Preliminary Stormwater Management Report

Wawa – Store #TBD

Franklin, IN

Date Prepared: 12/3/2024

Revised:

On behalf of:

Contact:

Paul Hanson
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618.604.7157

CESO
7777 Bonhomme Ave,
Suite 1853, Clayton MO 63105

Engineer of Record:

Table of Contents

APPENDICES

Introduction

This report covers the methodology and calculations used in the design of the stormwater management system for the proposed development anticipated for the Northeast Highway 31st & East County Road 300 North (Earlywood Drive), Franklin, IN 46131.

The stormwater management system is designed in accordance with the City of Franklin, Indiana Code of Ordinances Chapter 16.28.190 General Drainage Standards and INDOT requirements to accommodate the release rate requirements and the water quality volume requirements.

- Per the City of Franklin, Indiana Code of Ordinances, the 10-year post developed release rate must be reduced to the 2-year pre-developed release rate and the 100-year post developed release rate must be reduced to the 10-year pre-developed release rate.

- Per the City of Franklin, Indiana Code of Ordinances, the water quality volume requirement can be satisfied by designing a post construction BMP that is sized to treat the water quality volume for this site. Per the City of Franklin, Indiana Code of Ordinances, the developer shall be required to provide a water quality detention system that is designed to detain, for over 24 hours after peak run off from a 24-hour storm, at least 20% of the runoff from either a one and one-fourth inch storm or one-half inch of direct-runoff, whichever is greater. All paved areas shall be routed through a water quality detention area, with the minimum water quality outlet being two inches in diameter.

Storm routings for this project were performed using HydroCAD. Time of Concentration was determined using TR-55 method, within HydroCAD. The critical storm was determined using the HUFF method in HydroCAD.

Stormwater quality volume calculations were performed using HydroCAD. Refer to Appendix D for water quality calculations.

The onsite soils were obtained from USDA NRCS Web Soil Survey and can be found in Appendix E.

Existing Conditions

The site is a 10.0 Ac.± existing open field. There is a farm dealer located to the North, a private school to the East, a car dealership to the South, and Highway 31st to the West.

The existing runoff consists of two (2) major drainage areas as listed below:

- Pre-Developed Northwest Drainage Area (1A)- This drainage area drains to the Northwest portion of the site to the existing headwall and continues offsite to the North property.
- Pre-Developed Southeast Drainage Area (1B)- This drainage area drains to the southeast portion of the site, to an existing headwall and continues offsite to the East property.

The soil survey indicates the site to have Brookston Silty Clay Loam (Br), Hydrological Soil Group 'D' type soil, Crosby Silt Loam (CrA), Hydrological Soil Group 'D' type soil, Urban Land-Brookston Complex (UbaA), Hydrological Soil Group 'D', Urban Land-Crosby Silt Loam Complex (UcfA), Hydrological Soil Group 'D', and Crosy Silt Loam (YcIA), Hydrological Soil Grop 'D'. We assumed a CN value of 80 for Hydrological Soil Group D. We assumed the grass areas to be in good condition.

Please refer to Appendix B for Pre- and Post-Developed Drainage Plans.

Peak runoff rates from the existing conditions are listed in the following table:

Existing Conditions Peak Runoff Rates			
Drainage Area	**2-year Storm**	**10-year Storm**	**100-year storm**
1A	1.43	4.25	12.55
1B	0.22	0.65	1.91

Proposed Conditions

The proposed development of the site will consist of the construction of a 6,372 SF building, auto-fueling canopy, a paved parking area, paved drive aisles, associated site improvements, and two stormwater management systems. The stormwater management systems consist of two wet detention basins, associated outlet control structures, and emergency spillways. The wet detention basins in conjunction with the outlet control structures have been designed to address water quality requirements. The outlet from the stormwater management system will be routed through the outlet control structure and route to the existing outfall point to the Northwest and Southeast. Please refer to Appendix A for a detailed Site Plan for the proposed development.

The proposed improvements will create two (4) major drainage areas, (2) detention nodes, and (2) Final Outfall nodes as listed below:

- Post-Developed Northwest Drainage Area (Detained) (2A) - This drainage area drains toward the proposed North detention basin.
- Post-Developed Northwest Drainage Area Direct Runoff (3A) - This drainage area is undetained and drains to the Northwest.
- North Basin (4A)- North basin detention node.
- Final Northwest Outfall (5A)- This is the final outfall to the Northwest, combining nodes 2A, 3a, and 4A.
- Post-Developed Southeast Drainage Area (Detained) (2B) – The drainage area drains toward the proposed Southeast detention basin.
- Post-Developed Southeast Drainage Area Direct Runoff (3B) – This drainage area is undetained and drains to the Southeast.
- Southeast Basin (4B) – Southeast basin detention node.
- Final Southeast Outfall (5B) – This is the final outfall to the Southeast, combining nodes 2B, 3b, ad 4B.

Group 'D' was used for all Hydrological soil groups. We assumed CN values of 98 for impervious and 80 for pervious areas in good condition.

Please refer to Appendix B for Pre- and Post-Developed Drainage Plans.

Stormwater Quantity Summary

Downstream flows have also been analyzed utilizing HydroCAD© 2022. Rainfall depths were obtained from Rainfall Frequency Atlas of the Midwest. A storm analysis using the Huff Method was performed to determine the critical storm. For the North basin and the Southeast basin the critical storm durations were determined to be the 30 minute storms. The times of concentration were calculated using the TR-55 method, with a minimum time of concentration of 10 minutes. The downstream flows for the post developed conditions were determined to be less than the pre-developed flows for the 10 and 100-year storm events.

The resulting proposed conditions peak run off rates are listed in the following table:

Proposed Conditions Peak Runoff Rates			
Drainage Area	**2-year**	**10-year**	**100-year**
2A	5.48	10.46	21.45
3A	0.55	1.37	3.56
2B	1.51	2.78	5.56
3B	0.04	0.13	0.37

The discharge characteristics for the proposed stormwater management basin and drainage areas are listed in the following table:

Discharge Summary				
Storm	**Final Outfall Northwest Allowable Discharge (1A)**	**Final Outfall Northwest Discharge (5A)**	**Final Outfall Southeast Allowable Discharge (1B)**	**Final Outfall Southeast Discharge (5B)**
10-year	1.43	1.42	0.22	0.22
100-year	4.25	3.65	0.65	0.49

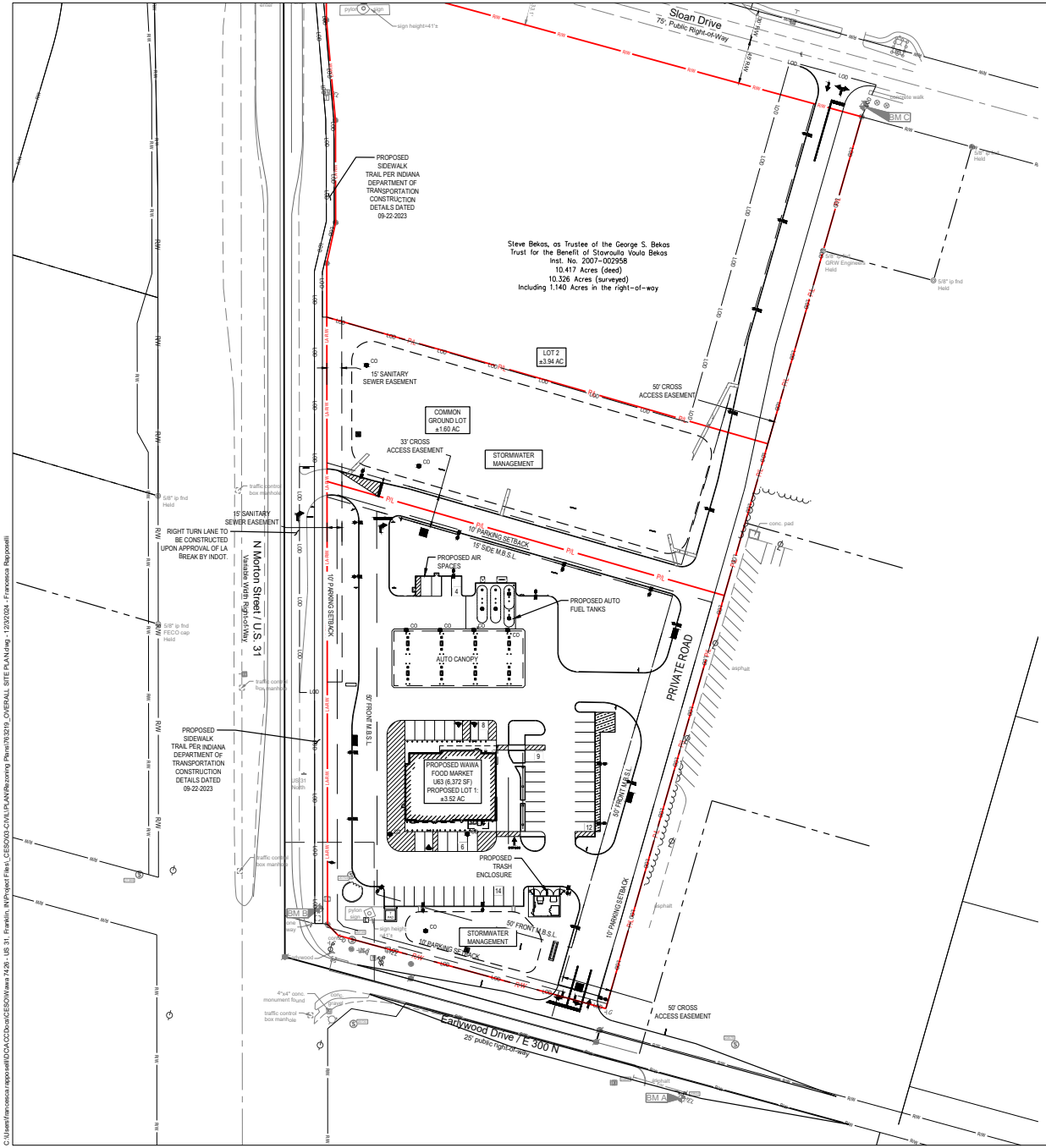
Reference Appendix C for full HydroCAD reports for each drainage area.

Stormwater Quality Summary

As part of the requirements from the City of Franklin, Indiana Code of Ordinances, the water quality volume requirement can be satisfied by designing a post construction BMP that is sized to treat the water quality volume for this site. Per the City of Franklin, Indiana Code of Ordinances, the developer shall be required to provide a water quality detention system that is designed to detain, for over 24 hours after peak run off from a 24-hour storm, at least 20% of the runoff from either a one and one-fourth inch storm or one-half inch of direct-runoff, whichever is greater. All paved areas shall be routed through a water quality detention area, with the minimum water quality outlet being two inches in diameter. It was determined that 20% of the 1.25-inch storm volume generated larger volumes for both the North basin and the Southeast basin. The proposed development meets the water quality requirement utilizing the wet detention basins. The outlet control structure and orifice have been sized to drain the required water quality volume within 24 hours, per the requirements.

Reference Appendix D for full Water Quality Calculations.

APPENDIX A:
SITE PLANS



SITE LEGEND

EXISTING

REFER TO ALTA/NSPS TOPOGRAPHIC SURVEY

PROPOSED

- R/W — RIGHT-OF-WAY (BOUNDARY)
- P/L — PROPERTY LINE
- LA/R/W — LANDSCAPE RIGHT OF WAY
- SETBACK
- EASEMENT
- BUILDING
- CONCRETE CURB
- PAVEMENT/WALK
- PARKING SPACE COUNT
- SIGN
- LIGHT POLE
- BOLLARD
- CO — CLEAN OUT
- CURB INLET
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BENCHMARK

Vertical Datum: NAVD88
derived from GPS Observations

BM "A":	Benchnail set northwest corner of power pole. South side of Earlywood Dr., east from service entrance to Dodge dealership. Elevation = 776.83'
BM "B":	Chiseled "X" southeast corner of concrete pad for signal pole. Northeast corner of U.S. 31 and Earlywood Dr., intersection, southwest from traffic control box. Elevation = 779.95'
BM "C":	Chiseled "X" on arrow bolt west side of hydrant, south side of Sloan Rd., across the street from the fire station, near the end of the sidewalk. Elevation = 780.33'
BM "D":	Chiseled "X" on bolt west side of hydrant. West from telephone box southeast corner of Sloan Rd. and U.S. 31. Elevation = 778.03'

Indiana 811
Know what's below. Call before you dig.

FORTY-EIGHT (48) HOURS BEFORE DIGGING IS TO COMMENCE, THE CONTRACTORS SHALL NOTIFY THE FOLLOWING AGENCIES: INDIANA UTILITIES PROTECTION SERVICE AT 811 OR 800-382-5544 AND ALL OTHER AGENCIES WHICH MIGHT HAVE UNDERGROUND UTILITIES INVOLVING THIS PROJECT AND ARE NONMEMBERS OF STATE UTILITIES PROTECTION SERVICE

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Wawa

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ZACHARY D. FRESHWATER
REGISTERED
PE11300243
STATE OF
INDIANA
PROFESSIONAL ENGINEER

WAWA
STORE #7426

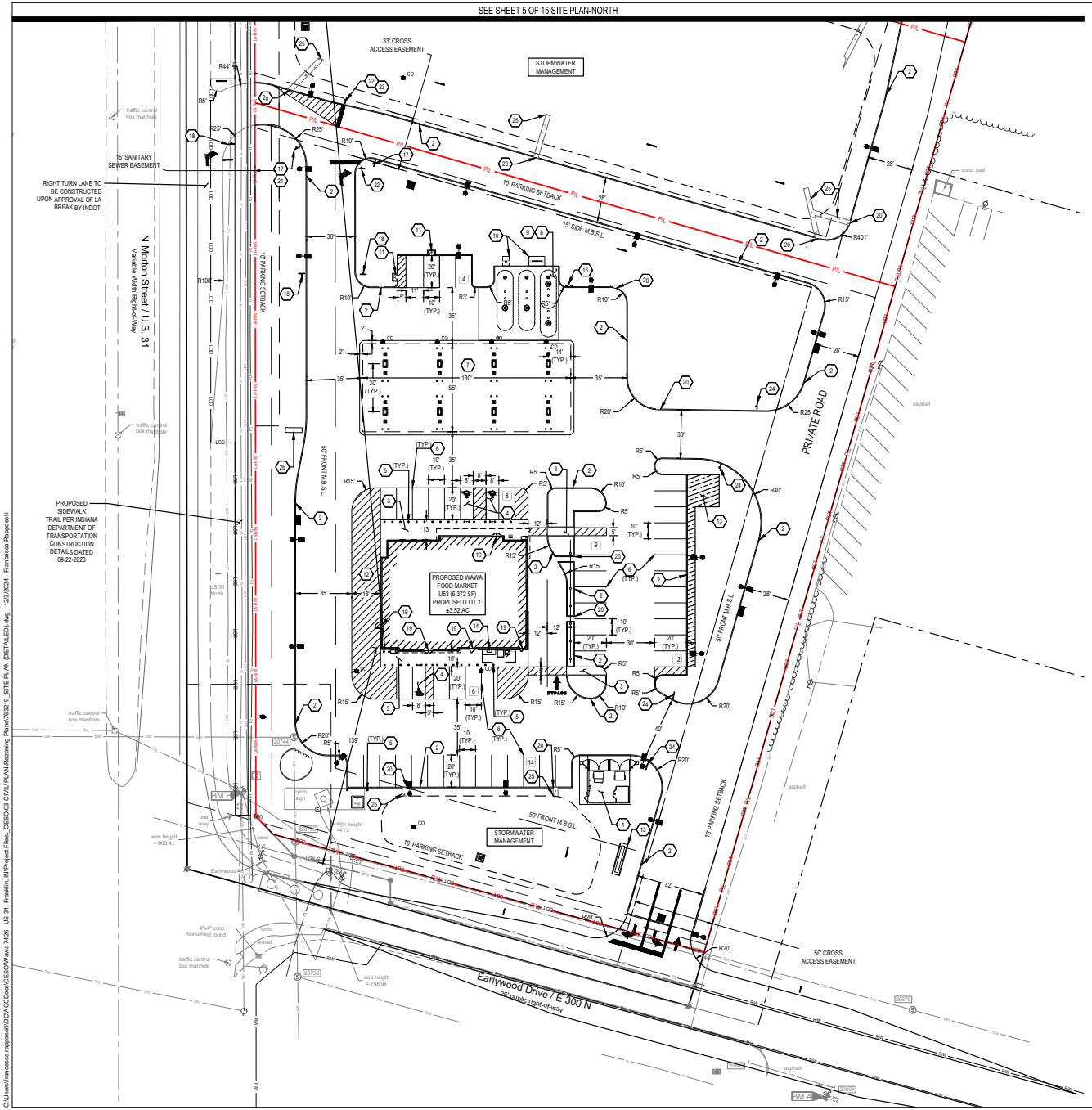
FRANKLIN, IN
NE HIGHWAY 31ST & E COUNTY ROAD 300 N (EARLYWOOD DRIVE)
FRANKLIN, IN 46131

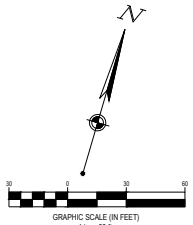
Revisions / Submissions

ID	Description	Date

Project Number:	763219
Scale:	1"=50'
Drawn By:	FAR
Checked By:	JTK
Date:	12/04/2024
Issue:	NOT FOR CONSTRUCTION

Drawing Title:
OVERALL SITE PLAN





SITE LEGEND

EXISTING

REFER TO ALTA/NSPS TOPOGRAPHIC SURVEY

PROPOSED

- RIGHT-OF-WAY
- PROPERTY LINE
- LANDSCAPE RIGHT OF WAY
- SETBACK
- EASEMENT
- BUILDING
- CONCRETE CURB
- PAVEMENT/WALK
- PARKING SPACE COUNT
- SIGN
- LIGHT POLE
- BOLLARD
- CLEAN OUT
- CURB INLET
- HEADWALL
- CATCH BASIN

SITE REQUIREMENTS:

BUILDING SETBACKS: FRONTAGE ALONG (EAST PRIVATE ROAD) - 50'
FRONTAGE ALONG (US 31 ROW) - 50'
FRONTAGE ALONG (EARLYWOOD DRIVE / E 300N) - 50'
SIDE YARD - 15'
REAR YARD - 20'

PARKING SETBACKS: FRONTAGE ALONG (EAST PRIVATE ROAD) - 10'
FRONTAGE ALONG (US 31 ROW) - 10'
FRONTAGE ALONG (EARLYWOOD DRIVE / E 300N) - 10'
SIDE YARD - 10'
REAR YARD - 10'

STANDARD PARKING DIMENSIONS: 10'Wx20'

PARKING REQUIRED: WAWA C-STORE:
(1) SPACE PER 300 S.F. OF GROSS FLOOR AREA
6,372 x (1/300 GFA) = 22 SPACES

TOTAL PARKING REQUIRED = 22 SPACES

TOTAL PARKING PROPOSED = 53 SPACES

CODED NOTES:

1. PROPOSED 8' MASONRY TRASH ENCLOSURE W/ 8" REINFORCED CONCRETE PAD.
2. PROPOSED 6" STRAIGHT CURB.
3. PROPOSED 4" CONCRETE SIDEWALK (4,000 PSI).
4. ADA ACCESSIBLE PARKING SPACE WITH SIGNAGE.
5. PROPOSED 6" CONCRETE BOLLARD. TYPICAL DISTANCE BETWEEN BOLLARDS ARE 5'.
6. PROPOSED 4" YELLOW PAINT PARKING LOT PAVEMENT MARKINGS.
7. PROPOSED 130' X 55' FUELING CANOPY (7,150 SF)
8. PROPOSED 8" CONCRETE PAD (4,000 PSI)
9. PROPOSED TWO (2) 22K AND TWO (2) 20K FUEL STORAGE TANKS. REFER TO FUELING PLANS FOR DETAILS.
10. PROPOSED 6'X6' VENT RISER CONCRETE PAD (4,000 PSI) WITH TWO BOLLARDS.
11. PROPOSED AIR PUMP.
12. PROPOSED 8" CONCRETE LOADING ZONE (4,000 PSI).
13. LIMITED BUILD AREA FOR FUTURE EV EQUIPMENT.
14. PROPOSED ICE CHEST.
15. PROPOSED GROUND MOUNTED SIGN.
16. E-STOP BUTTON LOCATION.
17. PROPOSED DO NOT ENTER SIGN.
18. PROPOSED RIGHT-IN SIGN.
19. PROPOSED BUILDING DOOR.
20. PROPOSED 3' CURB CUT.
21. PROPOSED ONE-WAY SIGN.
22. PROPOSED STOP SIGN.
23. PROPOSED LEFT TURN ONLY SIGN.
24. PROPOSED DIRECTIONAL SIGN.
25. PROPOSED 3' W CONCRETE FLUME.
26. PROPOSED PYLON SIGN.

SITE NOTES:

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2. ALL WET OR OTHERWISE UNSUITABLE SOILS MUST BE STABILIZED PRIOR TO PAVEMENT CONSTRUCTION.
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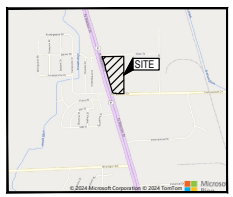
4. ALL RADII TO BE 3'-0" UNLESS OTHERWISE NOTED.
5. REFER TO ARCHITECTURAL DRAWINGS FOR BUILDING LAYOUT AND DIMENSIONS AND PROPOSED SIGNS.



VICINITY MAP
NO SCALE

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ZACHARY D. FRESHWATER
REGISTERED PROFESSIONAL ENGINEER
PE11300243
STATE OF INDIANA

WAWA
STORE #7426

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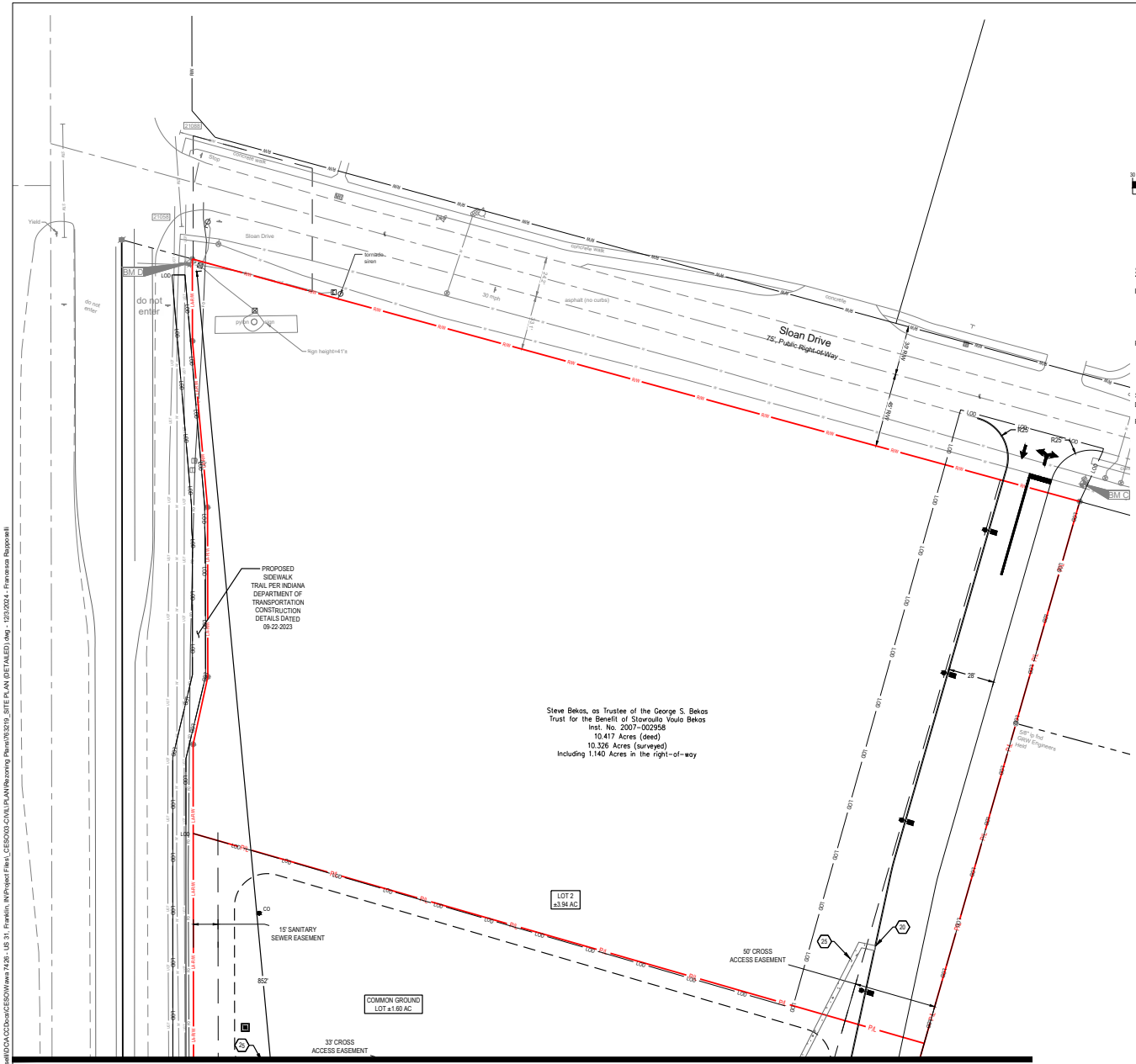
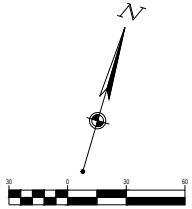
Revisions / Submissions

ID	Description	Date

Project Number:	763219
Scale:	1"=30'
Drawn By:	FAR
Checked By:	JTK
Date:	12/04/2024
Issue:	NOT FOR CONSTRUCTION

Drawing Title:
SITE PLAN-SOUTH





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VICINITY MAP
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Checked By:	JTK
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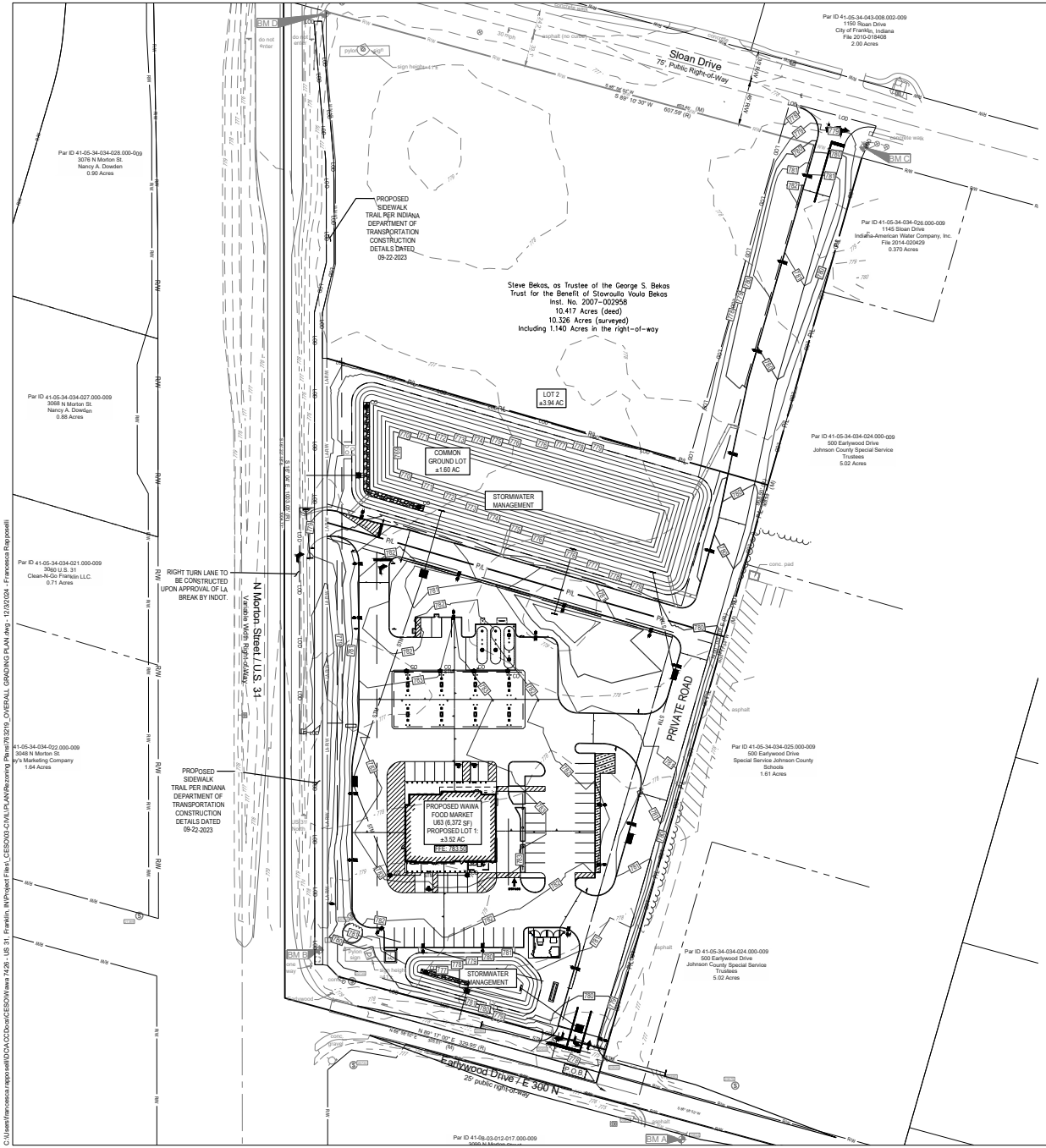
Issue:	NOT FOR CONSTRUCTION

Drawing Title:
SITE PLAN-NORTH

5 OF 15



GRADING LEGEND

EXISTING

REFER TO ALTA/NSPS TOPOGRAPHIC SURVEY

PROPOSED

- PIL — PROPERTY LINE
- SETBACK
- EASEMENT
- BUILDING
- 780 — MAJOR CONTOUR
- 781 — MINOR CONTOUR
- GRADE BREAK
- CO — CLEAN OUT
- CURB INLET
- STM — STORM SEWER LINE
- HEADWALL
- CATCH BASIN

GRADING NOTES:

1. REFER TO SECTION 9 WAWA EARTHWORK / GRADING / CLEARING / DEMOLITION SPECIFICATIONS FOR ADDITIONAL REQUIREMENTS THAT SHOULD BE FACTORED IN BIDDING, PREPARING THE SITE, AND SITE TURNOVER. ANY CONFLICTS OR DISCREPANCIES BETWEEN THE PLANS AND SPECIFICATIONS SHOULD BE BROUGHT TO THE ATTENTION OF THE ENGINEER TO OBTAIN CLARIFICATION.

EARTHWORK QUANTITIES

RAW CUT (CY)	RAW FILL (CY)
6599	23895

*ESTIMATED QUANTITIES NOT FOR BIDDING

BENCHMARK

Vertical Datum: NAVD88
derived from GPS Observations

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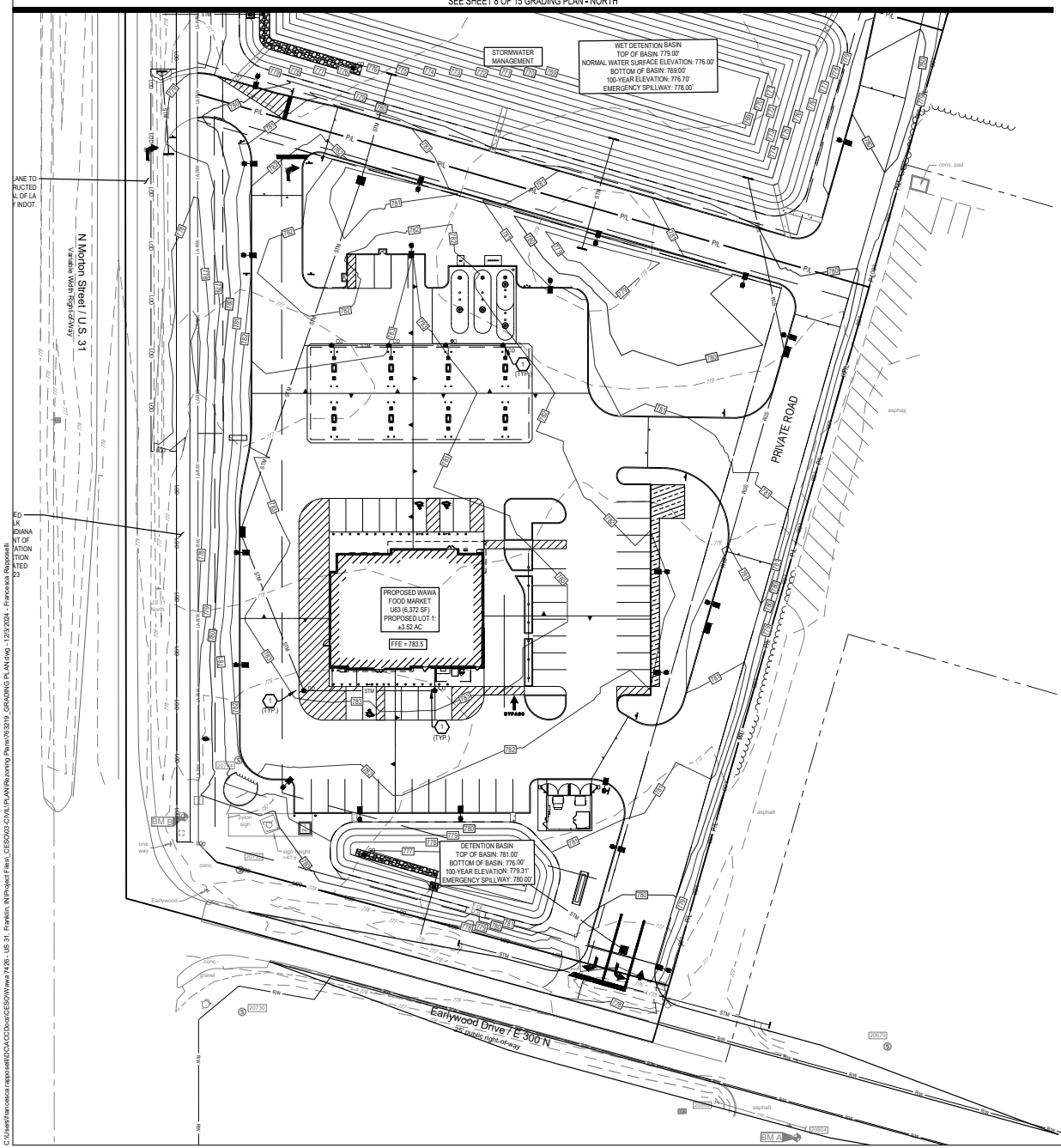
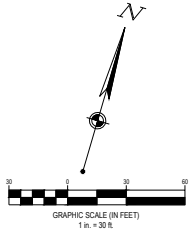
Issue:	NOT FOR CONSTRUCTION

Drawing Title:
OVERALL GRADING

C:\Users\francesca.rapposelli\ID\OA\CCDocs\CESO\Wawa 7426 - US 31, Franklin, IN\Project Files_CESO\03-CIVIL\PLAN\Rezoning Plans\763219_OVERALL GRADING PLAN.dwg - 12/3/2024 - Francesca Rapposelli





GRADING LEGEND

EXISTING

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- 780 MAJOR CONTOUR
- 781 MINOR CONTOUR
- GRADE BREAK
- CO CLEAN OUT
- CURB INLET
- STM STORM SEWER LINE
- HEADWALL
- CATCH BASIN

GRADING NOTES:

1. REFER TO SECTION 9 WAWA EARTHWORK / GRADING / CLEARING / DEMOLITION SPECIFICATIONS FOR ADDITIONAL REQUIREMENTS THAT SHOULD BE FACTORED IN BIDDING, PREPARING THE SITE, AND SITE TURNOVER. ANY CONFLICTS OR DISCREPANCIES BETWEEN THE PLANS AND SPECIFICATIONS SHOULD BE BROUGHT TO THE ATTENTION OF THE ENGINEER TO OBTAIN CLARIFICATION.

CODED NOTES:

1. WYE CONNECTION

EARTHWORK QUANTITIES

RAW CUT (CY)	RAW FILL (CY)
6599	23895

*ESTIMATED QUANTITIES NOT FOR BIDDING

BENCHMARK

Vertical Datum: NAVD88
derived from GPS Observations

BM "A":	Benchnail set northwest corner of power pole. South side of Earlywood Dr., east from service entrance to Dodge dealership. Elevation = 776.83'
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BM "C":	Chiseled "X" on arrow bolt west side of hydrant, south side of Sloan Rd., across the street from the fire station, near the end of the sidewalk. Elevation = 780.33'
BM "D":	Chiseled "X" on bolt west side of hydrant. West from telephone box southeast corner of Sloan Rd. and U.S. 31. Elevation = 778.03'

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Phone: 314.834.0883 Fax: 888.208.4826

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ZACHARY D. FRESHWATER
REGISTERED
PE11300243
STATE OF
INDIANA
PROFESSIONAL ENGINEER

WAWA
STORE #7426

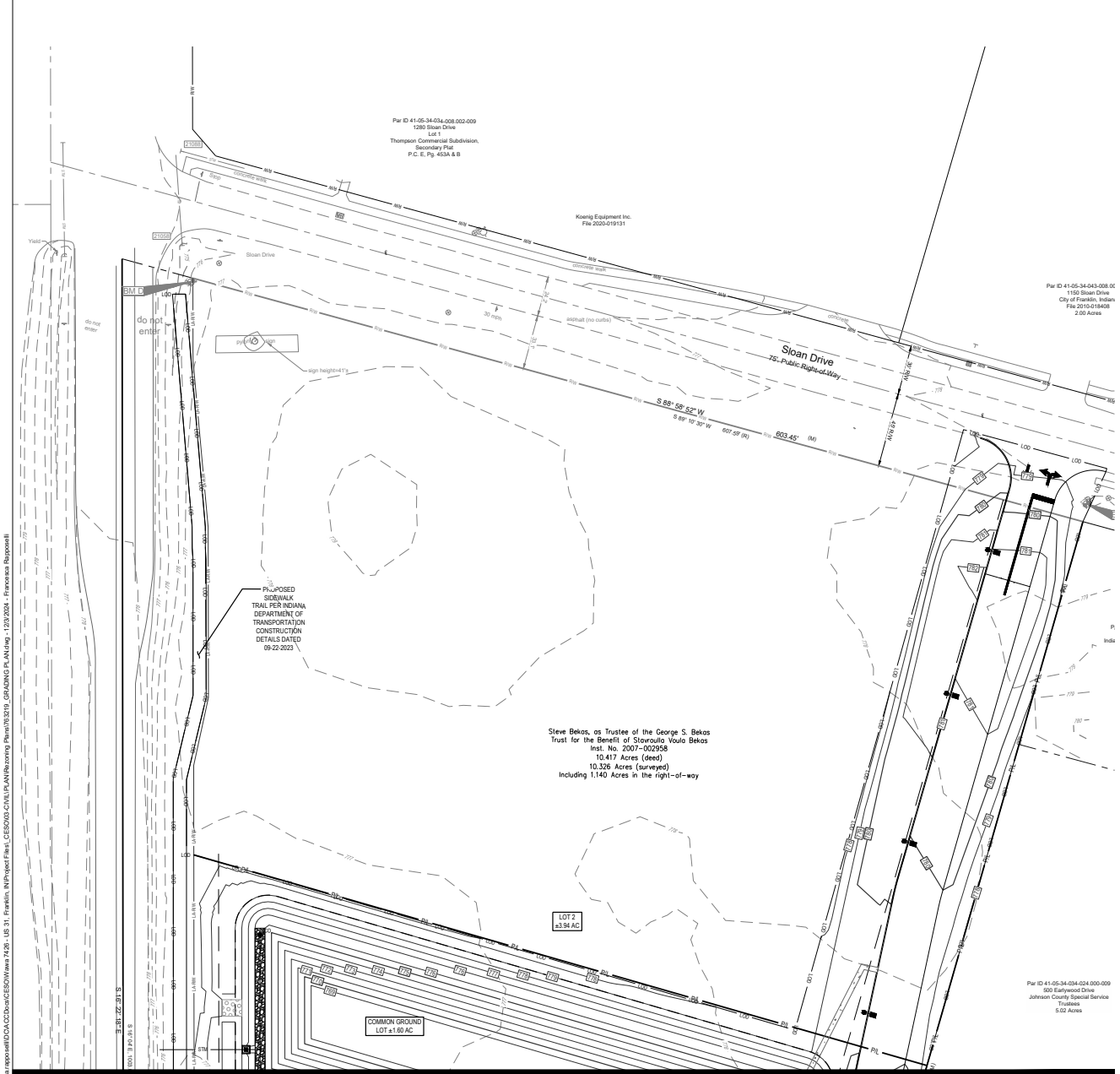
FRANKLIN, IN
NE HIGHWAY 31ST & E COUNTY ROAD 300 N (EARLYWOOD DRIVE)
FRANKLIN, IN 46131

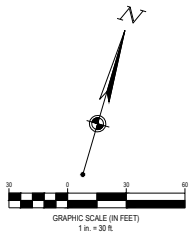
Revisions / Submissions

ID	Description	Date

Project Number:	763219
Scale:	1"=30'
Drawn By:	FAR
Checked By:	JTK
Date:	12/04/2024
Issue:	NOT FOR CONSTRUCTION

Drawing Title:
GRADING PLAN - SOUTH





GRADING LEGEND

EXISTING

REFER TO ALTA/NSPS TOPOGRAPHIC SURVEY

PROPOSED

- RIGHT-OF-WAY
- PROPERTY LINE
- SETBACK
- EASEMENT
- BUILDING
- MAJOR CONTOUR
- MINOR CONTOUR
- GRADE BREAK
- CLEAN OUT
- CURB INLET
- STORM SEWER LINE
- HEADWALL
- CATCH BASIN

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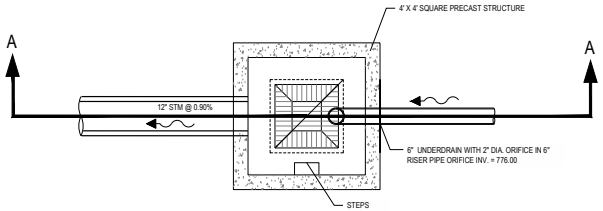
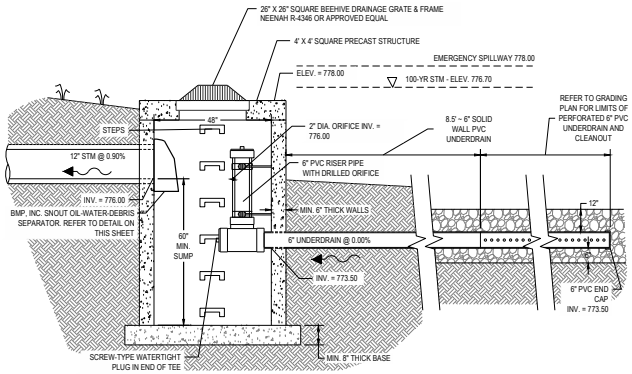
Drawing Title:
GRADING PLAN - NORTH

8 OF 15

C:\Users\francesca.rapposelli\DOCA.CC\Docs\CESO\Wawa 7426 - US 31, Franklin, IN\Project Files_CESO\03-CIVIL\PLAN\Rezoning Plans\763219_GRADING PLAN.dwg - 12/3/2024 - Francesca Rapposelli



PLAN VIEW
NTS



SECTION A-A
NTS

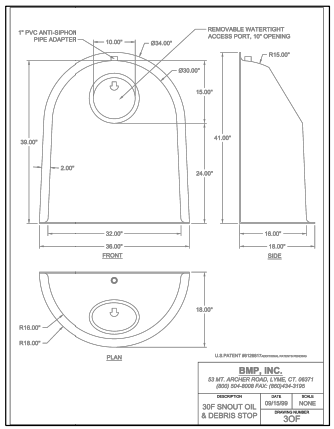
GRADING LEGEND

EXISTING

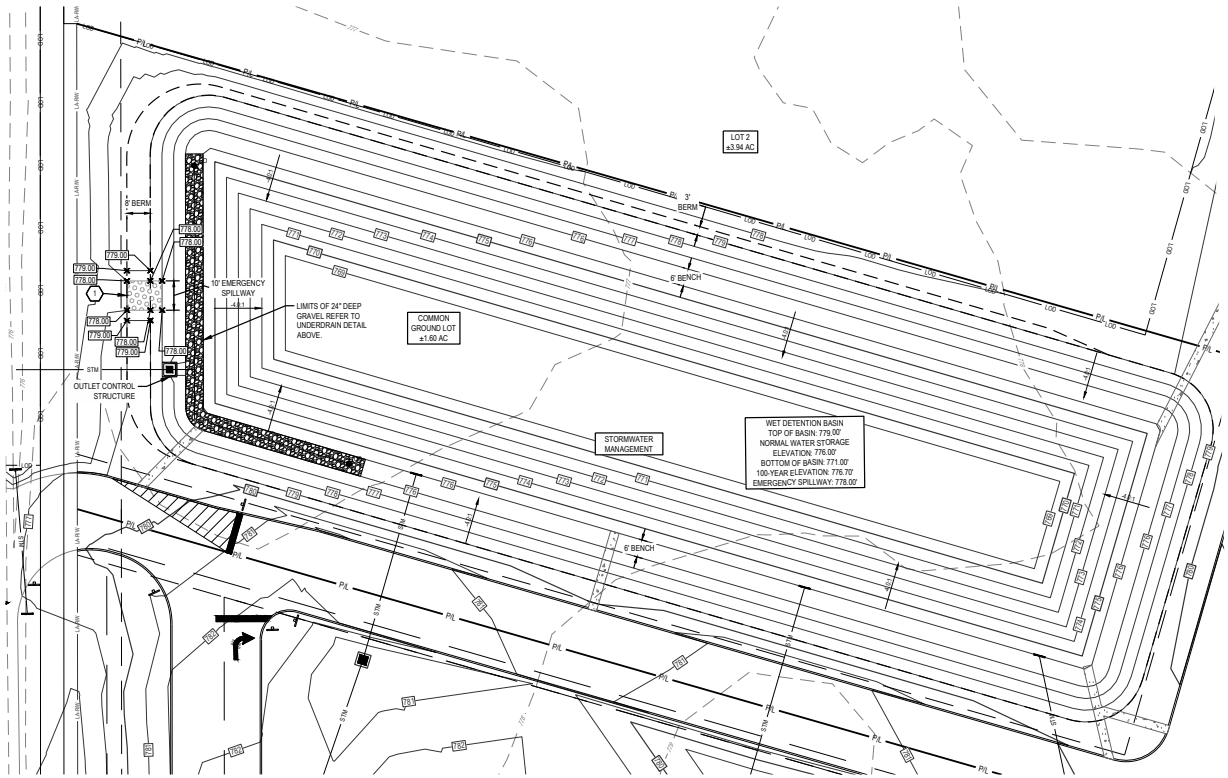
REFER TO ALTA/NSPS TOPOGRAPHIC SURVEY

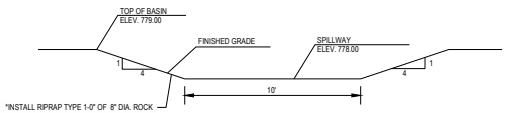
PROPOSED

- 780 — MAJOR CONTOUR
- 781 — MINOR CONTOUR
- CURB INLET
- STM — STORM SEWER LINE
- HEADWALL
- CO — CLEANOUT



OUTLET STRUCTURE
NTS





EMERGENCY SPILLWAY
NTS

CODED NOTES:

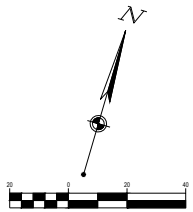
1. SHOREMAX FLEXIBLE TRANSITION MAT.

North Basin Spillway Calculations

(Q100) Estimated 100-yr Flow = 21.45 cfs

(Qs) Spillway Capacity = $C_w * L * (h^{3/2})$

Spillway Coefficient, C_w = 2.90
Bottom Width, L = 10.00 ft
Height, h = 1.00 ft
Qs = 29.00 cfs



GRAPHIC SCALE (IN FEET)
1 in. = 20 ft.

BMP WATER QUALITY STRUCTURE NOTICE

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EARTHWORK QUANTITIES

RAW CUT (CY)	RAW FILL (CY)
5791	23947

*ESTIMATED QUANTITIES NOT FOR BIDDING

BENCHMARK

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ZACHARY D. FRESHWATER
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STORE #7426

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FRANKLIN, IN 46131

Revisions / Submissions

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Checked By:	JTK
Date:	12/04/2024
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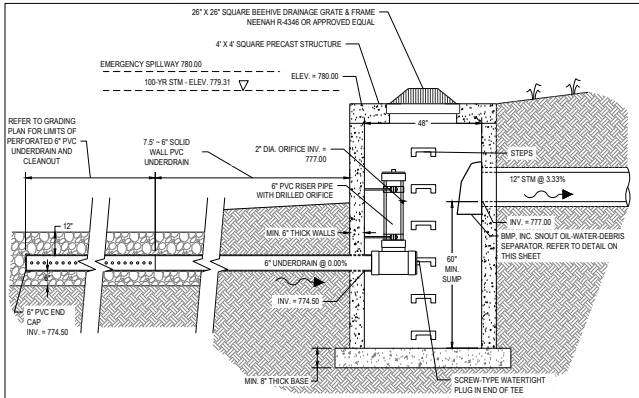
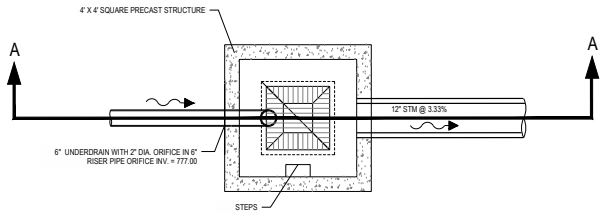
Drawing Title:
ENLARGED STORMWATER MANAGEMENT DETAIL NORTH BASIN



SECTION A-A
NTS



PLAN VIEW
NTS

GRADING LEGEND

EXISTING

REFER TO ALTA/NSPS TOPOGRAPHIC SURVEY

PROPOSED

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- 781 — MINOR CONTOUR
- CURB INLET
- STM — STORM SEWER LINE
- HEADWALL
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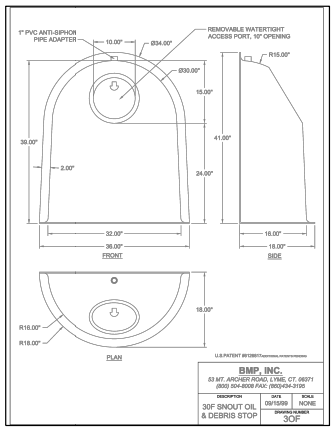

OUTLET STRUCTURE
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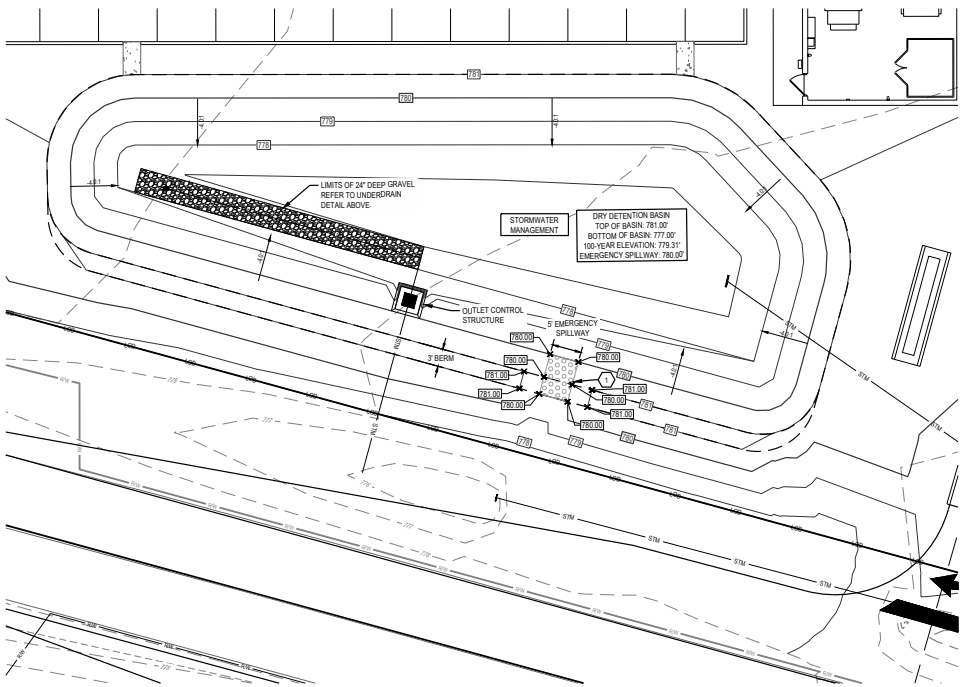
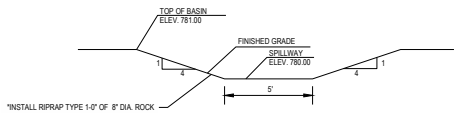




EMERGENCY SPILLWAY
NTS

CODED NOTES:

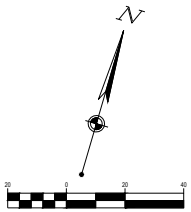
1. SHOREMAX FLEXIBLE TRANSITION MAT.

Southeast Basin Spillway Calculations

(Q100) Estimated 100-yr Flow = 5.56 cfs

(Qs) Spillway Capacity = $C_w * L * (h^{3/2})$

Spillway Coeffient, C_w = 2.90
Bottom Width, L = 5.00 ft
Height, h = 1.00 ft
Qs = 14.50 cfs



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Revisions / Submissions

ID	Description	Date

Project Number:	763219
Scale:	1"=10'
Drawn By:	FAR
Checked By:	JTK
Date:	12/04/2024
Issue:	NOT FOR CONSTRUCTION

Drawing Title:
ENLARGED STORMWATER MANAGEMENT DETAIL SOUTHEAST BASIN

10 OF 15

APPENDIX B:
PRE- AND POST-DEVELOPED DRAINAGE PLANS

PRE-DEVELOPED NORTHWEST DRAINAGE AREA

	GRASS COVER >75% (HSG RATING 'D' GOOD CONDITION)	- 5.38 ACRES (CN = 80)
	TOTAL:	- 5.38 ACRES (CN = 80)

PRE-DEVELOPED SOUTHEAST DRAINAGE AREA

	GRASS COVER >75% (HSG RATING 'D' GOOD CONDITION)	- 0.79 ACRES (CN = 80)
	TOTAL:	- 0.79 ACRES (CN = 80)

PRE-DEVELOPED LEGEND

- WEST DRAINAGE AREA BOUNDARY
- SOUTHEAST DRAINAGE AREA BOUNDARY
- SOIL BOUNDARY
- Xx — SOIL IDENTIFIER

TOTAL AREA : 6.31 ACRES

GRAPHIC SCALE (IN FEET)
1 in. = 50 ft.

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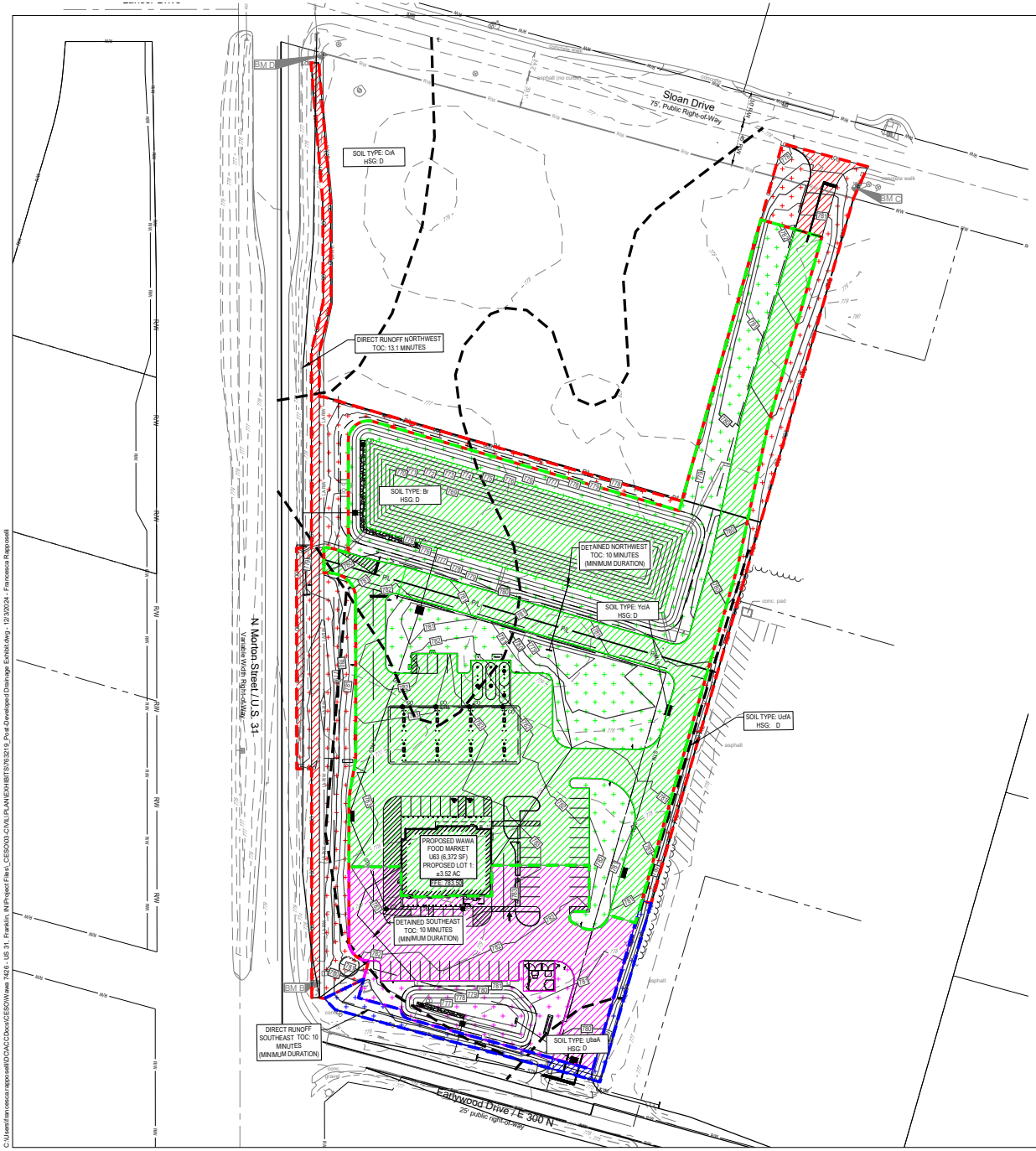
Drawn By:	FAR
Checked By:	JTK
Date:	09/05/2024
Issue:	NOT FOR CONSTRUCTION

Drawing Title:
PRE-DEVELOPED DRAINAGE EXHIBIT

EX 1.0



POST DEVELOPED NORTHWEST DRAINAGE AREA DETAINED

GRASS COVER >75% (HSG RATING 'D' GOOD CONDITION)	- 1.33 ACRES (CN = 80)	
IMPERVIOUS AREA (HSG RATING 'D' GOOD CONDITION)	- 2.59 ACRES (CN = 98)	
TOTAL:	- 3.92 ACRES (CN = 92)	

POST DEVELOPED NORTHWEST DRAINAGE AREA DIRECT RUNOFF

GRASS COVER >75% (HSG RATING 'D' GOOD CONDITION)	- 0.88 ACRES (CN = 80)	
IMPERVIOUS AREA (HSG RATING 'D' GOOD CONDITION)	- 0.27 ACRES (CN = 98)	
TOTAL:	- 1.16 ACRES (CN = 84)	

POST DEVELOPED SOUTHEAST DRAINAGE AREA (DETAINED)

GRASS COVER >75% (HSG RATING 'D' GOOD CONDITION)	- 0.26 ACRES (CN = 80)	
IMPERVIOUS AREA (HSG RATING 'D' GOOD CONDITION)	- 0.70 ACRES (CN = 98)	
TOTAL:	- 0.96 ACRES (CN = 93)	

POST DEVELOPED SOUTHEAST DRAINAGE AREA DIRECT RUNOFF

GRASS COVER >75% (HSG RATING 'D' GOOD CONDITION)	- 0.12 ACRES (CN = 80)	
IMPERVIOUS AREA (HSG RATING 'D' GOOD CONDITION)	- 0.01 ACRES (CN = 98)	
TOTAL:	- 0.13 ACRES (CN = 81)	

PRE-DEVELOPED LEGEND

- WEST DRAINAGE AREA BOUNDARY
- WEST DRAINAGE AREA BOUNDARY DIRECT RUNOFF BOUNDARY
- SOUTHEAST DRAINAGE AREA BOUNDARY
- SOUTHEAST DRAINAGE AREA DIRECT RUNOFF BOUNDARY
- SOIL BOUNDARY
- Xx — SOIL IDENTIFIER

TOTAL AREA : 6.31 ACRES

GRAPHIC SCALE (IN FEET)
1 in. = 50 ft.

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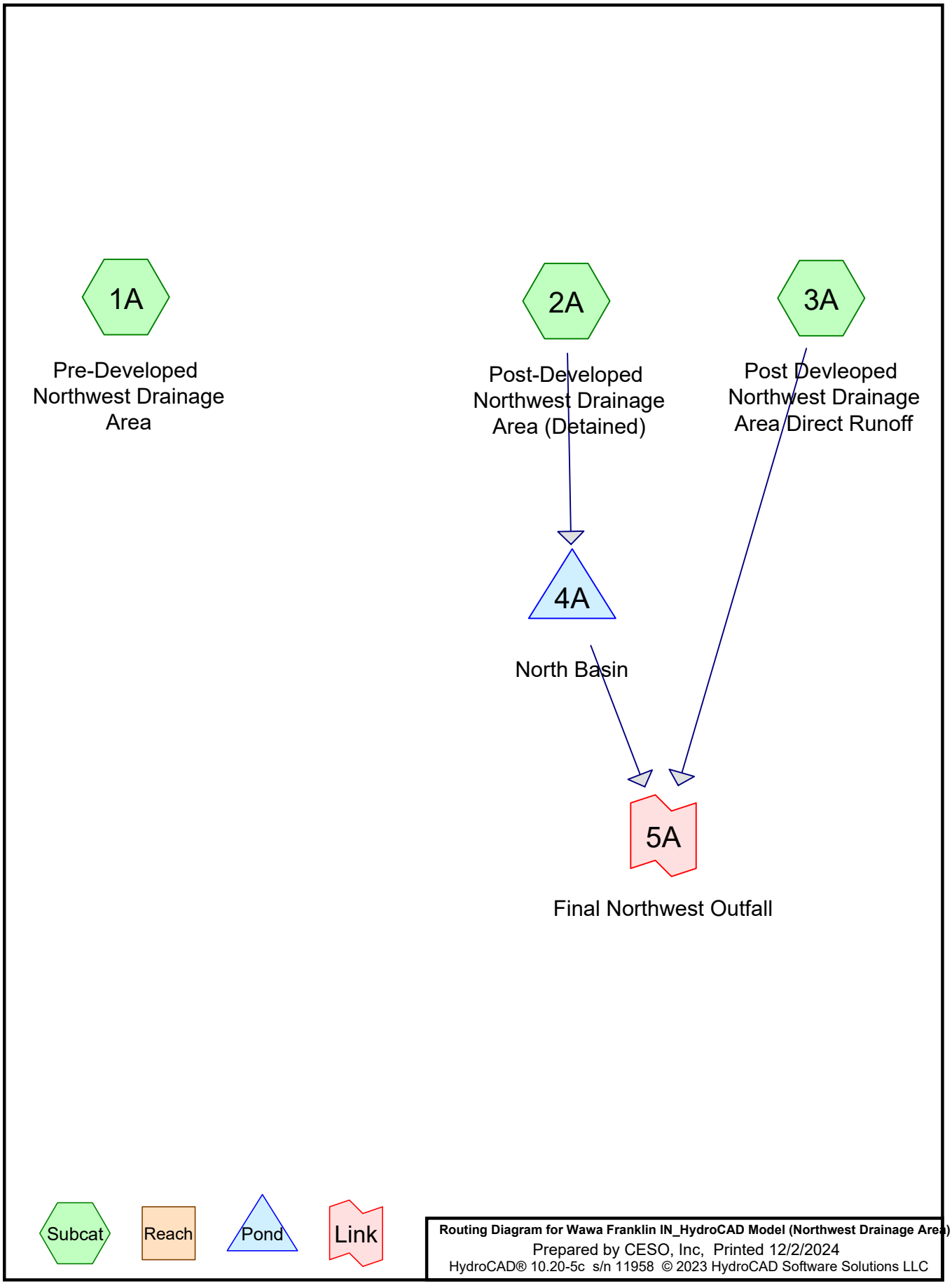
Drawing Title:
POST DEVELOPED DRAINAGE EXHIBIT

EX 2.0

APPENDIX C:
HYDROCAD REPORT

APPENDIX C1.1:
NORTHWEST DRAINAGE AREA REPORT



Routing Diagram for Wawa Franklin IN_HydroCAD Model (Northwest Drainage Area)

Prepared by CESO, Inc, Printed 12/2/2024

Rainfall Events Listing

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	2-YEAR	Huff 0-10sm	1Q	Scale	0.50	1	1.08	2
2	10-YEAR	Huff 0-10sm	1Q	Scale	0.50	1	1.57	2
3	100-YEAR	Huff 0-10sm	1Q	Scale	0.50	1	2.53	2

Summary for Subcatchment 1A: Pre-Developed Northwest Drainage Area

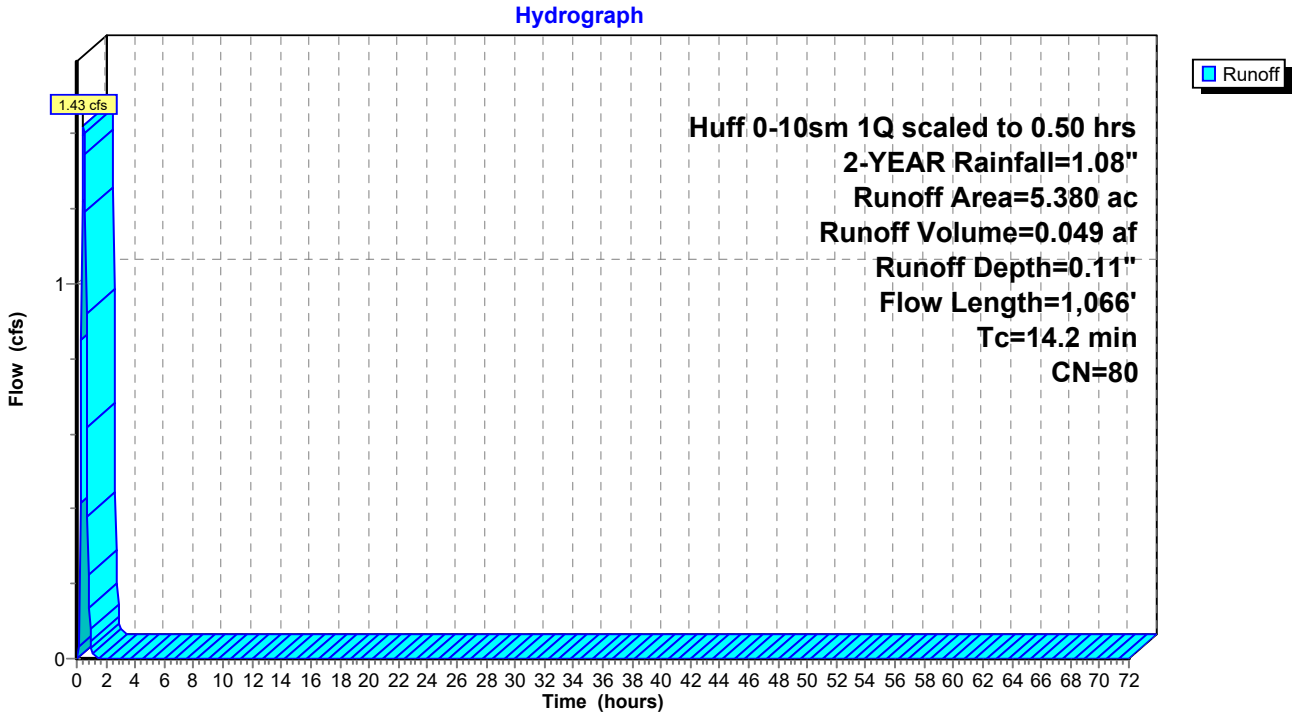
Runoff = 1.43 cfs @ 0.45 hrs, Volume= 0.049 af, Depth= 0.11"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Huff 0-10sm 1Q scaled to 0.50 hrs 2-YEAR Rainfall=1.08"

Area (ac)	CN	Description
5.380	80	>75% Grass cover, Good, HSG D
5.380		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.0	100	0.0170	0.15		**Sheet Flow, Sheet Flow** Grass: Short n= 0.150 P2= 2.91"
3.2	343	0.0670	1.81		**Shallow Concentrated Flow, Shallow Concentrated Flow** Short Grass Pasture Kv= 7.0 fps
0.0	623	0.2300	2,362194	304,766.71	**Channel Flow, Channel Flow** Area= 4,361.0 sf Perim= 7.0' r= 623.00' n= 0.022 Earth, clean & straight
14.2	1,066	Total			

Subcatchment 1A: Pre-Developed Northwest Drainage Area



Summary for Subcatchment 2A: Post-Developed Northwest Drainage Area (Detained)

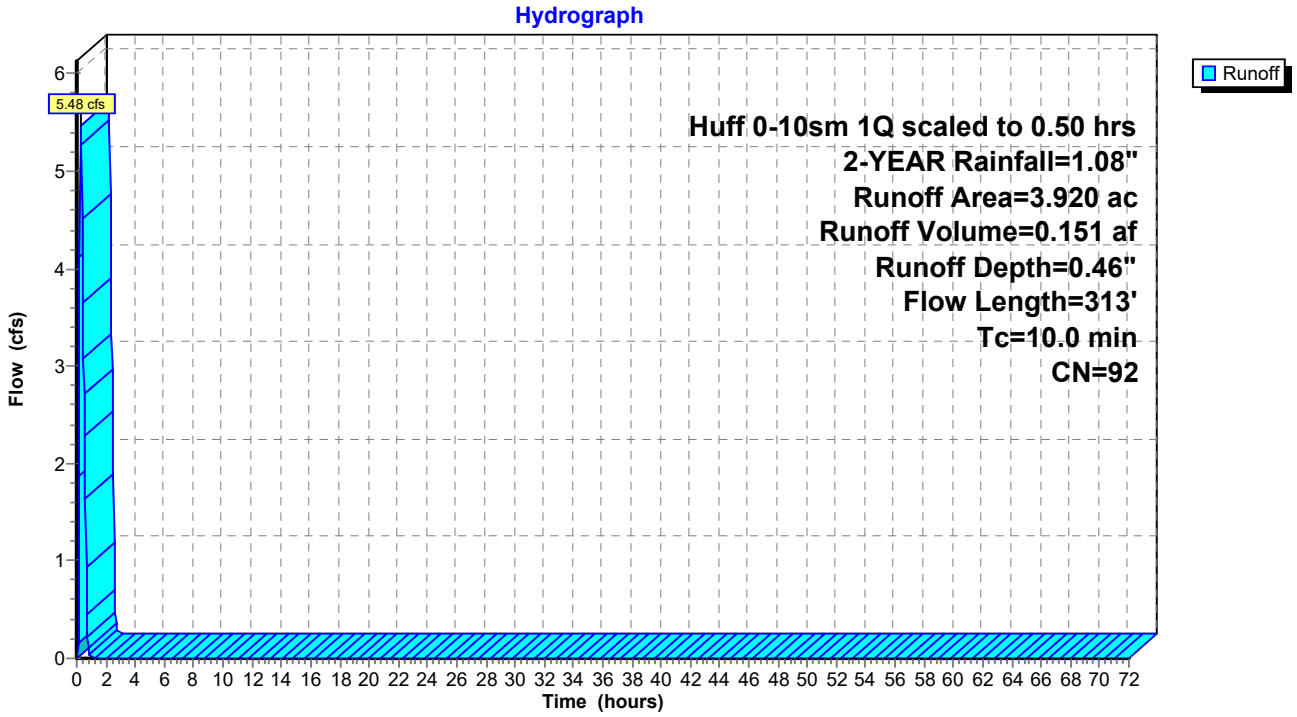
Runoff = 5.48 cfs @ 0.27 hrs, Volume= 0.151 af, Depth= 0.46"
Routed to Pond 4A : North Basin

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Huff 0-10sm 1Q scaled to 0.50 hrs 2-YEAR Rainfall=1.08"

Area (ac)	CN	Description
1.330	80	>75% Grass cover, Good, HSG D
2.590	98	Paved parking, HSG D
3.920	92	Weighted Average
1.330		33.93% Pervious Area
2.590		66.07% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.9	100	0.0025	0.57		**Sheet Flow, Sheet Flow** Smooth surfaces n= 0.011 P2= 2.91"
0.7	43	0.0025	1.02		**Shallow Concentrated Flow, Shallow Concentrated Flow** Paved Kv= 20.3 fps
2.5	111	0.0021	0.74		**Shallow Concentrated Flow, Shallow Concentrated Flow** Unpaved Kv= 16.1 fps
0.6	34	0.0021	0.93		**Shallow Concentrated Flow, Shallow Concentrated Flow** Paved Kv= 20.3 fps
0.1	25	0.0330	2.92		**Shallow Concentrated Flow, Shallow Concentrated Flow** Unpaved Kv= 16.1 fps
3.2					**Direct Entry, Direct Entry (To Reach Minmimum TOC)**
10.0	313	Total			

Subcatchment 2A: Post-Developed Northwest Drainage Area (Detained)



Summary for Subcatchment 3A: Post Devleoped Northwest Drainage Area Direct Runoff

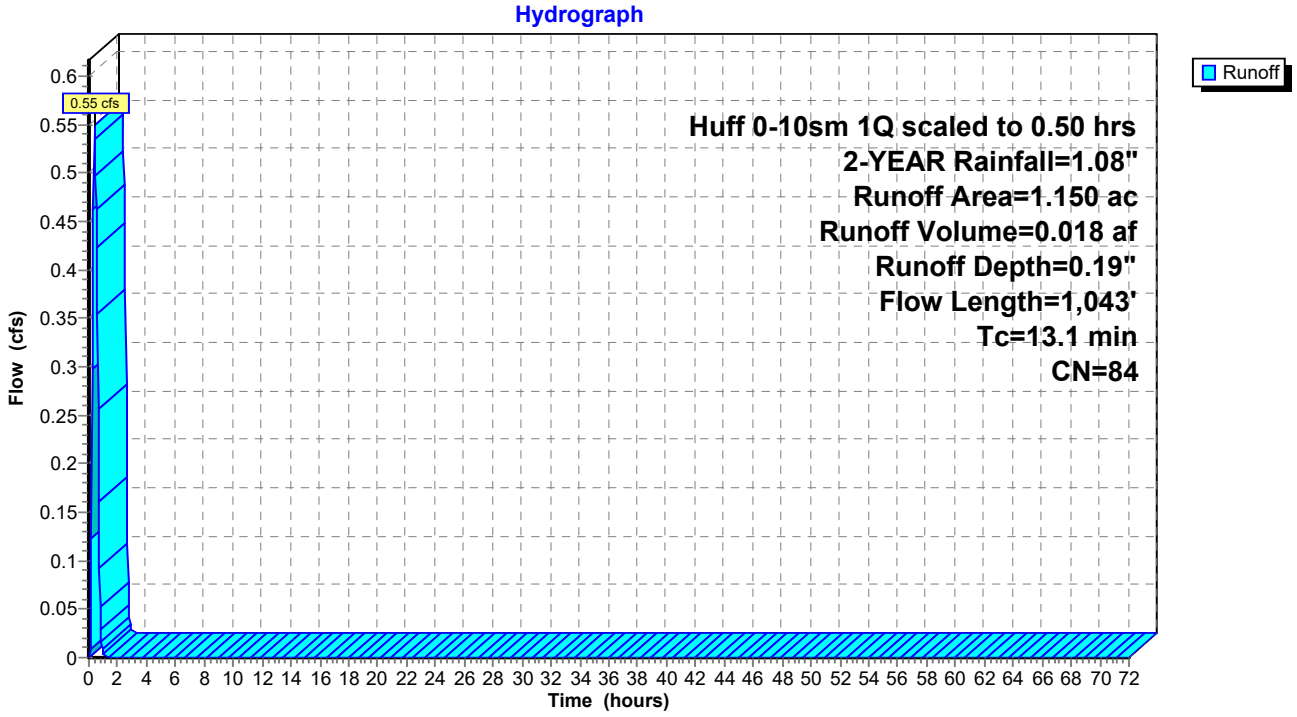
Runoff = 0.55 cfs @ 0.37 hrs, Volume= 0.018 af, Depth= 0.19"
Routed to Link 5A : Final Northwest Outfall

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Huff 0-10sm 1Q scaled to 0.50 hrs 2-YEAR Rainfall=1.08"

Area (ac)	CN	Description
0.880	80	>75% Grass cover, Good, HSG D
0.270	98	Paved parking, HSG D
1.150	84	Weighted Average
0.880		76.52% Pervious Area
0.270		23.48% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.6	100	0.0120	0.13		**Sheet Flow, Sheet Flow** Grass: Short n= 0.150 P2= 2.91"
0.5	50	0.0110	1.69		**Shallow Concentrated Flow, Shallow Concentrated Flow** Unpaved Kv= 16.1 fps
0.0	893	0.0150	767.14	4795,407.99	**Channel Flow, Channel Flow** Area= 6,251.0 sf Perim= 7.0' r= 893.00' n= 0.022 Earth, clean & straight
13.1	1,043	Total			

Subcatchment 3A: Post Devleoped Northwest Drainage Area Direct Runoff



Summary for Pond 4A: North Basin

Inflow Area = 3.920 ac, 66.07% Impervious, Inflow Depth = 0.46" for 2-YEAR event
Inflow = 5.48 cfs @ 0.27 hrs, Volume= 0.151 af
Outflow = 0.05 cfs @ 0.86 hrs, Volume= 0.109 af, Atten= 99%, Lag= 35.0 min
Primary = 0.05 cfs @ 0.86 hrs, Volume= 0.109 af
Routed to Link 5A : Final Northwest Outfall

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 776.19' @ 0.86 hrs Surf.Area= 34,260 sf Storage= 6,492 cf

Plug-Flow detention time= 1,398.5 min calculated for 0.109 af (72% of inflow)
Center-of-Mass det. time= 1,394.1 min (1,416.0 - 21.8)

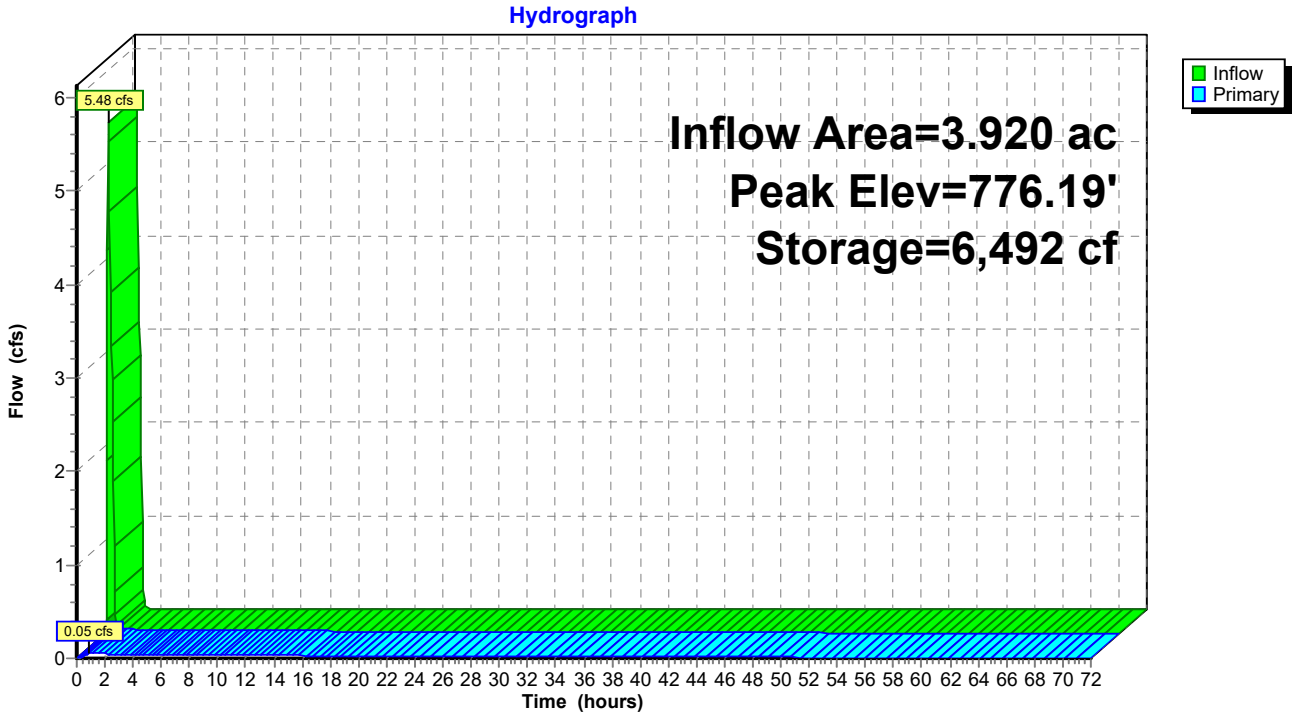
Volume	Invert	Avail.Storage	Storage Description
#1	776.00'	116,836 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
776.00	33,587	0	0
777.00	37,103	35,345	35,345
778.00	40,720	38,912	74,257
779.00	44,438	42,579	116,836

Device	Routing	Invert	Outlet Devices
#1	Primary	776.00'	**12.0" Round Culvert** L= 52.0' Ke= 0.500 Inlet / Outlet Invert= 776.00' / 775.52' S= 0.0092 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.79 sf
#2	Device 1	776.00'	**2.5" Vert. Orifice/Grate (WQ Orifice)** C= 0.600 Limited to weir flow at low heads
#3	Device 1	778.00'	**2.0" x 4.0" Horiz. Orifice/Grate X 6.00 columns** X 5 rows C= 0.600 in 24.0" x 24.0" Grate (42% open area) Limited to weir flow at low heads

Primary OutFlow Max=0.05 cfs @ 0.86 hrs HW=776.19' (Free Discharge)
└**1=Culvert** (Passes 0.05 cfs of 0.15 cfs potential flow)
  ├**2=Orifice/Grate (WQ Orifice)** (Orifice Controls 0.05 cfs @ 1.49 fps)
  └**3=Orifice/Grate** (Controls 0.00 cfs)

Pond 4A: North Basin

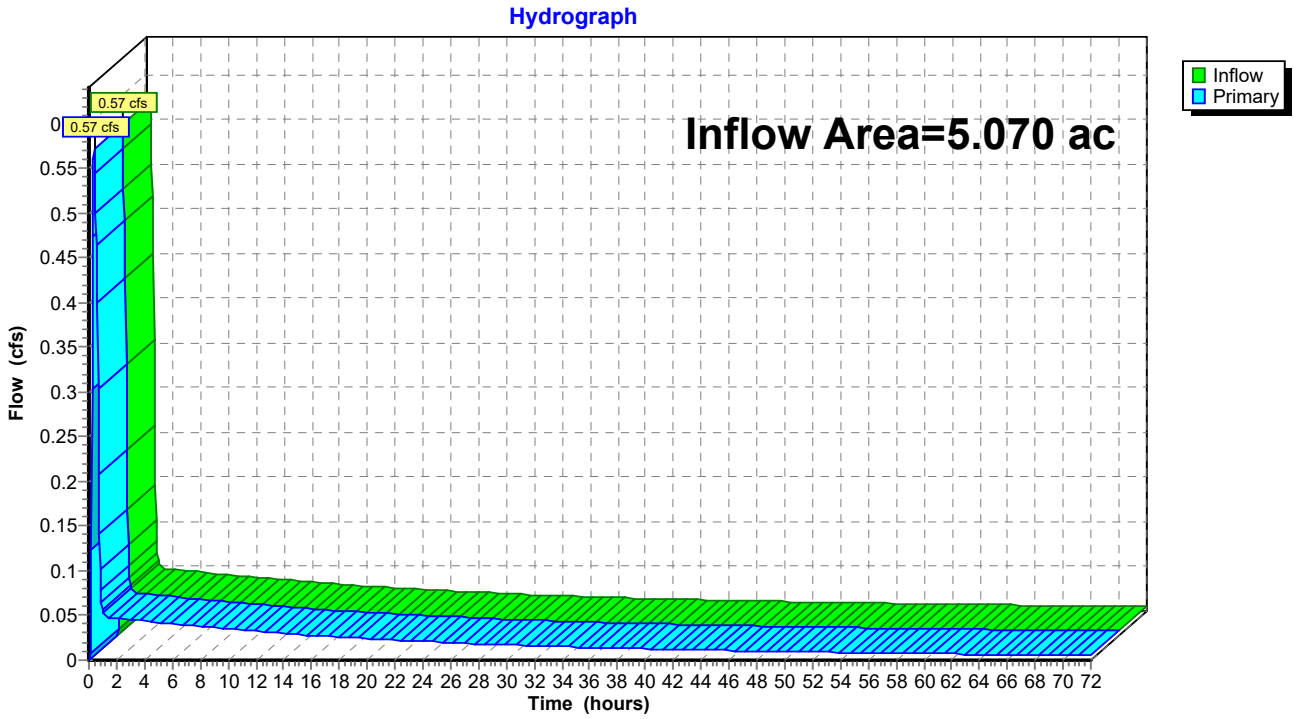


Summary for Link 5A: Final Northwest Outfall

Inflow Area = 5.070 ac, 56.41% Impervious, Inflow Depth > 0.30" for 2-YEAR event
Inflow = 0.57 cfs @ 0.37 hrs, Volume= 0.127 af
Primary = 0.57 cfs @ 0.37 hrs, Volume= 0.127 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Link 5A: Final Northwest Outfall



Summary for Subcatchment 1A: Pre-Developed Northwest Drainage Area

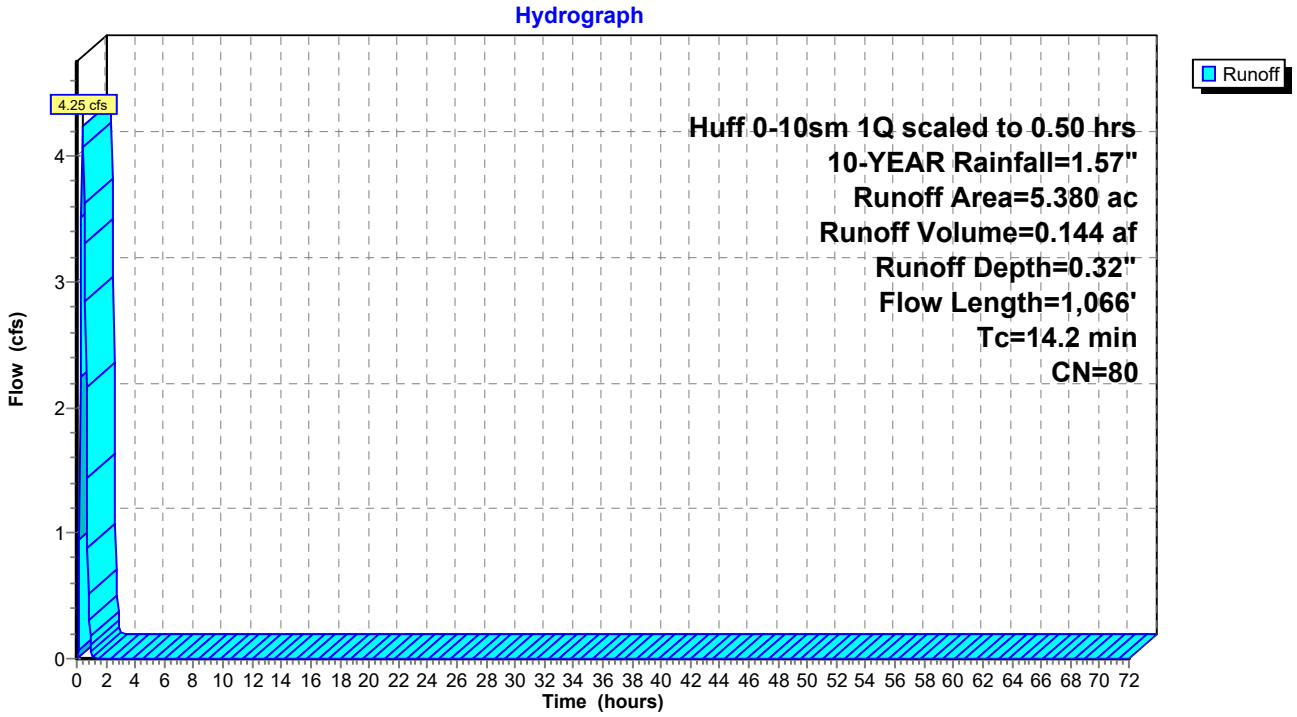
Runoff = 4.25 cfs @ 0.38 hrs, Volume= 0.144 af, Depth= 0.32"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Huff 0-10sm 1Q scaled to 0.50 hrs 10-YEAR Rainfall=1.57"

Area (ac)	CN	Description
5.380	80	>75% Grass cover, Good, HSG D
5.380		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.0	100	0.0170	0.15		**Sheet Flow, Sheet Flow** Grass: Short n= 0.150 P2= 2.91"
3.2	343	0.0670	1.81		**Shallow Concentrated Flow, Shallow Concentrated Flow** Short Grass Pasture Kv= 7.0 fps
0.0	623	0.2300	2,362194	304,766.71	**Channel Flow, Channel Flow** Area= 4,361.0 sf Perim= 7.0' r= 623.00' n= 0.022 Earth, clean & straight
14.2	1,066	Total			

Subcatchment 1A: Pre-Developed Northwest Drainage Area



Summary for Subcatchment 2A: Post-Developed Northwest Drainage Area (Detained)

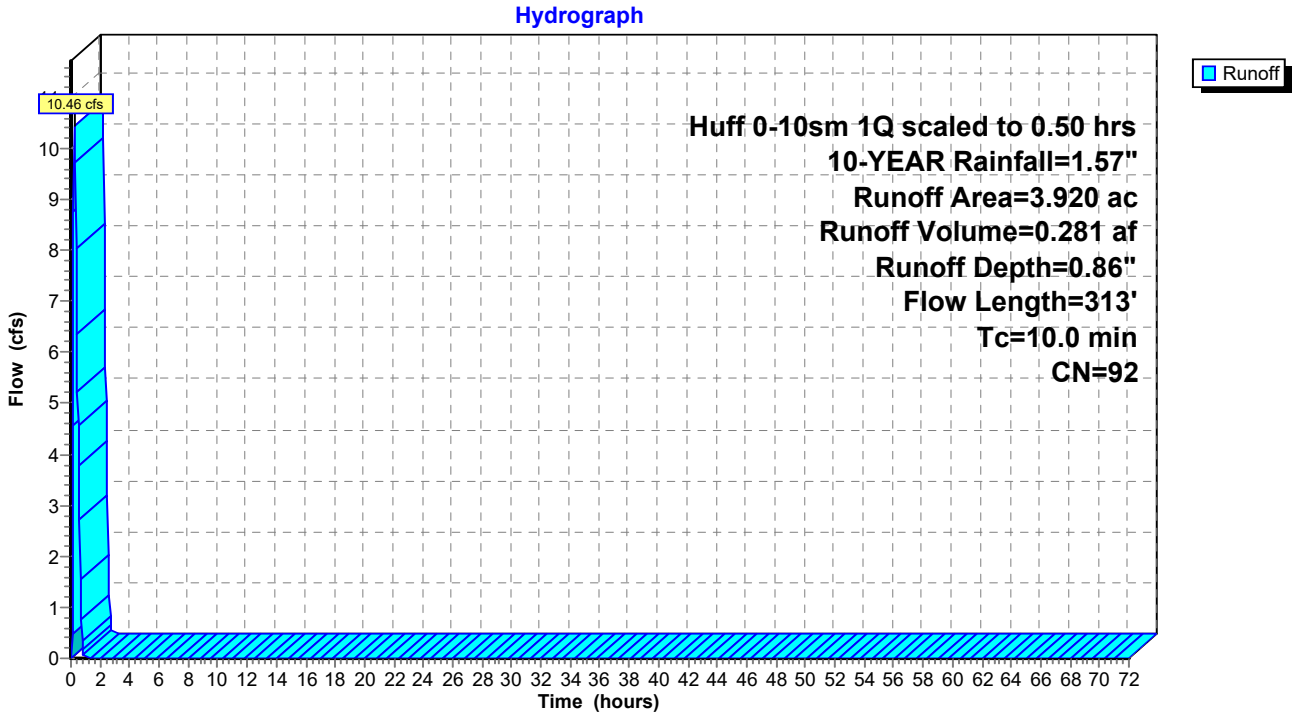
Runoff = 10.46 cfs @ 0.26 hrs, Volume= 0.281 af, Depth= 0.86"
Routed to Pond 4A : North Basin

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Huff 0-10sm 1Q scaled to 0.50 hrs 10-YEAR Rainfall=1.57"

Area (ac)	CN	Description
1.330	80	>75% Grass cover, Good, HSG D
2.590	98	Paved parking, HSG D
3.920	92	Weighted Average
1.330		33.93% Pervious Area
2.590		66.07% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.9	100	0.0025	0.57		**Sheet Flow, Sheet Flow** Smooth surfaces n= 0.011 P2= 2.91"
0.7	43	0.0025	1.02		**Shallow Concentrated Flow, Shallow Concentrated Flow** Paved Kv= 20.3 fps
2.5	111	0.0021	0.74		**Shallow Concentrated Flow, Shallow Concentrated Flow** Unpaved Kv= 16.1 fps
0.6	34	0.0021	0.93		**Shallow Concentrated Flow, Shallow Concentrated Flow** Paved Kv= 20.3 fps
0.1	25	0.0330	2.92		**Shallow Concentrated Flow, Shallow Concentrated Flow** Unpaved Kv= 16.1 fps
3.2					**Direct Entry, Direct Entry (To Reach Minmimum TOC)**
10.0	313	Total			

Subcatchment 2A: Post-Developed Northwest Drainage Area (Detained)



Summary for Subcatchment 3A: Post Devleoped Northwest Drainage Area Direct Runoff

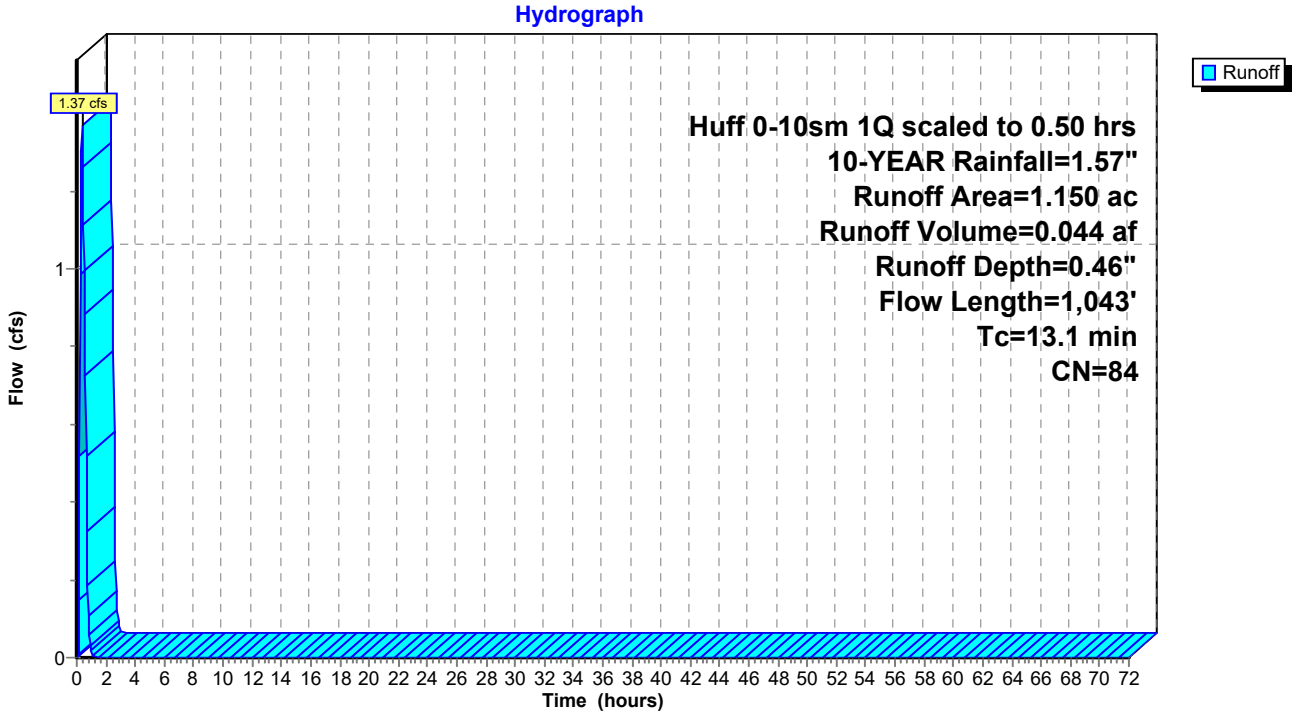
Runoff = 1.37 cfs @ 0.34 hrs, Volume= 0.044 af, Depth= 0.46"
Routed to Link 5A : Final Northwest Outfall

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Huff 0-10sm 1Q scaled to 0.50 hrs 10-YEAR Rainfall=1.57"

Area (ac)	CN	Description
0.880	80	>75% Grass cover, Good, HSG D
0.270	98	Paved parking, HSG D
1.150	84	Weighted Average
0.880		76.52% Pervious Area
0.270		23.48% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.6	100	0.0120	0.13		**Sheet Flow, Sheet Flow** Grass: Short n= 0.150 P2= 2.91"
0.5	50	0.0110	1.69		**Shallow Concentrated Flow, Shallow Concentrated Flow** Unpaved Kv= 16.1 fps
0.0	893	0.0150	767.14	4795,407.99	**Channel Flow, Channel Flow** Area= 6,251.0 sf Perim= 7.0' r= 893.00' n= 0.022 Earth, clean & straight
13.1	1,043	Total			

Subcatchment 3A: Post Devleoped Northwest Drainage Area Direct Runoff



Summary for Pond 4A: North Basin

Inflow Area = 3.920 ac, 66.07% Impervious, Inflow Depth = 0.86" for 10-YEAR event
Inflow = 10.46 cfs @ 0.26 hrs, Volume= 0.281 af
Outflow = 0.08 cfs @ 0.85 hrs, Volume= 0.224 af, Atten= 99%, Lag= 35.6 min
Primary = 0.08 cfs @ 0.85 hrs, Volume= 0.224 af
Routed to Link 5A : Final Northwest Outfall

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 776.35' @ 0.85 hrs Surf.Area= 34,828 sf Storage= 12,075 cf

Plug-Flow detention time= 1,429.2 min calculated for 0.224 af (80% of inflow)
Center-of-Mass det. time= 1,425.8 min (1,446.8 - 21.0)

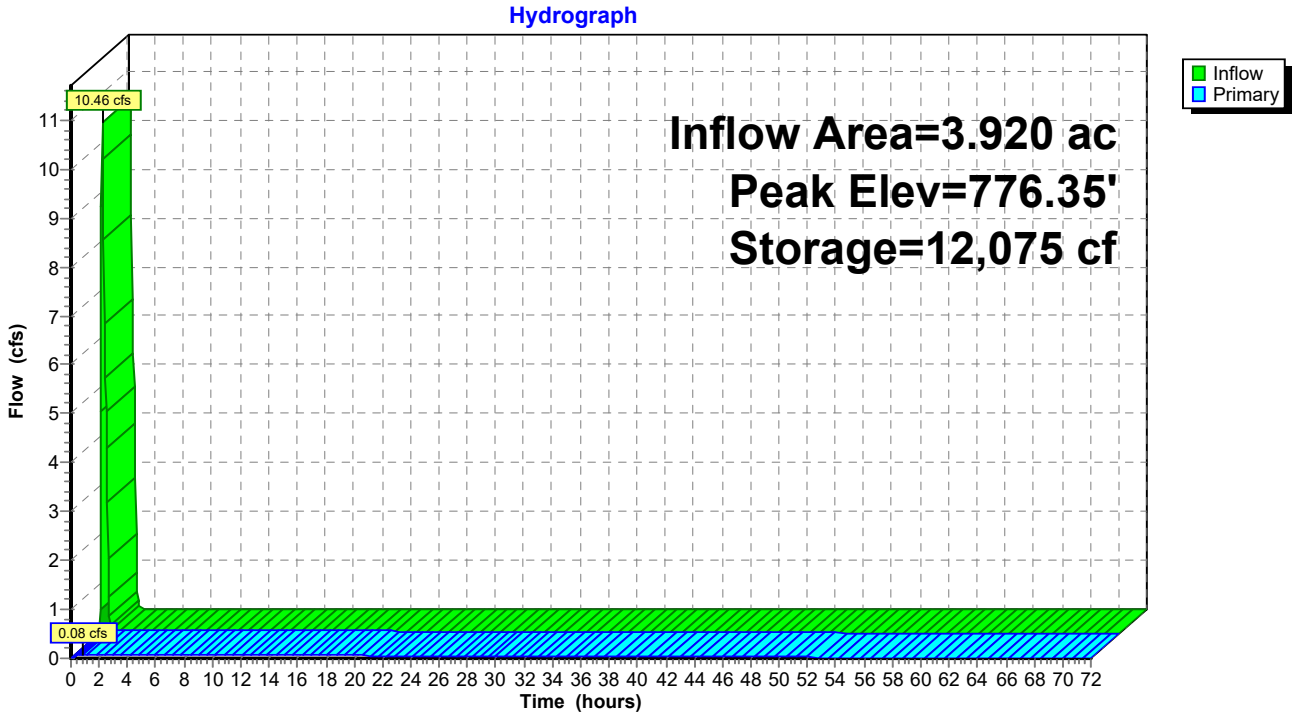
Volume	Invert	Avail.Storage	Storage Description
#1	776.00'	116,836 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
776.00	33,587	0	0
777.00	37,103	35,345	35,345
778.00	40,720	38,912	74,257
779.00	44,438	42,579	116,836

Device	Routing	Invert	Outlet Devices
#1	Primary	776.00'	**12.0" Round Culvert** L= 52.0' Ke= 0.500 Inlet / Outlet Invert= 776.00' / 775.52' S= 0.0092 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.79 sf
#2	Device 1	776.00'	**2.5" Vert. Orifice/Grate (WQ Orifice)** C= 0.600 Limited to weir flow at low heads
#3	Device 1	778.00'	**2.0" x 4.0" Horiz. Orifice/Grate X 6.00 columns** X 5 rows C= 0.600 in 24.0" x 24.0" Grate (42% open area) Limited to weir flow at low heads

Primary OutFlow Max=0.08 cfs @ 0.85 hrs HW=776.35' (Free Discharge)
└**1=Culvert** (Passes 0.08 cfs of 0.49 cfs potential flow)
├**2=Orifice/Grate (WQ Orifice)** (Orifice Controls 0.08 cfs @ 2.40 fps)
└**3=Orifice/Grate** (Controls 0.00 cfs)

Pond 4A: North Basin

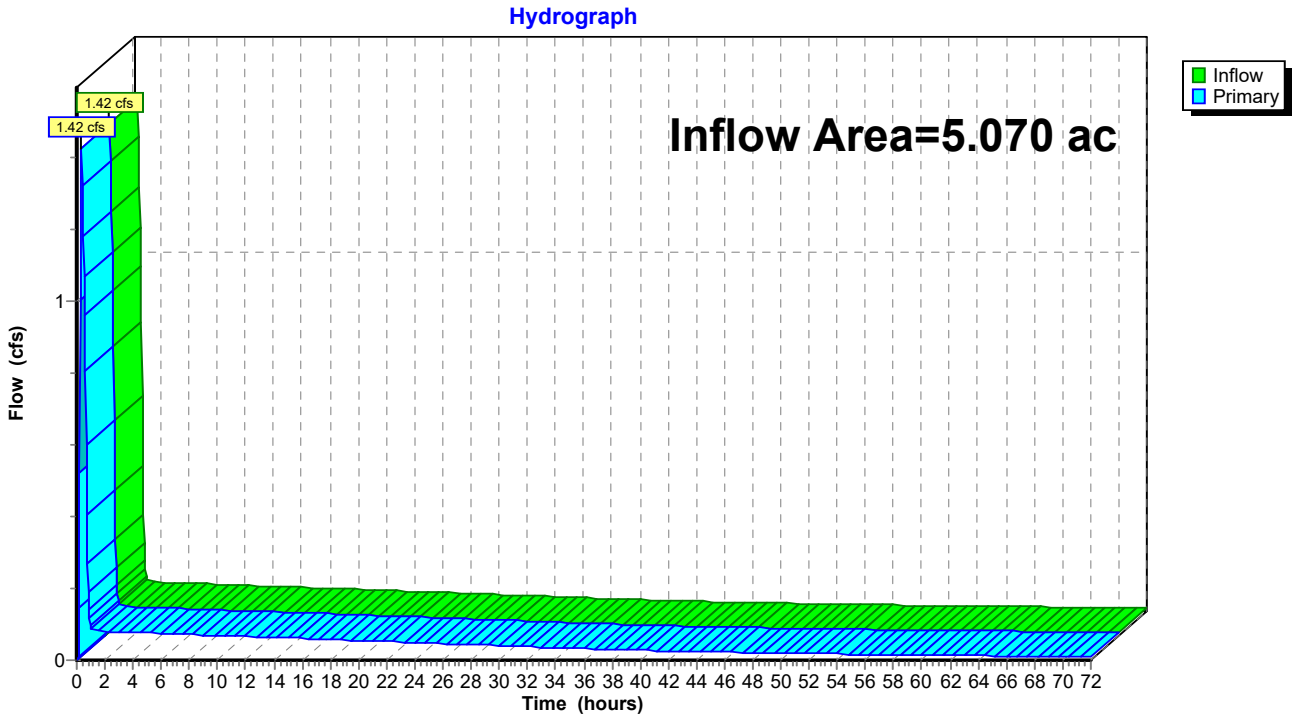


Summary for Link 5A: Final Northwest Outfall

Inflow Area = 5.070 ac, 56.41% Impervious, Inflow Depth > 0.63" for 10-YEAR event
Inflow = 1.42 cfs @ 0.35 hrs, Volume= 0.268 af
Primary = 1.42 cfs @ 0.35 hrs, Volume= 0.268 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Link 5A: Final Northwest Outfall



Summary for Subcatchment 1A: Pre-Developed Northwest Drainage Area

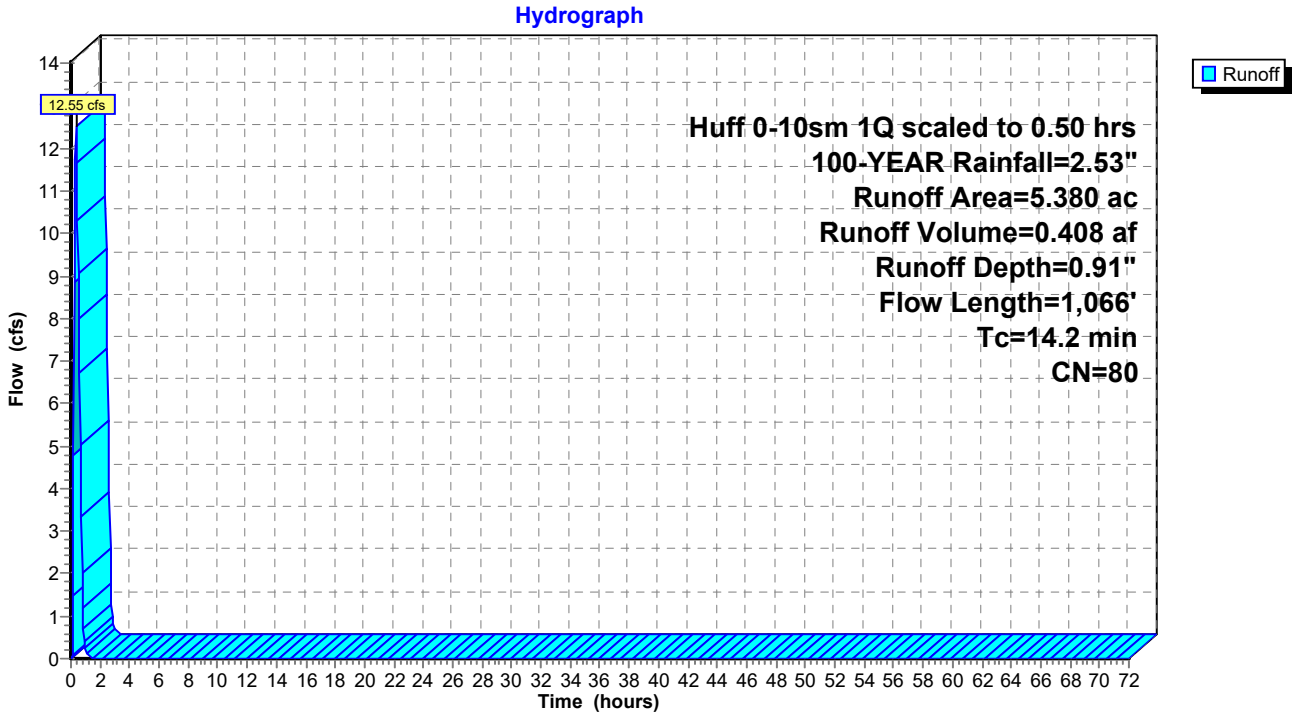
Runoff = 12.55 cfs @ 0.35 hrs, Volume= 0.408 af, Depth= 0.91"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Huff 0-10sm 1Q scaled to 0.50 hrs 100-YEAR Rainfall=2.53"

Area (ac)	CN	Description
5.380	80	>75% Grass cover, Good, HSG D
5.380		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.0	100	0.0170	0.15		**Sheet Flow, Sheet Flow** Grass: Short n= 0.150 P2= 2.91"
3.2	343	0.0670	1.81		**Shallow Concentrated Flow, Shallow Concentrated Flow** Short Grass Pasture Kv= 7.0 fps
0.0	623	0.2300	2,362194304,766.71		**Channel Flow, Channel Flow** Area= 4,361.0 sf Perim= 7.0' r= 623.00' n= 0.022 Earth, clean & straight
14.2	1,066	Total			

Subcatchment 1A: Pre-Developed Northwest Drainage Area



Summary for Subcatchment 2A: Post-Developed Northwest Drainage Area (Detained)

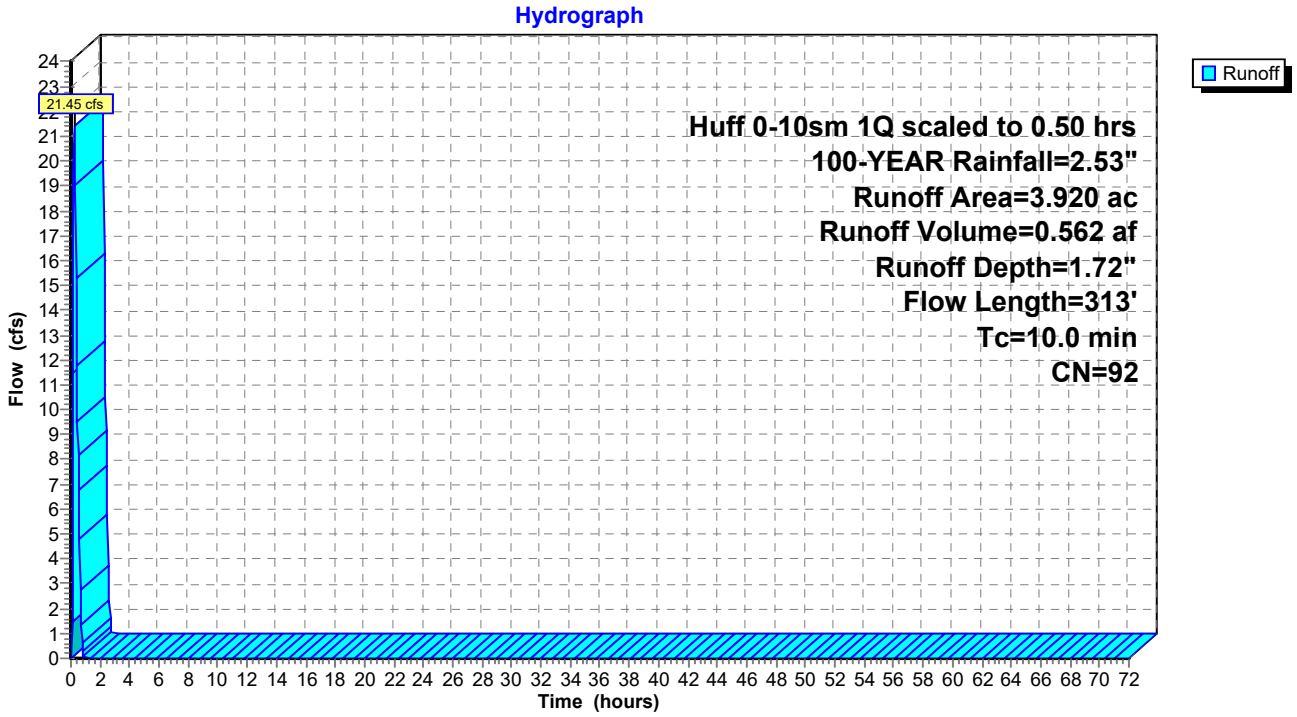
Runoff = 21.45 cfs @ 0.25 hrs, Volume= 0.562 af, Depth= 1.72"
Routed to Pond 4A : North Basin

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Huff 0-10sm 1Q scaled to 0.50 hrs 100-YEAR Rainfall=2.53"

Area (ac)	CN	Description
1.330	80	>75% Grass cover, Good, HSG D
2.590	98	Paved parking, HSG D
3.920	92	Weighted Average
1.330		33.93% Pervious Area
2.590		66.07% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.9	100	0.0025	0.57		**Sheet Flow, Sheet Flow** Smooth surfaces n= 0.011 P2= 2.91"
0.7	43	0.0025	1.02		**Shallow Concentrated Flow, Shallow Concentrated Flow** Paved Kv= 20.3 fps
2.5	111	0.0021	0.74		**Shallow Concentrated Flow, Shallow Concentrated Flow** Unpaved Kv= 16.1 fps
0.6	34	0.0021	0.93		**Shallow Concentrated Flow, Shallow Concentrated Flow** Paved Kv= 20.3 fps
0.1	25	0.0330	2.92		**Shallow Concentrated Flow, Shallow Concentrated Flow** Unpaved Kv= 16.1 fps
3.2					**Direct Entry, Direct Entry (To Reach Minmimum TOC)**
10.0	313	Total			

Subcatchment 2A: Post-Developed Northwest Drainage Area (Detained)



Summary for Subcatchment 3A: Post Devleoped Northwest Drainage Area Direct Runoff

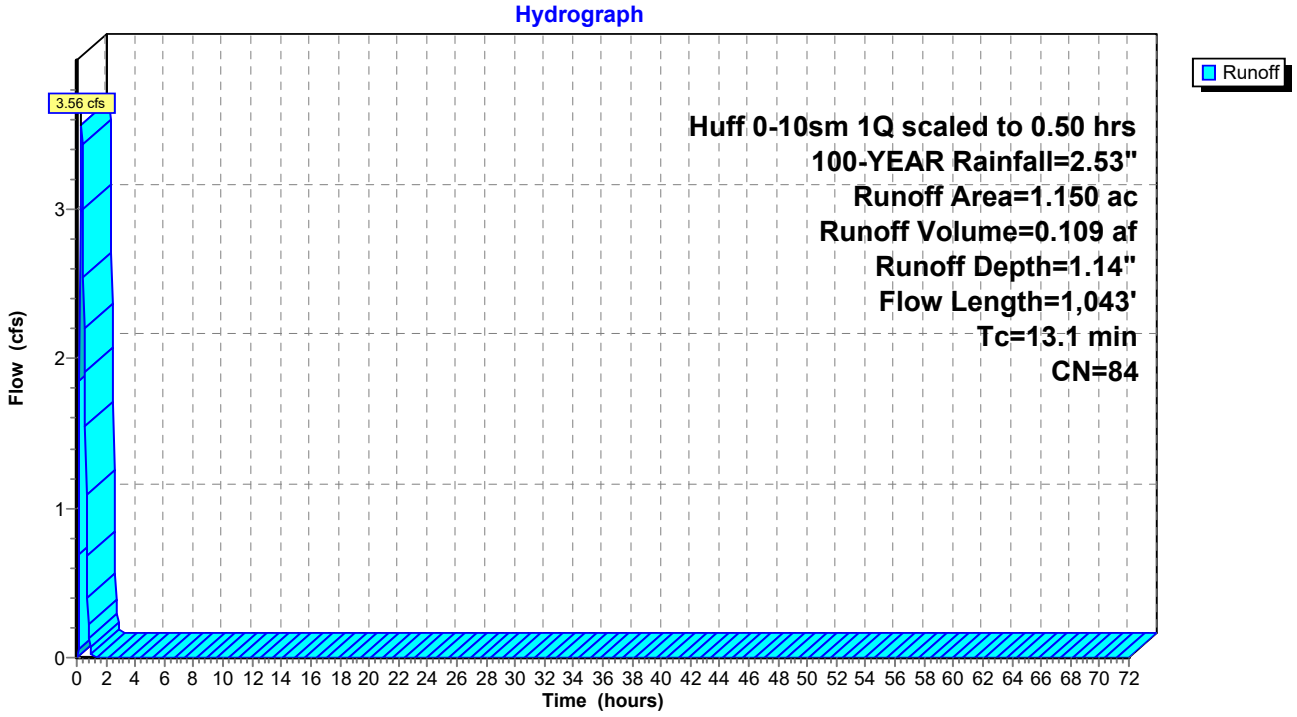
Runoff = 3.56 cfs @ 0.32 hrs, Volume= 0.109 af, Depth= 1.14"
Routed to Link 5A : Final Northwest Outfall

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Huff 0-10sm 1Q scaled to 0.50 hrs 100-YEAR Rainfall=2.53"

Area (ac)	CN	Description
0.880	80	>75% Grass cover, Good, HSG D
0.270	98	Paved parking, HSG D
1.150	84	Weighted Average
0.880		76.52% Pervious Area
0.270		23.48% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.6	100	0.0120	0.13		**Sheet Flow, Sheet Flow** Grass: Short n= 0.150 P2= 2.91"
0.5	50	0.0110	1.69		**Shallow Concentrated Flow, Shallow Concentrated Flow** Unpaved Kv= 16.1 fps
0.0	893	0.0150	767.14	4795,407.99	**Channel Flow, Channel Flow** Area= 6,251.0 sf Perim= 7.0' r= 893.00' n= 0.022 Earth, clean & straight
13.1	1,043	Total			

Subcatchment 3A: Post Devleoped Northwest Drainage Area Direct Runoff



Summary for Pond 4A: North Basin

Inflow Area = 3.920 ac, 66.07% Impervious, Inflow Depth = 1.72" for 100-YEAR event
Inflow = 21.45 cfs @ 0.25 hrs, Volume= 0.562 af
Outflow = 0.13 cfs @ 0.86 hrs, Volume= 0.460 af, Atten= 99%, Lag= 36.9 min
Primary = 0.13 cfs @ 0.86 hrs, Volume= 0.460 af
Routed to Link 5A : Final Northwest Outfall

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 776.70' @ 0.86 hrs Surf.Area= 36,032 sf Storage= 24,208 cf

Plug-Flow detention time= 1,688.4 min calculated for 0.459 af (82% of inflow)
Center-of-Mass det. time= 1,687.0 min (1,707.1 - 20.1)

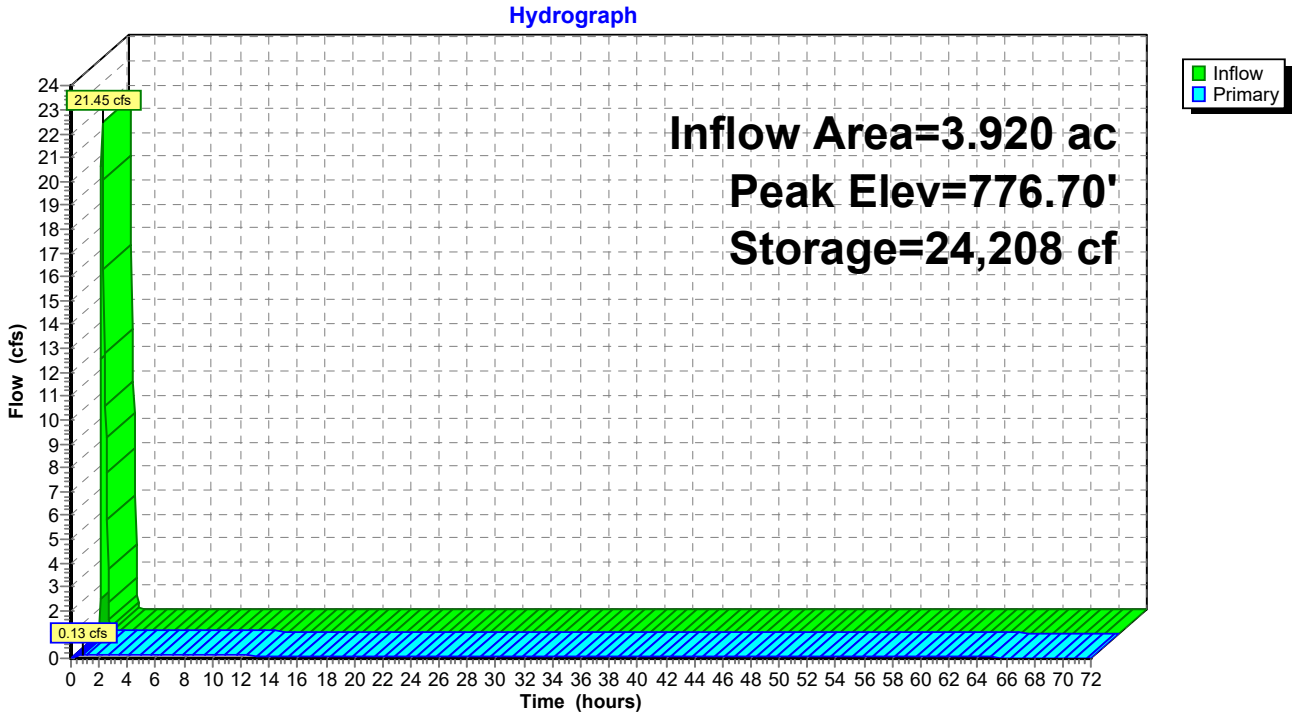
Volume	Invert	Avail.Storage	Storage Description
#1	776.00'	116,836 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
776.00	33,587	0	0
777.00	37,103	35,345	35,345
778.00	40,720	38,912	74,257
779.00	44,438	42,579	116,836

Device	Routing	Invert	Outlet Devices
#1	Primary	776.00'	**12.0" Round Culvert** L= 52.0' Ke= 0.500 Inlet / Outlet Invert= 776.00' / 775.52' S= 0.0092 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.79 sf
#2	Device 1	776.00'	**2.5" Vert. Orifice/Grate (WQ Orifice)** C= 0.600 Limited to weir flow at low heads
#3	Device 1	778.00'	**2.0" x 4.0" Horiz. Orifice/Grate X 6.00 columns** X 5 rows C= 0.600 in 24.0" x 24.0" Grate (42% open area) Limited to weir flow at low heads

Primary OutFlow Max=0.13 cfs @ 0.86 hrs HW=776.70' (Free Discharge)
└**1=Culvert** (Passes 0.13 cfs of 1.59 cfs potential flow)
  ├**2=Orifice/Grate (WQ Orifice)** (Orifice Controls 0.13 cfs @ 3.70 fps)
  └**3=Orifice/Grate** (Controls 0.00 cfs)

Pond 4A: North Basin

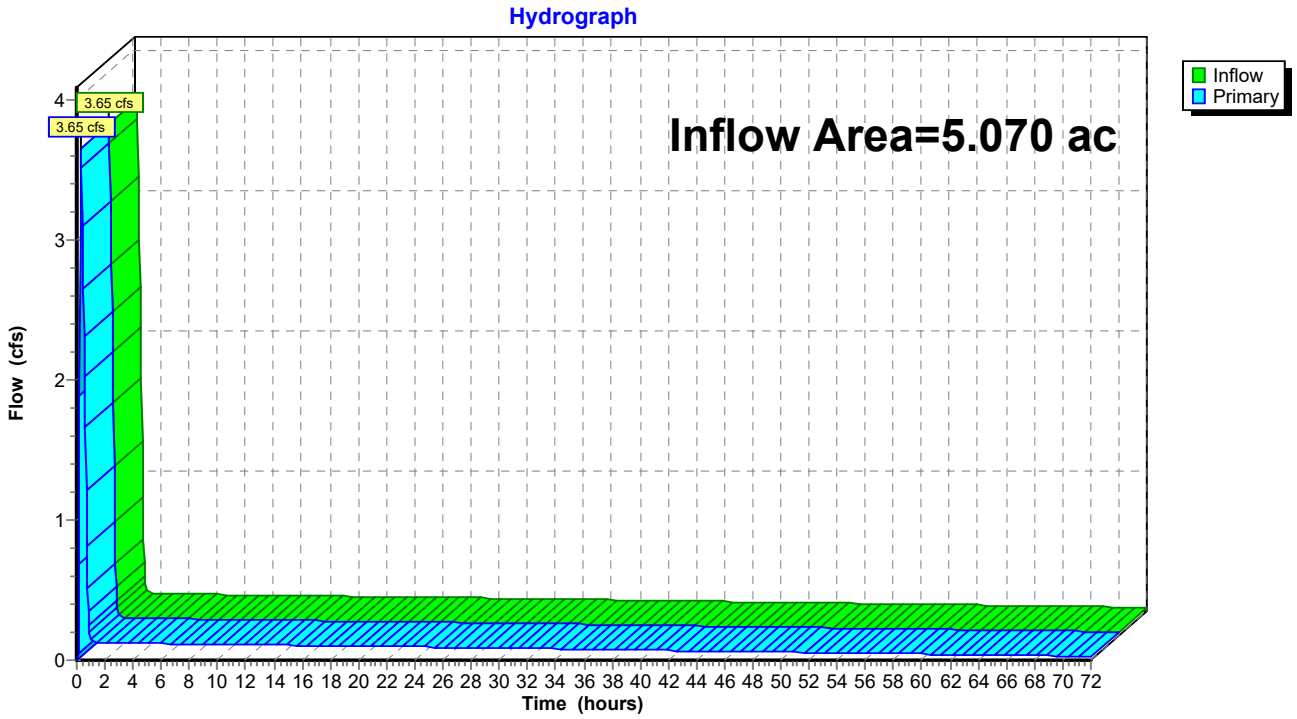


Summary for Link 5A: Final Northwest Outfall

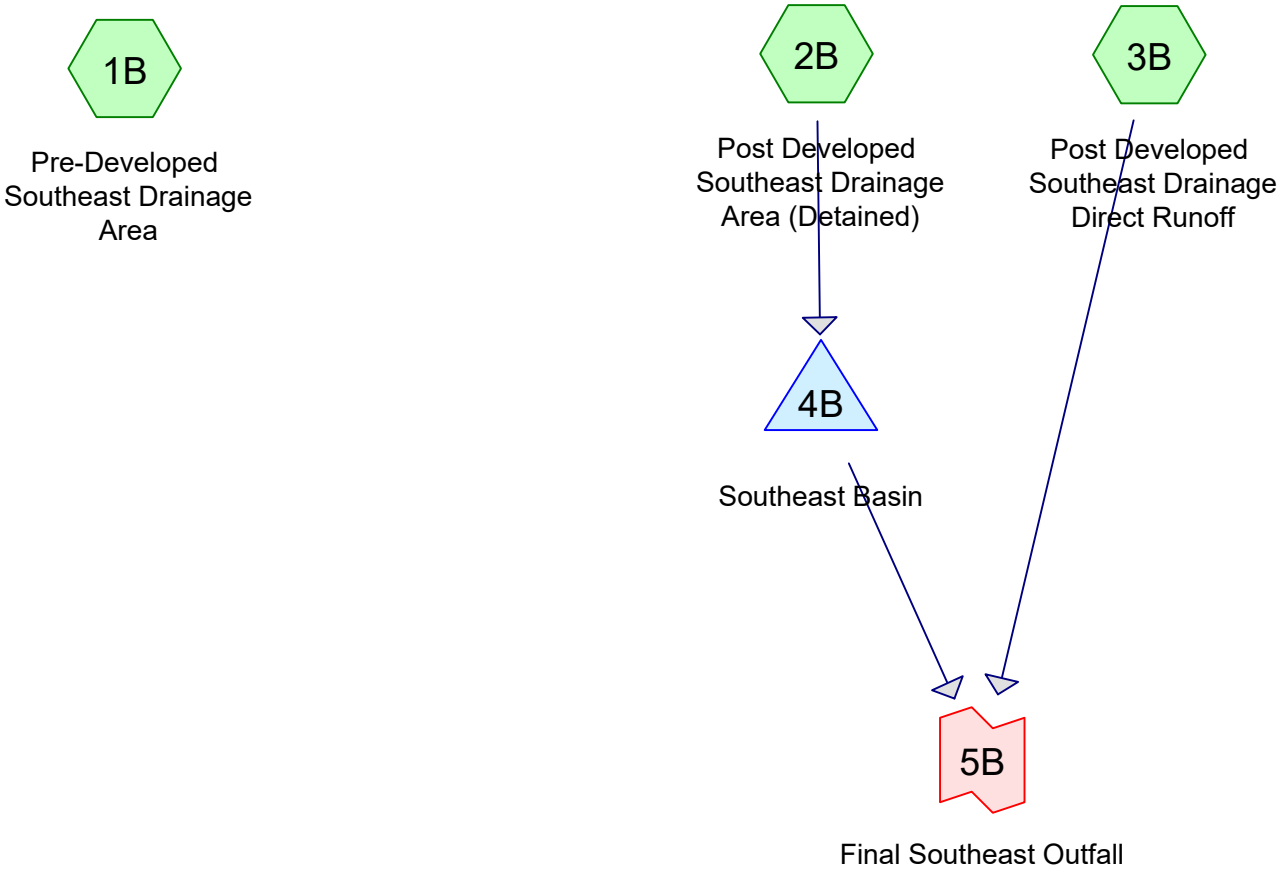
Inflow Area = 5.070 ac, 56.41% Impervious, Inflow Depth > 1.35" for 100-YEAR event
Inflow = 3.65 cfs @ 0.32 hrs, Volume= 0.569 af
Primary = 3.65 cfs @ 0.32 hrs, Volume= 0.569 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Link 5A: Final Northwest Outfall



APPENDIX C1.2:
SOUTHEAST DRAINAGE AREA REPORT



Subcat Reach Pond Link

Routing Diagram for Wawa Franklin IN_HydroCAD Model (Southeast)
Prepared by CESO, Inc, Printed 12/2/2024

Rainfall Events Listing

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	2-YEAR	Huff 0-10sm	1Q	Scale	0.50	1	1.08	2
2	10-YEAR	Huff 0-10sm	1Q	Scale	0.50	1	1.57	2
3	100-YEAR	Huff 0-10sm	1Q	Scale	0.50	1	2.53	2

Summary for Subcatchment 1B: Pre-Developed Southeast Drainage Area

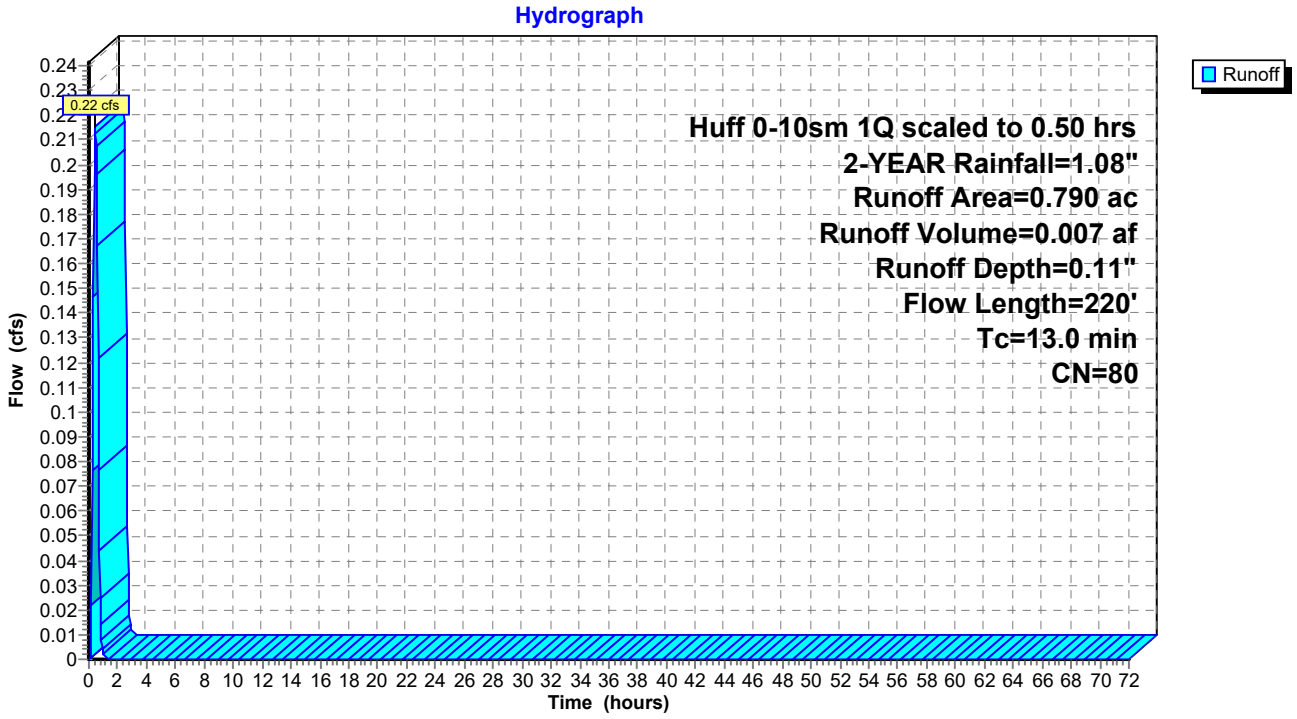
Runoff = 0.22 cfs @ 0.42 hrs, Volume= 0.007 af, Depth= 0.11"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Huff 0-10sm 1Q scaled to 0.50 hrs 2-YEAR Rainfall=1.08"

Area (ac)	CN	Description
0.790	80	>75% Grass cover, Good, HSG D
0.790		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.2	100	0.0160	0.15		**Sheet Flow, Sheet Flow** Grass: Short n= 0.150 P2= 2.91"
1.8	120	0.0240	1.08		**Shallow Concentrated Flow, Shallow Concentrated Flow** Short Grass Pasture Kv= 7.0 fps
13.0	220	Total			

Subcatchment 1B: Pre-Developed Southeast Drainage Area



Summary for Subcatchment 2B: Post Developed Southeast Drainage Area (Detained)

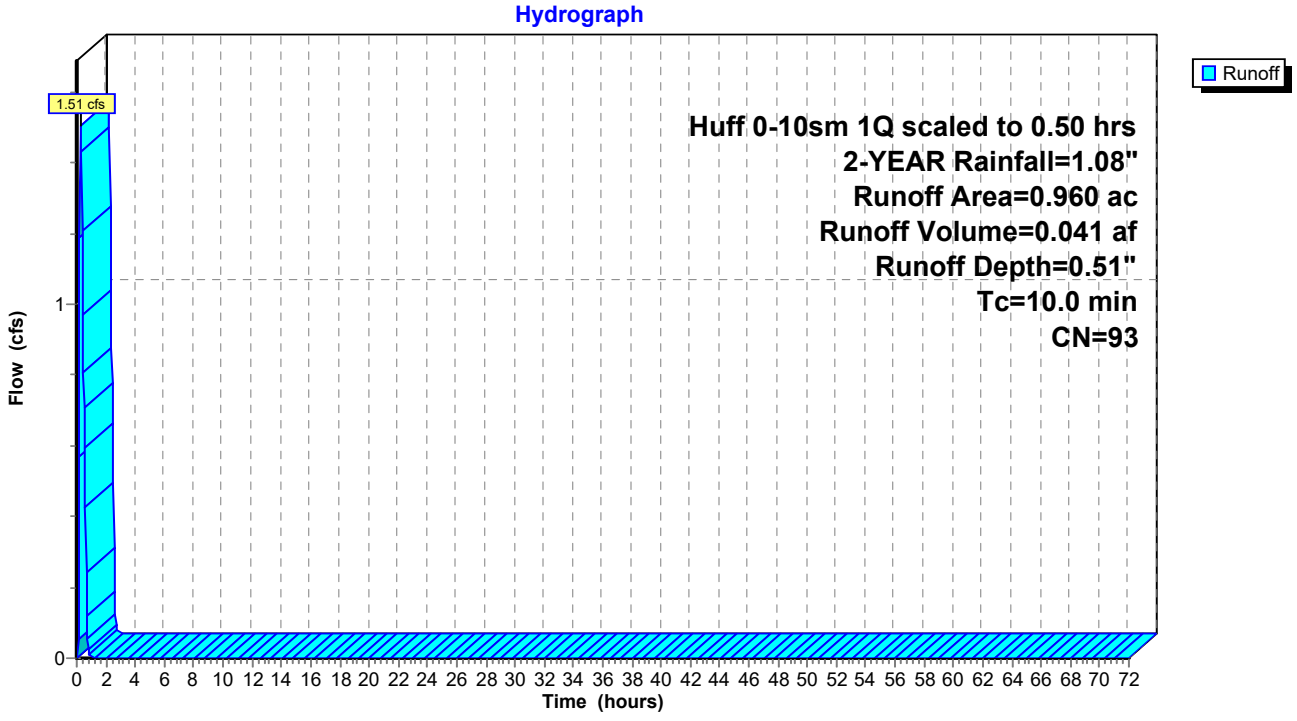
Runoff = 1.51 cfs @ 0.27 hrs, Volume= 0.041 af, Depth= 0.51"
Routed to Pond 4B : Southeast Basin

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Huff 0-10sm 1Q scaled to 0.50 hrs 2-YEAR Rainfall=1.08"

Area (ac)	CN	Description
0.260	80	>75% Grass cover, Good, HSG D
0.700	98	Paved parking, HSG D
0.960	93	Weighted Average
0.260		27.08% Pervious Area
0.700		72.92% Impervious Area

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

Subcatchment 2B: Post Developed Southeast Drainage Area (Detained)



Summary for Subcatchment 3B: Post Developed Southeast Drainage Direct Runoff

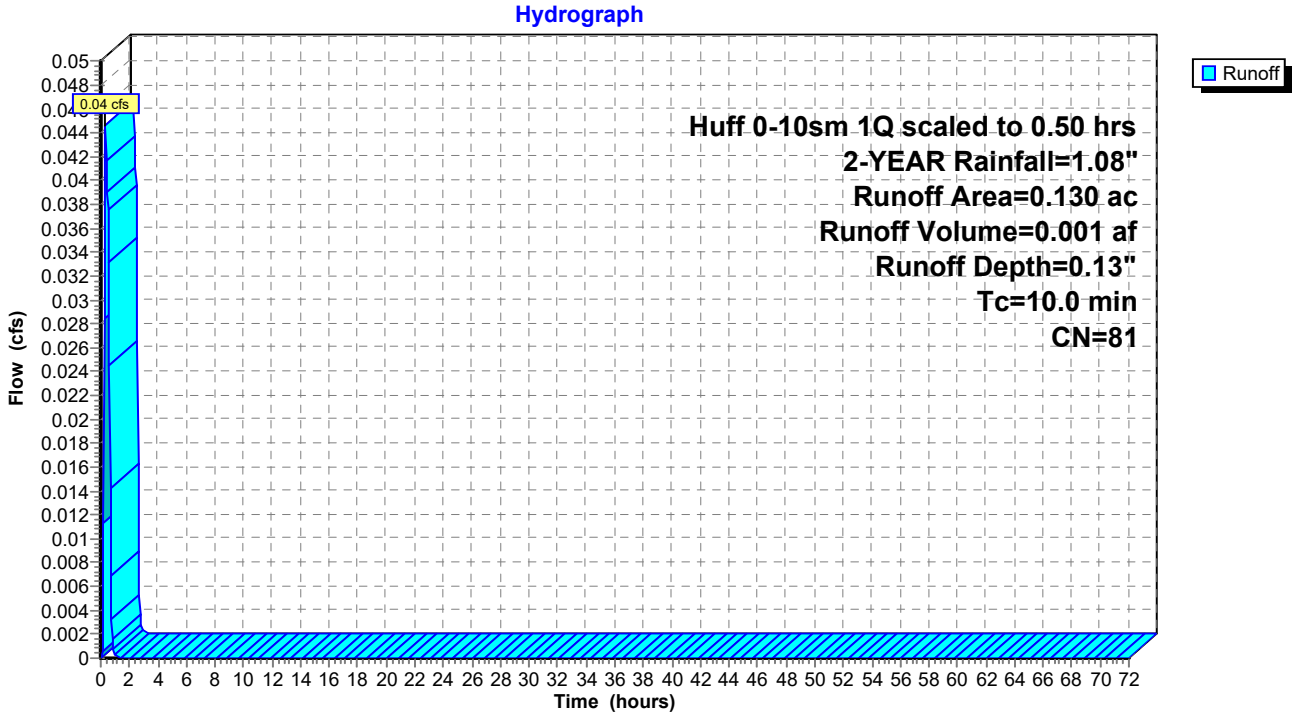
Runoff = 0.04 cfs @ 0.35 hrs, Volume= 0.001 af, Depth= 0.13"
Routed to Link 5B : Final Southeast Outfall

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Huff 0-10sm 1Q scaled to 0.50 hrs 2-YEAR Rainfall=1.08"

Area (ac)	CN	Description
0.120	80	>75% Grass cover, Good, HSG D
0.010	98	Paved parking, HSG D
0.130	81	Weighted Average
0.120		92.31% Pervious Area
0.010		7.69% Impervious Area

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

Subcatchment 3B: Post Developed Southeast Drainage Direct Runoff



Summary for Pond 4B: Southeast Basin

Inflow Area = 0.960 ac, 72.92% Impervious, Inflow Depth = 0.51" for 2-YEAR event
Inflow = 1.51 cfs @ 0.27 hrs, Volume= 0.041 af
Outflow = 0.09 cfs @ 0.72 hrs, Volume= 0.041 af, Atten= 94%, Lag= 27.2 min
Primary = 0.09 cfs @ 0.72 hrs, Volume= 0.041 af
Routed to Link 5B : Final Southeast Outfall

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 777.87' @ 0.72 hrs Surf.Area= 2,270 sf Storage= 1,621 cf

Plug-Flow detention time= 218.8 min calculated for 0.041 af (100% of inflow)
Center-of-Mass det. time= 220.3 min (241.7 - 21.5)

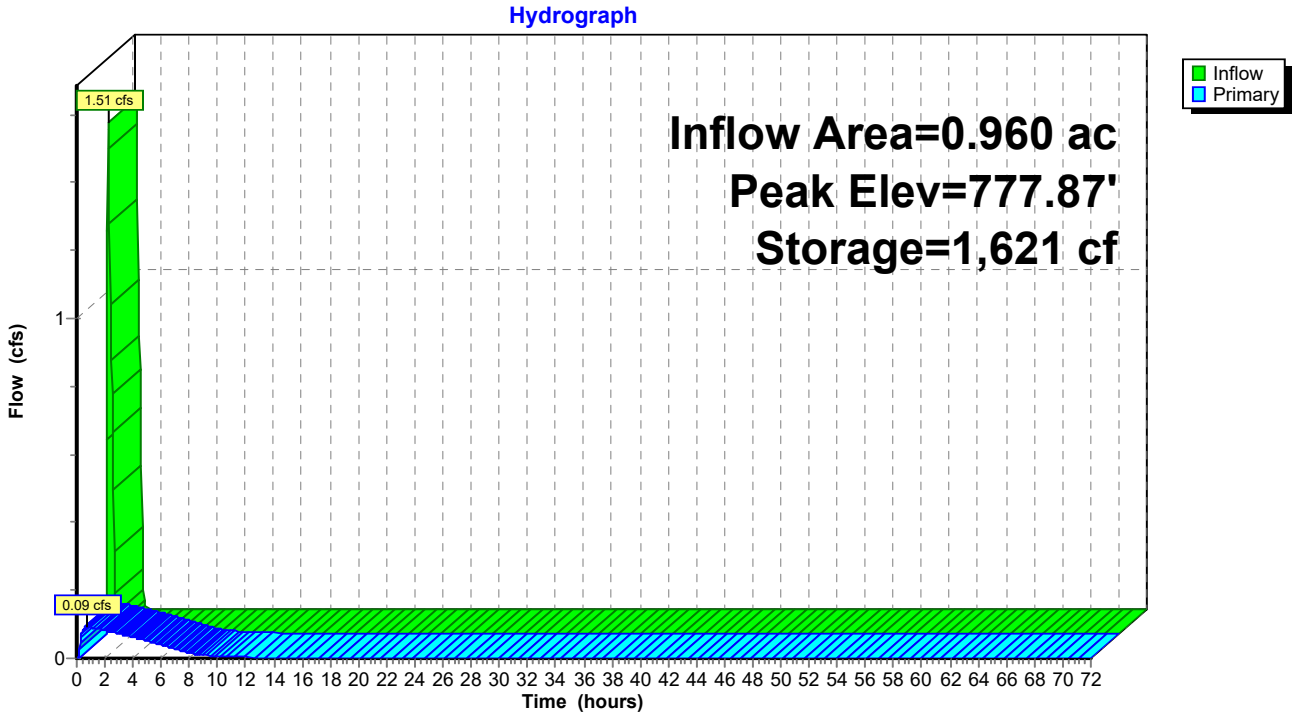
Volume	Invert	Avail.Storage	Storage Description
#1	777.00'	14,236 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
777.00	1,441	0	0
778.00	2,390	1,916	1,916
779.00	3,477	2,934	4,849
780.00	4,669	4,073	8,922
781.00	5,959	5,314	14,236

Device	Routing	Invert	Outlet Devices
#1	Primary	777.00'	**12.0" Round Culvert** L= 30.0' Ke= 0.500 Inlet / Outlet Invert= 777.00' / 776.00' S= 0.0333 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.79 sf
#2	Device 1	777.00'	**2.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Device 1	780.00'	**2.0" x 4.0" Horiz. Orifice/Grate X 6.00 columns** X 5 rows C= 0.600 in 24.0" x 24.0" Grate (42% open area) Limited to weir flow at low heads

Primary OutFlow Max=0.09 cfs @ 0.72 hrs HW=777.87' (Free Discharge)
└**1=Culvert** (Passes 0.09 cfs of 2.31 cfs potential flow)
├**2=Orifice/Grate** (Orifice Controls 0.09 cfs @ 4.28 fps)
└**3=Orifice/Grate** (Controls 0.00 cfs)

Pond 4B: Southeast Basin

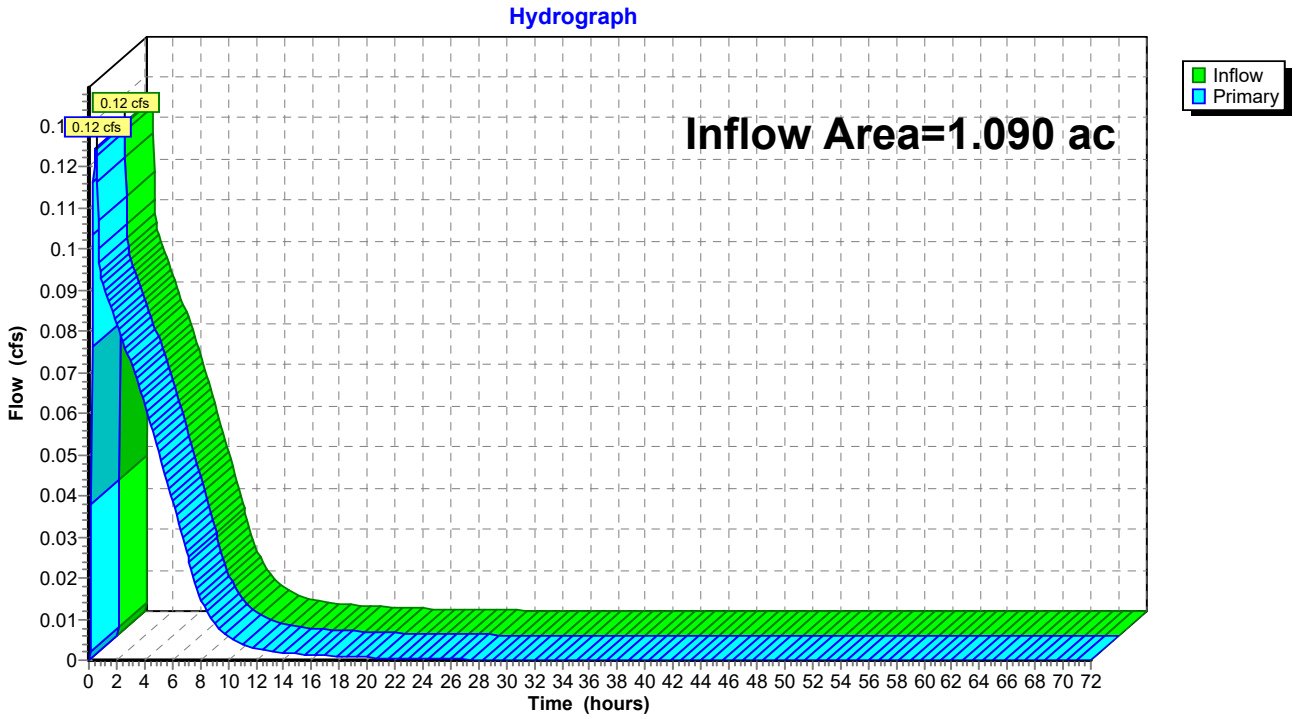


Summary for Link 5B: Final Southeast Outfall

Inflow Area = 1.090 ac, 65.14% Impervious, Inflow Depth = 0.47" for 2-YEAR event
Inflow = 0.12 cfs @ 0.50 hrs, Volume= 0.042 af
Primary = 0.12 cfs @ 0.50 hrs, Volume= 0.042 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Link 5B: Final Southeast Outfall



Summary for Subcatchment 1B: Pre-Developed Southeast Drainage Area

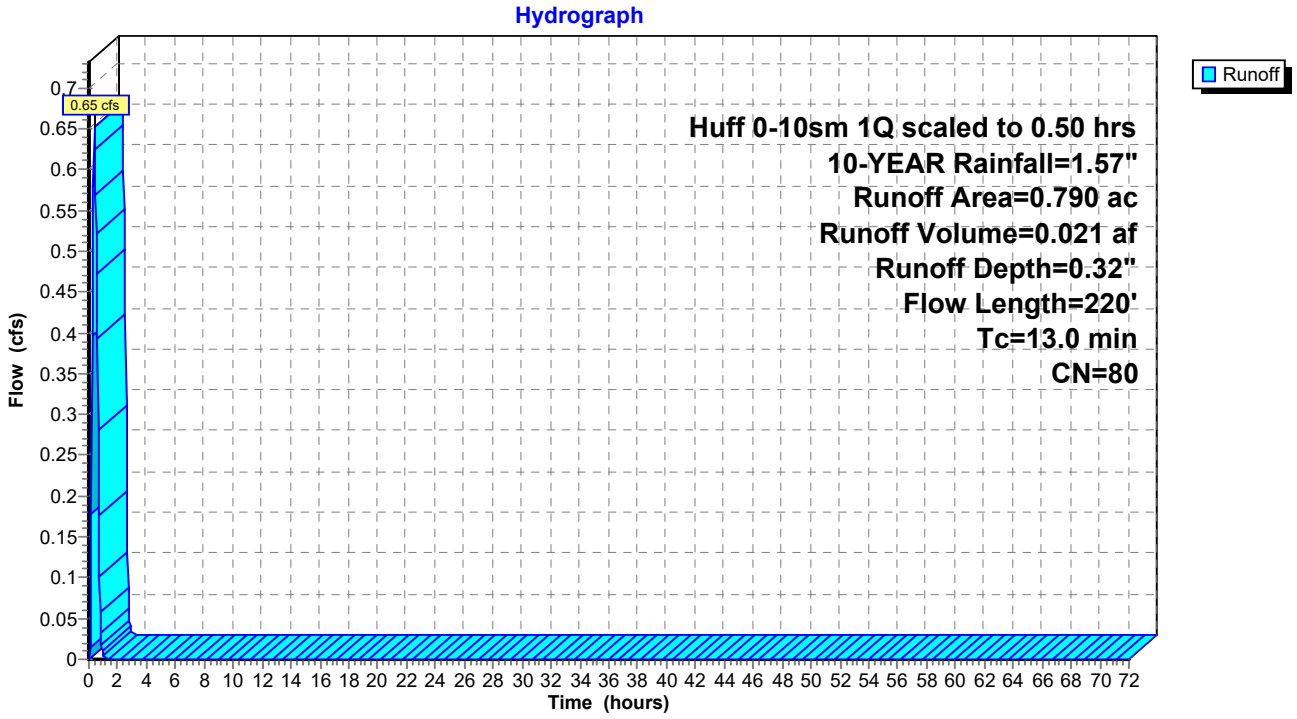
Runoff = 0.65 cfs @ 0.36 hrs, Volume= 0.021 af, Depth= 0.32"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Huff 0-10sm 1Q scaled to 0.50 hrs 10-YEAR Rainfall=1.57"

Area (ac)	CN	Description
0.790	80	>75% Grass cover, Good, HSG D
0.790		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.2	100	0.0160	0.15		**Sheet Flow, Sheet Flow** Grass: Short n= 0.150 P2= 2.91"
1.8	120	0.0240	1.08		**Shallow Concentrated Flow, Shallow Concentrated Flow** Short Grass Pasture Kv= 7.0 fps
13.0	220	Total			

Subcatchment 1B: Pre-Developed Southeast Drainage Area



Summary for Subcatchment 2B: Post Developed Southeast Drainage Area (Detained)

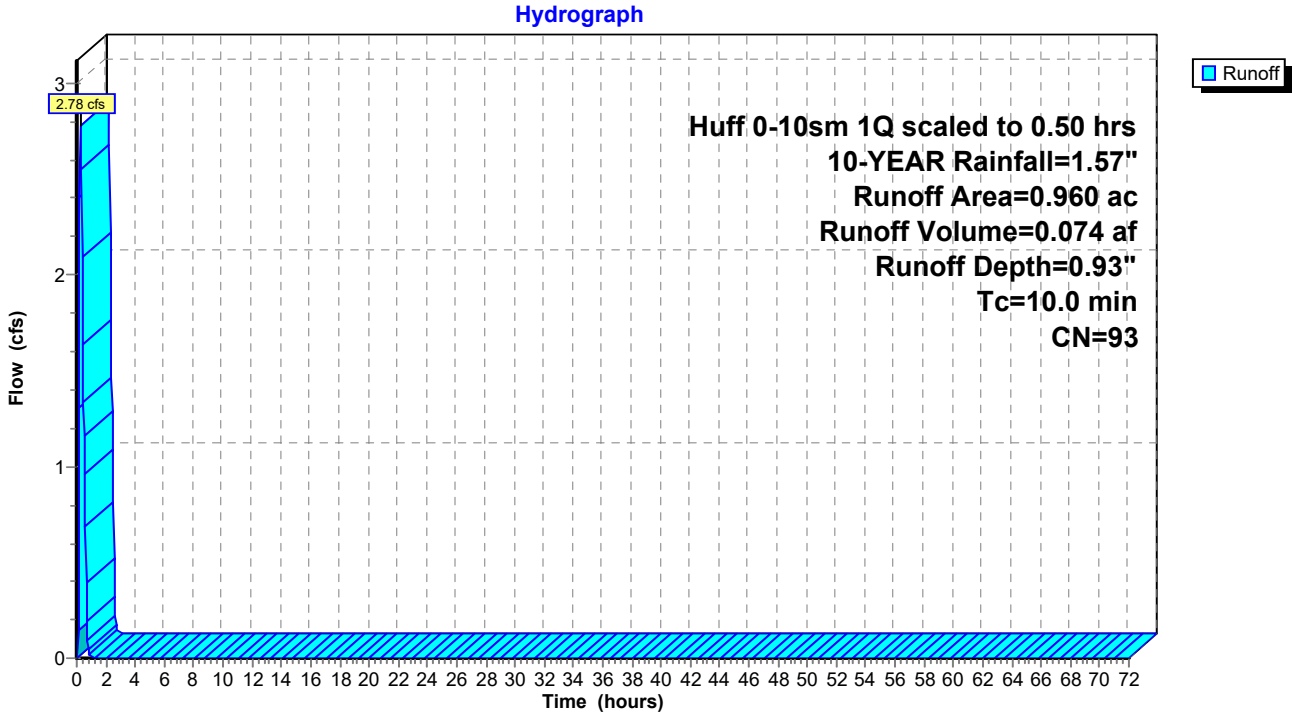
Runoff = 2.78 cfs @ 0.26 hrs, Volume= 0.074 af, Depth= 0.93"
Routed to Pond 4B : Southeast Basin

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Huff 0-10sm 1Q scaled to 0.50 hrs 10-YEAR Rainfall=1.57"

Area (ac)	CN	Description
0.260	80	>75% Grass cover, Good, HSG D
0.700	98	Paved parking, HSG D
0.960	93	Weighted Average
0.260		27.08% Pervious Area
0.700		72.92% Impervious Area

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

Subcatchment 2B: Post Developed Southeast Drainage Area (Detained)



Summary for Subcatchment 3B: Post Developed Southeast Drainage Direct Runoff

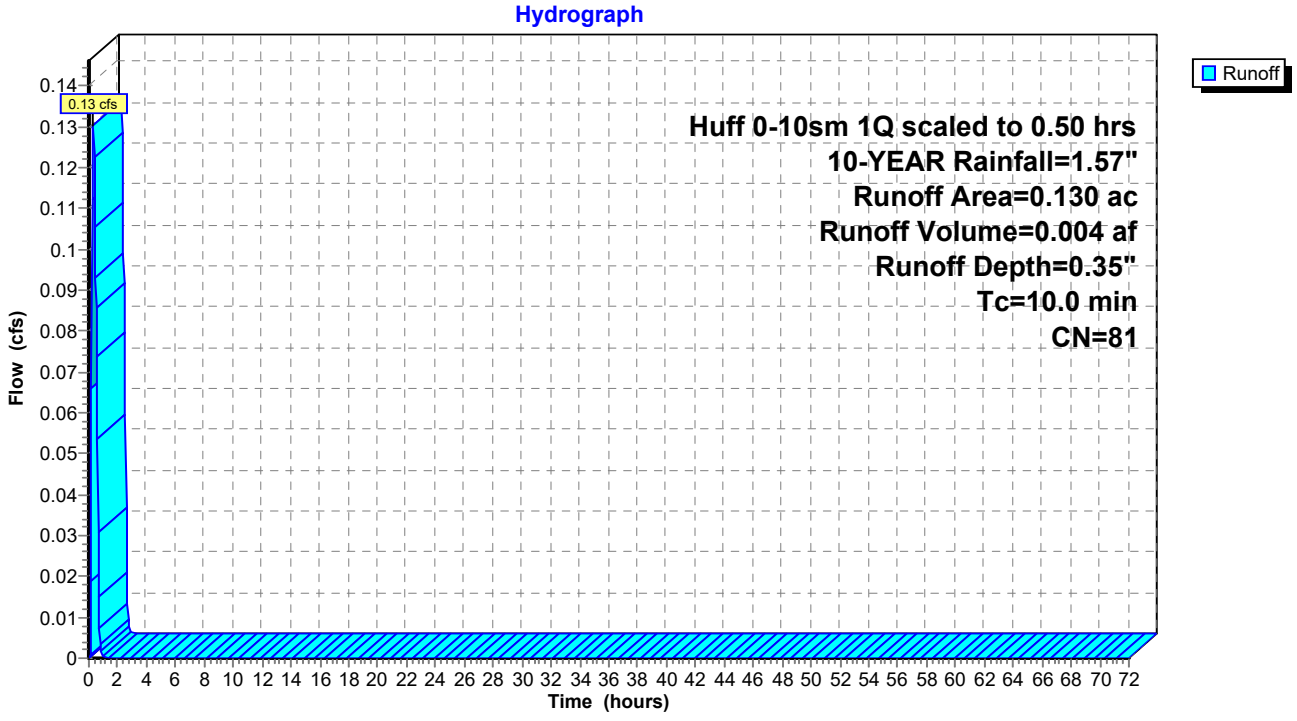
Runoff = 0.13 cfs @ 0.31 hrs, Volume= 0.004 af, Depth= 0.35"
Routed to Link 5B : Final Southeast Outfall

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Huff 0-10sm 1Q scaled to 0.50 hrs 10-YEAR Rainfall=1.57"

Area (ac)	CN	Description
0.120	80	>75% Grass cover, Good, HSG D
0.010	98	Paved parking, HSG D
0.130	81	Weighted Average
0.120		92.31% Pervious Area
0.010		7.69% Impervious Area

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

Subcatchment 3B: Post Developed Southeast Drainage Direct Runoff



Summary for Pond 4B: Southeast Basin

Inflow Area = 0.960 ac, 72.92% Impervious, Inflow Depth = 0.93" for 10-YEAR event
Inflow = 2.78 cfs @ 0.26 hrs, Volume= 0.074 af
Outflow = 0.12 cfs @ 0.74 hrs, Volume= 0.074 af, Atten= 96%, Lag= 28.9 min
Primary = 0.12 cfs @ 0.74 hrs, Volume= 0.074 af
Routed to Link 5B : Final Southeast Outfall

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 778.41' @ 0.74 hrs Surf.Area= 2,839 sf Storage= 2,996 cf

Plug-Flow detention time= 283.1 min calculated for 0.074 af (100% of inflow)
Center-of-Mass det. time= 284.5 min (305.2 - 20.7)

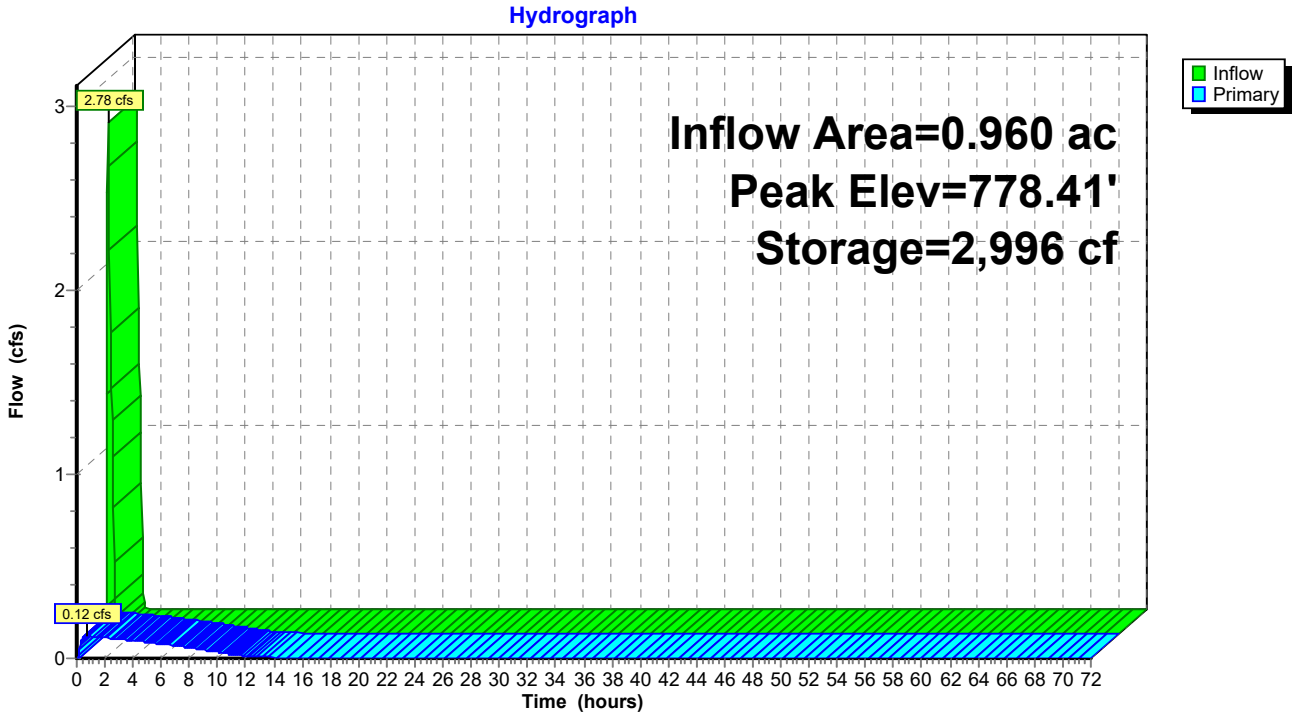
Volume	Invert	Avail.Storage	Storage Description
#1	777.00'	14,236 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
777.00	1,441	0	0
778.00	2,390	1,916	1,916
779.00	3,477	2,934	4,849
780.00	4,669	4,073	8,922
781.00	5,959	5,314	14,236

Device	Routing	Invert	Outlet Devices
#1	Primary	777.00'	**12.0" Round Culvert** L= 30.0' Ke= 0.500 Inlet / Outlet Invert= 777.00' / 776.00' S= 0.0333 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.79 sf
#2	Device 1	777.00'	**2.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Device 1	780.00'	**2.0" x 4.0" Horiz. Orifice/Grate X 6.00 columns** X 5 rows C= 0.600 in 24.0" x 24.0" Grate (42% open area) Limited to weir flow at low heads

Primary OutFlow Max=0.12 cfs @ 0.74 hrs HW=778.41' (Free Discharge)
└**1=Culvert** (Passes 0.12 cfs of 3.61 cfs potential flow)
├**2=Orifice/Grate** (Orifice Controls 0.12 cfs @ 5.55 fps)
└**3=Orifice/Grate** (Controls 0.00 cfs)

Pond 4B: Southeast Basin

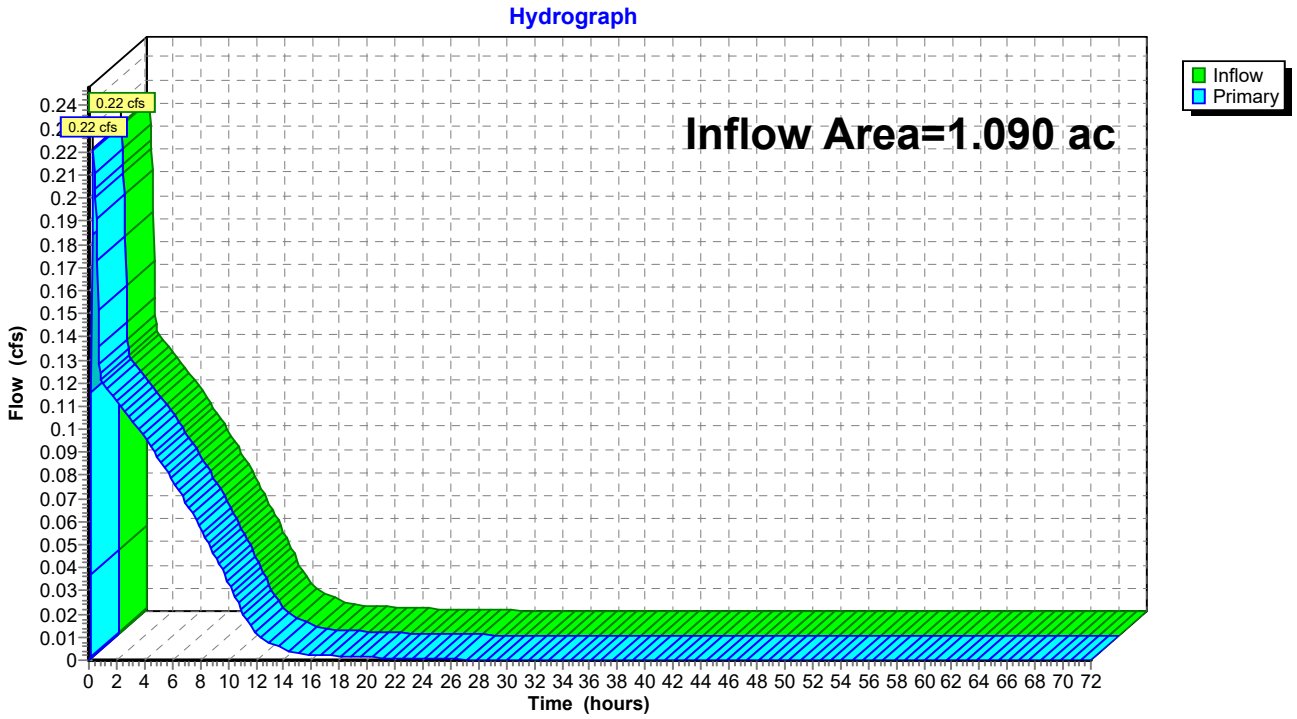


Summary for Link 5B: Final Southeast Outfall

Inflow Area = 1.090 ac, 65.14% Impervious, Inflow Depth = 0.86" for 10-YEAR event
Inflow = 0.22 cfs @ 0.34 hrs, Volume= 0.078 af
Primary = 0.22 cfs @ 0.34 hrs, Volume= 0.078 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Link 5B: Final Southeast Outfall



Summary for Subcatchment 1B: Pre-Developed Southeast Drainage Area

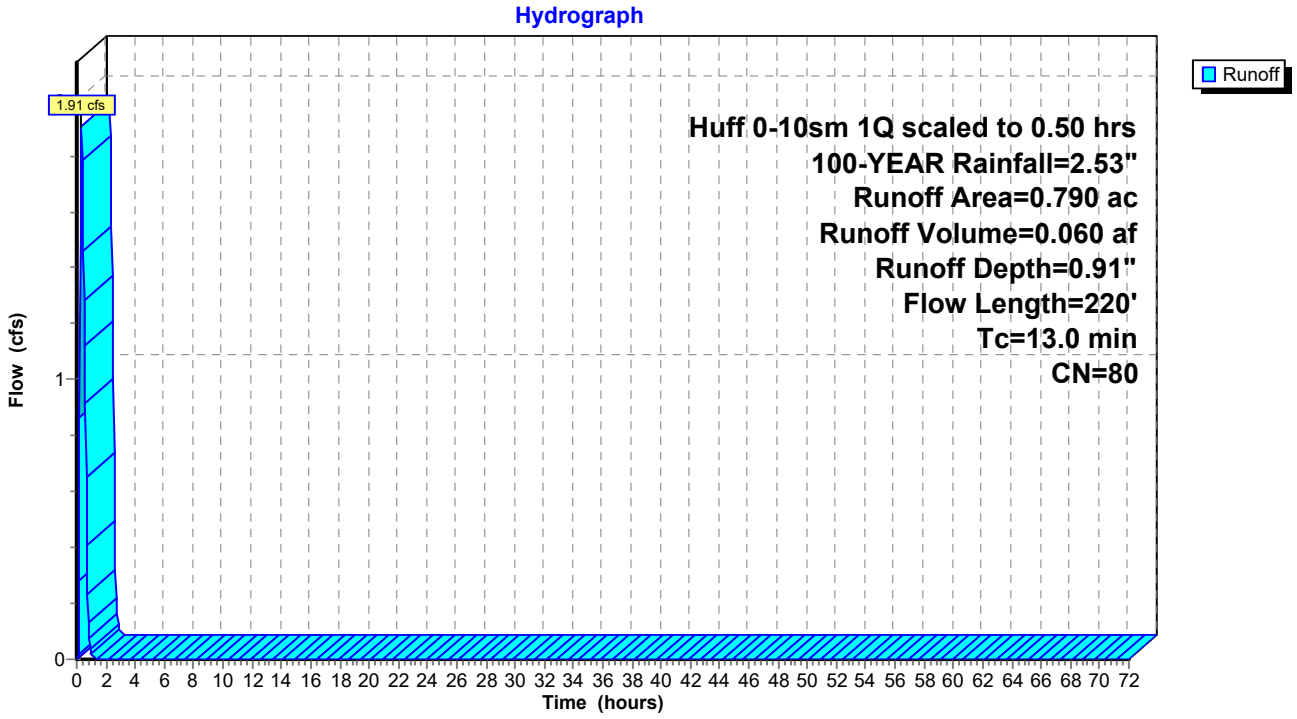
Runoff = 1.91 cfs @ 0.33 hrs, Volume= 0.060 af, Depth= 0.91"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Huff 0-10sm 1Q scaled to 0.50 hrs 100-YEAR Rainfall=2.53"

Area (ac)	CN	Description
0.790	80	>75% Grass cover, Good, HSG D
0.790		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.2	100	0.0160	0.15		**Sheet Flow, Sheet Flow** Grass: Short n= 0.150 P2= 2.91"
1.8	120	0.0240	1.08		**Shallow Concentrated Flow, Shallow Concentrated Flow** Short Grass Pasture Kv= 7.0 fps
13.0	220	Total			

Subcatchment 1B: Pre-Developed Southeast Drainage Area



Summary for Subcatchment 2B: Post Developed Southeast Drainage Area (Detained)

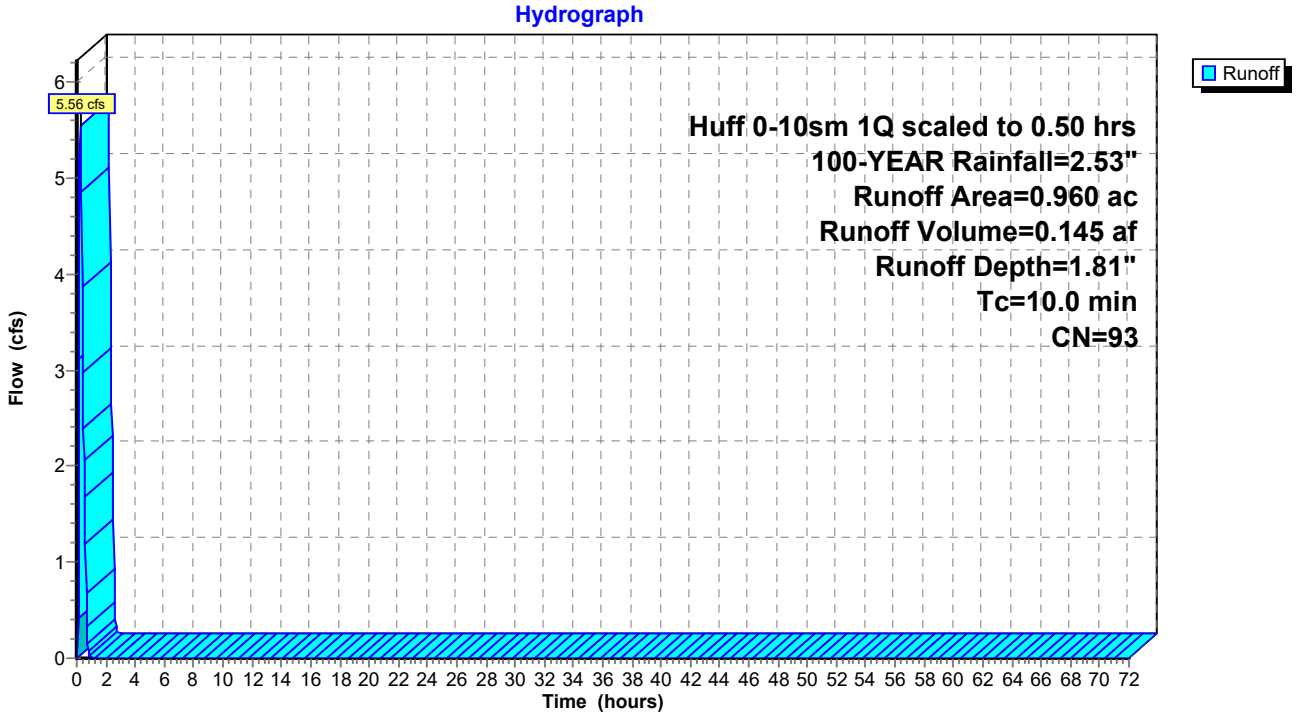
Runoff = 5.56 cfs @ 0.24 hrs, Volume= 0.145 af, Depth= 1.81"
Routed to Pond 4B : Southeast Basin

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Huff 0-10sm 1Q scaled to 0.50 hrs 100-YEAR Rainfall=2.53"

Area (ac)	CN	Description
0.260	80	>75% Grass cover, Good, HSG D
0.700	98	Paved parking, HSG D
0.960	93	Weighted Average
0.260		27.08% Pervious Area
0.700		72.92% Impervious Area

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

Subcatchment 2B: Post Developed Southeast Drainage Area (Detained)



Summary for Subcatchment 3B: Post Developed Southeast Drainage Direct Runoff

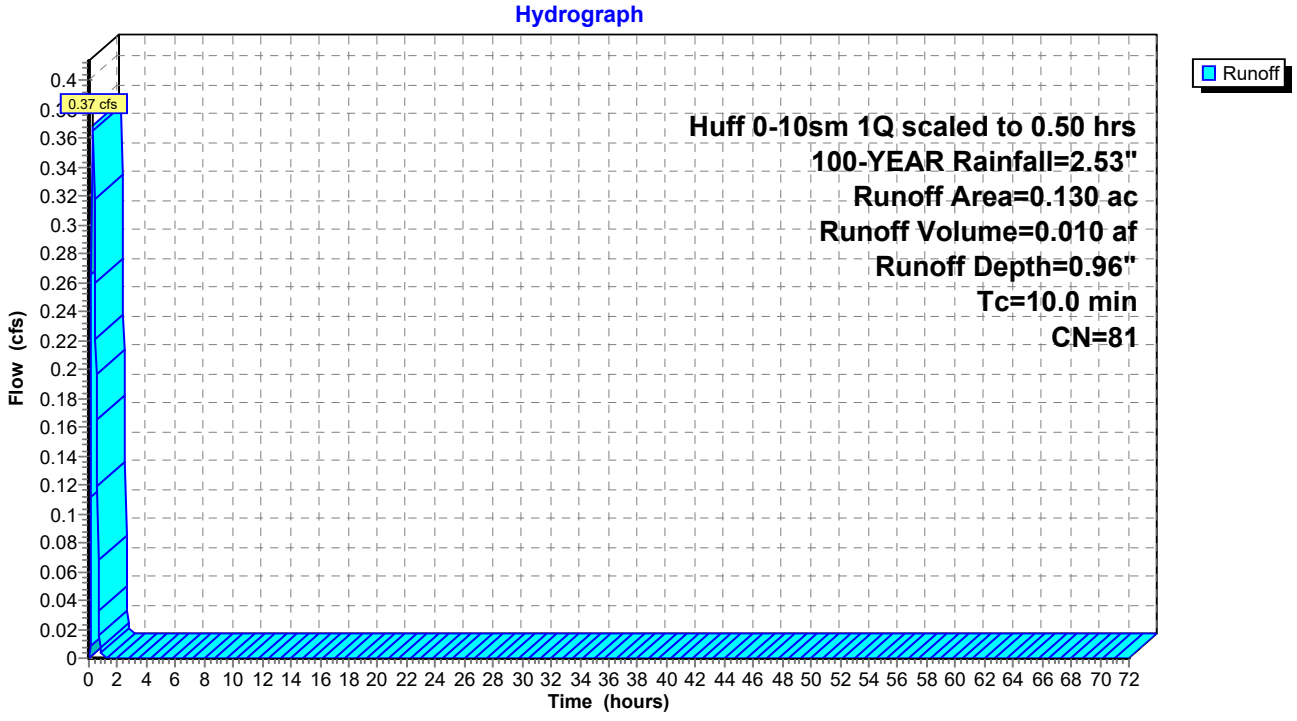
Runoff = 0.37 cfs @ 0.28 hrs, Volume= 0.010 af, Depth= 0.96"
Routed to Link 5B : Final Southeast Outfall

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Huff 0-10sm 1Q scaled to 0.50 hrs 100-YEAR Rainfall=2.53"

Area (ac)	CN	Description
0.120	80	>75% Grass cover, Good, HSG D
0.010	98	Paved parking, HSG D
0.130	81	Weighted Average
0.120		92.31% Pervious Area
0.010		7.69% Impervious Area

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

Subcatchment 3B: Post Developed Southeast Drainage Direct Runoff



Summary for Pond 4B: Southeast Basin

Inflow Area = 0.960 ac, 72.92% Impervious, Inflow Depth = 1.81" for 100-YEAR event
Inflow = 5.56 cfs @ 0.24 hrs, Volume= 0.145 af
Outflow = 0.16 cfs @ 0.76 hrs, Volume= 0.145 af, Atten= 97%, Lag= 30.9 min
Primary = 0.16 cfs @ 0.76 hrs, Volume= 0.145 af
Routed to Link 5B : Final Southeast Outfall

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 779.31' @ 0.76 hrs Surf.Area= 3,842 sf Storage= 5,970 cf

Plug-Flow detention time= 410.1 min calculated for 0.145 af (100% of inflow)
Center-of-Mass det. time= 409.6 min (429.5 - 19.9)

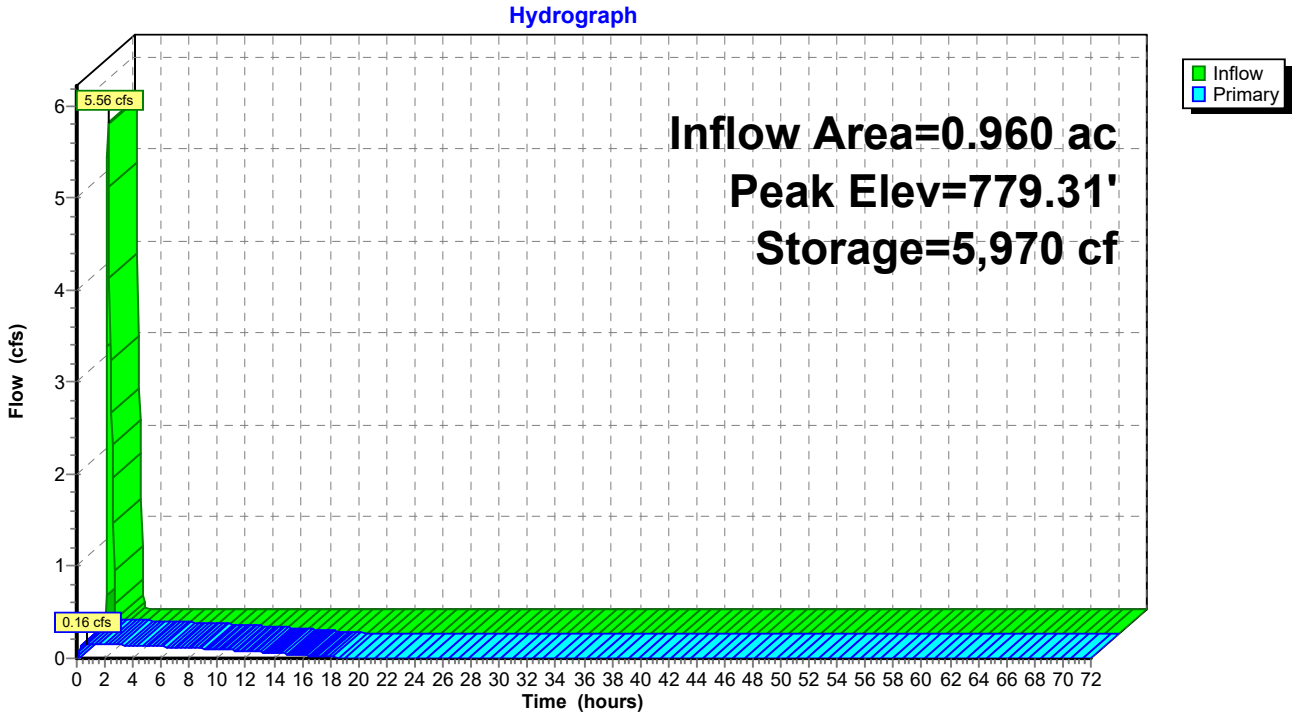
Volume	Invert	Avail.Storage	Storage Description
#1	777.00'	14,236 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
777.00	1,441	0	0
778.00	2,390	1,916	1,916
779.00	3,477	2,934	4,849
780.00	4,669	4,073	8,922
781.00	5,959	5,314	14,236

Device	Routing	Invert	Outlet Devices
#1	Primary	777.00'	**12.0" Round Culvert** L= 30.0' Ke= 0.500 Inlet / Outlet Invert= 777.00' / 776.00' S= 0.0333 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.79 sf
#2	Device 1	777.00'	**2.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Device 1	780.00'	**2.0" x 4.0" Horiz. Orifice/Grate X 6.00 columns** X 5 rows C= 0.600 in 24.0" x 24.0" Grate (42% open area) Limited to weir flow at low heads

Primary OutFlow Max=0.16 cfs @ 0.76 hrs HW=779.31' (Free Discharge)
└**1=Culvert** (Passes 0.16 cfs of 5.08 cfs potential flow)
├**2=Orifice/Grate** (Orifice Controls 0.16 cfs @ 7.18 fps)
└**3=Orifice/Grate** (Controls 0.00 cfs)

Pond 4B: Southeast Basin

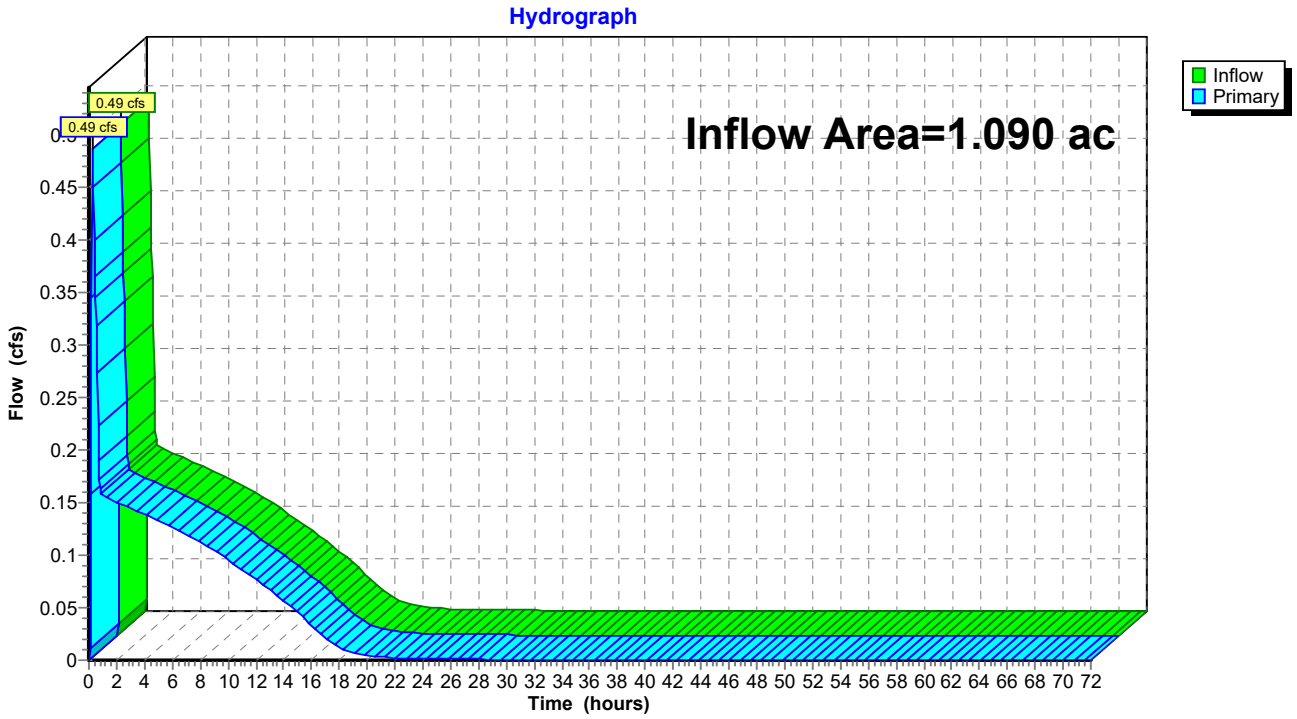


Summary for Link 5B: Final Southeast Outfall

Inflow Area = 1.090 ac, 65.14% Impervious, Inflow Depth = 1.71" for 100-YEAR event
Inflow = 0.49 cfs @ 0.29 hrs, Volume= 0.155 af
Primary = 0.49 cfs @ 0.29 hrs, Volume= 0.155 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Link 5B: Final Southeast Outfall



APPENDIX D:
WATER QUALITY CALCULATIONS

APPENDIX D1.1:
NORTHWEST DRAINAGE AREA
WATER QUALITY CALCULATIONS

Hydrograph for Pond 4A: North Basin

Time (hours)	Inflow (cfs)	Storage (cubic-feet)	Elevation (feet)	Primary (cfs)
0.00	**0.00**	**2,022**	**776.06**	**0.01**
0.25	0.00	2,015	776.06	0.01
0.50	0.00	2,009	776.06	0.01
0.75	0.00	2,003	776.06	0.01
1.00	0.00	1,997	776.06	0.01
1.25	0.00	1,991	776.06	0.01
1.50	0.00	1,985	776.06	0.01
1.75	0.00	1,980	776.06	0.01
2.00	0.00	1,974	776.06	0.01
2.25	0.00	1,968	776.06	0.01
2.50	0.00	1,962	776.06	0.01
2.75	0.00	1,956	776.06	0.01
3.00	0.00	1,950	776.06	0.01
3.25	0.00	1,944	776.06	0.01
3.50	0.00	1,939	776.06	0.01
3.75	0.00	1,933	776.06	0.01
4.00	0.00	1,927	776.06	0.01
4.25	0.00	1,922	776.06	0.01
4.50	0.00	1,916	776.06	0.01
4.75	0.00	1,910	776.06	0.01
5.00	0.00	1,905	776.06	0.01
5.25	0.00	1,899	776.06	0.01
5.50	0.00	1,894	776.06	0.01
5.75	0.00	1,888	776.06	0.01
6.00	0.00	1,883	776.06	0.01
6.25	0.00	1,877	776.06	0.01
6.50	0.00	1,872	776.06	0.01
6.75	0.00	1,866	776.06	0.01
7.00	0.00	1,861	776.06	0.01
7.25	0.00	1,856	776.06	0.01
7.50	0.00	1,850	776.05	0.01
7.75	0.00	1,845	776.05	0.01
8.00	0.00	1,840	776.05	0.01
8.25	0.00	1,834	776.05	0.01
8.50	0.00	1,829	776.05	0.01
8.75	0.00	1,824	776.05	0.01
9.00	0.00	1,819	776.05	0.01
9.25	0.00	1,813	776.05	0.01
9.50	0.00	1,808	776.05	0.01
9.75	0.00	1,803	776.05	0.01
10.00	0.00	1,798	776.05	0.01
10.25	0.00	1,793	776.05	0.01
10.50	0.00	1,788	776.05	0.01
10.75	0.00	1,783	776.05	0.01
11.00	0.00	1,778	776.05	0.01
11.25	0.00	1,773	776.05	0.01
11.50	0.00	1,768	776.05	0.01
11.75	0.00	1,763	776.05	0.01
12.00	0.00	1,758	776.05	0.01
12.25	0.00	1,753	776.05	0.01
12.50	0.00	1,748	776.05	0.01
12.75	0.00	1,743	776.05	0.01

Hydrograph for Pond 4A: North Basin (continued)

Time (hours)	Inflow (cfs)	Storage (cubic-feet)	Elevation (feet)	Primary (cfs)
13.00	0.00	1,738	776.05	0.01
13.25	0.00	1,733	776.05	0.01
13.50	0.00	1,729	776.05	0.01
13.75	0.00	1,724	776.05	0.01
14.00	0.00	1,719	776.05	0.01
14.25	0.00	1,714	776.05	0.01
14.50	0.00	1,710	776.05	0.01
14.75	0.00	1,705	776.05	0.01
15.00	0.00	1,700	776.05	0.01
15.25	0.00	1,696	776.05	0.01
15.50	0.00	1,691	776.05	0.01
15.75	0.00	1,686	776.05	0.01
16.00	0.00	1,682	776.05	0.01
16.25	0.00	1,677	776.05	0.01
16.50	0.00	1,673	776.05	0.01
16.75	0.00	1,668	776.05	0.01
17.00	0.00	1,664	776.05	0.01
17.25	0.00	1,659	776.05	0.00
17.50	0.00	1,655	776.05	0.00
17.75	0.00	1,650	776.05	0.00
18.00	0.00	1,646	776.05	0.00
18.25	0.00	1,641	776.05	0.00
18.50	0.00	1,637	776.05	0.00
18.75	0.00	1,632	776.05	0.00
19.00	0.00	1,628	776.05	0.00
19.25	0.00	1,624	776.05	0.00
19.50	0.00	1,619	776.05	0.00
19.75	0.00	1,615	776.05	0.00
20.00	0.00	1,611	776.05	0.00
20.25	0.00	1,607	776.05	0.00
20.50	0.00	1,602	776.05	0.00
20.75	0.00	1,598	776.05	0.00
21.00	0.00	1,594	776.05	0.00
21.25	0.00	1,590	776.05	0.00
21.50	0.00	1,586	776.05	0.00
21.75	0.00	1,581	776.05	0.00
22.00	0.00	1,577	776.05	0.00
22.25	0.00	1,573	776.05	0.00
22.50	0.00	1,569	776.05	0.00
22.75	0.00	1,565	776.05	0.00
23.00	0.00	1,561	776.05	0.00
23.25	0.00	1,557	776.05	0.00
23.50	0.00	1,553	776.05	0.00
23.75	0.00	1,549	776.05	0.00
24.00	0.00	1,545	776.05	0.00
24.25	0.00	1,541	776.05	0.00
24.50	0.00	1,537	776.05	0.00
24.75	0.00	1,533	776.05	0.00
25.00	0.00	1,529	776.05	0.00
25.25	0.00	1,525	776.05	0.00
25.50	0.00	1,521	776.05	0.00
25.75	0.00	1,517	776.05	0.00

Hydrograph for Pond 4A: North Basin (continued)

Time (hours)	Inflow (cfs)	Storage (cubic-feet)	Elevation (feet)	Primary (cfs)
26.00	0.00	1,514	776.04	0.00
26.25	0.00	1,510	776.04	0.00
26.50	0.00	1,506	776.04	0.00
26.75	0.00	1,502	776.04	0.00
27.00	0.00	1,498	776.04	0.00
27.25	0.00	1,495	776.04	0.00
27.50	0.00	1,491	776.04	0.00
27.75	0.00	1,487	776.04	0.00
28.00	0.00	1,483	776.04	0.00
28.25	0.00	1,480	776.04	0.00
28.50	0.00	1,476	776.04	0.00
28.75	0.00	1,472	776.04	0.00
29.00	0.00	1,469	776.04	0.00
29.25	0.00	1,465	776.04	0.00
29.50	0.00	1,461	776.04	0.00
29.75	0.00	1,458	776.04	0.00
30.00	0.00	1,454	776.04	0.00
30.25	0.00	1,451	776.04	0.00
30.50	0.00	1,447	776.04	0.00
30.75	0.00	1,443	776.04	0.00
31.00	0.00	1,440	776.04	0.00
31.25	0.00	1,436	776.04	0.00
31.50	0.00	1,433	776.04	0.00
31.75	0.00	1,429	776.04	0.00
32.00	0.00	1,426	776.04	0.00
32.25	0.00	1,423	776.04	0.00
32.50	0.00	1,419	776.04	0.00
32.75	0.00	1,416	776.04	0.00
33.00	0.00	1,412	776.04	0.00
33.25	0.00	1,409	776.04	0.00
33.50	0.00	1,406	776.04	0.00
33.75	0.00	1,402	776.04	0.00
34.00	0.00	1,399	776.04	0.00
34.25	0.00	1,396	776.04	0.00
34.50	0.00	1,392	776.04	0.00
34.75	0.00	1,389	776.04	0.00
35.00	0.00	1,386	776.04	0.00
35.25	0.00	1,382	776.04	0.00
35.50	0.00	1,379	776.04	0.00
35.75	0.00	1,376	776.04	0.00
36.00	0.00	1,373	776.04	0.00
36.25	0.00	1,369	776.04	0.00
36.50	0.00	1,366	776.04	0.00
36.75	0.00	1,363	776.04	0.00
37.00	0.00	1,360	776.04	0.00
37.25	0.00	1,357	776.04	0.00
37.50	0.00	1,354	776.04	0.00
37.75	0.00	1,350	776.04	0.00
38.00	0.00	1,347	776.04	0.00
38.25	0.00	1,344	776.04	0.00
38.50	0.00	1,341	776.04	0.00
38.75	0.00	1,338	776.04	0.00

Hydrograph for Pond 4A: North Basin (continued)

Time (hours)	Inflow (cfs)	Storage (cubic-feet)	Elevation (feet)	Primary (cfs)
39.00	0.00	1,335	776.04	0.00
39.25	0.00	1,332	776.04	0.00
39.50	0.00	1,329	776.04	0.00
39.75	0.00	1,326	776.04	0.00
40.00	0.00	1,323	776.04	0.00
40.25	0.00	1,320	776.04	0.00
40.50	0.00	1,317	776.04	0.00
40.75	0.00	1,314	776.04	0.00
41.00	0.00	1,311	776.04	0.00
41.25	0.00	1,308	776.04	0.00
41.50	0.00	1,305	776.04	0.00
41.75	0.00	1,302	776.04	0.00
42.00	0.00	1,299	776.04	0.00
42.25	0.00	1,297	776.04	0.00
42.50	0.00	1,294	776.04	0.00
42.75	0.00	1,291	776.04	0.00
43.00	0.00	1,288	776.04	0.00
43.25	0.00	1,285	776.04	0.00
43.50	0.00	1,282	776.04	0.00
43.75	0.00	1,279	776.04	0.00
44.00	0.00	1,277	776.04	0.00
44.25	0.00	1,274	776.04	0.00
44.50	0.00	1,271	776.04	0.00
44.75	0.00	1,268	776.04	0.00
45.00	0.00	1,266	776.04	0.00
45.25	0.00	1,263	776.04	0.00
45.50	0.00	1,260	776.04	0.00
45.75	0.00	1,257	776.04	0.00
46.00	0.00	1,255	776.04	0.00
46.25	0.00	1,252	776.04	0.00
46.50	0.00	1,249	776.04	0.00
46.75	0.00	1,247	776.04	0.00
47.00	0.00	1,244	776.04	0.00
47.25	0.00	1,241	776.04	0.00
47.50	0.00	1,239	776.04	0.00
47.75	0.00	1,236	776.04	0.00
48.00	0.00	1,234	776.04	0.00
48.25	0.00	1,231	776.04	0.00
48.50	0.00	1,228	776.04	0.00
48.75	0.00	1,226	776.04	0.00
49.00	0.00	1,223	776.04	0.00
49.25	0.00	1,221	776.04	0.00
49.50	0.00	1,218	776.04	0.00
49.75	0.00	1,216	776.04	0.00
50.00	0.00	1,213	776.04	0.00
50.25	0.00	1,211	776.04	0.00
50.50	0.00	1,208	776.04	0.00
50.75	0.00	1,206	776.04	0.00
51.00	0.00	1,203	776.04	0.00
51.25	0.00	1,201	776.04	0.00
51.50	0.00	1,198	776.04	0.00
51.75	0.00	1,196	776.04	0.00

Hydrograph for Pond 4A: North Basin (continued)

Time (hours)	Inflow (cfs)	Storage (cubic-feet)	Elevation (feet)	Primary (cfs)
52.00	0.00	1,193	776.04	0.00
52.25	0.00	1,191	776.04	0.00
52.50	0.00	1,189	776.04	0.00
52.75	0.00	1,186	776.04	0.00
53.00	0.00	1,184	776.04	0.00
53.25	0.00	1,181	776.04	0.00
53.50	0.00	1,179	776.04	0.00
53.75	0.00	1,177	776.03	0.00
54.00	0.00	1,174	776.03	0.00
54.25	0.00	1,172	776.03	0.00
54.50	0.00	1,170	776.03	0.00
54.75	0.00	1,167	776.03	0.00
55.00	0.00	1,165	776.03	0.00
55.25	0.00	1,163	776.03	0.00
55.50	0.00	1,161	776.03	0.00
55.75	0.00	1,158	776.03	0.00
56.00	0.00	1,156	776.03	0.00
56.25	0.00	1,154	776.03	0.00
56.50	0.00	1,151	776.03	0.00
56.75	0.00	1,149	776.03	0.00
57.00	0.00	1,147	776.03	0.00
57.25	0.00	1,145	776.03	0.00
57.50	0.00	1,143	776.03	0.00
57.75	0.00	1,140	776.03	0.00
58.00	0.00	1,138	776.03	0.00
58.25	0.00	1,136	776.03	0.00
58.50	0.00	1,134	776.03	0.00
58.75	0.00	1,132	776.03	0.00
59.00	0.00	1,130	776.03	0.00
59.25	0.00	1,127	776.03	0.00
59.50	0.00	1,125	776.03	0.00
59.75	0.00	1,123	776.03	0.00
60.00	0.00	1,121	776.03	0.00
60.25	0.00	1,119	776.03	0.00
60.50	0.00	1,117	776.03	0.00
60.75	0.00	1,115	776.03	0.00
61.00	0.00	1,113	776.03	0.00
61.25	0.00	1,111	776.03	0.00
61.50	0.00	1,109	776.03	0.00
61.75	0.00	1,107	776.03	0.00
62.00	0.00	1,105	776.03	0.00
62.25	0.00	1,103	776.03	0.00
62.50	0.00	1,101	776.03	0.00
62.75	0.00	1,099	776.03	0.00
63.00	0.00	1,097	776.03	0.00
63.25	0.00	1,095	776.03	0.00
63.50	0.00	1,093	776.03	0.00
63.75	0.00	1,091	776.03	0.00
64.00	0.00	1,089	776.03	0.00
64.25	0.00	1,087	776.03	0.00
64.50	0.00	1,085	776.03	0.00
64.75	0.00	1,083	776.03	0.00

Hydrograph for Pond 4A: North Basin (continued)

Time (hours)	Inflow (cfs)	Storage (cubic-feet)	Elevation (feet)	Primary (cfs)
65.00	0.00	1,081	776.03	0.00
65.25	0.00	1,079	776.03	0.00
65.50	0.00	1,077	776.03	0.00
65.75	0.00	1,075	776.03	0.00
66.00	0.00	1,073	776.03	0.00
66.25	0.00	1,071	776.03	0.00
66.50	0.00	1,070	776.03	0.00
66.75	0.00	1,068	776.03	0.00
67.00	0.00	1,066	776.03	0.00
67.25	0.00	1,064	776.03	0.00
67.50	0.00	1,062	776.03	0.00
67.75	0.00	1,060	776.03	0.00
68.00	0.00	1,058	776.03	0.00
68.25	0.00	1,057	776.03	0.00
68.50	0.00	1,055	776.03	0.00
68.75	0.00	1,053	776.03	0.00
69.00	0.00	1,051	776.03	0.00
69.25	0.00	1,049	776.03	0.00
69.50	0.00	1,048	776.03	0.00
69.75	0.00	1,046	776.03	0.00
70.00	0.00	1,044	776.03	0.00
70.25	0.00	1,042	776.03	0.00
70.50	0.00	1,041	776.03	0.00
70.75	0.00	1,039	776.03	0.00
71.00	0.00	1,037	776.03	0.00
71.25	0.00	1,035	776.03	0.00
71.50	0.00	1,034	776.03	0.00
71.75	0.00	1,032	776.03	0.00
72.00	0.00	1,030	776.03	0.00

APPENDIX D1.2:
SOUTHEAST DRAINAGE AREA
WATER QUALITY CALCULATIONS

Hydrograph for Pond 4B: Southeast Basin

Time (hours)	Inflow (cfs)	Storage (cubic-feet)	Elevation (feet)	Primary (cfs)
0.00	**0.00**	**458**	**777.29**	**0.05**
0.25	0.00	416	777.27	0.04
0.50	0.00	377	777.24	0.04
0.75	0.00	341	777.22	0.04
1.00	0.00	307	777.20	0.04
1.25	0.00	276	777.18	0.03
1.50	0.00	248	777.16	0.03
1.75	0.00	223	777.15	0.03
2.00	0.00	201	777.13	0.02
2.25	0.00	181	777.12	0.02
2.50	0.00	165	777.11	0.02
2.75	0.00	150	777.10	0.02
3.00	0.00	137	777.09	0.01
3.25	0.00	126	777.09	0.01
3.50	0.00	117	777.08	0.01
3.75	0.00	109	777.07	0.01
4.00	0.00	101	777.07	0.01
4.25	0.00	94	777.06	0.01
4.50	0.00	88	777.06	0.01
4.75	0.00	83	777.06	0.01
5.00	0.00	78	777.05	0.01
5.25	0.00	74	777.05	0.00
5.50	0.00	70	777.05	0.00
5.75	0.00	66	777.05	0.00
6.00	0.00	63	777.04	0.00
6.25	0.00	60	777.04	0.00
6.50	0.00	58	777.04	0.00
6.75	0.00	55	777.04	0.00
7.00	0.00	53	777.04	0.00
7.25	0.00	51	777.03	0.00
7.50	0.00	49	777.03	0.00
7.75	0.00	47	777.03	0.00
8.00	0.00	45	777.03	0.00
8.25	0.00	43	777.03	0.00
8.50	0.00	41	777.03	0.00
8.75	0.00	39	777.03	0.00
9.00	0.00	38	777.03	0.00
9.25	0.00	36	777.02	0.00
9.50	0.00	35	777.02	0.00
9.75	0.00	33	777.02	0.00
10.00	0.00	32	777.02	0.00
10.25	0.00	31	777.02	0.00
10.50	0.00	29	777.02	0.00
10.75	0.00	28	777.02	0.00
11.00	0.00	27	777.02	0.00
11.25	0.00	26	777.02	0.00
11.50	0.00	25	777.02	0.00
11.75	0.00	24	777.02	0.00
12.00	0.00	23	777.02	0.00
12.25	0.00	22	777.01	0.00
12.50	0.00	21	777.01	0.00
12.75	0.00	20	777.01	0.00

Hydrograph for Pond 4B: Southeast Basin (continued)

Time (hours)	Inflow (cfs)	Storage (cubic-feet)	Elevation (feet)	Primary (cfs)
13.00	0.00	19	777.01	0.00
13.25	0.00	18	777.01	0.00
13.50	0.00	18	777.01	0.00
13.75	0.00	17	777.01	0.00
14.00	0.00	16	777.01	0.00
14.25	0.00	16	777.01	0.00
14.50	0.00	15	777.01	0.00
14.75	0.00	14	777.01	0.00
15.00	0.00	14	777.01	0.00
15.25	0.00	13	777.01	0.00
15.50	0.00	13	777.01	0.00
15.75	0.00	12	777.01	0.00
16.00	0.00	12	777.01	0.00
16.25	0.00	11	777.01	0.00
16.50	0.00	11	777.01	0.00
16.75	0.00	10	777.01	0.00
17.00	0.00	10	777.01	0.00
17.25	0.00	9	777.01	0.00
17.50	0.00	9	777.01	0.00
17.75	0.00	9	777.01	0.00
18.00	0.00	8	777.01	0.00
18.25	0.00	8	777.01	0.00
18.50	0.00	8	777.01	0.00
18.75	0.00	7	777.00	0.00
19.00	0.00	7	777.00	0.00
19.25	0.00	7	777.00	0.00
19.50	0.00	6	777.00	0.00
19.75	0.00	6	777.00	0.00
20.00	0.00	6	777.00	0.00
20.25	0.00	6	777.00	0.00
20.50	0.00	5	777.00	0.00
20.75	0.00	5	777.00	0.00
21.00	0.00	5	777.00	0.00
21.25	0.00	5	777.00	0.00
21.50	0.00	5	777.00	0.00
21.75	0.00	4	777.00	0.00
22.00	0.00	4	777.00	0.00
22.25	0.00	4	777.00	0.00
22.50	0.00	4	777.00	0.00
22.75	0.00	4	777.00	0.00
23.00	0.00	4	777.00	0.00
23.25	0.00	3	777.00	0.00
23.50	0.00	3	777.00	0.00
23.75	0.00	3	777.00	0.00
24.00	0.00	3	777.00	0.00
24.25	0.00	3	777.00	0.00
24.50	0.00	3	777.00	0.00
24.75	0.00	3	777.00	0.00
25.00	0.00	3	777.00	0.00
25.25	0.00	2	777.00	0.00
25.50	0.00	2	777.00	0.00
25.75	0.00	2	777.00	0.00

Hydrograph for Pond 4B: Southeast Basin (continued)

Time (hours)	Inflow (cfs)	Storage (cubic-feet)	Elevation (feet)	Primary (cfs)
26.00	0.00	2	777.00	0.00
26.25	0.00	2	777.00	0.00
26.50	0.00	2	777.00	0.00
26.75	0.00	2	777.00	0.00
27.00	0.00	2	777.00	0.00
27.25	0.00	2	777.00	0.00
27.50	0.00	2	777.00	0.00
27.75	0.00	2	777.00	0.00
28.00	0.00	2	777.00	0.00
28.25	0.00	1	777.00	0.00
28.50	0.00	1	777.00	0.00
28.75	0.00	1	777.00	0.00
29.00	0.00	1	777.00	0.00
29.25	0.00	1	777.00	0.00
29.50	0.00	1	777.00	0.00
29.75	0.00	1	777.00	0.00
30.00	0.00	1	777.00	0.00
30.25	0.00	1	777.00	0.00
30.50	0.00	1	777.00	0.00
30.75	0.00	1	777.00	0.00
31.00	0.00	1	777.00	0.00
31.25	0.00	1	777.00	0.00
31.50	0.00	1	777.00	0.00
31.75	0.00	1	777.00	0.00
32.00	0.00	1	777.00	0.00
32.25	0.00	1	777.00	0.00
32.50	0.00	1	777.00	0.00
32.75	0.00	1	777.00	0.00
33.00	0.00	1	777.00	0.00
33.25	0.00	1	777.00	0.00
33.50	0.00	1	777.00	0.00
33.75	0.00	1	777.00	0.00
34.00	0.00	1	777.00	0.00
34.25	0.00	1	777.00	0.00
34.50	0.00	1	777.00	0.00
34.75	0.00	0	777.00	0.00
35.00	0.00	0	777.00	0.00
35.25	0.00	0	777.00	0.00
35.50	0.00	0	777.00	0.00
35.75	0.00	0	777.00	0.00
36.00	0.00	0	777.00	0.00
36.25	0.00	0	777.00	0.00
36.50	0.00	0	777.00	0.00
36.75	0.00	0	777.00	0.00
37.00	0.00	0	777.00	0.00
37.25	0.00	0	777.00	0.00
37.50	0.00	0	777.00	0.00
37.75	0.00	0	777.00	0.00
38.00	0.00	0	777.00	0.00
38.25	0.00	0	777.00	0.00
38.50	0.00	0	777.00	0.00
38.75	0.00	0	777.00	0.00

Hydrograph for Pond 4B: Southeast Basin (continued)

Time (hours)	Inflow (cfs)	Storage (cubic-feet)	Elevation (feet)	Primary (cfs)
39.00	0.00	0	777.00	0.00
39.25	0.00	0	777.00	0.00
39.50	0.00	0	777.00	0.00
39.75	0.00	0	777.00	0.00
40.00	0.00	0	777.00	0.00
40.25	0.00	0	777.00	0.00
40.50	0.00	0	777.00	0.00
40.75	0.00	0	777.00	0.00
41.00	0.00	0	777.00	0.00
41.25	0.00	0	777.00	0.00
41.50	0.00	0	777.00	0.00
41.75	0.00	0	777.00	0.00
42.00	0.00	0	777.00	0.00
42.25	0.00	0	777.00	0.00
42.50	0.00	0	777.00	0.00
42.75	0.00	0	777.00	0.00
43.00	0.00	0	777.00	0.00
43.25	0.00	0	777.00	0.00
43.50	0.00	0	777.00	0.00
43.75	0.00	0	777.00	0.00
44.00	0.00	0	777.00	0.00
44.25	0.00	0	777.00	0.00
44.50	0.00	0	777.00	0.00
44.75	0.00	0	777.00	0.00
45.00	0.00	0	777.00	0.00
45.25	0.00	0	777.00	0.00
45.50	0.00	0	777.00	0.00
45.75	0.00	0	777.00	0.00
46.00	0.00	0	777.00	0.00
46.25	0.00	0	777.00	0.00
46.50	0.00	0	777.00	0.00
46.75	0.00	0	777.00	0.00
47.00	0.00	0	777.00	0.00
47.25	0.00	0	777.00	0.00
47.50	0.00	0	777.00	0.00
47.75	0.00	0	777.00	0.00
48.00	0.00	0	777.00	0.00
48.25	0.00	0	777.00	0.00
48.50	0.00	0	777.00	0.00
48.75	0.00	0	777.00	0.00
49.00	0.00	0	777.00	0.00
49.25	0.00	0	777.00	0.00
49.50	0.00	0	777.00	0.00
49.75	0.00	0	777.00	0.00
50.00	0.00	0	777.00	0.00
50.25	0.00	0	777.00	0.00
50.50	0.00	0	777.00	0.00
50.75	0.00	0	777.00	0.00
51.00	0.00	0	777.00	0.00
51.25	0.00	0	777.00	0.00
51.50	0.00	0	777.00	0.00
51.75	0.00	0	777.00	0.00

Hydrograph for Pond 4B: Southeast Basin (continued)

Time (hours)	Inflow (cfs)	Storage (cubic-feet)	Elevation (feet)	Primary (cfs)
52.00	0.00	0	777.00	0.00
52.25	0.00	0	777.00	0.00
52.50	0.00	0	777.00	0.00
52.75	0.00	0	777.00	0.00
53.00	0.00	0	777.00	0.00
53.25	0.00	0	777.00	0.00
53.50	0.00	0	777.00	0.00
53.75	0.00	0	777.00	0.00
54.00	0.00	0	777.00	0.00
54.25	0.00	0	777.00	0.00
54.50	0.00	0	777.00	0.00
54.75	0.00	0	777.00	0.00
55.00	0.00	0	777.00	0.00
55.25	0.00	0	777.00	0.00
55.50	0.00	0	777.00	0.00
55.75	0.00	0	777.00	0.00
56.00	0.00	0	777.00	0.00
56.25	0.00	0	777.00	0.00
56.50	0.00	0	777.00	0.00
56.75	0.00	0	777.00	0.00
57.00	0.00	0	777.00	0.00
57.25	0.00	0	777.00	0.00
57.50	0.00	0	777.00	0.00
57.75	0.00	0	777.00	0.00
58.00	0.00	0	777.00	0.00
58.25	0.00	0	777.00	0.00
58.50	0.00	0	777.00	0.00
58.75	0.00	0	777.00	0.00
59.00	0.00	0	777.00	0.00
59.25	0.00	0	777.00	0.00
59.50	0.00	0	777.00	0.00
59.75	0.00	0	777.00	0.00
60.00	0.00	0	777.00	0.00
60.25	0.00	0	777.00	0.00
60.50	0.00	0	777.00	0.00
60.75	0.00	0	777.00	0.00
61.00	0.00	0	777.00	0.00
61.25	0.00	0	777.00	0.00
61.50	0.00	0	777.00	0.00
61.75	0.00	0	777.00	0.00
62.00	0.00	0	777.00	0.00
62.25	0.00	0	777.00	0.00
62.50	0.00	0	777.00	0.00
62.75	0.00	0	777.00	0.00
63.00	0.00	0	777.00	0.00
63.25	0.00	0	777.00	0.00
63.50	0.00	0	777.00	0.00
63.75	0.00	0	777.00	0.00
64.00	0.00	0	777.00	0.00
64.25	0.00	0	777.00	0.00
64.50	0.00	0	777.00	0.00
64.75	0.00	0	777.00	0.00

Hydrograph for Pond 4B: Southeast Basin (continued)

Time (hours)	Inflow (cfs)	Storage (cubic-feet)	Elevation (feet)	Primary (cfs)
65.00	0.00	0	777.00	0.00
65.25	0.00	0	777.00	0.00
65.50	0.00	0	777.00	0.00
65.75	0.00	0	777.00	0.00
66.00	0.00	0	777.00	0.00
66.25	0.00	0	777.00	0.00
66.50	0.00	0	777.00	0.00
66.75	0.00	0	777.00	0.00
67.00	0.00	0	777.00	0.00
67.25	0.00	0	777.00	0.00
67.50	0.00	0	777.00	0.00
67.75	0.00	0	777.00	0.00
68.00	0.00	0	777.00	0.00
68.25	0.00	0	777.00	0.00
68.50	0.00	0	777.00	0.00
68.75	0.00	0	777.00	0.00
69.00	0.00	0	777.00	0.00
69.25	0.00	0	777.00	0.00
69.50	0.00	0	777.00	0.00
69.75	0.00	0	777.00	0.00
70.00	0.00	0	777.00	0.00
70.25	0.00	0	777.00	0.00
70.50	0.00	0	777.00	0.00
70.75	0.00	0	777.00	0.00
71.00	0.00	0	777.00	0.00
71.25	0.00	0	777.00	0.00
71.50	0.00	0	777.00	0.00
71.75	0.00	0	777.00	0.00
72.00	0.00	0	777.00	0.00

APPENDIX F:
SITE SOILS

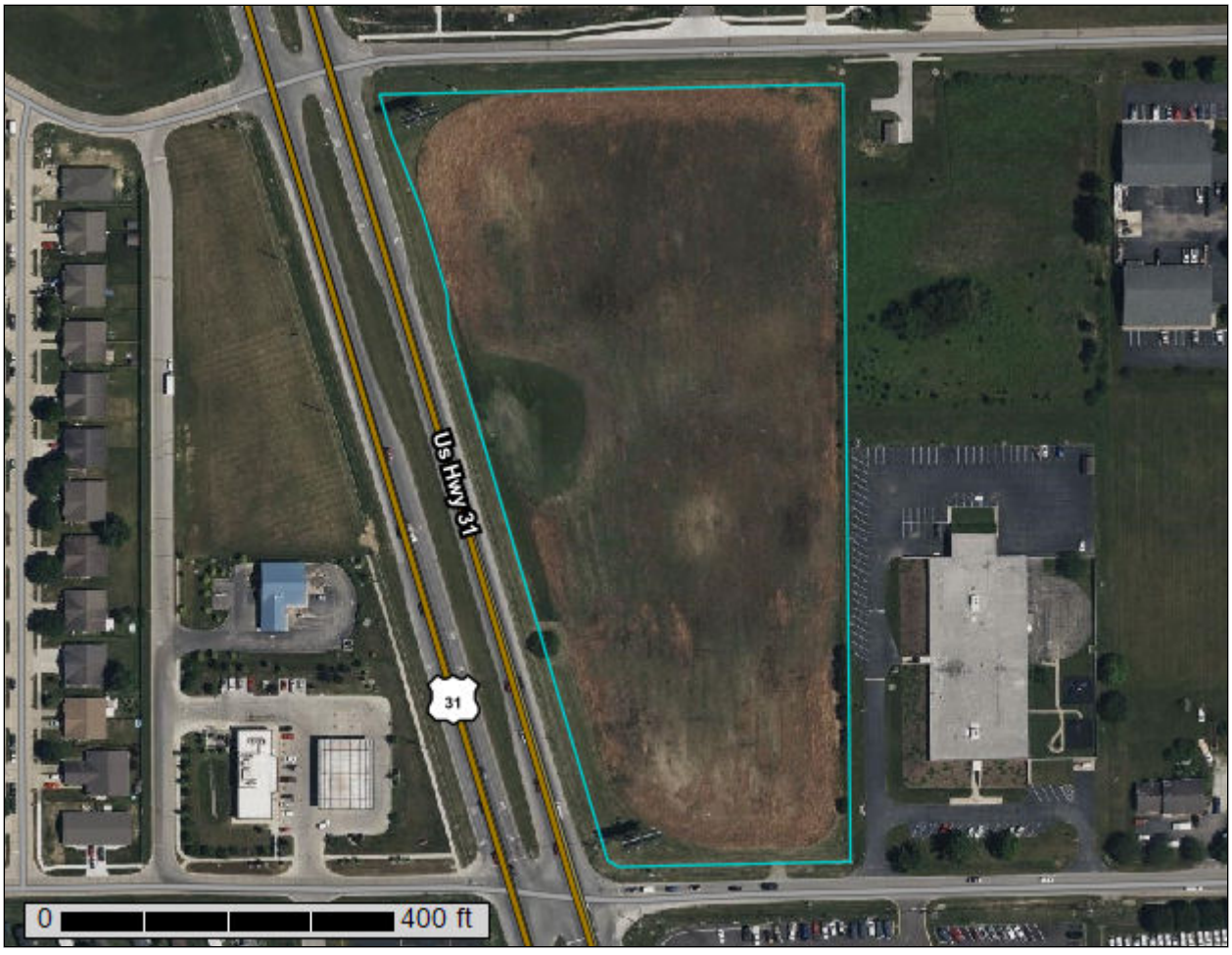
United States Department of Agriculture

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 Johnson County, Indiana



November 8, 2024

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.

Custom Soil Resource Report
Soil Map

Map Scale: 1:1,680 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 20 40 80 120

Feet: 0 50 100 200 300

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 16N 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 1:15,800.

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: Johnson County, Indiana
Survey Area Data: Version 32, Aug 26, 2024

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

Date(s) aerial images were photographed: Jun 15, 2022—Jun 21, 2022

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
Br	Brookston silty clay loam, 0 to 2 percent slopes	2.5	27.9%
CrA	Crosby silt loam, fine-loamy subsoil, 0 to 2 percent slopes	0.6	6.8%
UbaA	Urban land-Brookston complex, 0 to 2 percent slopes	0.1	1.3%
UcfA	Urban land-Crosby silt loam complex, fine-loamy subsoil, 0 to 2 percent slopes	0.3	3.6%
YclA	Crosby silt loam, fine-loamy subsoil-Urban land complex, 0 to 2 percent slopes	5.5	60.4%
Totals for Area of Interest		**9.1**	**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.

Johnson County, Indiana

Br—Brookston silty clay loam, 0 to 2 percent slopes

Map Unit Setting

National map unit symbol: 2t98n
Elevation: 600 to 1,260 feet
Mean annual precipitation: 37 to 46 inches
Mean annual air temperature: 48 to 55 degrees F
Frost-free period: 145 to 180 days
Farmland classification: Prime farmland if drained

Map Unit Composition

Brookston and similar soils: 95 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Brookston

Setting

Landform: Till plains, depressions
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Dip
Down-slope shape: Linear, concave
Across-slope shape: Concave
Parent material: Loess over loamy till

Typical profile

Ap - 0 to 16 inches: silty clay loam
Btg1 - 16 to 32 inches: silty clay loam
Btg2 - 32 to 44 inches: loam
C - 44 to 60 inches: loam

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Poorly drained
Runoff class: Negligible
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: About 0 to 12 inches
Frequency of flooding: None
Frequency of ponding: Frequent
Calcium carbonate, maximum content: 40 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Moderate (about 8.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2w
Hydrologic Soil Group: B/D
Ecological site: F111XA007IN - Till Depression Flatwood
Hydric soil rating: Yes

Minor Components

Crosby

Percent of map unit: 5 percent
Landform: Till plains
Landform position (two-dimensional): Summit, footslope
Landform position (three-dimensional): Talf
Down-slope shape: Concave
Across-slope shape: Linear
Ecological site: F111XA008IN - Wet Till Ridge
Hydric soil rating: No

CrA—Crosby silt loam, fine-loamy subsoil, 0 to 2 percent slopes

Map Unit Setting

National map unit symbol: 2thy4
Elevation: 600 to 1,000 feet
Mean annual precipitation: 36 to 44 inches
Mean annual air temperature: 49 to 54 degrees F
Frost-free period: 145 to 180 days
Farmland classification: Prime farmland if drained

Map Unit Composition

Crosby and similar soils: 93 percent
Minor components: 7 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Crosby

Setting

Landform: Ground moraines, recessionial moraines, water-lain moraines
Landform position (two-dimensional): Summit, backslope, footslope
Landform position (three-dimensional): Interfluve
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Silty material or loess over loamy till

Typical profile

Ap - 0 to 10 inches: silt loam
Btg - 10 to 17 inches: silty clay loam
2Bt - 17 to 29 inches: clay loam
2BCt - 29 to 36 inches: loam
2Cd - 36 to 79 inches: loam

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: 24 to 40 inches to densic material
Drainage class: Somewhat poorly drained
Runoff class: Medium

Capacity of the most limiting layer to transmit water (Ksat): Low to moderately high (0.01 to 0.20 in/hr)
Depth to water table: About 6 to 24 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 55 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Moderate (about 6.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2w
Hydrologic Soil Group: C/D
Ecological site: F111XA008IN - Wet Till Ridge
Hydric soil rating: No

Minor Components

Williamstown, moderately eroded

Percent of map unit: 5 percent
Landform: Water-lain moraines, ground moraines, recessionial moraines
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Head slope, nose slope, side slope, crest
Down-slope shape: Convex, linear
Across-slope shape: Linear, convex
Ecological site: F111XA009IN - Till Ridge
Hydric soil rating: No

Treaty, drained

Percent of map unit: 2 percent
Landform: Depressions, water-lain moraines, swales
Landform position (two-dimensional): Footslope, toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Linear
Across-slope shape: Concave
Ecological site: F111XA007IN - Till Depression Flatwood
Hydric soil rating: Yes

UbaA—Urban land-Brookston complex, 0 to 2 percent slopes

Map Unit Setting

National map unit symbol: 2y48h
Elevation: 640 to 930 feet
Mean annual precipitation: 36 to 42 inches
Mean annual air temperature: 49 to 53 degrees F
Frost-free period: 175 to 185 days
Farmland classification: Not prime farmland

Map Unit Composition

Urban land: 60 percent

Brookston, drained, and similar soils: 40 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Urban Land

Setting
Landform: Till plains

Description of Brookston, Drained

Setting
Landform: Depressions on till plains
Landform position (two-dimensional): Footslope
Down-slope shape: Concave
Across-slope shape: Linear
Parent material: Loess over loamy till

Typical profile
H1 - 0 to 14 inches: silty clay loam
H2 - 14 to 54 inches: clay loam
H3 - 54 to 60 inches: loam

Properties and qualities
Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Poorly drained
Runoff class: Negligible
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: About 0 to 12 inches
Frequency of flooding: None
Frequency of ponding: Frequent
Calcium carbonate, maximum content: 40 percent
Available water supply, 0 to 60 inches: High (about 9.7 inches)

Interpretive groups
Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2w
Hydrologic Soil Group: B/D
Ecological site: F111XA007IN - Till Depression Flatwood
Hydric soil rating: Yes

UcfA—Urban land-Crosby silt loam complex, fine-loamy subsoil, 0 to 2 percent slopes

Map Unit Setting
National map unit symbol: 2y47p
Elevation: 600 to 1,260 feet
Mean annual precipitation: 36 to 46 inches
Mean annual air temperature: 48 to 55 degrees F
Frost-free period: 145 to 180 days

Farmland classification: Not prime farmland

Map Unit Composition

Urban land: 60 percent
Crosby and similar soils: 35 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Crosby

Setting

Landform: Water-lain moraines, ground moraines, recessionial moraines
Landform position (two-dimensional): Summit, backslope, footslope
Landform position (three-dimensional): Interfluve, rise
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Silty material or loess over loamy till

Typical profile

Ap - 0 to 8 inches: silt loam
BE - 8 to 11 inches: silt loam
Bt - 11 to 14 inches: silt loam
2Bt - 14 to 28 inches: silty clay
2BCt - 28 to 36 inches: loam
2Cd - 36 to 79 inches: loam

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: 24 to 40 inches to densic material
Drainage class: Somewhat poorly drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Low to moderately high (0.01 to 0.20 in/hr)
Depth to water table: About 6 to 24 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 50 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 5.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2w
Hydrologic Soil Group: C/D
Ecological site: F111XA008IN - Wet Till Ridge
Hydric soil rating: No

Minor Components

Treaty, drained

Percent of map unit: 5 percent
Landform: Depressions, water-lain moraines, swales
Landform position (two-dimensional): Footslope, toeslope
Landform position (three-dimensional): Base slope, dip
Down-slope shape: Linear
Across-slope shape: Concave
Ecological site: F111XA007IN - Till Depression Flatwood

Hydric soil rating: Yes

YclA—Crosby silt loam, fine-loamy subsoil-Urban land complex, 0 to 2 percent slopes

Map Unit Setting

National map unit symbol: 2w57p
Elevation: 600 to 1,040 feet
Mean annual precipitation: 36 to 46 inches
Mean annual air temperature: 48 to 55 degrees F
Frost-free period: 145 to 180 days
Farmland classification: Not prime farmland

Map Unit Composition

Crosby and similar soils: 60 percent
Urban land: 30 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Crosby

Setting

Landform: Water-lain moraines, ground moraines, recessionial moraines
Landform position (two-dimensional): Summit, backslope, footslope
Landform position (three-dimensional): Interfluve, rise
Down-slope shape: Linear, convex
Across-slope shape: Convex, linear
Parent material: Silty material or loess over loamy till

Typical profile

Ap - 0 to 10 inches: silt loam
Btg - 10 to 17 inches: silty clay loam
2Bt - 17 to 29 inches: clay loam
2BCt - 29 to 36 inches: loam
2Cd - 36 to 79 inches: loam

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: 24 to 40 inches to densic material
Drainage class: Somewhat poorly drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Low to moderately high (0.01 to 0.20 in/hr)
Depth to water table: About 6 to 24 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 55 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Moderate (about 6.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2w
Hydrologic Soil Group: C/D
Ecological site: F111XA008IN - Wet Till Ridge
Hydric soil rating: No

Minor Components

Treaty, drained

Percent of map unit: 5 percent
Landform: Depressions, water-lain moraines, swales
Landform position (two-dimensional): Footslope, toeslope
Landform position (three-dimensional): Base slope, dip
Down-slope shape: Linear
Across-slope shape: Concave
Ecological site: F111XA007IN - Till Depression Flatwood
Hydric soil rating: Yes

Williamstown, eroded

Percent of map unit: 5 percent
Landform: Water-lain moraines, ground moraines, recessionial moraines
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Head slope, nose slope, side slope, crest, rise
Down-slope shape: Convex, linear
Across-slope shape: Linear, convex
Ecological site: F111XA009IN - Till Ridge
Hydric soil rating: No

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