

Constructing in the dry season, the risk of sediment laden runoff is minimized and the sequence of construction will occur during optimal conditions. The Owner and Contractor shall continually monitor the site conditions and progress of the work, keeping erosion control measures in good repair.

BMP 37: Staging Areas

Construction staging areas are feasible along the east side of the property which would be the desired location to ensure the existing stormwater facility on the west side of the property is not damaged. As construction progresses, the south/north ends of the parking lot/driveway would be a desired location for staging equipment/materials.

BMP 38: Preserve Topsoil and Vegetation

Construction fencing (orange or green) should be placed around areas of topsoil or natural areas to remain undisturbed to minimize bare soil exposure. Grading activity areas shall be limited to those shown on the Plan. Keep all construction equipment, materials, and waste within the areas designated on the Plan and out of areas to be preserved.

BMP 39: Clearing Limits

Minimize the total area of bare soil exposed to 1 acre and cover with straw or stone mulch within 14 days of disturbance. Mulch slopes and cover exposed driveway surfaces with rock as grading progresses to reduce dust and erosion potential. Do not disturb areas outside of the grading limits established by the Plan. At the end of construction, prepare all slopes and landscape areas for seeding or include seed in the erosion control mulch used.

BMP 40: Vehicle Sediment Control

A pad of coarse aggregate or a construction mat should be installed at the entry/exit of the project. If tracking onto the existing pavement is a problem, additional measures such as rattle plates, a wheel wash, or rumble strips should be included.

BMP 41: Stabilize Construction Roads and Staging Areas

A pad of coarse aggregate should be laid for staging areas if not already graveled or otherwise impervious.

BMP 42: Erosion Prevention on Construction Roads

Prevent erosion on the access road with waterbars, road sloping, or rolling dips to direct stormwater away from the road surface.

BMP 43: Dust Control

Control dust and wind erosion by roughening the disturbed surface areas to reduce with velocity. Seed, sod, mulch, roughen surface, use sprinklers, or us soil binders on disturbed areas to be stabilized. For construction roadways, stabilize (BMP 41), sprinkle, or use chemical tackifiers to eliminate dust. Do not overwater roadways, creating erosion. Additional dust control measures to consider:

- Minimize disturbed surface area by limiting the amount of bare soil exposed at one time.
- Limit work on exposed soils on windy days.
- Clean up dusty spills immediately and plan ahead to limit dust.
- Establish vegetation on disturbed areas already graded.
- Consider using wind barriers (berms, silt fence, or similar)
- Roughen surface using tilling, disking, furrows across prevailing wind, rip or scarify to an irregular surface (BMP 58).
- Water or sweep often.
- Spray-on chemical soil treatments (palliatives), including mineral salts, petroleum resins, asphalt emulsion, acrylics, and adhesives.
- Reduce speed limits on unpaved surfaces (never exceed 25 mph).
- Prevent transport of dusty materials uncovered.
- Enclose storage and handling areas in storage silos, three-sided bunkers, or open-ended buildings. Wind fencing may be used in temporary situations. Use of water or foam spay bars may also be used to reduce emissions.
- Keep dusty storage piles covered.

BMP 44: Stockpile Management

Cover stockpiles of erodible materials, particularly topsoil, sawdust, landscaping bark, compost, mulch, sand, fly ash, stucco, hydrated lime or gypsum, aggregates, cold mix asphalt, pressure treated wood, or sediments. Use plastic sheeting, pervious fabrics, or tarps and weight or stake down to prevent wind removal. Tie-down ropes, large rocks, tires, or other heavy objects may also be used. For long-term stockpiling, mulch, vegetation, or soil binders should be considered.

Additional erosion control measures around the stockpile may be required to reduce storm water runoff damage from the impervious surface of the stockpile. Use a sediment control barrier around the stockpile perimeter such as berms (BMP 70), dikes (BMP 69), fiber rolls (BMP 64), silt fences (BMP 65), or biofilter bags (BMP 63).

Locate stockpile 50 feet from storm water flows, drainages, inlets, outlets, lakes, or wetlands. Avoid placing in streets or paved areas if possible.

BMP 52: Mulching

Apply straw, grass, grass hay, compost, wood chips, or wood fibers onto exposed soils leaving no more than 1 acre exposed for no more than 14 days. Driveway graded surfaces should be mulched or covered by aggregate as soon as practical to prevent erosion and reduce dust. Slopes steeper than 2:1 may require netting or tacking agents to hold mulch in place.

If wood chips or fibers are used, especially if obtained by chipping trees or stumps on the site, limit use to slopes under 6%. If vegetation is desired, treat chipped areas with a nitrogen fertilizer to aid plant germination and growth – otherwise wood chips tent to reduce growth of undesirable plants.

Use wood or stone mulches in areas that are not desirable to mowed or maintain. Bark chips in particular should not be used on sloped areas as they tend to be carried away by spring runoff.

Gravel or crushed rock placed as mulch should be placed at 10 tons / 0.10 acre (4,400 sf) at a depth of 3 inches (average). Use where subject to traffic or on slopes where maintenance of vegetation is not desired.

Hay or straw mulch should be free of unwanted seeds and applied at 2 or 3 bales per 1,100 sf of exposed soil at a depth of 2 to 3 inches in a uniform mat. No more than 40% of the original ground or exposed soils should be visible through the mat. Netting or tacking agents may be needed on slopes exposed to wind or steeper than 2:1.

Wood fiber mulches should be used where plant growth is to be inhibited, particularly on slopes steeper than 3:1 where mowing or maintenance of vegetation is not desired. If used in areas where growth is to be encouraged, nitrogen treatment will be needed. Apply to an average depth of 3 inches or about 25 lbs per 1,000 sf.

Compost used as mulching should be applied to the Grassed Infiltration Area and any other areas where growth (grasses) is desired. Apply compost at a depth of 3 inches over areas where seeding is to be done.

Inspect all mulched areas weekly and repair any damaged or exposed soils immediately. Mulching should cease once vegetation is re-established.

BMP 64: Fiber Rolls

A Fiber Roll (wattle/compost-filled socks) consists of straw, flax, or other similar materials bound into a biodegradable tubular plastic or similar encasing material. Fibers rolls should be placed along a contour unless otherwise shown in plans. For slope inclinations 2:1 or greater, fiber rolls should be placed a maximum interval of 10 ft. When placing, turn the ends of the fiber roll up slope to prevent runoff from going around the roll. If more than one wattle is placed in a row, the rolls shall be overlapped a minimum of 12 inches. Maintain rolls daily during extended rain events, after rain events, and two-week intervals during dry season. Sediment shall be removed when sediment accumulation reaches one-half of the exposed height of the roll.

BMP 70 Temporary Berms

A berm or ridge of compacted soil, compost, or sandbags which is created to intercept and divert runoff from small construction areas. They are often constructed along the top edge

of a fill slope but may also be constructed along a roadway, across a roadway (a transverse berm) at an angle with the centerline.

Temporary berms are used to direct or divert runoff flow from newly constructed slopes until vegetation is established or other permanent measures are in place. They intercept the stormwater flow from the construction area and direct it to temporary slopes drains or protected outlets for safe discharge. They can also be used as barriers to collect and store runoff. They can be used at storm drain inlets, across minor ditches or swales, or other areas where the structure is temporary.

Soil berms have an approximate height of 12 to 20 inches with a minimum top width of 2 to 3 feet and side slopes of 2:1 or flatter. Berms should be high enough to prevent flow from overtopping and are normally constructed of embankment materials. Grade to drain to a slope or drain inlet. Compact the entire width of the berm with a bulldozer or loader/grader wheels.

Compost berms act as filter berms and are most effective when constructed 1 foot high by 2 feet wide or 1.5 feet high and 3 feet wide. Construct with 25-100% organic matter with particles not to exceed 3-inches thick or 6-inches long. Particle gradation should also be 90-100% passing a 1-in. filter, 70-100% passing the ¾ inch filter, and 30%-75% passing the ¼ inch filter.

Sandbag berms have the following dimensions

- Height: 20 in. minimum
- Top Width: 20 in. minimum
- Bottom Width: 4-1/4 to 5 feet
- Sandbag size – length 2 -2.6 ft, width 16-20 in., depth or thickness 6-8 inches. and weight 88 to 132 lbs.

Install so that flow between bags is prevented. Stack bags in an interlocking fashion but no more than 3 bags high without widening the base. Can be used to impound the volume of the design storm.

BMP 74: Inlet Protection

Inlet Filters that are placed inside catch basins or storm inlets. The inlet filtration/protection system is comprised of a corrosion resistant frame and a replaceable geotextile sediment bag attached to the frame with a stainless-steel locking band. The sediment bag hangs suspended from the rigid frame at a distance below the grate that shall allow full water flow into the drainage structure if the bag is completely filled with sediment. They are used to protect catch basins and storm systems against sedimentation, oils, debris and require certain considerations and light maintenance (see below).

1) Clean the ledge (lip) of the casting frame or drainage structure to ensure it is free of stone and dirt.
2) Drop in the Inlet Filter through the clear opening and be sure the suspension hangers rest firmly on the inside ledge (lip) of the casting.
3) Replace the grate and confirm it is elevated no more than 1/8", which is the thickness of the steel hangers.

4) To replace, engage the lifting bars or handles with the removal tool, and lift from the drainage structure.
5) Empty the sediment bag if more than half filled with sediment and debris, or as directed by the Engineer or Maintenance Contract in accordance with EPA guidelines. As an alternative, an industrial vacuum may be used to collect the accumulated sediment.
6) Remove any caked-on silt from the sediment bag and reverse flush the bag with medium spray for optimal filtration.
7) Replace the bag if torn or punctured to ½" diameter or greater on the lower half of the bag.
8) The skimmers start yellow in color and will gradually turn brown as they become saturated, indicating time for replacement. Dispose of all oil contaminated products in accordance with EPA guidelines.

Permanent Erosion Controls

After construction is complete, all exposed soils shall be covered by a minimum of 3-inches topsoil or mulch. Areas to be vegetated will be seeded, planted, or landscaped. Slopes in excess of 2:1 shall be armored with rip-rap or covered with topsoil, seeding, mulch, and matt.

Seeding and mulching shall not be applied to areas of standing water. Mulch shall be applied at a rate of 8-10 pounds per 100 square feet (2" – 3" thick when loose) with a maximum of 20% of original ground noticeable. Slopes in excess of 3:1 which are not rip-rapped shall be covered with Jute matting or hydro-seeded for stability of seed bed.

Plant List

Refer to Bonner County Code Title 12, Appendix B - North Idaho Native and Beneficial Plant List.

Operation and Maintenance Plan

Temporary and Permanent Erosion and Stormwater control measures will be the responsibility of the Owner:

Inspection Schedule & Maintenance Activities

As described above, both temporary and permanent erosion and sediment control measures should be inspected by the Owner and/or Contractor. Below is an inspection schedule table for convenience.

Stormwater Feature or Erosion Control Measure	Inspection Frequency	Maintenance Activities
Mulching	Weekly & following major rain event	Mulch exposed soil
Fiber Rolls or Compost Berms	Weekly & following major rain event	Repair and remove sediment
Treatment and Detention Facilities	Monthly the first year and bi-annually thereafter	Repair rivulets and damaged flow spreaders

In conclusion, I find that the proposed permanent improvements if properly constructed and maintained as described herein and shown on the plans, will treat and detain the additional runoff to be generated with the future construction on this property.

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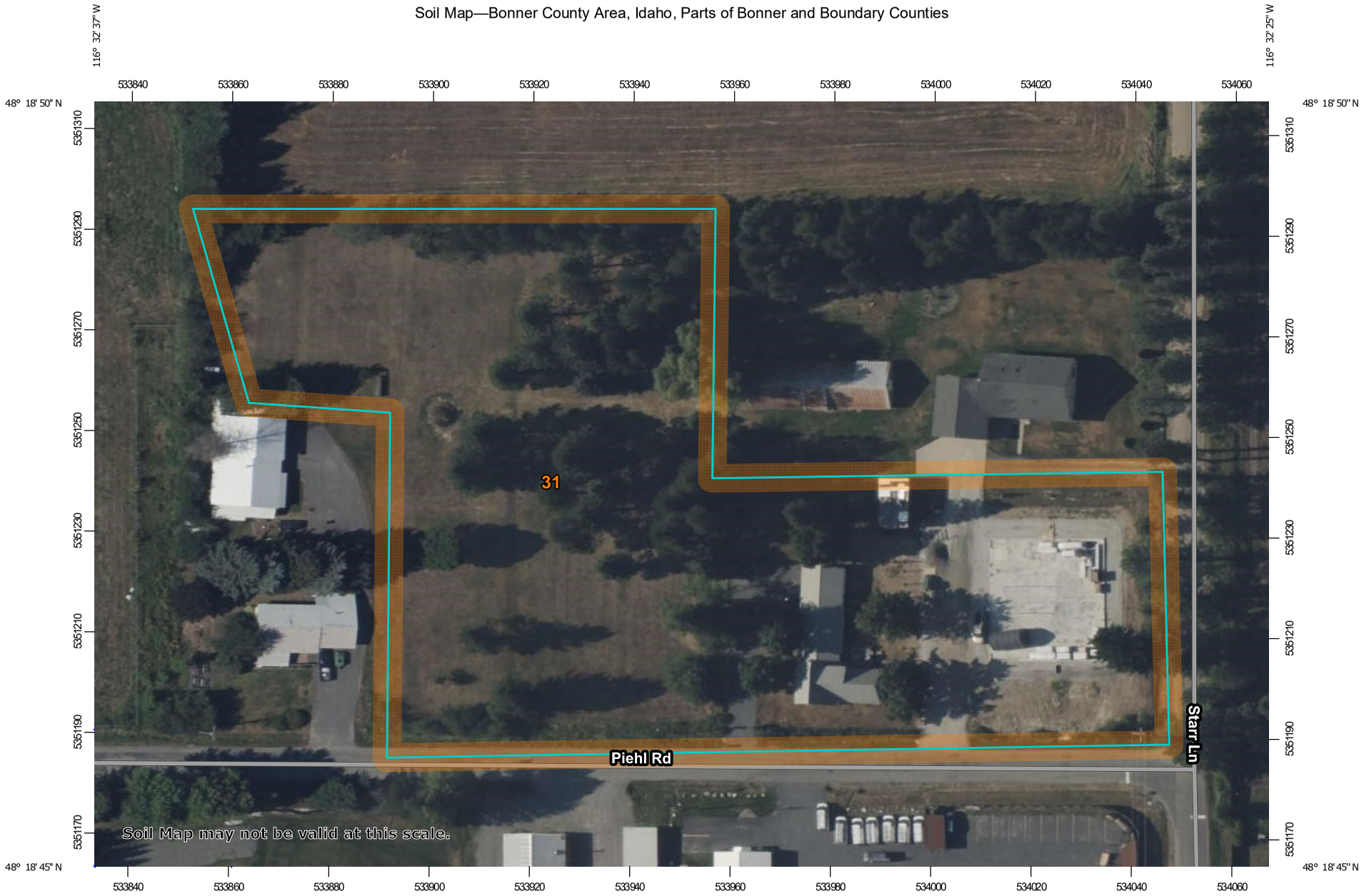


Map Scale: 1:1,070 if printed on A landscape (11" x 8.5") sheet.

N

Meters
0 15 30 60 90

Feet
0 50 100 200 300

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 11N 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 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

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: Bonner County Area, Idaho, Parts of Bonner and Boundary Counties
Survey Area Data: Version 20, Aug 22, 2024

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

Date(s) aerial images were photographed: Jul 14, 2023—Aug 13, 2023

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
31	Mission silt loam, 0 to 2 percent slopes	3.3	100.0%
Totals for Area of Interest		**3.3**	**100.0%**

Bonner County Area, Idaho, Parts of Bonner and Boundary Counties

34—Odenson silt loam, 0 to 2 percent slopes

Map Unit Setting

National map unit symbol: 5465
Elevation: 2,000 to 3,000 feet
Mean annual precipitation: 25 to 38 inches
Mean annual air temperature: 43 to 46 degrees F
Frost-free period: 80 to 120 days
Farmland classification: Prime farmland if drained

Map Unit Composition

Odenson and similar soils: 70 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Odenson

Setting

Landform: Terraces
Landform position (three-dimensional): Tread
Down-slope shape: Concave
Across-slope shape: Linear
Parent material: Volcanic ash and loess over silty glaciolacustrine deposits

Typical profile

A - 0 to 9 inches: silt loam
2Bg - 9 to 18 inches: silty clay loam
2Bgk - 18 to 35 inches: silty clay loam
3Cg - 35 to 46 inches: silt loam
4Cgk - 46 to 57 inches: silty clay
5Cg - 57 to 60 inches: very fine sandy loam
6Cgk - 60 to 62 inches: silty clay
7Cg - 62 to 65 inches: silt loam

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.57 in/hr)
Depth to water table: About 6 to 24 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 5 percent
Available water supply, 0 to 60 inches: High (about 11.0 inches)

Interpretive groups

Land capability classification (irrigated): 6e
Land capability classification (nonirrigated): 5w
Hydrologic Soil Group: B/D
Ecological site: R043AY512ID - Warm-Frigid Aquic-Udic Loamy Flood Plains (Wet) (DECA/CAREX)
Hydric soil rating: Yes

Minor Components

Pywell

Percent of map unit: 5 percent
Landform: Basin floors
Hydric soil rating: Yes

Wrencoe

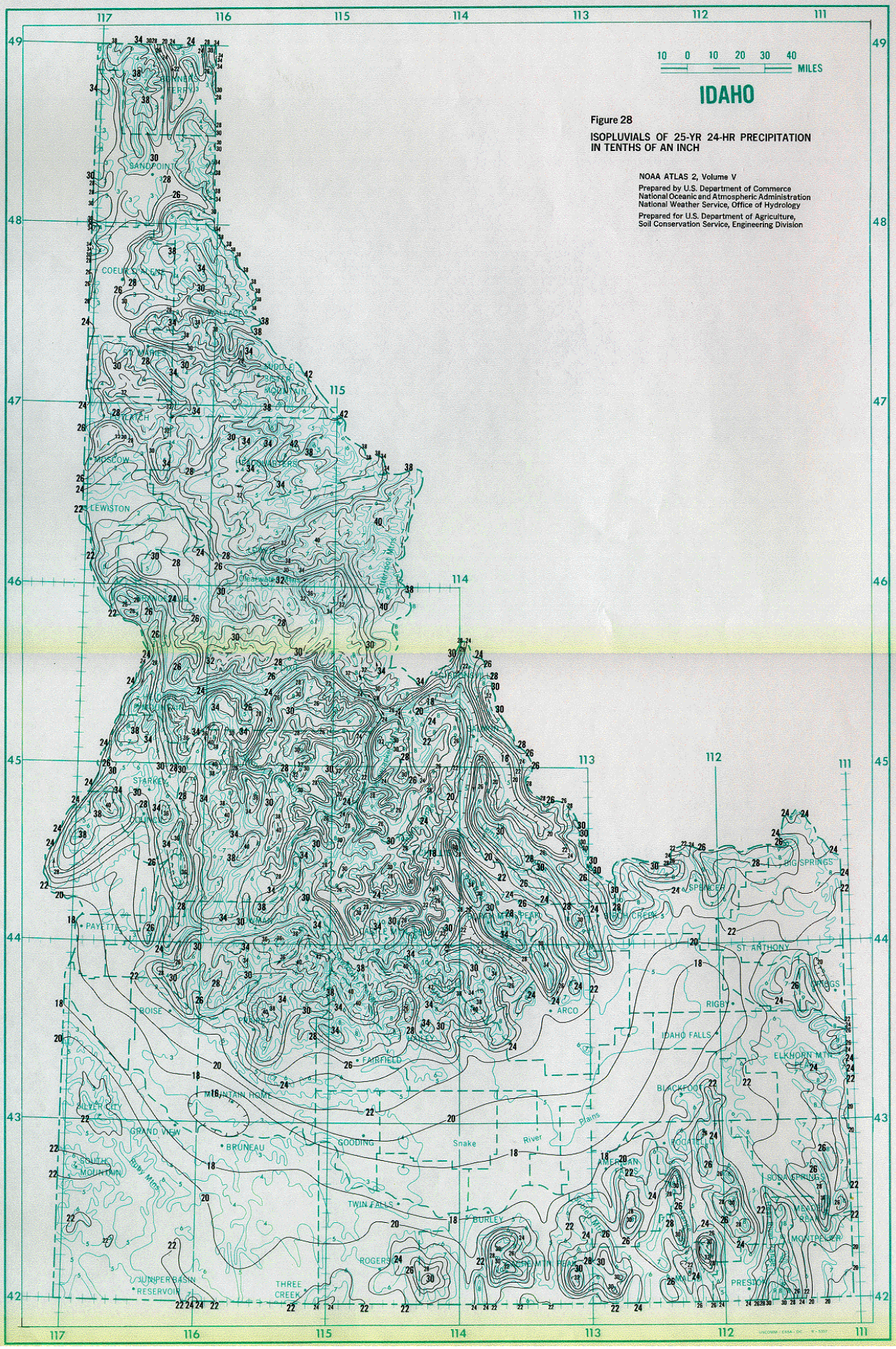
Percent of map unit: 5 percent
Landform: Depressions
Ecological site: R043AY512ID - Warm-Frigid Aquic-Udic Loamy Flood Plains (Wet) (DECA/CAREX)
Hydric soil rating: Yes

Hoodoo

Percent of map unit: 5 percent
Landform: Depressions
Hydric soil rating: Yes

Data Source Information

Soil Survey Area: Bonner County Area, Idaho, Parts of Bonner and Boundary Counties
Survey Area Data: Version 20, Aug 22, 2024


10 0 10 20 30 40
MILES
IDAHO
Figure 28
ISOPLUVIALS OF 25-YR 24-HR PRECIPITATION IN TENTHS OF AN INCH
NOAA ATLAS 2, Volume V
Prepared by U.S. Department of Commerce
National Oceanic and Atmospheric Administration
National Weather Service, Office of Hydrology
Prepared for U.S. Department of Agriculture,
Soil Conservation Service, Engineering Division
SANDPOINT
COEUR D'ALENE
MOSCOW
LEWISTON
PAYETTE
BOISE
MOUNTAIN HOME
GRAND VIEW
BRUNEAU
SOUTH MOUNTAIN
JUNIPER BASIN RESERVOIR
THREE CREEK
TWIN FALLS
BURLEY
ROGERS
GOODING
FAIRFIELD
ARCO
IDAHO FALLS
RIGBY
ST. ANTHONY
BLACKFOOT
POCATELLO
AMERICAN FALLS
SODA SPRINGS
MONTPELIER
PRESTON
BIG SPRINGS
SPENCER
Snake River Plains
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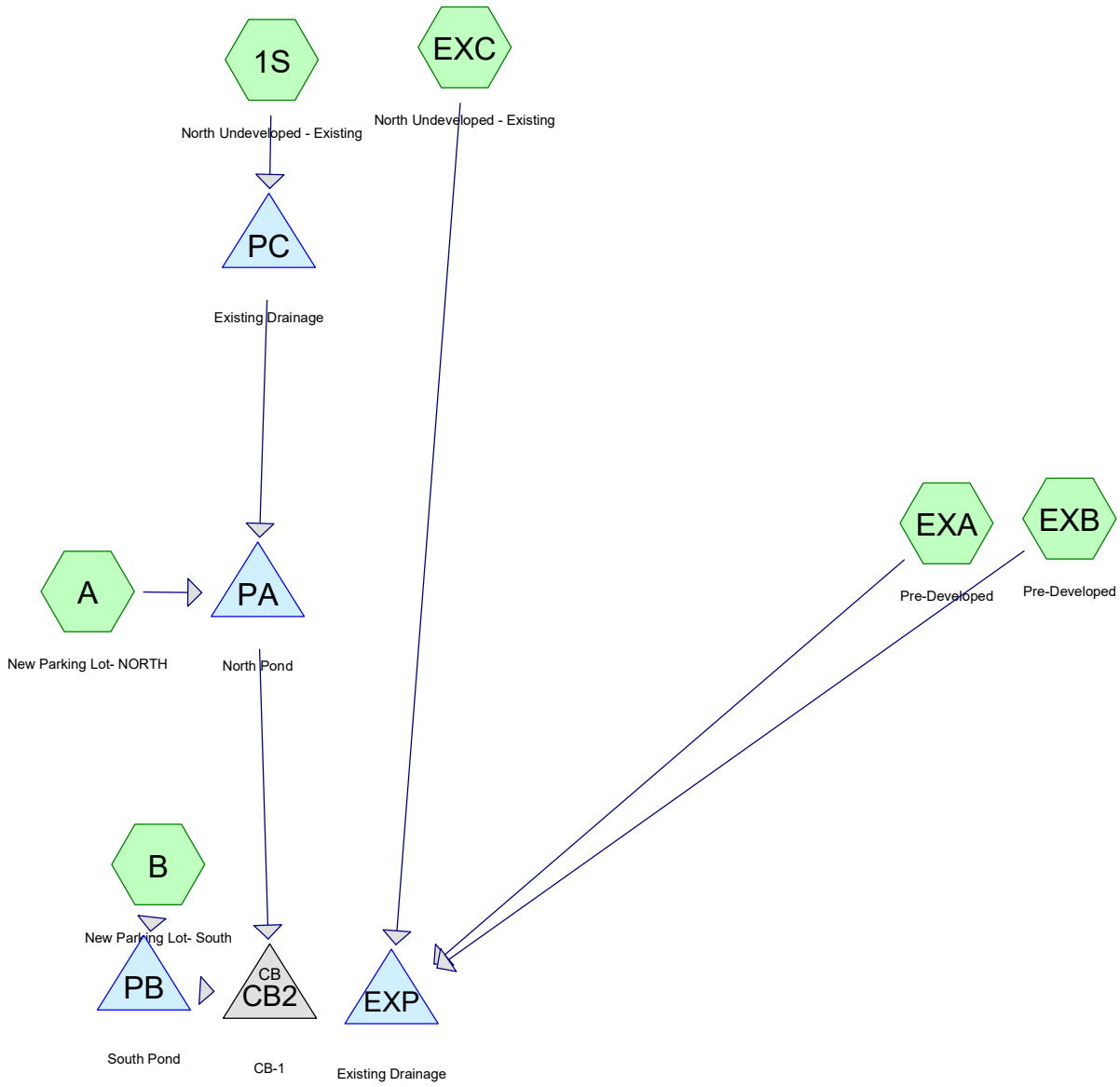


Routing Diagram for Hydrocad IN_OUT

Prepared by {enter your company name here}, Printed 8/20/2025

Project Notes

Rainfall events imported from "Developed example.hcp"

Rainfall Events Listing (selected events)

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	25-YR, 24-HR	Type II 24-hr		Default	24.00	1	3.00	2
2	50-YR, 24-HR	Type II 24-hr		Default	24.00	1	3.40	2

Area Listing (selected nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.453	84	50-75% Grass cover, Fair, HSG D (A, B)
3.239	89	Pasture/grassland/range, Poor, HSG D (1S, EXA, EXB, EXC)
0.326	98	Paved parking, HSG D (A, B)
4.017	**89**	**TOTAL AREA**

Soil Listing (selected nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
0.000	HSG C	
4.017	HSG D	1S, A, B, EXA, EXB, EXC
0.000	Other	
4.017		**TOTAL AREA**

Ground Covers (selected nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	0.000	0.000	0.453	0.000	0.453	50-75% Grass cover, Fair	A, B
0.000	0.000	0.000	3.239	0.000	3.239	Pasture/grassland/range, Poor	1S, EXA, EXB, EXC
0.000	0.000	0.000	0.326	0.000	0.326	Paved parking	A, B
0.000	**0.000**	**0.000**	**4.017**	**0.000**	**4.017**	**TOTAL AREA**	

Pipe Listing (selected nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Width (inches)	Diam/Height (inches)	Inside-Fill (inches)
1	CB2	2,128.99	2,128.97	20.0	0.0010	0.018	0.0	12.0	0.0
2	PA	2,129.09	2,128.99	100.0	0.0010	0.012	0.0	12.0	0.0

Time span=1.00-40.00 hrs, dt=0.01 hrs, 3901 points x 3
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1S: North Undeveloped - Runoff Area=53,574 sf 0.00% Impervious Runoff Depth=1.90"
Flow Length=100' Slope=0.0020 '/' Tc=31.1 min CN=89 Runoff=1.98 cfs 0.195 af

Subcatchment A: New Parking Lot- NORTH Runoff Area=15,417 sf 44.57% Impervious Runoff Depth=1.98"
Tc=5.0 min CN=90 Runoff=1.26 cfs 0.059 af

Subcatchment B: New Parking Lot- South Runoff Area=18,510 sf 39.52% Impervious Runoff Depth=1.98"
Tc=5.0 min CN=90 Runoff=1.51 cfs 0.070 af

Subcatchment EXA: Pre-Developed Runoff Area=15,417 sf 0.00% Impervious Runoff Depth=1.90"
Flow Length=100' Slope=0.0020 '/' Tc=31.1 min CN=89 Runoff=0.57 cfs 0.056 af

Subcatchment EXB: Pre-Developed Runoff Area=18,510 sf 0.00% Impervious Runoff Depth=1.90"
Flow Length=100' Slope=0.0020 '/' Tc=31.1 min CN=89 Runoff=0.68 cfs 0.067 af

Subcatchment EXC: North Undeveloped - Runoff Area=53,574 sf 0.00% Impervious Runoff Depth=1.90"
Flow Length=100' Slope=0.0020 '/' Tc=31.1 min CN=89 Runoff=1.98 cfs 0.195 af

Pond CB2: CB-1 Peak Elev=2,130.46' Inflow=2.50 cfs 0.210 af
12.0" Round Culvert n=0.018 L=20.0' S=0.0010 '/' Outflow=2.50 cfs 0.210 af

Pond EXP: Existing Drainage Peak Elev=2,130.69' Storage=0.054 af Inflow=3.23 cfs 0.318 af
Outflow=3.07 cfs 0.289 af

Pond PA: North Pond Peak Elev=2,130.79' Storage=946 cf Inflow=1.26 cfs 0.169 af
Outflow=1.08 cfs 0.152 af

Pond PB: South Pond Peak Elev=2,130.74' Storage=596 cf Inflow=1.51 cfs 0.070 af
Outflow=1.45 cfs 0.058 af

Pond PC: Existing Drainage Peak Elev=2,131.26' Storage=0.097 af Inflow=1.98 cfs 0.195 af
Outflow=0.75 cfs 0.111 af

Total Runoff Area = 4.017 ac Runoff Volume = 0.642 af Average Runoff Depth = 1.92"
91.89% Pervious = 3.692 ac 8.11% Impervious = 0.326 ac

Summary for Subcatchment 1S: North Undeveloped - Existing

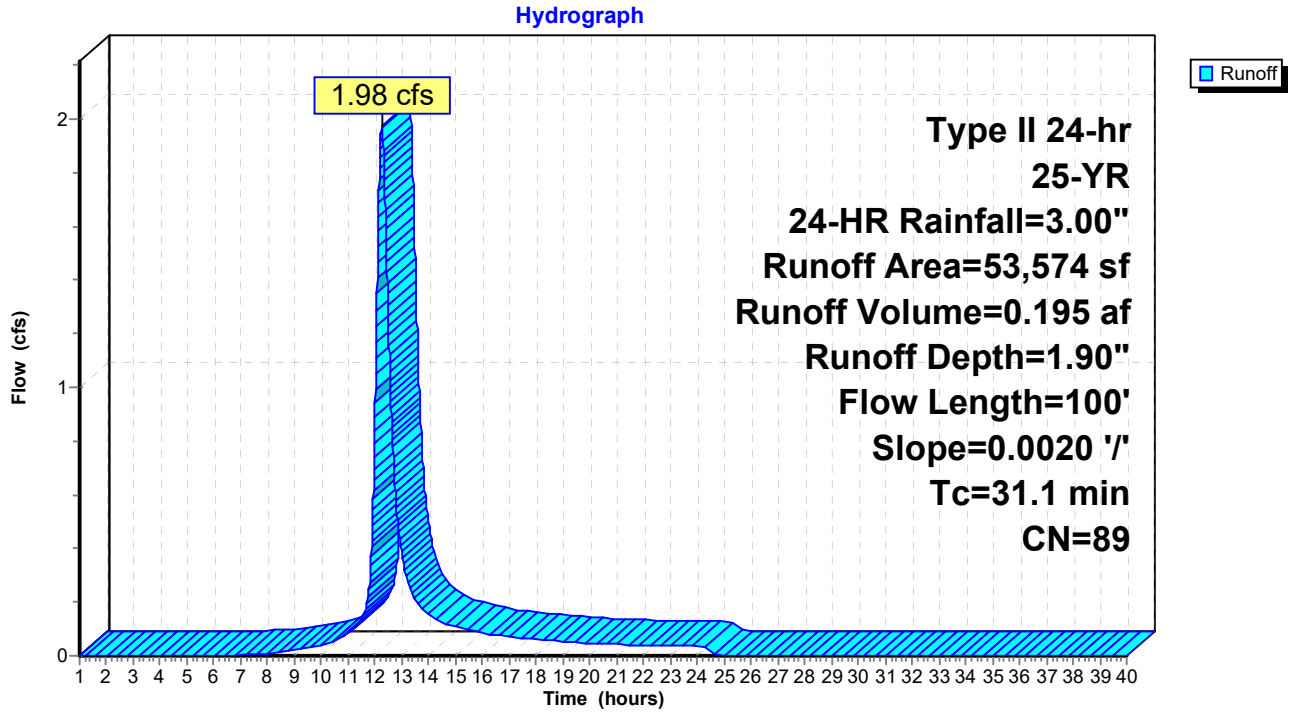
Runoff = 1.98 cfs @ 12.26 hrs, Volume= 0.195 af, Depth= 1.90"
Routed to Pond PC : Existing Drainage

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-40.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-YR, 24-HR Rainfall=3.00"

Area (sf)	CN	Description
53,574	89	Pasture/grassland/range, Poor, HSG D
53,574		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
31.1	100	0.0020	0.05		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.00"

Subcatchment 1S: North Undeveloped - Existing



Summary for Subcatchment A: New Parking Lot- NORTH

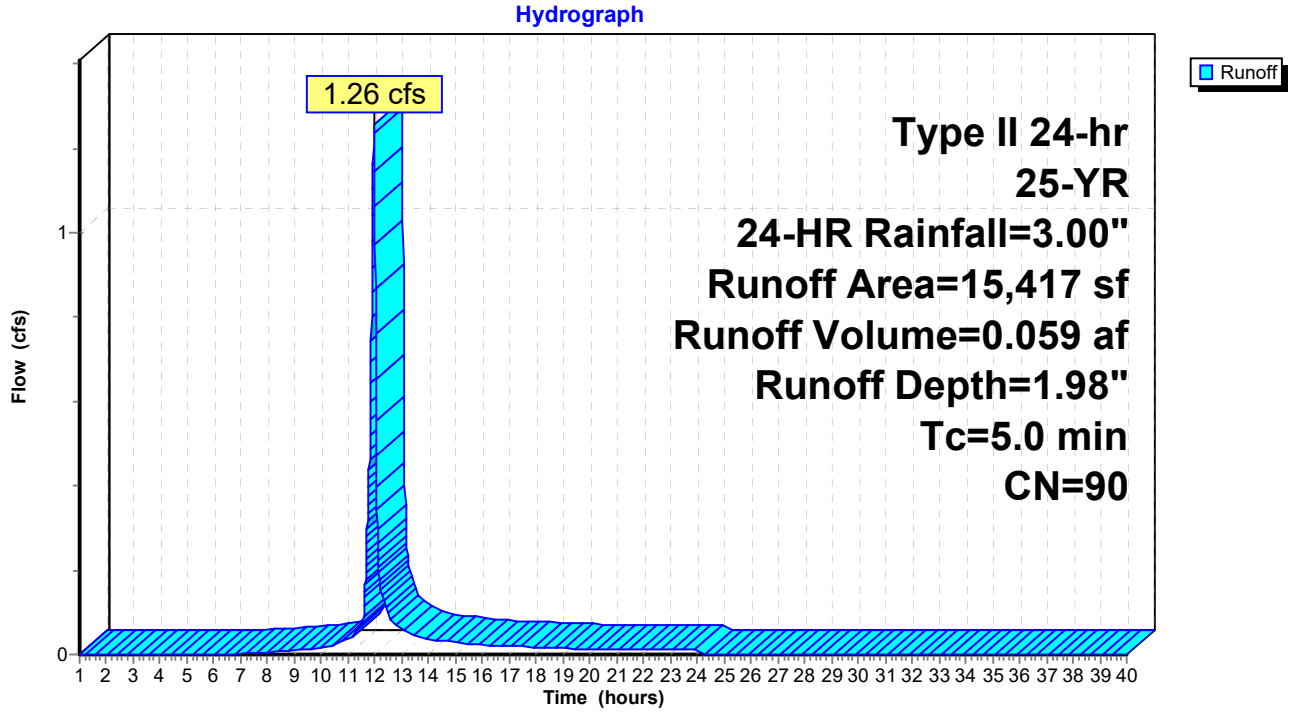
Runoff = 1.26 cfs @ 11.96 hrs, Volume= 0.059 af, Depth= 1.98"
Routed to Pond PA : North Pond

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-40.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-YR, 24-HR Rainfall=3.00"

Area (sf)	CN	Description
6,872	98	Paved parking, HSG D
8,545	84	50-75% Grass cover, Fair, HSG D
15,417	90	Weighted Average
8,545		55.43% Pervious Area
6,872		44.57% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment A: New Parking Lot- NORTH



Summary for Subcatchment B: New Parking Lot- South

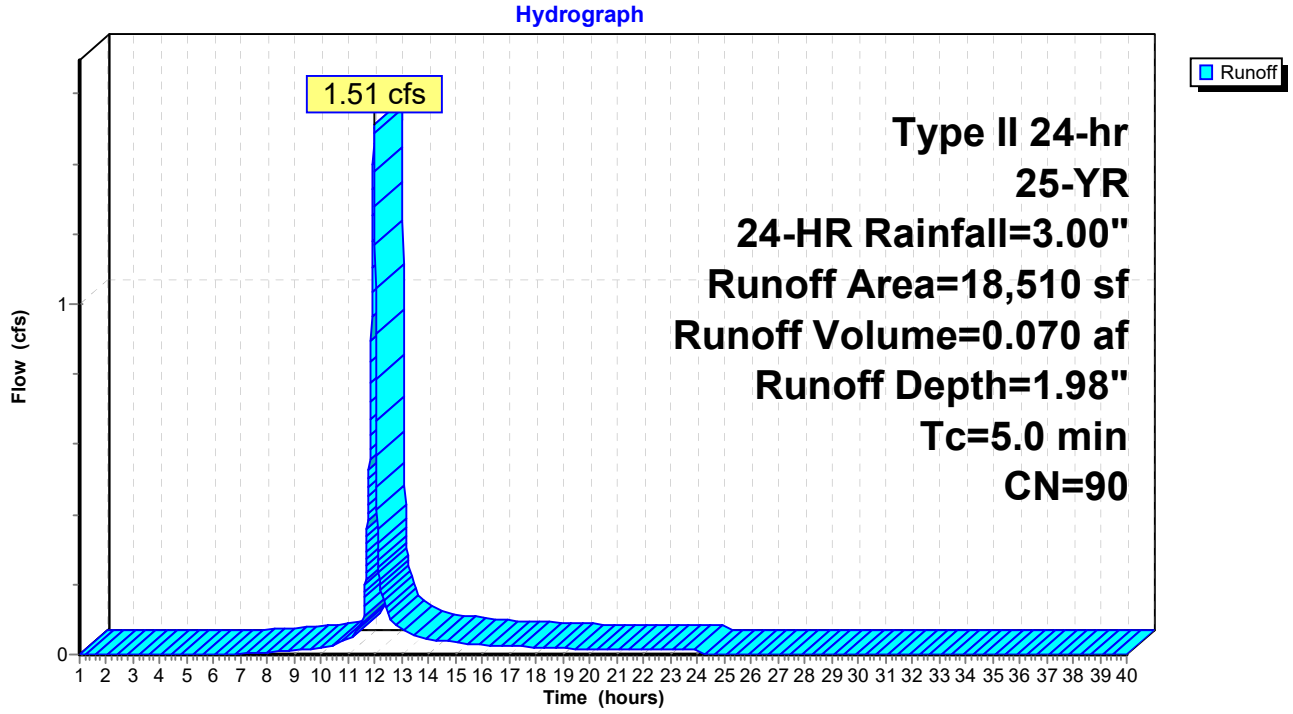
Runoff = 1.51 cfs @ 11.96 hrs, Volume= 0.070 af, Depth= 1.98"
Routed to Pond PB : South Pond

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-40.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-YR, 24-HR Rainfall=3.00"

Area (sf)	CN	Description
7,315	98	Paved parking, HSG D
11,195	84	50-75% Grass cover, Fair, HSG D
18,510	90	Weighted Average
11,195		60.48% Pervious Area
7,315		39.52% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment B: New Parking Lot- South



Summary for Subcatchment EXA: Pre-Developed

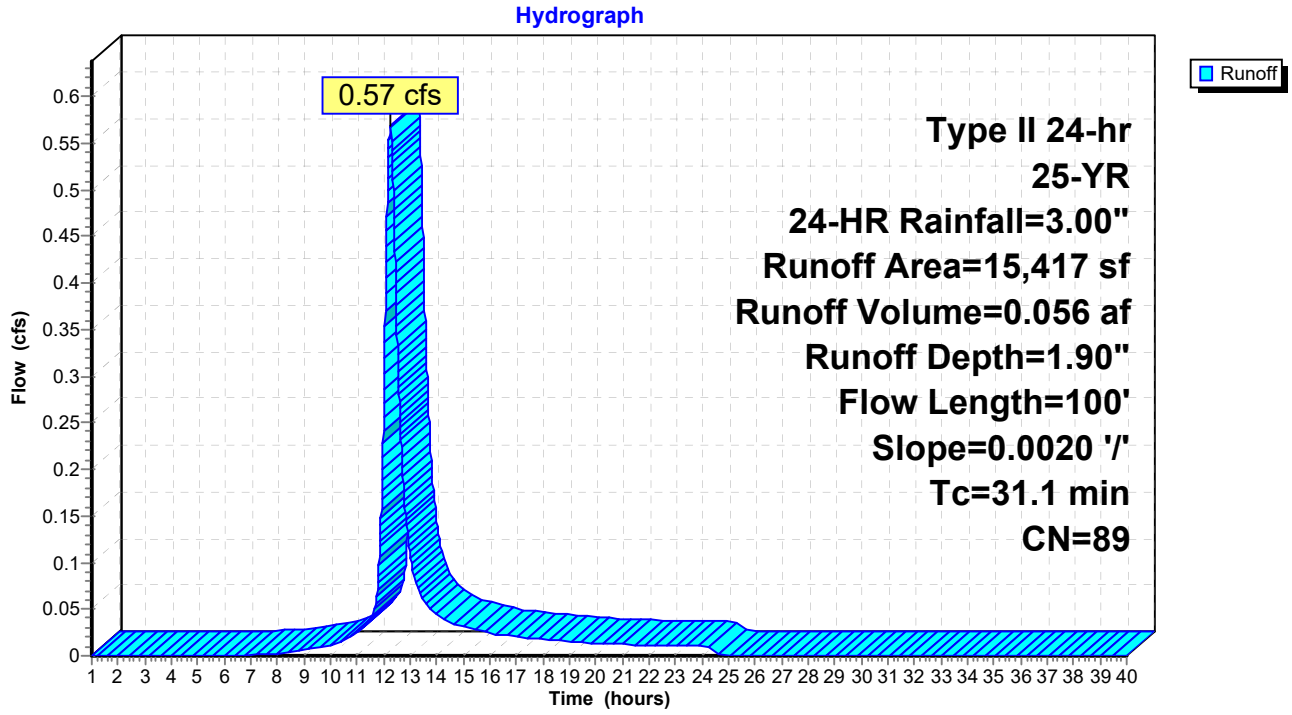
Runoff = 0.57 cfs @ 12.26 hrs, Volume= 0.056 af, Depth= 1.90"
Routed to Pond EXP : Existing Drainage

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-40.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-YR, 24-HR Rainfall=3.00"

Area (sf)	CN	Description
15,417	89	Pasture/grassland/range, Poor, HSG D
15,417		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
31.1	100	0.0020	0.05		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.00"

Subcatchment EXA: Pre-Developed



Summary for Subcatchment EXB: Pre-Developed

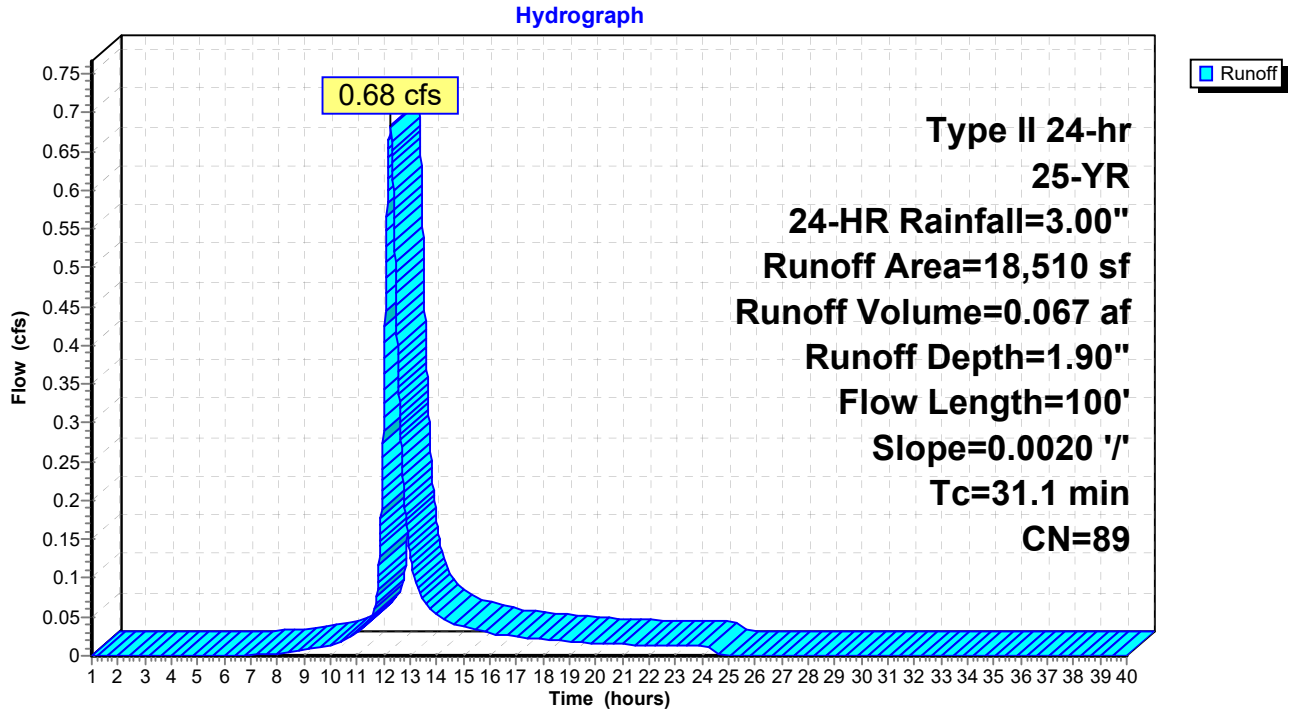
Runoff = 0.68 cfs @ 12.26 hrs, Volume= 0.067 af, Depth= 1.90"
Routed to Pond EXP : Existing Drainage

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-40.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-YR, 24-HR Rainfall=3.00"

Area (sf)	CN	Description
18,510	89	Pasture/grassland/range, Poor, HSG D
18,510		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
31.1	100	0.0020	0.05		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.00"

Subcatchment EXB: Pre-Developed



Summary for Subcatchment EXC: North Undeveloped - Existing

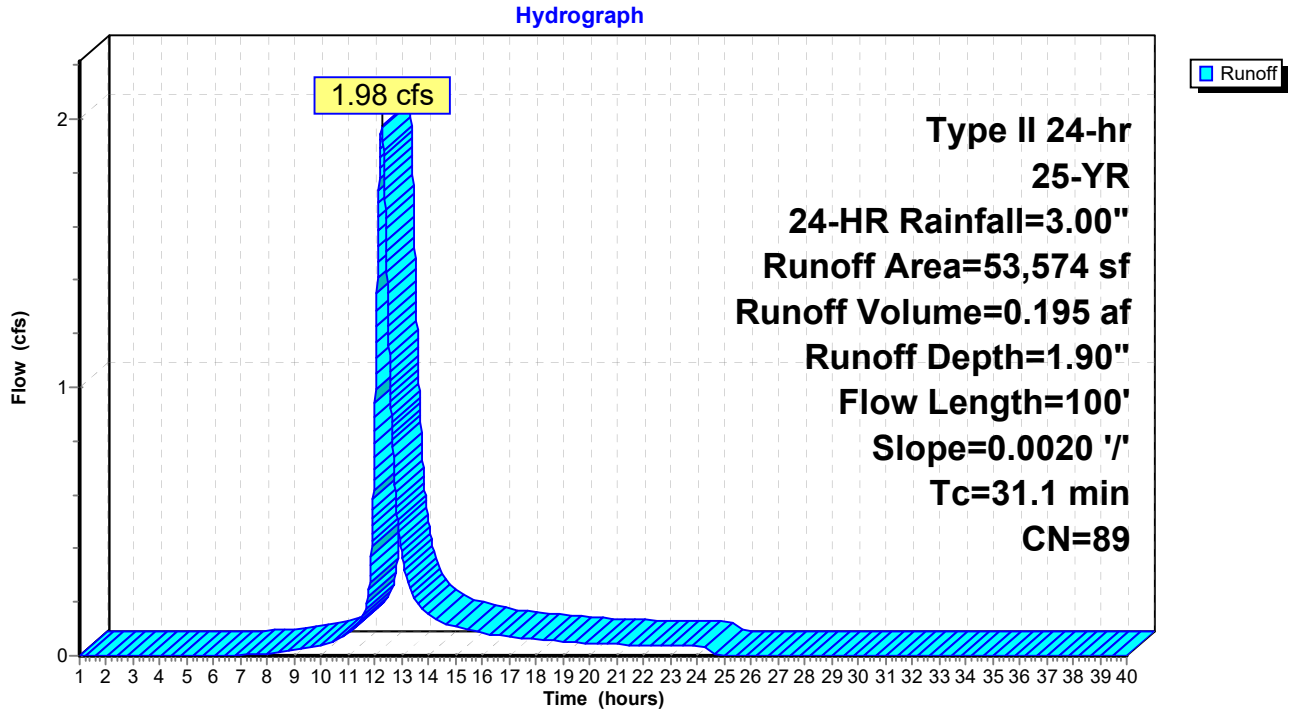
Runoff = 1.98 cfs @ 12.26 hrs, Volume= 0.195 af, Depth= 1.90"
Routed to Pond EXP : Existing Drainage

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-40.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-YR, 24-HR Rainfall=3.00"

Area (sf)	CN	Description
53,574	89	Pasture/grassland/range, Poor, HSG D
53,574		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
31.1	100	0.0020	0.05		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.00"

Subcatchment EXC: North Undeveloped - Existing



Summary for Pond CB2: CB-1

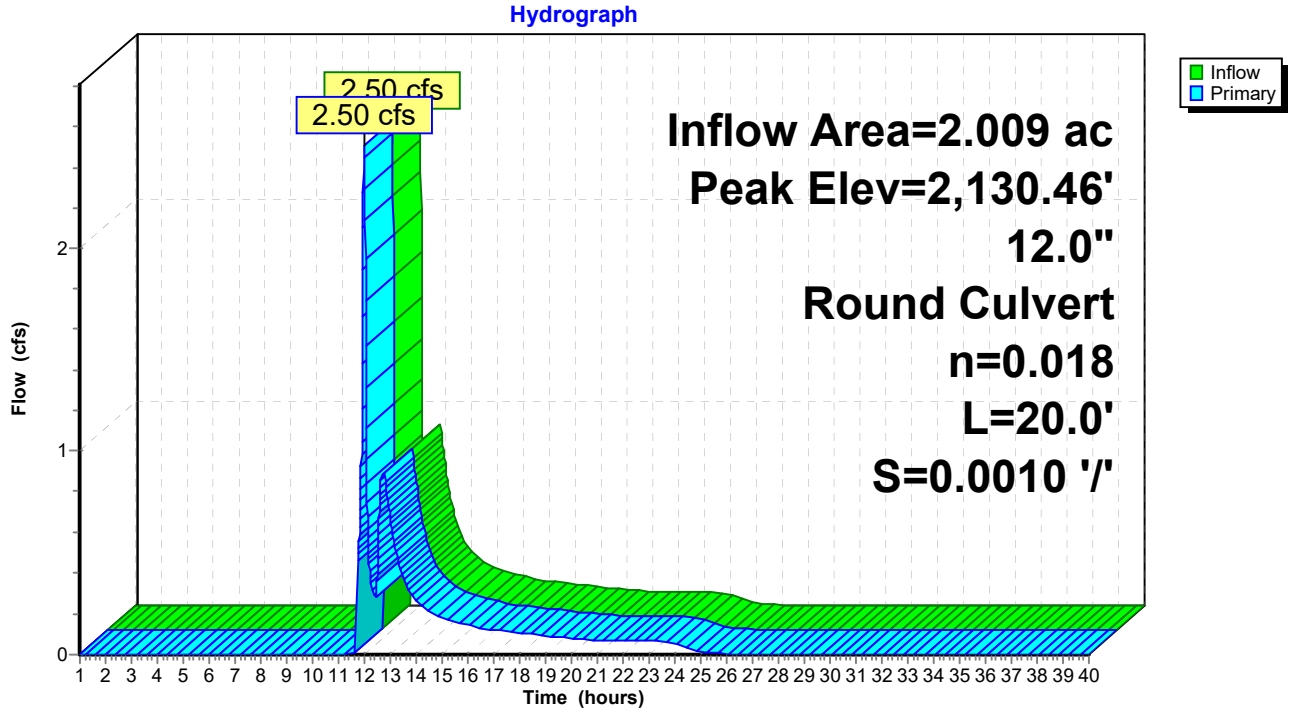
Inflow Area = 2.009 ac, 16.21% Impervious, Inflow Depth = 1.25" for 25-YR, 24-HR event
Inflow = 2.50 cfs @ 11.99 hrs, Volume= 0.210 af
Outflow = 2.50 cfs @ 11.99 hrs, Volume= 0.210 af, Atten= 0%, Lag= 0.0 min
Primary = 2.50 cfs @ 11.99 hrs, Volume= 0.210 af

Routing by Dyn-Stor-Ind method, Time Span= 1.00-40.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 2,130.46' @ 11.99 hrs
Flood Elev= 2,131.25'

Device	Routing	Invert	Outlet Devices
#1	Primary	2,128.99'	**12.0" Round Culvert** L= 20.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 2,128.99' / 2,128.97' S= 0.0010 '/' Cc= 0.900 n= 0.018 Corrugated PE, corrugated interior, Flow Area= 0.79 sf

Primary OutFlow Max=2.50 cfs @ 11.99 hrs HW=2,130.46' (Free Discharge)
1=Culvert (Barrel Controls 2.50 cfs @ 3.19 fps)

Pond CB2: CB-1



Summary for Pond EXP: Existing Drainage

Inflow Area = 2.009 ac, 0.00% Impervious, Inflow Depth = 1.90" for 25-YR, 24-HR event
Inflow = 3.23 cfs @ 12.26 hrs, Volume= 0.318 af
Outflow = 3.07 cfs @ 12.33 hrs, Volume= 0.289 af, Atten= 5%, Lag= 3.9 min
Primary = 3.07 cfs @ 12.33 hrs, Volume= 0.289 af

Routing by Dyn-Stor-Ind method, Time Span= 1.00-40.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 2,130.69' @ 12.33 hrs Surf.Area= 0.139 ac Storage= 0.054 af

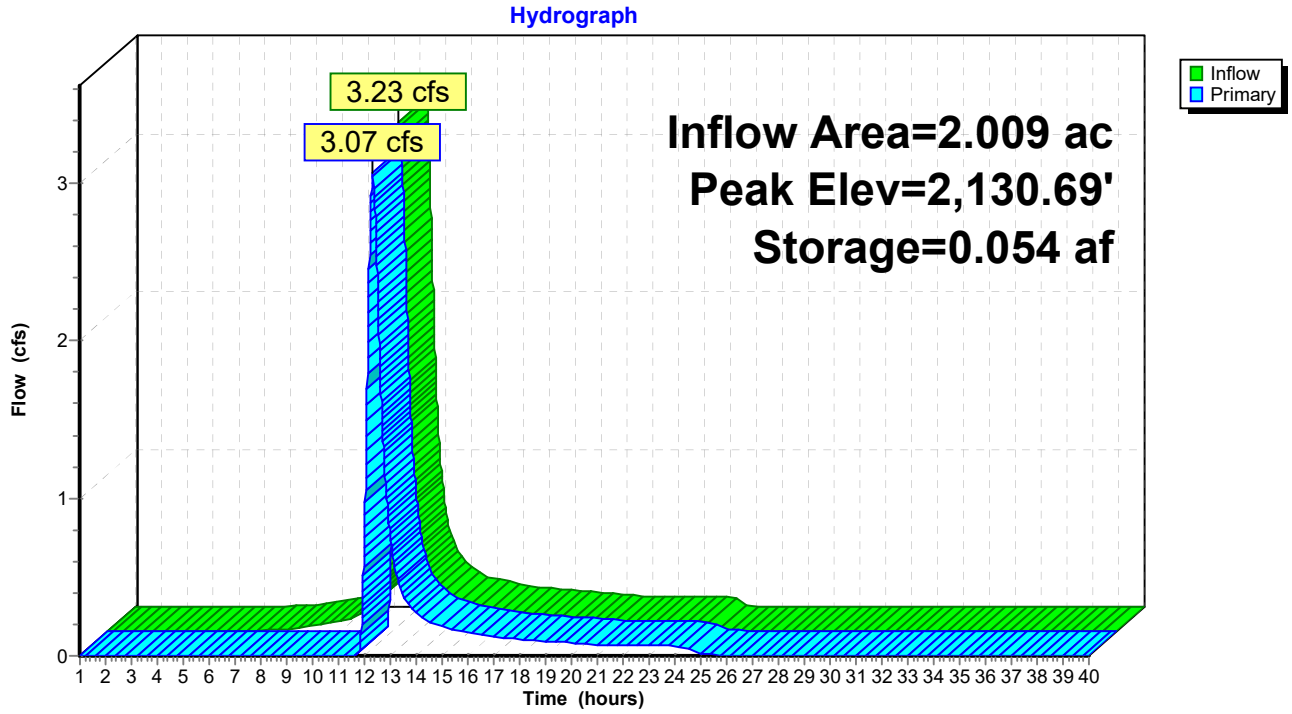
Plug-Flow detention time= 77.3 min calculated for 0.289 af (91% of inflow)
Center-of-Mass det. time= 30.3 min (864.2 - 833.9)

Volume	Invert	Avail.Storage	Storage Description
#1	2,130.25'	0.173 af	**14.00'W x 325.00'L x 1.15'H Prismatoid Z=5.0**

Device	Routing	Invert	Outlet Devices
#1	Primary	2,130.50'	**15.0' long + 5.0 '/' SideZ x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Primary OutFlow Max=3.07 cfs @ 12.33 hrs HW=2,130.69' (Free Discharge)
└**1=Broad-Crested Rectangular Weir** (Weir Controls 3.07 cfs @ 1.01 fps)

Pond EXP: Existing Drainage



Summary for Pond PA: North Pond

Inflow Area = 1.584 ac, 9.96% Impervious, Inflow Depth = 1.28" for 25-YR, 24-HR event
Inflow = 1.26 cfs @ 11.96 hrs, Volume= 0.169 af
Outflow = 1.08 cfs @ 12.00 hrs, Volume= 0.152 af, Atten= 14%, Lag= 2.4 min
Primary = 1.08 cfs @ 12.00 hrs, Volume= 0.152 af
Routed to Pond CB2 : CB-1

Routing by Dyn-Stor-Ind method, Time Span= 1.00-40.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 2,130.79' @ 12.00 hrs Surf.Area= 1,604 sf Storage= 946 cf

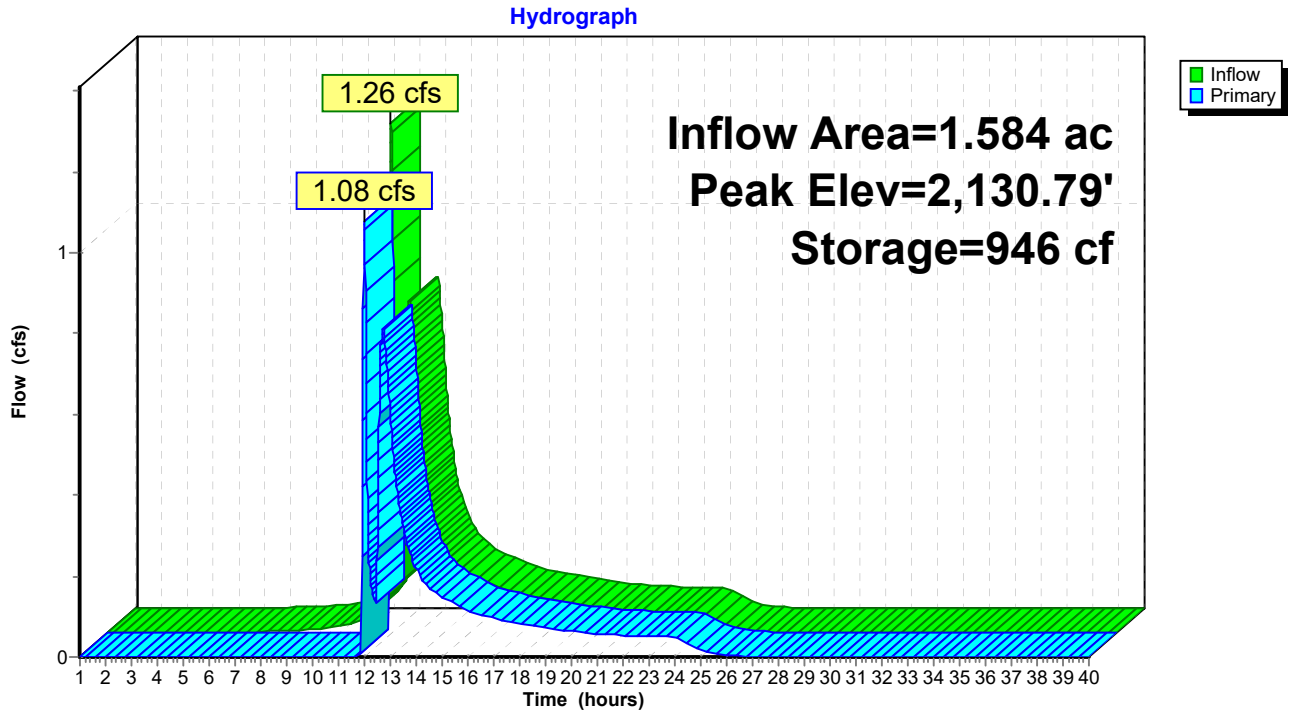
Plug-Flow detention time= 85.0 min calculated for 0.152 af (90% of inflow)
Center-of-Mass det. time= 31.0 min (930.1 - 899.1)

Volume	Invert	Avail.Storage	Storage Description
#1	2,130.00'	1,797 cf	**5.00'W x 160.00'L x 1.25'H Prismatoid Z=3.0**

Device	Routing	Invert	Outlet Devices
#1	Device 2	2,130.67'	**1.0" x 3.0" Horiz. Orifice/Grate X 8.00 columns** X 7 rows C= 0.600 in 24.0" x 24.0" Grate (29% open area) Limited to weir flow at low heads
#2	Primary	2,129.09'	**12.0" Round Culvert** L= 100.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 2,129.09' / 2,128.99' S= 0.0010 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=1.08 cfs @ 12.00 hrs HW=2,130.79' TW=2,130.45' (Dynamic Tailwater)
↑**2=Culvert** (Passes 1.08 cfs of 1.71 cfs potential flow)
↑**1=Orifice/Grate** (Weir Controls 1.08 cfs @ 1.13 fps)

Pond PA: North Pond



Summary for Pond PB: South Pond

Inflow Area = 0.425 ac, 39.52% Impervious, Inflow Depth = 1.98" for 25-YR, 24-HR event
Inflow = 1.51 cfs @ 11.96 hrs, Volume= 0.070 af
Outflow = 1.45 cfs @ 11.98 hrs, Volume= 0.058 af, Atten= 4%, Lag= 1.2 min
Primary = 1.45 cfs @ 11.98 hrs, Volume= 0.058 af
Routed to Pond CB2 : CB-1

Routing by Dyn-Stor-Ind method, Time Span= 1.00-40.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 2,130.74' @ 11.98 hrs Surf.Area= 1,113 sf Storage= 596 cf

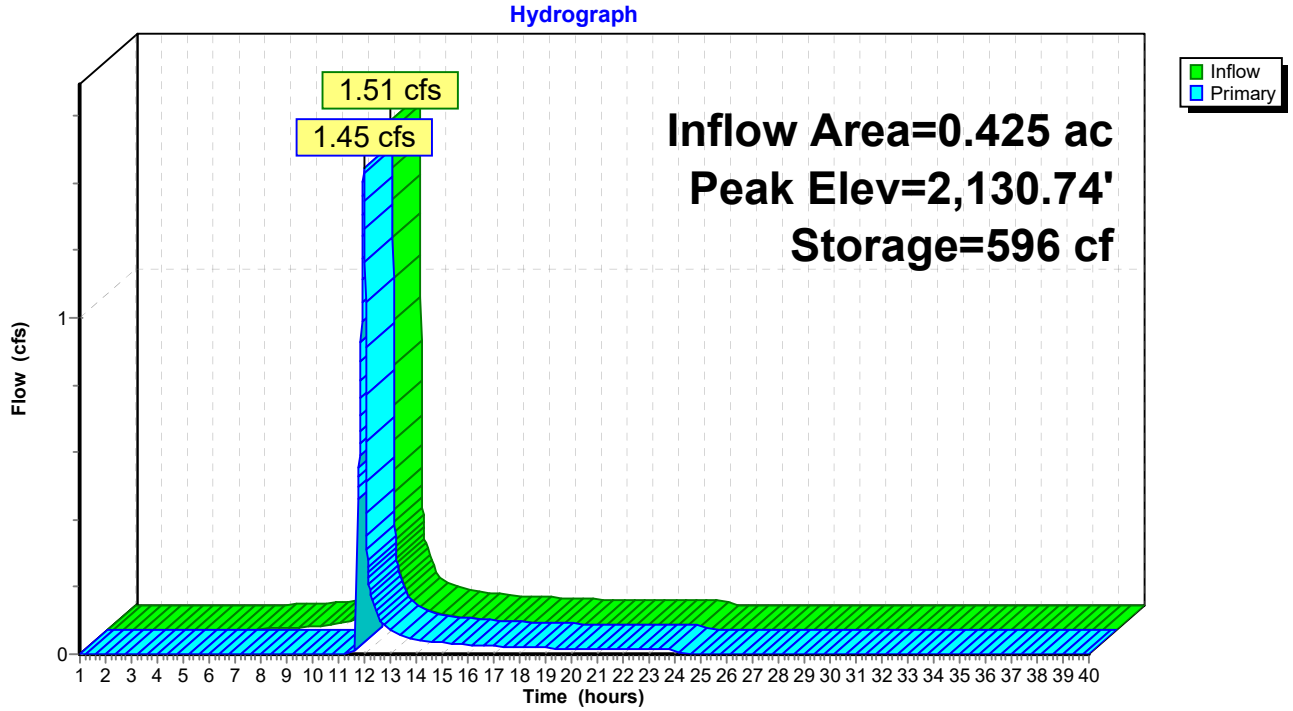
Plug-Flow detention time= 107.4 min calculated for 0.058 af (83% of inflow)
Center-of-Mass det. time= 33.0 min (838.5 - 805.4)

Volume	Invert	Avail.Storage	Storage Description
#1	2,130.00'	919 cf	**4.00'W x 127.80'L x 1.00'H Prismatoid Z=3.0**

Device	Routing	Invert	Outlet Devices
#1	Primary	2,130.67'	**1.0" x 3.0" Horiz. Orifice/Grate X 8.00 columns** X 7 rows C= 0.600 in 24.0" x 24.0" Grate (29% open area)

Primary OutFlow Max=1.45 cfs @ 11.98 hrs HW=2,130.74' TW=2,130.45' (Dynamic Tailwater)
└**1=Orifice/Grate** (Orifice Controls 1.45 cfs @ 1.24 fps)

Pond PB: South Pond



Summary for Pond PC: Existing Drainage

Inflow Area = 1.230 ac, 0.00% Impervious, Inflow Depth = 1.90" for 25-YR, 24-HR event
Inflow = 1.98 cfs @ 12.26 hrs, Volume= 0.195 af
Outflow = 0.75 cfs @ 12.68 hrs, Volume= 0.111 af, Atten= 62%, Lag= 25.2 min
Primary = 0.75 cfs @ 12.68 hrs, Volume= 0.111 af
Routed to Pond PA : North Pond

Routing by Dyn-Stor-Ind method, Time Span= 1.00-40.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 2,131.26' @ 12.68 hrs Surf.Area= 0.124 ac Storage= 0.097 af

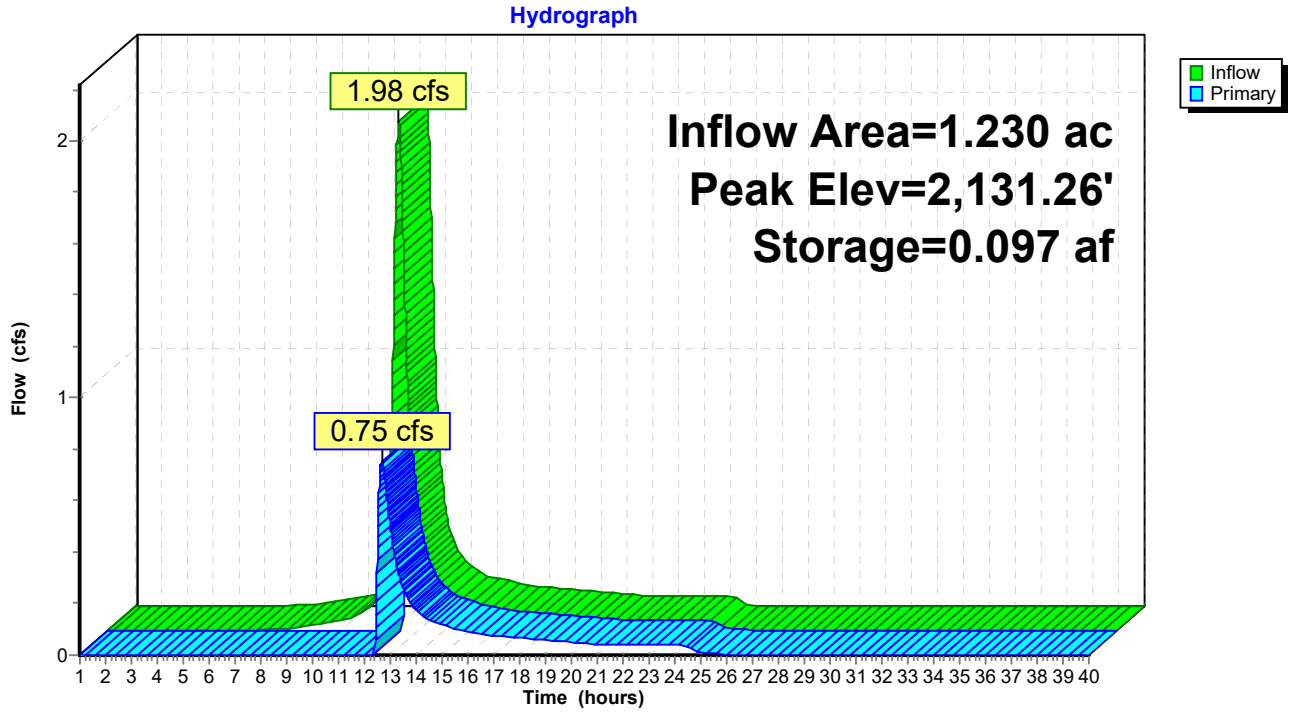
Plug-Flow detention time= 226.8 min calculated for 0.111 af (57% of inflow)
Center-of-Mass det. time= 114.7 min (948.6 - 833.9)

Volume	Invert	Avail.Storage	Storage Description
#1	2,130.25'	0.115 af	**14.00'W x 215.00'L x 1.15'H Prismatoid Z=5.0**

Device	Routing	Invert	Outlet Devices
#1	Primary	2,131.15'	**9.0' long + 4.0 '/' SideZ x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Primary OutFlow Max=0.75 cfs @ 12.68 hrs HW=2,131.26' TW=2,130.77' (Dynamic Tailwater)
1=Broad-Crested Rectangular Weir (Weir Controls 0.75 cfs @ 0.75 fps)

Pond PC: Existing Drainage



Time span=1.00-40.00 hrs, dt=0.01 hrs, 3901 points x 3
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1S: North Undeveloped - Runoff Area=53,574 sf 0.00% Impervious Runoff Depth=2.26"
Flow Length=100' Slope=0.0020 '/' Tc=31.1 min CN=89 Runoff=2.35 cfs 0.232 af

Subcatchment A: New Parking Lot- NORTH Runoff Area=15,417 sf 44.57% Impervious Runoff Depth=2.35"
Tc=5.0 min CN=90 Runoff=1.48 cfs 0.069 af

Subcatchment B: New Parking Lot- South Runoff Area=18,510 sf 39.52% Impervious Runoff Depth=2.35"
Tc=5.0 min CN=90 Runoff=1.78 cfs 0.083 af

Subcatchment EXA: Pre-Developed Runoff Area=15,417 sf 0.00% Impervious Runoff Depth=2.26"
Flow Length=100' Slope=0.0020 '/' Tc=31.1 min CN=89 Runoff=0.68 cfs 0.067 af

Subcatchment EXB: Pre-Developed Runoff Area=18,510 sf 0.00% Impervious Runoff Depth=2.26"
Flow Length=100' Slope=0.0020 '/' Tc=31.1 min CN=89 Runoff=0.81 cfs 0.080 af

Subcatchment EXC: North Undeveloped - Runoff Area=53,574 sf 0.00% Impervious Runoff Depth=2.26"
Flow Length=100' Slope=0.0020 '/' Tc=31.1 min CN=89 Runoff=2.35 cfs 0.232 af

Pond CB2: CB-1 Peak Elev=2,130.74' Inflow=3.13 cfs 0.271 af
12.0" Round Culvert n=0.018 L=20.0' S=0.0010 '/' Outflow=3.13 cfs 0.271 af

Pond EXP: Existing Drainage Peak Elev=2,130.71' Storage=0.057 af Inflow=3.84 cfs 0.379 af
Outflow=3.67 cfs 0.351 af

Pond PA: North Pond Peak Elev=2,130.82' Storage=990 cf Inflow=1.48 cfs 0.218 af
Outflow=1.47 cfs 0.200 af

Pond PB: South Pond Peak Elev=2,130.76' Storage=622 cf Inflow=1.78 cfs 0.083 af
Outflow=1.69 cfs 0.071 af

Pond PC: Existing Drainage Peak Elev=2,131.30' Storage=0.102 af Inflow=2.35 cfs 0.232 af
Outflow=1.30 cfs 0.148 af

Total Runoff Area = 4.017 ac Runoff Volume = 0.764 af Average Runoff Depth = 2.28"
91.89% Pervious = 3.692 ac 8.11% Impervious = 0.326 ac

Summary for Subcatchment 1S: North Undeveloped - Existing

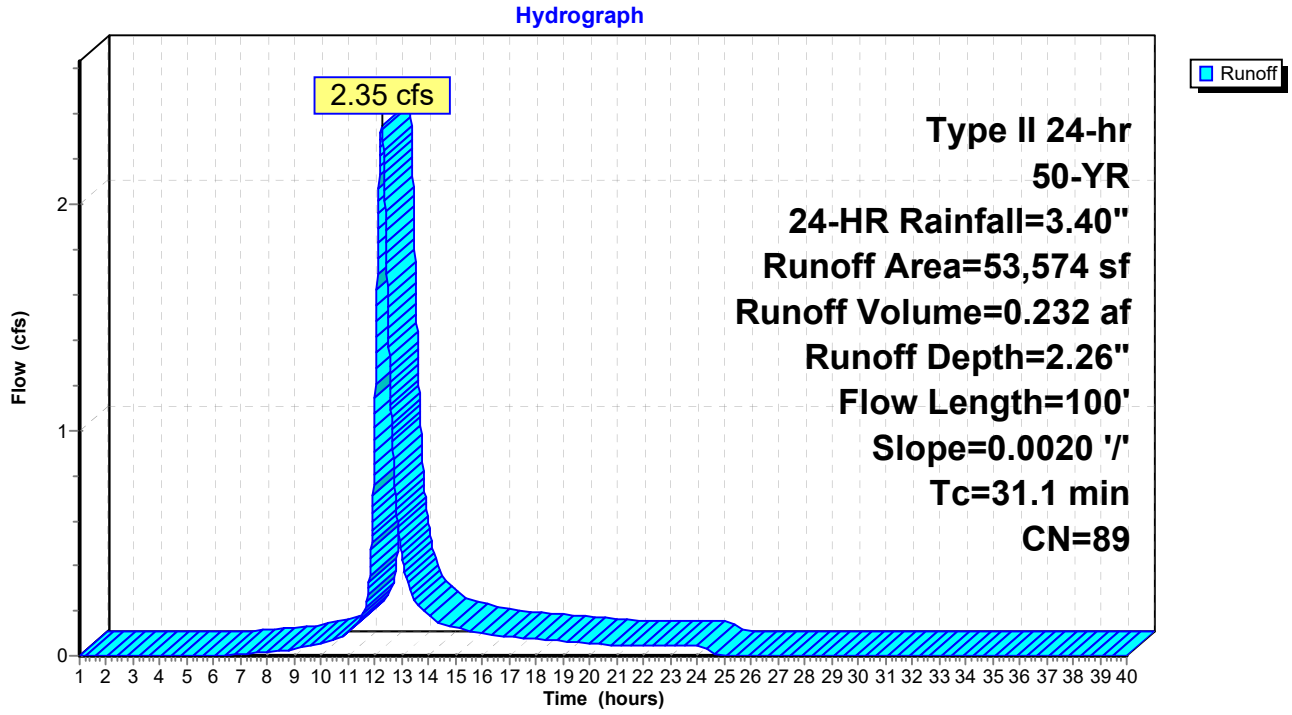
Runoff = 2.35 cfs @ 12.26 hrs, Volume= 0.232 af, Depth= 2.26"
Routed to Pond PC : Existing Drainage

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-40.00 hrs, dt= 0.01 hrs
Type II 24-hr 50-YR, 24-HR Rainfall=3.40"

Area (sf)	CN	Description
53,574	89	Pasture/grassland/range, Poor, HSG D
53,574		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
31.1	100	0.0020	0.05		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.00"

Subcatchment 1S: North Undeveloped - Existing



Summary for Subcatchment A: New Parking Lot- NORTH

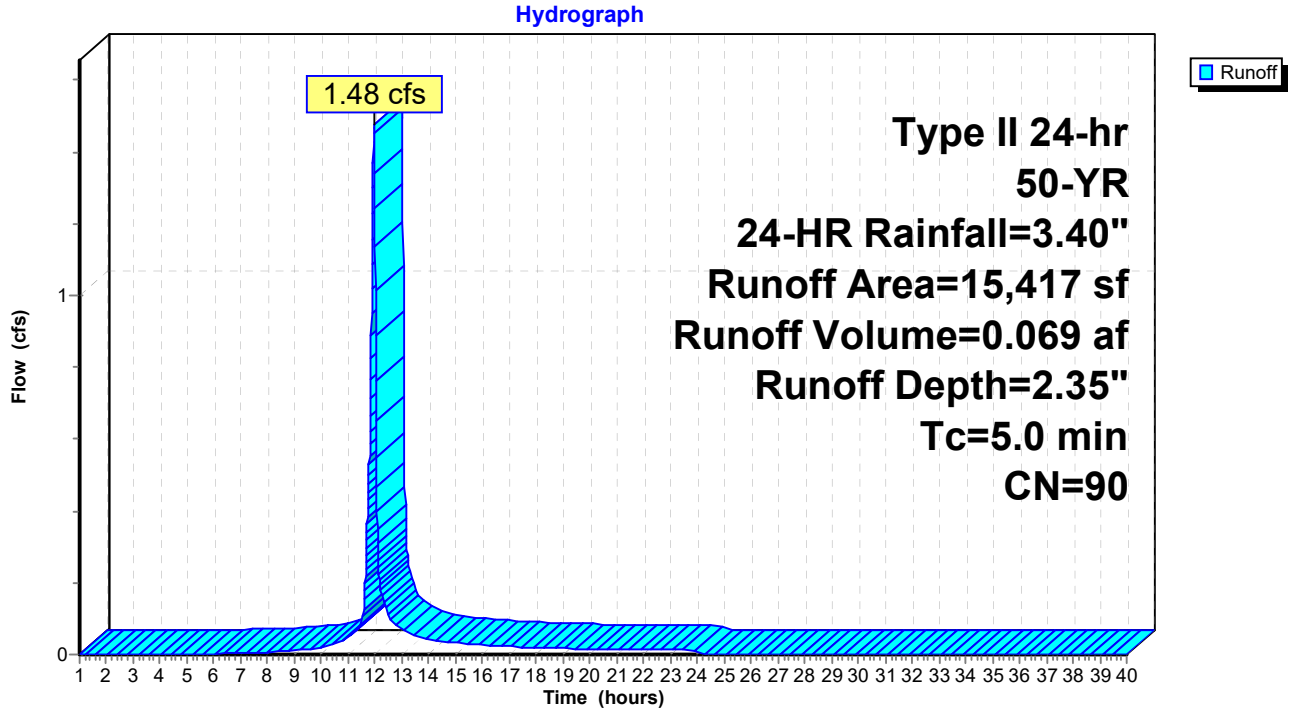
Runoff = 1.48 cfs @ 11.96 hrs, Volume= 0.069 af, Depth= 2.35"
Routed to Pond PA : North Pond

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-40.00 hrs, dt= 0.01 hrs
Type II 24-hr 50-YR, 24-HR Rainfall=3.40"

Area (sf)	CN	Description
6,872	98	Paved parking, HSG D
8,545	84	50-75% Grass cover, Fair, HSG D
15,417	90	Weighted Average
8,545		55.43% Pervious Area
6,872		44.57% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment A: New Parking Lot- NORTH



Summary for Subcatchment B: New Parking Lot- South

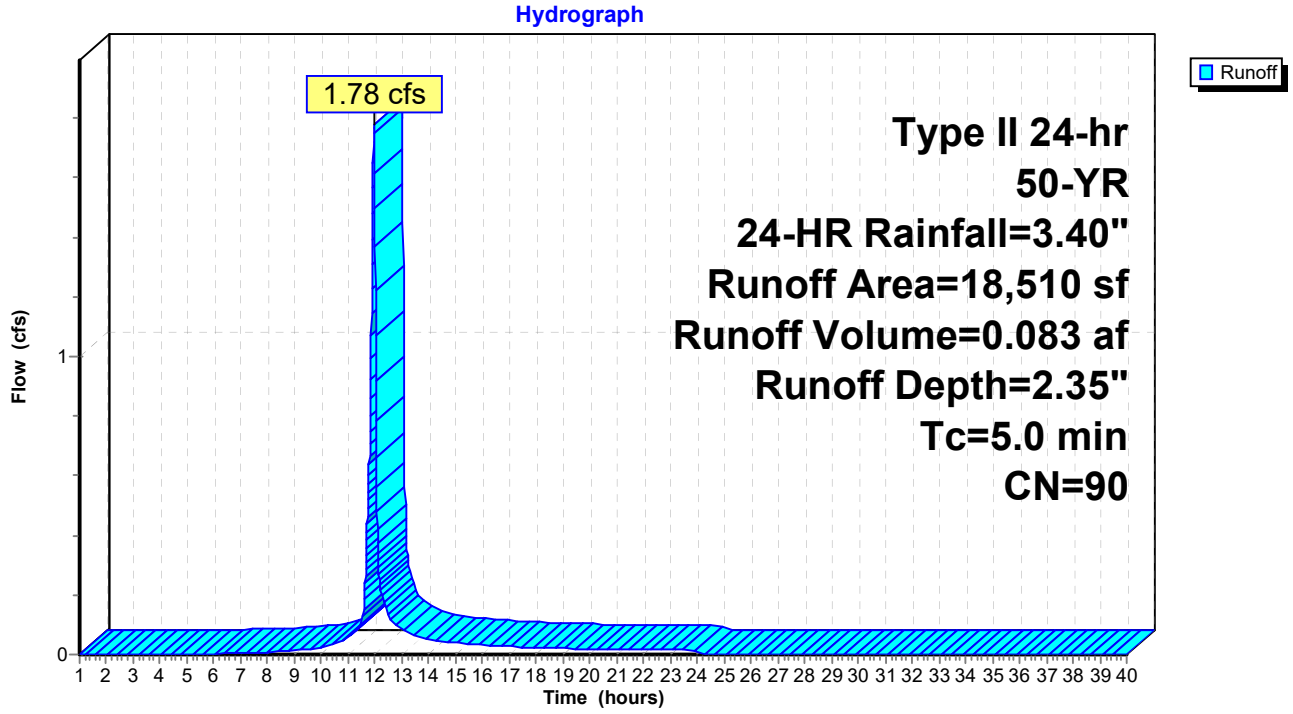
Runoff = 1.78 cfs @ 11.96 hrs, Volume= 0.083 af, Depth= 2.35"
Routed to Pond PB : South Pond

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-40.00 hrs, dt= 0.01 hrs
Type II 24-hr 50-YR, 24-HR Rainfall=3.40"

Area (sf)	CN	Description
7,315	98	Paved parking, HSG D
11,195	84	50-75% Grass cover, Fair, HSG D
18,510	90	Weighted Average
11,195		60.48% Pervious Area
7,315		39.52% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment B: New Parking Lot- South



Summary for Subcatchment EXA: Pre-Developed

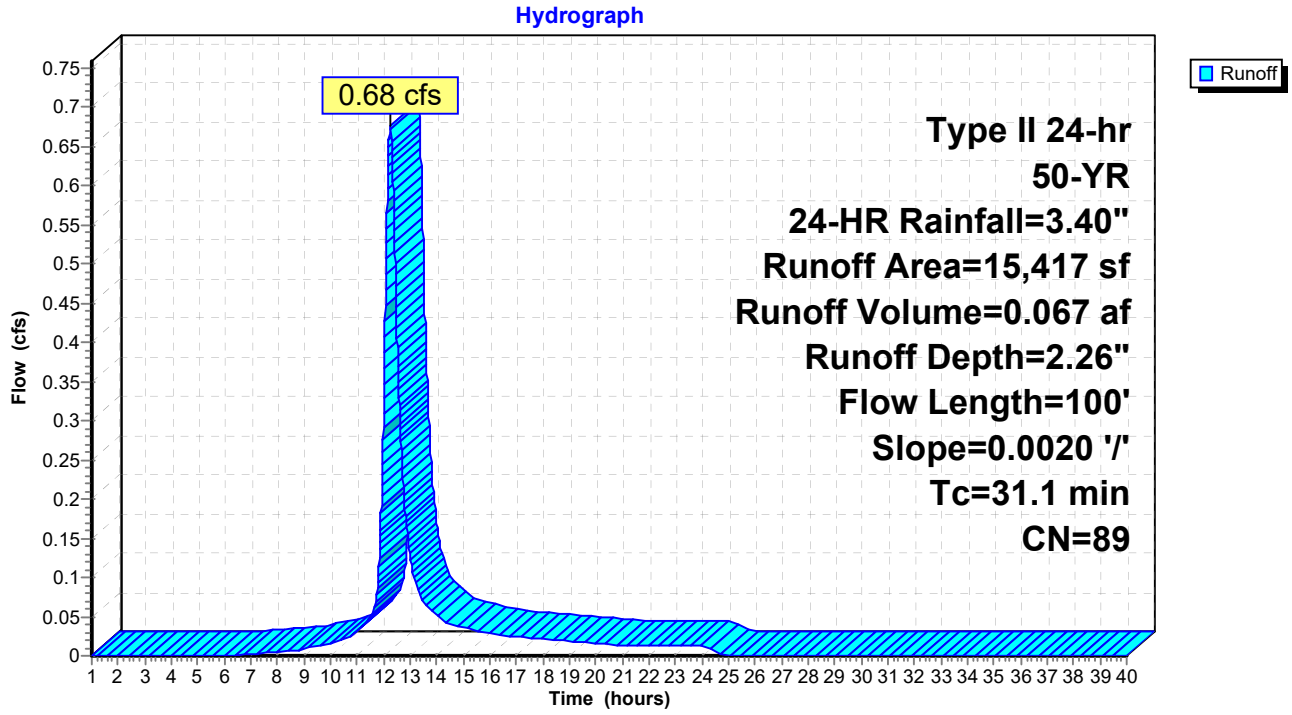
Runoff = 0.68 cfs @ 12.26 hrs, Volume= 0.067 af, Depth= 2.26"
Routed to Pond EXP : Existing Drainage

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-40.00 hrs, dt= 0.01 hrs
Type II 24-hr 50-YR, 24-HR Rainfall=3.40"

Area (sf)	CN	Description
15,417	89	Pasture/grassland/range, Poor, HSG D
15,417		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
31.1	100	0.0020	0.05		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.00"

Subcatchment EXA: Pre-Developed



Summary for Subcatchment EXB: Pre-Developed

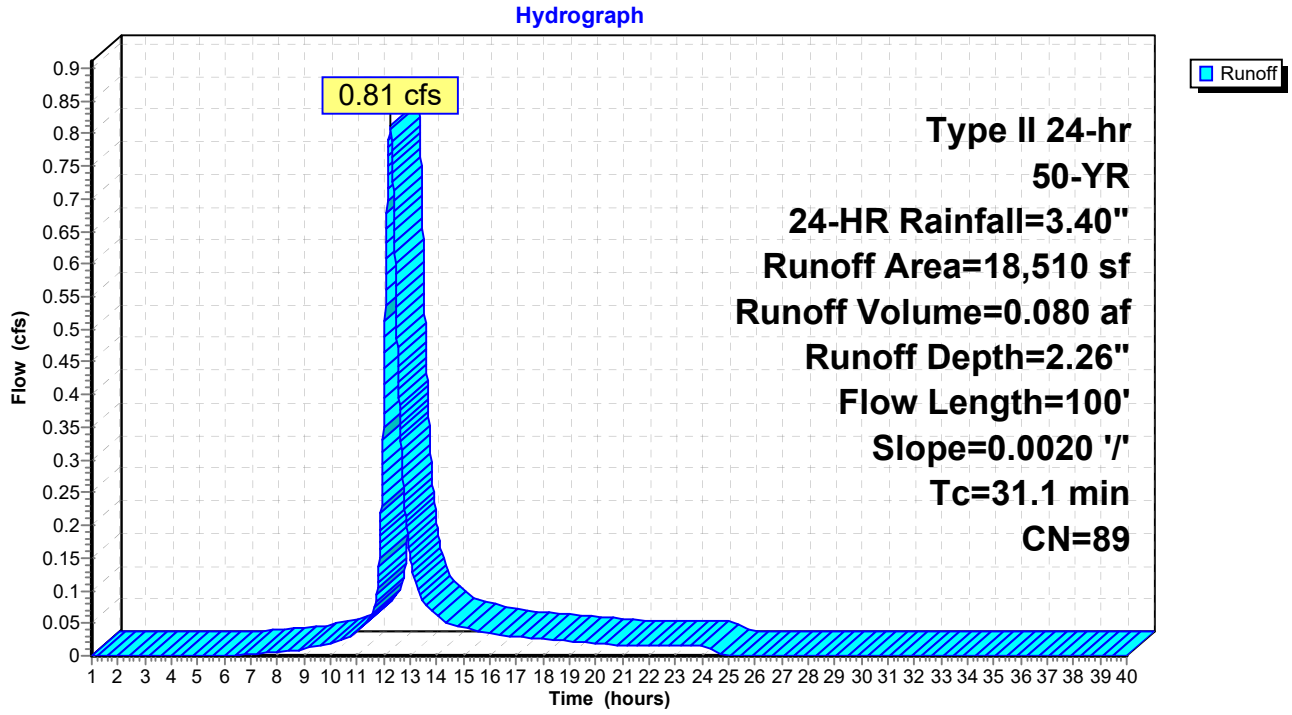
Runoff = 0.81 cfs @ 12.26 hrs, Volume= 0.080 af, Depth= 2.26"
Routed to Pond EXP : Existing Drainage

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-40.00 hrs, dt= 0.01 hrs
Type II 24-hr 50-YR, 24-HR Rainfall=3.40"

Area (sf)	CN	Description
18,510	89	Pasture/grassland/range, Poor, HSG D
18,510		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
31.1	100	0.0020	0.05		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.00"

Subcatchment EXB: Pre-Developed



Summary for Subcatchment EXC: North Undeveloped - Existing

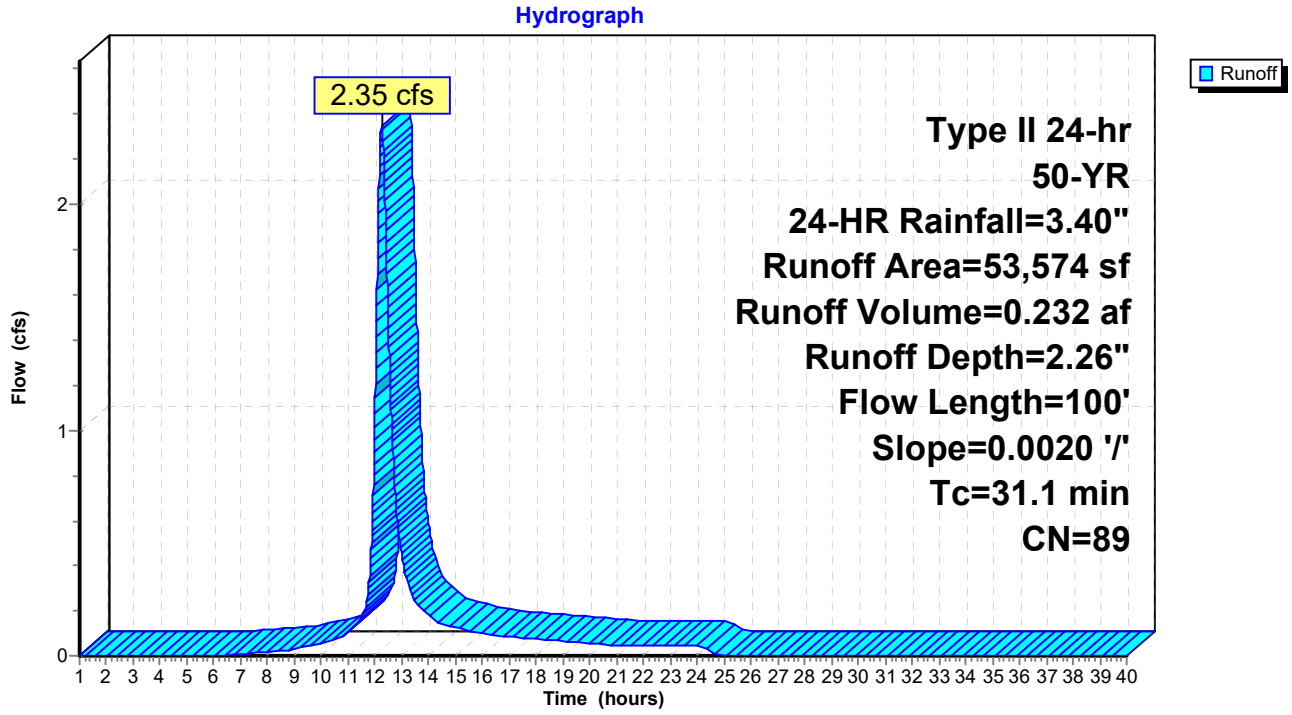
Runoff = 2.35 cfs @ 12.26 hrs, Volume= 0.232 af, Depth= 2.26"
Routed to Pond EXP : Existing Drainage

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-40.00 hrs, dt= 0.01 hrs
Type II 24-hr 50-YR, 24-HR Rainfall=3.40"

Area (sf)	CN	Description
53,574	89	Pasture/grassland/range, Poor, HSG D
53,574		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
31.1	100	0.0020	0.05		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.00"

Subcatchment EXC: North Undeveloped - Existing



Summary for Pond CB2: CB-1

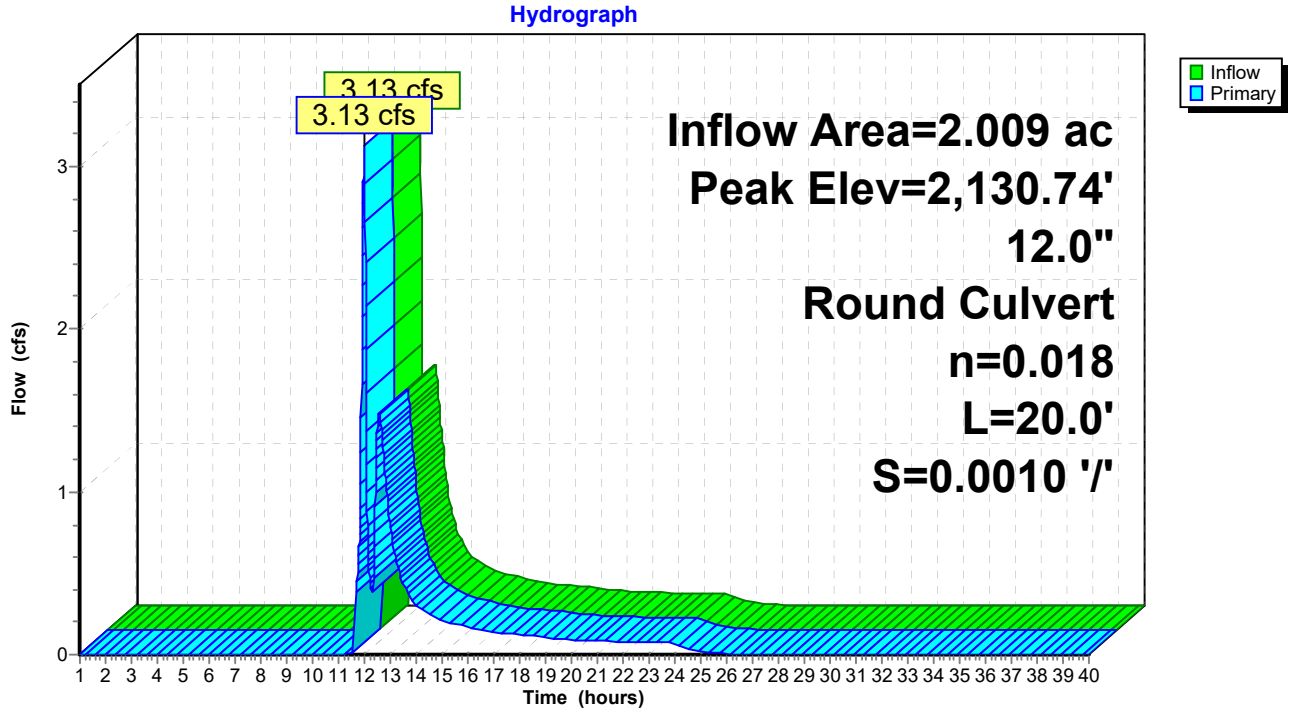
Inflow Area = 2.009 ac, 16.21% Impervious, Inflow Depth = 1.62" for 50-YR, 24-HR event
Inflow = 3.13 cfs @ 12.00 hrs, Volume= 0.271 af
Outflow = 3.13 cfs @ 12.00 hrs, Volume= 0.271 af, Atten= 0%, Lag= 0.0 min
Primary = 3.13 cfs @ 12.00 hrs, Volume= 0.271 af

Routing by Dyn-Stor-Ind method, Time Span= 1.00-40.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 2,130.74' @ 12.00 hrs
Flood Elev= 2,131.25'

Device	Routing	Invert	Outlet Devices
#1	Primary	2,128.99'	**12.0" Round Culvert** L= 20.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 2,128.99' / 2,128.97' S= 0.0010 '/' Cc= 0.900 n= 0.018 Corrugated PE, corrugated interior, Flow Area= 0.79 sf

Primary OutFlow Max=3.13 cfs @ 12.00 hrs HW=2,130.73' (Free Discharge)
1=Culvert (Barrel Controls 3.13 cfs @ 3.98 fps)

Pond CB2: CB-1



Summary for Pond EXP: Existing Drainage

Inflow Area = 2.009 ac, 0.00% Impervious, Inflow Depth = 2.26" for 50-YR, 24-HR event
Inflow = 3.84 cfs @ 12.26 hrs, Volume= 0.379 af
Outflow = 3.67 cfs @ 12.32 hrs, Volume= 0.351 af, Atten= 4%, Lag= 3.5 min
Primary = 3.67 cfs @ 12.32 hrs, Volume= 0.351 af

Routing by Dyn-Stor-Ind method, Time Span= 1.00-40.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 2,130.71' @ 12.32 hrs Surf.Area= 0.141 ac Storage= 0.057 af

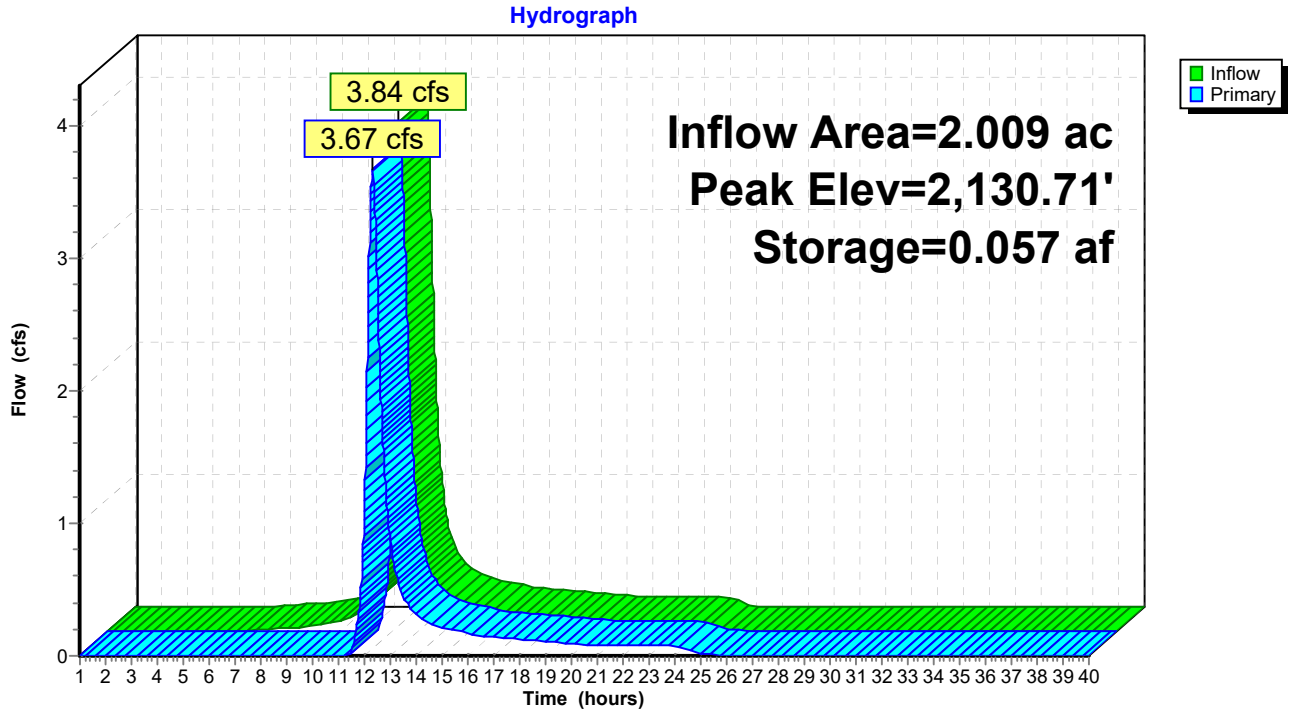
Plug-Flow detention time= 69.2 min calculated for 0.351 af (92% of inflow)
Center-of-Mass det. time= 28.4 min (857.3 - 828.9)

Volume	Invert	Avail.Storage	Storage Description
#1	2,130.25'	0.173 af	**14.00'W x 325.00'L x 1.15'H Prismatoid Z=5.0**

Device	Routing	Invert	Outlet Devices
#1	Primary	2,130.50'	**15.0' long + 5.0 '/' SideZ x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Primary OutFlow Max=3.67 cfs @ 12.32 hrs HW=2,130.71' (Free Discharge)
└**1=Broad-Crested Rectangular Weir** (Weir Controls 3.67 cfs @ 1.07 fps)

Pond EXP: Existing Drainage



Summary for Pond PA: North Pond

[87] Warning: Oscillations may require smaller dt or Finer Routing (severity=1)

Inflow Area = 1.584 ac, 9.96% Impervious, Inflow Depth = 1.65" for 50-YR, 24-HR event
Inflow = 1.48 cfs @ 11.96 hrs, Volume= 0.218 af
Outflow = 1.47 cfs @ 12.00 hrs, Volume= 0.200 af, Atten= 1%, Lag= 2.5 min
Primary = 1.47 cfs @ 12.00 hrs, Volume= 0.200 af
Routed to Pond CB2 : CB-1

Routing by Dyn-Stor-Ind method, Time Span= 1.00-40.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 2,130.82' @ 12.00 hrs Surf.Area= 1,633 sf Storage= 990 cf

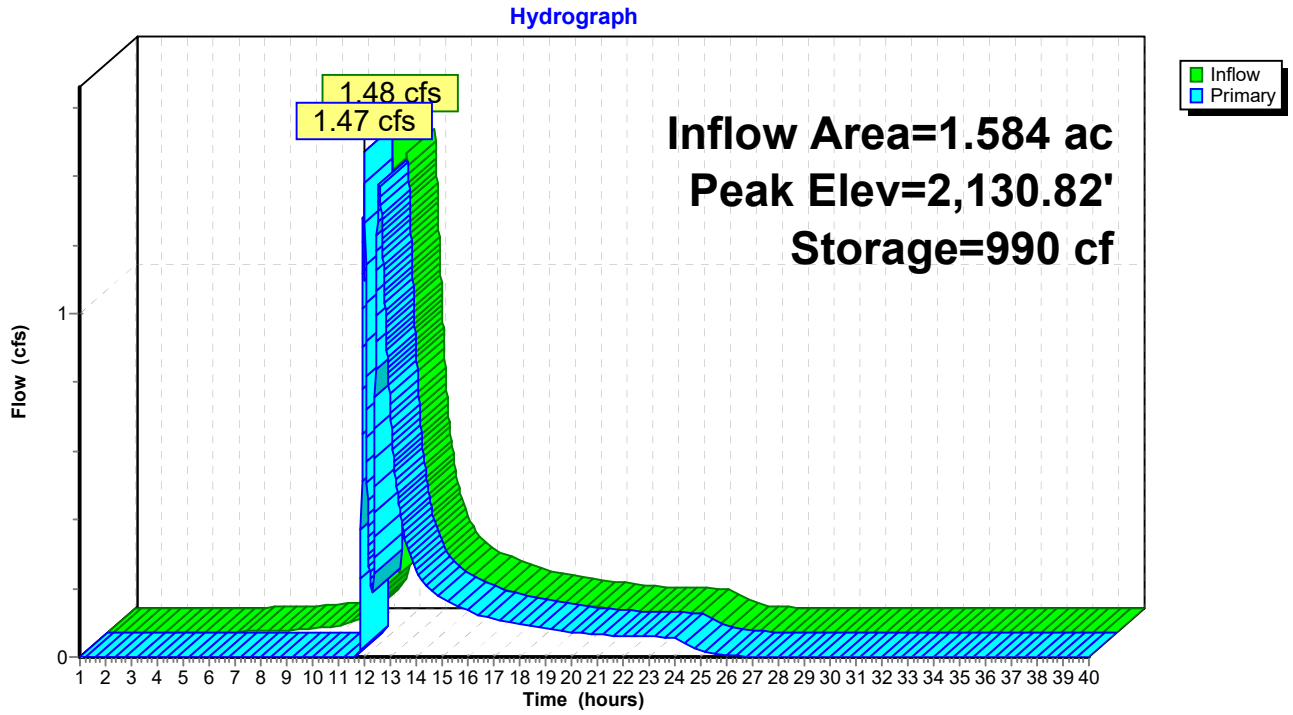
Plug-Flow detention time= 67.8 min calculated for 0.200 af (92% of inflow)
Center-of-Mass det. time= 24.1 min (906.7 - 882.6)

Volume	Invert	Avail.Storage	Storage Description
#1	2,130.00'	1,797 cf	**5.00'W x 160.00'L x 1.25'H Prismatoid Z=3.0**

Device	Routing	Invert	Outlet Devices
#1	Device 2	2,130.67'	**1.0" x 3.0" Horiz. Orifice/Grate X 8.00 columns** X 7 rows C= 0.600 in 24.0" x 24.0" Grate (29% open area) Limited to weir flow at low heads
#2	Primary	2,129.09'	**12.0" Round Culvert** L= 100.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 2,129.09' / 2,128.99' S= 0.0010 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.86 cfs @ 12.00 hrs HW=2,130.82' TW=2,130.73' (Dynamic Tailwater)
↑└**2=Culvert** (Outlet Controls 0.86 cfs @ 1.09 fps)
↑└**1=Orifice/Grate** (Passes 0.86 cfs of 1.30 cfs potential flow)

Pond PA: North Pond



Summary for Pond PB: South Pond

Inflow Area = 0.425 ac, 39.52% Impervious, Inflow Depth = 2.35" for 50-YR, 24-HR event
Inflow = 1.78 cfs @ 11.96 hrs, Volume= 0.083 af
Outflow = 1.69 cfs @ 11.98 hrs, Volume= 0.071 af, Atten= 5%, Lag= 1.1 min
Primary = 1.69 cfs @ 11.98 hrs, Volume= 0.071 af
Routed to Pond CB2 : CB-1

Routing by Dyn-Stor-Ind method, Time Span= 1.00-40.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 2,130.76' @ 11.99 hrs Surf.Area= 1,133 sf Storage= 622 cf

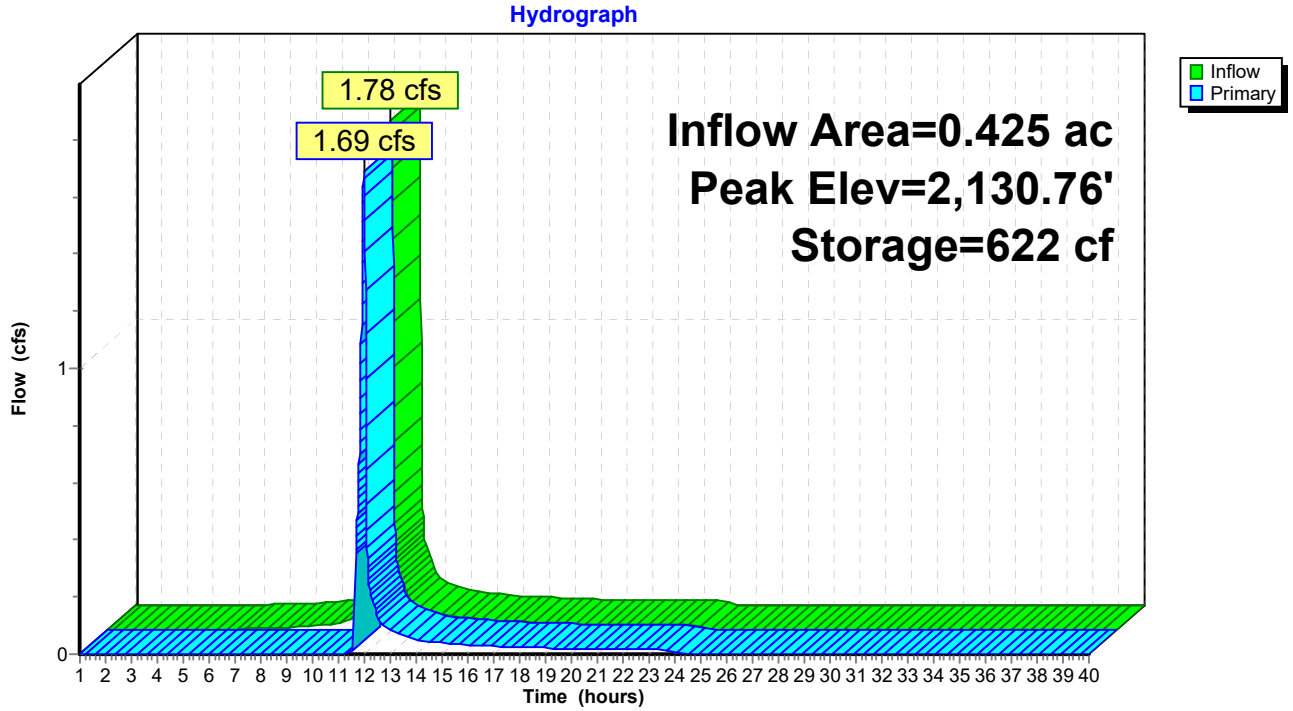
Plug-Flow detention time= 96.6 min calculated for 0.071 af (86% of inflow)
Center-of-Mass det. time= 30.2 min (830.8 - 800.6)

Volume	Invert	Avail.Storage	Storage Description
#1	2,130.00'	919 cf	**4.00'W x 127.80'L x 1.00'H Prismatoid Z=3.0**

Device	Routing	Invert	Outlet Devices
#1	Primary	2,130.67'	**1.0" x 3.0" Horiz. Orifice/Grate X 8.00 columns** X 7 rows C= 0.600 in 24.0" x 24.0" Grate (29% open area)

Primary OutFlow Max=1.68 cfs @ 11.98 hrs HW=2,130.76' TW=2,130.65' (Dynamic Tailwater)
↑—**1=Orifice/Grate** (Orifice Controls 1.68 cfs @ 1.44 fps)

Pond PB: South Pond



Summary for Pond PC: Existing Drainage

Inflow Area = 1.230 ac, 0.00% Impervious, Inflow Depth = 2.26" for 50-YR, 24-HR event
Inflow = 2.35 cfs @ 12.26 hrs, Volume= 0.232 af
Outflow = 1.30 cfs @ 12.54 hrs, Volume= 0.148 af, Atten= 45%, Lag= 16.8 min
Primary = 1.30 cfs @ 12.54 hrs, Volume= 0.148 af
Routed to Pond PA : North Pond

Routing by Dyn-Stor-Ind method, Time Span= 1.00-40.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 2,131.30' @ 12.54 hrs Surf.Area= 0.127 ac Storage= 0.102 af

Plug-Flow detention time= 197.4 min calculated for 0.148 af (64% of inflow)
Center-of-Mass det. time= 92.2 min (921.1 - 828.9)

Volume	Invert	Avail.Storage	Storage Description
#1	2,130.25'	0.115 af	**14.00'W x 215.00'L x 1.15'H Prismatoid Z=5.0**

Device	Routing	Invert	Outlet Devices
#1	Primary	2,131.15'	**9.0' long + 4.0 '/' SideZ x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Primary OutFlow Max=1.30 cfs @ 12.54 hrs HW=2,131.30' TW=2,130.81' (Dynamic Tailwater)
1=Broad-Crested Rectangular Weir (Weir Controls 1.30 cfs @ 0.90 fps)

Pond PC: Existing Drainage