

APPENDIX 10.8

STORMWATER MANAGEMENT SYSTEM DESIGN, DEWATERING PLANS, AND CALCULATIONS

September 23, 2015

**FPL Okeechobee Clean Energy Center
Storm Water Management Summary Report**

Overall Project Description

Florida Power & Light Company (FPL) is proposing to construct a 3-on-1 combined cycle power plant in Okeechobee County. The proposed plant consists of (3) highly efficient combustion turbines and (1) steam turbine to produce energy for the FPL system. Associated with the Project is an existing entrance road that provides access from SR-60 to the Project and lies within neighboring Indian River County to the north of the project Site.

The existing project Site consists mainly of citrus groves and pasture land with some wetlands. The proposed certified Site area is made up of approximately 2341 acres, of which 220 acres are within the proposed OCEC Unit 1 area. Of the 220 acres of the proposed OCEC Unit 1 area, 14.5 acres will be disturbed to develop the storm water diversion canals and 77 acres are designated to be impervious and will be treated by the proposed storm water management system.

Existing Storm Water Management System

The existing storm water management system consists of a series of irrigation and diversion canals to service the citrus groves and pasture land. The total pre-development basin area within the certified Site area that contributes to the existing outfalls is 2287.58 acres, which is made up of basins that extend off-Site in addition to the basins that lie solely on Site. The existing sub-basins, that contribute runoff to the proposed development area, contribute storm water runoff to two existing outfall locations identified as CP-1 and NN4B1. See Black & Veatch drawing 185922-DS-1103 for an overlay of the existing sub-basin areas on the existing topography, and for location of the existing outfalls. The table below provides a summary of the existing sub-basin areas for the Pre-Development condition.

PRE DEVELOPMENT PROJECT LIMITS SUMMARY				
CONTRIBUTING SUB BASIN	TOTAL AREA AND PERCENT PERVIOUS & IMPERVIOUS			OUTFALL
	ACRE	PERCENT PERVIOUS	PERCENT IMPERVIOUS	
BE 3	44.50	100%	0%	CP-1
BE 4	201.00	100%	0%	CP-1
BE 5	68.15	100%	0%	CP-1
BE 7	19.50	100%	0%	CP-1
BE 8	102.23	100%	0%	CP-1
BE 9	101.50	100%	0%	CP-1
BE 10	76.00	100%	0%	CP-1
BE 11	79.80	100%	0%	CP-1
BE 12	66.40	100%	0%	CP-1
BE 13	112.30	100%	0%	CP-1

BE 14A	499.20	100%	0%	CP-1
BE 14B	333.70	100%	0%	CP-1
BN 4C	210.70	100%	0%	CP-1 / NN4B1
BN 4B1B	311.40	100%	0%	CP-1 / NN4B1
BN 4B1	61.20	100%	0%	NN4B1
TOTAL CONTRIBUTING BASIN	2287.58	100%	0%	-

NOTE: CONTRIBUTING BASINS ARE BASINS THAT CONTRIBUTE RUNOFF TO THE EXISTING OUTFALLS

Reference Black & Veatch Calculation 58.5406.1000 "Storm Water Analysis – Summary Sheet", and Black & Veatch Calculation 58.5406.1101 "Pre-Development Storm Water Analysis" for further details.

Storm Water Management System Proposed Modifications

The Project to be developed is located in Okeechobee County, Florida; therefore the new storm water management system (SWMS) design is governed by the Florida Department of Environmental Protection (FDEP) regulations for Environmental Resource Permitting (ERP) (Chapter 62-330, F.A.C.). According to these regulations, the rules of the local water management district are adopted by reference for the FDEP ERP requirements. The Project Site falls within the St Johns River Water Management District (SJRWMD), therefore the SWMS for this Project is designed to meet or exceed the criteria set forth in the Applicant's Handbook, Volume II: For use Within the Geographic Limits of the St. Johns River Water Management District.

The development area has been designed in accordance with the SJRWMD regulations and established Best Management Practices (BMPs). The storm water runoff from the proposed development area is designed to be routed through two storm water wet detention ponds, identified as Pond 4-1 and Pond 4-2 on the design plans and within the design calculations. To prevent storm water run-on from the area west of the development area not currently planned for development, the existing diversion canals in conjunction with new storm water diversion canals will be used to route the storm water around the development area back to the existing outfalls. The new storm water wet detention ponds and the diversion canals will contribute runoff to the existing outfalls CP-1 and NN4B1 at a rate less than the pre-development condition. The tables below provide a summary of the existing sub-basin areas for the Post-Development condition.

POST DEVELOPMENT PROJECT LIMITS SUMMARY					
CONTRIBUTING BASIN	SUB	TOTAL AREA AND PERCENT PERVIOUS & IMPERVIOUS			OUTFALL
		ACRE	PERCENT PERVIOUS	PERCENT IMPERVIOUS	
*BE 3		22.95	100%	0%	CP-1
BE 4		40.27	100%	0%	NN4B1
BE 4-1		84.15	54%	46%	CP-1

BE 4-2	76.00	55%	45%	CP-1
BE 4-3	35.80	100%	0%	CP-1
*BE 5	51.65	100%	0%	CP-1
*BE 7	19.50	100%	0%	CP-1
*BE 8	102.23	100%	0%	CP-1
*BE 9	101.50	100%	0%	CP-1
*BE 10	76.00	100%	0%	CP-1
*BE 11	79.80	100%	0%	CP-1
*BE 12	66.40	100%	0%	CP-1
*BE 13	112.30	100%	0%	CP-1
*BE 14A	499.20	100%	0%	CP-1
*BE 14B	333.70	100%	0%	CP-1
*BN 4C	210.70	100%	0%	CP-1 / NN4B1
*BN 4B1B	311.40	100%	0%	CP-1 / NN4B1
*BN 4B1	61.20	100%	0%	NN4B1
TOTAL CONTRIBUTING BASIN	2284.75	96.6%	3.4%	-

NOTE 1. CONTRIBUTING BASINS ARE BASINS THAT CONTRIBUTE RUNOFF TO THE EXISTING OUTFALLS

NOTE 2. "*" INDICATES THAT SUB-BASIN SURFACING IS UNCHANGED FROM PRE DEVELOPMENT CONDITION. NO MODIFICATION TO EXISTING STORMWATER SYSTEM IS NECESSARY

OUTFALL	POST DEVELOPMENT PEAK FLOW RATE TO OUTFALL (25 YR – 24 HR)	PRE DEVELOPMENT PEAK FLOW RATE TO OUTFALL (25 YR- 24 HR)
	CFS	CFS
CP-1	534.00	541.37
NN4B1	108.55	117.11

The storm water ponds are designed to provide water quality treatment through residence time. The storm water ponds design criteria is to provide treatment for the greater of either 1.0 inch of runoff over the disturbed area, or 2.5 inches of the impervious area. The 2.5 inches of the impervious area criteria was determined to be the governing design case for the Project and the storm ponds have been sized to accommodate this condition. The storm water pond design depth for both ponds exceeds the 12 foot depth that can be used for the permanent pool volume (PPV) for water quality treatment in order to provide site fill material for the Project. While the maximum depth of Ponds 4-1 and 4-2 is greater than 12 feet, ponds are commonly dug deeper to obtain fill material and the stormwater treatment calculations only consider the treatment provided by depths of 12 feet or less consistent with prior agency practice and interpretation based on consultation with SJRWMD. Pond 4-1 exceeds the average length to width ratio of 2:1 which is part of the best management practices for demonstrating sufficient residence time to provide the required treatment required by SJRWMD because it will be larger than necessary in

width, as well as depth as described above, to obtain fill material needed to level the Site. However, the pond as designed provides for over two times the required treatment time using only the first 12 feet of depth. The treatment volume required could be met with a pond width of only 267 feet, however, the width was increased to 563 feet to obtain additional site fill material; therefore if the pond dimensions were limited to only what is required for treatment volume the 2:1 requirement would have been met and exceeded (W of 267'/ L of 943' = 3.53:1). The point of discharge into Pond 4-1 is located on the far opposite side of the pond compared to the outfall structure to maximize the distance and treatment time. Since the treatment volume provided (above 12 feet in depth) in Pond 4-1 is over two times the amount required, increasing the flow paths further using islands, peninsulas, or baffles is not necessary. A 21-day average residence time is provided SJRWMD requirements for a pond that does not include a littoral zone (1.5 times the 14 day average residence time is required as a littoral zone alternative) as shown in Appendix 10.8, Calculation No. 58.5406.1102, Section 7.5. The recovery time required is being met ($\frac{1}{2}$ required treatment volume within 24 and 30 hours but no more than $\frac{1}{2}$ of the volume discharged in first 24 hours) since Pond 4-1 draws down half of the treatment volume at 26.82 hours, and Pond 4-2 draws down half of the treatment volume at 28.21 hours as shown in Appendix 10.8, Calculation No. 58.5406.1102, Section 7.8. Consultation with FDEP Southeast District confirmed that the design basis outlined above is appropriate.

The storm water system was also designed to attenuate the 25-year/24-hour storm event to meet the SJRWMD requirements to provide discharges to the existing outfalls at a rate less than the pre-development condition as summarized in the table above. The ponds were also checked to ensure they are capable of providing detention for the 100-year/96-hour storm event runoff without over topping the equipment/building foundations and the top of embankments.

A plant loop road will surround the main equipment areas (power block), and will be asphalt surfaced. Maintenance access roads will also be asphalt surfaced. The area inside the plant loop road around the equipment foundations will be aggregate surfaced, along with the switchyard, balance of plant equipment, and maintenance/laydown areas outside of the plant loop road. Areas outside the equipment areas will be grass vegetated. The exterior embankment of the plant area and the pond slopes will be vegetated with seeded or sodded with a bahia grass mix.

Non-Contact storm water (non-oil/water sources) from the power block and switchyard areas will be conveyed to the ponds via a storm water sewer system, ditches and culverts. Non-Contact storm water from the areas outside of the power block including the Construction Laydown/Maintenance areas will be conveyed to the ponds via the combination of overland flow and the storm sewer system.

See Black & Veatch Drawing 185922-DS-1104 for a layout of the Storm Water Management System Plan, and Black & Veatch Calculation 58.5406.1102 Post Development Stormwater Analysis, for analysis of the storm water management system.

Contact Storm Water (Oily Waste Water): Contact storm water from areas with oil containing sources will be routed to an oil/water separator via an oil/water waste piping system. Secondary containment will be provided for areas with large oil storage volumes. A normally closed valve will be provided on the secondary containments. After storm events in excess of

0.5 inches, secondary containment will be inspected for large presence free-product or organic phase hydrocarbons. In the event no large presence is observed, the valve will be opened and the secondary containment will be drained to the oil/water separator. If a large presence is observed, it will be determined to either drain the containment to the oil/water separator or provide cleanup directly at the containment. The oil/water separator will be also used as the secondary containment for smaller oil storage volumes and sources. The oil/water separator will be sized during detail design to handle the largest single emergency spill from an open curbed area (non-normally closed valve containment), in addition to fire water and precipitation from the design storm event. The oil/water separator will be designed to provide treatment with an effluent concentration of 10 ppm or less within the effluent. The oily waste will be retained in the oil/water separator and transported off-Site to an approved disposal or recycling facility in accordance with local regulatory requirements. The treated oil/water separator effluent will be released to the storm water pond(s). The oil/water separator will be equipped with oil content monitoring on the discharge. In the event the oil/water separator effluent approaches 10ppm, the valve on the oil/water discharge will be closed. The pond outfall structure drawdown offices will also equipped with valves to allow closure in the extreme event a spill reaches one of the ponds. A detailed Spill Prevention Control and Countermeasure (SPCC) plan will be maintained on-Site during construction activities, and further revised for plant operation.

Reference Black & Veatch Drawing 185922-DS-1105 "Contact Storm Water Management Plan" for further details

Fill Operations: The plant area will be filled to a nominal elevation of 37.0 (NAVD88), with the "Top of Concrete" of the buildings and structures set at 37.5 (NAVD88) at a minimum. Suitable clean fill material will be excavated from the ponds and used to elevate and grade the plant area. If any additional fill material is required to be imported from off-Site sources, the plant construction contractor will be required to appropriately test the imported fill material to assure that it is free of contamination, per applicable requirements.

Dewatering Operations: During installation of large foundations and deep underground utilities, well point and sock systems will be utilized to dewater the excavations to facilitate installation and backfill operations. The dewatering effluent waters will be released to the storm water detention ponds. The ponds will allow for settlement of the sediment in the dewatering effluent, prior to release through the pond outfalls. The pond outfalls will be monitored to assure that discharge turbidity levels are below 29 NTU below background. In the event turbidity levels approach 29 NTU above background, the construction contractor will be required to implement additional BMPs to lower turbidity levels to acceptable levels. Surface waters entering excavations will be collected in turbidity filtered sumps and released to the storm water detention ponds for further treatment prior to release. Further specific dewatering means and methods will be determined by the construction contractor.

Reference Black & Veatch Dewatering Calculations 58.5406.1104, 58.5406.1105.01, 58.5406.1105.02, and 58.5406.1105.03 for further details.

Construction Storm Water Management System Establishment: The storm water detention ponds will be developed after clearing and grubbing of the plant area, to provide a source of fill material and allow for management of the storm water during construction. The ponds are

designed considering the construction laydown and parking areas will remain permanently; therefore the ponds are designed with the worst case impervious area condition. Temporary sumps and lift stations will be used during construction to manage the storm water until the permanent storm water management system is established.

At the end of construction once the majority of the grass vegetation and surfacing has been established, the temporary BMP devices will be removed.

On-Site Flood Protection: For protection of occupied structures, Okeechobee County requires the finished floor elevation of the occupied structures to be set 2' above the highest nominal grade point within the FEMA 100 year flood plain boundary (34 feet NAVD88) if the structure is located within the flood plain, or no lower than the 100 year flood elevation as determined by storm water calculation if the structure is located outside the flood plain boundary. The occupied structure at the Site is located outside the FEMA 100 year flood plain boundary. The 100 year storm water calculations established the flood elevation as 35.5 ft within the OCEC Unit 1 area. The proposed developed Site elevation was established at a nominal elevation of 37ft (NAVD88) to prevent against run on of storm water from the area west of the proposed developed Site, where the grade is nominally 36 ft (NAVD88). The minimum top of concrete elevation was established at 37.5 ft (NAVD88), which is 2 feet above the calculated 100 storm event flood elevation of 35.5 feet which is the Okeechobee County minimum required finished floor elevation and 3.5 feet above the FEMA 100 year flood plain elevation.

Off-Site Flood Protection: A portion of the plant area will be filled within the 100 year Flood Plain as determined by FEMA Flood Insurance Rate Map (FIRM) panel 12093C0100C. The FIRM does not provide the Base Flood Elevation (BFE), but the BFE was determined to be 34.0 NAVD88, based on comparing recent topographic surveys against the FEMA 100 year (1% probability) flood plain boundary.

Compensating storage was analyzed for the delta between the amount of fill placed within the flood plain and the storage provided within the plant area below the 100 year flood plain elevation (34 feet NAVD88). The proposed Site requires a fill of 117,200 CY yards within the 100 year flood plain. The proposed Site includes ponds and diversion canals that are contiguous to the 100 year flood plain, providing flood storage within these areas. The flood storage available within the ponds and the diversion canals below the 100 year flood plain elevation and above the seasonal high ground water is 155,300 CY; therefore no additional compensating storage is required outside of the flood storage provided within these areas.

Reference Black & Veatch Calculation 58.5406.1103 "Compensating Storage Plan" for further details.

Attachments

Drawings

The following listed drawings are included as supporting documents to the storm water design

Drawing No.	Title
185922-DS-G1000	Overall Plot Plan
185922-1DS-G1001	Site Arrangement
185822-DS-1103	Pre-Development Storm Water Management Plan
185822-DS-1104	Proposed Storm Water Management Plan
185822-DS-1105	Contact Storm Water Management Plan
185822-DS-1106	Proposed Storm Water Management Sections and Details
185922-DS-1110	Dewatering Plan
185822-DS-1120	Storm Water Pollution Prevention Plan
185822-DS-1121	Erosion Control Section and Details

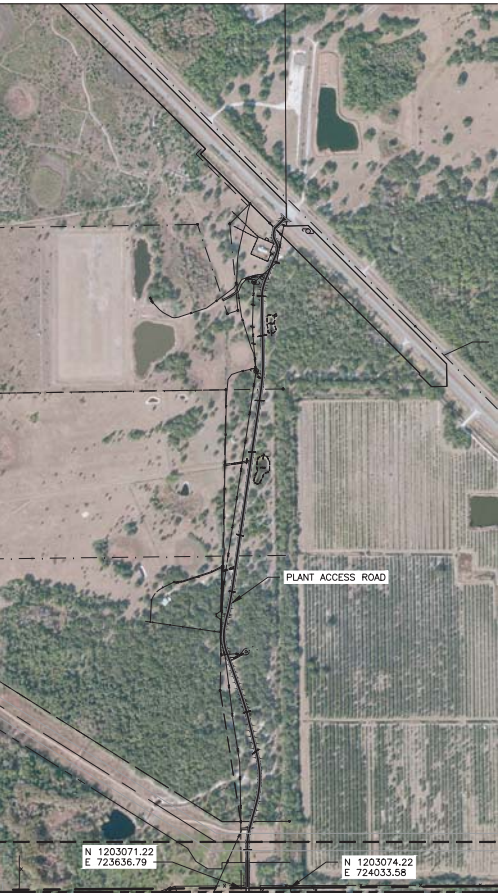
Calculations

The following listed Calculations are included as supporting documents to the storm water design

Calculation File No.	Title
58.5406.1100	Storm Water Analysis Summary Sheet
58.5406.1101	Pre-Development Storm Water Analysis
58.5406.1102	Post- Development Storm Water Analysis
58.5406.1103	Compensating Storage Analysis
58.5406.1104	Storm Water Pond Dewatering Calculation
58.5406.1105.01	Power Block Bathtub Dewatering Calculation
58.5406.1105.02	Cooling Tower Pit Dewatering Calculation
58.5406.1105.03	Underground Utility Trenches Dewatering Calculation

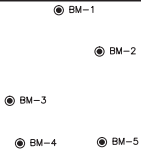
DRAWINGS

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PROJECT SURVEY CONTROL							
CONTROL MONUMENT LOCATIONS (STATE PLANE)							
BENCHMARK NO.	DESIGN COORDINATES			AS-BUILT COORDINATES			
	NORTHING	EASTING	ELEVATION	NORTHING	EASTING	ELEVATION	
BM-1	1202742.00	723260.00		1202756.82	723307.92	32.36	
BM-2	1201510.00	724470.00		1201113.92	724457.97	30.39	
BM-3	1200046.00	721798.00		1200326.61	722230.65	35.67	
BM-4	1198776.00	722103.00		1198259.06	722350.91	35.88	
BM-5	1198819.00	724544.00		1198783.19	724605.97	31.62	

- NOTE:
- HORIZONTAL CONTROL IS BASED ON THE FLORIDA STATE PLANE SYSTEM-EAST ZONE (NAD83). THE ELEVATIONS ARE BASED ON THE NAVD 88 DATUM.
 - BM-1 & BM-5 SEE DETAIL ON DRAWING 185922-DS-0004.
 - BM-2, BM-3 & BM-4 TO BE CARTER MONUMENT STD W/SNOW FENCE OR EQUAL.



NOTES

- THIS DRAWING IS THE BASIS FOR THE SITE ARRANGEMENT AND IS SUBJECT TO REVISIONS AS A RESULT DETAILED DESIGN AND DUE TO VARIATIONS IN SUPPLIERS OF MAJOR EQUIPMENT.
- SEE DWG 1GAU-G1001 FOR SITE ARRANGEMENT.
- LOW AREAS OF CITRUS GROVES WEST & SOUTH OF PROPOSED PLANT WILL BE FILLED AND LEVELED WITH EXCESS TOP SOIL MATERIAL.

ISSUED FOR PERMITTING

THE DISTRIBUTION AND USE OF THE NATIVE FORMAT CAD FILE OF THIS DRAWING IS UNCONTROLLED. THE USER SHALL VERIFY TRACEABILITY OF THIS DRAWING TO THE LATEST CONTROLLED VERSION.



FLORIDA POWER & LIGHT
OKEECHOBEE CLEAN ENERGY CENTER
PLOT PLAN

PROJECT NUMBER: 185922-DS-1000
DRAWING NUMBER: 1

CODE: REFERENCE DWG NUMBER:

AREA:

BLACK & VEATCH
12740 Glen Bay Parkway West
Suite 2140
Jacksonville, Florida 32256
CORPORATE OFFICE
TEL 904.452.1100

ENGINEER: EEB
DRAWN: DL
CHECKED: DATE:

I HEREBY CERTIFY THAT THIS DOCUMENT WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND THAT I AM A DULY REGISTERED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF FLORIDA

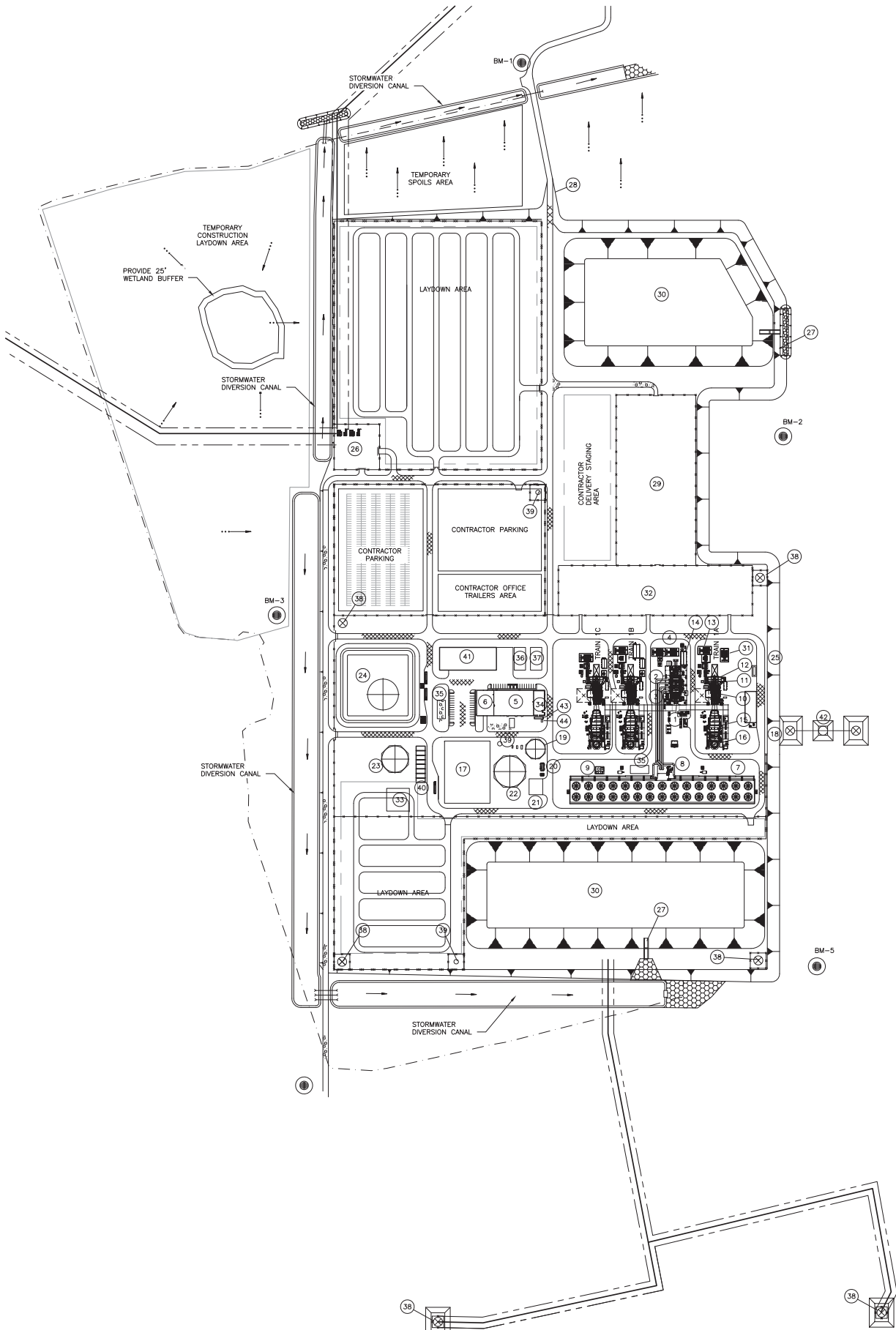
SHOWN: JOHN C. BARRANCO JR.
DATE: 22/SEP/2015, REG NO: 72091



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1"=500'

NO	DATE	REVISIONS AND RECORD OF ISSUE	DRN	DES	CHK	PDE	APP
2	22/SEP/2015	GENERAL REVISION	KED	OJ	JCB	EEB	
1	06/SEP/2015	GENERAL REVISION	KED	OJ	JCB	EEB	
0	03/SEP/2015	ISSUE FOR PERMIT	KED	OJ	JCB	EEB	

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FACILITIES LEGEND				
ID	FACILITY	FOUNDATION	TIEDOWN LOCATION	
			NORTH	EAST
1	STEAM TURBINE	-	-	-
2	STEAM TURBINE GENERATOR	-	-	-
3	SURFACE CONDENSER (BELOW)	-	-	-
4	ST GENERATOR STEP-UP TRANSFORMER	-	-	-
5	ADMINISTRATION BUILDING	-	-	-
6	WAREHOUSE	-	-	-
7	COOLING TOWER	-	-	-
8	CIRCULATING WATER PUMP STRUCTURE	-	-	-
9	COOLING TOWER CHEMICAL FEED	-	-	-
10	COMBUSTION TURBINE	-	-	-
11	COMBUSTION TURBINE GENERATOR	-	-	-
12	INLET AIR FILTER (ABOVE)	-	-	-
13	CT GENERATOR STEP-UP TRANSFORMER	-	-	-
14	POWER CONTROL MODULE	-	-	-
15	HEAT RECOVERY STEAM GENERATOR	-	-	-
16	HRSG EXHAUST STACK	-	-	-
17	WATER TREATMENT AREA	-	-	-
18	AMMONIA STORAGE AREA	-	-	-
19	FIRE/SERVICE WATER STORAGE TANK	-	-	-
20	FIRE PUMP ENCLOSURE	-	-	-
21	DEMINERALIZATION AREA	-	-	-
22	DEMINERALIZED WATER STORAGE TANK	-	-	-
23	RAW WATER STORAGE TANK	-	-	-
24	FUEL OIL STORAGE TANK	-	-	-
25	HYDROGEN STORAGE AREA	-	-	-
26	FUEL GAS REGULATING AREA	-	-	-
27	POND OUTFALL STRUCTURE	-	-	-
28	MAIN ENTRANCE ROAD	-	-	-
29	500KV SWITCHYARD	-	-	-
30	STORMWATER DETENTION POND	-	-	-
31	SPARE STG GSU TRANSFORMER	-	-	-
32	COLLECTOR YARD	-	-	-
33	LEACH FIELD	-	-	-
34	CONTROL AREA	-	-	-
35	OIL/WATER SEPARATOR	-	-	-
36	AUXILIARY BOILER	-	-	-
37	EMERGENCY DIESEL GENERATORS	-	-	-
38	MAKE-UP WATER WELL (FLORIDIAN)	-	-	-
39	POTABLE WATER WELL (SURFICIAL)	-	-	-
40	ROLL-OFF AREA AND MISC STORAGE FACILITY	-	-	-
41	FABRICATION/STORAGE BUILDING	-	-	-
42	UIC/DZMW WELLS	-	-	-
43	HURRICANE SHELTER	-	-	-
44	HURRICANE SHELTER GENERATORS	-	-	-

LEGEND	
	ASPHALT ROAD
	AGGREGATE ROAD
	PLANT FENCING
	CONTRACTOR FENCING

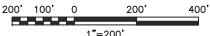
ISSUED FOR PERMITTING
THE DISTRIBUTION AND USE OF THE NATIVE FORMAT CAD FILE OF THIS DRAWING IS UNCONTROLLED. THE USER SHALL VERIFY TRACEABILITY OF THIS DRAWING TO THE LATEST CONTROLLED VERSION.

FLORIDA POWER & LIGHT
OKEECHOBEE CLEAN ENERGY CENTER
SITE ARRANGEMENT

PROJECT NUMBER:	DRAWING NUMBER:	REV
185922-DS-1001		1
CODE:	REFERENCE DWG NUMBER:	
AREA:		



NO	DATE	REVISIONS AND RECORD OF ISSUE	DRN	DES	CHK	PDE	APP
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0	03/SEP/2015	ISSUE FOR PERMIT	KED	QJ	JCB	EEB	



I HEREBY CERTIFY THAT THIS DOCUMENT WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND THAT I AM A DULY REGISTERED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF FLORIDA.

SIGNED: JOHN C. BARRANCO, JR.
DATE: 22/SEP/2015, REG NO: 72091

BLACK & VEATCH	127401 Civil Bay Primary Rev
ENGINEER: EEB	DATE: 22/SEP/2015, REG NO: 32288
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CHECKED:	DATE:



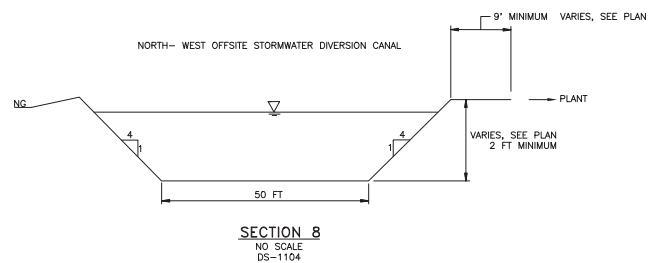
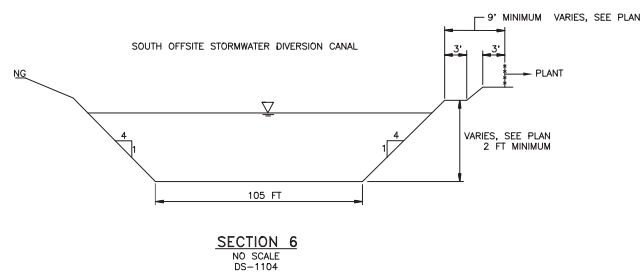
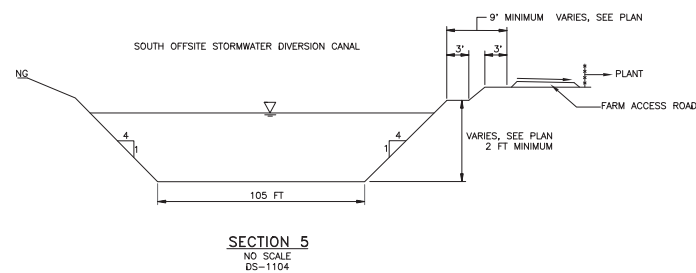
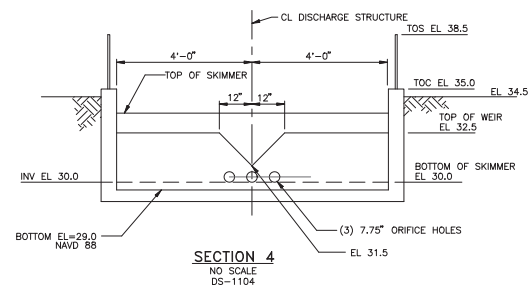
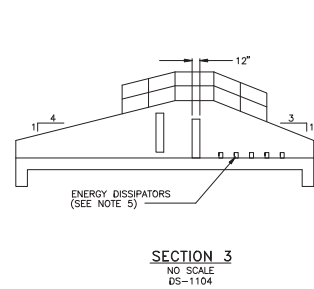
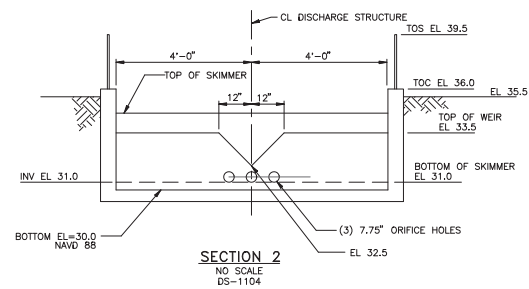
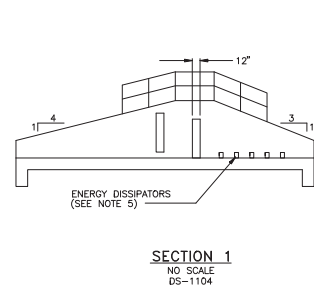
PRE DEVELOPMENT PROJECT LIMITS SUMMARY				
CONTRIBUTING SUB BASIN	TOTAL AREA AND PERCENT PERVIOUS & IMPVIOUS			OUTFALL
	ACRE	PERCENT PERVIOUS	PERCENT IMPVIOUS	
BE 3	44.50	100%	0%	CP-1
BE 4	201.00	100%	0%	CP-1
BE 5	68.15	100%	0%	CP-1
BE 6	19.50	100%	0%	CP-1
BE 7	102.23	100%	0%	CP-1
BE 9	101.50	100%	0%	CP-1
BE 10	76.00	100%	0%	CP-1
BE 11	79.80	100%	0%	CP-1
BE 12	66.40	100%	0%	CP-1
BE 13	112.30	100%	0%	CP-1
BE 14A	499.20	100%	0%	CP-1
BE 14B	333.70	100%	0%	CP-1
BN 40	210.70	100%	0%	CP-1 / NN401
BN 481B	311.40	100%	0%	CP-1 / NN481
BN 481	41.20	100%	0%	NN481
TOTAL CONTRIBUTING BASIN	2287.58	100%	0%	-

NOTES

LEGEND

ISSUED FOR
PERMITTING

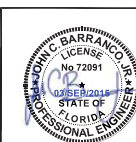
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185922-DS-1103			0
CODE:	REFERENCE DWG NUMBER:		
AREA:			



NOTES

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FLORIDA POWER & LIGHT
OKEECHOBEE CLEAN ENERGY CENTER
PROPOSED STORMWATER
MANAGEMENT DETAILS

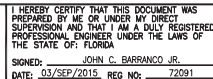
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185922-DS-1106			
CODE:	REFERENCE DWG NUMBER:		
AREA:			

I HEREBY CERTIFY THAT THIS DOCUMENT WAS
PREPARED BY ME OR UNDER MY DIRECT
SUPERVISION AND THAT I AM A DULY REGISTERED
PROFESSIONAL ENGINEER UNDER THE LAWS OF
THE STATE OF FLORIDA

SIGNED: JOHN C. BARRANCO JR.
DATE: 03/SEP/2015 REG NO: 72091

 BLACK & VEATCH	12740 Glen Bay Parkway West Suite 2140 Jacksonville, Florida 32256 CERTIFICATE OF AUTHORIZATION NO. 81-32	
	ENGINEER: EEB	DRAWN: SAJ
CHECKED:	DATE:	





FLORIDA POWER & LIGHT
OKEECHOBEE CLEAN ENERGY CENTER
STORMWATER POLLUTION
PREVENTION PLAN CONSTRUCTION

GENERAL:

1. TEMPO

2. DISTURBED AREAS SHALL BE STABILIZED WITHIN 14 DAYS AFTER CONSTRUCTION ACTIVITY HAS TEMPORARILY OR PERMANENTLY CEASED, WITH TWO EXCEPTIONS: WHEN SNOW COVER PRECLUDES CONSTRUCTION OR WHEN CONSTRUCTION WILL RESUME WITHIN 21 DAYS.

SITE PREPARATION:

1. INSTALL REQUIRED SURFACE WATER CONTROL MEASURES.
2. REMOVE LOOSE ROCK, STONE, AND CONSTRUCTION DEBRIS FROM AREA.
3. TILLAGE SHOULD ACHIEVE A REASONABLY UNIFORM LOOSE SEEDBED. WORK ON CONTOUR IF SITE IS SLOPING.

ESTABLISHMENT:

1. SELECT APPROPRIATE SPECIES FOR THE SITUATION. NOTE RATES AND SEEDING DATES AS SPECIFIED BY SEEDING SUPPLIER.
2. APPLY SEED UNIFORMLY ACCORDING TO THE RATE INDICATED BY BROADCASTING, DRILLING, OR HYDRAULIC APPLICATION.
3. APPLICATION.
4. UNLESS HYDROSEEDING, COVER SEEDS WITH NOT MORE THAN 1/4 INCH OF SOIL USING SUITABLE EQUIPMENT.

MULCH IMMEDIATELY AFTER SEEDING IF REQUIRED. APPLY STRAW OR HAY MULCH AND ANCHOR TO SLOPES GREATER THAN 3% OR WHERE CONCENTRATED FLOW WILL OCCUR.

PERMANENT VEGATIVE COVER

1. PERMANENT VEGETATIVE COVER SHALL BE IN ACCORDANCE WITH THE GENERAL CONSTRUCTION SPECIFICATION 71.0203 SITE FINISHING.

GENERAL:

1. TEMPORARY PERVIOUS BARRIERS USING BALES OF HAY OR STRAW, HELD IN PLACE WITH STAKES DRIVEN THROUGH THE BALES AND INTO THE GROUND OR SEDIMENT FILTER FABRIC FASTENED TO A FENCE POST AND BURIED INTO THE GROUND, SHALL BE INSTALLED AND MAINTAINED AS REQUIRED TO CHECK EROSION AND REDUCE SEDIMENTATION.

CONSTRU

1. BALES SHOULD BE PLACED IN A ROW WITH ENDS TIGHTLY ABUTTING THE ADJACENT BALES.
2. EACH BALE SHALL BE EMBEDDED INTO THE SOIL A MINIMUM OF FOUR (4") INCHES.
3. BALES SHALL BE SECURELY ANCHORED IN PLACE BY WOOD STAKES OR REINFORCEMENT BARS DRIVEN THROUGH THE BALES AND INTO THE GROUND. THE FIRST STAKE IN EACH BALE SHALL BE ANGLED TOWARD THE PREVIOUSLY LAID BALE TO FORCE BALES TOGETHER.
4. FILTER FABRIC SHALL BE SECURELY ANCHORED AT THE TOP OF A THREE FOOT (3') HIGH FENCE AND BURIED A MINIMUM OF SIX INCHES (6") TO THE SOIL. SEAMS BETWEEN SECTIONS OF FILTER FABRIC SHALL OVERLAP A MINIMUM OF THREE FEET (3').

INSTALLATION AND MAINTENANCE:

1. SILT FENCE SHALL BE INSTALLED AT ALL CULVERT AND TRENCH DRAIN INLETS, AND WHERE INDICATED ON DRAWINGS.
2. AN INLET SEDIMENT FILTER SHALL BE INSTALLED AT ALL CATCH BASIN INLETS. SEE DWG CSTF-S3920 FOR DETAILS.
3. BAILED MAY EROSION BARRIERS AND SILT FENCE SHALL BE INSTALLED IN AREAS AS MAY BE DEEMED APPROPRIATE DURING CONSTRUCTION.
4. ALL EROSION CHECKS SHALL BE MAINTAINED UNTIL ADJACENT AREAS ARE STABILIZED.
5. INSPECTION SHALL BE FREQUENT (AT MINIMUM WEEKLY AND BEFORE AND AFTER ANY RAINFALL THAT EXCEEDS 1/2") AND REPAIR OR REPLACEMENT SHALL BE MADE PROMPTLY AS NEEDED.
6. EROSION CHECKS SHALL BE REMOVED WHEN THEY HAVE SERVED THEIR USEFULNESS SO AS NOT TO BLOCK OR IMPEDE STORMWATER FLOW OR DRAINAGE.

SEDIMENT & EROSION CONTROL PLAN NOTES:

GENERAL:

1. THESE GUIDELINES SHALL APPLY TO ALL WORK CONSISTING OF ANY AND ALL TEMPORARY AND/OR PERMANENT CONSTRUCTION OF THE PROJECT, CONTROL WATER POLLUTION AND SOIL EROSION, AS MAY BE REQUIRED, DURING THE CONSTRUCTION OF THE PROJECT.
2. IN GENERAL, ALL CONSTRUCTION ACTIVITIES SHALL PROCEED IN SUCH A MANNER SO AS NOT TO POLLUTE ANY WETLANDS, WATERCOURSE, WATERBODY, AND CONDUIT CARRYING WATER, ETC. THE CONTRACTOR SHALL LIMIT, AS NEARLY AS POSSIBLE, THE SURFACE AREA OF EARTH MATERIALS EXPOSED BY CONSTRUCTION METHODS AND IMMEDIATELY PROVIDE PROTECTION TO REDUCE OR PREVENT EROSION OF EXPOSED AREAS OF ALL TYPES OF WETLANDS, WATERCOURSES, AND WATERBODIES, AND TO PREVENT, INsofar AS POSSIBLE, EROSION ON THE SITE.
3. BEST MANAGEMENT PRACTICES FOR EROSION CONTROL SHALL BE IMPLEMENTED AND MAINTAINED AT ALL TIMES DURING CONSTRUCTION TO PREVENT SILTATION AND TURBID DISCHARGES IN EXCESS OF THE APPLICABLE PROHIBITED LEVELS. BEST MANAGEMENT PRACTICES SHALL INCLUDE, BUT ARE NOT LIMITED TO THE USE OF STAKED HAY BALES, STAGED FILTER CLOTH, SODDING, SEEDING, AND MULCHING; STAGED CONSTRUCTION; AND THE INSTALLATION OF TURBIDITY SCREENS AROUND THE IMMEDIATE

SITE GRADING:

GENERAL:

1. THE RESHAPING OF THE GROUND SURFACE BY EXCAVATION AND FILLING OR A COMBINATION OF BOTH, TO OBTAIN PLANNED GRADES, SHALL PROCEED IN ACCORDANCE WITH THE FOLLOWING CRITERIA:
 - a. THE PERMANENT CUT FACE OF EARTH EXCAVATION SHALL NOT BE STEEPER THAN THREE HORIZONTAL TO ONE VERTICAL (3:1), UNO.
 - b. THE PERMANENT EXPOSED FACES OF FILLS SHALL NOT BE STEEPER THAN THREE HORIZONTAL TO ONE VERTICAL (3:1), UNO.
 - c. TEMPORARY CONSTRUCTION FACES OF FILLS AND EXCAVATION CUTS SHALL NOT BE STEEPER THAN ONE AND A HALF HORIZONTAL TO ONE VERTICAL (1.5:1).
2. PROVISION SHOULD BE MADE TO CONDUCT SURFACE WATER SAFELY TO DRAINAGE DITCHES TO PREVENT SURFACE RUNOFF FROM DAMAGING CUT FACES AND FILL SLOPES.
3. EXCAVATIONS SHOULD NOT BE MADE SO CLOSE TO PROPERTY LINES AS TO ENDANGER ADJOINING PROPERTY WITHOUT PROTECTING SUCH PROPERTY FROM EROSION, SLIDING, SETTLING, OR CRACKING.
4. NO FILL SHOULD BE PLACED WHERE IT WILL SLIDE OR WASH UPON THE PREMISES OF ANOTHER OWNER OR ADJOINING LANDS, WATERWAYS, OR WATERBODIES.
5. PRIOR TO ANY AGGRAVATING, A STABILIZED CONSTRUCTION ENTRANCE SHALL BE PLACED AT THE ENTRANCE TO THE WORK AREA IN ORDER TO REDUCE MUD AND OTHER SEDIMENTS FROM LEAVING THE SITE.

LEGEND

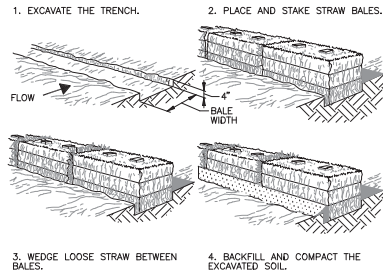
	SILT FENCING		WATTLES
	CATCH BASIN INLET SEDIMENT FILTER		INLET PROTECTION
	SYNTHETIC STRAW BALE CHECK DAM		
	RIPRAP		STABILIZED CONSTRUCTION ENTRANCE / EXIT
	WETLANDS		CULVERT INLET PROTECTION
	MITIGATION AREA		
	GRADE SURFACE FLOW INDICATOR		

ISSUED FOR
PERMITTING

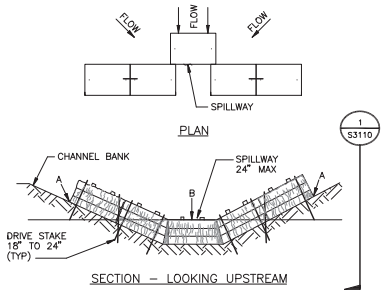
THE DISTRIBUTION AND USE OF THE NATIVE FORMAT CA
FILE OF THIS DRAWING IS UNCONTROLLED. THE USER
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LATEST CONTROLLED VERSION.

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185922-DS-1120		0

CODE:	REFERENCE D/WG NUMBER:
AREA:	

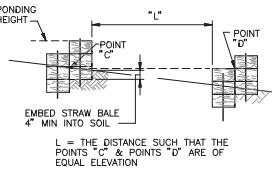


SYNTHETIC BALE BARRIER CONSTRUCTION DETAIL
NO SCALE

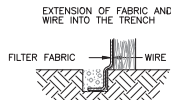
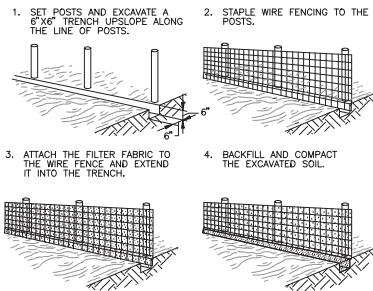


- NOTES:
1. EMBED BALES 4" INTO SOIL AND "KEY" BALES INTO CHANNEL BANKS.
 2. POINT "A" MUST BE HIGHER THAN POINT "B" (SPILLWAY HEIGHT).
 3. PLACE BALES PERPENDICULAR TO THE FLOW WITH ENDS TIGHTLY ABUTTING.
 4. SPILLWAY HEIGHT SHALL NOT EXCEED 24".
 5. INSPECT AFTER EACH SIGNIFICANT STORM, MAINTAIN AND REPAIR PROMPTLY.

STRAW BALE CHECK DAM
IN DRAINAGE WAY
NO SCALE

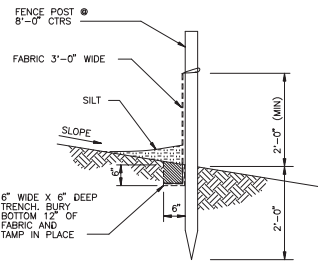


SECTION 1
THIS DWG
SPACING BETWEEN CHECK DAMS
NO SCALE

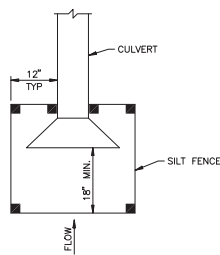


PLANS

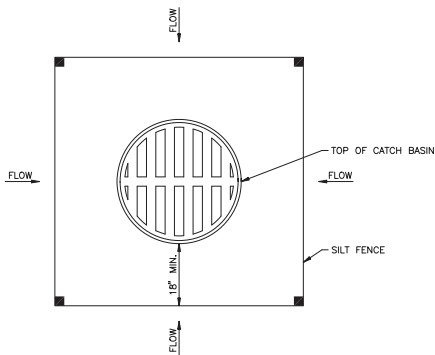
SILT FENCE CONSTRUCTION DETAIL
NO SCALE



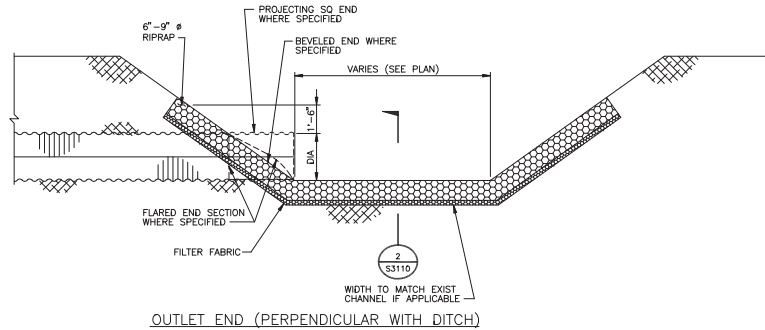
ELEVATION



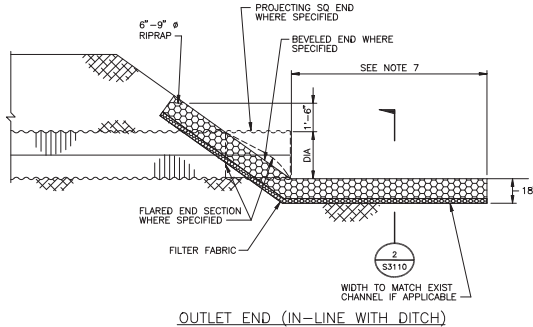
SILT FENCE
CULVERT
INLET PROTECTION
NO SCALE



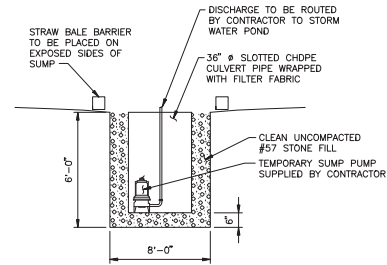
SILT FENCE
CATCH BASIN
INLET PROTECTION
NO SCALE



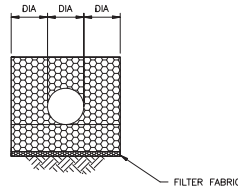
OUTLET END (PERPENDICULAR WITH DITCH)



OUTLET END (IN-LINE WITH DITCH)



TYPICAL TEMPORARY STORMWATER SUMP
NO SCALE



SECTION 2
NO SCALE
SEE THIS DWG

GENERAL NOTES

1. SEE DWG DS-1000 FOR PLOT PLAN.
2. SEE DWGS DS-1110 FOR EROSION CONTROL PLANS.
3. TEMPORARY BARRIER SYSTEM SHALL BE FURNISHED AND INSTALLED BY CONTRACTOR TO PROTECT THE FLORIDA OUTSTANDING WETLANDS AS REQUIRED BY THE SITE CERTIFICATION APPLICATION.
4. FINAL SIZING OF RIP-RAP INCLUDING APRON LENGTH & WIDTH TO BE DETERMINED BY EPC CONTRACTOR DURING DETAIL DESIGN TO NON-ERODIBLE DISCHARGE VELOCITIES.

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FLORIDA POWER & LIGHT
LAUDERDALE PLANT COMBUSTION TURBINE PROJECT
SITE - GRADING
MISC. SECTIONS & DETAILS

PROJECT NUMBER: 185922-DS-1121
DRAWING NUMBER: 0
CODE: REFERENCE DWG NUMBER:
AREA:

I HEREBY CERTIFY THAT THIS DOCUMENT WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND THAT I AM A DULY REGISTERED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF FLORIDA.
SIGNED: JOHN C. BARRANCO JR.
DATE: 03/SEP/2015, REG NO: 72091

BLACK & VEATCH
ENGINEER: DLW
DRAWN: SAJ
CHECKED: DATE:

CALCULATIONS

St Johns Water Management District Wet Detention Requirements Summary

Standard	Pre-Condition	Post-Condition	Post Report Location	Pre Report Location
25-year, 24-hour Flow	Q = 541.37 cfs	Q = 534.00 cfs	Calc # 1102 Page # 2	Calc # 1101 Page # 3
Drainage Area	DA = 2287.58 acres	DA = 2284.75 acres	Calc # 1102 & 1101 Page # 6 & 3	Calc # 1101 Page # 3
Pond Volume	N/A	Pond 4-1 = 35.47 acre-ft Pond 4-2 = 34.84 acre-ft	Calc # 1102 Page # Att 3 Page 41, 43	Calc # n/a Page # n/a
Pond Surface Area	N/A	Pond 4-1 = 10.18 acres Pond 4-2 = 10.57 acres	Calc # 1102 Page # Att 3 Page 41, 43	Calc # n/a Page # n/a
Curve Numbers	BE-3 = 76 BE-4 = 74 BE-5 = 76	BE-3 = 76 BE-4 = 74 BE4-1 = 83 BE4-2 = 84 BE-5 = 76	Calc # 1102 Page # 5	Calc # 1101 Page # 5
Treatment Volume: Volume is greater than 1-inch of runoff over drainage area, or 2.5 inches over impervious area (excluding water bodies). Actual treatment volume must be greater than required.	N/A	Pond 4-1	Calc # 1102 Page # 15	Calc # n/a Page # n/a
		TV _{actual} = 14.57 acre-ft TV _{required} = 6.93 acre-ft		
		Pond 4-2		
		TV _{actual} = 15.17 acre-ft TV _{required} = 5.19 acre-ft		
Recovery Time: Outfall structure should be designed to drawdown half of the treatment volume between 24 and 30 hours.	N/A	Pond 4-1	Calc # 1102 Page # 17	Calc # n/a Page # n/a
		26.82 hrs		
		Pond 4-2		
		28.21 hrs		
Permanent Pool Volume: 1. PPV should be desinged to provide 14-day + residence time during wet season (June to October) 2. $PPV_{actual} > PPV_{required}$	N/A	Pond 4-1	Calc # 1102 Page # 12-14	Calc # n/a Page # n/a
		Residence time, t, equals 21 days. PPV_{actual} = 20.82 acre-ft $PPV_{required}$ = 18.63 acre-ft		
		Pond 4-2		
		Residence time, t, equals 21 days. PPV_{actual} = 19.03 acre-ft $PPV_{required}$ = 16.73 acre-ft		
Outlet Structures: 1. Control elevation should be set at or above design tailwater elevation. 2. Drawdown devices smaller than 3 inches width or less than 20 degrees for "V" notches shall include a device to eliminate clogging.	N/A	Control Elevation is set above tailwater elevation and the V-notch opening is 90 degrees and orifice is 7.25 inches.	Calc # 1102 Page # Att 3 Page 41, 43	Calc # n/a Page # n/a
Littoral Zone: An alternative to designing a littoral zone is: 1. An additional 50% needs to be added to PPV. or 2. Pre-treatment of stormwater required.	N/A	The 50% was reflected in the increase of residence time from 14 days to 21 days.	Calc # 1102 Page # 12-13	Calc # n/a Page # n/a
Pond Depth: 1. Max pond depth of 12 feet. 2. Mean depth is required to be between 2 and 8 feet.	N/A	Pond 4-1	Calc # 1102 Page # 14	Tab # n/a Calc # n/a Page # n/a
		Pond depth is 12 feet. Mean depth = 2.18 feet		
		Pond 4-2		
		Pond depth is 12 feet. Mean depth = 2.18 feet		
Pond Configuration: The average length to width ratio must be at least 2:1. NOTE 1. Although the width to length ratio does not meet the 2:1 requirement for Pond 4-1, the pond still exceeds almost twice the minimum treatment volume requirements and the point discharge in to the pond are opposite of the outfall structure to maximize treatment time; therefore the pond has sufficient residence time.	N/A	Pond 4-1	Calc # 1102 Page # 20	Calc # n/a Page # n/a
		Due to space constraints the L:W ratio is 1.67. ***See Note 1		
		Pond 4-2		
		The L:W ratio is 2.01		
Groudwater Table: 1. Control elevation should be set at or above normal on-site groundwater table elevation. 2. Design of outfall structure must provide for the discharge of baseflow at the design normal water level in pond.	N/A	Pond 4-1	Geotechnical Report	Calc # n/a Page # n/a
		Control elevation is set to 30 feet. This is above the seasonal high groundwater elevation.		
		Pond 4-2		
		Control elevation is set to 31 feet. This is above the seasonal high groundwater elevation.		
Pond Side Slope: The side slopes must be no steeper than 3:1.	N/A	Pond side slopes are 3:1 for Pond 4-1 and Pond 4-2.	Calc # n/a Page # n/a	Calc # n/a Page # n/a

Client Name FPL Page 1 of 6Project Name NE Okeechobee Clean Energy Center Project No. 185922Calculation Title Pre-Development Storm Water AnalysisCalculation No./File No. 58.5406.1101Verification Method: ☒ Check and Review ☐ Alternate Calculations**Objective:** The purpose of this calculation is to analyze the Project site for a 25 year - 24 hour design storm event during the pre-development condition.**Unverified Assumptions Requiring Subsequent Verification**

No.	Assumption	Verified By	Date
N/A	N/A	N/A	N/A

Refer to Page ____ of this calculation for additional assumptions.

This Section Used for Software-Generated CalculationsProgram Name/Number HydroCAD / ICPR Version 10.00 / 3.10Standard B&V Application Used? ☒ Yes ☐ No

If no, list approved deviation permit number below and attach approved deviation permit.

Review and Approval

Rev	Prepared By	Date	Verified By	Date	Approved By	Date
0	Steven Williams	4/27/15	O Jankauskaite	4/28/15	J C Barranco, Jr.	4/28/15
1	O Jankauskaite	8/19/15	J C Barranco, Jr.	8/20/15	J C Barranco, Jr.	8/20/15
	<i>O Jankauskaite</i>	<i>8/20/15</i>	<i>J C Barranco, Jr.</i>	<i>8/20/15</i>	<i>J C Barranco, Jr.</i>	

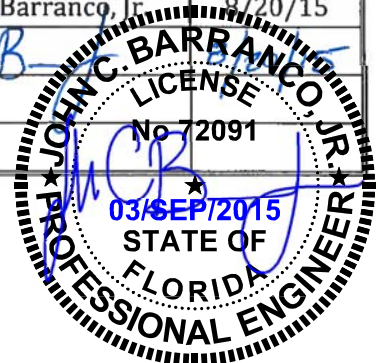


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Attachment 2 - Basin Drawings.....	1 - 2
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Attachment 4 - HydroCAD Report.....	1 - 85

1.0 Purpose

The purpose of this calculation is to analyze the Project site for a 25yr - 24 hr design storm event during the pre-development conditions.

2.0 References

- 2.1 St. Johns River Water Management District, Permit Information Manual. October 1, 2013
- 2.2 Hydrology - Water Quantity and Quality Control. Wanielista, Martin.
- 2.3 Black & Veatch Drawing 185922-DS-1103, Pre-Development Storm Water Management Plan
- 2.4 Ardaman & Associates report titled "Subsurface Exploration, Florida Power & Light Okeechobee Clean Energy Center", March 27, 2015
- 2.5 Google Earth
- 2.6 AutoCAD Civil 3D 2014

3.0 Conclusions

3.1 The pre-development condition flow rate was calculated to be 541.37 cfs at Outfall CP-1 and 117.11 cfs at Outfall NN4B1 for the 25 yr - 24 hr design storm event.

Table 1 presents a summary of the sub basin acreage and surfacing. Table 2 presents a summary of the outfall inflow rate.

Table 1

PRE DEVELOPMENT PROJECT LIMITS SUMMARY				
CONTRIBUTING SUB BASIN	TOTAL AREA AND PERCENT PERVIOUS & IMPERVIOUS			OUTFALL
	ACRE	PERCENT PERVIOUS	PERCENT IMPERVIOUS	
BE 3	44.50	100%	0%	CP-1
BE 4	201.00	100%	0%	CP-1
BE 5	68.15	100%	0%	CP-1
BE 7	19.50	100%	0%	CP-1
BE 8	102.23	100%	0%	CP-1
BE 9	101.50	100%	0%	CP-1
BE 10	76.00	100%	0%	CP-1
BE 11	79.80	100%	0%	CP-1
BE 12	66.40	100%	0%	CP-1
BE 13	112.30	100%	0%	CP-1
BE 14A	499.20	100%	0%	CP-1
BE 14B	333.70	100%	0%	CP-1
BN 4C	210.70	100%	0%	CP-1 / NN4B1
BN 4B1B	311.40	100%	0%	CP-1 / NN4B1
BN 4B1	61.20	100%	0%	NN4B1
TOTAL CONTRIBUTING BASIN	2287.58	100%	0%	-

Table 2

OUTFALL	PRE DEVELOPMENT FLOW RATE TO OUTFALL
	CFS
CP-1	541.37
NN4B1	117.11

4.0 Procedure/Methodology of Design

As a design basis, the site survey was reviewed against the ICPR inputs that were created for a house development that was previously proposed on the project area. The existing site conditions were determined from creating the existing ICPR inputs, geotechnical exploration (Ref. 2.4), current aerial imagery from Google Earth (Ref. 2.5) and data gathered during a site walk down. Pre-development drainage basins were mapped in AutocAD (Ref. 2.6) to determine basin delineation and acreage. The design storm event depth was determined from the data provided by SJRWMD (Ref. 1, Attch 1).

Using the inputs from the ICPR model, HydroCAD was used to create the existing conditions model applicable to the FPL Okeechobee Energy Center model. Following the guidelines of Reference 2.1, the 25-year, 24-hour storm event was modeled under existing conditions. Two outlet points were analyzed, CP-1 and NN4B1 (Attch. 2). These are the two points where the post-development flows will concentrate to.

5.0 Assumptions

none

6.0 Definitions of Units and Constants

CN = NRCS Curve Number for Storm Water Runoff

CFS = Cubic feet per second

T_C = Time of Concentration

7.0 Analysis/Solution

7.1 Summary of HydroCAD inputs for Existing

7.2 Summary of results for Existing Conditions Model

7.0 Analysis

General Drainage Design Criteria

Applicable Regulations:

The project to be developed is located in Okeechobee, FL hence the storm water management system (SWMS) is governed by Environmental Resource Permitting (ERP) (Chapter 62-330, F.A.C.) and the Florida Department of Environmental Protection (FDEP) regulations for Storm Water Discharge (Chapter 62-25, F.A.C.). According to these regulations, the rules of the local water management district are adopted by reference for FDEP ERP requirements. Volume II and portions of Volume I are adopted by reference in chapter 62-330, F.A.C., and are therefore rules of the (FDEP). In accordance with paragraph 373.4131(2)(a), F.S. (2012), they are also rules of the District. The storm water management regulations for the Project site location in Okeechobee County is administered by St Johns River Water Management District (SJRWMD). Thus, the SWMS for this project will be designed to meet or exceed the criteria set forth in the SJRWMD ERP Information Manual, Volume I and Volume II.

7.1 Existing Conditions

Below are the inputs for the basins directly affected by the development. See the model files for the input information for the remaining input information. See the results in Appendix B for a flow diagram of the model.

7.1.1 General Inputs:

Rainfall: 9.2 inches (25yr, 24hr) (Att.1)

Storm Type: Type II 24-hr

Unit Hydrograph: SCS (Ref.1)

7.1.2 Basin Information:

7.1.2.1 BE-3

Area = 44.5 Acres

CN = 76

Tc = 138 minutes

7.1.2.3 BE-5

Area = 68.15 Acres

CN = 76

Tc = 103 minutes

7.1.2.2 BE-4

Area = 201 Acres

CN = 74

Tc = 62 minutes



Owner: FPL
Plant: Okeechobee Clean Energy Center
Project No. 185922
File No. 58.5406.1101
Title: Pre-Development Stormwater
Analysis

Prepared by: S. J. Williams
Date: 04/27/15
Verified by: J C Barranco
Date: 04/28/15
Page No. 6 of 6
Template Rev: 0

7.2 Summary of Results

See the results in Appendix B for more information.

7.2.1 Existing Conditions

Peak Flow at CP-1 = 541.37 cfs (25-yr, 24-hr)

Peak Flow at NN4B1 = 117.11 cfs (25-yr, 24-hr)



BLACK & VEATCH

Owner: FPL
Plant: Okeechobee Clean Energy Center
Project No. 185922
File No. 58.5406.1101
Title: Pre-Development Stormwater
Analysis

Prepared by: S. J. Williams
Date: 04/27/15
Verified by: _____
Date: _____
Page No. 7 of 6
Template Rev: 0

Attachments



BLACK & VEATCH

Owner: FPL
Plant: Okeechobee Clean Energy Center
Project No. 185922
File No. 58.5406.1101
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Analysis

Prepared by: S. J. Williams
Date: 04/27/15
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Page No. 8 of 6
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Attachment 1
Rainfall Maps

3/20/2015

Precipitation Frequency Data Server



NOAA Atlas 14, Volume 9, Version 2
Location name: Okeechobee, Florida, US*
Latitude: 27.6275°, Longitude: -80.7870°
Elevation: 32 ft*
* source: Google Maps



POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Deborah Martin, Sandra Pavlovic, Ishani Roy, Michael St. Laurent, Carl Trypaluk,
Dale Unruh, Michael Yekta, Geoffrey Bonnin

NOAA, National Weather Service, Silver Spring, Maryland

[PF_tabular](#) | [PF_graphical](#) | [Maps & aerials](#)

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches) ¹										
Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.514 (0.406-0.643)	0.587 (0.463-0.736)	0.708 (0.557-0.889)	0.808 (0.632-1.02)	0.947 (0.719-1.24)	1.05 (0.784-1.41)	1.16 (0.838-1.60)	1.27 (0.884-1.81)	1.42 (0.952-2.09)	1.53 (1.00-2.30)
10-min	0.753 (0.594-0.942)	0.860 (0.678-1.08)	1.04 (0.815-1.30)	1.18 (0.926-1.50)	1.39 (1.05-1.82)	1.54 (1.15-2.06)	1.70 (1.23-2.34)	1.86 (1.29-2.65)	2.08 (1.39-3.06)	2.24 (1.47-3.37)
15-min	0.918 (0.725-1.15)	1.05 (0.827-1.31)	1.26 (0.994-1.59)	1.44 (1.13-1.82)	1.69 (1.28-2.22)	1.88 (1.40-2.51)	2.08 (1.50-2.86)	2.27 (1.58-3.23)	2.54 (1.70-3.73)	2.73 (1.79-4.11)
30-min	1.44 (1.14-1.80)	1.64 (1.29-2.06)	1.98 (1.55-2.48)	2.26 (1.77-2.85)	2.65 (2.01-3.48)	2.96 (2.20-3.95)	3.26 (2.35-4.49)	3.58 (2.48-5.09)	4.00 (2.68-5.89)	4.32 (2.83-6.49)
60-min	1.92 (1.52-2.40)	2.19 (1.73-2.74)	2.63 (2.06-3.30)	2.99 (2.34-3.78)	3.51 (2.67-4.60)	3.91 (2.91-5.22)	4.32 (3.12-5.95)	4.74 (3.29-6.75)	5.30 (3.56-7.80)	5.73 (3.75-8.61)
2-hr	2.40 (1.92-2.99)	2.73 (2.17-3.40)	3.27 (2.60-4.08)	3.73 (2.94-4.68)	4.37 (3.35-5.69)	4.87 (3.65-6.46)	5.38 (3.91-7.35)	5.90 (4.13-8.34)	6.60 (4.46-9.66)	7.15 (4.71-10.7)
3-hr	2.65 (2.12-3.27)	3.01 (2.41-3.73)	3.62 (2.88-4.49)	4.13 (3.27-5.16)	4.86 (3.74-6.31)	5.43 (4.09-7.18)	6.01 (4.39-8.20)	6.62 (4.66-9.33)	7.44 (5.05-10.8)	8.07 (5.34-12.0)
6-hr	3.02 (2.44-3.71)	3.48 (2.81-4.28)	4.26 (3.42-5.25)	4.93 (3.94-6.11)	5.89 (4.59-7.63)	6.67 (5.07-8.78)	7.47 (5.51-10.1)	8.31 (5.90-11.7)	9.46 (6.48-13.7)	10.4 (6.92-15.3)
12-hr	3.39 (2.76-4.13)	3.98 (3.24-4.86)	5.01 (4.07-6.14)	5.92 (4.78-7.29)	7.25 (5.71-9.37)	8.34 (6.41-10.9)	9.48 (7.06-12.8)	10.7 (7.66-15.0)	12.4 (8.55-17.9)	13.7 (9.23-20.1)
24-hr	3.88 (3.19-4.69)	4.58 (3.79-5.65)	5.82 (4.76-7.08)	6.93 (5.64-8.48)	8.59 (6.84-11.1)	9.97 (7.74-13.0)	11.4 (8.60-15.4)	13.0 (9.40-18.1)	15.2 (10.6-21.9)	17.0 (11.5-24.8)
2-day	4.60 (3.81-5.52)	5.35 (4.43-6.43)	6.69 (5.53-8.07)	7.91 (6.49-9.59)	9.73 (7.81-12.5)	11.3 (8.81-14.6)	12.9 (9.76-17.2)	14.6 (10.7-20.2)	17.1 (12.0-24.5)	19.1 (13.0-27.7)
3-day	5.10 (4.25-6.11)	5.92 (4.93-7.09)	7.36 (6.11-8.84)	8.64 (7.13-10.4)	10.5 (8.48-13.4)	12.1 (9.50-15.6)	13.7 (10.4-18.3)	15.5 (11.3-21.3)	18.0 (12.7-25.5)	19.9 (13.7-28.7)
4-day	5.54 (4.63-6.60)	6.40 (5.35-7.64)	7.89 (6.57-9.45)	9.20 (7.62-11.1)	11.1 (8.97-14.0)	12.7 (10.0-16.3)	14.3 (10.9-19.0)	16.1 (11.8-22.0)	18.5 (13.1-26.2)	20.4 (14.0-29.4)
7-day	6.68 (5.63-7.92)	7.57 (6.37-8.98)	9.10 (7.63-10.8)	10.4 (8.70-12.5)	12.4 (10.0-15.5)	13.9 (11.0-17.7)	15.5 (11.9-20.4)	17.3 (12.7-23.5)	19.6 (14.0-27.6)	21.5 (14.9-30.8)
10-day	7.72 (6.54-9.11)	8.65 (7.31-10.2)	10.2 (8.62-12.1)	11.6 (9.72-13.8)	13.6 (11.1-16.9)	15.2 (12.1-19.2)	16.8 (13.0-22.0)	18.6 (13.7-25.1)	20.9 (14.9-29.3)	22.8 (15.9-32.5)
20-day	10.7 (9.17-12.6)	11.9 (10.2-14.0)	13.9 (11.8-16.3)	15.5 (13.2-18.4)	17.8 (14.6-21.9)	19.7 (15.8-24.6)	21.5 (16.7-27.8)	23.4 (17.4-31.3)	25.9 (18.6-35.9)	27.8 (19.5-39.4)
30-day	13.2 (11.4-15.4)	14.7 (12.6-17.2)	17.1 (14.6-20.0)	19.1 (16.2-22.5)	21.7 (17.9-26.5)	23.8 (19.1-29.6)	25.8 (20.1-33.1)	27.8 (20.8-37.0)	30.5 (22.0-42.0)	32.5 (22.8-45.7)
45-day	16.4 (14.2-19.1)	18.3 (15.8-21.2)	21.2 (18.3-24.8)	23.6 (20.2-27.7)	26.8 (22.1-32.4)	29.1 (23.5-36.0)	31.4 (24.5-40.0)	33.6 (25.2-44.3)	36.4 (26.3-49.8)	38.4 (27.1-53.9)
60-day	19.1 (16.6-22.1)	21.3 (18.5-24.7)	24.8 (21.4-28.8)	27.5 (23.6-32.2)	31.1 (25.7-37.5)	33.7 (27.3-41.4)	36.2 (28.3-45.9)	38.5 (29.0-50.6)	41.4 (30.0-56.4)	43.4 (30.7-60.7)

¹ Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS). Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values. Please refer to NOAA Atlas 14 document for more information.

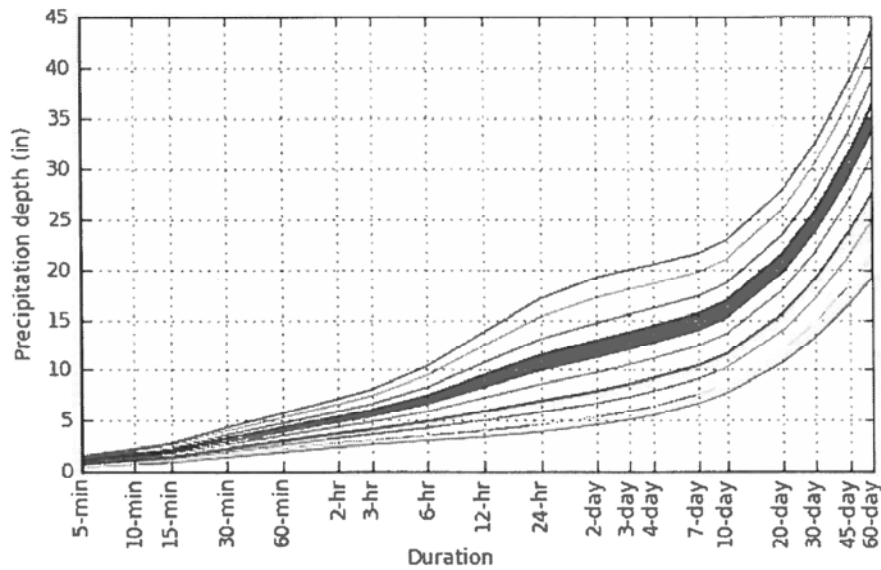
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3/20/2015

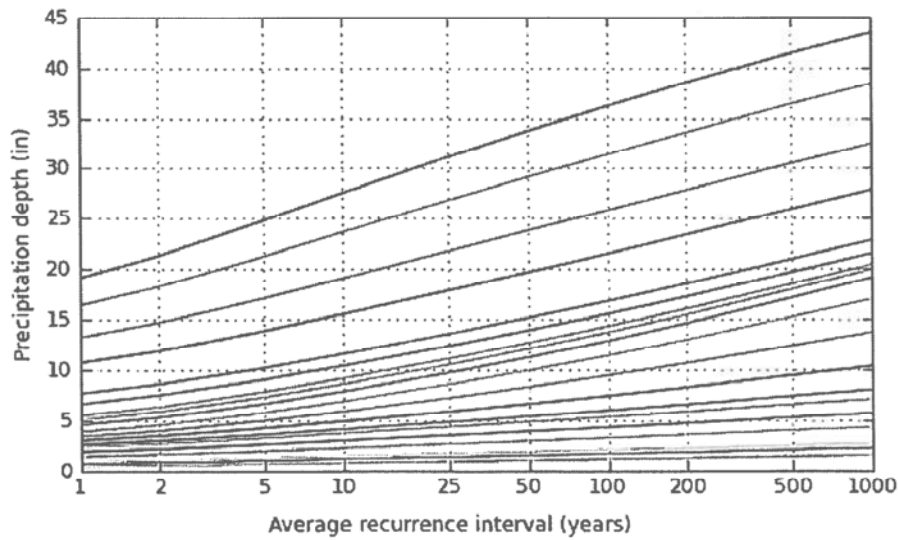
Precipitation Frequency Data Server

PF graphical

PDS-based depth-duration-frequency (DDF) curves
Latitude: 27.6275°, Longitude: -80.7870°



Average recurrence interval (years)	
1	—
2	—
5	—
10	—
25	—
50	—
100	—
200	—
500	—
1000	—



NOAA Atlas 14, Volume 9, Version 2

Created (GMT): Fri Mar 20 15:35:31 2015

Duration	
5-min	—
10-min	—
15-min	—
30-min	—
60-min	—
2-hr	—
3-hr	—
6-hr	—
12-hr	—
24-hr	—
2-day	—
3-day	—
4-day	—
7-day	—
10-day	—
20-day	—
30-day	—
45-day	—
60-day	—

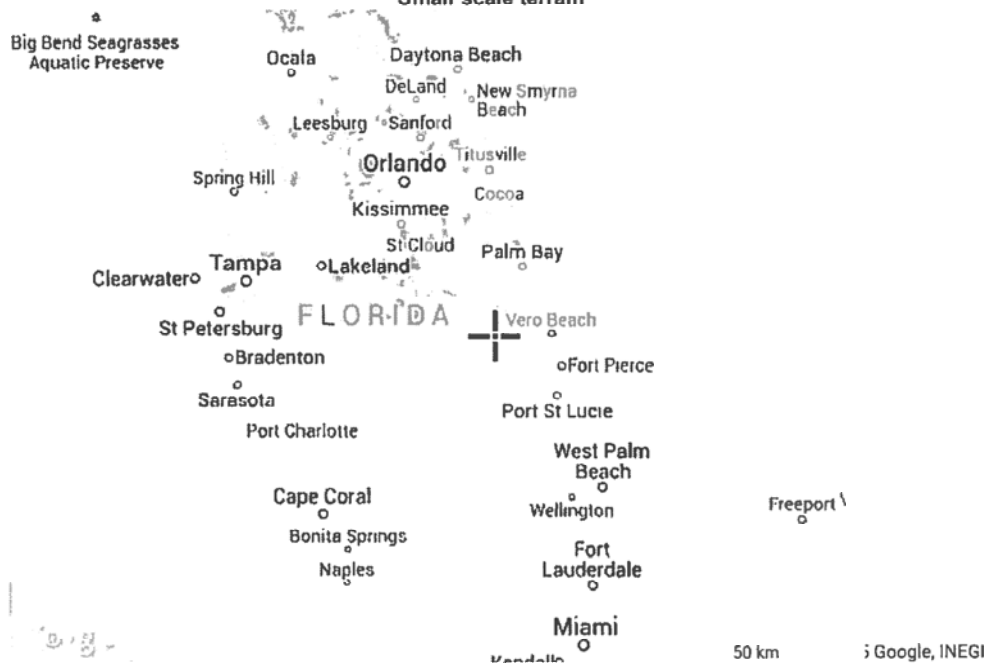
3/20/2015

Precipitation Frequency Data Server

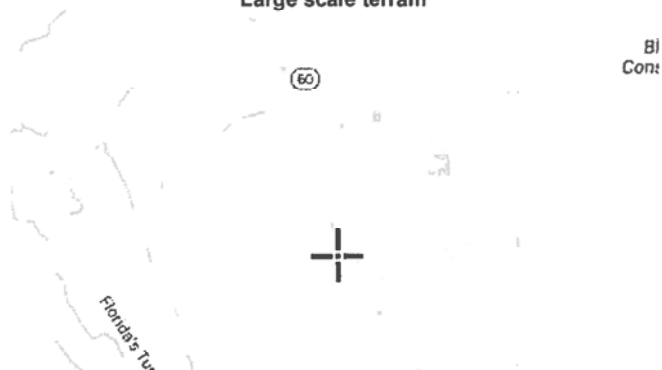
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Maps & aerals

Small scale terrain



Large scale terrain



3/20/2015

Precipitation Frequency Data Server



Large scale map



Large scale aerial



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[Office of Hydrologic Development](#)
1325 East West Highway
Silver Spring, MD 20910
Questions?: HDSC.Questions@noaa.gov

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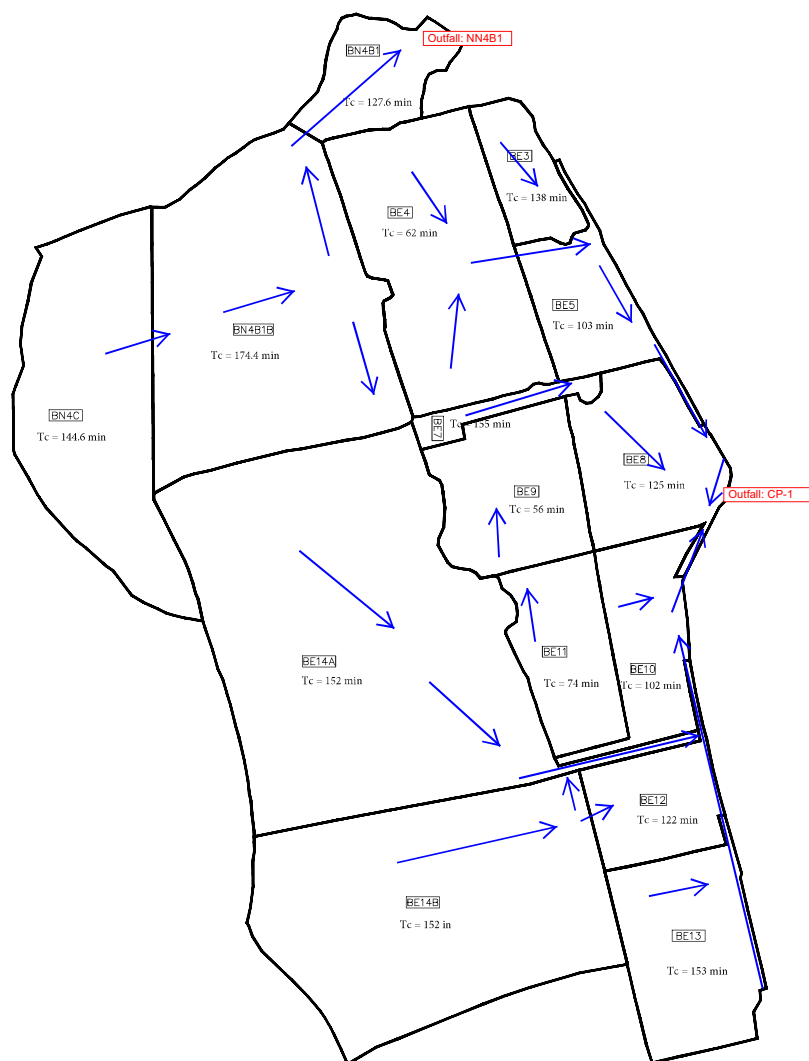
BLACK & VEATCH

Owner: FPL
Plant: Okeechobee Clean Energy Center
Project No. 185922
File No. 58.5406.1101
Title: Pre-Development Stormwater
Analysis

Prepared by: S. J. Williams
Date: 04/27/15
Verified by: _____
Date: _____
Page No. 1
Template Rev: 0

Attachment 2

Basin Sketch



PRE DEVELOPMENT PROJECT LIMITS SUMMARY			
SUB BASIN	TOTAL AREA AND PERCENT PERVIOUS & IMPERVIOUS		
	ACRE	PERCENT PERVIOUS	PERCENT IMPERVIOUS
BE 3	44.50	100%	0%
BE 4	201.00	100%	0%
BE 5	68.15	100%	0%
BE 7	19.50	100%	0%
BE 8	102.23	100%	0%
BE 9	101.50	100%	0%
BE 10	76.00	100%	0%
BE 11	79.80	100%	0%
BE 12	66.40	100%	0%
BE 13	112.30	100%	0%
BE 14A	499.20	100%	0%
BE 14B	333.70	100%	0%
BN 4C	210.70	100%	0%
BN 4B1B	311.40	100%	0%
BN 4B1	61.20	100%	0%
TOTAL PROJECT LIMITS	2287.58	100%	0%



Owner: FPL_____
Plant: Okeechobee Clean Energy Center
Project No. 185922
File No. 58.5406.1101
Title: Pre-Development Storm Water
Analysis

Prepared by: S. J. Williams
Date: 04/27/15
Verified by: _____
Date: _____
Page No. 1
Template Rev: 0

Attachment 3

ICPR Report

ICPR Existing - All Basins.TXT

=====

Basins

=====

Name: BE1	Node: NE1	Status: Onsite
Group: PRE	Type: SCS Unit Hydrograph CN	

Unit Hydrograph: UH256	Peaking Factor: 256.0
Rainfall File: SCSII-24	Storm Duration(hrs): 24.00
Rainfall Amount(in): 9.000	Time of Conc(min): 333.00
Area(ac): 357.900	Time Shift(hrs): 0.00
Curve Number: 77.00	Max Allowable Q(cfs): 999999.000
DCIA(%): 0.00	

PRE DEV (25 YR)

Name: BE10	Node: NE10	Status: Onsite
Group: PRE	Type: SCS Unit Hydrograph CN	

Unit Hydrograph: UH256	Peaking Factor: 256.0
Rainfall File: SCSII-24	Storm Duration(hrs): 24.00
Rainfall Amount(in): 9.000	Time of Conc(min): 102.00
Area(ac): 73.900	Time Shift(hrs): 0.00
Curve Number: 75.00	Max Allowable Q(cfs): 999999.000
DCIA(%): 0.00	

PRE DEV (25 YR)

Name: BE11	Node: NE11	Status: Onsite
Group: PRE	Type: SCS Unit Hydrograph CN	

Unit Hydrograph: UH323	Peaking Factor: 323.0
Rainfall File: SCSII-24	Storm Duration(hrs): 24.00
Rainfall Amount(in): 9.000	Time of Conc(min): 74.00
Area(ac): 79.800	Time Shift(hrs): 0.00
Curve Number: 73.00	Max Allowable Q(cfs): 999999.000
DCIA(%): 0.00	

PRE DEV (25 YR)

Name: BE12	Node: NE12	Status: Onsite
Group: PRE	Type: SCS Unit Hydrograph CN	

Unit Hydrograph: UH256	Peaking Factor: 256.0
Rainfall File: SCSII-24	Storm Duration(hrs): 24.00
Rainfall Amount(in): 9.000	Time of Conc(min): 122.00
Area(ac): 61.700	Time Shift(hrs): 0.00
Curve Number: 75.00	Max Allowable Q(cfs): 999999.000
DCIA(%): 0.00	

PRE DEV (25 YR)

Name: BE13A	Node: NE13	Status: Onsite
Group: PRE	Type: SCS Unit Hydrograph CN	

ICPR Existing - All Basins.TXT

Unit Hydrograph:	UH256	Peaking Factor:	256.0
Rainfall File:	SCSII-24	Storm Duration(hrs):	24.00
Rainfall Amount(in):	9.000	Time of Conc(min):	153.00
Area(ac):	56.000	Time Shift(hrs):	0.00
Curve Number:	75.00	Max Allowable Q(cfs):	999999.000
DCIA(%):	0.00		

PRE DEV (25 YR)

Name: BE13B	Node: NED16	Status: Onsite	
Group: PRE	Type: SCS Unit Hydrograph CN		
Unit Hydrograph:	UH256	Peaking Factor:	256.0
Rainfall File:	SCSII-24	Storm Duration(hrs):	24.00
Rainfall Amount(in):	9.000	Time of Conc(min):	134.00
Area(ac):	56.300	Time Shift(hrs):	0.00
Curve Number:	75.00	Max Allowable Q(cfs):	999999.000
DCIA(%):	0.00		

PRE DEV (25 YR)

Name: BE14A	Node: NE14A	Status: Onsite	
Group: PRE	Type: SCS Unit Hydrograph CN		
Unit Hydrograph:	UH323	Peaking Factor:	323.0
Rainfall File:	SCSII-24	Storm Duration(hrs):	24.00
Rainfall Amount(in):	9.000	Time of Conc(min):	152.00
Area(ac):	499.200	Time Shift(hrs):	0.00
Curve Number:	73.00	Max Allowable Q(cfs):	999999.000
DCIA(%):	0.00		

PRE DEV (25 YR)

Name: BE14B	Node: NE14B	Status: Onsite	
Group: PRE	Type: SCS Unit Hydrograph CN		
Unit Hydrograph:	UH323	Peaking Factor:	323.0
Rainfall File:	SCSII-24	Storm Duration(hrs):	24.00
Rainfall Amount(in):	9.000	Time of Conc(min):	152.00
Area(ac):	333.700	Time Shift(hrs):	0.00
Curve Number:	73.00	Max Allowable Q(cfs):	999999.000
DCIA(%):	0.00		

PRE DEV (25 YR)

Name: BE2	Node: NE2	Status: Onsite	
Group: PRE	Type: SCS Unit Hydrograph CN		
Unit Hydrograph:	UH323	Peaking Factor:	323.0
Rainfall File:	SCSII-24	Storm Duration(hrs):	24.00
Rainfall Amount(in):	9.000	Time of Conc(min):	116.00
Area(ac):	15.100	Time Shift(hrs):	0.00
Curve Number:	74.00	Max Allowable Q(cfs):	999999.000
DCIA(%):	0.00		

ICPR Existing - All Basins.TXT

Unit Hydrograph:	UH256	Peaking Factor:	256.0
Rainfall File:	SCSII-24	Storm Duration(hrs):	24.00
Rainfall Amount(in):	9.000	Time of Conc(min):	125.00
Area(ac):	96.900	Time Shift(hrs):	0.00
Curve Number:	76.00	Max Allowable Q(cfs):	999999.000
DCIA(%):	0.00		

PRE DEV (25 YR)

Name: BE9	Node: NE9	Status: Onsite
Group: PRE	Type: SCS Unit Hydrograph CN	

Unit Hydrograph:	UH323	Peaking Factor:	323.0
Rainfall File:	SCSII-24	Storm Duration(hrs):	24.00
Rainfall Amount(in):	9.000	Time of Conc(min):	156.00
Area(ac):	101.500	Time Shift(hrs):	0.00
Curve Number:	73.00	Max Allowable Q(cfs):	999999.000
DCIA(%):	0.00		

PRE DEV (25 YR)

Name: BED10	Node: NED10	Status: Onsite
Group: PRE	Type: SCS Unit Hydrograph CN	

Unit Hydrograph:	UH323	Peaking Factor:	323.0
Rainfall File:	SCSII-24	Storm Duration(hrs):	24.00
Rainfall Amount(in):	9.000	Time of Conc(min):	15.00
Area(ac):	2.100	Time Shift(hrs):	0.00
Curve Number:	78.00	Max Allowable Q(cfs):	999999.000
DCIA(%):	20.00		

PRE DEV (25 YR)

Name: BED12	Node: NED12	Status: Onsite
Group: PRE	Type: SCS Unit Hydrograph CN	

Unit Hydrograph:	UH323	Peaking Factor:	323.0
Rainfall File:	SCSII-24	Storm Duration(hrs):	24.00
Rainfall Amount(in):	9.000	Time of Conc(min):	15.00
Area(ac):	4.700	Time Shift(hrs):	0.00
Curve Number:	78.00	Max Allowable Q(cfs):	999999.000
DCIA(%):	20.00		

PRE DEV (25 YR)

Name: BED13	Node: NED13	Status: Onsite
Group: PRE	Type: SCS Unit Hydrograph CN	

Unit Hydrograph:	UH323	Peaking Factor:	323.0
Rainfall File:	SCSII-24	Storm Duration(hrs):	24.00
Rainfall Amount(in):	9.000	Time of Conc(min):	15.00
Area(ac):	5.320	Time Shift(hrs):	0.00
Curve Number:	78.00	Max Allowable Q(cfs):	999999.000
DCIA(%):	20.00		

ICPR Existing - All Basins.TXT

Unit Hydrograph:	UH323	Peaking Factor:	323.0
Rainfall File:	SCSII-24	Storm Duration(hrs):	24.00
Rainfall Amount(in):	9.000	Time of Conc(min):	15.00
Area(ac):	4.330	Time Shift(hrs):	0.00
Curve Number:	78.00	Max Allowable Q(cfs):	999999.000
DCIA(%):	20.00		

PRE DEV (25 YR)

Name: BM1	Node: NM1	Status: Onsite
Group: PRE	Type: SCS Unit Hydrograph CN	
Unit Hydrograph:	UH256	Peaking Factor: 256.0
Rainfall File:	SCSII-24	Storm Duration(hrs): 24.00
Rainfall Amount(in):	9.000	Time of Conc(min): 194.00
Area(ac):	31.600	Time Shift(hrs): 0.00
Curve Number:	79.20	Max Allowable Q(cfs): 999999.000
DCIA(%):	0.00	

PRE DEV (25 YR)

Name: BM2	Node: NM2	Status: Onsite
Group: PRE	Type: SCS Unit Hydrograph CN	
Unit Hydrograph:	UH256	Peaking Factor: 256.0
Rainfall File:	SCSII-24	Storm Duration(hrs): 24.00
Rainfall Amount(in):	9.000	Time of Conc(min): 183.00
Area(ac):	297.000	Time Shift(hrs): 0.00
Curve Number:	76.40	Max Allowable Q(cfs): 999999.000
DCIA(%):	0.00	

PRE DEV (25 YR)

Name: BN1	Node: NN1	Status: Onsite
Group: PRE	Type: SCS Unit Hydrograph CN	
Unit Hydrograph:	UH256	Peaking Factor: 256.0
Rainfall File:	SCSII-24	Storm Duration(hrs): 24.00
Rainfall Amount(in):	9.000	Time of Conc(min): 92.00
Area(ac):	24.600	Time Shift(hrs): 0.00
Curve Number:	76.00	Max Allowable Q(cfs): 999999.000
DCIA(%):	0.00	

PRE DEV (25 YR)

Name: BN1A	Node: NN1A	Status: Onsite
Group: PRE	Type: SCS Unit Hydrograph CN	
Unit Hydrograph:	UH256	Peaking Factor: 256.0
Rainfall File:	SCSII-24	Storm Duration(hrs): 24.00
Rainfall Amount(in):	9.000	Time of Conc(min): 173.00
Area(ac):	167.500	Time Shift(hrs): 0.00
Curve Number:	79.00	Max Allowable Q(cfs): 999999.000
DCIA(%):	0.00	

ICPR Existing - All Basins.TXT

Unit Hydrograph:	UH256	Peaking Factor:	256.0
Rainfall File:	SCSII-24	Storm Duration(hrs):	24.00
Rainfall Amount(in):	9.000	Time of Conc(min):	218.20
Area(ac):	100.100	Time Shift(hrs):	0.00
Curve Number:	80.00	Max Allowable Q(cfs):	999999.000
DCIA(%):	0.00		

PRE DEV (25 YR)

Name: BN3B	Node: NN3B	Status: Onsite
Group: PRE	Type: SCS Unit Hydrograph CN	
Unit Hydrograph:	UH323	Peaking Factor: 323.0
Rainfall File:	SCSII-24	Storm Duration(hrs): 24.00
Rainfall Amount(in):	9.000	Time of Conc(min): 181.80
Area(ac):	369.600	Time Shift(hrs): 0.00
Curve Number:	72.00	Max Allowable Q(cfs): 999999.000
DCIA(%):	0.00	

PRE DEV (25 YR)

Name: BN4	Node: NN4	Status: Onsite
Group: PRE	Type: SCS Unit Hydrograph CN	
Unit Hydrograph:	UH256	Peaking Factor: 256.0
Rainfall File:	SCSII-24	Storm Duration(hrs): 24.00
Rainfall Amount(in):	9.000	Time of Conc(min): 118.30
Area(ac):	4.600	Time Shift(hrs): 0.00
Curve Number:	68.00	Max Allowable Q(cfs): 999999.000
DCIA(%):	0.00	

PRE DEV (25 YR)

Name: BN4A	Node: NN4A	Status: Onsite
Group: PRE	Type: SCS Unit Hydrograph CN	
Unit Hydrograph:	UH323	Peaking Factor: 323.0
Rainfall File:	SCSII-24	Storm Duration(hrs): 24.00
Rainfall Amount(in):	9.000	Time of Conc(min): 76.20
Area(ac):	8.800	Time Shift(hrs): 0.00
Curve Number:	70.00	Max Allowable Q(cfs): 999999.000
DCIA(%):	0.00	

PRE DEV (25 YR)

Name: BN4B1	Node: NN4B1	Status: Onsite
Group: PRE	Type: SCS Unit Hydrograph CN	
Unit Hydrograph:	UH256	Peaking Factor: 256.0
Rainfall File:	SCSII-24	Storm Duration(hrs): 24.00
Rainfall Amount(in):	9.000	Time of Conc(min): 127.60
Area(ac):	61.200	Time Shift(hrs): 0.00
Curve Number:	82.00	Max Allowable Q(cfs): 999999.000
DCIA(%):	0.00	

ICPR Existing - All Basins.TXT

29.500	53.7000
30.000	107.4000
31.000	250.5000
32.000	350.7000
33.000	350.7000

Name: NE10	Base Flow(cfs): 0.000	Init Stage(ft): 30.000
Group: PRE		warn Stage(ft): 35.000
Type: Stage/Area		

Stage(ft)	Area(ac)
30.000	2.2000
31.000	3.7000
32.000	15.5000
33.000	31.8000
34.000	59.1000
35.000	72.4000

Name: NE11	Base Flow(cfs): 0.000	Init Stage(ft): 29.000
Group: PRE		warn Stage(ft): 36.000
Type: Stage/Area		

Stage(ft)	Area(ac)
29.000	0.0000
30.000	0.8000
31.000	0.8000
32.000	2.4000
33.000	4.8000
34.000	10.4000
35.000	52.7000
36.000	78.2000

Name: NE12	Base Flow(cfs): 0.000	Init Stage(ft): 29.000
Group: PRE		warn Stage(ft): 37.000
Type: Stage/Area		

Stage(ft)	Area(ac)
30.000	0.6000
31.000	1.2000
32.000	1.9000
33.000	6.2000
34.000	8.6000
35.000	25.9000
36.000	57.4000
37.000	57.4000

Name: NE12A	Base Flow(cfs): 0.000	Init Stage(ft): 33.000
Group: PRE		warn Stage(ft): 41.000
Type: Stage/Area		

ICPR Existing - All Basins.TXT

Stage(ft)	Area(ac)
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Name: NE13	Base Flow(cfs): 0.000	Init Stage(ft): 30.000
Group: PRE		Warn Stage(ft): 37.000
Type: Stage/Area		

Stage(ft)	Area(ac)
30.000	0.6000
31.000	1.1000
32.000	1.7000
33.000	5.6000
34.000	9.0000
35.000	21.3000
36.000	35.8000
37.000	51.5000

Name: NE14A	Base Flow(cfs): 0.000	Init Stage(ft): 33.000
Group: PRE		Warn Stage(ft): 44.000
Type: Stage/Area		

Stage(ft)	Area(ac)
34.000	0.0000
35.000	5.0000
36.000	15.0000
37.000	44.9000
38.000	79.9000
40.000	114.8000
42.000	144.8000
44.000	184.7000

Name: NE14B	Base Flow(cfs): 0.000	Init Stage(ft): 34.000
Group: PRE		Warn Stage(ft): 44.000
Type: Stage/Area		

Stage(ft)	Area(ac)
36.000	3.3000
37.000	10.0000
38.000	30.0000
39.000	60.1000
40.000	83.4000
42.000	110.1000
44.000	136.8000

Name: NE1A	Base Flow(cfs): 0.000	Init Stage(ft): 28.000
Group: PRE		Warn Stage(ft): 33.000
Type: Stage/Area		

ICPR Existing - All Basins.TXT

Stage(ft)	Area(ac)
28.000	1.0000
30.000	2.5000
32.000	5.0000

Name: NE2 Base Flow(cfs): 0.000 Init Stage(ft): 30.000
Group: PRE Warn Stage(ft): 36.000
Type: Stage/Area

Stage(ft)	Area(ac)
31.000	0.3000
32.000	1.1000
33.000	1.5000
34.000	3.0000
35.000	8.6000
36.000	13.9000

Name: NE3 Base Flow(cfs): 0.000 Init Stage(ft): 30.000
Group: PRE Warn Stage(ft): 34.000
Type: Stage/Area

Stage(ft)	Area(ac)
30.000	2.2000
31.000	6.2000
32.000	17.4000
33.000	28.0000
34.000	40.9000

Name: NE4 Base Flow(cfs): 0.000 Init Stage(ft): 29.000
Group: PRE Warn Stage(ft): 37.000
Type: Stage/Area

Stage(ft)	Area(ac)
30.000	0.0000
31.000	2.0000
32.000	4.0000
33.000	12.1000
34.000	42.2000
35.000	78.4000
36.000	126.6000
37.000	172.9000

Name: NE5 Base Flow(cfs): 0.000 Init Stage(ft): 29.000
Group: PRE Warn Stage(ft): 33.000
Type: Stage/Area

ICPR Existing - All Basins.TXT

Stage(ft)	Area(ac)
29.000	0.0000
30.000	1.2000
31.000	10.0000
32.000	33.4000
33.000	53.9000

Name: NE7 Base Flow(cfs): 0.000 Init Stage(ft): 29.000
Group: PRE Warn Stage(ft): 37.000
Type: Stage/Area

Stage(ft)	Area(ac)
31.000	1.0000
32.000	4.7000
33.000	6.4000
34.000	8.4000
35.000	9.8000
36.000	14.0000
37.000	19.1000

Name: NE8 Base Flow(cfs): 0.000 Init Stage(ft): 29.500
Group: PRE Warn Stage(ft): 34.000
Type: Stage/Area

Stage(ft)	Area(ac)
30.000	1.9000
31.000	15.5000
32.000	66.9000
33.000	87.2000
34.000	96.9000

Name: NE9 Base Flow(cfs): 0.000 Init Stage(ft): 30.000
Group: PRE Warn Stage(ft): 36.000
Type: Stage/Area

Stage(ft)	Area(ac)
30.000	0.0000
31.000	1.0000
32.000	2.0000
33.000	6.1000
34.000	11.2000
35.000	71.1000
36.000	99.5000

Name: NED1 Base Flow(cfs): 0.000 Init Stage(ft): 28.000
Group: PRE Warn Stage(ft): 36.000
Type: Stage/Area

ICPR Existing - All Basins.TXT

Stage(ft) Area(ac)

Name: NED10 Base Flow(cfs): 0.000 Init Stage(ft): 28.200
Group: PRE Warn Stage(ft): 36.000
Type: Stage/Area

Stage(ft) Area(ac)

Name: NED11 Base Flow(cfs): 0.000 Init Stage(ft): 28.800
Group: PRE Warn Stage(ft): 36.000
Type: Stage/Area

Stage(ft) Area(ac)

Name: NED11A Base Flow(cfs): 0.000 Init Stage(ft): 29.000
Group: PRE Warn Stage(ft): 38.000
Type: Stage/Area

Stage(ft) Area(ac)

Name: NED11B Base Flow(cfs): 0.000 Init Stage(ft): 29.000
Group: PRE Warn Stage(ft): 38.000
Type: Stage/Area

Stage(ft) Area(ac)

Name: NED11C Base Flow(cfs): 0.000 Init Stage(ft): 30.000
Group: PRE Warn Stage(ft): 41.000
Type: Stage/Area

Stage(ft) Area(ac)

Name: NED11D Base Flow(cfs): 0.000 Init Stage(ft): 31.000
Group: PRE Warn Stage(ft): 41.000
Type: Stage/Area

ICPR Existing - All Basins.TXT

Stage(ft) Area(ac)

Name: NED12 Base Flow(cfs): 0.000 Init Stage(ft): 29.000
Group: PRE Warn Stage(ft): 36.000
Type: Stage/Area

Stage(ft) Area(ac)

Name: NED13 Base Flow(cfs): 0.000 Init Stage(ft): 30.000
Group: PRE Warn Stage(ft): 36.000
Type: Stage/Area

Stage(ft) Area(ac)

Name: NED14 Base Flow(cfs): 0.000 Init Stage(ft): 31.500
Group: PRE Warn Stage(ft): 36.000
Type: Stage/Area

Stage(ft) Area(ac)

Name: NED15 Base Flow(cfs): 0.000 Init Stage(ft): 31.500
Group: PRE Warn Stage(ft): 36.000
Type: Stage/Area

Stage(ft) Area(ac)

Name: NED16 Base Flow(cfs): 0.000 Init Stage(ft): 31.500
Group: PRE Warn Stage(ft): 37.000
Type: Stage/Area

Stage(ft) Area(ac)

31.000	1.1000
32.000	1.7000
33.000	5.6000
34.000	9.0000
35.000	21.4000
36.000	36.0000
37.000	51.8000

Name: NED2 Base Flow(cfs): 0.000 Init Stage(ft): 28.000
Group: PRE Warn Stage(ft): 36.000

ICPR Existing - All Basins.TXT

Type: Stage/Area

Stage(ft) Area(ac)

Name: NED3 Base Flow(cfs): 0.000 Init Stage(ft): 28.000
Group: PRE Warn Stage(ft): 36.000
Type: Stage/Area

Stage(ft) Area(ac)

Name: NED4 Base Flow(cfs): 0.000 Init Stage(ft): 28.100
Group: PRE Warn Stage(ft): 36.000
Type: Stage/Area

Stage(ft) Area(ac)

Name: NED5 Base Flow(cfs): 0.000 Init Stage(ft): 28.100
Group: PRE Warn Stage(ft): 36.000
Type: Stage/Area

Stage(ft) Area(ac)

Name: NED5A Base Flow(cfs): 0.000 Init Stage(ft): 29.000
Group: PRE Warn Stage(ft): 38.000
Type: Stage/Area

Stage(ft) Area(ac)

Name: NED5B Base Flow(cfs): 0.000 Init Stage(ft): 29.000
Group: PRE Warn Stage(ft): 38.000
Type: Stage/Area

Stage(ft) Area(ac)

Name: NED5C Base Flow(cfs): 0.000 Init Stage(ft): 29.000
Group: PRE Warn Stage(ft): 38.000
Type: Stage/Area

ICPR Existing - All Basins.TXT

Stage(ft) Area(ac)

Name: NED5D Base Flow(cfs): 0.000 Init Stage(ft): 29.000
Group: PRE Warn Stage(ft): 38.000
Type: Stage/Area

Stage(ft) Area(ac)

Name: NED6 Base Flow(cfs): 0.000 Init Stage(ft): 28.100
Group: PRE Warn Stage(ft): 36.000
Type: Stage/Area

Stage(ft) Area(ac)

Name: NED6A Base Flow(cfs): 0.000 Init Stage(ft): 29.000
Group: PRE Warn Stage(ft): 38.000
Type: Stage/Area

Stage(ft) Area(ac)

Name: NED6B Base Flow(cfs): 0.000 Init Stage(ft): 29.000
Group: PRE Warn Stage(ft): 38.000
Type: Stage/Area

Stage(ft) Area(ac)

Name: NED6C Base Flow(cfs): 0.000 Init Stage(ft): 29.000
Group: PRE Warn Stage(ft): 38.000
Type: Stage/Area

Stage(ft) Area(ac)

Name: NED7 Base Flow(cfs): 0.000 Init Stage(ft): 28.100
Group: PRE Warn Stage(ft): 36.000
Type: Stage/Area

Stage(ft) Area(ac)

ICPR Existing - All Basins.TXT

Name: NED8 Base Flow(cfs): 0.000 Init Stage(ft): 28.100
Group: PRE Warn Stage(ft): 36.000
Type: Stage/Area

Stage(ft) Area(ac)

Name: NED9 Base Flow(cfs): 0.000 Init Stage(ft): 24.000
Group: PRE Warn Stage(ft): 36.000
Type: Stage/Area

Stage(ft) Area(ac)

Name: NED9A Base Flow(cfs): 0.000 Init Stage(ft): 24.000
Group: PRE Warn Stage(ft): 38.000
Type: Stage/Area

Stage(ft) Area(ac)

Name: NED9B Base Flow(cfs): 0.000 Init Stage(ft): 29.000
Group: PRE Warn Stage(ft): 38.000
Type: Stage/Area

Stage(ft) Area(ac)

Name: NED9C Base Flow(cfs): 0.000 Init Stage(ft): 29.000
Group: PRE Warn Stage(ft): 38.000
Type: Stage/Area

Stage(ft) Area(ac)

Name: NM1 Base Flow(cfs): 0.000 Init Stage(ft): 28.000
Group: PRE Warn Stage(ft): 33.000
Type: Stage/Area

Stage(ft) Area(ac)

30.000 3.2000
31.000 7.6000
32.000 20.9000

ICPR Existing - All Basins.TXT

33.000

31.6000

Name: NM2
Group: PRE
Type: Stage/Area

Base Flow(cfs): 0.000

Init Stage(ft): 28.000
Warn Stage(ft): 34.000

Stage(ft)	Area(ac)
28.000	0.0000
29.000	0.0000
30.000	3.0000
31.000	5.9000
32.000	23.8000
33.000	139.6000
34.000	285.1000

Name: NN1
Group: PRE
Type: Stage/Area

Base Flow(cfs): 0.000

Init Stage(ft): 29.250
Warn Stage(ft): 33.000

Stage(ft)	Area(ac)
29.000	0.0000
29.500	4.9000
30.000	8.1000
31.000	16.2000
32.000	19.2000
33.000	24.6000

Name: NN1A
Group: PRE
Type: Stage/Area

Base Flow(cfs): 0.000

Init Stage(ft): 29.000
Warn Stage(ft): 35.000

Stage(ft)	Area(ac)
29.000	0.0000
30.000	6.7000
31.000	26.8000
32.000	40.2000
33.000	70.4000
34.000	80.4000
35.000	93.8000

Name: NN1AA
Group: PRE
Type: Stage/Area

Base Flow(cfs): 0.000

Init Stage(ft): 29.000
Warn Stage(ft): 36.000

Stage(ft)	Area(ac)
29.000	0.0000
30.000	0.6000

ICPR Existing - All Basins.TXT

31.000	3.2000
32.000	15.2000
33.000	20.3000
34.000	31.1000
35.000	45.6000
36.000	63.4000

Name: NN1B	Base Flow(cfs): 0.000	Init Stage(ft): 29.000
Group: PRE		Warn Stage(ft): 34.000
Type: Stage/Area		

Stage(ft)	Area(ac)
31.000	3.2000
32.000	15.2000
33.000	20.3000
34.000	31.1000
35.000	45.6000
36.000	63.4000

Name: NN2	Base Flow(cfs): 0.000	Init Stage(ft): 30.000
Group: PRE		Warn Stage(ft): 33.000
Type: Stage/Area		

Stage(ft)	Area(ac)
31.000	0.0000
31.500	0.6000
32.000	3.6000
32.500	9.1000
33.000	12.1000

Name: NN2A	Base Flow(cfs): 0.000	Init Stage(ft): 31.000
Group: PRE		Warn Stage(ft): 34.000
Type: Stage/Area		

Stage(ft)	Area(ac)
31.000	0.0000
32.500	1.6000
33.000	4.5000
33.500	12.7000
34.000	14.9000

Name: NN3	Base Flow(cfs): 0.000	Init Stage(ft): 29.000
Group: PRE		Warn Stage(ft): 33.000
Type: Stage/Area		

Stage(ft)	Area(ac)
31.000	0.0000
32.000	1.9000
32.500	4.0000
33.000	7.4000

Name: NN3A	Base Flow(cfs): 0.000	Init stage(ft): 29.000
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ICPR Existing - All Basins.TXT

Group: PRE
Type: Stage/Area

warn Stage(ft): 38.000

Stage(ft)	Area(ac)
31.500	0.0000
32.000	2.0000
33.000	5.0000
34.000	17.0000
35.000	34.0000
36.000	70.1000
37.000	92.1000
38.000	98.1000

Name: NN3AB
Group: PRE
Type: Stage/Area

Base Flow(cfs): 0.000

Init Stage(ft): 33.000
warn Stage(ft): 39.000

Stage(ft)	Area(ac)
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Name: NN3B
Group: PRE
Type: Stage/Area

Base Flow(cfs): 0.000

Init Stage(ft): 33.000
warn Stage(ft): 46.000

Stage(ft)	Area(ac)
34.000	0.0000
35.000	7.4000
36.000	14.8000
37.000	29.6000
38.000	48.0000
39.000	81.3000
40.000	99.8000
42.000	133.1000
44.000	188.5000
46.000	232.8000

Name: NN4
Group: PRE
Type: Stage/Area

Base Flow(cfs): 0.000

Init Stage(ft): 31.000
warn Stage(ft): 34.000

Stage(ft)	Area(ac)
31.000	0.0000
31.500	0.2500
32.000	0.9000
33.000	3.6000
34.000	4.6000

Name: NN4A

Base Flow(cfs): 0.000
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Init stage(ft): 27.400

ICPR Existing - All Basins.TXT

Group: PRE
Type: Stage/Area

warn Stage(ft): 37.000

Stage(ft)	Area(ac)
31.500	0.0000
32.000	0.5000
33.000	1.3000
34.000	3.0000
35.000	7.0000
36.000	8.5000
37.000	8.8000

Name: NN4AB
Group: PRE
Type: Stage/Area

Base Flow(cfs): 0.000

Init Stage(ft): 33.000
warn Stage(ft): 40.000

Stage(ft)	Area(ac)
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Name: NN4B1
Group: PRE
Type: Stage/Area

Base Flow(cfs): 0.000

Init Stage(ft): 34.000
warn Stage(ft): 39.000

Stage(ft)	Area(ac)
34.000	2.4000
35.000	9.8000
36.000	31.8000
37.000	46.5000
38.000	56.3000
39.000	60.6000

Name: NN4B2
Group: PRE
Type: Stage/Area

Base Flow(cfs): 0.000

Init Stage(ft): 32.000
warn Stage(ft): 37.000

Stage(ft)	Area(ac)
33.000	0.0000
34.000	0.5000
35.000	2.4000
36.000	6.6000
37.000	7.4000

Name: NN4B21
Group: PRE
Type: Stage/Area

Base Flow(cfs): 0.000

Init Stage(ft): 37.000
warn Stage(ft): 43.000

ICPR Existing - All Basins.TXT

Stage(ft) Area(ac)

Name: NN4B3 Base Flow(cfs): 0.000 Init Stage(ft): 37.000
Group: PRE Warn Stage(ft): 48.000
Type: Stage/Area

Stage(ft) Area(ac)

37.000	0.0000
37.500	9.3000
38.000	34.3000
39.000	56.1000
40.000	77.9000
42.000	109.0000
44.000	149.5000
46.000	180.6000
48.000	218.0000

Name: NN4B4 Base Flow(cfs): 0.000 Init Stage(ft): 48.500
Group: PRE Warn Stage(ft): 55.000
Type: Stage/Area

Stage(ft) Area(ac)

Name: NN4C Base Flow(cfs): 0.000 Init Stage(ft): 54.000
Group: PRE Warn Stage(ft): 57.000
Type: Stage/Area

Stage(ft) Area(ac)

54.000	29.5000
55.000	71.6000
56.000	185.4000
57.000	210.7000

Name: NND1 Base Flow(cfs): 0.000 Init Stage(ft): 26.800
Group: PRE Warn Stage(ft): 37.000
Type: Stage/Area

Stage(ft) Area(ac)

Name: NND1A Base Flow(cfs): 0.000 Init Stage(ft): 26.900
Group: PRE Warn Stage(ft): 37.000
Type: Stage/Area

ICPR Existing - All Basins.TXT

Stage(ft) Area(ac)

Name: NND1B Base Flow(cfs): 0.000 Init Stage(ft): 26.950
Group: PRE Warn Stage(ft): 35.000
Type: Stage/Area

Stage(ft) Area(ac)

Name: NND2 Base Flow(cfs): 0.000 Init Stage(ft): 27.000
Group: PRE Warn Stage(ft): 37.000
Type: Stage/Area

Stage(ft) Area(ac)

Name: NND3 Base Flow(cfs): 0.000 Init Stage(ft): 27.050
Group: PRE Warn Stage(ft): 37.000
Type: Stage/Area

Stage(ft) Area(ac)

Name: NND4 Base Flow(cfs): 0.000 Init Stage(ft): 27.100
Group: PRE Warn Stage(ft): 37.000
Type: Stage/Area

Stage(ft) Area(ac)

Name: NND5 Base Flow(cfs): 0.000 Init Stage(ft): 27.200
Group: PRE Warn Stage(ft): 35.000
Type: Stage/Area

Stage(ft) Area(ac)

32.000	0.0000
32.500	0.5000
33.000	2.3000
34.000	2.8000
35.000	3.3000

Name: NS1 Base Flow(cfs): 0.000 Init Stage(ft): 30.500
Group: PRE Warn Stage(ft): 34.000
Type: Stage/Area

ICPR Existing - All Basins.TXT

Stage(ft)	Area(ac)
31.000	0.2000
32.000	0.7000
33.000	14.7000
34.000	22.0000

Name: NS1A Base Flow(cfs): 0.000 Init Stage(ft): 30.500
Group: PRE Warn Stage(ft): 36.000
Type: Stage/Area

Stage(ft)	Area(ac)
31.000	0.7000
32.000	1.5000
33.000	2.2000
34.000	15.6000
35.000	60.9000
36.000	72.8000

Name: NS1A2 Base Flow(cfs): 0.000 Init Stage(ft): 33.000
Group: PRE Warn Stage(ft): 38.000
Type: Stage/Area

Stage(ft)	Area(ac)
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Name: NS1B Base Flow(cfs): 0.000 Init Stage(ft): 33.000
Group: PRE Warn Stage(ft): 40.000
Type: Stage/Area

Stage(ft)	Area(ac)
34.000	3.0000
35.000	15.2000
36.000	24.3000
37.000	42.4000
38.000	60.6000
39.000	87.9000
40.000	100.1000

Name: NSD1 Base Flow(cfs): 0.000 Init Stage(ft): 30.500
Group: PRE Warn Stage(ft): 38.000
Type: Stage/Area

Stage(ft)	Area(ac)
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ICPR Existing - All Basins.TXT

Name: NSD1A
Group: PRE
Type: Stage/Area

Base Flow(cfs): 0.000

Init Stage(ft): 30.500
Warn Stage(ft): 38.000

Stage(ft) Area(ac)

Name: NSD2
Group: PRE
Type: Stage/Area

Base Flow(cfs): 0.000

Init Stage(ft): 30.500
Warn Stage(ft): 38.000

Stage(ft) Area(ac)

Name: NW1
Group: PRE
Type: Stage/Area

Base Flow(cfs): 0.000

Init Stage(ft): 55.000
Warn Stage(ft): 58.000

Stage(ft) Area(ac)

55.000	2.5000
56.000	20.9000
57.000	42.6000
58.000	61.0000

==== Cross Sections =====

Name: RE1
Encroachment: No

Group: PRE

Station(ft)	Elevation(ft)	Manning's N
0.000	31.580	0.050000
26.000	31.070	0.050000
47.000	30.390	0.050000
71.000	29.800	0.050000
96.000	29.810	0.050000
119.000	29.940	0.050000
146.000	29.790	0.050000
175.000	30.030	0.050000
246.000	28.520	0.035000
249.000	26.480	0.035000
253.000	26.730	0.035000
259.000	29.800	0.035000
376.000	30.000	0.050000

Name: RE1B
Encroachment: No

Group: PRE

ICPR Existing - All Basins.TXT

Station(ft)	Elevation(ft)	Manning's N
0.000	31.440	0.045000
97.000	31.450	0.045000
230.000	31.340	0.045000
376.000	31.290	0.045000
522.000	31.390	0.045000
652.000	31.190	0.045000
829.000	31.350	0.045000
967.000	31.460	0.045000
1101.000	31.630	0.045000
1217.000	31.460	0.045000
1344.000	31.440	0.045000
1462.000	31.780	0.045000
1587.000	31.690	0.045000
1717.000	31.530	0.045000
1780.000	32.210	0.045000

Name: RED10
Encroachment: No

Group: PRE

Station(ft)	Elevation(ft)	Manning's N
0.000	31.900	0.050000
6.000	27.700	0.050000
13.000	25.600	0.035000
20.000	27.700	0.035000
23.000	30.200	0.035000
35.000	32.600	0.050000

Name: RED11
Encroachment: No

Group: PRE

Station(ft)	Elevation(ft)	Manning's N
0.000	31.900	0.050000
6.000	27.700	0.050000
13.000	25.600	0.035000
20.000	27.700	0.035000
23.000	30.200	0.035000
35.000	32.600	0.050000

Name: RED11A
Encroachment: No

Group: PRE

Station(ft)	Elevation(ft)	Manning's N
0.000	34.400	0.050000
2.000	32.600	0.050000
4.000	30.600	0.040000
8.000	29.400	0.040000
12.000	30.600	0.040000
15.000	32.400	0.040000

ICPR Existing - All Basins.TXT

18.000	34.100	0.050000
36.000	31.100	0.060000
53.000	34.500	0.100000

Name: RED11B
Encroachment: No

Group: PRE

Station(ft)	Elevation(ft)	Manning's N
0.000	34.400	0.050000
2.000	32.600	0.050000
4.000	30.600	0.040000
8.000	29.400	0.040000
12.000	30.600	0.040000
15.000	32.400	0.040000
18.000	34.100	0.050000
36.000	31.100	0.060000
53.000	34.500	0.100000

Name: RED11C
Encroachment: No

Group: PRE

Station(ft)	Elevation(ft)	Manning's N
0.000	36.100	0.090000
14.000	35.500	0.090000
18.000	33.500	0.080000
20.000	31.700	0.070000
26.000	30.600	0.070000
35.000	33.400	0.070000
44.000	39.200	0.090000

Name: RED11D
Encroachment: No

Group: PRE

Station(ft)	Elevation(ft)	Manning's N
0.000	36.000	0.090000
16.000	35.700	0.090000
20.000	33.500	0.080000
23.000	31.500	0.070000
27.000	30.800	0.070000
32.000	31.500	0.070000
36.000	33.500	0.070000
39.000	35.900	0.090000
49.000	38.700	0.090000

Name: RED12
Encroachment: No

Group: PRE

Station(ft)	Elevation(ft)	Manning's N
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ICPR Existing - All Basins.TXT

0.000	31.900	0.050000
6.000	27.700	0.050000
13.000	25.600	0.035000
20.000	27.700	0.035000
23.000	30.200	0.035000
35.000	32.600	0.050000

Name: RED13
Encroachment: No

Group: PRE

Station(ft)	Elevation(ft)	Manning's N
0.000	33.600	0.090000
14.000	30.800	0.090000
25.000	30.700	0.060000
34.000	30.800	0.060000
39.000	31.900	0.060000
53.000	32.800	0.060000
57.000	34.600	0.090000

Name: RED14
Encroachment: No

Group: PRE

Station(ft)	Elevation(ft)	Manning's N
0.000	33.200	0.090000
4.000	31.100	0.090000
10.000	30.100	0.060000
15.000	31.000	0.060000
17.000	32.900	0.090000

Name: RED16
Encroachment: No

Group: PRE

Station(ft)	Elevation(ft)	Manning's N
0.000	32.600	0.090000
4.000	30.200	0.090000
10.000	28.000	0.060000
16.000	30.600	0.060000
21.000	32.700	0.090000

Name: RED2
Encroachment: No

Group: PRE

Station(ft)	Elevation(ft)	Manning's N
0.000	30.300	0.050000
5.000	27.600	0.050000
8.000	25.800	0.035000

ICPR Existing - All Basins.TXT

21.000	25.500	0.035000
29.000	24.600	0.035000
34.000	25.100	0.035000
42.000	27.600	0.035000
45.000	29.600	0.050000
62.000	30.600	0.050000

Name: RED3
Encroachment: No

Group: PRE

Station(ft)	Elevation(ft)	Manning's N
0.000	30.600	0.050000
5.000	27.600	0.050000
11.000	26.000	0.035000
21.000	25.000	0.035000
26.000	25.100	0.035000
38.000	27.600	0.035000
43.000	30.900	0.050000

Name: RED4
Encroachment: No

Group: PRE

Station(ft)	Elevation(ft)	Manning's N
0.000	30.500	0.090000
3.000	29.100	0.090000
8.000	27.100	0.060000
14.000	26.000	0.060000
19.000	26.600	0.060000
23.000	28.700	0.060000
25.000	30.700	0.090000
36.000	31.100	0.060000
53.000	34.500	0.100000

Name: RED5
Encroachment: No

Group: PRE

Station(ft)	Elevation(ft)	Manning's N
0.000	31.000	0.050000
4.000	27.800	0.050000
7.000	26.300	0.035000
12.000	25.800	0.035000
18.000	26.300	0.035000
21.000	27.800	0.035000
26.000	30.700	0.050000
36.000	31.100	0.060000
53.000	34.500	0.100000

Name: RED5A
Encroachment: No

Group: PRE

ICPR Existing - All Basins.TXT

Station(ft)	Elevation(ft)	Manning's N
0.000	32.500	0.050000
4.000	27.600	0.050000
9.000	27.000	0.035000
15.000	27.600	0.035000
19.000	30.600	0.035000
22.000	31.300	0.050000
32.000	26.400	0.050000
36.000	31.100	0.060000
53.000	34.500	0.100000

Name: RED5B
Encroachment: No

Group: PRE

Station(ft)	Elevation(ft)	Manning's N
0.000	34.300	0.050000
7.000	31.200	0.050000
8.000	28.000	0.035000
14.000	27.800	0.035000
18.000	27.600	0.035000
23.000	32.200	0.050000
32.000	26.400	0.050000
36.000	31.100	0.060000
53.000	34.500	0.100000

Name: RED5D
Encroachment: No

Group: PRE

Station(ft)	Elevation(ft)	Manning's N
0.000	34.300	0.050000
7.000	31.200	0.050000
8.000	28.000	0.035000
14.000	27.800	0.035000
18.000	27.600	0.035000
23.000	32.200	0.050000
32.000	26.400	0.050000
36.000	31.100	0.060000
53.000	34.500	0.100000

Name: RED6
Encroachment: No

Group: PRE

Station(ft)	Elevation(ft)	Manning's N
0.000	31.000	0.050000
3.000	28.600	0.050000
6.000	27.800	0.035000
8.000	26.000	0.035000
14.000	25.200	0.035000

ICPR Existing - All Basins.TXT

20.000	26.500	0.035000
24.000	27.800	0.035000
27.000	31.100	0.050000
53.000	34.500	0.100000

Name: RED6A
Encroachment: No

Group: PRE

Station(ft)	Elevation(ft)	Manning's N
0.000	31.400	0.050000
4.000	27.800	0.050000
7.000	27.400	0.035000
12.000	27.800	0.035000
13.000	30.100	0.035000
20.000	32.900	0.050000
32.000	26.400	0.050000
36.000	31.100	0.060000
53.000	34.500	0.100000

Name: RED6B
Encroachment: No

Group: PRE

Station(ft)	Elevation(ft)	Manning's N
0.000	31.400	0.050000
4.000	27.800	0.050000
7.000	27.400	0.035000
12.000	27.800	0.035000
13.000	30.100	0.035000
20.000	32.900	0.050000
32.000	26.400	0.050000
36.000	31.100	0.060000
53.000	34.500	0.100000

Name: RED7
Encroachment: No

Group: PRE

Station(ft)	Elevation(ft)	Manning's N
0.000	31.000	0.050000
3.000	28.600	0.050000
6.000	27.800	0.035000
8.000	26.000	0.035000
14.000	25.200	0.035000
20.000	26.500	0.035000
24.000	27.800	0.035000
27.000	31.100	0.050000
53.000	34.500	0.100000

Name: RED8
Encroachment: No

Group: PRE

ICPR Existing - All Basins.TXT

Station(ft)	Elevation(ft)	Manning's N
0.000	31.200	0.050000
4.000	27.600	0.050000
7.000	25.800	0.035000
11.000	26.000	0.035000
14.000	26.300	0.035000
19.000	27.600	0.035000
25.000	30.500	0.035000
31.000	31.200	0.050000
53.000	34.500	0.100000

Name: RED9
Encroachment: No

Group: PRE

Station(ft)	Elevation(ft)	Manning's N
0.000	30.700	0.050000
10.000	27.600	0.050000
12.000	26.600	0.035000
16.000	26.300	0.035000
19.000	26.500	0.035000
23.000	27.600	0.035000
30.000	31.500	0.050000
36.000	31.100	0.060000
53.000	34.500	0.100000

Name: REQUAL
Encroachment: No

Group: PRE

Station(ft)	Elevation(ft)	Manning's N
0.000	41.000	0.400000
80.000	37.000	0.400000
86.000	34.000	0.080000
94.000	34.000	0.080000
100.000	37.000	0.080000
180.000	41.000	0.400000

Name: RN1B1
Encroachment: No

Group: PRE

Station(ft)	Elevation(ft)	Manning's N
0.000	31.000	0.070000
12.000	30.700	0.070000
14.000	30.100	0.050000
18.000	29.600	0.050000
22.000	29.200	0.050000
26.000	29.600	0.050000
32.000	30.100	0.050000
38.000	30.700	0.070000

53.000 34.500 ICPR Existing - All Basins.TXT
0.100000

Name: RN1B2 Group: PRE
Encroachment: No

Station(ft)	Elevation(ft)	Manning's N
0.000	31.500	0.070000
3.000	28.900	0.070000
4.000	28.700	0.050000
6.000	28.900	0.050000
10.000	31.900	0.070000

Name: RN4B3 Group: PRE
Encroachment: No

Station(ft)	Elevation(ft)	Manning's N
0.000	40.700	0.060000
20.000	40.100	0.060000
33.000	40.900	0.060000
38.000	33.300	0.040000
44.000	33.100	0.040000
48.000	38.500	0.040000
71.000	38.000	0.060000
100.000	37.900	0.060000

Name: RN4C Group: PRE
Encroachment: No

Station(ft)	Elevation(ft)	Manning's N
0.000	50.400	0.060000
14.000	50.200	0.060000
20.000	48.900	0.060000
27.000	48.400	0.040000
31.000	49.200	0.040000
38.000	50.200	0.040000
58.000	50.400	0.060000

Name: RND1 Group: PRE
Encroachment: No

Station(ft)	Elevation(ft)	Manning's N
0.000	36.400	0.080000
5.000	33.700	0.080000
9.000	32.100	0.080000
15.000	30.500	0.060000
21.000	26.700	0.050000
26.000	26.100	0.050000

ICPR Existing - All Basins.TXT

33.000	26.700	0.050000
38.000	27.100	0.060000
48.000	31.000	0.060000

Name: RND2
Encroachment: No

Group: PRE

Station(ft)	Elevation(ft)	Manning's N
0.000	37.500	0.080000
11.000	33.400	0.080000
18.000	31.800	0.080000
21.000	28.200	0.060000
27.000	25.800	0.050000
33.000	25.500	0.050000
39.000	26.400	0.050000
45.000	28.200	0.060000
49.000	30.500	0.080000
56.000	32.400	0.080000

Name: RND3
Encroachment: No

Group: PRE

Station(ft)	Elevation(ft)	Manning's N
0.000	37.500	0.080000
11.000	33.400	0.080000
18.000	31.800	0.080000
21.000	28.200	0.060000
27.000	25.800	0.050000
33.000	25.500	0.050000
39.000	26.400	0.050000
45.000	28.200	0.060000
49.000	30.500	0.080000
56.000	32.400	0.080000

Name: RND4
Encroachment: No

Group: PRE

Station(ft)	Elevation(ft)	Manning's N
0.000	37.500	0.080000
11.000	33.400	0.080000
18.000	31.800	0.080000
21.000	28.200	0.060000
27.000	25.800	0.050000
33.000	25.500	0.050000
39.000	26.400	0.050000
45.000	28.200	0.060000
49.000	30.500	0.080000
56.000	32.400	0.080000

Name: RND5

Group: PRE

ICPR Existing - All Basins.TXT

Encroachment: No

Station(ft)	Elevation(ft)	Manning's N
0.000	34.400	0.080000
10.000	31.900	0.080000
17.000	29.200	0.080000
19.000	28.900	0.080000
22.000	25.400	0.060000
25.000	21.900	0.050000
34.000	22.500	0.050000
37.000	24.500	0.050000
40.000	26.400	0.060000
51.000	29.500	0.080000
53.000	30.600	0.080000
61.000	31.800	0.080000
73.000	33.300	0.080000

Name: RND6
Encroachment: No

Group: PRE

Station(ft)	Elevation(ft)	Manning's N
0.000	32.200	0.045000
30.000	31.200	0.045000
60.000	29.800	0.045000
84.000	28.700	0.045000
90.000	28.300	0.045000
101.000	28.700	0.045000
120.000	30.000	0.045000
150.000	31.500	0.045000
190.000	32.500	0.045000

Name: RS1A
Encroachment: No

Group: PRE

Station(ft)	Elevation(ft)	Manning's N
0.000	34.900	0.070000
7.000	34.100	0.070000
10.000	32.900	0.040000
17.000	32.600	0.040000
24.000	32.700	0.040000
26.000	33.900	0.040000
30.000	34.900	0.070000
36.000	31.100	0.070000
53.000	34.500	0.100000

Name: RS1A1
Encroachment: No

Group: PRE

Station(ft) Elevation(ft) Manning's N

ICPR Existing - All Basins.TXT

0.000	34.300	0.090000
6.000	32.200	0.090000
8.000	31.400	0.060000
10.000	31.000	0.060000
13.000	30.000	0.060000
15.000	32.500	0.090000
32.000	28.800	0.070000
36.000	31.100	0.070000
53.000	34.500	0.100000

Name: RS1A2
Encroachment: No

Group: PRE

Station(ft)	Elevation(ft)	Manning's N
0.000	34.400	0.060000
5.000	31.500	0.060000
9.000	30.900	0.030000
15.000	31.500	0.030000
20.000	33.900	0.060000
24.000	28.300	0.070000
32.000	28.800	0.070000
36.000	31.100	0.070000
53.000	34.500	0.100000

Name: RS1B
Encroachment: No

Group: PRE

Station(ft)	Elevation(ft)	Manning's N
0.000	37.000	0.100000
15.000	34.500	0.100000
26.000	33.700	0.100000
36.000	33.600	0.100000
47.000	34.400	0.070000
60.000	35.700	0.070000
77.000	35.500	0.070000
97.000	35.300	0.070000
107.000	35.500	0.100000

Name: RSD1
Encroachment: No

Group: PRE

Station(ft)	Elevation(ft)	Manning's N
0.000	33.100	0.100000
5.000	32.000	0.100000
12.000	31.500	0.100000
13.000	31.100	0.100000
17.000	29.600	0.070000
24.000	28.300	0.070000
32.000	28.800	0.070000
36.000	31.100	0.070000

53.000 34.500 ICPR Existing - All Basins.TXT
0.100000

Name: RSD2
Encroachment: No

Group: PRE

Station(ft)	Elevation(ft)	Manning's N
0.000	33.100	0.100000
5.000	32.000	0.100000
12.000	31.500	0.100000
13.000	31.100	0.100000
17.000	29.600	0.070000
24.000	28.300	0.070000
32.000	28.800	0.070000
36.000	31.100	0.070000
53.000	34.500	0.100000

==== Pipes =====

Name: RC10
Group: PRE

From Node: NN3B
To Node: NN3AB

Length(ft): 39.00
Count: 1

UPSTREAM
Geometry: Circular
Span(in): 24.00
Rise(in): 24.00
Invert(ft): 33.100
Manning's N: 0.024000
Top Clip(in): 0.000
Bot Clip(in): 0.000

DOWNSTREAM
Circular
24.00
24.00
32.910
0.024000
0.000
0.000

Friction Equation: Average Conveyance
Solution Algorithm: Automatic
Flow: Both
Entrance Loss Coef: 0.90
Exit Loss Coef: 0.00
Bend Loss Coef: 0.00
Outlet Ctrl Spec: Use dc or tw
Inlet Ctrl Spec: Use dn
Stabilizer Option: None

Upstream FHWA Inlet Edge Description:
Circular CMP: Projecting

Downstream FHWA Inlet Edge Description:
Circular CMP: Projecting

Name: RC11
Group: PRE

From Node: NN3B
To Node: NN3AB

Length(ft): 36.00
Count: 1

UPSTREAM
Geometry: Circular
Span(in): 24.00
Rise(in): 24.00
Invert(ft): 33.020
Manning's N: 0.024000
Top Clip(in): 0.000
Bot Clip(in): 0.000

DOWNSTREAM
Circular
24.00
24.00
32.950
0.024000
0.000
0.000

Friction Equation: Average Conveyance
Solution Algorithm: Automatic
Flow: Both
Entrance Loss Coef: 0.90
Exit Loss Coef: 0.00
Bend Loss Coef: 0.00
Outlet Ctrl Spec: Use dc or tw
Inlet Ctrl Spec: Use dn
Stabilizer Option: None

Upstream FHWA Inlet Edge Description:

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ICPR Existing - All Basins.TXT

Rise(in): 36.00	36.00	Exit Loss Coef: 0.00
Invert(ft): 29.420	29.260	Bend Loss Coef: 0.00
Manning's N: 0.024000	0.024000	Outlet Ctrl Spec: Use dc or tw
Top Clip(in): 0.000	0.000	Inlet Ctrl Spec: Use dn
Bot Clip(in): 0.000	0.000	Stabilizer Option: None

Upstream FHWA Inlet Edge Description:
Circular CMP: Projecting

Downstream FHWA Inlet Edge Description:
Circular CMP: Projecting

Name: RC1A	From Node: NN1A	Length(ft): 29.00
Group: PRE	To Node: NN1B	Count: 1
		Friction Equation: Average Conveyance
		Solution Algorithm: Automatic
		Flow: Both
		Entrance Loss Coef: 0.90
		Exit Loss Coef: 0.00
		Bend Loss Coef: 0.00
		Outlet Ctrl Spec: Use dc or tw
		Inlet Ctrl Spec: Use dn
		Stabilizer Option: None

	UPSTREAM	DOWNSTREAM
Geometry:	Circular	Circular
Span(in):	18.00	18.00
Rise(in):	18.00	18.00
Invert(ft):	29.500	29.820
Manning's N:	0.015000	0.015000
Top Clip(in):	0.000	0.000
Bot Clip(in):	0.000	0.000

Upstream FHWA Inlet Edge Description:
Circular CMP: Projecting

Downstream FHWA Inlet Edge Description:
Circular CMP: Projecting

Name: RC1B	From Node: NN1A	Length(ft): 29.00
Group: PRE	To Node: NN1B	Count: 1
		Friction Equation: Average Conveyance
		Solution Algorithm: Automatic
		Flow: Both
		Entrance Loss Coef: 0.90
		Exit Loss Coef: 0.00
		Bend Loss Coef: 0.00
		Outlet Ctrl Spec: Use dc or tw
		Inlet Ctrl Spec: Use dn
		Stabilizer Option: None

	UPSTREAM	DOWNSTREAM
Geometry:	Circular	Circular
Span(in):	18.00	18.00
Rise(in):	18.00	18.00
Invert(ft):	29.710	30.360
Manning's N:	0.015000	0.015000
Top Clip(in):	0.000	0.000
Bot Clip(in):	0.000	0.000

Upstream FHWA Inlet Edge Description:
Circular CMP: Projecting

Downstream FHWA Inlet Edge Description:
Circular CMP: Projecting

ICPR Existing - All Basins.TXT

Name: RC1C From Node: NN1A Length(ft): 26.00
Group: PRE To Node: NND1B Count: 1
Friction Equation: Average Conveyance
Solution Algorithm: Automatic
Flow: Both
Entrance Loss Coef: 0.90
Exit Loss Coef: 0.00
Bend Loss Coef: 0.00
Outlet Ctrl Spec: Use dc or tw
Inlet Ctrl Spec: Use dn
Stabilizer Option: None

UPSTREAM DOWNSTREAM
Geometry: Circular Circular
Span(in): 24.00 24.00
Rise(in): 24.00 24.00
Invert(ft): 29.630 29.000
Manning's N: 0.022000 0.022000
Top Clip(in): 0.000 0.000
Bot Clip(in): 0.000 0.000

Upstream FHWA Inlet Edge Description:
Circular CMP: Projecting

Downstream FHWA Inlet Edge Description:
Circular CMP: Headwall

Name: RC21 From Node: NED9B Length(ft): 34.00
Group: PRE To Node: NED9A Count: 1
Friction Equation: Average Conveyance
Solution Algorithm: Automatic
Flow: Both
Entrance Loss Coef: 0.90
Exit Loss Coef: 0.00
Bend Loss Coef: 0.00
Outlet Ctrl Spec: Use dc or tw
Inlet Ctrl Spec: Use dn
Stabilizer Option: None

UPSTREAM DOWNSTREAM
Geometry: Circular Circular
Span(in): 36.00 36.00
Rise(in): 36.00 36.00
Invert(ft): 27.280 27.160
Manning's N: 0.024000 0.024000
Top Clip(in): 0.000 0.000
Bot Clip(in): 0.000 0.000

Upstream FHWA Inlet Edge Description:
Circular CMP: Projecting

Downstream FHWA Inlet Edge Description:
Circular CMP: Projecting

Name: RC25 From Node: NED15 Length(ft): 23.00
Group: PRE To Node: NED14 Count: 1
Friction Equation: Average Conveyance
Solution Algorithm: Automatic
Flow: Both
Entrance Loss Coef: 0.90
Exit Loss Coef: 0.00
Bend Loss Coef: 0.00
Outlet Ctrl Spec: Use dc or tw
Inlet Ctrl Spec: Use dn
Stabilizer Option: None

UPSTREAM DOWNSTREAM
Geometry: Circular Circular
Span(in): 36.00 36.00
Rise(in): 36.00 36.00
Invert(ft): 32.040 31.390
Manning's N: 0.024000 0.024000
Top Clip(in): 0.000 0.000
Bot Clip(in): 0.000 0.000

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ICPR Existing - All Basins.TXT

	UPSTREAM	DOWNSTREAM	
Geometry:	Circular	Circular	Solution Algorithm: Automatic
Span(in):	72.00	72.00	Flow: Both
Rise(in):	72.00	72.00	Entrance Loss Coef: 0.90
Invert(ft):	24.590	23.410	Exit Loss Coef: 0.00
Manning's N:	0.024000	0.024000	Bend Loss Coef: 0.00
Top Clip(in):	0.000	0.000	Outlet Ctrl Spec: Use dc or tw
Bot Clip(in):	0.000	0.000	Inlet Ctrl Spec: Use dn
			Stabilizer Option: None

Upstream FHWA Inlet Edge Description:
Circular CMP: Projecting

Downstream FHWA Inlet Edge Description:
Circular CMP: Projecting

		From Node: NM1	Length(ft): 38.00
Name:	RC28	To Node: NMBNDRY	Count: 1
Group:	PRE		Friction Equation: Average Conveyance
			Solution Algorithm: Automatic
			Flow: Both
Geometry:	UPSTREAM	DOWNSTREAM	Entrance Loss Coef: 0.90
Span(in):	Circular	Circular	Exit Loss Coef: 0.00
Span(in):	30.00	30.00	Bend Loss Coef: 0.00
Rise(in):	30.00	30.00	Outlet Ctrl Spec: Use dc or tw
Invert(ft):	27.820	27.960	Inlet Ctrl Spec: Use dn
Manning's N:	0.024000	0.024000	Stabilizer Option: None
Top Clip(in):	0.000	0.000	
Bot Clip(in):	0.000	0.000	

Upstream FHWA Inlet Edge Description:
Circular CMP: Projecting

Downstream FHWA Inlet Edge Description:
Circular CMP: Projecting

		From Node: NM1	Length(ft): 40.00
Name:	RC29	To Node: NMBNDRY	Count: 1
Group:	PRE		Friction Equation: Average Conveyance
			Solution Algorithm: Automatic
			Flow: Both
Geometry:	UPSTREAM	DOWNSTREAM	Entrance Loss Coef: 0.90
Span(in):	Circular	Circular	Exit Loss Coef: 0.00
Span(in):	36.00	36.00	Bend Loss Coef: 0.00
Rise(in):	36.00	36.00	Outlet Ctrl Spec: Use dc or tw
Invert(ft):	27.750	28.050	Inlet Ctrl Spec: Use dn
Manning's N:	0.024000	0.024000	Stabilizer Option: None
Top Clip(in):	0.000	0.000	
Bot Clip(in):	0.000	0.000	

Upstream FHWA Inlet Edge Description:
Circular CMP: Projecting

Downstream FHWA Inlet Edge Description:

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ICPR Existing - All Basins.TXT

Top Clip(in): 0.000 0.000 Inlet Ctrl Spec: Use dn
Bot Clip(in): 0.000 0.000 Stabilizer Option: None

Upstream FHWA Inlet Edge Description:
Circular Concrete: Square edge w/ headwall

Downstream FHWA Inlet Edge Description:
Circular Concrete: Square edge w/ headwall

Name: RC31 From Node: NM2 Length(ft): 50.00
Group: PRE To Node: NMBNDRY Count: 1
Friction Equation: Average Conveyance
Solution Algorithm: Automatic
Flow: Both
UPSTREAM DOWNSTREAM
Geometry: Circular Circular
Span(in): 18.00 18.00
Rise(in): 18.00 18.00
Invert(ft): 28.600 28.530
Manning's N: 0.024000 0.024000
Entrance Loss Coef: 0.90
Exit Loss Coef: 0.00
Bend Loss Coef: 0.00
Top Clip(in): 0.000 0.000 Outlet Ctrl Spec: Use dc or tw
Bot Clip(in): 0.000 0.000 Inlet Ctrl Spec: Use dn
Stabilizer Option: None

Upstream FHWA Inlet Edge Description:
Circular Concrete: Square edge w/ headwall

Downstream FHWA Inlet Edge Description:
Circular Concrete: Square edge w/ headwall

Name: RC32 From Node: NM2 Length(ft): 32.50
Group: PRE To Node: NMBNDRY Count: 1
Friction Equation: Average Conveyance
Solution Algorithm: Automatic
Flow: Both
UPSTREAM DOWNSTREAM
Geometry: Horz Ellipse Horz Ellipse
Span(in): 18.00 18.00
Rise(in): 14.00 14.00
Invert(ft): 30.450 30.390
Manning's N: 0.024000 0.024000
Entrance Loss Coef: 0.90
Exit Loss Coef: 0.00
Bend Loss Coef: 0.00
Top Clip(in): 0.000 0.000 Outlet Ctrl Spec: Use dc or tw
Bot Clip(in): 0.000 0.000 Inlet Ctrl Spec: Use dn
Stabilizer Option: None

Upstream FHWA Inlet Edge Description:
Horizontal Ellipse Concrete: Square edge with headwall

Downstream FHWA Inlet Edge Description:
Horizontal Ellipse Concrete: Square edge with headwall

ICPR Existing - All Basins.TXT

Name: RC33
Group: PRE

From Node: NM2
To Node: NMBNDRY

Length(ft): 32.50
Count: 1

	UPSTREAM	DOWNSTREAM
Geometry:	Horz Ellipse	Horz Ellipse
Span(in):	18.00	18.00
Rise(in):	14.00	14.00
Invert(ft):	30.410	30.210
Manning's N:	0.024000	0.024000
Top Clip(in):	0.000	0.000
Bot Clip(in):	0.000	0.000

Friction Equation: Average Conveyance
Solution Algorithm: Automatic
Flow: Both
Entrance Loss Coef: 0.90
Exit Loss Coef: 0.00
Bend Loss Coef: 0.00
Outlet Ctrl Spec: Use dc or tw
Inlet Ctrl Spec: Use dn
Stabilizer Option: None

Upstream FHWA Inlet Edge Description:
Horizontal Ellipse Concrete: Square edge with headwall

Downstream FHWA Inlet Edge Description:
Horizontal Ellipse Concrete: Square edge with headwall

	UPSTREAM	DOWNSTREAM	
Name: RC34			Length(ft): 36.00
Group: PRE			Count: 1
			Friction Equation: Average Conveyance
			Solution Algorithm: Automatic
			Flow: Both
Geometry: Circular	Circular		Entrance Loss Coef: 0.90
Span(in): 24.00	24.00		Exit Loss Coef: 0.00
Rise(in): 24.00	24.00		Bend Loss Coef: 0.00
Invert(ft): 30.390	29.710		Outlet Ctrl Spec: Use dc or tw
Manning's N: 0.024000	0.024000		Inlet Ctrl Spec: Use dn
Top Clip(in): 0.000	0.000		Stabilizer Option: None
Bot Clip(in): 0.000	0.000		

Upstream FHWA Inlet Edge Description:
Circular CMP: Projecting

Downstream FHWA Inlet Edge Description:
Circular CMP: Projecting

	UPSTREAM	DOWNSTREAM	
Name: RC35			Length(ft): 36.00
Group: PRE			Count: 1
			Friction Equation: Average Conveyance
			Solution Algorithm: Automatic
			Flow: Both
Geometry: Circular	Circular		Entrance Loss Coef: 0.90
Span(in): 24.00	24.00		Exit Loss Coef: 0.00
Rise(in): 24.00	24.00		Bend Loss Coef: 0.00
Invert(ft): 29.600	29.070		Outlet Ctrl Spec: Use dc or tw
Manning's N: 0.024000	0.024000		Inlet Ctrl Spec: Use dn
Top Clip(in): 0.000	0.000		Stabilizer Option: None
Bot Clip(in): 0.000	0.000		

Upstream FHWA Inlet Edge Description:

ICPR Existing - All Basins.TXT

Circular CMP: Projecting

Downstream FHWA Inlet Edge Description:
Circular CMP: Projecting

Name: RC36 From Node: NM2 Length(ft): 34.00
Group: PRE To Node: NMBNDRY Count: 1
Friction Equation: Average Conveyance
Solution Algorithm: Automatic
Flow: Both
Entrance Loss Coef: 0.90
Exit Loss Coef: 0.00
Bend Loss Coef: 0.00
Outlet Ctrl Spec: Use dc or tw
Inlet Ctrl Spec: Use dn
Stabilizer Option: None

UPSTREAM DOWNSTREAM
Geometry: Circular Circular
Span(in): 18.00 18.00
Rise(in): 18.00 18.00
Invert(ft): 30.210 29.840
Manning's N: 0.024000 0.024000
Top Clip(in): 0.000 0.000
Bot Clip(in): 0.000 0.000

Upstream FHWA Inlet Edge Description:
Circular CMP: Projecting

Downstream FHWA Inlet Edge Description:
Circular CMP: Projecting

Name: RC37 From Node: NM2 Length(ft): 34.00
Group: PRE To Node: NMBNDRY Count: 1
Friction Equation: Average Conveyance
Solution Algorithm: Automatic
Flow: Both
Entrance Loss Coef: 0.90
Exit Loss Coef: 0.00
Bend Loss Coef: 0.00
Outlet Ctrl Spec: Use dc or tw
Inlet Ctrl Spec: Use dn
Stabilizer Option: None

UPSTREAM DOWNSTREAM
Geometry: Circular Circular
Span(in): 18.00 18.00
Rise(in): 18.00 18.00
Invert(ft): 30.200 29.570
Manning's N: 0.024000 0.024000
Top Clip(in): 0.000 0.000
Bot Clip(in): 0.000 0.000

Upstream FHWA Inlet Edge Description:
Circular CMP: Projecting

Downstream FHWA Inlet Edge Description:
Circular CMP: Projecting

Name: RC38 From Node: NM2 Length(ft): 34.00
Group: PRE To Node: NMBNDRY Count: 1
Friction Equation: Average Conveyance
Solution Algorithm: Automatic
Flow: Both
Entrance Loss Coef: 0.90

UPSTREAM DOWNSTREAM
Geometry: Circular Circular
Span(in): 18.00 18.00

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Rise(in): 18.00	18.00	Exit Loss Coef: 0.00
Invert(ft): 30.930	30.470	Bend Loss Coef: 0.00
Manning's N: 0.024000	0.024000	Outlet Ctrl Spec: Use dc or tw
Top Clip(in): 0.000	0.000	Inlet Ctrl Spec: Use dn
Bot Clip(in): 0.000	0.000	Stabilizer Option: None

Upstream FHWA Inlet Edge Description:
Circular CMP: Projecting

Downstream FHWA Inlet Edge Description:
Circular CMP: Projecting

Name: RC39	From Node: NM2	Length(ft): 34.00
Group: PRE	To Node: NMBNDRY	Count: 1
		Friction Equation: Average Conveyance
		Solution Algorithm: Automatic
		Flow: Both
		Entrance Loss Coef: 0.90
		Exit Loss Coef: 0.00
		Bend Loss Coef: 0.00
		Outlet Ctrl Spec: Use dc or tw
		Inlet Ctrl Spec: Use dn
		Stabilizer Option: None

	UPSTREAM	DOWNSTREAM
Geometry:	Circular	Circular
Span(in):	18.00	18.00
Rise(in):	18.00	18.00
Invert(ft):	30.980	30.840
Manning's N:	0.024000	0.024000
Top Clip(in):	0.000	0.000
Bot Clip(in):	0.000	0.000

Upstream FHWA Inlet Edge Description:
Circular CMP: Projecting

Downstream FHWA Inlet Edge Description:
Circular CMP: Projecting

Name: RC3A	From Node: NN3A	Length(ft): 30.00
Group: PRE	To Node: NN3	Count: 1
		Friction Equation: Average Conveyance
		Solution Algorithm: Automatic
		Flow: Both
		Entrance Loss Coef: 0.90
		Exit Loss Coef: 0.00
		Bend Loss Coef: 0.00
		Outlet Ctrl Spec: Use dc or tw
		Inlet Ctrl Spec: Use dn
		Stabilizer Option: None

	UPSTREAM	DOWNSTREAM
Geometry:	Circular	Circular
Span(in):	42.00	42.00
Rise(in):	42.00	42.00
Invert(ft):	27.590	27.780
Manning's N:	0.024000	0.024000
Top Clip(in):	0.000	0.000
Bot Clip(in):	0.000	0.000

Upstream FHWA Inlet Edge Description:
Circular CMP: Projecting

Downstream FHWA Inlet Edge Description:
Circular CMP: Projecting

ICPR Existing - All Basins.TXT

	UPSTREAM	DOWNSTREAM	
Geometry:	Circular	Circular	Solution Algorithm: Automatic
Span(in):	18.00	18.00	Flow: Both
Rise(in):	18.00	18.00	Entrance Loss Coef: 0.90
Invert(ft):	30.630	30.400	Exit Loss Coef: 0.00
Manning's N:	0.024000	0.024000	Bend Loss Coef: 0.00
Top Clip(in):	0.000	0.000	Outlet Ctrl Spec: Use dc or tw
Bot Clip(in):	0.000	0.000	Inlet Ctrl Spec: Use dn
			Stabilizer Option: None

Upstream FHWA Inlet Edge Description:
Circular CMP: Projecting

Downstream FHWA Inlet Edge Description:
Circular CMP: Projecting

		From Node: NM2	Length(ft): 36.00
Name:	RC44	To Node: NMBNDRY	Count: 1
Group:	PRE		Friction Equation: Average Conveyance
			Solution Algorithm: Automatic
Geometry:	UPSTREAM	DOWNSTREAM	Flow: Both
Span(in):	Circular	Circular	Entrance Loss Coef: 0.90
Rise(in):	24.00	24.00	Exit Loss Coef: 0.00
Invert(ft):	30.180	30.480	Bend Loss Coef: 0.00
Manning's N:	0.024000	0.024000	Outlet Ctrl Spec: Use dc or tw
Top Clip(in):	0.000	0.000	Inlet Ctrl Spec: Use dn
Bot Clip(in):	0.000	0.000	Stabilizer Option: None

Upstream FHWA Inlet Edge Description:
Circular CMP: Projecting

Downstream FHWA Inlet Edge Description:
Circular CMP: Projecting

		From Node: NM2	Length(ft): 33.00
Name:	RC45	To Node: NMBNDRY	Count: 1
Group:	PRE		Friction Equation: Average Conveyance
			Solution Algorithm: Automatic
Geometry:	UPSTREAM	DOWNSTREAM	Flow: Both
Span(in):	Circular	Circular	Entrance Loss Coef: 0.90
Rise(in):	18.00	18.00	Exit Loss Coef: 0.00
Invert(ft):	30.580	30.360	Bend Loss Coef: 0.00
Manning's N:	0.024000	0.024000	Outlet Ctrl Spec: Use dc or tw
Top Clip(in):	0.000	0.000	Inlet Ctrl Spec: Use dn
Bot Clip(in):	0.000	0.000	Stabilizer Option: None

Upstream FHWA Inlet Edge Description:
Circular CMP: Projecting

Downstream FHWA Inlet Edge Description:

ICPR Existing - All Basins.TXT

Top Clip(in): 0.000 0.000 Inlet Ctrl Spec: Use dn
Bot Clip(in): 0.000 0.000 Stabilizer Option: None

Upstream FHWA Inlet Edge Description:
Circular CMP: Projecting

Downstream FHWA Inlet Edge Description:
Circular CMP: Projecting

Name: RC49 From Node: NM2 Length(ft): 41.00
Group: PRE To Node: NMBNDRY Count: 1
Friction Equation: Average Conveyance
Solution Algorithm: Automatic
Flow: Both
UPSTREAM DOWNSTREAM
Geometry: Circular Circular
Span(in): 24.00 24.00
Rise(in): 24.00 24.00
Invert(ft): 30.330 30.260
Entrance Loss Coef: 0.90
Manning's N: 0.024000 0.024000 Exit Loss Coef: 0.00
Bend Loss Coef: 0.00
Top Clip(in): 0.000 0.000 Outlet Ctrl Spec: Use dc or tw
Inlet Ctrl Spec: Use dn
Bot Clip(in): 0.000 0.000 Stabilizer Option: None

Upstream FHWA Inlet Edge Description:
Circular CMP: Projecting

Downstream FHWA Inlet Edge Description:
Circular CMP: Projecting

Name: RC5 From Node: NN4B2 Length(ft): 32.00
Group: PRE To Node: NN4A Count: 1
Friction Equation: Average Conveyance
Solution Algorithm: Automatic
Flow: Both
UPSTREAM DOWNSTREAM
Geometry: Circular Circular
Span(in): 15.00 15.00
Rise(in): 15.00 15.00
Invert(ft): 32.270 31.850
Entrance Loss Coef: 0.90
Manning's N: 0.024000 0.024000 Exit Loss Coef: 0.00
Bend Loss Coef: 0.00
Top Clip(in): 0.000 0.000 Outlet Ctrl Spec: Use dc or tw
Inlet Ctrl Spec: Use dn
Bot Clip(in): 0.000 0.000 Stabilizer Option: None

Upstream FHWA Inlet Edge Description:
Circular CMP: Projecting

Downstream FHWA Inlet Edge Description:
Circular CMP: Projecting

ICPR Existing - All Basins.TXT

Name: RC50	From Node: NM2	Length(ft): 23.00
Group: PRE	To Node: NMBNDRY	Count: 1
		Friction Equation: Average Conveyance
		Solution Algorithm: Automatic
		Flow: Both
		Entrance Loss Coef: 0.90
		Exit Loss Coef: 0.00
		Bend Loss Coef: 0.00
		Outlet Ctrl Spec: Use dc or tw
		Inlet Ctrl Spec: Use dn
		Stabilizer Option: None
UPSTREAM	DOWNSTREAM	
Geometry: Circular	Circular	
Span(in): 36.00	36.00	
Rise(in): 36.00	36.00	
Invert(ft): 29.080	28.890	
Manning's N: 0.024000	0.024000	
Top Clip(in): 0.000	0.000	
Bot Clip(in): 0.000	0.000	

Upstream FHWA Inlet Edge Description:
Circular CMP: Projecting

Downstream FHWA Inlet Edge Description:
Circular CMP: Projecting

Name: RC5A	From Node: NN4B2	Length(ft): 29.00
Group: PRE	To Node: NND5	Count: 1
		Friction Equation: Average Conveyance
		Solution Algorithm: Automatic
		Flow: Both
		Entrance Loss Coef: 0.90
		Exit Loss Coef: 0.00
		Bend Loss Coef: 0.00
		Outlet Ctrl Spec: Use dc or tw
		Inlet Ctrl Spec: Use dn
		Stabilizer Option: None
UPSTREAM	DOWNSTREAM	
Geometry: Horz Ellipse	Horz Ellipse	
Span(in): 26.00	26.00	
Rise(in): 20.00	20.00	
Invert(ft): 30.900	30.820	
Manning's N: 0.024000	0.024000	
Top Clip(in): 0.000	0.000	
Bot Clip(in): 0.000	0.000	

Upstream FHWA Inlet Edge Description:
Horizontal Ellipse Concrete: Square edge with headwall

Downstream FHWA Inlet Edge Description:
Horizontal Ellipse Concrete: Square edge with headwall

Name: RC8A	From Node: NN4B1	Length(ft): 45.00
Group: PRE	To Node: NN4AB	Count: 1
		Friction Equation: Average Conveyance
		Solution Algorithm: Automatic
		Flow: Both
		Entrance Loss Coef: 0.90
		Exit Loss Coef: 0.00
		Bend Loss Coef: 0.00
		Outlet Ctrl Spec: Use dc or tw
		Inlet Ctrl Spec: Use dn
		Stabilizer Option: None
UPSTREAM	DOWNSTREAM	
Geometry: Circular	Circular	
Span(in): 30.00	30.00	
Rise(in): 30.00	30.00	
Invert(ft): 29.700	29.500	
Manning's N: 0.024000	0.024000	
Top Clip(in): 0.000	0.000	
Bot Clip(in): 0.000	0.000	

Upstream FHWA Inlet Edge Description:

ICPR Existing - All Basins.TXT

Rise(in): 24.00	24.00	Exit Loss Coef: 0.00
Invert(ft): 33.020	32.870	Bend Loss Coef: 0.00
Manning's N: 0.024000	0.024000	Outlet Ctrl Spec: Use dc or tw
Top Clip(in): 0.000	0.000	Inlet Ctrl Spec: Use dn
Bot Clip(in): 0.000	0.000	Stabilizer Option: None

Upstream FHWA Inlet Edge Description:
Circular CMP: Projecting

Downstream FHWA Inlet Edge Description:
Circular CMP: Projecting

Name: RD14	From Node: NE4	Length(ft): 34.00
Group: PRE	To Node: NED5D	Count: 1
		Friction Equation: Average Conveyance
		Solution Algorithm: Automatic
		Flow: Both
		Entrance Loss Coef: 0.90
		Exit Loss Coef: 0.00
		Bend Loss Coef: 0.00
		Outlet Ctrl Spec: Use dc or tw
		Inlet Ctrl Spec: Use dn
		Stabilizer Option: None

	UPSTREAM	DOWNSTREAM
Geometry:	Circular	Circular
Span(in):	36.00	36.00
Rise(in):	36.00	36.00
Invert(ft):	28.870	28.390
Manning's N:	0.024000	0.024000
Top Clip(in):	0.000	0.000
Bot Clip(in):	0.000	0.000

Upstream FHWA Inlet Edge Description:
Circular Concrete: Square edge w/ headwall

Downstream FHWA Inlet Edge Description:
Circular Concrete: Square edge w/ headwall

Name: RD17	From Node: NE9	Length(ft): 34.00
Group: PRE	To Node: NED6C	Count: 1
		Friction Equation: Average Conveyance
		Solution Algorithm: Automatic
		Flow: Both
		Entrance Loss Coef: 0.90
		Exit Loss Coef: 0.00
		Bend Loss Coef: 0.00
		Outlet Ctrl Spec: Use dc or tw
		Inlet Ctrl Spec: Use dn
		Stabilizer Option: None

	UPSTREAM	DOWNSTREAM
Geometry:	Circular	Circular
Span(in):	36.00	36.00
Rise(in):	36.00	36.00
Invert(ft):	29.620	29.070
Manning's N:	0.024000	0.024000
Top Clip(in):	0.000	0.000
Bot Clip(in):	0.000	0.000

Upstream FHWA Inlet Edge Description:
Circular Concrete: Square edge w/ headwall

Downstream FHWA Inlet Edge Description:
Circular Concrete: Square edge w/ headwall

ICPR Existing - All Basins.TXT

Name: RD19 From Node: NE8 Length(ft): 29.00
Group: PRE To Node: NED7 Count: 1
Friction Equation: Average Conveyance
Solution Algorithm: Automatic
Flow: Both
Entrance Loss Coef: 0.90
Exit Loss Coef: 0.00
Bend Loss Coef: 0.00
Outlet Ctrl Spec: Use dc or tw
Inlet Ctrl Spec: Use dn
Stabilizer Option: None

UPSTREAM DOWNSTREAM
Geometry: Circular Circular
Span(in): 24.00 24.00
Rise(in): 24.00 24.00
Invert(ft): 29.630 28.900
Manning's N: 0.024000 0.024000
Top Clip(in): 0.000 0.000
Bot Clip(in): 0.000 0.000

Upstream FHWA Inlet Edge Description:
Circular CMP: Projecting

Downstream FHWA Inlet Edge Description:
Circular CMP: Projecting

Name: RD20 From Node: NE11 Length(ft): 29.00
Group: PRE To Node: NED9C Count: 1
Friction Equation: Average Conveyance
Solution Algorithm: Automatic
Flow: Both
Entrance Loss Coef: 0.90
Exit Loss Coef: 0.00
Bend Loss Coef: 0.00
Outlet Ctrl Spec: Use dc or tw
Inlet Ctrl Spec: Use dn
Stabilizer Option: None

UPSTREAM DOWNSTREAM
Geometry: Circular Circular
Span(in): 36.00 36.00
Rise(in): 36.00 36.00
Invert(ft): 29.170 28.740
Manning's N: 0.024000 0.024000
Top Clip(in): 0.000 0.000
Bot Clip(in): 0.000 0.000

Upstream FHWA Inlet Edge Description:
Circular Concrete: Square edge w/ headwall

Downstream FHWA Inlet Edge Description:
Circular Concrete: Square edge w/ headwall

Name: RD23 From Node: NE14B Length(ft): 23.00
Group: PRE To Node: NE12A Count: 1
Friction Equation: Average Conveyance
Solution Algorithm: Automatic
Flow: Both
Entrance Loss Coef: 0.90
Exit Loss Coef: 0.00
Bend Loss Coef: 0.00
Outlet Ctrl Spec: Use dc or tw
Inlet Ctrl Spec: Use dn
Stabilizer Option: None

UPSTREAM DOWNSTREAM
Geometry: Circular Circular
Span(in): 24.00 24.00
Rise(in): 24.00 24.00
Invert(ft): 31.700 30.080
Manning's N: 0.024000 0.024000
Top Clip(in): 0.000 0.000
Bot Clip(in): 0.000 0.000

ICPR Existing - All Basins.TXT

Upstream FHWA Inlet Edge Description:
Circular CMP: Projecting

Downstream FHWA Inlet Edge Description:
Circular CMP: Projecting

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      Name: RD24              From Node: NE12              Length(ft): 20.00
      Group: PRE              To Node: NED12              Count: 1
                                Friction Equation: Average Conveyance
                                Solution Algorithm: Automatic
                                Flow: Both
      UPSTREAM                DOWNSTREAM
Geometry: Circular           Circular
Span(in): 36.00              36.00
Rise(in): 36.00              36.00
Invert(ft): 28.870           28.680
Manning's N: 0.024000        0.024000
Top Clip(in): 0.000          0.000
Bot Clip(in): 0.000          0.000
                                Entrance Loss Coef: 0.90
                                Exit Loss Coef: 0.00
                                Bend Loss Coef: 0.00
                                Outlet Ctrl Spec: Use dc or tw
                                Inlet Ctrl Spec: Use dn
                                Stabilizer Option: None
```

Upstream FHWA Inlet Edge Description:
Circular CMP: Projecting

Downstream FHWA Inlet Edge Description:
Circular CMP: Projecting

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----
      Name: REC22              From Node: NED11B           Length(ft): 40.00
      Group: PRE              To Node: NED11A           Count: 1
                                Friction Equation: Average Conveyance
                                Solution Algorithm: Automatic
                                Flow: Both
      UPSTREAM                DOWNSTREAM
Geometry: Circular           Circular
Span(in): 72.00              72.00
Rise(in): 72.00              72.00
Invert(ft): 27.240           27.180
Manning's N: 0.024000        0.024000
Top Clip(in): 0.000          0.000
Bot Clip(in): 0.000          0.000
                                Entrance Loss Coef: 0.90
                                Exit Loss Coef: 0.00
                                Bend Loss Coef: 0.00
                                Outlet Ctrl Spec: Use dc or tw
                                Inlet Ctrl Spec: Use dn
                                Stabilizer Option: None
```

Upstream FHWA Inlet Edge Description:
Circular CMP: Projecting

Downstream FHWA Inlet Edge Description:
Circular CMP: Projecting

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==== Channels =====
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Name: RE12A

From Node: NE12A
Page 59

Length(ft): 1600.00

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To Node: NE12

Group: PRE

Count: 1

	UPSTREAM	DOWNSTREAM	Friction Equation: Average Conveyance
Geometry:	Trapezoidal	Trapezoidal	Solution Algorithm: Automatic
Invert(ft):	31.500	28.000	Flow: Both
TCIpInitZ(ft):	38.500	35.000	Contraction Coef: 0.000
Manning's N:	0.060000	0.060000	Expansion Coef: 0.000
Top Clip(ft):	0.000	0.000	Entrance Loss Coef: 0.000
Bot Clip(ft):	0.000	0.000	Exit Loss Coef: 0.000
Main XSec:			Outlet Ctrl Spec: Use dc or tw
AuxElev1(ft):			Inlet Ctrl Spec: Use dn
Aux XSec1:			Stabilizer Option: None
AuxElev2(ft):			
Aux XSec2:			
Top width(ft):			
Depth(ft):			
Bot width(ft):	4.000	4.000	
LtSdSlp(h/v):	1.00	1.00	
RtSdSlp(h/v):	1.00	1.00	

Name: RE14B
Group: PRE

From Node: NE14B
To Node: NED11C

Length(ft): 80.00
Count: 1

	UPSTREAM	DOWNSTREAM	Friction Equation: Average Conveyance
Geometry:	Trapezoidal	Trapezoidal	Solution Algorithm: Automatic
Invert(ft):	35.000	35.000	Flow: Both
TCIpInitZ(ft):	41.000	41.000	Contraction Coef: 0.000
Manning's N:	0.050000	0.050000	Expansion Coef: 0.000
Top Clip(ft):	0.000	0.000	Entrance Loss Coef: 0.000
Bot Clip(ft):	0.000	0.000	Exit Loss Coef: 0.000
Main XSec:			Outlet Ctrl Spec: Use dc or tw
AuxElev1(ft):			Inlet Ctrl Spec: Use dn
Aux XSec1:			Stabilizer Option: None
AuxElev2(ft):			
Aux XSec2:			
Top width(ft):			
Depth(ft):			
Bot width(ft):	6.000	6.000	
LtSdSlp(h/v):	1.00	1.00	
RtSdSlp(h/v):	1.00	1.00	

Name: RE1A
Group: PRE

From Node: NE1
To Node: NE1A

Length(ft): 70.00
Count: 1

	UPSTREAM	DOWNSTREAM	Friction Equation: Average Conveyance
Geometry:	Trapezoidal	Trapezoidal	Solution Algorithm: Automatic
Invert(ft):	29.750	26.480	Flow: Both
TCIpInitZ(ft):	9999.000	9999.000	Contraction Coef: 0.000
Manning's N:	0.040000	0.040000	Expansion Coef: 0.000
Top Clip(ft):	0.000	0.000	Entrance Loss Coef: 0.000
Bot Clip(ft):	0.000	0.000	Exit Loss Coef: 0.000
Main XSec:			Outlet Ctrl Spec: Use dc or tw
AuxElev1(ft):			Inlet Ctrl Spec: Use dn
Aux XSec1:			Stabilizer Option: None
AuxElev2(ft):			

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Aux XSec2:
Top Width(ft):
Depth(ft):
Bot Width(ft): 8.000 8.000
LtSdsSlp(h/v): 2.00 2.00
RtSdsSlp(h/v): 2.00 2.00

Name: RE2
Group: PRE

From Node: NE2
To Node: NED4

Length(ft): 100.00
Count: 1

UPSTREAM DOWNSTREAM
Geometry: Trapezoidal Trapezoidal
Invert(ft): 30.000 30.000
TClpInitZ(ft): 33.000 33.000
Manning's N: 0.090000 0.090000
Top Clip(ft): 0.000 0.000
Bot Clip(ft): 0.000 0.000
Main XSec:
AuxElev1(ft):
Aux XSec1:
AuxElev2(ft):
Aux XSec2:
Top Width(ft):
Depth(ft):
Bot Width(ft): 10.000 10.000
LtSdsSlp(h/v): 15.00 15.00
RtSdsSlp(h/v): 15.00 15.00

Friction Equation: Average Conveyance
Solution Algorithm: Automatic
Flow: Both
Contraction Coef: 0.000
Expansion Coef: 0.000
Entrance Loss Coef: 0.000
Exit Loss Coef: 0.000
Outlet Ctrl Spec: Use dc or tw
Inlet Ctrl Spec: Use dn
Stabilizer Option: None

Name: RE3
Group: PRE

From Node: NE3
To Node: NED5

Length(ft): 400.00
Count: 1

UPSTREAM DOWNSTREAM
Geometry: Trapezoidal Trapezoidal
Invert(ft): 30.000 28.000
TClpInitZ(ft): 36.000 34.000
Manning's N: 0.060000 0.060000
Top Clip(ft): 0.000 0.000
Bot Clip(ft): 0.000 0.000
Main XSec:
AuxElev1(ft):
Aux XSec1:
AuxElev2(ft):
Aux XSec2:
Top Width(ft):
Depth(ft):
Bot Width(ft): 4.000 4.000
LtSdsSlp(h/v): 1.00 1.00
RtSdsSlp(h/v): 1.00 1.00

Friction Equation: Average Conveyance
Solution Algorithm: Automatic
Flow: Both
Contraction Coef: 0.000
Expansion Coef: 0.000
Entrance Loss Coef: 0.000
Exit Loss Coef: 0.000
Outlet Ctrl Spec: Use dc or tw
Inlet Ctrl Spec: Use dn
Stabilizer Option: None

Name: RE5
Group: PRE

From Node: NE5
To Node: NED5A

Length(ft): 400.00
Count: 1

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	UPSTREAM	DOWNSTREAM	Friction Equation: Average Conveyance
Geometry:	Trapezoidal	Trapezoidal	Solution Algorithm: Automatic
Invert(ft):	30.000	28.000	Flow: Both
TClpInitZ(ft):	35.000	33.000	Contraction Coef: 0.000
Manning's N:	0.060000	0.060000	Expansion Coef: 0.000
Top Clip(ft):	0.000	0.000	Entrance Loss Coef: 0.000
Bot Clip(ft):	0.000	0.000	Exit Loss Coef: 0.000
Main XSec:			Outlet Ctrl Spec: Use dc or tw
AuxElev1(ft):			Inlet Ctrl Spec: Use dn
Aux XSec1:			Stabilizer Option: None
AuxElev2(ft):			
Aux XSec2:			
Top width(ft):			
Depth(ft):			
Bot width(ft):	4.000	4.000	
LtSdsIp(h/v):	1.00	1.00	
RtSdsIp(h/v):	1.00	1.00	

 Name: RE7 From Node: NE7 Length(ft): 100.00
 Group: PRE To Node: NED6A Count: 1

	UPSTREAM	DOWNSTREAM	Friction Equation: Average Conveyance
Geometry:	Trapezoidal	Trapezoidal	Solution Algorithm: Automatic
Invert(ft):	31.000	28.000	Flow: Both
TClpInitZ(ft):	34.000	31.000	Contraction Coef: 0.000
Manning's N:	0.090000	0.090000	Expansion Coef: 0.000
Top Clip(ft):	0.000	0.000	Entrance Loss Coef: 0.000
Bot Clip(ft):	0.000	0.000	Exit Loss Coef: 0.000
Main XSec:			Outlet Ctrl Spec: Use dc or tw
AuxElev1(ft):			Inlet Ctrl Spec: Use dn
Aux XSec1:			Stabilizer Option: None
AuxElev2(ft):			
Aux XSec2:			
Top width(ft):			
Depth(ft):			
Bot width(ft):	10.000	10.000	
LtSdsIp(h/v):	15.00	15.00	
RtSdsIp(h/v):	15.00	15.00	

 Name: RED10 From Node: NED10 Length(ft): 1400.00
 Group: PRE To Node: NED9 Count: 1

	UPSTREAM	DOWNSTREAM	Friction Equation: Average Conveyance
Geometry:	Irregular	Irregular	Solution Algorithm: Automatic
Invert(ft):	25.600	26.200	Flow: Both
TClpInitZ(ft):	33.600	34.200	Contraction Coef: 0.000
Manning's N:			Expansion Coef: 0.000
Top Clip(ft):			Entrance Loss Coef: 0.000
Bot Clip(ft):			Exit Loss Coef: 0.000
Main XSec:	RED10	RED10	Outlet Ctrl Spec: Use dc or tw
AuxElev1(ft):	0.000	0.000	Inlet Ctrl Spec: Use dn
Aux XSec1:			Stabilizer Option: None
AuxElev2(ft):	0.000	0.000	
Aux XSec2:			

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Top width(ft):
Depth(ft):
Bot width(ft):
LtsdSlp(h/v):
RtsdSlp(h/v):

```

-----
Name: RED10A                      From Node: NE10                      Length(ft): 50.00
Group: PRE                        To Node: NED10                      Count: 1

      UPSTREAM      DOWNSTREAM      Friction Equation: Average Conveyance
Geometry: Trapezoidal Trapezoidal Solution Algorithm: Automatic
Invert(ft): 30.000    29.500      Flow: Both
TClpInitZ(ft): 35.000 34.500      Contraction Coef: 0.000
Manning's N: 0.050000 0.050000 Expansion Coef: 0.000
Top Clip(ft): 0.000   0.000      Entrance Loss Coef: 0.000
Bot Clip(ft): 0.000   0.000      Exit Loss Coef: 0.000
Main XSec:                                     Outlet Ctrl Spec: Use dc or tw
AuxElev1(ft):                                     Inlet Ctrl Spec: Use dn
Aux XSec1:                                     Stabilizer Option: None
AuxElev2(ft):
Aux XSec2:
Top width(ft):
Depth(ft):
Bot width(ft): 12.000    12.000
LtsdSlp(h/v): 1.50      1.50
RtsdSlp(h/v): 1.50      1.50

```

```

-----
Name: RED11                      From Node: NED11                      Length(ft): 1600.00
Group: PRE                        To Node: NED10                      Count: 1

      UPSTREAM      DOWNSTREAM      Friction Equation: Average Conveyance
Geometry: Irregular Irregular Solution Algorithm: Automatic
Invert(ft): 25.600    25.600      Flow: Both
TClpInitZ(ft): 33.600 33.600      Contraction Coef: 0.000
Manning's N:                                     Expansion Coef: 0.000
Top Clip(ft):                                     Entrance Loss Coef: 0.000
Bot Clip(ft):                                     Exit Loss Coef: 0.000
Main XSec: RED11      RED11      Outlet Ctrl Spec: Use dc or tw
AuxElev1(ft): 0.000    0.000      Inlet Ctrl Spec: Use dn
Aux XSec1:                                     Stabilizer Option: None
AuxElev2(ft): 0.000    0.000
Aux XSec2:
Top width(ft):
Depth(ft):
Bot width(ft):
LtsdSlp(h/v):
RtsdSlp(h/v):

```

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-----
Name: RED11A                      From Node: NED11A                      Length(ft): 800.00
Group: PRE                        To Node: NED11                      Count: 1

```

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	UPSTREAM	DOWNSTREAM	Friction Equation: Average Conveyance
Geometry:	Irregular	Irregular	Solution Algorithm: Automatic
Invert(ft):	29.500	26.500	Flow: Both
TClpInitZ(ft):	37.500	34.500	Contraction Coef: 0.000
Manning's N:			Expansion Coef: 0.000
Top Clip(ft):			Entrance Loss Coef: 0.000
Bot Clip(ft):			Exit Loss Coef: 0.000
Main XSec:	RED11A	RED11A	Outlet Ctrl Spec: Use dc or tw
AuxElev1(ft):	0.000	0.000	Inlet Ctrl Spec: Use dn
Aux XSec1:			Stabilizer Option: None
AuxElev2(ft):	0.000	0.000	
Aux XSec2:			
Top width(ft):			
Depth(ft):			
Bot width(ft):			
LtSdSlp(h/v):			
RtSdSlp(h/v):			

Name: RED11B From Node: NED11C Length(ft): 1200.00
Group: PRE To Node: NED11B Count: 1

	UPSTREAM	DOWNSTREAM	Friction Equation: Average Conveyance
Geometry:	Irregular	Irregular	Solution Algorithm: Automatic
Invert(ft):	30.700	29.500	Flow: Both
TClpInitZ(ft):	38.700	37.500	Contraction Coef: 0.000
Manning's N:			Expansion Coef: 0.000
Top Clip(ft):			Entrance Loss Coef: 0.000
Bot Clip(ft):			Exit Loss Coef: 0.000
Main XSec:	RED11B	RED11B	Outlet Ctrl Spec: Use dc or tw
AuxElev1(ft):	0.000	0.000	Inlet Ctrl Spec: Use dn
Aux XSec1:			Stabilizer Option: None
AuxElev2(ft):	0.000	0.000	
Aux XSec2:			
Top width(ft):			
Depth(ft):			
Bot width(ft):			
LtSdSlp(h/v):			
RtSdSlp(h/v):			

Name: RED11C From Node: NED11D Length(ft): 1100.00
Group: PRE To Node: NED11C Count: 1

	UPSTREAM	DOWNSTREAM	Friction Equation: Average Conveyance
Geometry:	Irregular	Irregular	Solution Algorithm: Automatic
Invert(ft):	30.700	30.700	Flow: Both
TClpInitZ(ft):	38.700	38.700	Contraction Coef: 0.000
Manning's N:			Expansion Coef: 0.000
Top Clip(ft):			Entrance Loss Coef: 0.000
Bot Clip(ft):			Exit Loss Coef: 0.000
Main XSec:	RED11C	RED11C	Outlet Ctrl Spec: Use dc or tw
AuxElev1(ft):	0.000	0.000	Inlet Ctrl Spec: Use dn
Aux XSec1:			Stabilizer Option: None
AuxElev2(ft):	0.000	0.000	
Aux XSec2:			
Top width(ft):			

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Depth(ft):
Bot Width(ft):
LtSdSlp(h/v):
RtSdSlp(h/v):

```

-----
Name: RED11D          From Node: NE14A          Length(ft): 1000.00
Group: PRE            To Node: NED11D           Count: 1

      UPSTREAM      DOWNSTREAM      Friction Equation: Average Conveyance
Geometry: Irregular Irregular      Solution Algorithm: Automatic
Invert(ft): 31.000  30.700          Flow: Both
TClpInitZ(ft): 39.000 38.700      Contraction Coef: 0.000
Manning's N:                               Expansion Coef: 0.000
Top Clip(ft):                               Entrance Loss Coef: 0.000
Bot Clip(ft):                               Exit Loss Coef: 0.000
Main XSec: RED11D      RED11D      Outlet Ctrl Spec: Use dc or tw
AuxElev1(ft): 0.000    0.000      Inlet Ctrl Spec: Use dn
Aux XSec1:                               Stabilizer Option: None
AuxElev2(ft): 0.000    0.000
Aux XSec2:
Top Width(ft):
Depth(ft):
Bot Width(ft):
LtSdSlp(h/v):
RtSdSlp(h/v):

```

```

-----
Name: RED12          From Node: NED12          Length(ft): 400.00
Group: PRE            To Node: NED11           Count: 1

      UPSTREAM      DOWNSTREAM      Friction Equation: Average Conveyance
Geometry: Irregular Irregular      Solution Algorithm: Automatic
Invert(ft): 28.600  25.600          Flow: Both
TClpInitZ(ft): 36.600 33.600      Contraction Coef: 0.000
Manning's N:                               Expansion Coef: 0.000
Top Clip(ft):                               Entrance Loss Coef: 0.000
Bot Clip(ft):                               Exit Loss Coef: 0.000
Main XSec: RED12      RED12      Outlet Ctrl Spec: Use dc or tw
AuxElev1(ft): 0.000    0.000      Inlet Ctrl Spec: Use dn
Aux XSec1:                               Stabilizer Option: None
AuxElev2(ft): 0.000    0.000
Aux XSec2:
Top Width(ft):
Depth(ft):
Bot Width(ft):
LtSdSlp(h/v):
RtSdSlp(h/v):

```

```

-----
Name: RED13          From Node: NED13          Length(ft): 1750.00
Group: PRE            To Node: NED12           Count: 1

      UPSTREAM      DOWNSTREAM      Friction Equation: Average Conveyance

```


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Geometry: Irregular	Irregular	Solution Algorithm: Automatic
Invert(ft): 30.600	28.600	Flow: Both
TClpInitZ(ft): 36.600	34.600	Contraction Coef: 0.000
Manning's N:		Expansion Coef: 0.000
Top Clip(ft):		Entrance Loss Coef: 0.000
Bot Clip(ft):		Exit Loss Coef: 0.000
Main XSec: RED13	RED13	Outlet Ctrl Spec: Use dc or tw
AuxElev1(ft): 0.000	0.000	Inlet Ctrl Spec: Use dn
Aux XSec1:		Stabilizer Option: None
AuxElev2(ft): 0.000	0.000	
Aux XSec2:		
Top width(ft):		
Depth(ft):		
Bot width(ft):		
LtSdSlp(h/v):		
RtSdSlp(h/v):		

Name: RED13A From Node: NE13 Length(ft): 60.00
Group: PRE To Node: NED13 Count: 1

	UPSTREAM	DOWNSTREAM	Friction Equation: Average Conveyance
Geometry: Trapezoidal	Trapezoidal		Solution Algorithm: Automatic
Invert(ft): 30.600	30.000		Flow: Both
TClpInitZ(ft): 35.600	35.000		Contraction Coef: 0.000
Manning's N: 0.050000	0.050000		Expansion Coef: 0.000
Top Clip(ft): 0.000	0.000		Entrance Loss Coef: 0.000
Bot Clip(ft): 0.000	0.000		Exit Loss Coef: 0.000
Main XSec:			Outlet Ctrl Spec: Use dc or tw
AuxElev1(ft):			Inlet Ctrl Spec: Use dn
Aux XSec1:			Stabilizer Option: None
AuxElev2(ft):			
Aux XSec2:			
Top width(ft):			
Depth(ft):			
Bot width(ft): 18.000	18.000		
LtSdSlp(h/v): 2.50	2.50		
RtSdSlp(h/v): 2.50	2.50		

Name: RED14 From Node: NED14 Length(ft): 1700.00
Group: PRE To Node: NE13 Count: 1

	UPSTREAM	DOWNSTREAM	Friction Equation: Average Conveyance
Geometry: Irregular	Irregular		Solution Algorithm: Automatic
Invert(ft): 31.000	30.600		Flow: Both
TClpInitZ(ft): 37.000	36.600		Contraction Coef: 0.000
Manning's N:			Expansion Coef: 0.000
Top Clip(ft):			Entrance Loss Coef: 0.000
Bot Clip(ft):			Exit Loss Coef: 0.000
Main XSec: RED14	RED14		Outlet Ctrl Spec: Use dc or tw
AuxElev1(ft): 0.000	0.000		Inlet Ctrl Spec: Use dn
Aux XSec1:			Stabilizer Option: None
AuxElev2(ft): 0.000	0.000		
Aux XSec2:			
Top width(ft):			
Depth(ft):			

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Bot width(ft):
LtSdsSlp(h/v):
RtSdsSlp(h/v):

```

-----
Name: RED16          From Node: NED16          Length(ft): 500.00
Group: PRE           To Node: NED15             Count: 1

      UPSTREAM      DOWNSTREAM      Friction Equation: Average Conveyance
Geometry: Irregular Irregular      Solution Algorithm: Automatic
Invert(ft): 28.000  31.000          Flow: Both
TClpInitZ(ft): 35.000 38.000      Contraction Coef: 0.000
Manning's N:                               Expansion Coef: 0.000
Top Clip(ft):                               Entrance Loss Coef: 0.000
Bot Clip(ft):                               Exit Loss Coef: 0.000
Main XSec: RED16      RED16          Outlet Ctrl Spec: Use dc or tw
AuxElev1(ft): 0.000  0.000          Inlet Ctrl Spec: Use dn
Aux XSec1:                               Stabilizer Option: None
AuxElev2(ft): 0.000  0.000
Aux XSec2:
Top width(ft):
Depth(ft):
Bot width(ft):
LtSdsSlp(h/v):
RtSdsSlp(h/v):
  
```

```

-----
Name: RED2          From Node: NED2          Length(ft): 750.00
Group: PRE           To Node: NED1             Count: 1

      UPSTREAM      DOWNSTREAM      Friction Equation: Average Conveyance
Geometry: Irregular Irregular      Solution Algorithm: Automatic
Invert(ft): 24.500  25.000          Flow: Both
TClpInitZ(ft): 32.500 33.000      Contraction Coef: 0.000
Manning's N:                               Expansion Coef: 0.000
Top Clip(ft):                               Entrance Loss Coef: 0.000
Bot Clip(ft):                               Exit Loss Coef: 0.000
Main XSec: RED2      RED2          Outlet Ctrl Spec: Use dc or tw
AuxElev1(ft): 0.000  0.000          Inlet Ctrl Spec: Use dn
Aux XSec1:                               Stabilizer Option: None
AuxElev2(ft): 0.000  0.000
Aux XSec2:
Top width(ft):
Depth(ft):
Bot width(ft):
LtSdsSlp(h/v):
RtSdsSlp(h/v):
  
```

```

-----
Name: RED3          From Node: NED3          Length(ft): 700.00
Group: PRE           To Node: NED2             Count: 1

      UPSTREAM      DOWNSTREAM      Friction Equation: Average Conveyance
Geometry: Irregular Irregular      Solution Algorithm: Automatic
  
```

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Invert(ft):	26.000	24.500	Flow:	Both
TClpInitZ(ft):	34.000	32.500	Contraction Coef:	0.000
Manning's N:			Expansion Coef:	0.000
Top Clip(ft):			Entrance Loss Coef:	0.000
Bot Clip(ft):			Exit Loss Coef:	0.000
Main XSec:	RED3	RED3	Outlet Ctrl Spec:	Use dc or tw
AuxElev1(ft):	0.000	0.000	Inlet Ctrl Spec:	Use dn
Aux XSec1:			Stabilizer Option:	None
AuxElev2(ft):	0.000	0.000		
Aux XSec2:				
Top width(ft):				
Depth(ft):				
Bot width(ft):				
LtSdsSlp(h/v):				
RtSdsSlp(h/v):				

 Name: RED3A From Node: NE8 Length(ft): 50.00
 Group: PRE To Node: NED3 Count: 1

	UPSTREAM	DOWNSTREAM	Friction Equation:	Average Conveyance
Geometry:	Trapezoidal	Trapezoidal	Solution Algorithm:	Automatic
Invert(ft):	30.000	29.500	Flow:	Both
TClpInitZ(ft):	35.000	34.500	Contraction Coef:	0.000
Manning's N:	0.050000	0.050000	Expansion Coef:	0.000
Top Clip(ft):	0.000	0.000	Entrance Loss Coef:	0.000
Bot Clip(ft):	0.000	0.000	Exit Loss Coef:	0.000
Main XSec:			Outlet Ctrl Spec:	Use dc or tw
AuxElev1(ft):			Inlet Ctrl Spec:	Use dn
Aux XSec1:			Stabilizer Option:	None
AuxElev2(ft):				
Aux XSec2:				
Top width(ft):				
Depth(ft):				
Bot width(ft):	12.000	12.000		
LtSdsSlp(h/v):	1.50	1.50		
RtSdsSlp(h/v):	1.50	1.50		

 Name: RED4 From Node: NED4 Length(ft): 2400.00
 Group: PRE To Node: NED5 Count: 1

	UPSTREAM	DOWNSTREAM	Friction Equation:	Average Conveyance
Geometry:	Irregular	Irregular	Solution Algorithm:	Automatic
Invert(ft):	27.000	26.000	Flow:	Both
TClpInitZ(ft):	35.000	34.000	Contraction Coef:	0.000
Manning's N:			Expansion Coef:	0.000
Top Clip(ft):			Entrance Loss Coef:	0.000
Bot Clip(ft):			Exit Loss Coef:	0.000
Main XSec:	RED4	RED4	Outlet Ctrl Spec:	Use dc or tw
AuxElev1(ft):	0.000	0.000	Inlet Ctrl Spec:	Use dn
Aux XSec1:			Stabilizer Option:	None
AuxElev2(ft):	0.000	0.000		
Aux XSec2:				
Top width(ft):				
Depth(ft):				
Bot width(ft):				

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LtSdSlp(h/v):
RtSdSlp(h/v):

```

-----
Name: RED5                      From Node: NED5          Length(ft): 2000.00
Group: PRE                      To Node: NED6          Count: 1

      UPSTREAM      DOWNSTREAM
Geometry: Irregular  Irregular
Invert(ft): 26.000   25.500
TClpInitZ(ft): 34.000 33.500
Manning's N:
Top Clip(ft):
Bot Clip(ft):
Main XSec: RED5      RED5
AuxElev1(ft): 0.000   0.000
Aux XSec1:
AuxElev2(ft): 0.000   0.000
Aux XSec2:
Top width(ft):
Depth(ft):
Bot width(ft):
LtSdSlp(h/v):
RtSdSlp(h/v):

Friction Equation: Average Conveyance
Solution Algorithm: Automatic
Flow: Both
Contraction Coef: 0.000
Expansion Coef: 0.000
Entrance Loss Coef: 0.000
Exit Loss Coef: 0.000
Outlet Ctrl Spec: Use dc or tw
Inlet Ctrl Spec: Use dn
Stabilizer Option: None

```

```

-----
Name: RED5A                      From Node: NED5A        Length(ft): 450.00
Group: PRE                      To Node: NED5          Count: 1

      UPSTREAM      DOWNSTREAM
Geometry: Irregular  Irregular
Invert(ft): 27.000   26.000
TClpInitZ(ft): 35.000 34.000
Manning's N:
Top Clip(ft):
Bot Clip(ft):
Main XSec: RED5A      RED5A
AuxElev1(ft): 0.000   0.000
Aux XSec1:
AuxElev2(ft): 0.000   0.000
Aux XSec2:
Top width(ft):
Depth(ft):
Bot width(ft):
LtSdSlp(h/v):
RtSdSlp(h/v):

Friction Equation: Average Conveyance
Solution Algorithm: Automatic
Flow: Both
Contraction Coef: 0.000
Expansion Coef: 0.000
Entrance Loss Coef: 0.000
Exit Loss Coef: 0.000
Outlet Ctrl Spec: Use dc or tw
Inlet Ctrl Spec: Use dn
Stabilizer Option: None

```

```

-----
Name: RED5B                      From Node: NED5B        Length(ft): 350.00
Group: PRE                      To Node: NED5A          Count: 1

      UPSTREAM      DOWNSTREAM
Geometry: Irregular  Irregular
Invert(ft): 27.500   27.000

Friction Equation: Average Conveyance
Solution Algorithm: Automatic
Flow: Both

```

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TClpInitZ(ft):	35.500	35.000	Contraction Coef:	0.000
Manning's N:			Expansion Coef:	0.000
Top Clip(ft):			Entrance Loss Coef:	0.000
Bot Clip(ft):			Exit Loss Coef:	0.000
Main XSec:	RED5B	RED5B	Outlet Ctrl Spec:	Use dc or tw
AuxElev1(ft):	0.000	0.000	Inlet Ctrl Spec:	Use dn
Aux XSec1:			Stabilizer Option:	None
AuxElev2(ft):	0.000	0.000		
Aux XSec2:				
Top width(ft):				
Depth(ft):				
Bot width(ft):				
LtSdSlp(h/v):				
RtSdSlp(h/v):				

Name: RED5D From Node: NED5D Length(ft): 300.00
Group: PRE To Node: NED5C Count: 1

	UPSTREAM	DOWNSTREAM	Friction Equation:	Average Conveyance
Geometry:	Irregular	Irregular	Solution Algorithm:	Automatic
Invert(ft):	28.000	28.000	Flow:	Both
TClpInitZ(ft):	36.000	36.000	Contraction Coef:	0.000
Manning's N:			Expansion Coef:	0.000
Top Clip(ft):			Entrance Loss Coef:	0.000
Bot Clip(ft):			Exit Loss Coef:	0.000
Main XSec:	RED5D	RED5D	Outlet Ctrl Spec:	Use dc or tw
AuxElev1(ft):	0.000	0.000	Inlet Ctrl Spec:	Use dn
Aux XSec1:			Stabilizer Option:	None
AuxElev2(ft):	0.000	0.000		
Aux XSec2:				
Top width(ft):				
Depth(ft):				
Bot width(ft):				
LtSdSlp(h/v):				
RtSdSlp(h/v):				

Name: RED6 From Node: NED6 Length(ft): 400.00
Group: PRE To Node: NED7 Count: 1

	UPSTREAM	DOWNSTREAM	Friction Equation:	Average Conveyance
Geometry:	Irregular	Irregular	Solution Algorithm:	Automatic
Invert(ft):	25.500	25.500	Flow:	Both
TClpInitZ(ft):	33.500	33.500	Contraction Coef:	0.000
Manning's N:			Expansion Coef:	0.000
Top Clip(ft):			Entrance Loss Coef:	0.000
Bot Clip(ft):			Exit Loss Coef:	0.000
Main XSec:	RED6	RED6	Outlet Ctrl Spec:	Use dc or tw
AuxElev1(ft):	0.000	0.000	Inlet Ctrl Spec:	Use dn
Aux XSec1:			Stabilizer Option:	None
AuxElev2(ft):	0.000	0.000		
Aux XSec2:				
Top width(ft):				
Depth(ft):				
Bot width(ft):				
LtSdSlp(h/v):				

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RtSdSlp(h/v):

```

-----
Name: RED6A                      From Node: NED6A          Length(ft): 2300.00
Group: PRE                      To Node: NED6            Count: 1

      UPSTREAM      DOWNSTREAM      Friction Equation: Average Conveyance
Geometry: Irregular Irregular      Solution Algorithm: Automatic
Invert(ft): 29.500   26.000          Flow: Both
TClpInitZ(ft): 37.500 34.000      Contraction Coef: 0.000
Manning's N:                               Expansion Coef: 0.000
Top Clip(ft):                               Entrance Loss Coef: 0.000
Bot Clip(ft):                               Exit Loss Coef: 0.000
Main XSec: RED6A      RED6A      Outlet Ctrl Spec: Use dc or tw
AuxElev1(ft): 0.000   0.000      Inlet Ctrl Spec: Use dn
Aux XSec1:                               Stabilizer Option: None
AuxElev2(ft): 0.000   0.000
Aux XSec2:
Top Width(ft):
Depth(ft):
Bot Width(ft):
LtSdSlp(h/v):
RtSdSlp(h/v):

```

```

-----
Name: RED6B                      From Node: NED6C          Length(ft): 350.00
Group: PRE                      To Node: NED6B          Count: 1

      UPSTREAM      DOWNSTREAM      Friction Equation: Average Conveyance
Geometry: Irregular Irregular      Solution Algorithm: Automatic
Invert(ft): 29.500   29.500          Flow: Both
TClpInitZ(ft): 37.500 37.500      Contraction Coef: 0.000
Manning's N:                               Expansion Coef: 0.000
Top Clip(ft):                               Entrance Loss Coef: 0.000
Bot Clip(ft):                               Exit Loss Coef: 0.000
Main XSec: RED6B      RED6B      Outlet Ctrl Spec: Use dc or tw
AuxElev1(ft): 0.000   0.000      Inlet Ctrl Spec: Use dn
Aux XSec1:                               Stabilizer Option: None
AuxElev2(ft): 0.000   0.000
Aux XSec2:
Top Width(ft):
Depth(ft):
Bot Width(ft):
LtSdSlp(h/v):
RtSdSlp(h/v):

```

```

-----
Name: RED7                      From Node: NED7          Length(ft): 800.00
Group: PRE                      To Node: NED8          Count: 1

      UPSTREAM      DOWNSTREAM      Friction Equation: Average Conveyance
Geometry: Irregular Irregular      Solution Algorithm: Automatic
Invert(ft): 25.500   25.800          Flow: Both
TClpInitZ(ft): 33.500 33.800      Contraction Coef: 0.000

```

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Manning's N:			Expansion Coef: 0.000
Top Clip(ft):			Entrance Loss Coef: 0.000
Bot Clip(ft):			Exit Loss Coef: 0.000
Main XSec: RED7	RED7		Outlet Ctrl Spec: Use dc or tw
AuxElev1(ft): 0.000	0.000		Inlet Ctrl Spec: Use dn
Aux XSec1:			Stabilizer Option: None
AuxElev2(ft): 0.000	0.000		
Aux XSec2:			
Top width(ft):			
Depth(ft):			
Bot width(ft):			
LtSdSlp(h/v):			
RtSdSlp(h/v):			

Name: RED8	From Node: NED8	Length(ft): 1000.00
Group: PRE	To Node: NED3	Count: 1
UPSTREAM	DOWNSTREAM	Friction Equation: Average Conveyance
Geometry: Irregular	Irregular	Solution Algorithm: Automatic
Invert(ft): 25.800	26.000	Flow: Both
TClpInitZ(ft): 33.800	34.000	Contraction Coef: 0.000
Manning's N:		Expansion Coef: 0.000
Top Clip(ft):		Entrance Loss Coef: 0.000
Bot Clip(ft):		Exit Loss Coef: 0.000
Main XSec: RED8	RED8	Outlet Ctrl Spec: Use dc or tw
AuxElev1(ft): 0.000	0.000	Inlet Ctrl Spec: Use dn
Aux XSec1:		Stabilizer Option: None
AuxElev2(ft): 0.000	0.000	
Aux XSec2:		
Top width(ft):		
Depth(ft):		
Bot width(ft):		
LtSdSlp(h/v):		
RtSdSlp(h/v):		

Name: RED9	From Node: NED9	Length(ft): 500.00
Group: PRE	To Node: NED3	Count: 1
UPSTREAM	DOWNSTREAM	Friction Equation: Average Conveyance
Geometry: Irregular	Irregular	Solution Algorithm: Automatic
Invert(ft): 26.200	26.000	Flow: Both
TClpInitZ(ft): 34.200	34.000	Contraction Coef: 0.000
Manning's N:		Expansion Coef: 0.000
Top Clip(ft):		Entrance Loss Coef: 0.000
Bot Clip(ft):		Exit Loss Coef: 0.000
Main XSec: RED9	RED9	Outlet Ctrl Spec: Use dc or tw
AuxElev1(ft): 0.000	0.000	Inlet Ctrl Spec: Use dn
Aux XSec1:		Stabilizer Option: None
AuxElev2(ft): 0.000	0.000	
Aux XSec2:		
Top width(ft):		
Depth(ft):		
Bot width(ft):		
LtSdSlp(h/v):		
RtSdSlp(h/v):		

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```

-----
Name: RED9A                      From Node: NED9A                      Length(ft): 1100.00
Group: PRE                        To Node: NED9                      Count: 1

      UPSTREAM      DOWNSTREAM      Friction Equation: Average Conveyance
Geometry: Trapezoidal Trapezoidal Solution Algorithm: Automatic
Invert(ft): 24.000    26.000          Flow: Both
TClpInitZ(ft): 34.000 36.000          Contraction Coef: 0.000
Manning's N: 0.040000 0.040000      Expansion Coef: 0.000
Top Clip(ft): 0.000  0.000      Entrance Loss Coef: 0.000
Bot Clip(ft): 0.000  0.000      Exit Loss Coef: 0.000
Main XSec:                                Outlet Ctrl Spec: Use dc or tw
AuxElev1(ft):                                Inlet Ctrl Spec: Use dn
Aux XSec1:                                Stabilizer Option: None
AuxElev2(ft):
Aux XSec2:
Top width(ft):
Depth(ft):
Bot width(ft): 4.000    4.000
LtSdSlp(h/v): 1.00    1.00
RtSdSlp(h/v): 1.00    1.00

```

```

-----
Name: RED9B                      From Node: NED9C                      Length(ft): 400.00
Group: PRE                        To Node: NED9B                      Count: 1

      UPSTREAM      DOWNSTREAM      Friction Equation: Average Conveyance
Geometry: Trapezoidal Trapezoidal Solution Algorithm: Automatic
Invert(ft): 25.500    24.000          Flow: Both
TClpInitZ(ft): 35.500 34.000          Contraction Coef: 0.000
Manning's N: 0.040000 0.040000      Expansion Coef: 0.000
Top Clip(ft): 0.000  0.000      Entrance Loss Coef: 0.000
Bot Clip(ft): 0.000  0.000      Exit Loss Coef: 0.000
Main XSec:                                Outlet Ctrl Spec: Use dc or tw
AuxElev1(ft):                                Inlet Ctrl Spec: Use dn
Aux XSec1:                                Stabilizer Option: None
AuxElev2(ft):
Aux XSec2:
Top width(ft):
Depth(ft):
Bot width(ft): 4.000    4.000
LtSdSlp(h/v): 1.00    1.00
RtSdSlp(h/v): 1.00    1.00

```

```

-----
Name: REQUAL                      From Node: NN4B3                      Length(ft): 5000.00
Group: PRE                        To Node: NE14A                      Count: 1

      UPSTREAM      DOWNSTREAM      Friction Equation: Average Conveyance
Geometry: Irregular Irregular Solution Algorithm: Automatic
Invert(ft): 34.000    34.000          Flow: Both
TClpInitZ(ft): 41.000 41.000          Contraction Coef: 0.000
Manning's N:                                Expansion Coef: 0.000

```


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Top Clip(ft):		Entrance Loss Coef: 0.000
Bot Clip(ft):		Exit Loss Coef: 0.000
Main XSec: REQUAL	REQUAL	Outlet Ctrl Spec: Use dc or tw
AuxElev1(ft): 0.000	0.000	Inlet Ctrl Spec: Use dn
Aux XSec1:		Stabilizer Option: None
AuxElev2(ft): 0.000	0.000	
Aux XSec2:		
Top Width(ft):		
Depth(ft):		
Bot Width(ft):		
LtSdSlp(h/v):		
RtSdSlp(h/v):		

Name: RN1
Group: PRE

From Node: NN1
To Node: NBNDRY

Length(ft): 50.00
Count: 1

	UPSTREAM	DOWNSTREAM	Friction Equation: Average Conveyance
Geometry:	Trapezoidal	Trapezoidal	Solution Algorithm: Automatic
Invert(ft):	30.000	30.000	Flow: Both
TClpInitZ(ft):	33.000	33.000	Contraction Coef: 0.000
Manning's N:	0.090000	0.090000	Expansion Coef: 0.000
Top Clip(ft):	0.000	0.000	Entrance Loss Coef: 0.000
Bot Clip(ft):	0.000	0.000	Exit Loss Coef: 0.000
Main XSec:			Outlet Ctrl Spec: Use dc or tw
AuxElev1(ft):			Inlet Ctrl Spec: Use dn
Aux XSec1:			Stabilizer Option: None
AuxElev2(ft):			
Aux XSec2:			
Top Width(ft):			
Depth(ft):			
Bot width(ft):	20.000	20.000	
LtSdSlp(h/v):	10.00	10.00	
RtSdSlp(h/v):	10.00	10.00	

Name: RN1B1
Group: PRE

From Node: NN1B
To Node: NN1

Length(ft): 300.00
Count: 1

	UPSTREAM	DOWNSTREAM	Friction Equation: Average Conveyance
Geometry:	Irregular	Irregular	Solution Algorithm: Automatic
Invert(ft):	30.000	29.000	Flow: Both
TClpInitZ(ft):	34.000	33.000	Contraction Coef: 0.000
Manning's N:			Expansion Coef: 0.000
Top Clip(ft):			Entrance Loss Coef: 0.000
Bot Clip(ft):			Exit Loss Coef: 0.000
Main XSec: RN1B1	RN1B1		Outlet Ctrl Spec: Use dc or tw
AuxElev1(ft): 0.000	0.000		Inlet Ctrl Spec: Use dn
Aux XSec1:			Stabilizer Option: None
AuxElev2(ft): 0.000	0.000		
Aux XSec2:			
Top Width(ft):			
Depth(ft):			
Bot Width(ft):			
LtSdSlp(h/v):			
RtSdSlp(h/v):			

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```

-----
Name: RN1B2                      From Node: NN1B                      Length(ft): 500.00
Group: PRE                        To Node: NND1                      Count: 1

      UPSTREAM      DOWNSTREAM      Friction Equation: Average Conveyance
Geometry: Irregular Irregular      Solution Algorithm: Automatic
Invert(ft): 30.000  26.000          Flow: Both
TClpInitZ(ft): 35.000 31.000      Contraction Coef: 0.000
Manning's N:                               Expansion Coef: 0.000
Top Clip(ft):                               Entrance Loss Coef: 0.000
Bot Clip(ft):                               Exit Loss Coef: 0.000
Main XSec: RN1B2      RN1B2      Outlet Ctrl Spec: Use dc or tw
AuxElev1(ft): 0.000  0.000      Inlet Ctrl Spec: Use dn
Aux XSec1:                               Stabilizer Option: None
AuxElev2(ft): 0.000  0.000
Aux XSec2:
Top width(ft):
Depth(ft):
Bot width(ft):
LtSdsSlp(h/v):
RtSdsSlp(h/v):

```

```

-----
Name: RN2                      From Node: NN2                      Length(ft): 200.00
Group: PRE                        To Node: NND2                      Count: 1

      UPSTREAM      DOWNSTREAM      Friction Equation: Average Conveyance
Geometry: Trapezoidal Trapezoidal Solution Algorithm: Automatic
Invert(ft): 31.300  31.500          Flow: Both
TClpInitZ(ft): 34.300 34.500      Contraction Coef: 0.000
Manning's N: 0.090000 0.090000 Expansion Coef: 0.000
Top Clip(ft): 0.000  0.000      Entrance Loss Coef: 0.000
Bot Clip(ft): 0.000  0.000      Exit Loss Coef: 0.000
Main XSec:                               Outlet Ctrl Spec: Use dc or tw
AuxElev1(ft):                               Inlet Ctrl Spec: Use dn
Aux XSec1:                               Stabilizer Option: None
AuxElev2(ft):
Aux XSec2:
Top width(ft):
Depth(ft):
Bot width(ft): 20.000 20.000
LtSdsSlp(h/v): 10.00 10.00
RtSdsSlp(h/v): 10.00 10.00

```

```

-----
Name: RN3                      From Node: NN3                      Length(ft): 300.00
Group: PRE                        To Node: NND3                      Count: 1

      UPSTREAM      DOWNSTREAM      Friction Equation: Average Conveyance
Geometry: Trapezoidal Trapezoidal Solution Algorithm: Automatic
Invert(ft): 27.400  27.400          Flow: Both
TClpInitZ(ft): 32.400 32.400      Contraction Coef: 0.000
Manning's N: 0.040000 0.040000 Expansion Coef: 0.000
Top Clip(ft): 0.000  0.000      Entrance Loss Coef: 0.000

```

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Bot Clip(ft):	0.000	0.000	Exit Loss Coef:	0.000
Main XSec:			Outlet Ctrl Spec:	Use dc or tw
AuxElev1(ft):			Inlet Ctrl Spec:	Use dn
Aux XSec1:			Stabilizer Option:	None
AuxElev2(ft):				
Aux XSec2:				
Top width(ft):				
Depth(ft):				
Bot width(ft):	6.000	6.000		
LtSdSlp(h/v):	1.50	1.50		
RtSdSlp(h/v):	1.50	1.50		

Name: RN3AB
Group: PRE

From Node: NN3AB
To Node: NN3A

Length(ft): 1700.00
Count: 1

	UPSTREAM	DOWNSTREAM	Friction Equation:	Average Conveyance
Geometry:	Trapezoidal	Trapezoidal	Solution Algorithm:	Automatic
Invert(ft):	33.000	29.000	Flow:	Both
TClpInitZ(ft):	36.000	32.000	Contraction Coef:	0.000
Manning's N:	0.090000	0.090000	Expansion Coef:	0.000
Top Clip(ft):	0.000	0.000	Entrance Loss Coef:	0.000
Bot Clip(ft):	0.000	0.000	Exit Loss Coef:	0.000
Main XSec:			Outlet Ctrl Spec:	Use dc or tw
AuxElev1(ft):			Inlet Ctrl Spec:	Use dn
Aux XSec1:			Stabilizer Option:	None
AuxElev2(ft):				
Aux XSec2:				
Top width(ft):				
Depth(ft):				
Bot width(ft):	10.000	10.000		
LtSdSlp(h/v):	4.00	4.00		
RtSdSlp(h/v):	4.00	4.00		

Name: RN4
Group: PRE

From Node: NN4
To Node: NND4

Length(ft): 200.00
Count: 1

	UPSTREAM	DOWNSTREAM	Friction Equation:	Average Conveyance
Geometry:	Trapezoidal	Trapezoidal	Solution Algorithm:	Automatic
Invert(ft):	29.200	29.200	Flow:	Both
TClpInitZ(ft):	33.200	33.200	Contraction Coef:	0.000
Manning's N:	0.040000	0.040000	Expansion Coef:	0.000
Top Clip(ft):	0.000	0.000	Entrance Loss Coef:	0.000
Bot Clip(ft):	0.000	0.000	Exit Loss Coef:	0.000
Main XSec:			Outlet Ctrl Spec:	Use dc or tw
AuxElev1(ft):			Inlet Ctrl Spec:	Use dn
Aux XSec1:			Stabilizer Option:	None
AuxElev2(ft):				
Aux XSec2:				
Top width(ft):				
Depth(ft):				
Bot width(ft):	3.000	3.000		
LtSdSlp(h/v):	2.20	2.20		
RtSdSlp(h/v):	2.40	2.40		

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-----
Name: RN43                      From Node: NN4A                      Length(ft): 350.00
Group: PRE                      To Node: NN3A                      Count: 1

      UPSTREAM      DOWNSTREAM      Friction Equation: Average Conveyance
Geometry: Trapezoidal Trapezoidal Solution Algorithm: Automatic
Invert(ft): 27.500    27.500      Flow: Both
TClpInitZ(ft): 33.000 33.000      Contraction Coef: 0.000
Manning's N: 0.040000 0.040000 Expansion Coef: 0.000
Top Clip(ft): 0.000  0.000      Entrance Loss Coef: 0.000
Bot Clip(ft): 0.000  0.000      Exit Loss Coef: 0.000
Main XSec:                               Outlet Ctrl Spec: Use dc or tw
AuxElev1(ft):                               Inlet Ctrl Spec: Use dn
Aux XSec1:                               Stabilizer Option: None
AuxElev2(ft):
Aux XSec2:
Top width(ft):
Depth(ft):
Bot width(ft): 6.000    6.000
LtSdSlp(h/v): 1.10     1.10
RtSdSlp(h/v): 1.10     1.10

```

```

-----
Name: RN4AB                      From Node: NN4AB                      Length(ft): 800.00
Group: PRE                      To Node: NN4A                      Count: 1

      UPSTREAM      DOWNSTREAM      Friction Equation: Average Conveyance
Geometry: Trapezoidal Trapezoidal Solution Algorithm: Automatic
Invert(ft): 31.000    28.500      Flow: Both
TClpInitZ(ft): 37.000 34.500      Contraction Coef: 0.000
Manning's N: 0.040000 0.040000 Expansion Coef: 0.000
Top Clip(ft): 0.000  0.000      Entrance Loss Coef: 0.000
Bot Clip(ft): 0.000  0.000      Exit Loss Coef: 0.000
Main XSec:                               Outlet Ctrl Spec: Use dc or tw
AuxElev1(ft):                               Inlet Ctrl Spec: Use dn
Aux XSec1:                               Stabilizer Option: None
AuxElev2(ft):
Aux XSec2:
Top width(ft):
Depth(ft):
Bot width(ft): 5.000    5.000
LtSdSlp(h/v): 1.10     1.10
RtSdSlp(h/v): 1.40     1.40

```

```

-----
Name: RN4B21                      From Node: NN4B21                      Length(ft): 1800.00
Group: PRE                      To Node: NN4B1                      Count: 1

      UPSTREAM      DOWNSTREAM      Friction Equation: Average Conveyance
Geometry: Trapezoidal Trapezoidal Solution Algorithm: Automatic
Invert(ft): 35.000    32.000      Flow: Both
TClpInitZ(ft): 40.000 37.000      Contraction Coef: 0.000
Manning's N: 0.040000 0.040000 Expansion Coef: 0.000
Top Clip(ft): 0.000  0.000      Entrance Loss Coef: 0.000
Bot Clip(ft): 0.000  0.000      Exit Loss Coef: 0.000

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Main XSec:			Outlet Ctrl Spec: Use dc or tw
AuxElev1(ft):			Inlet Ctrl Spec: Use dn
Aux XSec1:			Stabilizer Option: None
AuxElev2(ft):			
Aux XSec2:			
Top width(ft):			
Depth(ft):			
Bot width(ft):	7.000	7.000	
LtSdSlp(h/v):	1.00	1.00	
RtSdSlp(h/v):	1.20	1.20	

Name: RN4B3		From Node: NN4B3	Length(ft): 2000.00
Group: PRE		To Node: NN4B21	Count: 1

UPSTREAM	DOWNSTREAM	Friction Equation: Average Conveyance
Geometry: Irregular	Irregular	Solution Algorithm: Automatic
Invert(ft): 33.700	33.100	Flow: Both
TClpInitZ(ft): 40.700	40.100	Contraction Coef: 0.000
Manning's N:		Expansion Coef: 0.000
Top Clip(ft):		Entrance Loss Coef: 0.000
Bot Clip(ft):		Exit Loss Coef: 0.000
Main XSec: RN4B3	RN4B3	Outlet Ctrl Spec: Use dc or tw
AuxElev1(ft): 0.000	0.000	Inlet Ctrl Spec: Use dn
Aux XSec1:		Stabilizer Option: None
AuxElev2(ft): 0.000	0.000	
Aux XSec2:		
Top width(ft):		
Depth(ft):		
Bot width(ft):		
LtSdSlp(h/v):		
RtSdSlp(h/v):		

Name: RN4B4		From Node: NN4B4	Length(ft): 2200.00
Group: PRE		To Node: NN4B3	Count: 1

UPSTREAM	DOWNSTREAM	Friction Equation: Average Conveyance
Geometry: Trapezoidal	Trapezoidal	Solution Algorithm: Automatic
Invert(ft): 48.000	38.000	Flow: Both
TClpInitZ(ft): 50.000	40.000	Contraction Coef: 0.000
Manning's N: 0.060000	0.060000	Expansion Coef: 0.000
Top Clip(ft): 0.000	0.000	Entrance Loss Coef: 0.000
Bot Clip(ft): 0.000	0.000	Exit Loss Coef: 0.000
Main XSec:		Outlet Ctrl Spec: Use dc or tw
AuxElev1(ft):		Inlet Ctrl Spec: Use dn
Aux XSec1:		Stabilizer Option: None
AuxElev2(ft):		
Aux XSec2:		
Top width(ft):		
Depth(ft):		
Bot width(ft): 20.000	20.000	
LtSdSlp(h/v): 15.00	15.00	
RtSdSlp(h/v): 15.00	15.00	

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```

-----
Name: RN4C                      From Node: NN4C                      Length(ft): 1000.00
Group: PRE                      To Node: NN4B4                      Count: 1

UPSTREAM                      DOWNSTREAM
Geometry: Irregular            Irregular
Invert(ft): 54.000             48.000
TClpInitZ(ft): 58.000          52.000
Manning's N:
Top Clip(ft):
Bot Clip(ft):
Main XSec: RN4C                RN4C
AuxElev1(ft): 0.000            0.000
Aux XSec1:
AuxElev2(ft): 0.000            0.000
Aux XSec2:
Top width(ft):
Depth(ft):
Bot width(ft):
LtSdsSlp(h/v):
RtSdsSlp(h/v):

Friction Equation: Average Conveyance
Solution Algorithm: Automatic
Flow: Both
Contraction Coef: 0.000
Expansion Coef: 0.000
Entrance Loss Coef: 0.000
Exit Loss Coef: 0.000
Outlet Ctrl Spec: Use dc or tw
Inlet Ctrl Spec: Use dn
Stabilizer Option: None

```

```

-----
Name: RND1                      From Node: NND1                      Length(ft): 1300.00
Group: PRE                      To Node: NBNDRY                      Count: 1

UPSTREAM                      DOWNSTREAM
Geometry: Irregular            Irregular
Invert(ft): 25.800             26.000
TClpInitZ(ft): 33.800          34.000
Manning's N:
Top Clip(ft):
Bot Clip(ft):
Main XSec: RND1                RND1
AuxElev1(ft): 0.000            0.000
Aux XSec1:
AuxElev2(ft): 0.000            0.000
Aux XSec2:
Top width(ft):
Depth(ft):
Bot width(ft):
LtSdsSlp(h/v):
RtSdsSlp(h/v):

Friction Equation: Average Conveyance
Solution Algorithm: Automatic
Flow: Both
Contraction Coef: 0.000
Expansion Coef: 0.000
Entrance Loss Coef: 0.000
Exit Loss Coef: 0.000
Outlet Ctrl Spec: Use dc or tw
Inlet Ctrl Spec: Use dn
Stabilizer Option: None

```

```

-----
Name: RND1B                    From Node: NND1B                    Length(ft): 200.00
Group: PRE                      To Node: NND1A                      Count: 1

UPSTREAM                      DOWNSTREAM
Geometry: Trapezoidal          Trapezoidal
Invert(ft): 29.200             28.000
TClpInitZ(ft): 31.400          31.400
Manning's N: 0.040000          0.040000
Top Clip(ft): 0.000            0.000
Bot Clip(ft): 0.000            0.000
Main XSec:
Friction Equation: Average Conveyance
Solution Algorithm: Automatic
Flow: Both
Contraction Coef: 0.000
Expansion Coef: 0.000
Entrance Loss Coef: 0.000
Exit Loss Coef: 0.000
Outlet Ctrl Spec: Use dc or tw

```

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AuxElev1(ft):
Aux XSec1:
AuxElev2(ft):
Aux XSec2:
Top width(ft):
Depth(ft):
Bot width(ft): 3.000 3.000
LtSdsIp(h/v): 3.00 3.00
RtSdsIp(h/v): 3.00 3.00

Inlet Ctrl Spec: Use dn
Stabilizer Option: None

Name: RND2 From Node: NND2 Length(ft): 1050.00
Group: PRE To Node: NND1A Count: 1

	UPSTREAM	DOWNSTREAM	
Geometry:	Irregular	Irregular	Friction Equation: Average Conveyance
Invert(ft):	25.800	25.800	Solution Algorithm: Automatic
TCIpInitZ(ft):	33.800	33.800	Flow: Both
Manning's N:			Contraction Coef: 0.000
Top Clip(ft):			Expansion Coef: 0.000
Bot Clip(ft):			Entrance Loss Coef: 0.000
Main XSec:	RND2	RND2	Exit Loss Coef: 0.000
AuxElev1(ft):	0.000	0.000	Outlet Ctrl Spec: Use dc or tw
Aux XSec1:			Inlet Ctrl Spec: Use dn
AuxElev2(ft):	0.000	0.000	Stabilizer Option: None
Aux XSec2:			
Top width(ft):			
Depth(ft):			
Bot width(ft):			
LtSdsIp(h/v):			
RtSdsIp(h/v):			

Name: RND2A From Node: NND1A Length(ft): 600.00
Group: PRE To Node: NND1 Count: 1

	UPSTREAM	DOWNSTREAM	
Geometry:	Irregular	Irregular	Friction Equation: Average Conveyance
Invert(ft):	25.800	25.800	Solution Algorithm: Automatic
TCIpInitZ(ft):	33.800	33.800	Flow: Both
Manning's N:			Contraction Coef: 0.000
Top Clip(ft):			Expansion Coef: 0.000
Bot Clip(ft):			Entrance Loss Coef: 0.000
Main XSec:	RND2	RND2	Exit Loss Coef: 0.000
AuxElev1(ft):	0.000	0.000	Outlet Ctrl Spec: Use dc or tw
Aux XSec1:			Inlet Ctrl Spec: Use dn
AuxElev2(ft):	0.000	0.000	Stabilizer Option: None
Aux XSec2:			
Top width(ft):			
Depth(ft):			
Bot width(ft):			
LtSdsIp(h/v):			
RtSdsIp(h/v):			

ICPR Existing - All Basins.TXT

```

-----
Name: RND3                      From Node: NND3                      Length(ft): 900.00
Group: PRE                      To Node: NND2                      Count: 1

      UPSTREAM      DOWNSTREAM
Geometry: Irregular  Irregular
Invert(ft): 25.800   25.800
TClpInitZ(ft): 33.800 33.800
Manning's N:
Top Clip(ft):
Bot Clip(ft):
Main XSec: RND3      RND3
AuxElev1(ft): 0.000  0.000
Aux XSec1:
AuxElev2(ft): 0.000  0.000
Aux XSec2:
Top width(ft):
Depth(ft):
Bot width(ft):
LtSdSlp(h/v):
RtSdSlp(h/v):

Friction Equation: Average Conveyance
Solution Algorithm: Automatic
Flow: Both
Contraction Coef: 0.000
Expansion Coef: 0.000
Entrance Loss Coef: 0.000
Exit Loss Coef: 0.000
Outlet Ctrl Spec: Use dc or tw
Inlet Ctrl Spec: Use dn
Stabilizer Option: None

```

```

-----
Name: RND4                      From Node: NND4                      Length(ft): 500.00
Group: PRE                      To Node: NND3                      Count: 1

      UPSTREAM      DOWNSTREAM
Geometry: Irregular  Irregular
Invert(ft): 25.800   25.800
TClpInitZ(ft): 33.800 33.800
Manning's N:
Top Clip(ft):
Bot Clip(ft):
Main XSec: RND4      RND4
AuxElev1(ft): 0.000  0.000
Aux XSec1:
AuxElev2(ft): 0.000  0.000
Aux XSec2:
Top width(ft):
Depth(ft):
Bot width(ft):
LtSdSlp(h/v):
RtSdSlp(h/v):

Friction Equation: Average Conveyance
Solution Algorithm: Automatic
Flow: Both
Contraction Coef: 0.000
Expansion Coef: 0.000
Entrance Loss Coef: 0.000
Exit Loss Coef: 0.000
Outlet Ctrl Spec: Use dc or tw
Inlet Ctrl Spec: Use dn
Stabilizer Option: None

```

```

-----
Name: RND5                      From Node: NND5                      Length(ft): 1000.00
Group: PRE                      To Node: NND4                      Count: 1

      UPSTREAM      DOWNSTREAM
Geometry: Irregular  Irregular
Invert(ft): 27.000   25.800
TClpInitZ(ft): 35.000 33.800
Manning's N:
Top Clip(ft):
Bot Clip(ft):
Main XSec: RND5      RND5
AuxElev1(ft): 0.000  0.000

Friction Equation: Average Conveyance
Solution Algorithm: Automatic
Flow: Both
Contraction Coef: 0.000
Expansion Coef: 0.000
Entrance Loss Coef: 0.000
Exit Loss Coef: 0.000
Outlet Ctrl Spec: Use dc or tw
Inlet Ctrl Spec: Use dn

```


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Aux XSec1: Stabilizer Option: None
AuxElev2(ft): 0.000 0.000
Aux XSec2:
Top width(ft):
Depth(ft):
Bot width(ft):
LtSdsIp(h/v):
RtSdsIp(h/v):

Name: RNN1AA2 From Node: NN1AA Length(ft): 100.00
Group: PRE To Node: NBNDRY Count: 1

	UPSTREAM	DOWNSTREAM	
Geometry:	Trapezoidal	Trapezoidal	Friction Equation: Average Conveyance
Invert(ft):	30.000	30.000	Solution Algorithm: Automatic
TClpInitZ(ft):	33.000	33.000	Flow: Both
Manning's N:	0.090000	0.090000	Contraction Coef: 0.000
Top Clip(ft):	0.000	0.000	Expansion Coef: 0.000
Bot Clip(ft):	0.000	0.000	Entrance Loss Coef: 0.000
Main XSec:			Exit Loss Coef: 0.000
AuxElev1(ft):			Outlet Ctrl Spec: Use dc or tw
Aux XSec1:			Inlet Ctrl Spec: Use dn
AuxElev2(ft):			Stabilizer Option: None
Aux XSec2:			
Top width(ft):			
Depth(ft):			
Bot width(ft):	20.000	20.000	
LtSdsIp(h/v):	10.00	10.00	
RtSdsIp(h/v):	10.00	10.00	

Name: RNN1B From Node: NN1AA Length(ft): 500.00
Group: PRE To Node: NN1A Count: 1

	UPSTREAM	DOWNSTREAM	
Geometry:	Trapezoidal	Trapezoidal	Friction Equation: Average Conveyance
Invert(ft):	30.000	30.000	Solution Algorithm: Automatic
TClpInitZ(ft):	34.000	34.000	Flow: Both
Manning's N:	0.400000	0.400000	Contraction Coef: 0.000
Top Clip(ft):	0.000	0.000	Expansion Coef: 0.000
Bot Clip(ft):	0.000	0.000	Entrance Loss Coef: 0.000
Main XSec:			Exit Loss Coef: 0.000
AuxElev1(ft):			Outlet Ctrl Spec: Use dc or tw
Aux XSec1:			Inlet Ctrl Spec: Use dn
AuxElev2(ft):			Stabilizer Option: None
Aux XSec2:			
Top width(ft):			
Depth(ft):			
Bot width(ft):	20.000	20.000	
LtSdsIp(h/v):	20.00	20.00	
RtSdsIp(h/v):	20.00	20.00	

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Name: RS1A From Node: NS1A Length(ft): 50.00
Group: PRE To Node: NSD1A Count: 1

	UPSTREAM	DOWNSTREAM	Friction Equation: Average Conveyance
Geometry:	Irregular	Irregular	Solution Algorithm: Automatic
Invert(ft):	32.600	32.600	Flow: Both
TCIPIInitZ(ft):	37.600	37.600	Contraction Coef: 0.000
Manning's N:			Expansion Coef: 0.000
Top Clip(ft):			Entrance Loss Coef: 0.000
Bot Clip(ft):			Exit Loss Coef: 0.000
Main XSec:	RS1A	RS1A	Outlet Ctrl Spec: Use dc or tw
AuxElev1(ft):	0.000	0.000	Inlet Ctrl Spec: Use dn
Aux XSec1:			Stabilizer Option: None
AuxElev2(ft):	0.000	0.000	
Aux XSec2:			
Top width(ft):			
Depth(ft):			
Bot width(ft):			
LtSdSlp(h/v):			
RtSdSlp(h/v):			

Name: RS1A1 From Node: NS1A Length(ft): 400.00
Group: PRE To Node: NSD2 Count: 1

	UPSTREAM	DOWNSTREAM	Friction Equation: Average Conveyance
Geometry:	Irregular	Irregular	Solution Algorithm: Automatic
Invert(ft):	30.000	28.500	Flow: Both
TCIPIInitZ(ft):	36.000	34.500	Contraction Coef: 0.000
Manning's N:			Expansion Coef: 0.000
Top Clip(ft):			Entrance Loss Coef: 0.000
Bot Clip(ft):			Exit Loss Coef: 0.000
Main XSec:	RS1A1	RS1A1	Outlet Ctrl Spec: Use dc or tw
AuxElev1(ft):	0.000	0.000	Inlet Ctrl Spec: Use dn
Aux XSec1:			Stabilizer Option: None
AuxElev2(ft):	0.000	0.000	
Aux XSec2:			
Top width(ft):			
Depth(ft):			
Bot width(ft):			
LtSdSlp(h/v):			
RtSdSlp(h/v):			

Name: RS1A2 From Node: NS1A2 Length(ft): 1800.00
Group: PRE To Node: NS1A Count: 1

	UPSTREAM	DOWNSTREAM	Friction Equation: Average Conveyance
Geometry:	Irregular	Irregular	Solution Algorithm: Automatic
Invert(ft):	30.900	30.900	Flow: Both
TCIPIInitZ(ft):	35.900	35.900	Contraction Coef: 0.000
Manning's N:			Expansion Coef: 0.000
Top Clip(ft):			Entrance Loss Coef: 0.000
Bot Clip(ft):			Exit Loss Coef: 0.000
Main XSec:	RS1A2	RS1A2	Outlet Ctrl Spec: Use dc or tw
AuxElev1(ft):	0.000	0.000	Inlet Ctrl Spec: Use dn
Aux XSec1:			Stabilizer Option: None

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0.000

AuxElev2(ft): 0.000
Aux XSec2:
Top width(ft):
Depth(ft):
Bot width(ft):
LtSdSlp(h/v):
RtSdSlp(h/v):

Name: RS1B
Group: PRE

From Node: NS1B
To Node: NS1A2

Length(ft): 50.00
Count: 1

	UPSTREAM	DOWNSTREAM	
Geometry:	Irregular	Irregular	Friction Equation: Average Conveyance
Invert(ft):	33.000	33.000	Solution Algorithm: Automatic
TClpInitZ(ft):	37.000	37.000	Flow: Both
Manning's N:			Contraction Coef: 0.000
Top Clip(ft):			Expansion Coef: 0.000
Bot Clip(ft):			Entrance Loss Coef: 0.000
Main XSec:	RS1B	RS1B	Exit Loss Coef: 0.000
AuxElev1(ft):	0.000	0.000	Outlet Ctrl Spec: Use dc or tw
Aux XSec1:			Inlet Ctrl Spec: Use dn
AuxElev2(ft):	0.000	0.000	Stabilizer Option: None
Aux XSec2:			
Top width(ft):			
Depth(ft):			
Bot width(ft):			
LtSdSlp(h/v):			
RtSdSlp(h/v):			

Name: RSD1
Group: PRE

From Node: NSD2
To Node: NSD1

Length(ft): 700.00
Count: 1

	UPSTREAM	DOWNSTREAM	
Geometry:	Irregular	Irregular	Friction Equation: Average Conveyance
Invert(ft):	28.500	28.000	Solution Algorithm: Automatic
TClpInitZ(ft):	34.500	34.000	Flow: Both
Manning's N:			Contraction Coef: 0.000
Top Clip(ft):			Expansion Coef: 0.000
Bot Clip(ft):			Entrance Loss Coef: 0.000
Main XSec:	RSD1	RSD1	Exit Loss Coef: 0.000
AuxElev1(ft):	0.000	0.000	Outlet Ctrl Spec: Use dc or tw
Aux XSec1:			Inlet Ctrl Spec: Use dn
AuxElev2(ft):	0.000	0.000	Stabilizer Option: None
Aux XSec2:			
Top width(ft):			
Depth(ft):			
Bot width(ft):			
LtSdSlp(h/v):			
RtSdSlp(h/v):			

Name: RSD1A

From Node: NSD1A
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Length(ft): 400.00

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To Node: NSD1

Group: PRE

Count: 1

	UPSTREAM	DOWNSTREAM	
Geometry:	Trapezoidal	Trapezoidal	Friction Equation: Average Conveyance
Invert(ft):	32.600	31.600	Solution Algorithm: Automatic
TClpInitZ(ft):	34.600	33.600	Flow: Both
Manning's N:	0.300000	0.300000	Contraction Coef: 0.000
Top Clip(ft):	0.000	0.000	Expansion Coef: 0.000
Bot Clip(ft):	0.000	0.000	Entrance Loss Coef: 0.000
Main XSec:			Exit Loss Coef: 0.000
AuxElev1(ft):			Outlet Ctrl Spec: Use dc or tw
Aux XSec1:			Inlet Ctrl Spec: Use dn
AuxElev2(ft):			Stabilizer Option: None
Aux XSec2:			
Top width(ft):			
Depth(ft):			
Bot width(ft):	150.000	150.000	
LtSdsSlp(h/v):	20.00	20.00	
RtSdsSlp(h/v):	20.00	20.00	

Name: RSD2
Group: PRE

From Node: NS1
To Node: NSD2

Length(ft): 400.00
Count: 1

	UPSTREAM	DOWNSTREAM	
Geometry:	Irregular	Irregular	Friction Equation: Average Conveyance
Invert(ft):	29.000	28.500	Solution Algorithm: Automatic
TClpInitZ(ft):	35.000	34.500	Flow: Both
Manning's N:			Contraction Coef: 0.000
Top Clip(ft):			Expansion Coef: 0.000
Bot Clip(ft):			Entrance Loss Coef: 0.000
Main XSec:	RSD2	RSD2	Exit Loss Coef: 0.000
AuxElev1(ft):	0.000	0.000	Outlet Ctrl Spec: Use dc or tw
Aux XSec1:			Inlet Ctrl Spec: Use dn
AuxElev2(ft):	0.000	0.000	Stabilizer Option: None
Aux XSec2:			
Top width(ft):			
Depth(ft):			
Bot width(ft):			
LtSdsSlp(h/v):			
RtSdsSlp(h/v):			

Name: RW1
Group: PRE

From Node: NW1
To Node: NWBNDRY

Length(ft): 200.00
Count: 1

	UPSTREAM	DOWNSTREAM	
Geometry:	Trapezoidal	Trapezoidal	Friction Equation: Average Conveyance
Invert(ft):	55.500	56.000	Solution Algorithm: Automatic
TClpInitZ(ft):	57.500	58.000	Flow: Both
Manning's N:	0.300000	0.300000	Contraction Coef: 0.000
Top Clip(ft):	0.000	0.000	Expansion Coef: 0.000
Bot Clip(ft):	0.000	0.000	Entrance Loss Coef: 0.000
Main XSec:			Exit Loss Coef: 0.000
AuxElev1(ft):			Outlet Ctrl Spec: Use dc or tw
Aux XSec1:			Inlet Ctrl Spec: Use dn
AuxElev2(ft):			Stabilizer Option: None

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Aux XSec2:
Top Width(ft):
Depth(ft):
Bot Width(ft): 500.000 500.000
LtsdSlp(h/v): 20.00 20.00
RtsdSlp(h/v): 20.00 20.00

===== Weirs =====

Name: RE1 From Node: NE1A
Group: PRE To Node: NED1
Flow: Both Count: 1
Type: Vertical: Fread Geometry: Irregular

XSec: RE1
Invert(ft): 26.480
Control Elevation(ft): 26.480
Struct Opening Dim(ft): 999.00

TABLE

Bottom Clip(ft): 0.000
Top Clip(ft): 0.000
Weir Discharge Coef: 2.800
Orifice Discharge Coef: 0.600

EAST OUTFALL DITCH NORTH BANK WEIR

Name: RE1B From Node: NE1
Group: PRE To Node: NEBNDRY
Flow: Both Count: 1
Type: Vertical: Fread Geometry: Irregular

XSec: RE1B
Invert(ft): 31.200
Control Elevation(ft): 31.200
Struct Opening Dim(ft): 999.00

TABLE

Bottom Clip(ft): 0.000
Top Clip(ft): 0.000
Weir Discharge Coef: 2.800
Orifice Discharge Coef: 0.600

POWER LINE MAINTENANCE ROAD

Name: RND6 From Node: NED4
Group: PRE To Node: NND5
Flow: Both Count: 1
Type: Vertical: Fread Geometry: Irregular

XSec: RND6
Invert(ft): 28.300
Control Elevation(ft): 28.300
Struct Opening Dim(ft): 999.00

TABLE

Bottom Clip(ft): 0.000
Top Clip(ft): 0.000

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Weir Discharge Coef: 2.800
Orifice Discharge Coef: 0.600

DITCH CROSSING

Name: WRC10 From Node: NN3B
Group: PRE To Node: NN3AB
Flow: Both Count: 1
Type: Vertical: Fread Geometry: Rectangular

Span(in): 600.00
Rise(in): 11988.00
Invert(ft): 39.000
Control Elevation(ft): 39.000

TABLE

Bottom Clip(in): 0.000
Top Clip(in): 0.000
Weir Discharge Coef: 2.800
Orifice Discharge Coef: 0.600

Name: WRC11 From Node: NN3B
Group: PRE To Node: NN3AB
Flow: Both Count: 1
Type: Vertical: Fread Geometry: Rectangular

Span(in): 420.00
Rise(in): 11988.00
Invert(ft): 39.000
Control Elevation(ft): 39.000

TABLE

Bottom Clip(in): 0.000
Top Clip(in): 0.000
Weir Discharge Coef: 2.800
Orifice Discharge Coef: 0.600

Name: WRC12 From Node: NN3B
Group: PRE To Node: NN3AB
Flow: Both Count: 1
Type: Vertical: Fread Geometry: Rectangular

Span(in): 600.00
Rise(in): 11988.00
Invert(ft): 39.000
Control Elevation(ft): 39.000

TABLE

Bottom Clip(in): 0.000
Top Clip(in): 0.000
Weir Discharge Coef: 2.800
Orifice Discharge Coef: 0.600

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Name: WRC15 From Node: NED5C
Group: PRE To Node: NED5B
Flow: Both Count: 1
Type: Vertical: Fread Geometry: Rectangular

Span(in): 264.00
Rise(in): 11988.00
Invert(ft): 34.500
Control Elevation(ft): 34.500

TABLE

Bottom Clip(in): 0.000
Top Clip(in): 0.000
Weir Discharge Coef: 2.800
Orifice Discharge Coef: 0.600

Name: WRC18 From Node: NED6B
Group: PRE To Node: NED6A
Flow: Both Count: 1
Type: Vertical: Fread Geometry: Rectangular

Span(in): 264.00
Rise(in): 11988.00
Invert(ft): 34.500
Control Elevation(ft): 34.500

TABLE

Bottom Clip(in): 0.000
Top Clip(in): 0.000
Weir Discharge Coef: 2.800
Orifice Discharge Coef: 0.600

Name: WRC1A From Node: NN1A
Group: PRE To Node: NN1B
Flow: Both Count: 1
Type: Vertical: Gravel Geometry: Parabolic

Top Width(ft): 300.00
Corres Depth(ft): 0.30
Invert(ft): 31.700
Control Elevation(ft): 31.700
Struct Opening Dim(ft): 11988.00

TABLE

Bottom Clip(ft): 0.000
Top Clip(ft): 0.000
Weir Discharge Coef: 2.800
Orifice Discharge Coef: 0.600

Name: WRC1C From Node: NN1A
Group: PRE To Node: NND1B
Flow: Both Count: 1
Type: Vertical: Gravel Geometry: Parabolic

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Top Width(ft): 400.00
Corres Depth(ft): 0.20
Invert(ft): 32.200
Control Elevation(ft): 32.200
Struct Opening Dim(ft): 11988.00

TABLE

Bottom Clip(ft): 0.000
Top Clip(ft): 0.000
Weir Discharge Coef: 2.800
Orifice Discharge Coef: 0.600

Name: WRC21 From Node: NED9B
Group: PRE To Node: NED9A
Flow: Both Count: 1
Type: Vertical: Fread Geometry: Rectangular

Span(in): 264.00
Rise(in): 11988.00
Invert(ft): 35.500
Control Elevation(ft): 35.500

TABLE

Bottom Clip(in): 0.000
Top Clip(in): 0.000
Weir Discharge Coef: 2.800
Orifice Discharge Coef: 0.600

Name: WRC25 From Node: NED15
Group: PRE To Node: NED14
Flow: Both Count: 1
Type: Vertical: Fread Geometry: Rectangular

Span(in): 264.00
Rise(in): 11988.00
Invert(ft): 36.000
Control Elevation(ft): 36.000

TABLE

Bottom Clip(in): 0.000
Top Clip(in): 0.000
Weir Discharge Coef: 2.800
Orifice Discharge Coef: 0.600

Name: WRC26 From Node: NSD1
Group: PRE To Node: NSBNDRY
Flow: Both Count: 1
Type: Vertical: Fread Geometry: Rectangular

Span(in): 600.00
Rise(in): 11988.00
Invert(ft): 34.500
Control Elevation(ft): 34.500

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TABLE

Bottom Clip(in): 0.000
Top Clip(in): 0.000
Weir Discharge Coef: 2.800
Orifice Discharge Coef: 0.600

Name: WRC27 From Node: NED1
Group: PRE To Node: NEBNDRY
Flow: Both Count: 1
Type: Vertical: Fread Geometry: Rectangular

Span(in): 300.00
Rise(in): 11988.00
Invert(ft): 32.000
Control Elevation(ft): 32.000

TABLE

Bottom Clip(in): 0.000
Top Clip(in): 0.000
Weir Discharge Coef: 2.800
Orifice Discharge Coef: 0.600

Name: WRC28 From Node: NM1
Group: PRE To Node: NMBNDRY
Flow: Both Count: 1
Type: Vertical: Fread Geometry: Rectangular

Span(in): 300.00
Rise(in): 11988.00
Invert(ft): 32.000
Control Elevation(ft): 32.000

TABLE

Bottom Clip(in): 0.000
Top Clip(in): 0.000
Weir Discharge Coef: 2.800
Orifice Discharge Coef: 0.600

Name: WRC29 From Node: NM1
Group: PRE To Node: NMBNDRY
Flow: Both Count: 1
Type: Vertical: Fread Geometry: Rectangular

Span(in): 300.00
Rise(in): 11988.00
Invert(ft): 32.000
Control Elevation(ft): 32.000

TABLE

Bottom Clip(in): 0.000
Top Clip(in): 0.000
Weir Discharge Coef: 2.800
Orifice Discharge Coef: 0.600

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Name: WRC2A From Node: NN2A
Group: PRE To Node: NN2
Flow: Both Count: 1
Type: Vertical: Gravel Geometry: Parabolic

Top width(ft): 300.00
Corres Depth(ft): 0.20
Invert(ft): 32.300
Control Elevation(ft): 32.300
Struct Opening Dim(ft): 11988.00

TABLE

Bottom Clip(ft): 0.000
Top Clip(ft): 0.000
Weir Discharge Coef: 2.800
Orifice Discharge Coef: 0.600

Name: WRC32 From Node: NM2
Group: PRE To Node: NMBNDRY
Flow: Both Count: 1
Type: Vertical: Fread Geometry: Rectangular

Span(in): 300.00
Rise(in): 11988.00
Invert(ft): 33.200
Control Elevation(ft): 33.200

TABLE

Bottom Clip(in): 0.000
Top Clip(in): 0.000
Weir Discharge Coef: 2.800
Orifice Discharge Coef: 0.600

Name: WRC33 From Node: NM2
Group: PRE To Node: NMBNDRY
Flow: Both Count: 1
Type: Vertical: Fread Geometry: Rectangular

Span(in): 300.00
Rise(in): 11988.00
Invert(ft): 32.200
Control Elevation(ft): 32.200

TABLE

Bottom Clip(in): 0.000
Top Clip(in): 0.000
Weir Discharge Coef: 2.800
Orifice Discharge Coef: 0.600

Name: WRC34 From Node: NM2
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Group: PRE To Node: NMBNDRY
Flow: Both Count: 1
Type: Vertical: Fread Geometry: Rectangular

Span(in): 300.00
Rise(in): 11988.00
Invert(ft): 32.700
Control Elevation(ft): 32.700

TABLE

Bottom Clip(in): 0.000
Top Clip(in): 0.000
Weir Discharge Coef: 2.800
Orifice Discharge Coef: 0.600

Name: WRC35 From Node: NM2
Group: PRE To Node: NMBNDRY
Flow: Both Count: 1
Type: Vertical: Fread Geometry: Rectangular

Span(in): 300.00
Rise(in): 11988.00
Invert(ft): 32.700
Control Elevation(ft): 32.700

TABLE

Bottom Clip(in): 0.000
Top Clip(in): 0.000
Weir Discharge Coef: 2.800
Orifice Discharge Coef: 0.600

Name: WRC36 From Node: NM2
Group: PRE To Node: NMBNDRY
Flow: Both Count: 1
Type: Vertical: Fread Geometry: Rectangular

Span(in): 300.00
Rise(in): 11988.00
Invert(ft): 32.700
Control Elevation(ft): 32.700

TABLE

Bottom Clip(in): 0.000
Top Clip(in): 0.000
Weir Discharge Coef: 2.800
Orifice Discharge Coef: 0.600

Name: WRC37 From Node: NM2
Group: PRE To Node: NMBNDRY
Flow: Both Count: 1
Type: Vertical: Fread Geometry: Rectangular

Span(in): 300.00
Rise(in): 11988.00

ICPR Existing - All Basins.TXT

Invert(ft): 32.600
Control Elevation(ft): 32.600

TABLE

Bottom Clip(in): 0.000
Top Clip(in): 0.000
Weir Discharge Coef: 2.800
Orifice Discharge Coef: 0.600

Name: WRC38 From Node: NM2
Group: PRE To Node: NMBNDRY
Flow: Both Count: 1
Type: Vertical: Fread Geometry: Rectangular

Span(in): 300.00
Rise(in): 11988.00
Invert(ft): 32.700
Control Elevation(ft): 32.700

TABLE

Bottom Clip(in): 0.000
Top Clip(in): 0.000
Weir Discharge Coef: 2.800
Orifice Discharge Coef: 0.600

Name: WRC39 From Node: NM2
Group: PRE To Node: NMBNDRY
Flow: Both Count: 1
Type: Vertical: Fread Geometry: Rectangular

Span(in): 300.00
Rise(in): 11988.00
Invert(ft): 33.700
Control Elevation(ft): 33.700

TABLE

Bottom Clip(in): 0.000
Top Clip(in): 0.000
Weir Discharge Coef: 2.800
Orifice Discharge Coef: 0.600

Name: WRC3A From Node: NN3A
Group: PRE To Node: NN3
Flow: Both Count: 1
Type: Vertical: Gravel Geometry: Rectangular

Span(in): 100.00
Rise(in): 11988.00
Invert(ft): 32.300
Control Elevation(ft): 32.300

TABLE

Bottom Clip(in): 0.000
Top Clip(in): 0.000
Weir Discharge Coef: 2.800

ICPR Existing - All Basins.TXT
Orifice Discharge Coef: 0.600

Name: WRC40 From Node: NM2
Group: PRE To Node: NMBNDRY
Flow: Both Count: 1
Type: Vertical: Fread Geometry: Rectangular

Span(in): 300.00
Rise(in): 11988.00
Invert(ft): 33.800
Control Elevation(ft): 33.800

TABLE

Bottom Clip(in): 0.000
Top Clip(in): 0.000
Weir Discharge Coef: 2.800
Orifice Discharge Coef: 0.600

Name: WRC41 From Node: NM2
Group: PRE To Node: NMBNDRY
Flow: Both Count: 1
Type: Vertical: Fread Geometry: Rectangular

Span(in): 300.00
Rise(in): 11988.00
Invert(ft): 33.000
Control Elevation(ft): 33.000

TABLE

Bottom Clip(in): 0.000
Top Clip(in): 0.000
Weir Discharge Coef: 2.800
Orifice Discharge Coef: 0.600

Name: WRC42 From Node: NM2
Group: PRE To Node: NMBNDRY
Flow: Both Count: 1
Type: Vertical: Fread Geometry: Rectangular

Span(in): 300.00
Rise(in): 11988.00
Invert(ft): 33.000
Control Elevation(ft): 33.000

TABLE

Bottom Clip(in): 0.000
Top Clip(in): 0.000
Weir Discharge Coef: 2.800
Orifice Discharge Coef: 0.600

ICPR Existing - All Basins.TXT

Name: WRC43 From Node: NM2
Group: PRE To Node: NMBNDRY
Flow: Both Count: 1
Type: Vertical: Fread Geometry: Rectangular

Span(in): 300.00
Rise(in): 11988.00
Invert(ft): 32.700
Control Elevation(ft): 32.700

TABLE

Bottom Clip(in): 0.000
Top Clip(in): 0.000
Weir Discharge Coef: 2.800
Orifice Discharge Coef: 0.600

Name: WRC44 From Node: NM2
Group: PRE To Node: NMBNDRY
Flow: Both Count: 1
Type: Vertical: Fread Geometry: Rectangular

Span(in): 300.00
Rise(in): 11988.00
Invert(ft): 32.900
Control Elevation(ft): 32.900

TABLE

Bottom Clip(in): 0.000
Top Clip(in): 0.000
Weir Discharge Coef: 2.800
Orifice Discharge Coef: 0.600

Name: WRC46 From Node: NM2
Group: PRE To Node: NMBNDRY
Flow: Both Count: 1
Type: Vertical: Fread Geometry: Rectangular

Span(in): 300.00
Rise(in): 11988.00
Invert(ft): 33.500
Control Elevation(ft): 33.500

TABLE

Bottom Clip(in): 0.000
Top Clip(in): 0.000
Weir Discharge Coef: 2.800
Orifice Discharge Coef: 0.600

Name: WRC47 From Node: NM2
Group: PRE To Node: NMBNDRY
Flow: Both Count: 1
Type: Vertical: Fread Geometry: Rectangular

Span(in): 300.00

ICPR Existing - All Basins.TXT

Rise(in): 11988.00
Invert(ft): 33.300
Control Elevation(ft): 33.300

TABLE

Bottom Clip(in): 0.000
Top Clip(in): 0.000
Weir Discharge Coef: 2.800
Orifice Discharge Coef: 0.600

Name: WRC48 From Node: NM2
Group: PRE To Node: NMBNDRY
Flow: Both Count: 1
Type: Vertical: Fread Geometry: Rectangular

Span(in): 300.00
Rise(in): 11988.00
Invert(ft): 34.600
Control Elevation(ft): 34.600

TABLE

Bottom Clip(in): 0.000
Top Clip(in): 0.000
Weir Discharge Coef: 2.800
Orifice Discharge Coef: 0.600

Name: WRC4A From Node: NN4A
Group: PRE To Node: NN4
Flow: Both Count: 1
Type: Vertical: Gravel Geometry: Rectangular

Span(in): 240.00
Rise(in): 11988.00
Invert(ft): 32.200
Control Elevation(ft): 32.200

TABLE

Bottom Clip(in): 0.000
Top Clip(in): 0.000
Weir Discharge Coef: 2.800
Orifice Discharge Coef: 0.600

Name: WRC5 From Node: NN4B2
Group: PRE To Node: NN4A
Flow: Both Count: 1
Type: Vertical: Gravel Geometry: Rectangular

Span(in): 20.00
Rise(in): 11988.00
Invert(ft): 33.800
Control Elevation(ft): 33.800

TABLE

Bottom Clip(in): 0.000
Top Clip(in): 0.000

ICPR Existing - All Basins.TXT

Weir Discharge Coef: 2.800
Orifice Discharge Coef: 0.600

Name: WRC50 From Node: NM2
Group: PRE To Node: NMBNDRY
Flow: Both Count: 1
Type: Vertical: Fread Geometry: Rectangular

Span(in): 300.00
Rise(in): 11988.00
Invert(ft): 33.900
Control Elevation(ft): 33.900

TABLE

Bottom Clip(in): 0.000
Top Clip(in): 0.000
Weir Discharge Coef: 2.800
Orifice Discharge Coef: 0.600

Name: WRC5A From Node: NN4B2
Group: PRE To Node: NND5
Flow: Both Count: 1
Type: Vertical: Gravel Geometry: Rectangular

Span(in): 100.00
Rise(in): 11988.00
Invert(ft): 32.800
Control Elevation(ft): 32.800

TABLE

Bottom Clip(in): 0.000
Top Clip(in): 0.000
Weir Discharge Coef: 2.800
Orifice Discharge Coef: 0.600

Name: WRC8A From Node: NN4B1
Group: PRE To Node: NN4AB
Flow: Both Count: 1
Type: Vertical: Fread Geometry: Rectangular

Span(in): 240.00
Rise(in): 11988.00
Invert(ft): 37.000
Control Elevation(ft): 37.000

TABLE

Bottom Clip(in): 0.000
Top Clip(in): 0.000
Weir Discharge Coef: 2.800
Orifice Discharge Coef: 0.600

ICPR Existing - All Basins.TXT

Name: WRC8B From Node: NN4B1
Group: PRE To Node: NN4AB
Flow: Both Count: 1
Type: Vertical: Fread Geometry: Rectangular

Span(in): 240.00
Rise(in): 11988.00
Invert(ft): 37.000
Control Elevation(ft): 37.000

TABLE

Bottom Clip(in): 0.000
Top Clip(in): 0.000
Weir Discharge Coef: 2.800
Orifice Discharge Coef: 0.600

Name: WRC8C From Node: NN4B1
Group: PRE To Node: NN4AB
Flow: Both Count: 1
Type: Vertical: Fread Geometry: Rectangular

Span(in): 240.00
Rise(in): 11988.00
Invert(ft): 37.000
Control Elevation(ft): 37.000

TABLE

Bottom Clip(in): 0.000
Top Clip(in): 0.000
Weir Discharge Coef: 2.800
Orifice Discharge Coef: 0.600

Name: WRC9 From Node: NN3B
Group: PRE To Node: NN3AB
Flow: Both Count: 1
Type: Vertical: Fread Geometry: Rectangular

Span(in): 600.00
Rise(in): 11988.00
Invert(ft): 39.000
Control Elevation(ft): 39.000

TABLE

Bottom Clip(in): 0.000
Top Clip(in): 0.000
Weir Discharge Coef: 2.800
Orifice Discharge Coef: 0.600

Name: WRD14 From Node: NE4
Group: PRE To Node: NED5D
Flow: Both Count: 1
Type: Vertical: Fread Geometry: Rectangular

ICPR Existing - All Basins.TXT

Span(in): 264.00
Rise(in): 11988.00
Invert(ft): 34.000
Control Elevation(ft): 34.000

TABLE

Bottom Clip(in): 0.000
Top Clip(in): 0.000
Weir Discharge Coef: 2.800
Orifice Discharge Coef: 0.600

Name: WRD17 From Node: NE9
Group: PRE To Node: NED6C
Flow: Both Count: 1
Type: Vertical: Fread Geometry: Rectangular

Span(in): 264.00
Rise(in): 11988.00
Invert(ft): 34.000
Control Elevation(ft): 34.000

TABLE

Bottom Clip(in): 0.000
Top Clip(in): 0.000
Weir Discharge Coef: 2.800
Orifice Discharge Coef: 0.600

Name: WRD19 From Node: NE8
Group: PRE To Node: NED7
Flow: Both Count: 1
Type: Vertical: Fread Geometry: Rectangular

Span(in): 600.00
Rise(in): 11988.00
Invert(ft): 36.000
Control Elevation(ft): 36.000

TABLE

Bottom Clip(in): 0.000
Top Clip(in): 0.000
Weir Discharge Coef: 2.800
Orifice Discharge Coef: 0.600

Name: WRD20 From Node: NE11
Group: PRE To Node: NED9C
Flow: Both Count: 1
Type: Vertical: Fread Geometry: Rectangular

Span(in): 264.00
Rise(in): 11988.00
Invert(ft): 34.000
Control Elevation(ft): 34.000

TABLE

Bottom Clip(in): 0.000

ICPR Existing - All Basins.TXT

Top Clip(in): 0.000
Weir Discharge Coef: 2.800
Orifice Discharge Coef: 0.600

Name: WRD23 From Node: NE14B
Group: PRE To Node: NE12A
Flow: Both Count: 1
Type: Vertical: Fread Geometry: Rectangular

Span(in): 480.00
Rise(in): 11988.00
Invert(ft): 38.000
Control Elevation(ft): 38.000

TABLE

Bottom Clip(in): 0.000
Top Clip(in): 0.000
Weir Discharge Coef: 2.800
Orifice Discharge Coef: 0.600

Name: WRD24 From Node: NE12
Group: PRE To Node: NED12
Flow: Both Count: 1
Type: Vertical: Fread Geometry: Rectangular

Span(in): 600.00
Rise(in): 11988.00
Invert(ft): 36.000
Control Elevation(ft): 36.000

TABLE

Bottom Clip(in): 0.000
Top Clip(in): 0.000
Weir Discharge Coef: 2.800
Orifice Discharge Coef: 0.600

Name: WREC22 From Node: NED11B
Group: PRE To Node: NED11A
Flow: Both Count: 1
Type: Vertical: Fread Geometry: Rectangular

Span(in): 240.00
Rise(in): 11988.00
Invert(ft): 36.000
Control Elevation(ft): 36.000

TABLE

Bottom Clip(in): 0.000
Top Clip(in): 0.000
Weir Discharge Coef: 2.800
Orifice Discharge Coef: 0.600

ICPR Existing - All Basins.TXT

==== Hydrology Simulations =====

Name: 10-yr,24-hr pre
Filename: C:\Users\wil53615\Desktop\Projects\FPL\Okeechobee\ICPR\10-year 24-hr pre .R32

Override Defaults: Yes
Storm Duration(hrs): 24.00
Rainfall File: Scsiii-24
Rainfall Amount(in): 7.50

Time(hrs)	Print Inc(min)
24.000	5.00

Name: 100y96hr-pre
Filename: C:\Users\wil53615\Desktop\Projects\FPL\Okeechobee\ICPR\100y96hr-pre.R32

Override Defaults: Yes
Storm Duration(hrs): 96.00
Rainfall File: Sjrwm96
Rainfall Amount(in): 15.00

Time(hrs)	Print Inc(min)
96.000	10.00

Name: 25y24hr-pre
Filename: C:\Users\wil53615\Desktop\Projects\FPL\Okeechobee\ICPR\25y24hr-pre.R32

Override Defaults: Yes
Storm Duration(hrs): 24.00
Rainfall File: Scsiii-24
Rainfall Amount(in): 9.20

Time(hrs)	Print Inc(min)
24.000	5.00

Name: 25y96hr-pre
Filename: C:\Users\wil53615\Desktop\Projects\FPL\Okeechobee\ICPR\25y96hr-pre.R32

Override Defaults: Yes
Storm Duration(hrs): 96.00
Rainfall File: Sjrwm96
Rainfall Amount(in): 11.70

Time(hrs)	Print Inc(min)
-----------	----------------

ICPR Existing - All Basins.TXT

96.000 10.00

==== Routing Simulations =====

Name: 100y96hr-pre Hydrology Sim: 100y96hr-pre
Filename: C:\Users\wil53615\Desktop\Projects\FPL\Okeechobee\ICPR\100y96hr-pre.I32

Execute: Yes Restart: No Patch: No
Alternative: No

Max Delta Z(ft): 1.00 Delta Z Factor: 0.00500
Time Step Optimizer: 10.000
Start Time(hrs): 0.000 End Time(hrs): 144.00
Min Calc Time(sec): 0.1000 Max Calc Time(sec): 10.0000
Boundary Stages: 100YR96HR Boundary Flows:

Time(hrs) Print Inc(min)

144.000 60.000

Group Run

BNDRY Yes
PRE Yes

Name: 10y24hr-pre Hydrology Sim: 10-yr,24-hr pre
Filename: C:\Users\wil53615\Desktop\Projects\FPL\Okeechobee\ICPR\10y24hr-pre.I32

Execute: Yes Restart: No Patch: No
Alternative: No

Max Delta Z(ft): 1.00 Delta Z Factor: 0.00500
Time Step Optimizer: 10.000
Start Time(hrs): 0.000 End Time(hrs): 96.00
Min Calc Time(sec): 0.1000 Max Calc Time(sec): 10.0000
Boundary Stages: 10YR24HR Boundary Flows:

Time(hrs) Print Inc(min)

96.000 60.000

Group Run

BNDRY Yes
PRE Yes

ICPR Existing - All Basins.TXT

Name: 25yr24hr-pre Hydrology Sim: 25y24hr-pre
Filename: C:\Users\wil53615\Desktop\Projects\FPL\Okeechobee\ICPR\25yr24hr-pre.I32

Execute: Yes Restart: No Patch: No
Alternative: No

Max Delta Z(ft): 1.00 Delta Z Factor: 0.00500
Time Step Optimizer: 10.000
Start Time(hrs): 0.000 End Time(hrs): 72.00
Min Calc Time(sec): 0.1000 Max Calc Time(sec): 10.0000
Boundary Stages: 25YR24HR Boundary Flows:

Time(hrs)	Print Inc(min)
72.000	15.000

Group	Run
BNDRY	Yes
PRE	Yes

Name: 25yr96hr-pre Hydrology Sim: 25y96hr-pre
Filename: C:\Users\wil53615\Desktop\Projects\FPL\Okeechobee\ICPR\25yr96hr-pre.I32

Execute: Yes Restart: No Patch: No
Alternative: No

Max Delta Z(ft): 1.00 Delta Z Factor: 0.00100
Time Step Optimizer: 10.000
Start Time(hrs): 0.000 End Time(hrs): 96.00
Min Calc Time(sec): 0.1000 Max Calc Time(sec): 10.0000
Boundary Stages: 25YR24HR Boundary Flows:

Time(hrs)	Print Inc(min)
96.000	60.000

Group	Run
BNDRY	Yes
PRE	Yes

==== Boundary Conditions =====

Name: 25YR24HR Node: NBNDRY Type: Stage

Time(hrs)	Stage(ft)
0.000	26.700

ICPR Existing - All Basins.TXT

8.000	27.200
16.000	28.900
24.000	29.300
36.000	29.400
48.000	29.300
72.000	29.100
96.000	28.800
120.000	28.000

Name: 25YR24HR

Node: NEBNDRY

Type: Stage

Time(hrs)	Stage(ft)
0.000	28.000
8.000	28.200
16.000	29.000
24.000	29.300
36.000	29.500
48.000	29.300
72.000	29.200
96.000	29.000
120.000	28.800

Name: 25YR24HR

Node: NMBNDRY

Type: Stage

Time(hrs)	Stage(ft)
0.000	28.000
8.000	28.200
16.000	29.000
24.000	29.300
36.000	29.500
48.000	29.300
72.000	29.200
96.000	29.000
120.000	28.800

Name: 25YR24HR

Node: NSBNDRY

Type: Stage

Time(hrs)	Stage(ft)
0.000	29.000
8.000	29.200
16.000	30.000
24.000	30.500
48.000	31.000
72.000	30.900
96.000	30.800
120.000	30.700

Name: 25YR24HR

Node: NWBNDRY

Type: Stage

Time(hrs)	Stage(ft)
0.000	55.000

ICPR Existing - All Basins.TXT

8.000	55.100
16.000	55.600
24.000	55.800
48.000	55.800
72.000	55.700
96.000	55.600
120.000	55.500

Name: 100YR96HR	Node: NBNDRY	Type: Stage
Time(hrs)	Stage(ft)	

0.000	26.700	
8.000	26.800	
24.000	27.500	
48.000	29.000	
60.000	29.500	
72.000	30.500	
84.000	30.600	
96.000	30.400	
120.000	30.200	
144.000	30.000	

Name: 100YR96HR	Node: NEBNDRY	Type: Stage
Time(hrs)	Stage(ft)	

0.000	28.000	
8.000	28.200	
24.000	29.000	
48.000	29.500	
60.000	30.000	
72.000	30.600	
84.000	30.700	
96.000	30.500	
120.000	30.300	
144.000	30.100	

Name: 100YR96HR	Node: NMBNDRY	Type: Stage
Time(hrs)	Stage(ft)	

0.000	28.000	
8.000	28.200	
24.000	29.000	
48.000	29.500	
60.000	30.000	
72.000	30.600	
84.000	30.700	
96.000	30.500	
120.000	30.300	
144.000	30.100	

Name: 100YR96HR	Node: NSBNDRY	Type: Stage

ICPR Existing - All Basins.TXT

Time(hrs)	Stage(ft)
0.000	29.000
8.000	29.200
24.000	30.000
48.000	30.500
60.000	31.000
72.000	31.500
96.000	32.000
120.000	31.900
144.000	31.700

Name: 100YR96HR Node: NWBNDRY Type: Stage

Time(hrs)	Stage(ft)
0.000	55.000
8.000	55.100
24.000	55.300
48.000	55.500
60.000	56.000
72.000	55.700
96.000	55.500
144.000	55.200

Name: 10YR24HR Node: NBNDRY Type: Stage

Time(hrs)	Stage(ft)
0.000	26.700
8.000	27.000
16.000	28.200
24.000	29.000
48.000	29.000
72.000	28.800
96.000	28.200

Name: 10YR24HR Node: NEBNDRY Type: Stage

Time(hrs)	Stage(ft)
0.000	28.000
8.000	28.200
16.000	28.800
24.000	29.000
48.000	29.000
72.000	28.800
96.000	28.200

Name: 10YR24HR Node: NMBNDRY Type: Stage

Time(hrs)	Stage(ft)
0.000	28.000
8.000	28.200

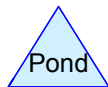
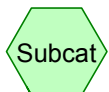
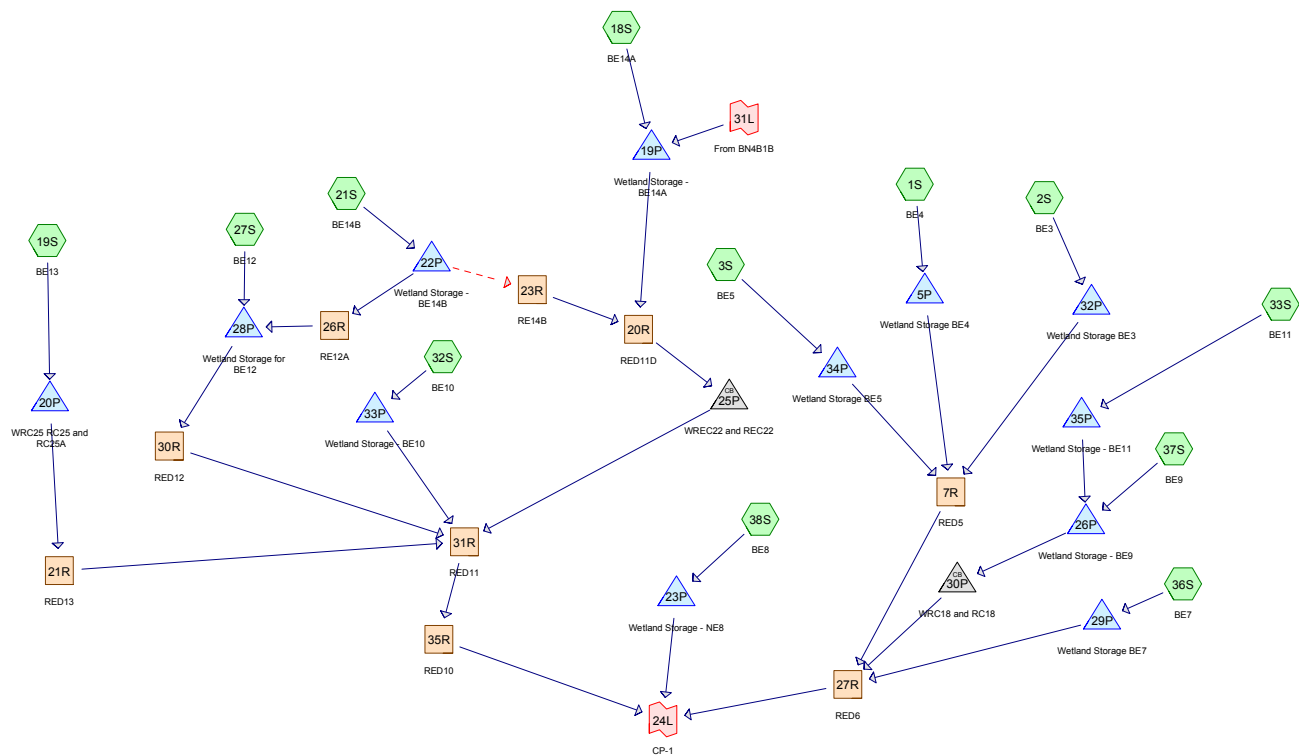


BLACK & VEATCH

Owner: FPL_____
Plant: Okeechobee Clean Energy Center
Project No. 185922_____
File No. 58.5406.1101_____
Title: Pre-Development Storm Water
Analysis

Prepared by: S. J. Williams
Date: 04/27/15
Verified by: _____
Date: _____
Page No. 1
Template Rev: 0

Attachment 4
HydroCAD Report



Routing Diagram for Existing
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Existing

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Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
201.000	74	(1S)
234.380	76	(2S, 3S, 36S, 38S)
1,014.200	73	(18S, 21S, 33S, 37S)
254.700	75	(19S, 27S, 32S)
1,704.280	74	TOTAL AREA

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Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
0.000	HSG C	
0.000	HSG D	
1,704.280	Other	1S, 2S, 3S, 18S, 19S, 21S, 27S, 32S, 33S, 36S, 37S, 38S
1,704.280		TOTAL AREA

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Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	0.000	0.000	0.000	1,704.280	1,704.280		1S, 2S, 3S, 18S, 19S, 21S, 27S, 32S, 33S, 36S, 37S, 38S
0.000	0.000	0.000	0.000	1,704.280	1,704.280	TOTAL AREA	

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Pipe Listing (all nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Diam/Width (inches)	Height (inches)	Inside-Fill (inches)
1	5P	28.87	28.39	34.0	0.0141	0.024	36.0	0.0	0.0
2	20P	32.04	31.39	23.0	0.0283	0.024	36.0	0.0	0.0
3	20P	30.01	29.99	29.0	0.0007	0.024	8.0	0.0	0.0
4	22P	36.00	34.30	23.0	0.0739	0.024	24.0	0.0	0.0
5	23P	29.63	28.90	29.0	0.0252	0.024	24.0	0.0	0.0
6	25P	27.24	27.18	40.0	0.0015	0.024	72.0	0.0	0.0
7	26P	29.62	29.07	34.0	0.0162	0.024	36.0	0.0	0.0
8	28P	28.87	28.68	20.0	0.0095	0.024	36.0	0.0	0.0
9	30P	29.42	29.26	17.0	0.0094	0.024	36.0	0.0	0.0
10	35P	29.17	28.74	29.0	0.0148	0.024	36.0	0.0	0.0

Existing

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Type II 24-hr 25yr-24hr Rainfall=9.20", Ia/S=0.30

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Time span=0.00-50.00 hrs, dt=0.05 hrs, 1001 points

Runoff by SCS TR-20 method, UH=SCS

Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment1S: BE4	Runoff Area=201.000 ac 0.00% Impervious Runoff Depth=5.69" Tc=62.0 min CN=74 Runoff=606.52 cfs 95.328 af
Subcatchment2S: BE3	Runoff Area=44.500 ac 0.00% Impervious Runoff Depth=5.97" Tc=138.0 min CN=76 Runoff=76.88 cfs 22.134 af
Subcatchment3S: BE5	Runoff Area=68.150 ac 0.00% Impervious Runoff Depth=5.97" Tc=103.0 min CN=76 Runoff=147.12 cfs 33.897 af
Subcatchment18S: BE14A	Runoff Area=499.200 ac 0.00% Impervious Runoff Depth=5.55" Tc=152.0 min CN=73 Runoff=739.32 cfs 230.970 af
Subcatchment19S: BE13	Runoff Area=112.300 ac 0.00% Impervious Runoff Depth=5.83" Tc=153.0 min CN=75 Runoff=174.11 cfs 54.560 af
Subcatchment21S: BE14B	Runoff Area=333.700 ac 0.00% Impervious Runoff Depth=5.55" Tc=152.0 min CN=73 Runoff=494.21 cfs 154.397 af
Subcatchment27S: BE12	Runoff Area=66.400 ac 0.00% Impervious Runoff Depth=5.83" Tc=122.0 min CN=75 Runoff=122.98 cfs 32.260 af
Subcatchment32S: BE10	Runoff Area=76.000 ac 0.00% Impervious Runoff Depth=5.83" Tc=102.0 min CN=75 Runoff=161.68 cfs 36.924 af
Subcatchment33S: BE11	Runoff Area=79.800 ac 0.00% Impervious Runoff Depth=5.55" Tc=74.0 min CN=73 Runoff=205.62 cfs 36.922 af
Subcatchment36S: BE7	Runoff Area=19.500 ac 0.00% Impervious Runoff Depth=5.97" Tc=155.0 min CN=76 Runoff=30.81 cfs 9.699 af
Subcatchment37S: BE9	Runoff Area=101.500 ac 0.00% Impervious Runoff Depth=5.55" Tc=156.0 min CN=73 Runoff=147.50 cfs 46.962 af
Subcatchment38S: BE8	Runoff Area=102.230 ac 0.00% Impervious Runoff Depth=5.97" Tc=125.0 min CN=76 Runoff=190.46 cfs 50.848 af
Reach 7R: RED5	Avg. Flow Depth=4.78' Max Vel=2.33 fps Inflow=162.75 cfs 150.463 af n=0.050 L=1,267.0' S=0.0024 ' Capacity=614.53 cfs Outflow=162.08 cfs 150.435 af
Reach 20R: RED11D	Avg. Flow Depth=26,138,157.87' Max Vel=1.12 fps Inflow=368.34 cfs 402.671 af n=0.070 L=2,100.0' S=0.0007 ' Capacity=69.98 cfs Outflow=76.27 cfs 7.256 af
Reach 21R: RED13	Avg. Flow Depth=1.56' Max Vel=0.88 fps Inflow=36.10 cfs 52.056 af n=0.060 L=1,750.0' S=0.0011 ' Capacity=135.42 cfs Outflow=36.04 cfs 51.801 af
Reach 23R: RE14B	Avg. Flow Depth=2.43' Max Vel=4.53 fps Inflow=92.80 cfs 83.942 af n=0.050 L=80.0' S=0.0125 ' Capacity=357.03 cfs Outflow=92.79 cfs 83.941 af

Existing

Type II 24-hr 25yr-24hr Rainfall=9.20", Ia/S=0.30

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Reach 26R: RE12A	Avg. Flow Depth=9.25' Max Vel=2.82 fps Inflow=336.40 cfs 70.360 af n=0.060 L=1,600.0' S=0.0022 ' Capacity=195.11 cfs Outflow=330.51 cfs 70.357 af
Reach 27R: RED6	Avg. Flow Depth=5.50' Max Vel=3.63 fps Inflow=349.98 cfs 244.004 af n=0.035 L=2,300.0' S=0.0015 ' Capacity=389.01 cfs Outflow=347.54 cfs 243.941 af
Reach 30R: RED12	Avg. Flow Depth=2.20' Max Vel=3.87 fps Inflow=62.48 cfs 102.616 af n=0.035 L=400.0' S=0.0075 ' Capacity=762.50 cfs Outflow=62.48 cfs 102.616 af
Reach 31R: RED11	Avg. Flow Depth=10.72' Max Vel=0.74 fps Inflow=220.49 cfs 198.596 af n=0.035 L=1,600.0' S=0.0001 ' Capacity=69.61 cfs Outflow=191.07 cfs 198.269 af
Reach 35R: RED10	Avg. Flow Depth=6.39' Max Vel=1.74 fps Inflow=191.07 cfs 198.269 af n=0.035 L=1,400.0' S=0.0004 ' Capacity=182.27 cfs Outflow=188.37 cfs 198.123 af
Pond 5P: Wetland Storage BE4	Peak Elev=34.18' Storage=47.539 af Inflow=606.52 cfs 95.328 af Outflow=122.41 cfs 95.329 af
Pond 19P: Wetland Storage - BE14A	Peak Elev=37.87' Storage=95.021 af Inflow=739.32 cfs 318.844 af Outflow=284.50 cfs 318.730 af
Pond 20P: WRC25 RC25 and RC25A	Peak Elev=35.13' Storage=31.279 af Inflow=174.11 cfs 54.560 af Outflow=36.10 cfs 52.056 af
Pond 22P: Wetland Storage - BE14B	Peak Elev=38.35' Storage=38.882 af Inflow=494.21 cfs 154.397 af Primary=336.40 cfs 70.360 af Secondary=92.80 cfs 83.942 af Outflow=429.20 cfs 154.302 af
Pond 23P: Wetland Storage - NE8	Peak Elev=31.80' Storage=37.725 af Inflow=190.46 cfs 50.848 af Outflow=12.93 cfs 36.519 af
Pond 25P: WREC22 and REC22	Peak Elev=31.22' Inflow=76.27 cfs 7.256 af Outflow=76.27 cfs 7.256 af
Pond 26P: Wetland Storage - BE9	Peak Elev=34.26' Storage=19.754 af Inflow=216.16 cfs 83.870 af Outflow=165.11 cfs 83.870 af
Pond 28P: Wetland Storage for BE12	Peak Elev=35.78' Storage=60.781 af Inflow=388.23 cfs 102.616 af Outflow=62.48 cfs 102.616 af
Pond 29P: Wetland Storage BE7	Peak Elev=31.78' Storage=1.888 af Inflow=30.81 cfs 9.699 af Outflow=24.45 cfs 9.699 af
Pond 30P: WRC18 and RC18	Peak Elev=34.76' Inflow=165.11 cfs 83.870 af Outflow=165.11 cfs 83.870 af
Pond 32P: Wetland Storage BE3	Peak Elev=31.67' Storage=10.826 af Inflow=76.88 cfs 22.134 af Outflow=22.73 cfs 22.010 af
Pond 33P: Wetland Storage - BE10	Peak Elev=31.73' Storage=8.804 af Inflow=161.68 cfs 36.924 af Outflow=104.83 cfs 36.924 af
Pond 34P: Wetland Storage BE5	Peak Elev=31.73' Storage=19.852 af Inflow=147.12 cfs 33.897 af Outflow=24.12 cfs 33.124 af

Existing

Type II 24-hr 25yr-24hr Rainfall=9.20", Ia/S=0.30

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Pond 35P: Wetland Storage - BE11

Peak Elev=34.09' Storage=15.125 af Inflow=205.62 cfs 36.922 af
Outflow=68.66 cfs 36.908 af

Link 24L: CP-1

Inflow=541.37 cfs 478.584 af
Primary=541.37 cfs 478.584 af

Link 31L: 25yr-24hr Primary Outflow Imported from Existing - Part 2~Link 18L.hce Inflow=69.79 cfs 87.873 af
Area= 522.100 ac Primary=69.79 cfs 87.873 af

Total Runoff Area = 1,704.280 ac Runoff Volume = 804.900 af Average Runoff Depth = 5.67"
100.00% Pervious = 1,704.280 ac 0.00% Impervious = 0.000 ac

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Type II 24-hr 25yr-24hr Rainfall=9.20", Ia/S=0.30

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Summary for Subcatchment 1S: BE4

Runoff = 606.52 cfs @ 12.64 hrs, Volume= 95.328 af, Depth= 5.69"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-50.00 hrs, dt= 0.05 hrs

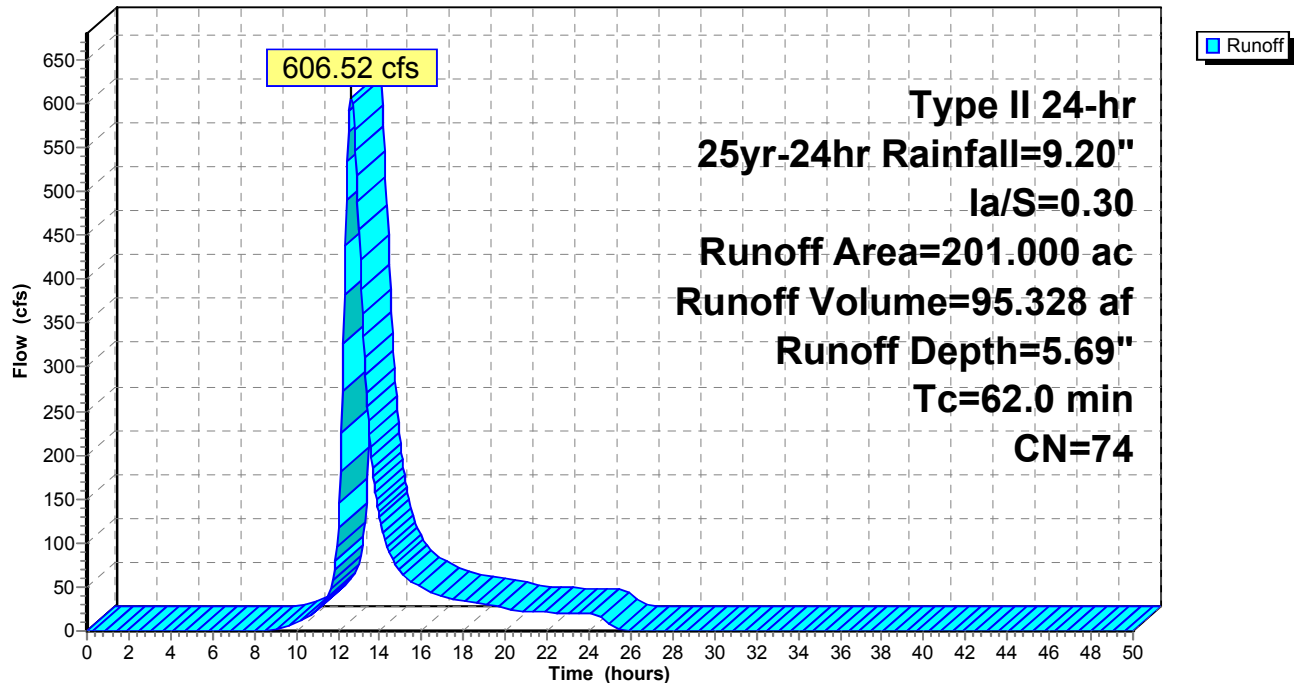
Type II 24-hr 25yr-24hr Rainfall=9.20", Ia/S=0.30

Area (ac)	CN	Description
* 201.000	74	
201.000		100.00% Pervious Area

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

Subcatchment 1S: BE4

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Type II 24-hr 25yr-24hr Rainfall=9.20", Ia/S=0.30

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Summary for Subcatchment 2S: BE3

Runoff = 76.88 cfs @ 13.64 hrs, Volume= 22.134 af, Depth= 5.97"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-50.00 hrs, dt= 0.05 hrs

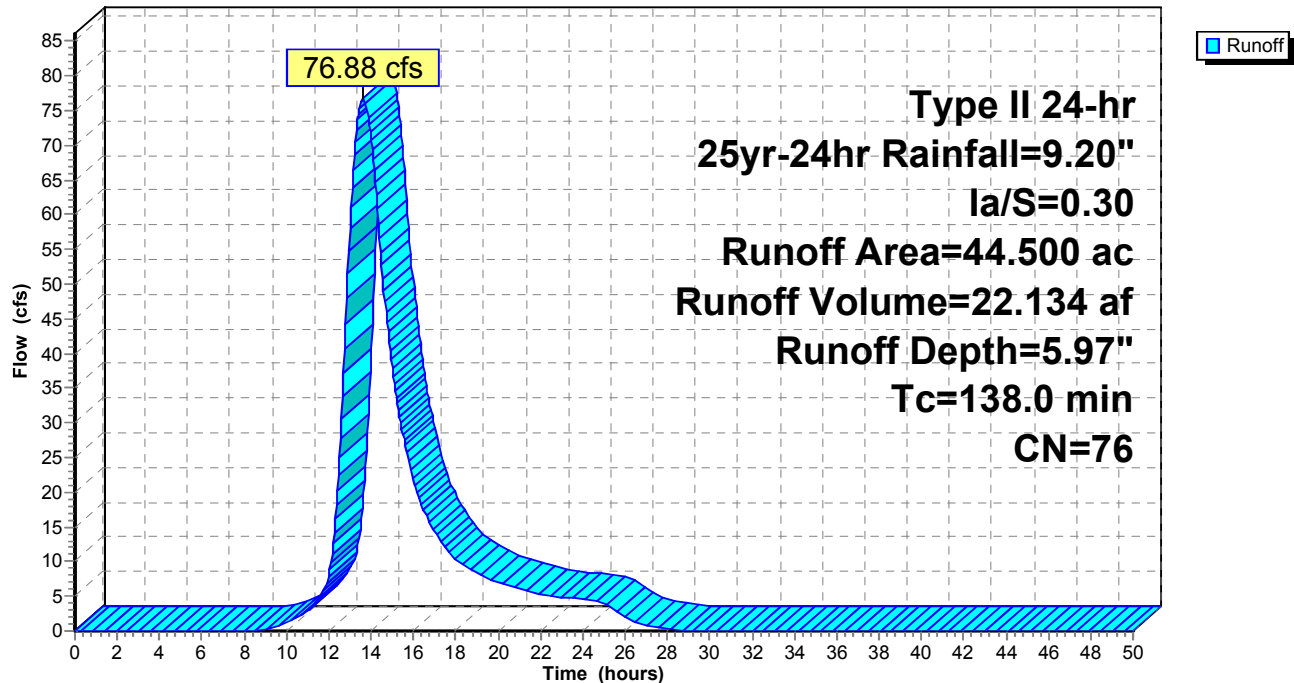
Type II 24-hr 25yr-24hr Rainfall=9.20", Ia/S=0.30

Area (ac)	CN	Description
* 44.500	76	
44.500		100.00% Pervious Area

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

Subcatchment 2S: BE3

Hydrograph



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Type II 24-hr 25yr-24hr Rainfall=9.20", Ia/S=0.30

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Summary for Subcatchment 3S: BE5

Runoff = 147.12 cfs @ 13.16 hrs, Volume= 33.897 af, Depth= 5.97"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-50.00 hrs, dt= 0.05 hrs

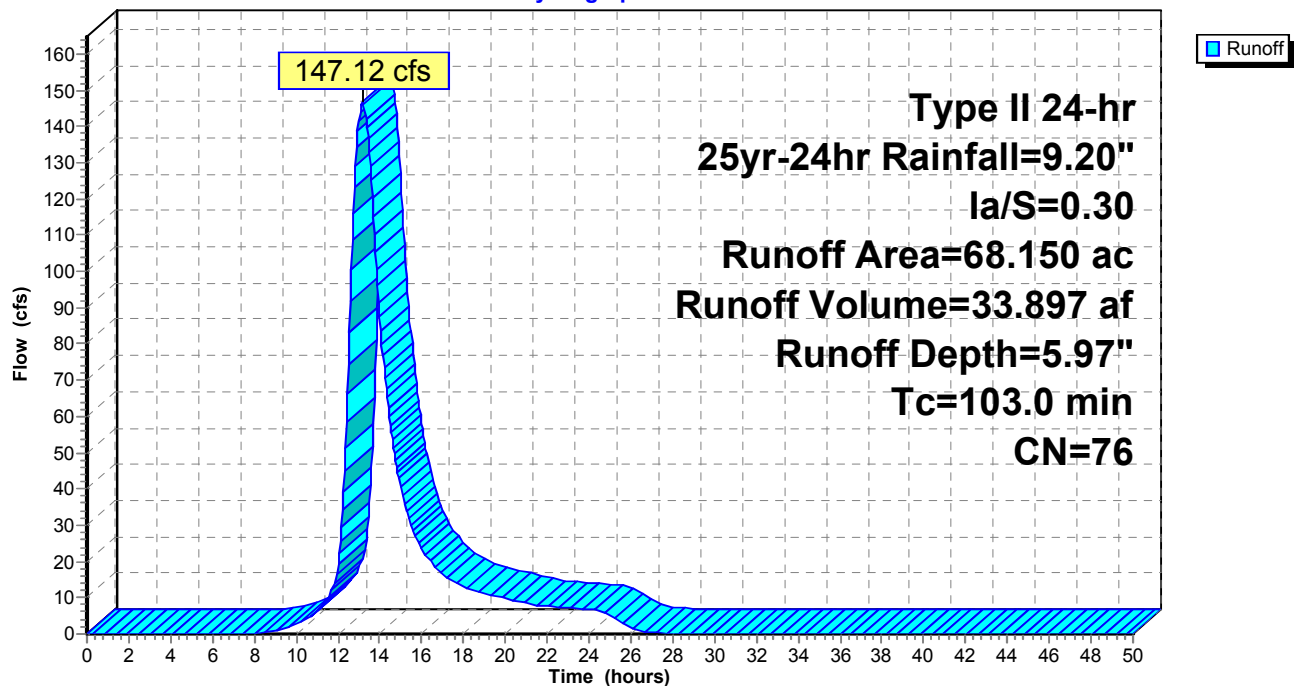
Type II 24-hr 25yr-24hr Rainfall=9.20", Ia/S=0.30

Area (ac)	CN	Description
* 68.150	76	
68.150		100.00% Pervious Area

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

Subcatchment 3S: BE5

Hydrograph



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Type II 24-hr 25yr-24hr Rainfall=9.20", Ia/S=0.30

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Summary for Subcatchment 18S: BE14A

Runoff = 739.32 cfs @ 13.86 hrs, Volume= 230.970 af, Depth= 5.55"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-50.00 hrs, dt= 0.05 hrs

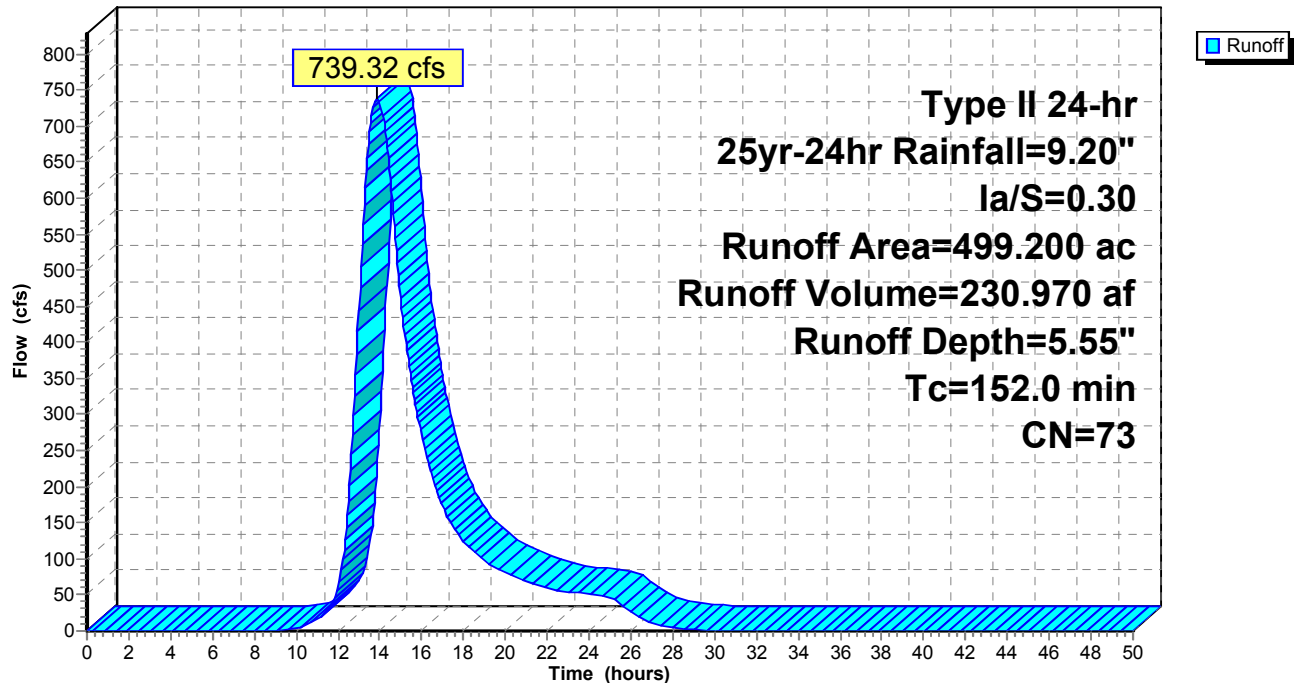
Type II 24-hr 25yr-24hr Rainfall=9.20", Ia/S=0.30

Area (ac)	CN	Description
* 499.200	73	
499.200		100.00% Pervious Area

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

Subcatchment 18S: BE14A

Hydrograph



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Type II 24-hr 25yr-24hr Rainfall=9.20", Ia/S=0.30

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Summary for Subcatchment 19S: BE13

Runoff = 174.11 cfs @ 13.79 hrs, Volume= 54.560 af, Depth= 5.83"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-50.00 hrs, dt= 0.05 hrs

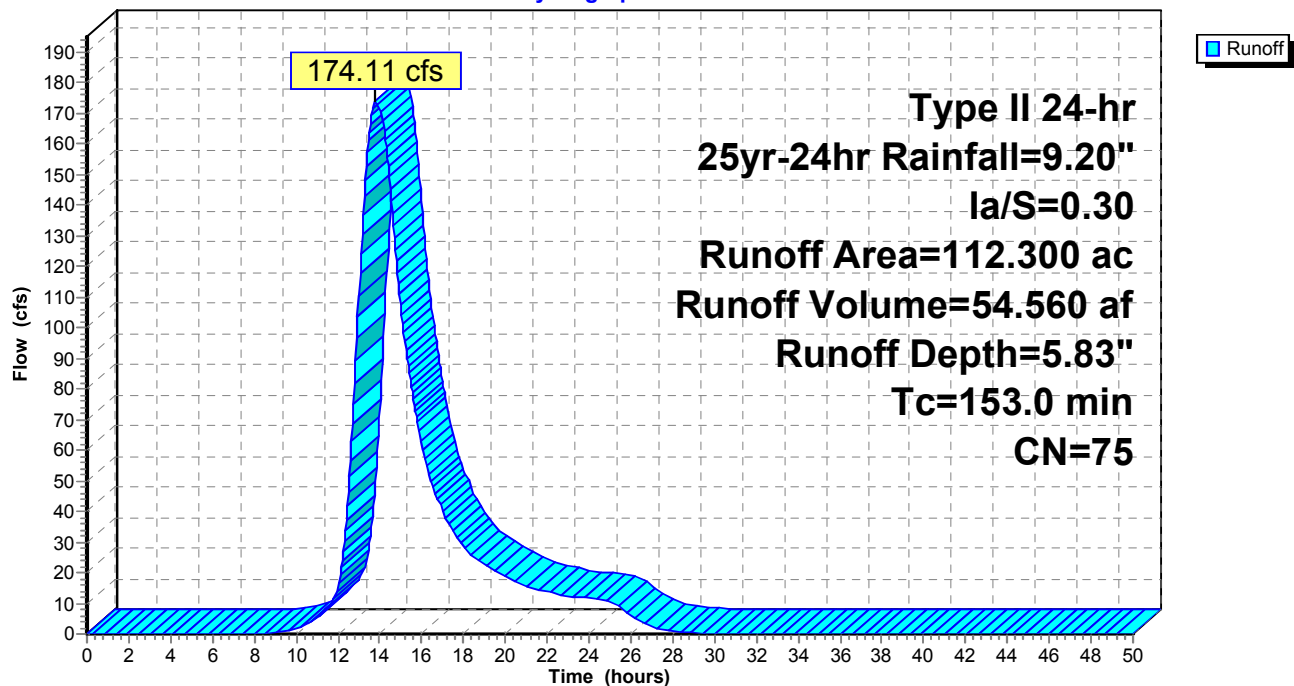
Type II 24-hr 25yr-24hr Rainfall=9.20", Ia/S=0.30

Area (ac)	CN	Description
* 112.300	75	
112.300		100.00% Pervious Area

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

Subcatchment 19S: BE13

Hydrograph



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Type II 24-hr 25yr-24hr Rainfall=9.20", Ia/S=0.30

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Summary for Subcatchment 21S: BE14B

Runoff = 494.21 cfs @ 13.86 hrs, Volume= 154.397 af, Depth= 5.55"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-50.00 hrs, dt= 0.05 hrs

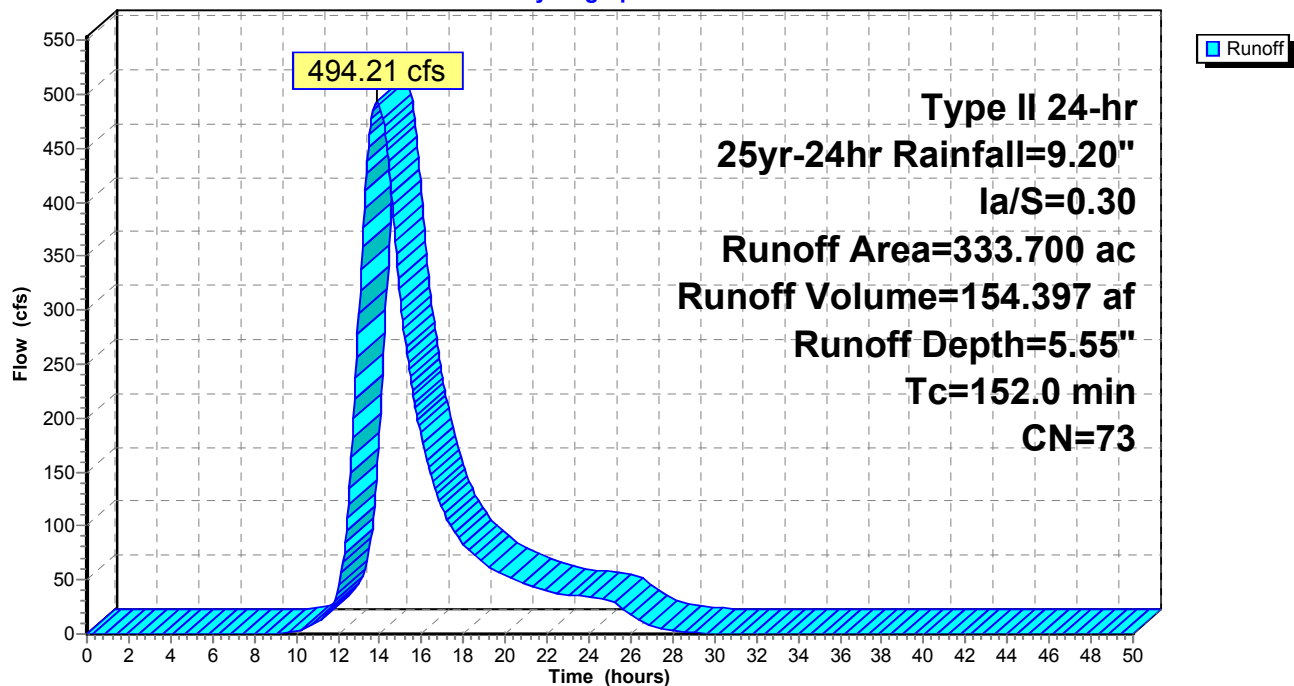
Type II 24-hr 25yr-24hr Rainfall=9.20", Ia/S=0.30

Area (ac)	CN	Description
* 333.700	73	
333.700		100.00% Pervious Area

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

Subcatchment 21S: BE14B

Hydrograph



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Type II 24-hr 25yr-24hr Rainfall=9.20", Ia/S=0.30

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Summary for Subcatchment 27S: BE12

Runoff = 122.98 cfs @ 13.41 hrs, Volume= 32.260 af, Depth= 5.83"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-50.00 hrs, dt= 0.05 hrs

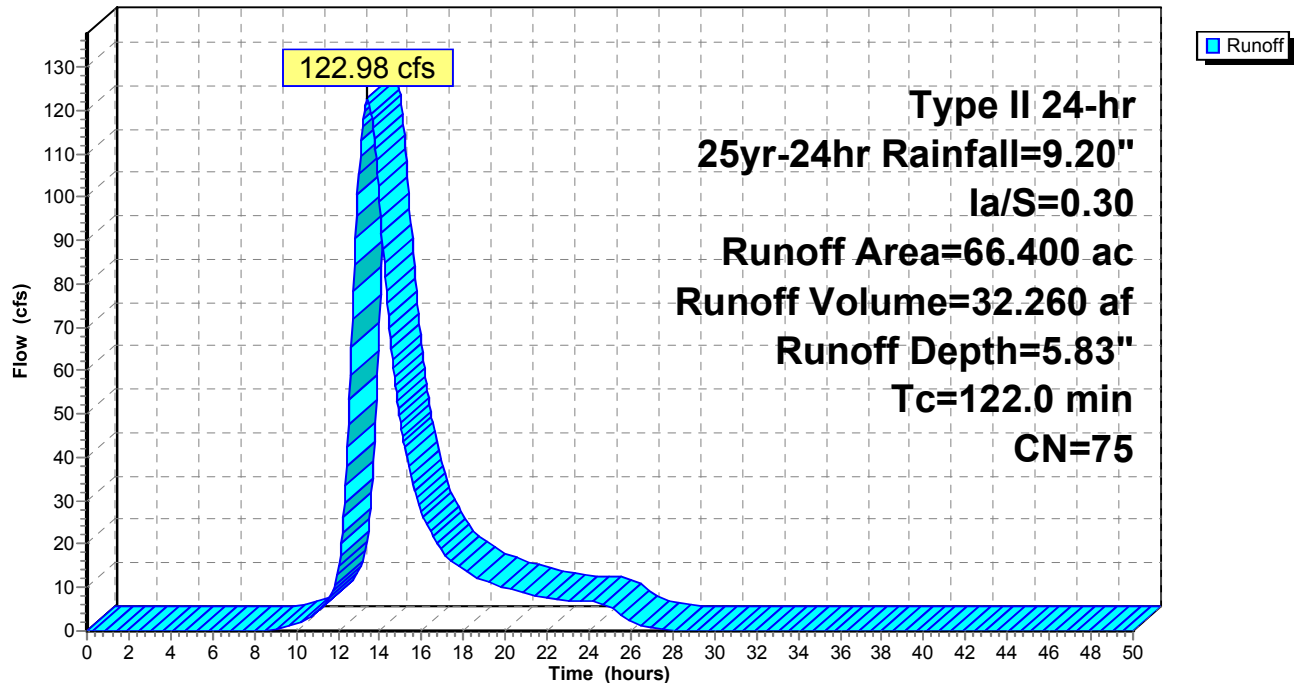
Type II 24-hr 25yr-24hr Rainfall=9.20", Ia/S=0.30

Area (ac)	CN	Description
* 66.400	75	
66.400		100.00% Pervious Area

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

Subcatchment 27S: BE12

Hydrograph



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Type II 24-hr 25yr-24hr Rainfall=9.20", Ia/S=0.30

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Summary for Subcatchment 32S: BE10

Runoff = 161.68 cfs @ 13.17 hrs, Volume= 36.924 af, Depth= 5.83"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-50.00 hrs, dt= 0.05 hrs

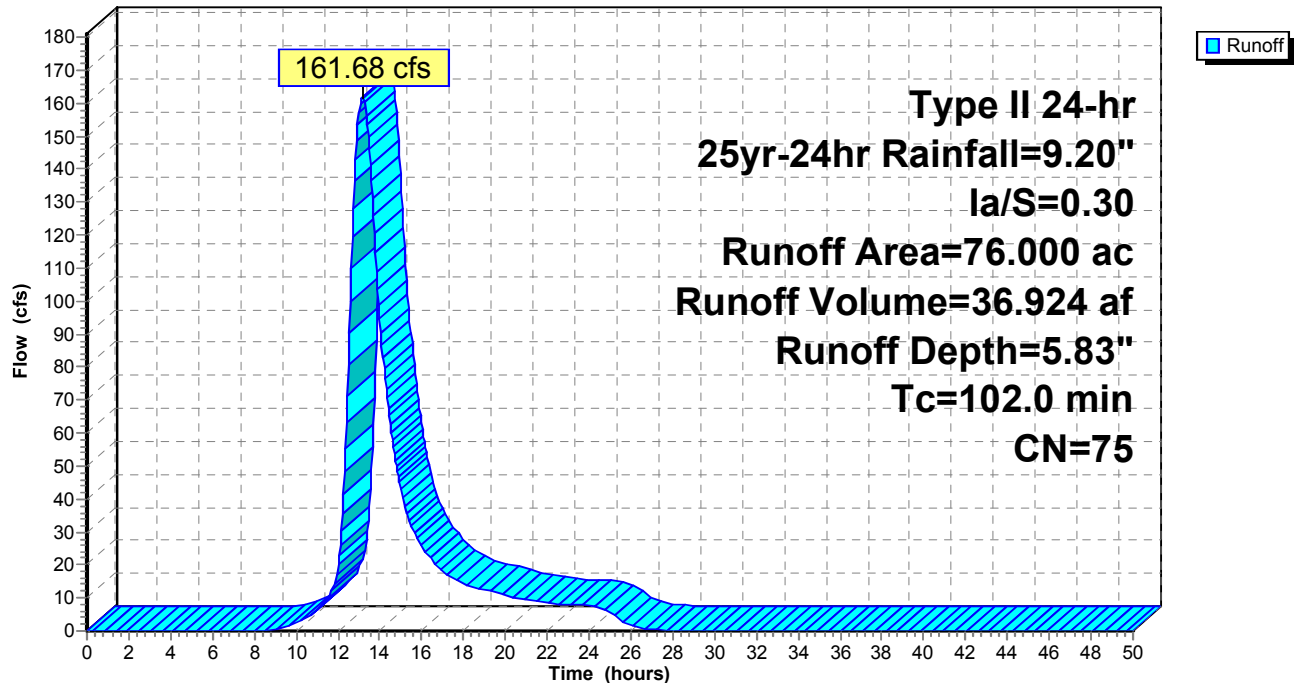
Type II 24-hr 25yr-24hr Rainfall=9.20", Ia/S=0.30

Area (ac)	CN	Description
* 76.000	75	
76.000		100.00% Pervious Area

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

Subcatchment 32S: BE10

Hydrograph



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Summary for Subcatchment 33S: BE11

Runoff = 205.62 cfs @ 12.80 hrs, Volume= 36.922 af, Depth= 5.55"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-50.00 hrs, dt= 0.05 hrs

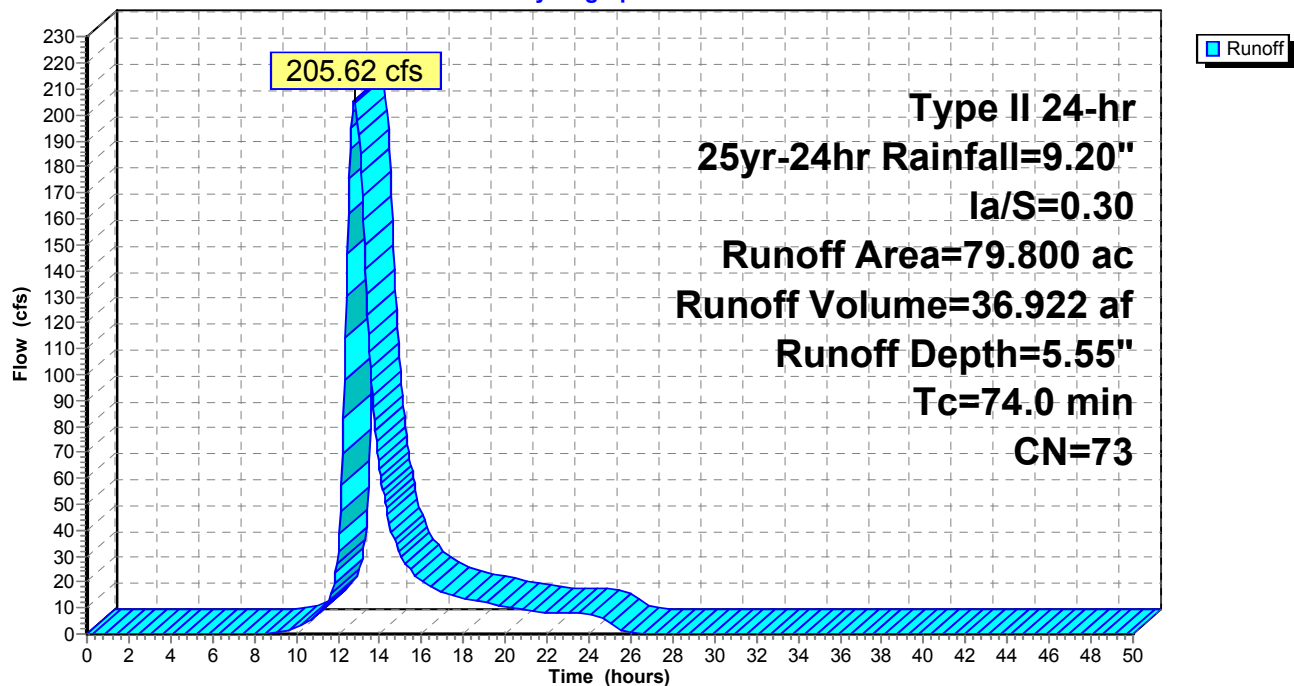
Type II 24-hr 25yr-24hr Rainfall=9.20", Ia/S=0.30

Area (ac)	CN	Description
* 79.800	73	
79.800		100.00% Pervious Area

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

Subcatchment 33S: BE11

Hydrograph



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Summary for Subcatchment 36S: BE7

Runoff = 30.81 cfs @ 13.93 hrs, Volume= 9.699 af, Depth= 5.97"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-50.00 hrs, dt= 0.05 hrs

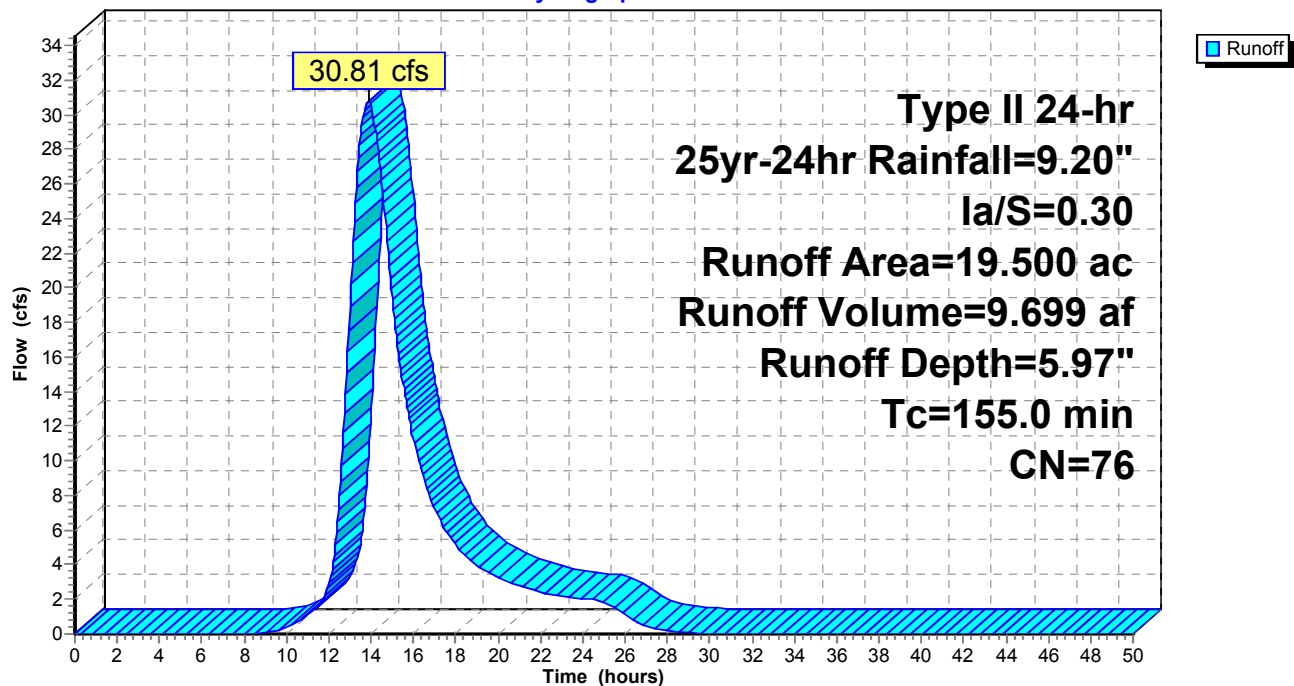
Type II 24-hr 25yr-24hr Rainfall=9.20", Ia/S=0.30

Area (ac)	CN	Description
* 19.500	76	
19.500		100.00% Pervious Area

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

Subcatchment 36S: BE7

Hydrograph



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Summary for Subcatchment 37S: BE9

Runoff = 147.50 cfs @ 13.92 hrs, Volume= 46.962 af, Depth= 5.55"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-50.00 hrs, dt= 0.05 hrs

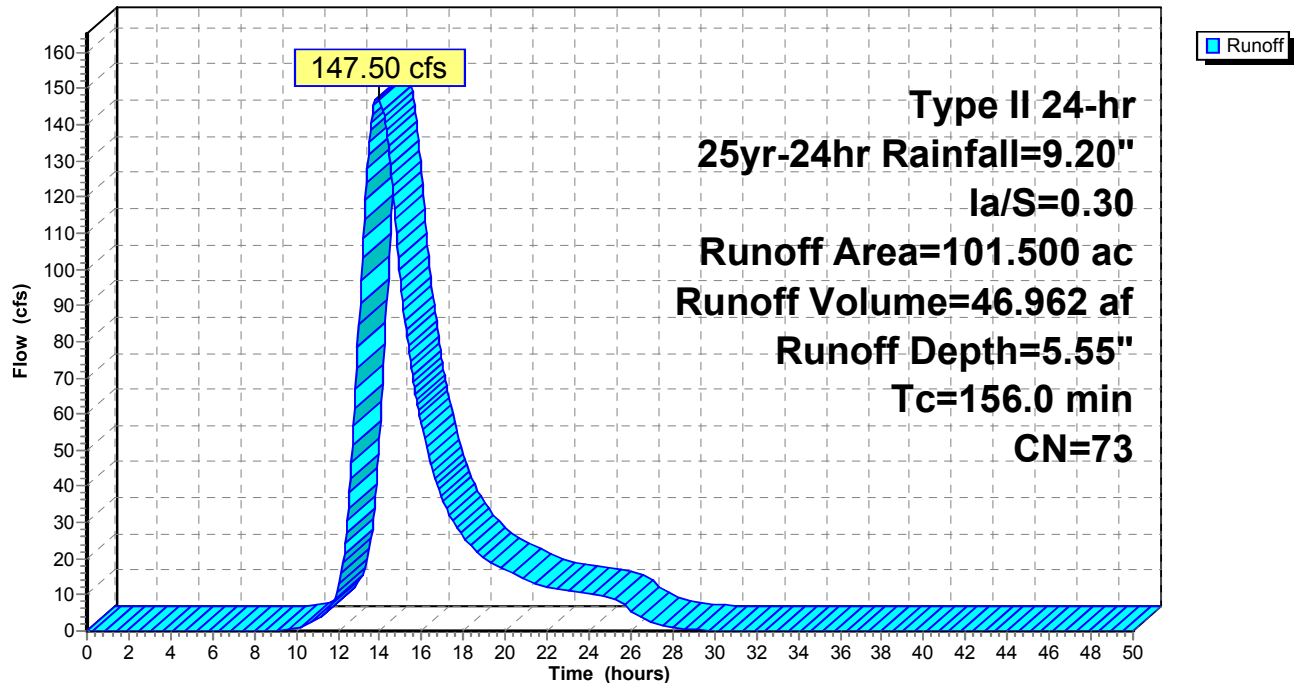
Type II 24-hr 25yr-24hr Rainfall=9.20", Ia/S=0.30

Area (ac)	CN	Description
* 101.500	73	
101.500		100.00% Pervious Area

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

Subcatchment 37S: BE9

Hydrograph



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Type II 24-hr 25yr-24hr Rainfall=9.20", Ia/S=0.30

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Summary for Subcatchment 38S: BE8

Runoff = 190.46 cfs @ 13.46 hrs, Volume= 50.848 af, Depth= 5.97"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-50.00 hrs, dt= 0.05 hrs

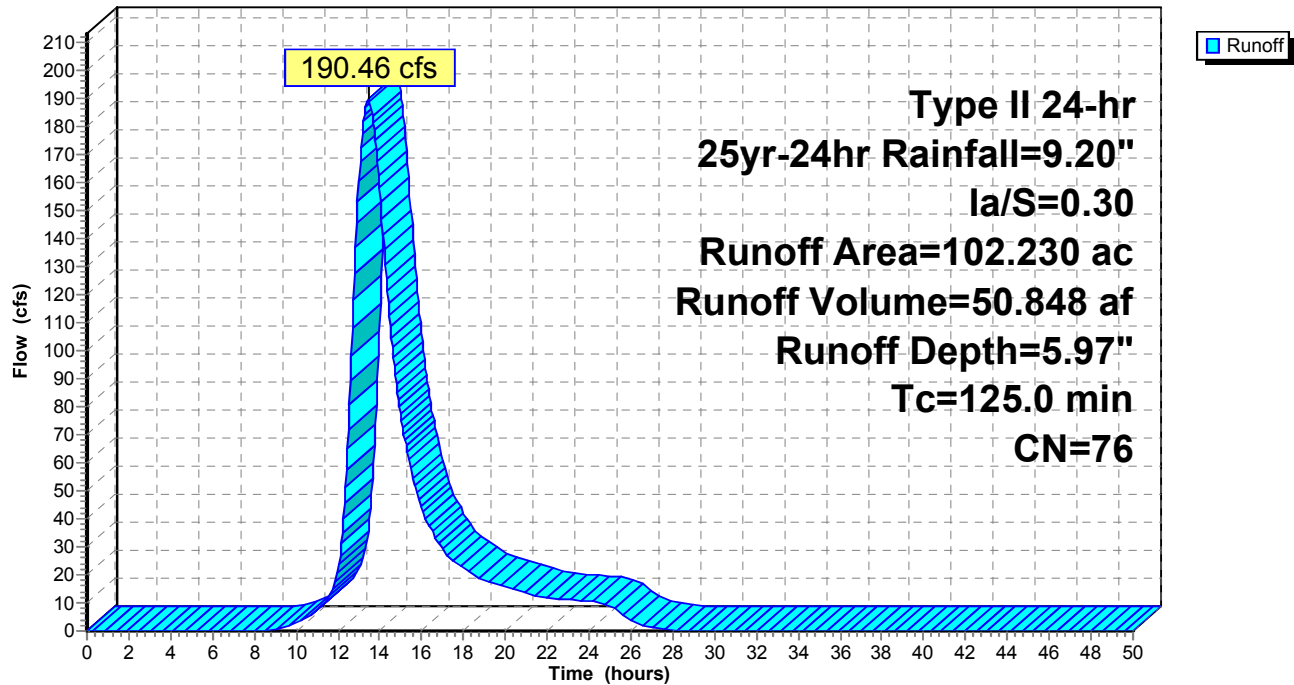
Type II 24-hr 25yr-24hr Rainfall=9.20", Ia/S=0.30

Area (ac)	CN	Description
* 102.230	76	
102.230		100.00% Pervious Area

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

Subcatchment 38S: BE8

Hydrograph



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Summary for Reach 7R: RED5

[81] Warning: Exceeded Pond 5P by 0.45' @ 30.15 hrs

[81] Warning: Exceeded Pond 32P by 1.32' @ 14.00 hrs

[81] Warning: Exceeded Pond 34P by 1.13' @ 14.20 hrs

Inflow Area = 313.650 ac, 0.00% Impervious, Inflow Depth > 5.76" for 25yr-24hr event
Inflow = 162.75 cfs @ 14.20 hrs, Volume= 150.463 af
Outflow = 162.08 cfs @ 14.49 hrs, Volume= 150.435 af, Atten= 0%, Lag= 17.7 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-50.00 hrs, dt= 0.05 hrs

Max. Velocity= 2.33 fps, Min. Travel Time= 9.1 min

Avg. Velocity= 1.31 fps, Avg. Travel Time= 16.1 min

Peak Storage= 88,169 cf @ 14.34 hrs

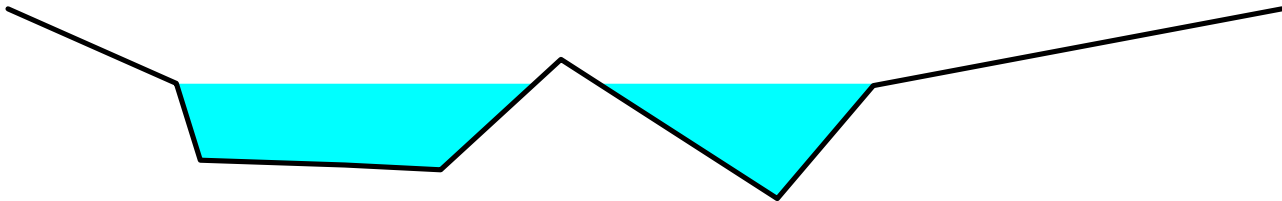
Average Depth at Peak Storage= 4.78'

Bank-Full Depth= 7.90' Flow Area= 196.7 sf, Capacity= 614.53 cfs

Custom cross-section, Length= 1,267.0' Slope= 0.0024 '/' (106 Elevation Intervals)

Constant n= 0.050

Inlet Invert= 28.00', Outlet Invert= 25.00'



Offset (feet)	Elevation (feet)	Chan.Depth (feet)
0.00	34.30	0.00
7.00	31.20	3.10
8.00	28.00	6.30
14.00	27.80	6.50
18.00	27.60	6.70
23.00	32.20	2.10
32.00	26.40	7.90
36.00	31.10	3.20
53.00	34.30	0.00

Depth (feet)	End Area (sq-ft)	Perim. (feet)	Storage (cubic-feet)	Discharge (cfs)
0.00	0.0	0.0	0	0.00
1.20	1.7	3.8	2,192	1.48
1.40	2.8	8.7	3,518	1.87
1.60	5.0	15.7	6,288	3.34
4.70	67.5	33.3	85,520	156.42
4.80	70.1	34.3	88,875	163.60
5.80	102.1	45.4	129,415	253.44
7.90	196.7	62.0	249,282	614.53

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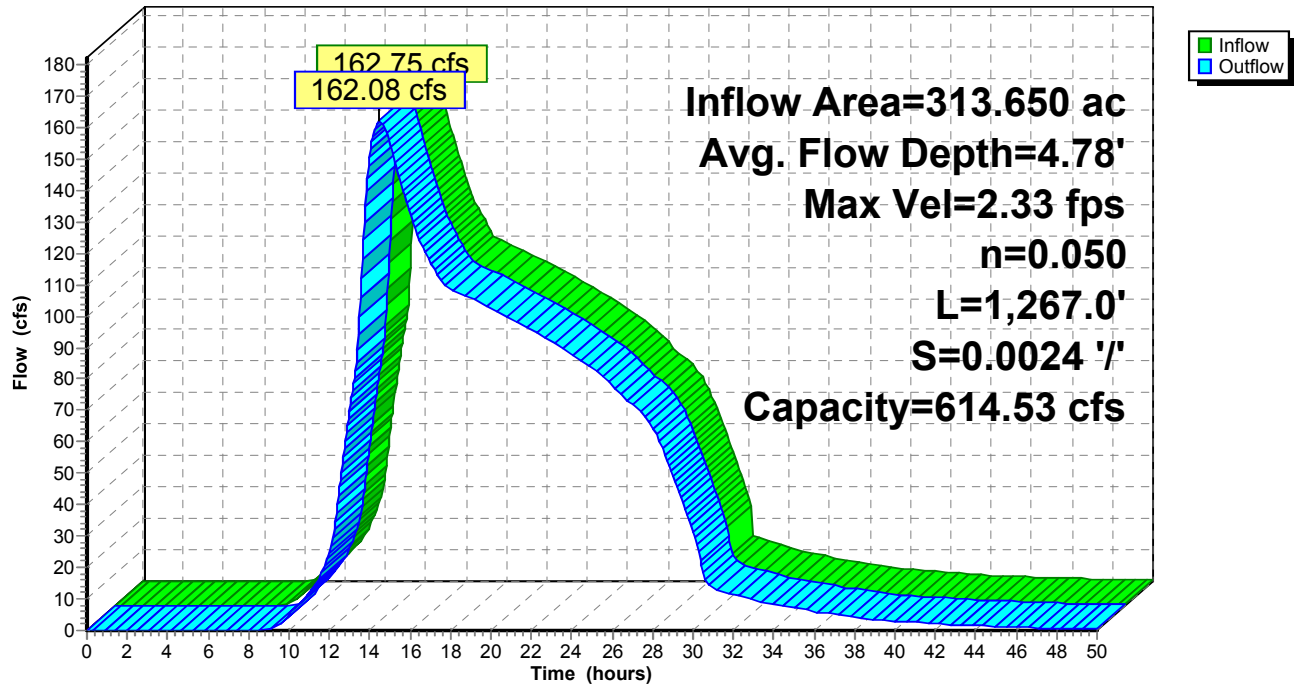
Type II 24-hr 25yr-24hr Rainfall=9.20", $I_a/S=0.30$

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Reach 7R: RED5

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Summary for Reach 20R: RED11D

[91] Warning: Storage range exceeded by 26,138,152.67'

[55] Hint: Peak inflow is 526% of Manning's capacity

[63] Warning: Exceeded Reach 23R INLET depth by 25,655,273.69' @ 49.95 hrs

[81] Warning: Exceeded Pond 19P by 25,655,275.53' @ 49.95 hrs

Inflow Area = 1,021.300 ac, 0.00% Impervious, Inflow Depth > 4.73" for 25yr-24hr event
Inflow = 368.34 cfs @ 15.61 hrs, Volume= 402.671 af
Outflow = 76.27 cfs @ 13.57 hrs, Volume= 7.256 af, Atten= 79%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-50.00 hrs, dt= 0.05 hrs

Max. Velocity= 1.12 fps, Min. Travel Time= 31.2 min

Avg. Velocity= -0.13 fps, Avg. Travel Time= 0.0 min

Peak Storage= 2,062,887,999,411 cf @ 50.00 hrs

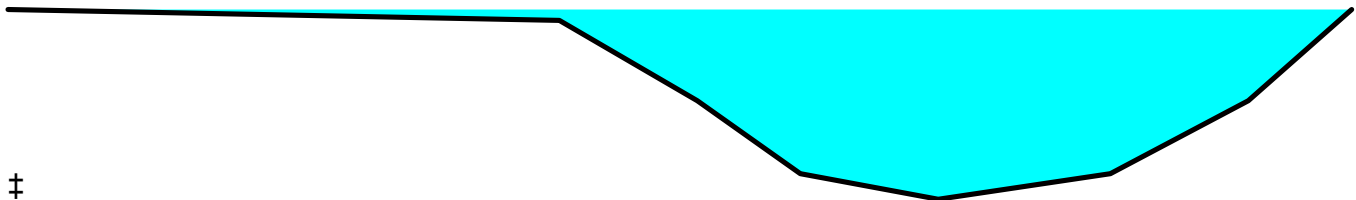
Average Depth at Peak Storage= 26,138,157.87'

Bank-Full Depth= 5.20' Flow Area= 79.9 sf, Capacity= 69.98 cfs

Custom cross-section, Length= 2,100.0' Slope= 0.0007 '/' (102 Elevation Intervals)

Constant n= 0.070

Inlet Invert= 31.00', Outlet Invert= 29.50'



Offset (feet)	Elevation (feet)	Chan.Depth (feet)
0.00	36.00	0.00
16.00	35.70	0.30
20.00	33.50	2.50
23.00	31.50	4.50
27.00	30.80	5.20
32.00	31.50	4.50
36.00	33.50	2.50
39.00	36.00	0.00

Depth (feet)	End Area (sq-ft)	Perim. (feet)	Storage (cubic-feet)	Discharge (cfs)
0.00	0.0	0.0	0	0.00
0.70	3.1	9.1	6,615	0.88
2.70	28.1	17.2	59,116	22.19
4.90	70.7	25.2	148,373	79.73
5.20	79.9	41.7	167,790	69.98

Existing

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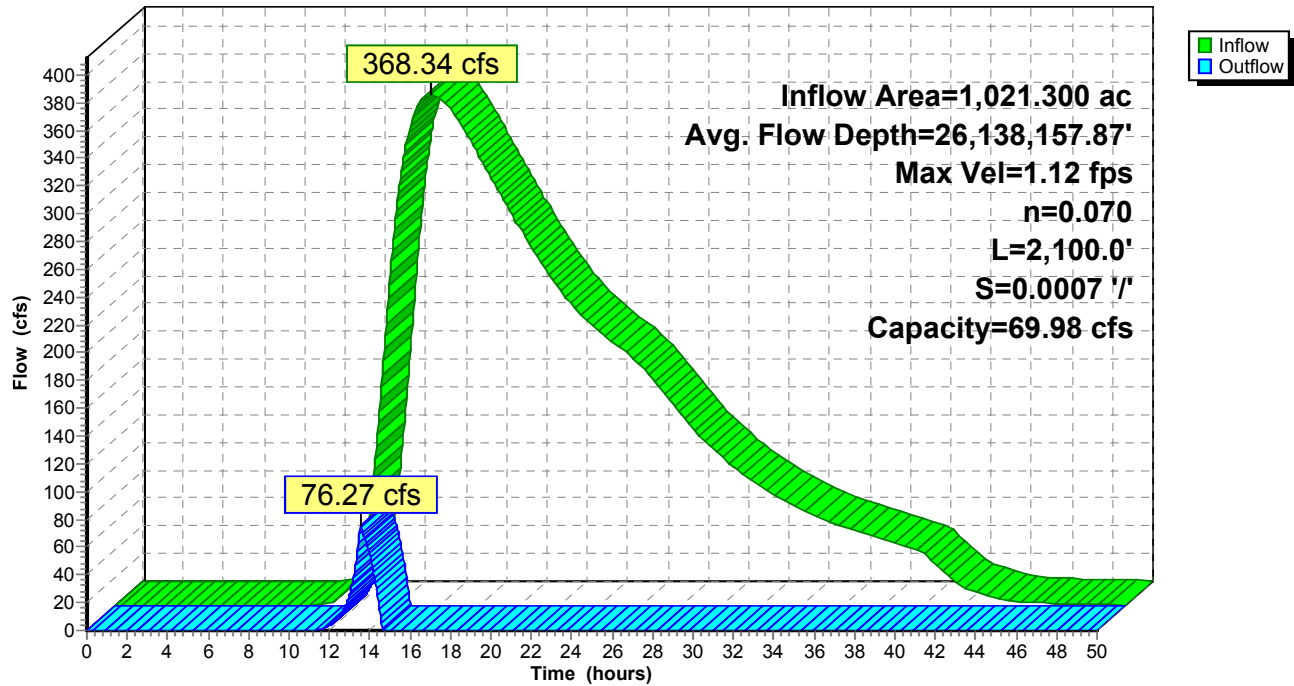
Type II 24-hr 25yr-24hr Rainfall=9.20", Ia/S=0.30

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Reach 20R: RED11D

Hydrograph



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Summary for Reach 21R: RED13

[81] Warning: Exceeded Pond 20P by 0.60' @ 0.00 hrs

Inflow Area = 112.300 ac, 0.00% Impervious, Inflow Depth > 5.56" for 25yr-24hr event
Inflow = 36.10 cfs @ 17.29 hrs, Volume= 52.056 af
Outflow = 36.04 cfs @ 18.38 hrs, Volume= 51.801 af, Atten= 0%, Lag= 65.3 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-50.00 hrs, dt= 0.05 hrs

Max. Velocity= 0.88 fps, Min. Travel Time= 33.2 min

Avg. Velocity = 0.59 fps, Avg. Travel Time= 49.4 min

Peak Storage= 71,761 cf @ 17.82 hrs

Average Depth at Peak Storage= 1.56'

Bank-Full Depth= 2.90' Flow Area= 107.0 sf, Capacity= 135.42 cfs

Custom cross-section, Length= 1,750.0' Slope= 0.0011 '/' (103 Elevation Intervals)

Constant n= 0.060

Inlet Invert= 30.60', Outlet Invert= 28.60'



Offset (feet)	Elevation (feet)	Chan.Depth (feet)
0.00	33.60	0.00
14.00	30.80	2.80
25.00	30.70	2.90
34.00	30.80	2.80
39.00	31.90	1.70
53.00	32.80	0.80
57.00	33.60	0.00

Depth (feet)	End Area (sq-ft)	Perim. (feet)	Storage (cubic-feet)	Discharge (cfs)
0.00	0.0	0.0	0	0.00
0.10	1.0	20.0	1,750	0.11
1.20	28.8	30.7	50,356	23.06
2.10	64.5	49.3	112,962	64.64
2.90	107.0	57.5	187,163	135.42

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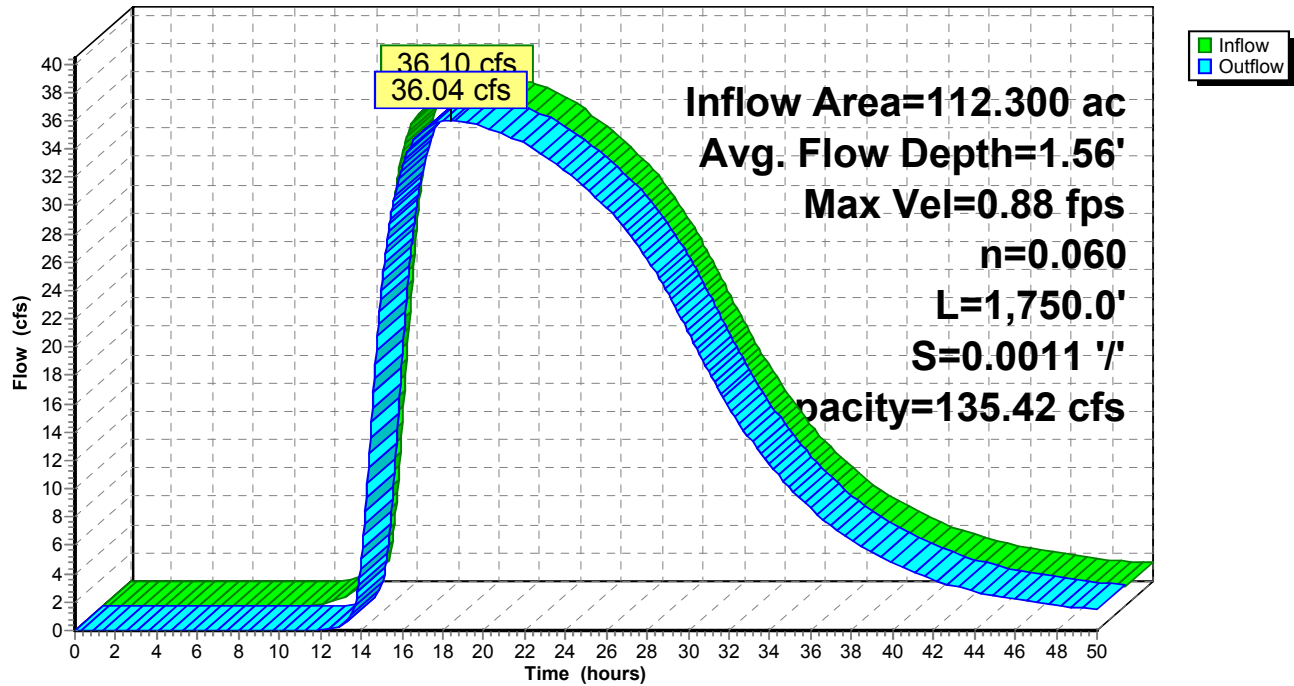
Type II 24-hr 25yr-24hr Rainfall=9.20", $Ia/S=0.30$

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Reach 21R: RED13

Hydrograph



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Summary for Reach 23R: RE14B

[81] Warning: Exceeded Pond 22P by 0.08' @ 15.05 hrs

Inflow = 92.80 cfs @ 14.45 hrs, Volume= 83.942 af
Outflow = 92.79 cfs @ 14.46 hrs, Volume= 83.941 af, Atten= 0%, Lag= 0.5 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-50.00 hrs, dt= 0.05 hrs

Max. Velocity= 4.53 fps, Min. Travel Time= 0.3 min

Avg. Velocity= 2.21 fps, Avg. Travel Time= 0.6 min

Peak Storage= 1,639 cf @ 14.45 hrs

Average Depth at Peak Storage= 2.43'

Bank-Full Depth= 5.00' Flow Area= 55.0 sf, Capacity= 357.03 cfs

6.00' x 5.00' deep channel, n= 0.050

Side Slope Z-value= 1.0 '/' Top Width= 16.00'

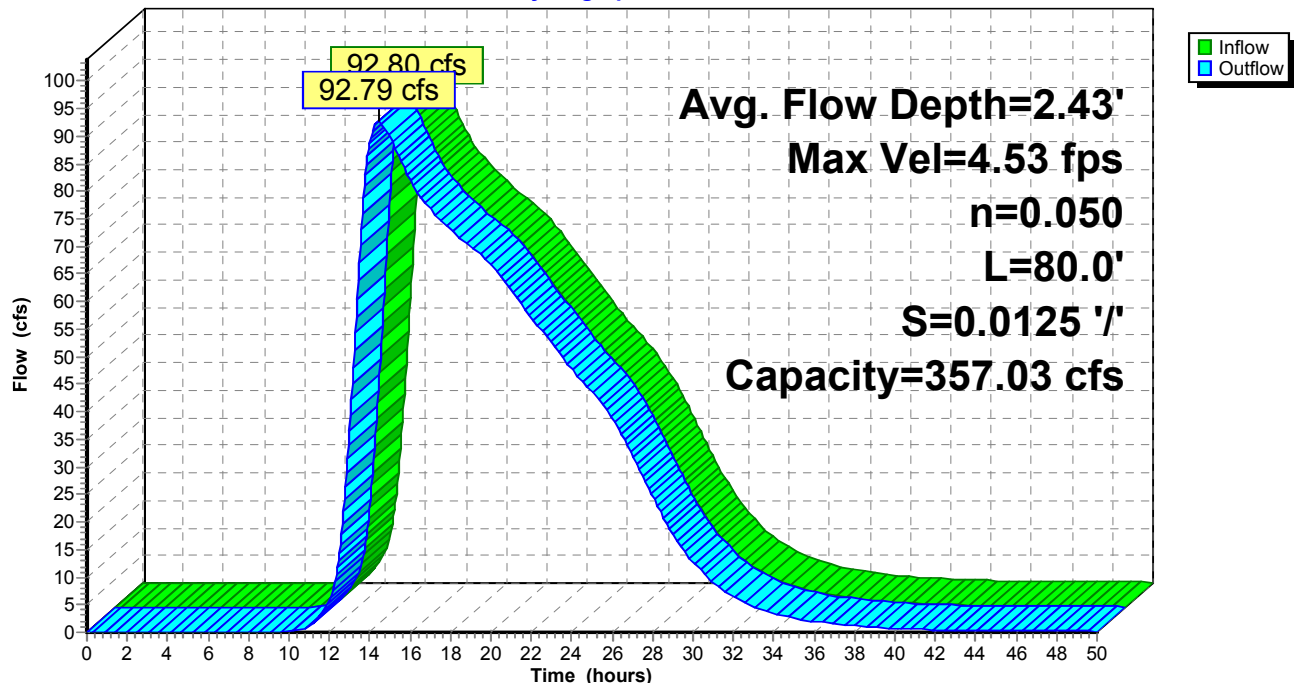
Length= 80.0' Slope= 0.0125 '/'

Inlet Invert= 36.00', Outlet Invert= 35.00'



Reach 23R: RE14B

Hydrograph



Existing

Type II 24-hr 25yr-24hr Rainfall=9.20", $I_a/S=0.30$

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Summary for Reach 26R: RE12A

[91] Warning: Storage range exceeded by 2.25'

[55] Hint: Peak inflow is 172% of Manning's capacity

[81] Warning: Exceeded Pond 22P by 2.41' @ 14.60 hrs

Inflow Area = 333.700 ac, 0.00% Impervious, Inflow Depth = 2.53" for 25yr-24hr event
Inflow = 336.40 cfs @ 14.45 hrs, Volume= 70.360 af
Outflow = 330.51 cfs @ 14.76 hrs, Volume= 70.357 af, Atten= 2%, Lag= 18.6 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-50.00 hrs, dt= 0.05 hrs

Max. Velocity= 2.82 fps, Min. Travel Time= 9.5 min

Avg. Velocity= 0.78 fps, Avg. Travel Time= 34.1 min

Peak Storage= 187,802 cf @ 14.60 hrs

Average Depth at Peak Storage= 9.25'

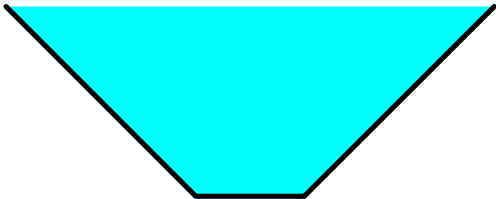
Bank-Full Depth= 7.00' Flow Area= 77.0 sf, Capacity= 195.11 cfs

4.00' x 7.00' deep channel, $n=0.060$

Side Slope Z-value= 1.0 ' ' Top Width= 18.00'

Length= 1,600.0' Slope= 0.0022 ' '

Inlet Invert= 31.50', Outlet Invert= 28.00'



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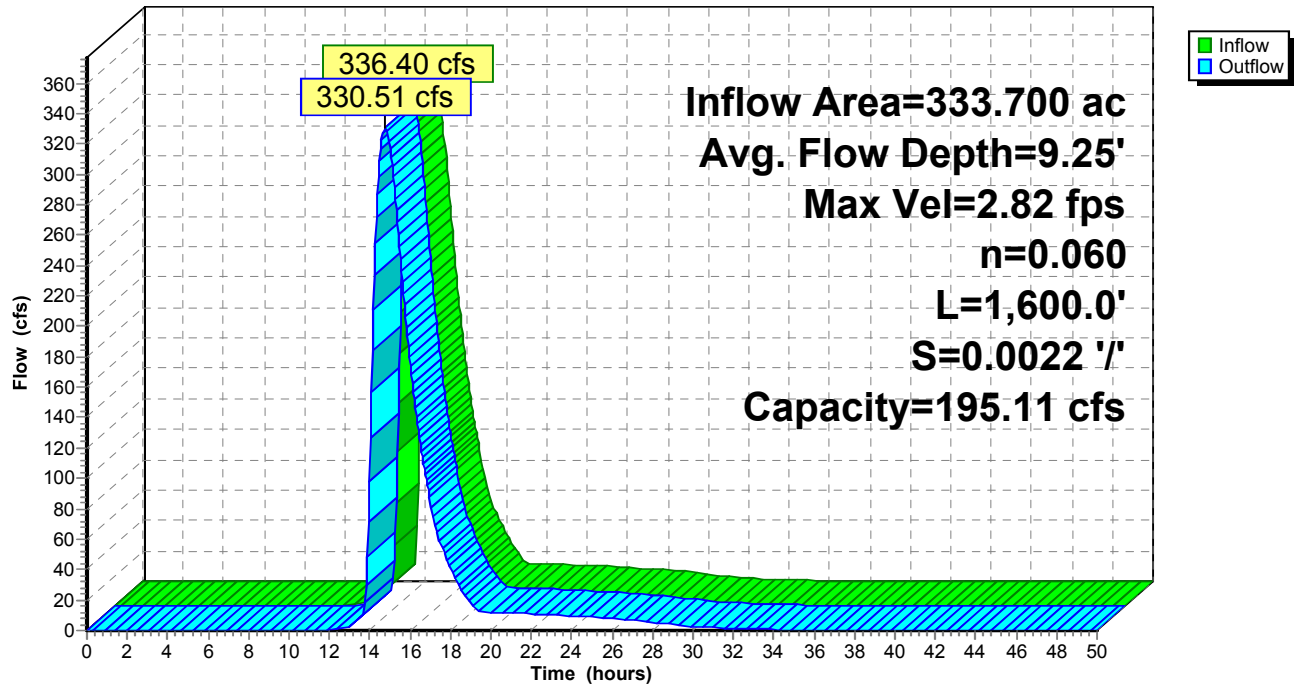
Type II 24-hr 25yr-24hr Rainfall=9.20", Ia/S=0.30

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Reach 26R: RE12A

Hydrograph



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Summary for Reach 27R: RED6

[63] Warning: Exceeded Reach 7R INLET depth by 2.33' @ 15.00 hrs

[81] Warning: Exceeded Pond 29P by 3.24' @ 14.85 hrs

[81] Warning: Exceeded Pond 30P by 1.64' @ 30.45 hrs

Inflow Area = 514.450 ac, 0.00% Impervious, Inflow Depth > 5.69" for 25yr-24hr event
Inflow = 349.98 cfs @ 14.69 hrs, Volume= 244.004 af
Outflow = 347.54 cfs @ 15.01 hrs, Volume= 243.941 af, Atten= 1%, Lag= 19.1 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-50.00 hrs, dt= 0.05 hrs

Max. Velocity= 3.63 fps, Min. Travel Time= 10.6 min

Avg. Velocity= 1.73 fps, Avg. Travel Time= 22.2 min

Peak Storage= 220,337 cf @ 14.84 hrs

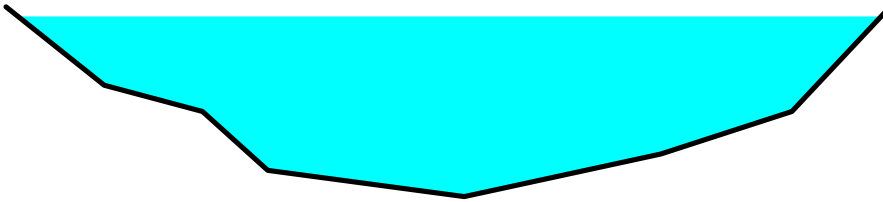
Average Depth at Peak Storage= 5.50'

Bank-Full Depth= 5.80' Flow Area= 103.7 sf, Capacity= 389.01 cfs

Custom cross-section, Length= 2,300.0' Slope= 0.0015 '/' (104 Elevation Intervals)

Constant n= 0.035

Inlet Invert= 29.50', Outlet Invert= 26.00'



Offset (feet)	Elevation (feet)	Chan.Depth (feet)
0.00	31.00	0.00
3.00	28.60	2.40
6.00	27.80	3.20
8.00	26.00	5.00
14.00	25.20	5.80
20.00	26.50	4.50
24.00	27.80	3.20
27.00	31.00	0.00

Depth (feet)	End Area (sq-ft)	Perim. (feet)	Storage (cubic-feet)	Discharge (cfs)
0.00	0.0	0.0	0	0.00
0.80	3.9	9.8	8,917	3.45
1.30	9.4	12.9	21,709	12.67
2.60	29.3	19.1	67,390	64.57
3.40	45.2	23.3	103,960	116.48
5.80	103.7	30.4	238,510	389.01

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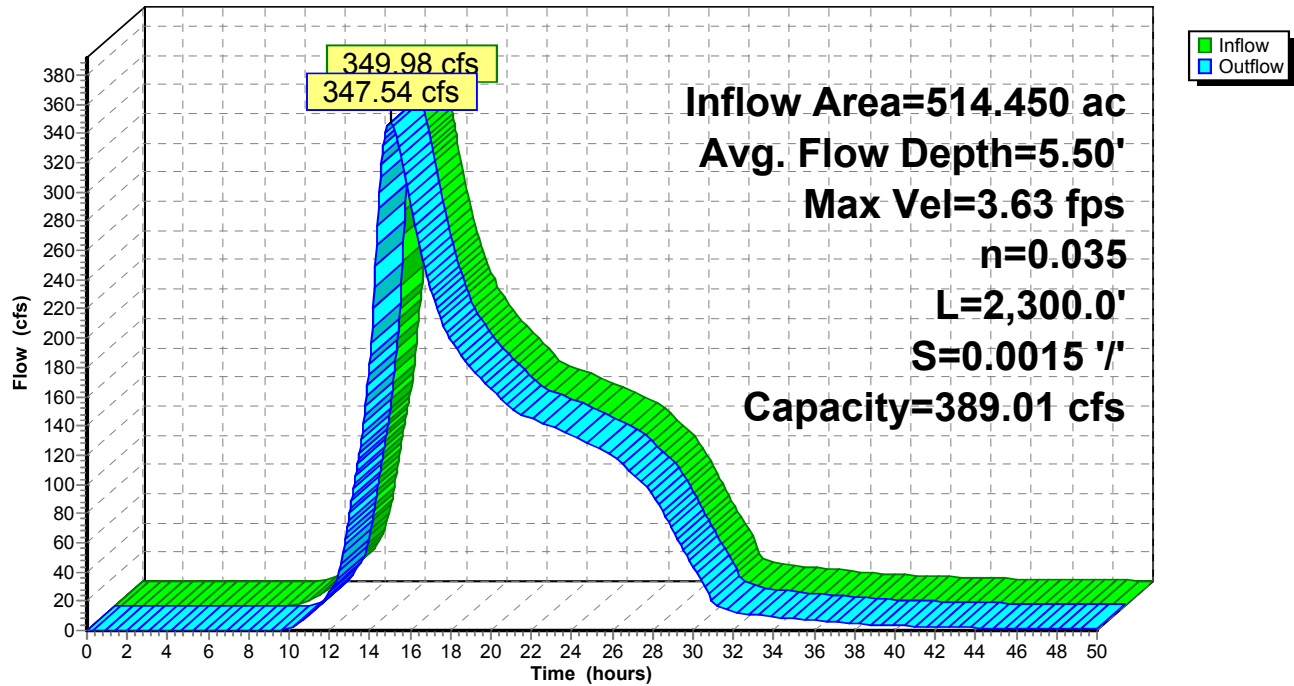
Type II 24-hr 25yr-24hr Rainfall=9.20", $Ia/S=0.30$

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Reach 27R: RED6

Hydrograph



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Summary for Reach 30R: RED12

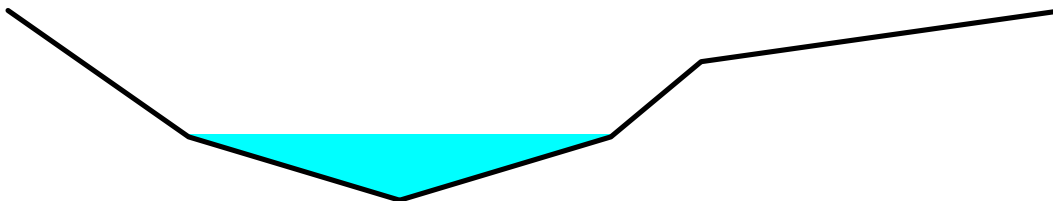
[79] Warning: Submerged Pond 28P Primary device # 2 INLET by 1.93'

Inflow Area = 400.100 ac, 0.00% Impervious, Inflow Depth > 3.08" for 25yr-24hr event
Inflow = 62.48 cfs @ 17.76 hrs, Volume= 102.616 af
Outflow = 62.48 cfs @ 17.81 hrs, Volume= 102.616 af, Atten= 0%, Lag= 2.9 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-50.00 hrs, dt= 0.05 hrs
Max. Velocity= 3.87 fps, Min. Travel Time= 1.7 min
Avg. Velocity= 2.42 fps, Avg. Travel Time= 2.8 min

Peak Storage= 6,458 cf @ 17.78 hrs
Average Depth at Peak Storage= 2.20'
Bank-Full Depth= 6.30' Flow Area= 105.1 sf, Capacity= 762.50 cfs

Custom cross-section, Length= 400.0' Slope= 0.0075 '/' (101 Elevation Intervals)
Constant n= 0.035
Inlet Invert= 28.60', Outlet Invert= 25.60'



Offset (feet)	Elevation (feet)	Chan.Depth (feet)
0.00	31.90	0.00
6.00	27.70	4.20
13.00	25.60	6.30
20.00	27.70	4.20
23.00	30.20	1.70
35.00	31.90	0.00

Depth (feet)	End Area (sq-ft)	Perim. (feet)	Storage (cubic-feet)	Discharge (cfs)
0.00	0.0	0.0	0	0.00
2.10	14.7	14.6	5,880	54.26
4.60	57.9	22.9	23,166	395.43
6.30	105.1	38.0	42,060	762.50

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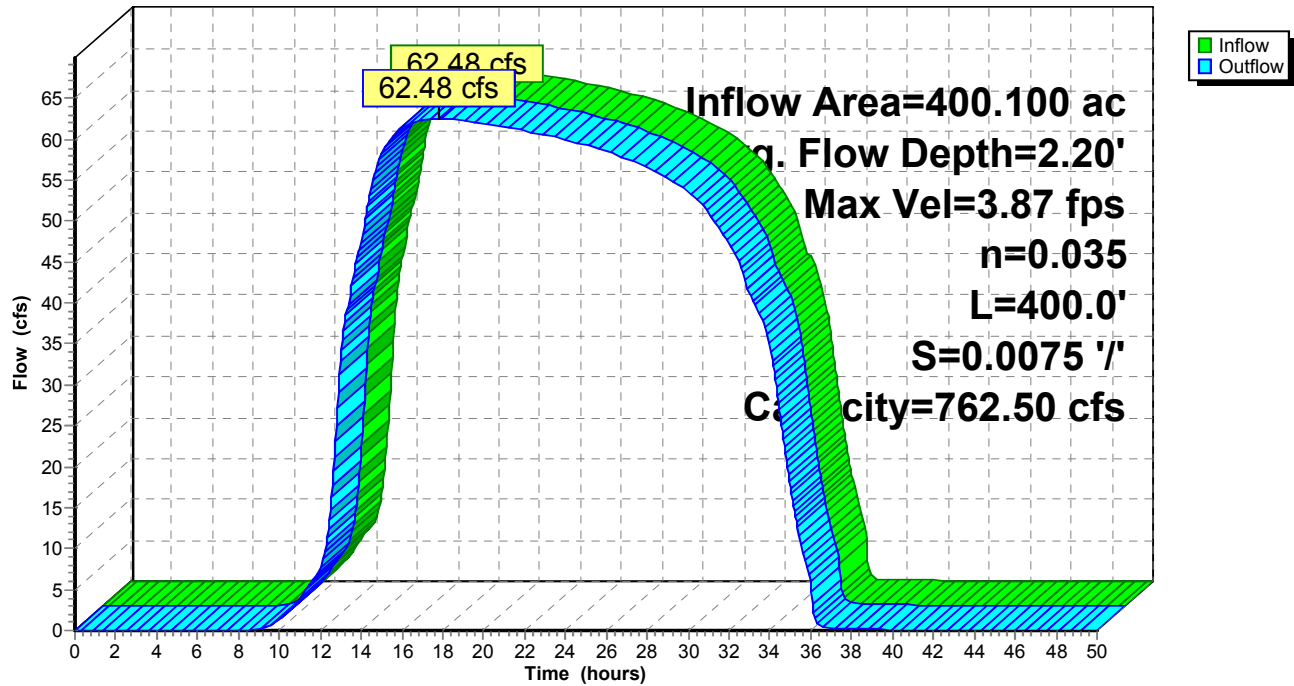
Type II 24-hr 25yr-24hr Rainfall=9.20", $Ia/S=0.30$

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Reach 30R: RED12

Hydrograph



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Summary for Reach 31R: RED11

[91] Warning: Storage range exceeded by 4.42'

[55] Hint: Peak inflow is 317% of Manning's capacity

[63] Warning: Exceeded Reach 21R INLET depth by 4.55' @ 14.25 hrs

[63] Warning: Exceeded Reach 30R INLET depth by 5.64' @ 14.35 hrs

[81] Warning: Exceeded Pond 25P by 8.84' @ 14.70 hrs

[81] Warning: Exceeded Pond 33P by 4.66' @ 14.40 hrs

Inflow Area = 1,609.700 ac, 0.00% Impervious, Inflow Depth > 1.48" for 25yr-24hr event

Inflow = 220.49 cfs @ 13.59 hrs, Volume= 198.596 af

Outflow = 191.07 cfs @ 14.98 hrs, Volume= 198.269 af, Atten= 13%, Lag= 83.1 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-50.00 hrs, dt= 0.05 hrs

Max. Velocity= 0.74 fps, Min. Travel Time= 36.1 min

Avg. Velocity= 0.52 fps, Avg. Travel Time= 51.7 min

Peak Storage= 414,134 cf @ 14.38 hrs

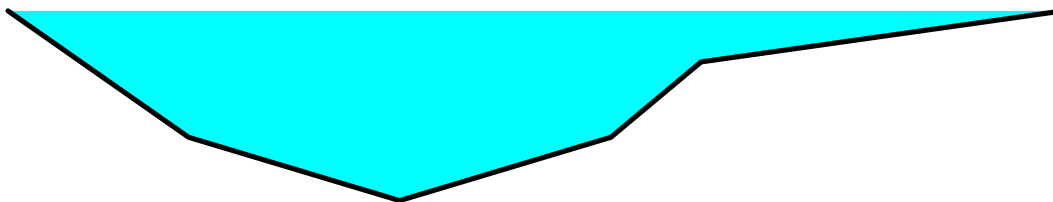
Average Depth at Peak Storage= 10.72'

Bank-Full Depth= 6.30' Flow Area= 105.1 sf, Capacity= 69.61 cfs

Custom cross-section, Length= 1,600.0' Slope= 0.0001 '/' (101 Elevation Intervals)

Constant n= 0.035

Inlet Invert= 25.60', Outlet Invert= 25.50'



Offset (feet)	Elevation (feet)	Chan.Depth (feet)
0.00	31.90	0.00
6.00	27.70	4.20
13.00	25.60	6.30
20.00	27.70	4.20
23.00	30.20	1.70
35.00	31.90	0.00

Depth (feet)	End Area (sq-ft)	Perim. (feet)	Storage (cubic-feet)	Discharge (cfs)
0.00	0.0	0.0	0	0.00
2.10	14.7	14.6	23,520	4.95
4.60	57.9	22.9	92,663	36.10
6.30	105.1	38.0	168,240	69.61

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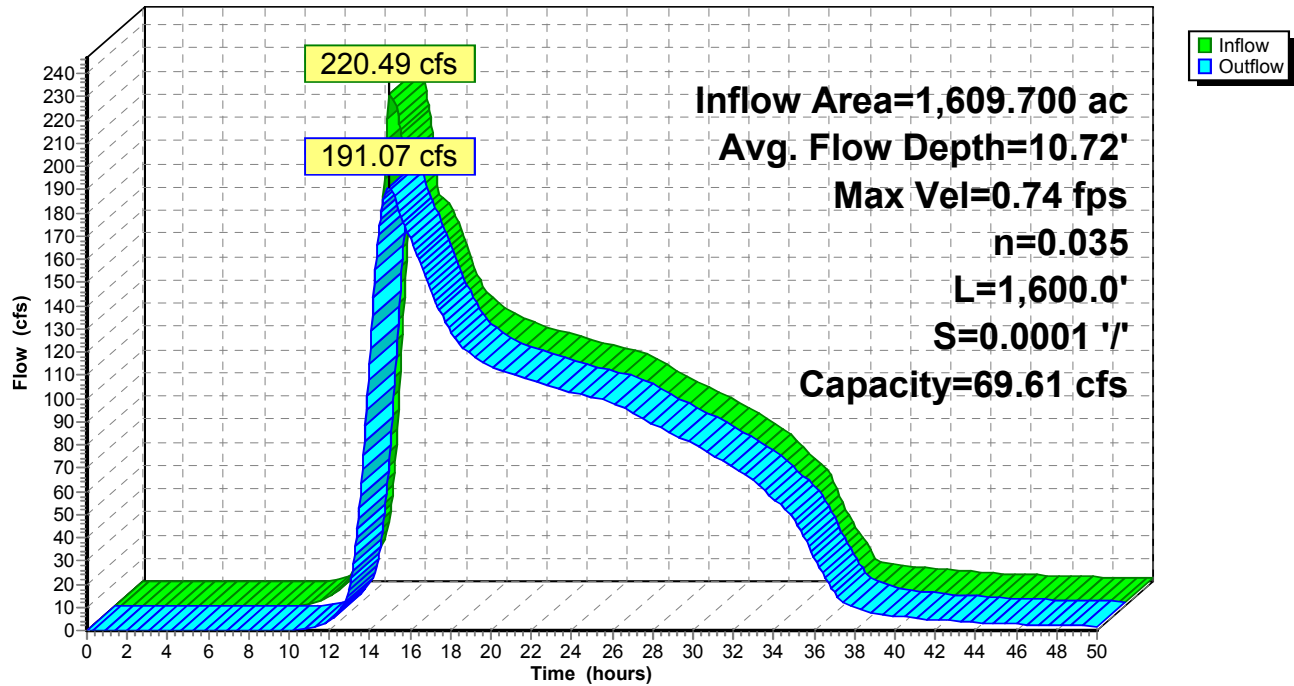
Type II 24-hr 25yr-24hr Rainfall=9.20", $Ia/S=0.30$

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Reach 31R: RED11

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Summary for Reach 35R: RED10

[91] Warning: Storage range exceeded by 0.09'

[55] Hint: Peak inflow is 105% of Manning's capacity

[63] Warning: Exceeded Reach 31R INLET depth by 0.60' @ 0.00 hrs

Inflow Area = 1,609.700 ac, 0.00% Impervious, Inflow Depth > 1.48" for 25yr-24hr event
Inflow = 191.07 cfs @ 14.98 hrs, Volume= 198.269 af
Outflow = 188.37 cfs @ 15.40 hrs, Volume= 198.123 af, Atten= 1%, Lag= 25.2 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-50.00 hrs, dt= 0.05 hrs

Max. Velocity= 1.74 fps, Min. Travel Time= 13.4 min

Avg. Velocity= 1.16 fps, Avg. Travel Time= 20.1 min

Peak Storage= 151,367 cf @ 15.18 hrs

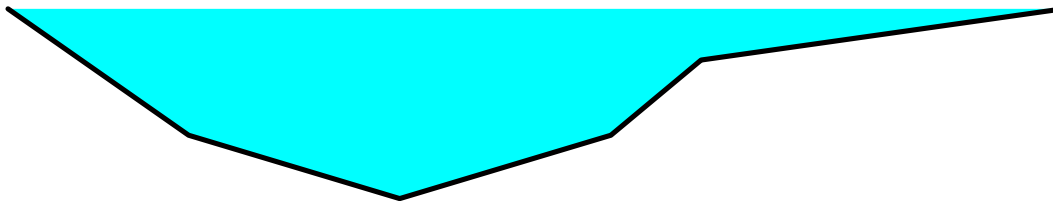
Average Depth at Peak Storage= 6.39'

Bank-Full Depth= 6.30' Flow Area= 105.1 sf, Capacity= 182.27 cfs

Custom cross-section, Length= 1,400.0' Slope= 0.0004 '/' (101 Elevation Intervals)

Constant n= 0.035

Inlet Invert= 26.20', Outlet Invert= 25.60'



Offset (feet)	Elevation (feet)	Chan.Depth (feet)
0.00	31.90	0.00
6.00	27.70	4.20
13.00	25.60	6.30
20.00	27.70	4.20
23.00	30.20	1.70
35.00	31.90	0.00

Depth (feet)	End Area (sq-ft)	Perim. (feet)	Storage (cubic-feet)	Discharge (cfs)
0.00	0.0	0.0	0	0.00
2.10	14.7	14.6	20,580	12.97
4.60	57.9	22.9	81,080	94.53
6.30	105.1	38.0	147,210	182.27

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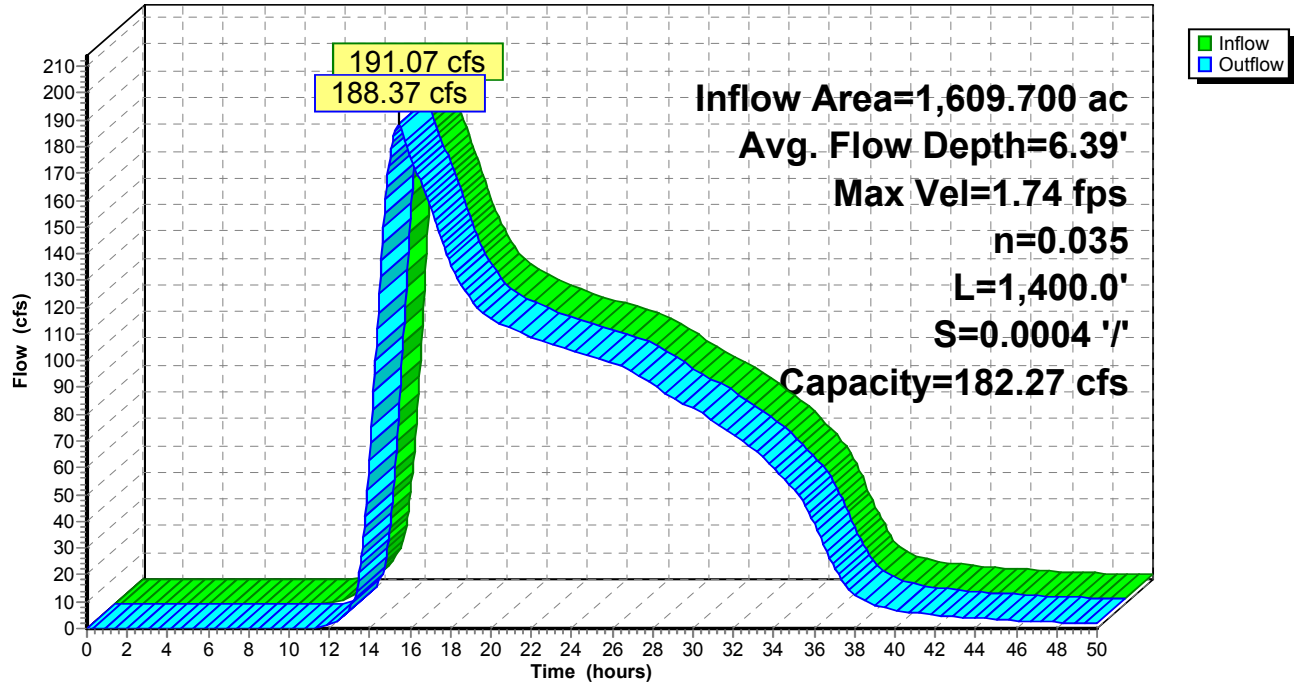
Type II 24-hr 25yr-24hr Rainfall=9.20", $I_a/S=0.30$

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Reach 35R: RED10

Hydrograph



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Summary for Pond 5P: Wetland Storage BE4

Inflow Area = 201.000 ac, 0.00% Impervious, Inflow Depth = 5.69" for 25yr-24hr event
Inflow = 606.52 cfs @ 12.64 hrs, Volume= 95.328 af
Outflow = 122.41 cfs @ 14.06 hrs, Volume= 95.329 af, Atten= 80%, Lag= 85.5 min
Primary = 122.41 cfs @ 14.06 hrs, Volume= 95.329 af

Routing by Stor-Ind method, Time Span= 0.00-50.00 hrs, dt= 0.05 hrs
Peak Elev= 34.18' @ 14.06 hrs Surf.Area= 48.832 ac Storage= 47.539 af

Plug-Flow detention time= 289.5 min calculated for 95.234 af (100% of inflow)
Center-of-Mass det. time= 289.5 min (1,158.4 - 869.0)

Volume	Invert	Avail.Storage	Storage Description
#1	30.00'	351.750 af	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
30.00	0.000	0.000	0.000
31.00	2.000	1.000	1.000
32.00	4.000	3.000	4.000
33.00	12.100	8.050	12.050
34.00	42.200	27.150	39.200
35.00	78.400	60.300	99.500
36.00	126.600	102.500	202.000
37.00	172.900	149.750	351.750

Device	Routing	Invert	Outlet Devices
#1	Primary	28.87'	36.0" Round Culvert L= 34.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 28.87' / 28.39' S= 0.0141 '/' Cc= 0.900 n= 0.024, Flow Area= 7.07 sf
#2	Primary	34.00'	264.0' long x 15.0' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=121.82 cfs @ 14.06 hrs HW=34.18' (Free Discharge)

1=Culvert (Barrel Controls 66.36 cfs @ 9.39 fps)

2=Broad-Crested Rectangular Weir (Weir Controls 55.46 cfs @ 1.15 fps)

Existing

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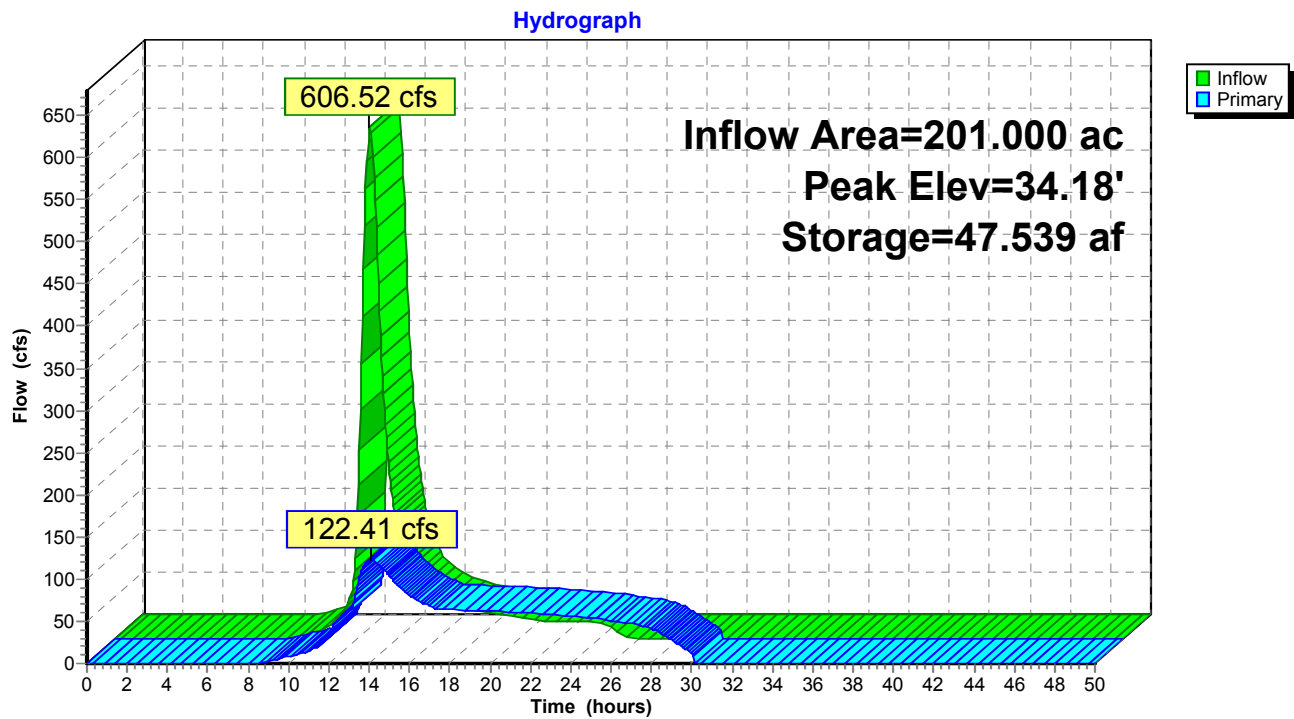
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Pond 5P: Wetland Storage BE4



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Summary for Pond 19P: Wetland Storage - BE14A

Inflow Area = 1,021.300 ac, 0.00% Impervious, Inflow Depth = 3.75" for 25yr-24hr event
Inflow = 739.32 cfs @ 13.86 hrs, Volume= 318.844 af
Outflow = 284.50 cfs @ 15.88 hrs, Volume= 318.730 af, Atten= 62%, Lag= 121.7 min
Primary = 284.50 cfs @ 15.88 hrs, Volume= 318.730 af

Routing by Stor-Ind method, Time Span= 0.00-50.00 hrs, dt= 0.05 hrs
Peak Elev= 37.87' @ 15.88 hrs Surf.Area= 75.472 ac Storage= 95.021 af

Plug-Flow detention time= 188.3 min calculated for 318.730 af (100% of inflow)
Center-of-Mass det. time= 187.9 min (1,368.4 - 1,180.5)

Volume	Invert	Avail.Storage	Storage Description
#1	34.00'	988.550 af	Custom Stage Data (Prismatic) Listed below (Recalc)
Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
34.00	0.000	0.000	0.000
35.00	5.000	2.500	2.500
36.00	15.000	10.000	12.500
37.00	44.900	29.950	42.450
38.00	79.900	62.400	104.850
40.00	144.800	224.700	329.550
44.00	184.700	659.000	988.550

Device	Routing	Invert	Outlet Devices
#1	Primary	34.00'	Custom Weir/Orifice, Cv= 2.62 (C= 3.28) Head (feet) 0.00 0.70 2.70 5.10 Width (feet) 0.00 9.00 16.00 33.00

Primary OutFlow Max=284.44 cfs @ 15.88 hrs HW=37.87' (Free Discharge)
↑1=Custom Weir/Orifice (Weir Controls 284.44 cfs @ 5.49 fps)

Existing

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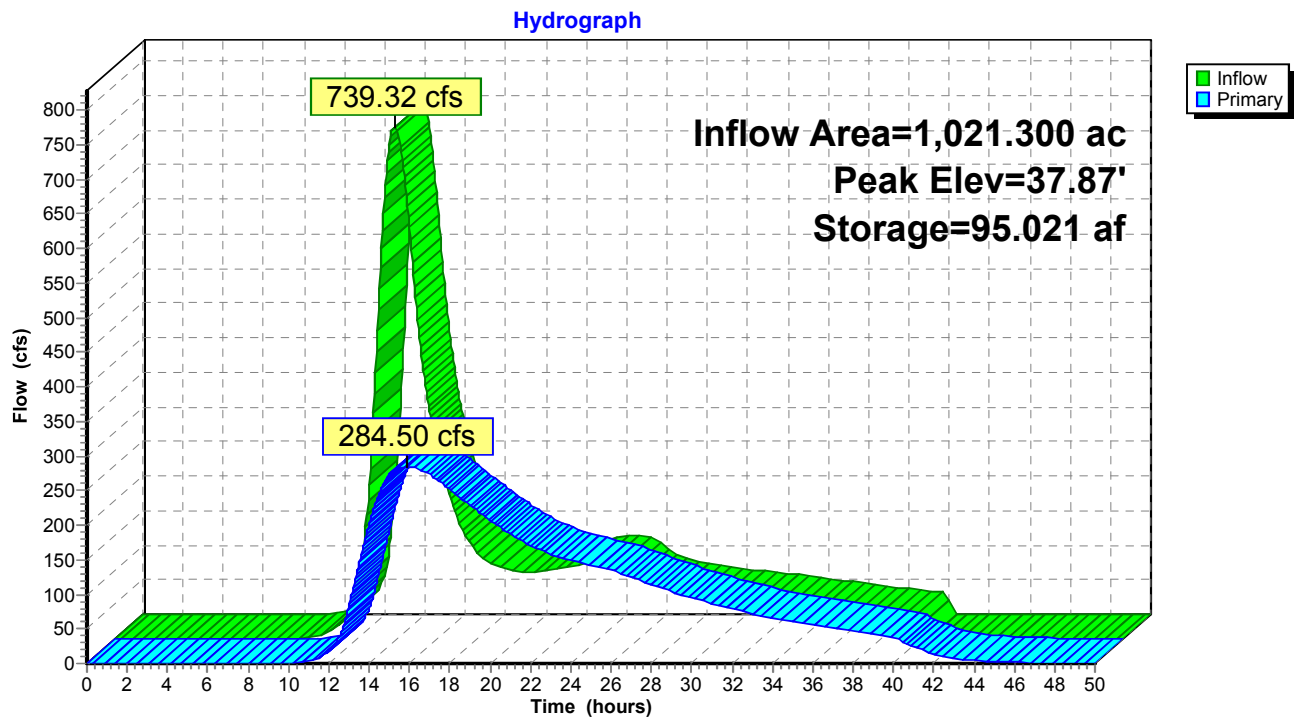
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Pond 19P: Wetland Storage - BE14A



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Summary for Pond 20P: WRC25 RC25 and RC25A

Inflow Area = 112.300 ac, 0.00% Impervious, Inflow Depth = 5.83" for 25yr-24hr event
Inflow = 174.11 cfs @ 13.79 hrs, Volume= 54.560 af
Outflow = 36.10 cfs @ 17.29 hrs, Volume= 52.056 af, Atten= 79%, Lag= 209.7 min
Primary = 36.10 cfs @ 17.29 hrs, Volume= 52.056 af

Routing by Stor-Ind method, Time Span= 0.00-50.00 hrs, dt= 0.05 hrs
Peak Elev= 35.13' @ 17.29 hrs Surf.Area= 23.209 ac Storage= 31.279 af

Plug-Flow detention time= 503.7 min calculated for 52.004 af (95% of inflow)
Center-of-Mass det. time= 477.7 min (1,428.5 - 950.8)

Volume	Invert	Avail.Storage	Storage Description
#1	30.00'	100.550 af	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
30.00	0.600	0.000	0.000
31.00	1.100	0.850	0.850
32.00	1.700	1.400	2.250
33.00	5.600	3.650	5.900
34.00	9.000	7.300	13.200
35.00	21.300	15.150	28.350
36.00	35.800	28.550	56.900
37.00	51.500	43.650	100.550

Device	Routing	Invert	Outlet Devices
#1	Primary	36.00'	264.0' long Sharp-Crested Rectangular Weir 2 End Contraction(s)
#2	Primary	32.04'	36.0" Round Culvert L= 23.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 32.04' / 31.39' S= 0.0283 '/' Cc= 0.900 n= 0.024, Flow Area= 7.07 sf
#3	Primary	30.01'	8.0" Round Culvert L= 29.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 30.01' / 29.99' S= 0.0007 '/' Cc= 0.900 n= 0.024, Flow Area= 0.35 sf

Primary OutFlow Max=36.10 cfs @ 17.29 hrs HW=35.13' (Free Discharge)

1=Sharp-Crested Rectangular Weir (Controls 0.00 cfs)
2=Culvert (Inlet Controls 33.90 cfs @ 4.80 fps)
3=Culvert (Barrel Controls 2.20 cfs @ 6.31 fps)

Existing

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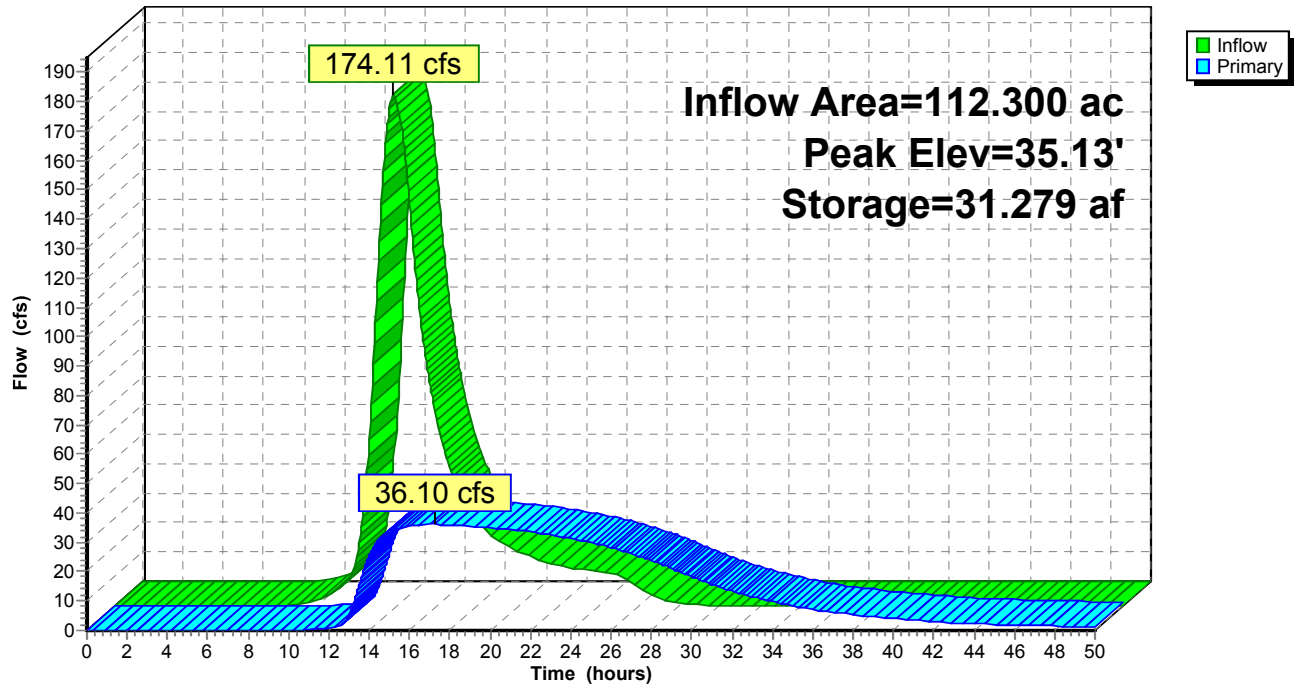
Type II 24-hr 25yr-24hr Rainfall=9.20", Ia/S=0.30

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Pond 20P: WRC25 RC25 and RC25A

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Type II 24-hr 25yr-24hr Rainfall=9.20", Ia/S=0.30

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Summary for Pond 22P: Wetland Storage - BE14B

Inflow Area = 333.700 ac, 0.00% Impervious, Inflow Depth = 5.55" for 25yr-24hr event
 Inflow = 494.21 cfs @ 13.86 hrs, Volume= 154.397 af
 Outflow = 429.20 cfs @ 14.45 hrs, Volume= 154.302 af, Atten= 13%, Lag= 35.5 min
 Primary = 336.40 cfs @ 14.45 hrs, Volume= 70.360 af
 Secondary = 92.80 cfs @ 14.45 hrs, Volume= 83.942 af

Routing by Stor-Ind method, Time Span= 0.00-50.00 hrs, dt= 0.05 hrs
 Peak Elev= 38.35' @ 14.45 hrs Surf.Area= 40.452 ac Storage= 38.882 af

Plug-Flow detention time= 144.8 min calculated for 154.302 af (100% of inflow)
 Center-of-Mass det. time= 144.3 min (1,099.7 - 955.4)

Volume	Invert	Avail.Storage	Storage Description
#1	36.00'	583.850 af	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
36.00	3.300	0.000	0.000
37.00	10.000	6.650	6.650
38.00	30.000	20.000	26.650
39.00	60.100	45.050	71.700
40.00	83.400	71.750	143.450
42.00	110.100	193.500	336.950
44.00	136.800	246.900	583.850

Device	Routing	Invert	Outlet Devices
#1	Primary	38.00'	480.0' long Sharp-Crested Rectangular Weir 2 End Contraction(s)
#2	Primary	36.00'	24.0" Round Culvert L= 23.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 36.00' / 34.30' S= 0.0739 ' S= 0.0739 ' Cc= 0.900 n= 0.024, Flow Area= 3.14 sf
#3	Secondary	36.00'	Custom Weir/Orifice, Cv= 2.62 (C= 3.28) Head (feet) 0.00 1.00 5.00 Width (feet) 6.00 8.00 16.00

Primary OutFlow Max=334.95 cfs @ 14.45 hrs HW=38.35' (Free Discharge)

↑ **1=Sharp-Crested Rectangular Weir** (Weir Controls 321.09 cfs @ 1.93 fps)
 ↓ **2=Culvert** (Inlet Controls 13.86 cfs @ 4.41 fps)

Secondary OutFlow Max=92.78 cfs @ 14.45 hrs HW=38.35' (Free Discharge)

↑ **3=Custom Weir/Orifice** (Weir Controls 92.78 cfs @ 4.74 fps)

Existing

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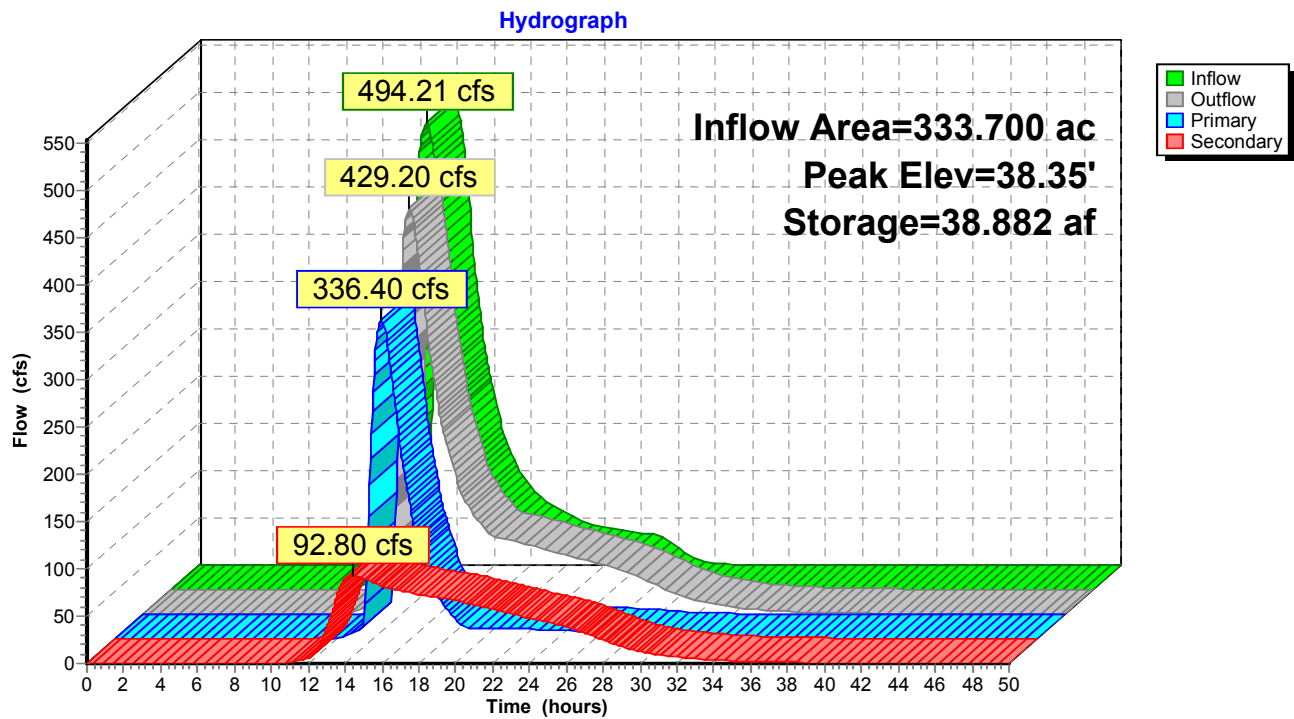
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Pond 22P: Wetland Storage - BE14B



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Type II 24-hr 25yr-24hr Rainfall=9.20", Ia/S=0.30

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Summary for Pond 23P: Wetland Storage - NE8

Inflow Area = 102.230 ac, 0.00% Impervious, Inflow Depth = 5.97" for 25yr-24hr event
Inflow = 190.46 cfs @ 13.46 hrs, Volume= 50.848 af
Outflow = 12.93 cfs @ 21.24 hrs, Volume= 36.519 af, Atten= 93%, Lag= 466.8 min
Primary = 12.93 cfs @ 21.24 hrs, Volume= 36.519 af

Routing by Stor-Ind method, Time Span= 0.00-50.00 hrs, dt= 0.05 hrs
Peak Elev= 31.80' @ 21.24 hrs Surf.Area= 56.781 ac Storage= 37.725 af

Plug-Flow detention time= 1,007.9 min calculated for 36.483 af (72% of inflow)
Center-of-Mass det. time= 908.6 min (1,830.8 - 922.2)

Volume	Invert	Avail.Storage	Storage Description
#1	30.00'	219.000 af	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
30.00	1.900	0.000	0.000
31.00	15.500	8.700	8.700
32.00	66.900	41.200	49.900
33.00	87.200	77.050	126.950
34.00	96.900	92.050	219.000

Device	Routing	Invert	Outlet Devices
#1	Primary	33.50'	600.0' long Sharp-Crested Rectangular Weir 2 End Contraction(s)
#2	Primary	29.63'	24.0" Round Culvert L= 29.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 29.63' / 28.90' S= 0.0252 ' /' Cc= 0.900 n= 0.024, Flow Area= 3.14 sf

Primary OutFlow Max=12.93 cfs @ 21.24 hrs HW=31.80' (Free Discharge)

1=Sharp-Crested Rectangular Weir (Controls 0.00 cfs)
2=Culvert (Inlet Controls 12.93 cfs @ 4.12 fps)

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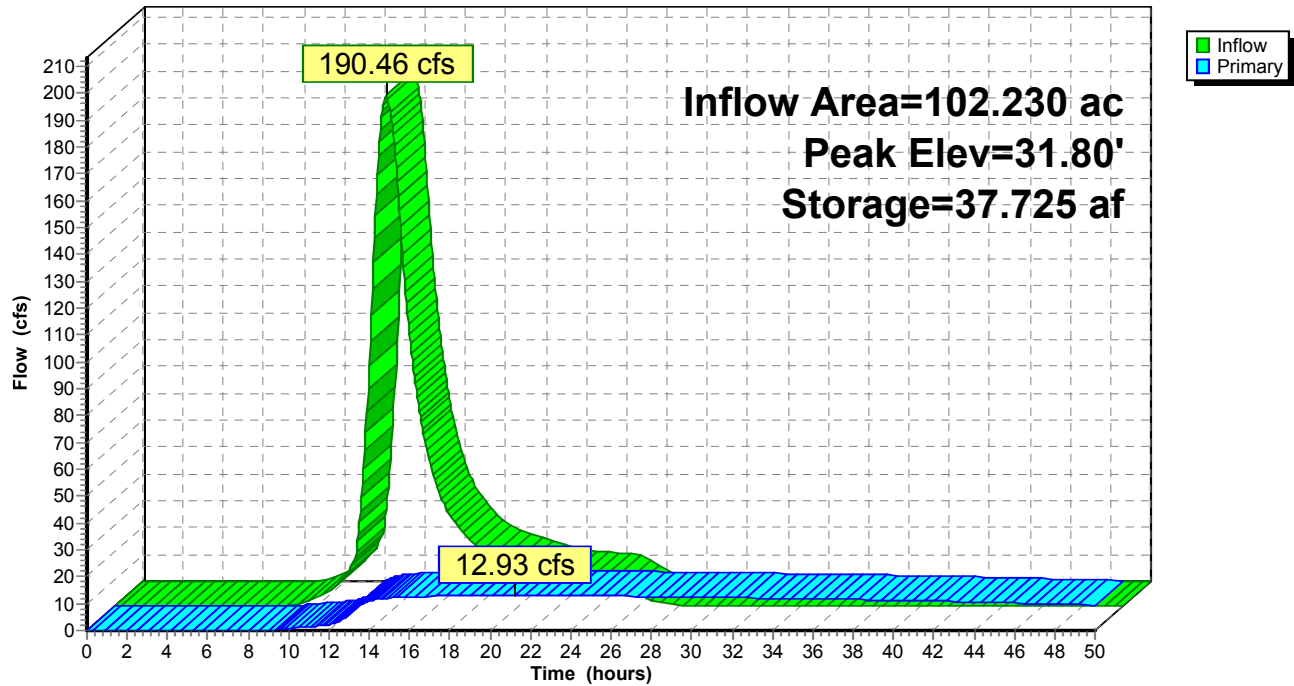
Type II 24-hr 25yr-24hr Rainfall=9.20", Ia/S=0.30

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Pond 23P: Wetland Storage - NE8

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Summary for Pond 25P: WREC22 and REC22

[57] Hint: Peaked at 31.22' (Flood elevation advised)

[61] Hint: Exceeded Reach 20R outlet invert by 1.70' @ 13.55 hrs

Inflow Area = 1,021.300 ac, 0.00% Impervious, Inflow Depth = 0.09" for 25yr-24hr event
Inflow = 76.27 cfs @ 13.57 hrs, Volume= 7.256 af
Outflow = 76.27 cfs @ 13.57 hrs, Volume= 7.256 af, Atten= 0%, Lag= 0.0 min
Primary = 76.27 cfs @ 13.57 hrs, Volume= 7.256 af

Routing by Stor-Ind method, Time Span= 0.00-50.00 hrs, dt= 0.05 hrs

Peak Elev= 31.22' @ 13.57 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	36.00'	240.0' long Sharp-Crested Rectangular Weir 2 End Contraction(s) 72.0" Round Culvert L= 40.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 27.24' / 27.18' S= 0.0015 ' / Cc= 0.900 n= 0.024, Flow Area= 28.27 sf
#2	Primary	27.24'	

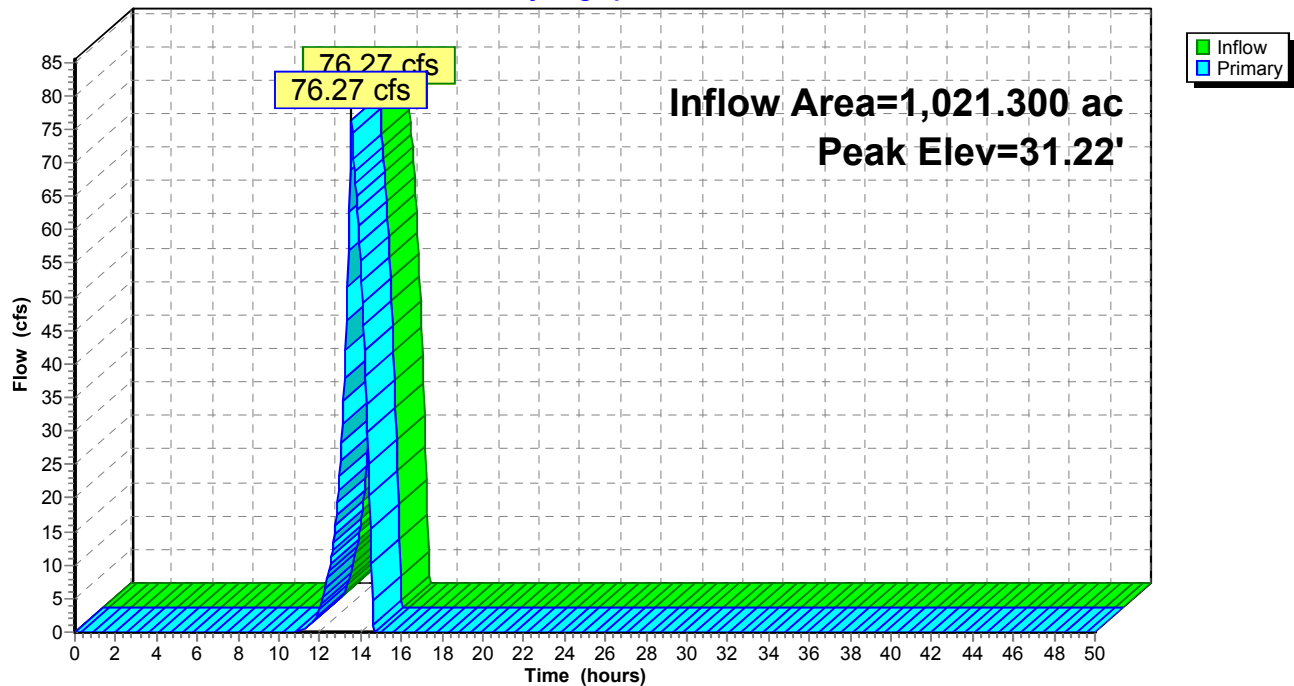
Primary OutFlow Max=75.36 cfs @ 13.57 hrs HW=31.19' (Free Discharge)

1=Sharp-Crested Rectangular Weir (Controls 0.00 cfs)

2=Culvert (Barrel Controls 75.36 cfs @ 5.42 fps)

Pond 25P: WREC22 and REC22

Hydrograph



Existing

Type II 24-hr 25yr-24hr Rainfall=9.20", Ia/S=0.30

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Summary for Pond 26P: Wetland Storage - BE9

[81] Warning: Exceeded Pond 35P by 3.11' @ 22.75 hrs

Inflow Area = 181.300 ac, 0.00% Impervious, Inflow Depth = 5.55" for 25yr-24hr event
Inflow = 216.16 cfs @ 13.92 hrs, Volume= 83.870 af
Outflow = 165.11 cfs @ 14.76 hrs, Volume= 83.870 af, Atten= 24%, Lag= 50.4 min
Primary = 165.11 cfs @ 14.76 hrs, Volume= 83.870 af

Routing by Stor-Ind method, Time Span= 0.00-50.00 hrs, dt= 0.05 hrs
Peak Elev= 34.26' @ 14.76 hrs Surf.Area= 27.035 ac Storage= 19.754 af

Plug-Flow detention time= 136.6 min calculated for 83.786 af (100% of inflow)
Center-of-Mass det. time= 136.5 min (1,121.4 - 984.9)

Volume	Invert	Avail.Storage	Storage Description
#1	30.00'	141.150 af	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
30.00	0.000	0.000	0.000
31.00	1.000	0.500	0.500
32.00	2.000	1.500	2.000
33.00	6.100	4.050	6.050
34.00	11.200	8.650	14.700
35.00	71.100	41.150	55.850
36.00	99.500	85.300	141.150

Device	Routing	Invert	Outlet Devices
#1	Primary	34.00'	264.0' long Sharp-Crested Rectangular Weir 2 End Contraction(s)
#2	Primary	29.62'	36.0" Round Culvert L= 34.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 29.62' / 29.07' S= 0.0162 '/' Cc= 0.900 n= 0.024, Flow Area= 7.07 sf

Primary OutFlow Max=164.93 cfs @ 14.76 hrs HW=34.26' (Free Discharge)

1=Sharp-Crested Rectangular Weir (Weir Controls 117.28 cfs @ 1.68 fps)
2=Culvert (Inlet Controls 47.65 cfs @ 6.74 fps)

Existing

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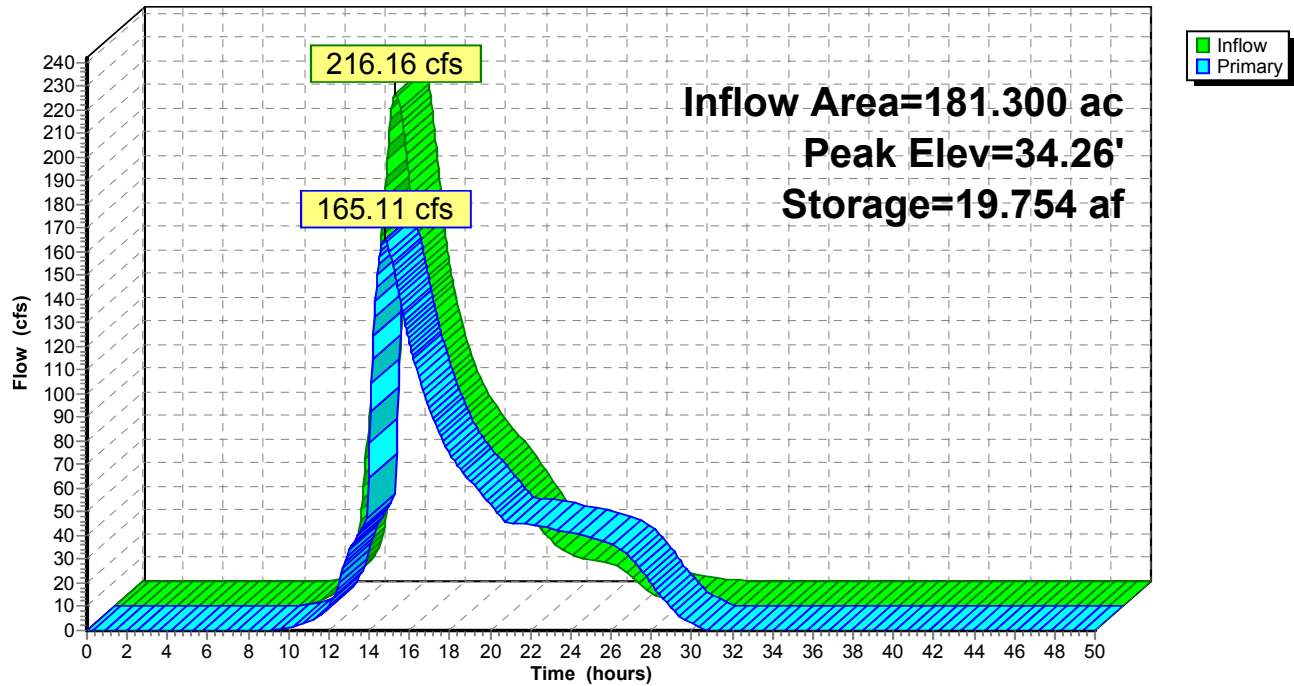
Type II 24-hr 25yr-24hr Rainfall=9.20", Ia/S=0.30

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Pond 26P: Wetland Storage - BE9

Hydrograph



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Summary for Pond 28P: Wetland Storage for BE12

[63] Warning: Exceeded Reach 26R INLET depth by 2.49' @ 19.75 hrs

Inflow Area = 400.100 ac, 0.00% Impervious, Inflow Depth = 3.08" for 25yr-24hr event
Inflow = 388.23 cfs @ 14.69 hrs, Volume= 102.616 af
Outflow = 62.48 cfs @ 17.76 hrs, Volume= 102.616 af, Atten= 84%, Lag= 184.3 min
Primary = 62.48 cfs @ 17.76 hrs, Volume= 102.616 af

Routing by Stor-Ind method, Time Span= 0.00-50.00 hrs, dt= 0.05 hrs
Starting Elev= 29.00' Surf.Area= 0.000 ac Storage= 0.000 af
Peak Elev= 35.78' @ 17.76 hrs Surf.Area= 50.374 ac Storage= 60.781 af
Flood Elev= 37.00' Surf.Area= 57.400 ac Storage= 130.200 af

Plug-Flow detention time= 424.2 min calculated for 102.616 af (100% of inflow)
Center-of-Mass det. time= 424.2 min (1,395.4 - 971.2)

Volume	Invert	Avail.Storage	Storage Description
#1	30.00'	130.200 af	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
30.00	0.600	0.000	0.000
31.00	1.200	0.900	0.900
32.00	1.900	1.550	2.450
33.00	6.200	4.050	6.500
34.00	8.600	7.400	13.900
35.00	25.900	17.250	31.150
36.00	57.400	41.650	72.800
37.00	57.400	57.400	130.200

Device	Routing	Invert	Outlet Devices
#1	Primary	36.00'	600.0' long Sharp-Crested Rectangular Weir 2 End Contraction(s)
#2	Primary	28.87'	36.0" Round Culvert L= 20.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 28.87' / 28.68' S= 0.0095 ' / ' Cc= 0.900 n= 0.024, Flow Area= 7.07 sf

Primary OutFlow Max=62.48 cfs @ 17.76 hrs HW=35.78' (Free Discharge)

1=Sharp-Crested Rectangular Weir (Controls 0.00 cfs)

2=Culvert (Inlet Controls 62.48 cfs @ 8.84 fps)

Existing

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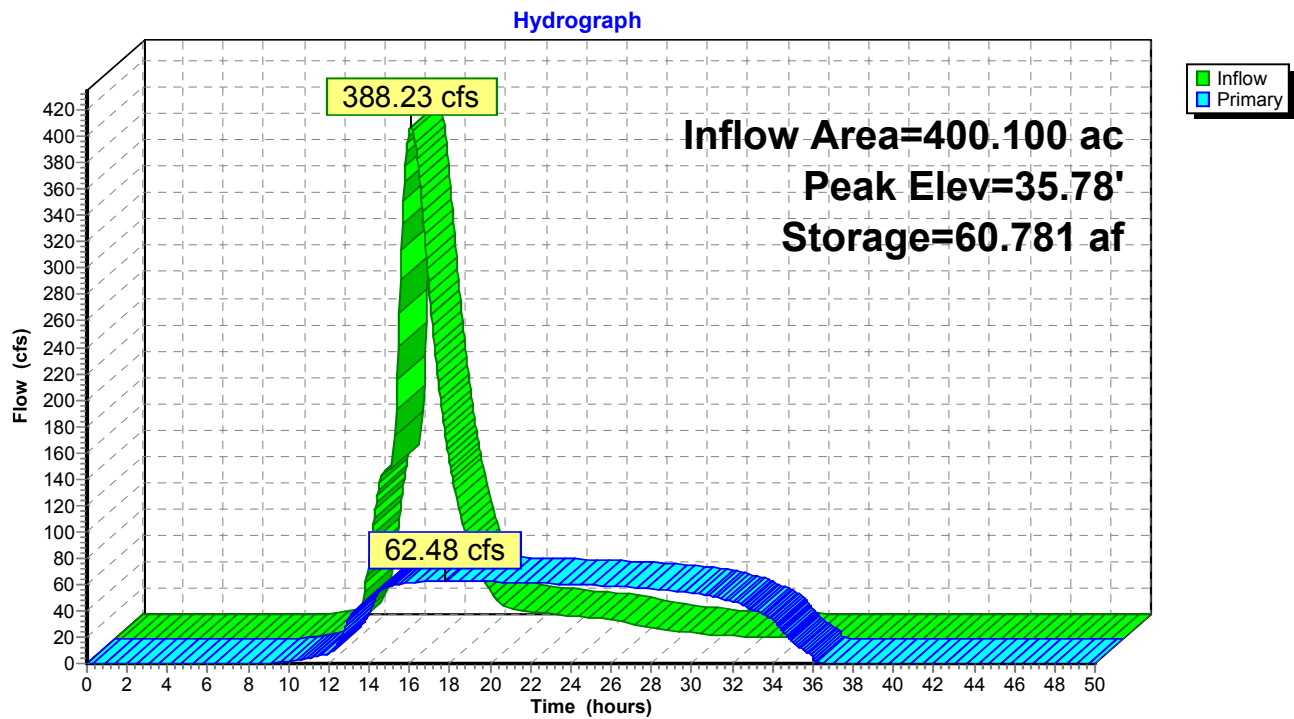
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Pond 28P: Wetland Storage for BE12



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Type II 24-hr 25yr-24hr Rainfall=9.20", Ia/S=0.30

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Summary for Pond 29P: Wetland Storage BE7

Inflow Area = 19.500 ac, 0.00% Impervious, Inflow Depth = 5.97" for 25yr-24hr event
Inflow = 30.81 cfs @ 13.93 hrs, Volume= 9.699 af
Outflow = 24.45 cfs @ 14.63 hrs, Volume= 9.699 af, Atten= 21%, Lag= 42.5 min
Primary = 24.45 cfs @ 14.63 hrs, Volume= 9.699 af

Routing by Stor-Ind method, Time Span= 0.00-50.00 hrs, dt= 0.05 hrs
Peak Elev= 31.78' @ 14.63 hrs Surf.Area= 3.869 ac Storage= 1.888 af

Plug-Flow detention time= 60.1 min calculated for 9.699 af (100% of inflow)
Center-of-Mass det. time= 59.7 min (1,010.3 - 950.6)

Volume	Invert	Avail.Storage	Storage Description
#1	31.00'	53.350 af	Custom Stage Data (Prismatic) Listed below (Recalc)
Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
31.00	1.000	0.000	0.000
32.00	4.700	2.850	2.850
33.00	6.400	5.550	8.400
34.00	8.400	7.400	15.800
35.00	9.800	9.100	24.900
36.00	14.000	11.900	36.800
37.00	19.100	16.550	53.350

Device	Routing	Invert	Outlet Devices
#1	Primary	31.00'	Custom Weir/Orifice, Cv= 2.62 (C= 3.28) Head (feet) 0.00 1.00 5.00 Width (feet) 10.00 13.00 25.00

Primary OutFlow Max=24.44 cfs @ 14.63 hrs HW=31.78' (Free Discharge)

↑1=Custom Weir/Orifice (Weir Controls 24.44 cfs @ 2.82 fps)

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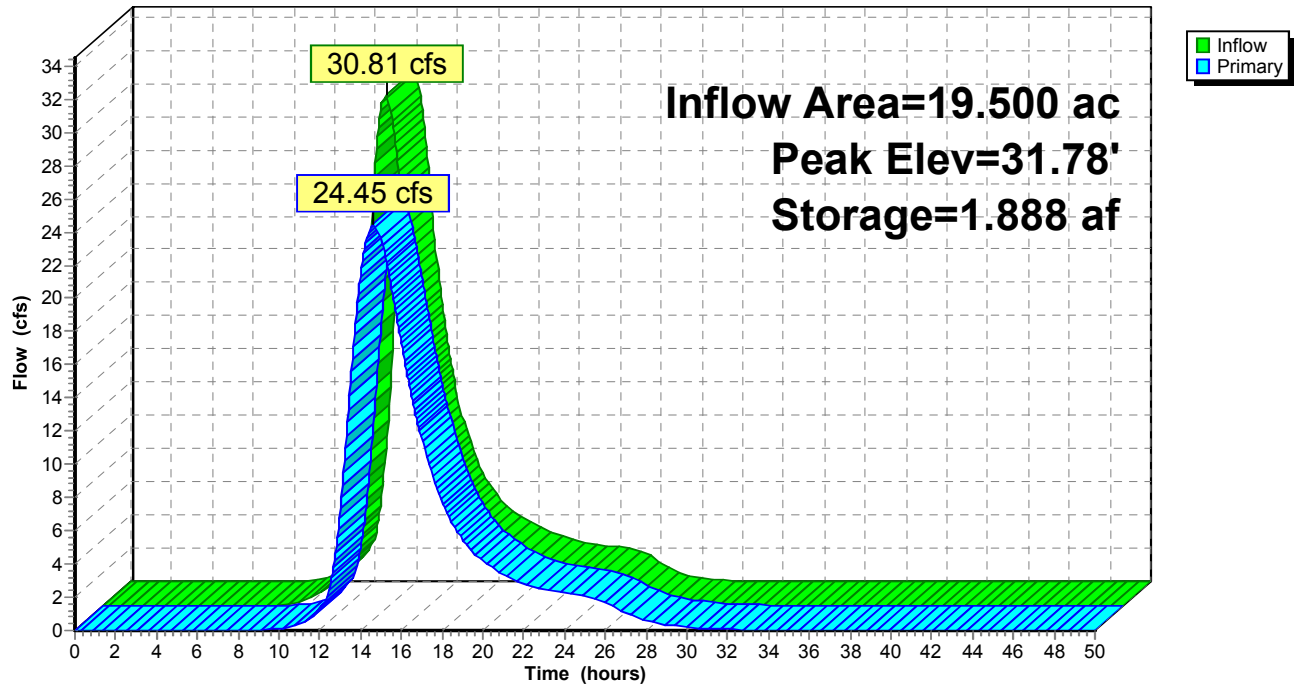
Type II 24-hr 25yr-24hr Rainfall=9.20", Ia/S=0.30

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Pond 29P: Wetland Storage BE7

Hydrograph



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Summary for Pond 30P: WRC18 and RC18

[57] Hint: Peaked at 34.76' (Flood elevation advised)

[81] Warning: Exceeded Pond 26P by 0.49' @ 14.75 hrs

Inflow Area = 181.300 ac, 0.00% Impervious, Inflow Depth = 5.55" for 25yr-24hr event
Inflow = 165.11 cfs @ 14.76 hrs, Volume= 83.870 af
Outflow = 165.11 cfs @ 14.76 hrs, Volume= 83.870 af, Atten= 0%, Lag= 0.0 min
Primary = 165.11 cfs @ 14.76 hrs, Volume= 83.870 af

Routing by Stor-Ind method, Time Span= 0.00-50.00 hrs, dt= 0.05 hrs

Peak Elev= 34.76' @ 14.76 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	34.50'	264.0' long Sharp-Crested Rectangular Weir 2 End Contraction(s) 36.0" Round Culvert L= 17.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 29.42' / 29.26' S= 0.0094 ' S= 0.0094 ' Cc= 0.900 n= 0.024, Flow Area= 7.07 sf
#2	Primary	29.42'	

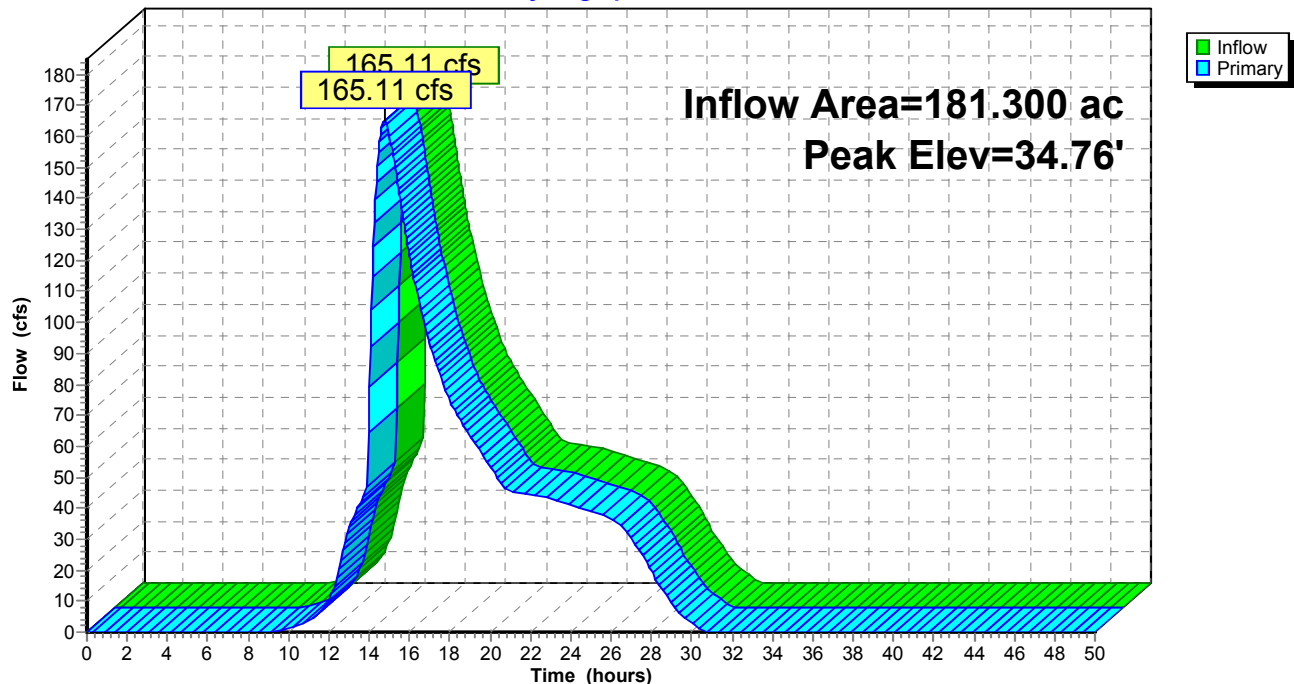
Primary OutFlow Max=164.99 cfs @ 14.76 hrs HW=34.76' (Free Discharge)

1=Sharp-Crested Rectangular Weir (Weir Controls 112.36 cfs @ 1.66 fps)

2=Culvert (Inlet Controls 52.63 cfs @ 7.45 fps)

Pond 30P: WRC18 and RC18

Hydrograph



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Type II 24-hr 25yr-24hr Rainfall=9.20", Ia/S=0.30

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Summary for Pond 32P: Wetland Storage BE3

Inflow Area = 44.500 ac, 0.00% Impervious, Inflow Depth = 5.97" for 25yr-24hr event
Inflow = 76.88 cfs @ 13.64 hrs, Volume= 22.134 af
Outflow = 22.73 cfs @ 15.91 hrs, Volume= 22.010 af, Atten= 70%, Lag= 136.5 min
Primary = 22.73 cfs @ 15.91 hrs, Volume= 22.010 af

Routing by Stor-Ind method, Time Span= 0.00-50.00 hrs, dt= 0.05 hrs
Peak Elev= 31.67' @ 15.91 hrs Surf.Area= 13.670 ac Storage= 10.826 af

Plug-Flow detention time= 312.0 min calculated for 21.988 af (99% of inflow)
Center-of-Mass det. time= 309.2 min (1,243.2 - 934.1)

Volume	Invert	Avail.Storage	Storage Description
#1	30.00'	73.150 af	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
30.00	2.200	0.000	0.000
31.00	6.200	4.200	4.200
32.00	17.400	11.800	16.000
33.00	28.000	22.700	38.700
34.00	40.900	34.450	73.150

Device	Routing	Invert	Outlet Devices
#1	Primary	30.00'	4.0' long x 10.0' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64

Primary OutFlow Max=22.73 cfs @ 15.91 hrs HW=31.67' (Free Discharge)

↑1=**Broad-Crested Rectangular Weir** (Weir Controls 22.73 cfs @ 3.41 fps)

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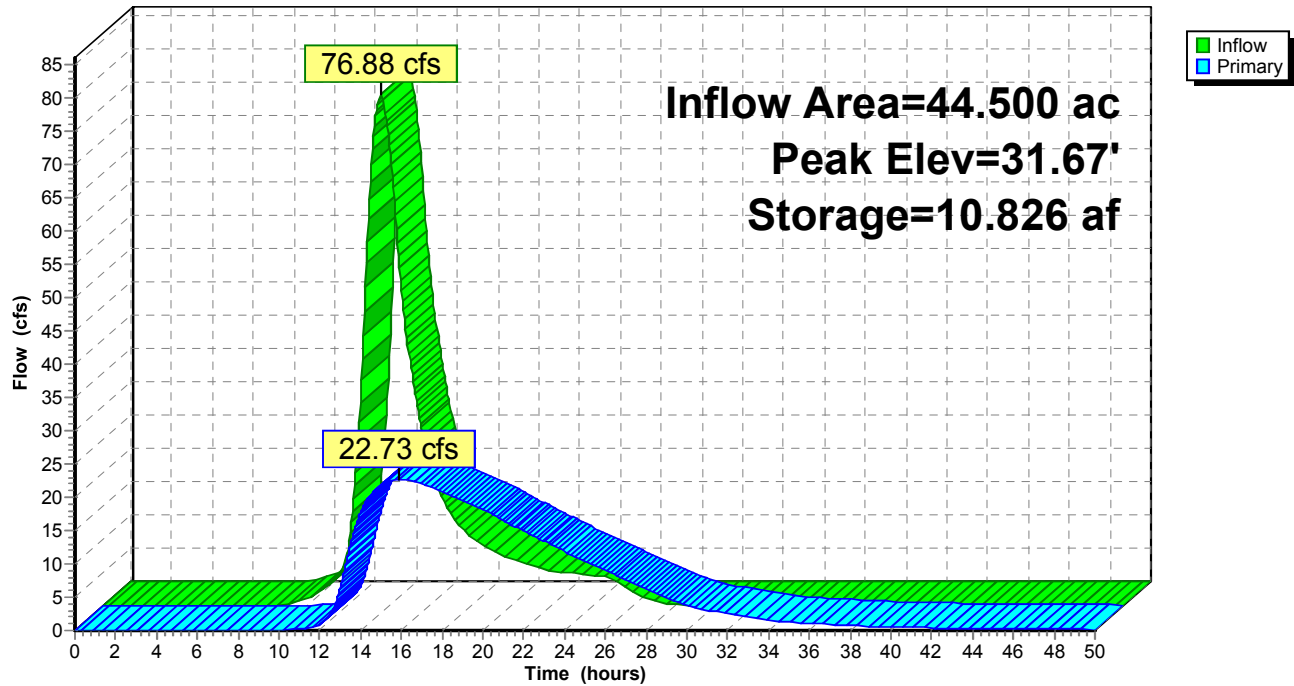
Type II 24-hr 25yr-24hr Rainfall=9.20", Ia/S=0.30

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Pond 32P: Wetland Storage BE3

Hydrograph



Existing

Type II 24-hr 25yr-24hr Rainfall=9.20", Ia/S=0.30

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Summary for Pond 33P: Wetland Storage - BE10

Inflow Area = 76.000 ac, 0.00% Impervious, Inflow Depth = 5.83" for 25yr-24hr event
Inflow = 161.68 cfs @ 13.17 hrs, Volume= 36.924 af
Outflow = 104.83 cfs @ 13.89 hrs, Volume= 36.924 af, Atten= 35%, Lag= 43.4 min
Primary = 104.83 cfs @ 13.89 hrs, Volume= 36.924 af

Routing by Stor-Ind method, Time Span= 0.00-50.00 hrs, dt= 0.05 hrs
Peak Elev= 31.73' @ 13.89 hrs Surf.Area= 12.322 ac Storage= 8.804 af

Plug-Flow detention time= 60.4 min calculated for 36.924 af (100% of inflow)
Center-of-Mass det. time= 60.2 min (964.0 - 903.8)

Volume	Invert	Avail.Storage	Storage Description
#1	30.00'	147.400 af	Custom Stage Data (Prismatic) Listed below (Recalc)
Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
30.00	2.200	0.000	0.000
31.00	3.700	2.950	2.950
32.00	15.500	9.600	12.550
33.00	31.800	23.650	36.200
34.00	59.100	45.450	81.650
35.00	72.400	65.750	147.400

Device	Routing	Invert	Outlet Devices
#1	Primary	30.00'	Custom Weir/Orifice, Cv= 2.62 (C= 3.28) Head (feet) 0.00 1.00 5.00 Width (feet) 12.00 15.00 26.00

Primary OutFlow Max=104.80 cfs @ 13.89 hrs HW=31.73' (Free Discharge)
↑1=Custom Weir/Orifice (Weir Controls 104.80 cfs @ 4.16 fps)

Existing

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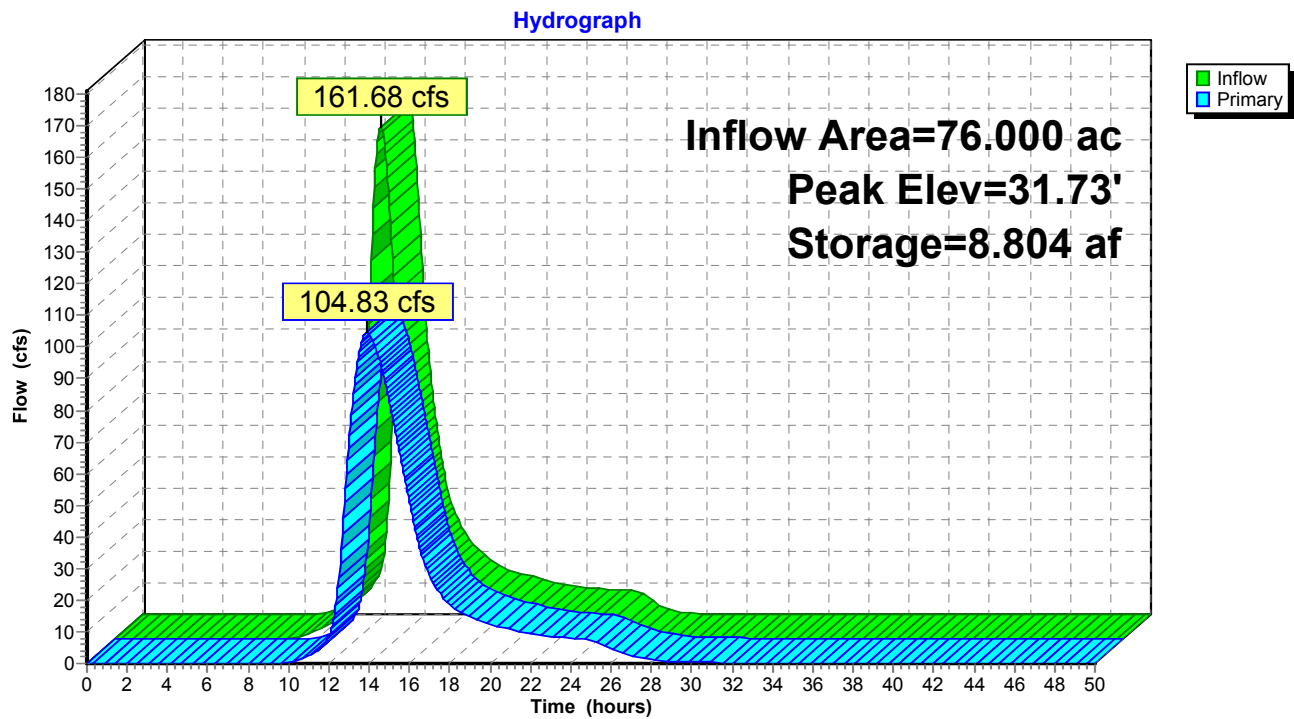
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Type II 24-hr 25yr-24hr Rainfall=9.20", Ia/S=0.30

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Pond 33P: Wetland Storage - BE10



Existing

Type II 24-hr 25yr-24hr Rainfall=9.20", Ia/S=0.30

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Summary for Pond 34P: Wetland Storage BE5

Inflow Area = 68.150 ac, 0.00% Impervious, Inflow Depth = 5.97" for 25yr-24hr event
Inflow = 147.12 cfs @ 13.16 hrs, Volume= 33.897 af
Outflow = 24.12 cfs @ 15.94 hrs, Volume= 33.124 af, Atten= 84%, Lag= 166.7 min
Primary = 24.12 cfs @ 15.94 hrs, Volume= 33.124 af

Routing by Stor-Ind method, Time Span= 0.00-50.00 hrs, dt= 0.05 hrs
Peak Elev= 31.73' @ 15.94 hrs Surf.Area= 27.183 ac Storage= 19.852 af

Plug-Flow detention time= 491.3 min calculated for 33.124 af (98% of inflow)
Center-of-Mass det. time= 477.3 min (1,379.5 - 902.2)

Volume	Invert	Avail.Storage	Storage Description
#1	29.00'	71.550 af	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
29.00	0.000	0.000	0.000
30.00	1.200	0.600	0.600
31.00	10.000	5.600	6.200
32.00	33.400	21.700	27.900
33.00	53.900	43.650	71.550

Device	Routing	Invert	Outlet Devices
#1	Primary	30.00'	4.0' long x 10.0' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64

Primary OutFlow Max=24.12 cfs @ 15.94 hrs HW=31.73' (Free Discharge)

↑1=**Broad-Crested Rectangular Weir** (Weir Controls 24.12 cfs @ 3.48 fps)

Existing

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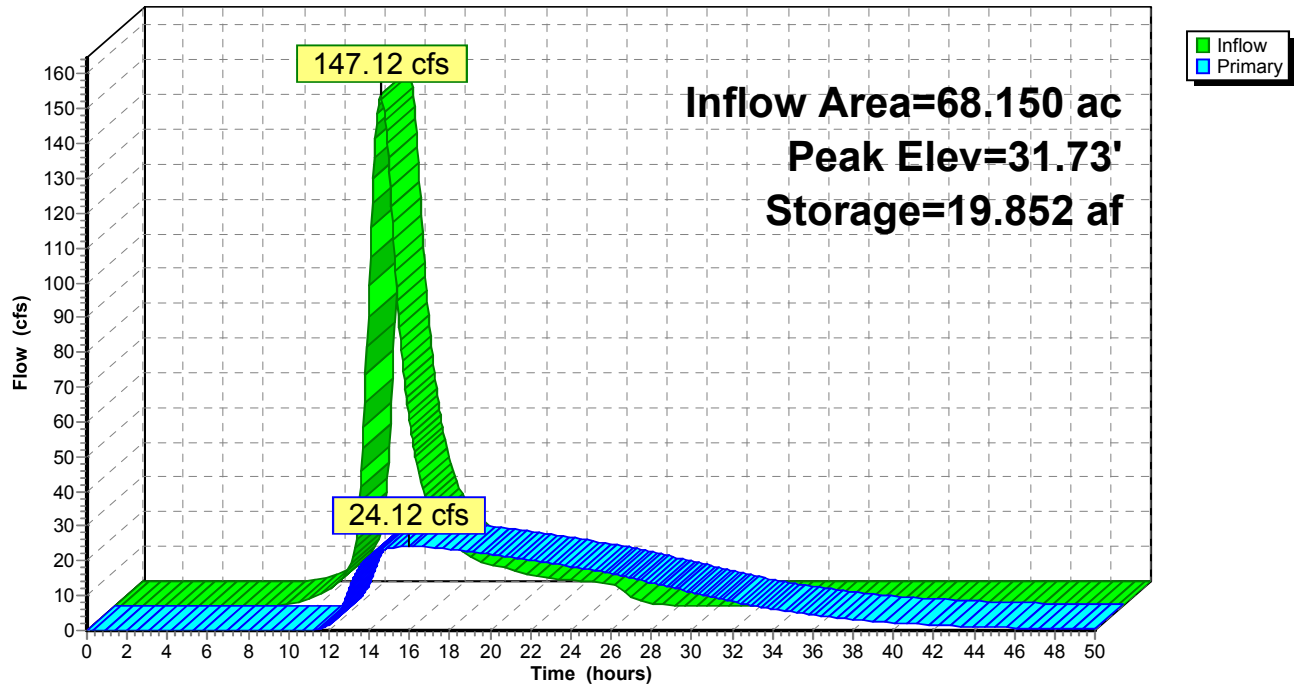
Type II 24-hr 25yr-24hr Rainfall=9.20", Ia/S=0.30

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Pond 34P: Wetland Storage BE5

Hydrograph



Existing

Type II 24-hr 25yr-24hr Rainfall=9.20", Ia/S=0.30

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Summary for Pond 35P: Wetland Storage - BE11

Inflow Area = 79.800 ac, 0.00% Impervious, Inflow Depth = 5.55" for 25yr-24hr event
Inflow = 205.62 cfs @ 12.80 hrs, Volume= 36.922 af
Outflow = 68.66 cfs @ 13.93 hrs, Volume= 36.908 af, Atten= 67%, Lag= 67.9 min
Primary = 68.66 cfs @ 13.93 hrs, Volume= 36.908 af

Routing by Stor-Ind method, Time Span= 0.00-50.00 hrs, dt= 0.05 hrs
Peak Elev= 34.09' @ 13.93 hrs Surf.Area= 14.259 ac Storage= 15.125 af

Plug-Flow detention time= 135.7 min calculated for 36.908 af (100% of inflow)
Center-of-Mass det. time= 135.1 min (1,017.6 - 882.5)

Volume	Invert	Avail.Storage	Storage Description
#1	29.00'	111.000 af	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
29.00	0.000	0.000	0.000
30.00	0.800	0.400	0.400
31.00	0.800	0.800	1.200
32.00	2.400	1.600	2.800
33.00	4.800	3.600	6.400
34.00	10.400	7.600	14.000
35.00	52.700	31.550	45.550
36.00	78.200	65.450	111.000

Device	Routing	Invert	Outlet Devices
#1	Primary	34.00'	264.0' long x 10.0' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64
#2	Primary	29.17'	36.0" Round Culvert L= 29.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 29.17' / 28.74' S= 0.0148 '/' Cc= 0.900 n= 0.024, Flow Area= 7.07 sf

Primary OutFlow Max=67.77 cfs @ 13.93 hrs HW=34.09' (Free Discharge)

1=Broad-Crested Rectangular Weir (Weir Controls 18.08 cfs @ 0.75 fps)

2=Culvert (Inlet Controls 49.70 cfs @ 7.03 fps)

Existing

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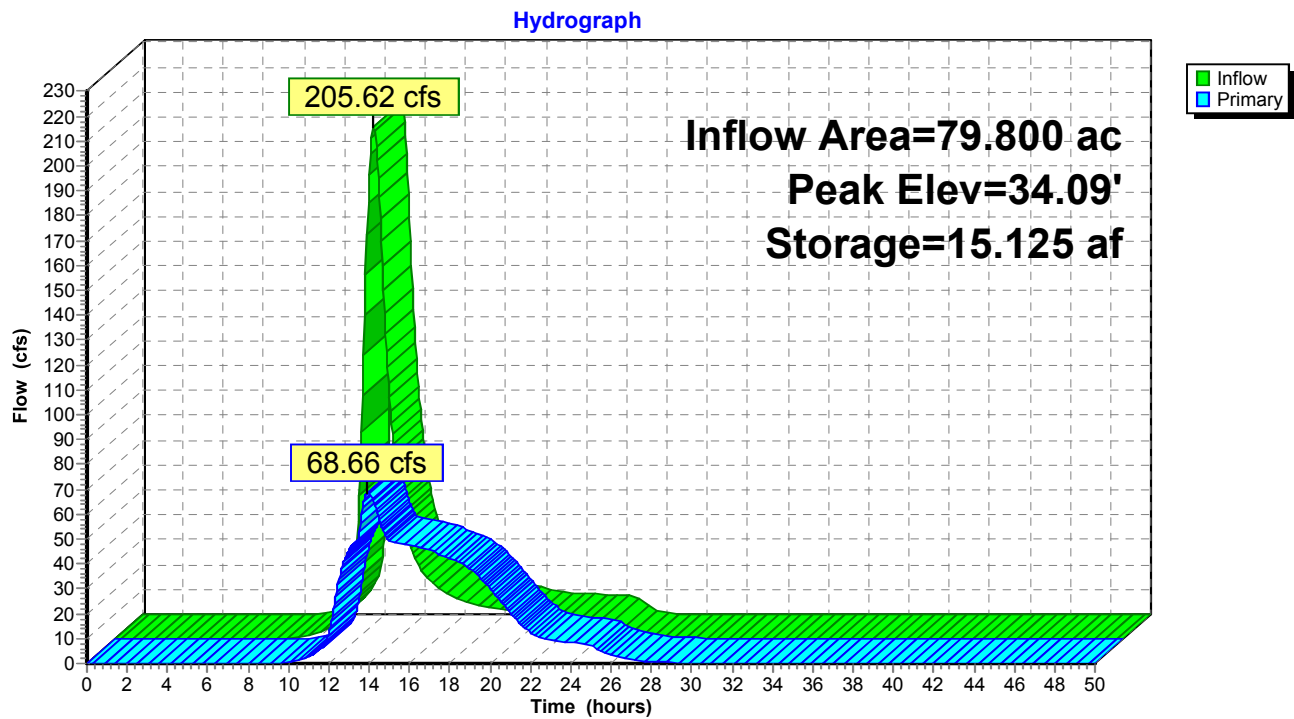
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Type II 24-hr 25yr-24hr Rainfall=9.20", Ia/S=0.30

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Pond 35P: Wetland Storage - BE11



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Type II 24-hr 25yr-24hr Rainfall=9.20", $I_a/S=0.30$

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Summary for Link 24L: CP-1

Inflow Area = 2,226.380 ac, 0.00% Impervious, Inflow Depth > 2.58" for 25yr-24hr event

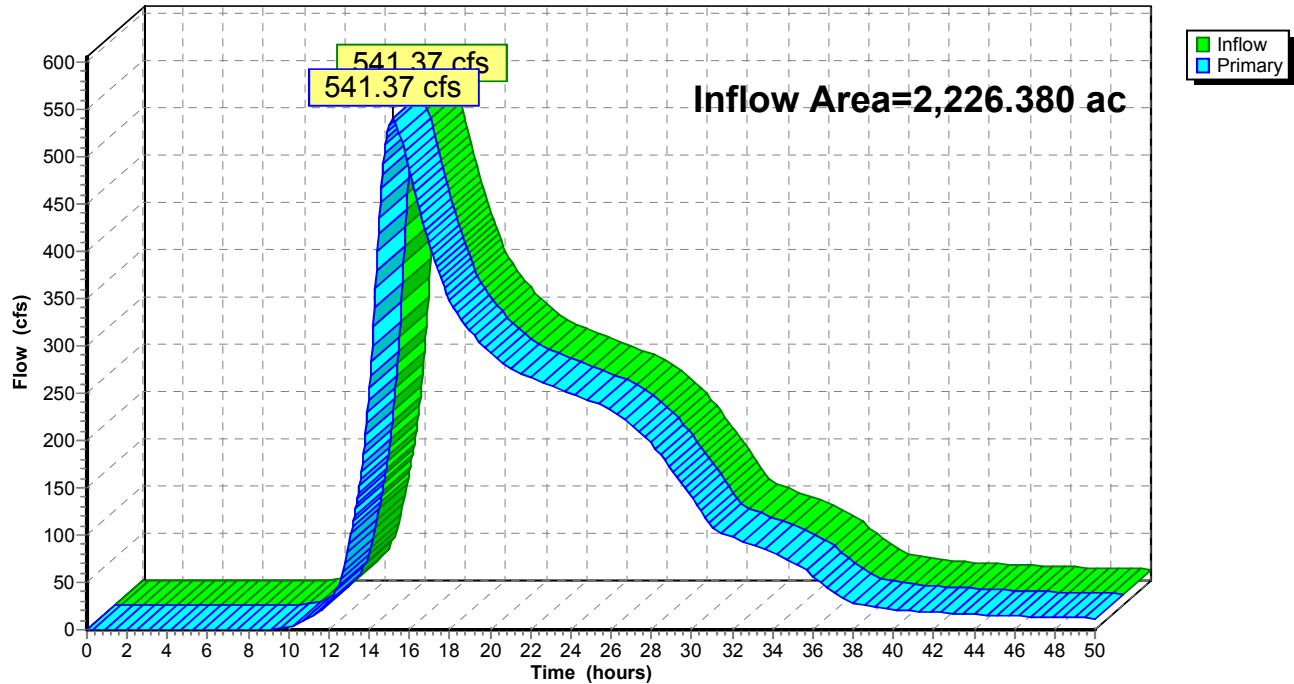
Inflow = 541.37 cfs @ 15.17 hrs, Volume= 478.584 af

Primary = 541.37 cfs @ 15.17 hrs, Volume= 478.584 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-50.00 hrs, dt= 0.05 hrs

Link 24L: CP-1

Hydrograph



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Type II 24-hr 25yr-24hr Rainfall=9.20", Ia/S=0.30

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Summary for Link 31L: From BN4B1B

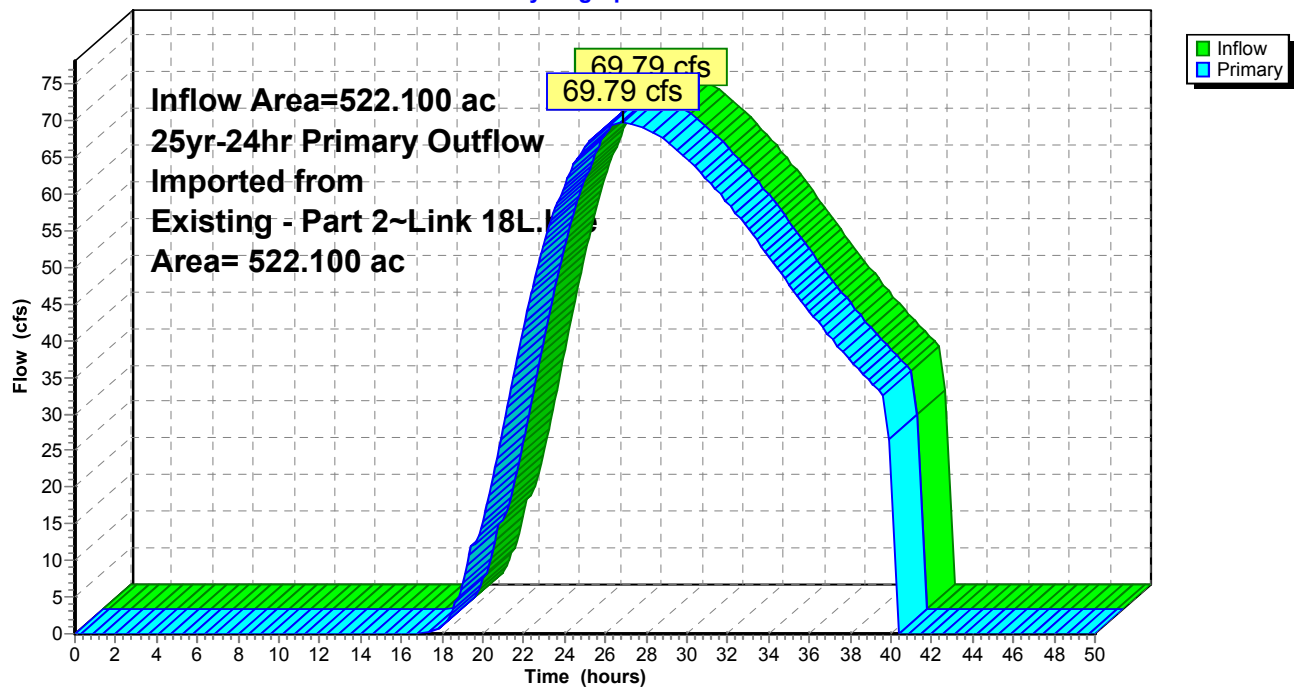
Inflow Area = 522.100 ac, 0.00% Impervious, Inflow Depth = 2.02" for 25yr-24hr event
Inflow = 69.79 cfs @ 26.89 hrs, Volume= 87.873 af
Primary = 69.79 cfs @ 26.89 hrs, Volume= 87.873 af, Atten= 0%, Lag= 0.0 min

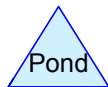
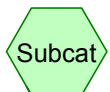
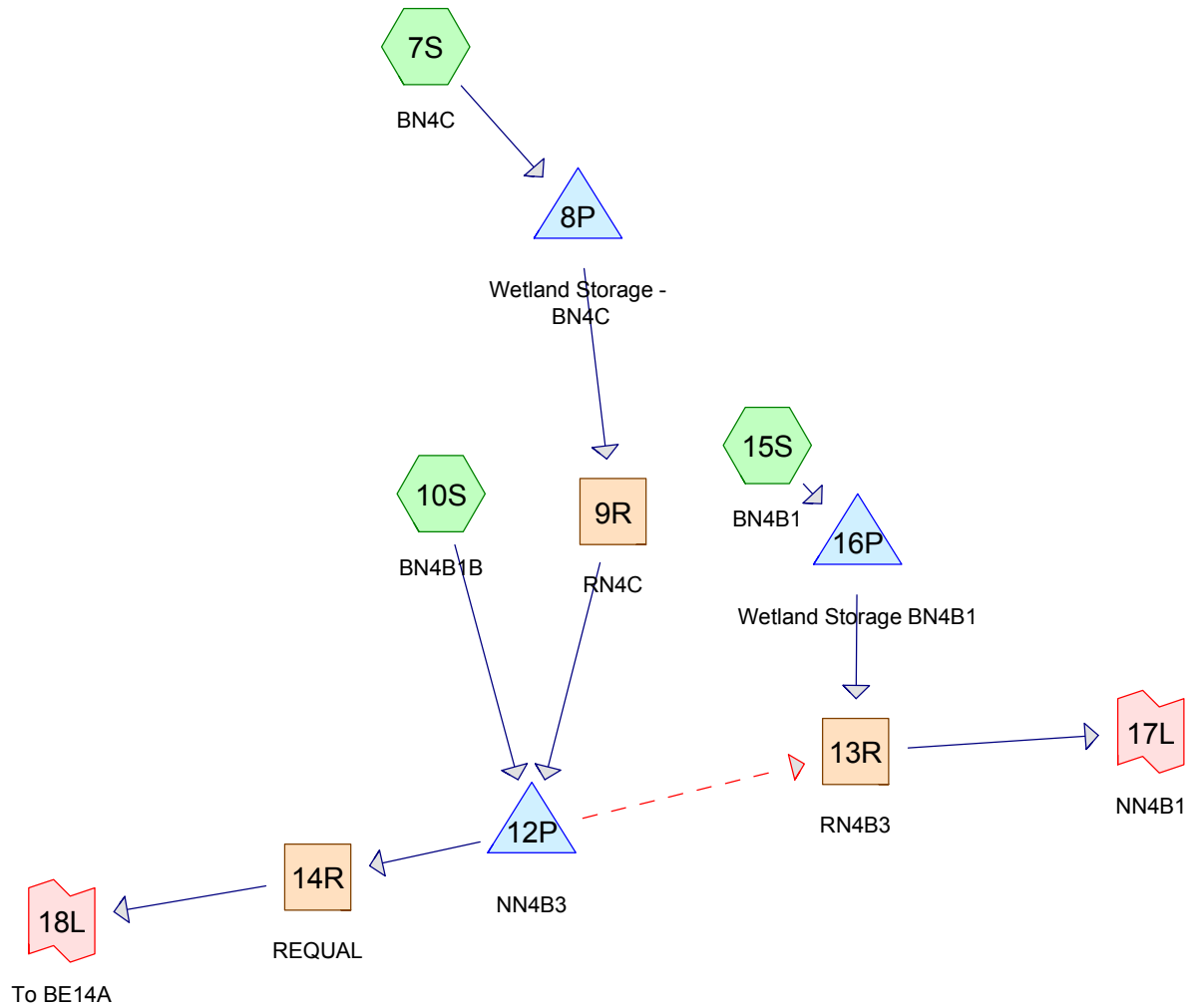
Primary outflow = Inflow, Time Span= 0.00-50.00 hrs, dt= 0.05 hrs

25yr-24hr Primary Outflow Imported from Existing - Part 2~Link 18L.hce

Link 31L: From BN4B1B

Hydrograph





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Page 2

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
210.700	76	(7S)
311.400	72	(10S)
61.200	82	(15S)
583.300	74	TOTAL AREA

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Page 3

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
0.000	HSG C	
0.000	HSG D	
583.300	Other	7S, 10S, 15S
583.300		TOTAL AREA

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Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	0.000	0.000	0.000	583.300	583.300		7S, 10S, 15S
0.000	0.000	0.000	0.000	583.300	583.300	TOTAL AREA	

Existing - Part 2

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Type II 24-hr 25yr-24hr Rainfall=9.20"

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Time span=5.00-40.00 hrs, dt=0.05 hrs, 701 points

Runoff by SCS TR-20 method, UH=SCS

Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 7S: BN4C

Runoff Area=210.700 ac 0.00% Impervious Runoff Depth=6.26"
Tc=144.6 min CN=76 Runoff=362.83 cfs 109.932 af

Subcatchment 10S: BN4B1B

Runoff Area=311.400 ac 0.00% Impervious Runoff Depth=5.76"
Tc=174.4 min CN=72 Runoff=428.53 cfs 149.518 af

Subcatchment 15S: BN4B1

Runoff Area=61.200 ac 0.00% Impervious Runoff Depth>7.01"
Tc=127.6 min CN=82 Runoff=129.02 cfs 35.728 af

Reach 9R: RN4C

Avg. Flow Depth=1.76' Max Vel=1.87 fps Inflow=42.85 cfs 68.879 af
n=0.060 L=1,000.0' S=0.0060 '/' Capacity=41.26 cfs Outflow=42.84 cfs 68.420 af

Reach 13R: RN4B3

Avg. Flow Depth=6.44' Max Vel=1.35 fps Inflow=121.70 cfs 136.618 af
n=0.040 L=4,459.0' S=0.0004 '/' Capacity=206.00 cfs Outflow=117.11 cfs 133.394 af

Reach 14R: REQUAL

Avg. Flow Depth=5.74' Max Vel=0.29 fps Inflow=97.45 cfs 108.656 af
n=0.080 L=5,000.0' S=0.0001 '/' Capacity=148.55 cfs Outflow=69.79 cfs 87.873 af

Pond 8P: Wetland Storage - BN4C

Peak Elev=55.31' Storage=77.986 af Inflow=362.83 cfs 109.932 af
Outflow=42.85 cfs 68.879 af

Pond 12P: NN4B3

Peak Elev=39.23' Storage=71.932 af Inflow=442.45 cfs 217.938 af
Primary=97.45 cfs 108.656 af Secondary=79.11 cfs 101.028 af Outflow=176.56 cfs 209.683 af

Pond 16P: Wetland Storage BN4B1

Peak Elev=35.60' Storage=15.953 af Inflow=129.02 cfs 35.728 af
Outflow=45.25 cfs 35.591 af

Link 17L: NN4B1

Inflow=117.11 cfs 133.394 af
Primary=117.11 cfs 133.394 af

Link 18L: To BE14A

Inflow=69.79 cfs 87.873 af
Primary=69.79 cfs 87.873 af

Total Runoff Area = 583.300 ac Runoff Volume = 295.178 af Average Runoff Depth = 6.07"
100.00% Pervious = 583.300 ac 0.00% Impervious = 0.000 ac

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Type II 24-hr 25yr-24hr Rainfall=9.20"

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Summary for Subcatchment 7S: BN4C

Runoff = 362.83 cfs @ 13.67 hrs, Volume= 109.932 af, Depth= 6.26"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-40.00 hrs, dt= 0.05 hrs

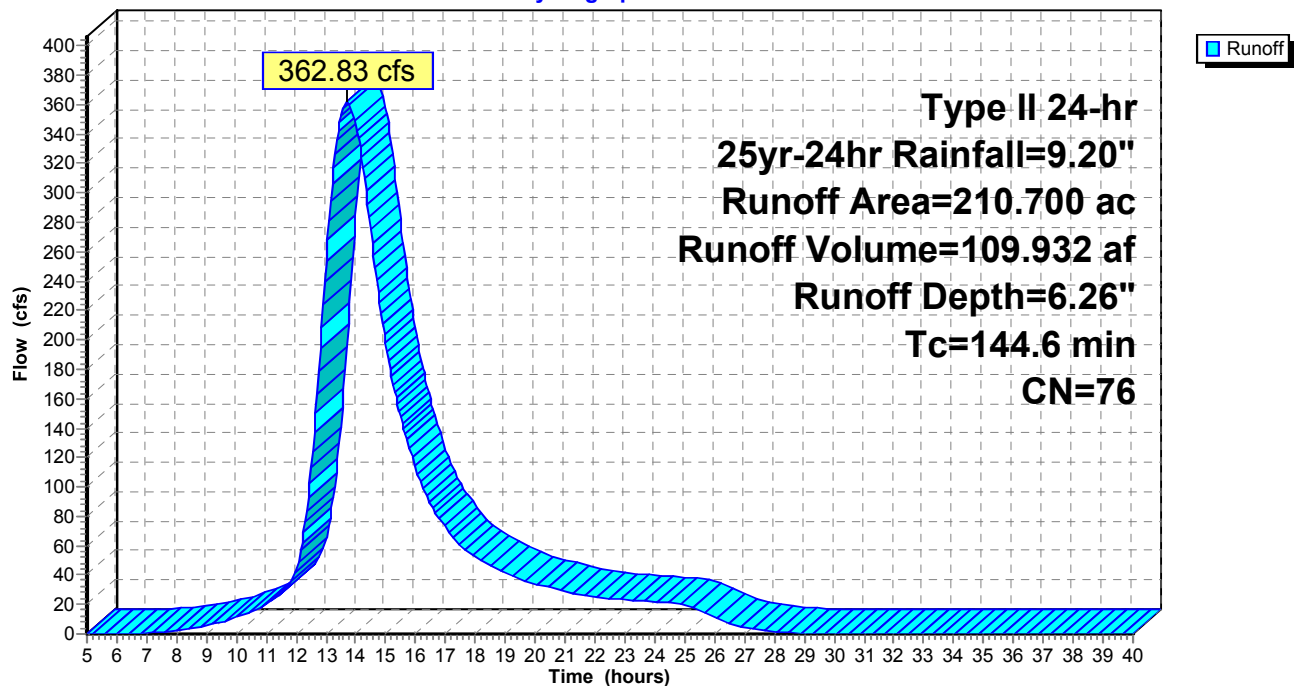
Type II 24-hr 25yr-24hr Rainfall=9.20"

Area (ac)	CN	Description
* 210.700	76	
210.700		100.00% Pervious Area

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

Subcatchment 7S: BN4C

Hydrograph



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Type II 24-hr 25yr-24hr Rainfall=9.20"

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Summary for Subcatchment 10S: BN4B1B

Runoff = 428.53 cfs @ 14.13 hrs, Volume= 149.518 af, Depth= 5.76"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-40.00 hrs, dt= 0.05 hrs

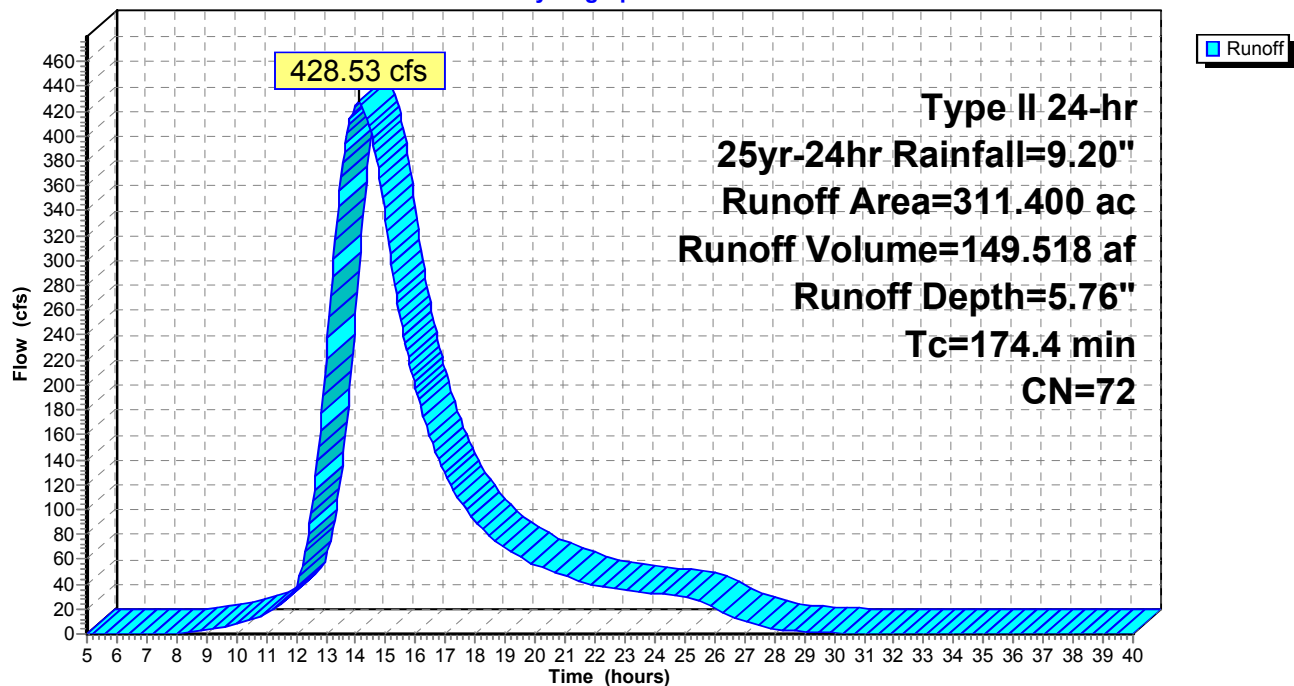
Type II 24-hr 25yr-24hr Rainfall=9.20"

Area (ac)	CN	Description
* 311.400	72	
311.400		100.00% Pervious Area

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

Subcatchment 10S: BN4B1B

Hydrograph



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Type II 24-hr 25yr-24hr Rainfall=9.20"

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Summary for Subcatchment 15S: BN4B1

Runoff = 129.02 cfs @ 13.46 hrs, Volume= 35.728 af, Depth> 7.01"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-40.00 hrs, dt= 0.05 hrs

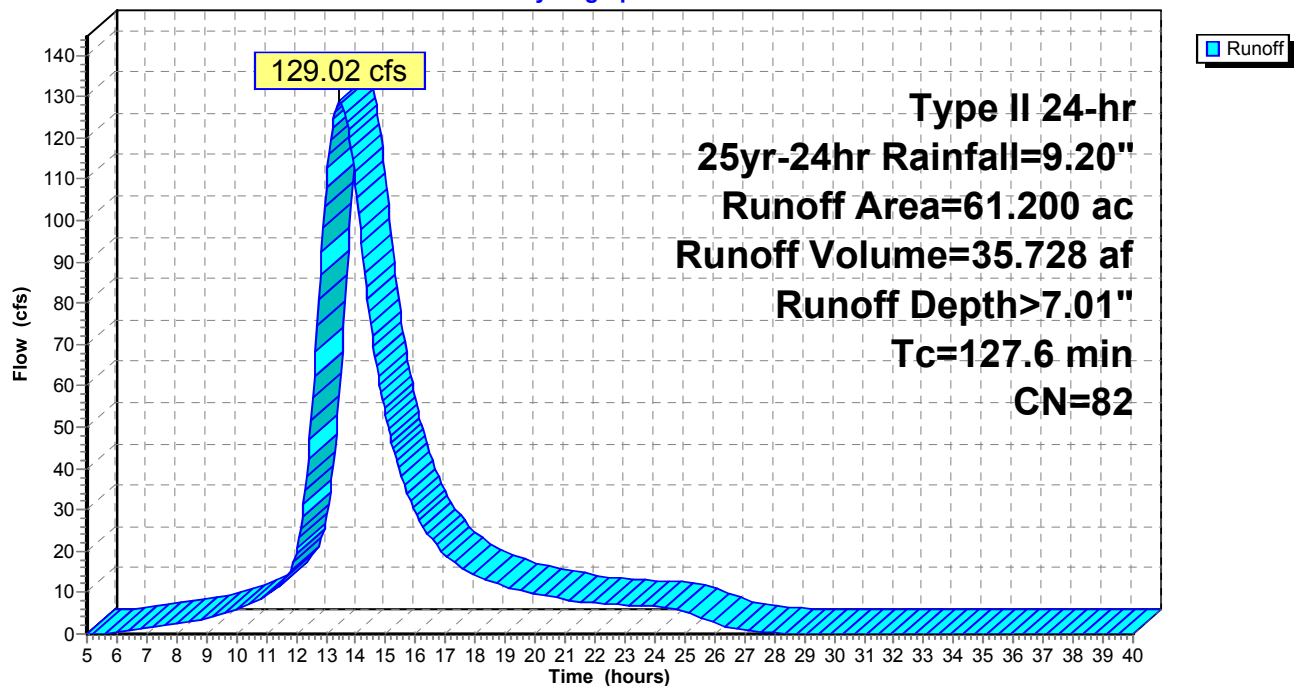
Type II 24-hr 25yr-24hr Rainfall=9.20"

Area (ac)	CN	Description
* 61.200	82	
61.200		100.00% Pervious Area

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

Subcatchment 15S: BN4B1

Hydrograph



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Type II 24-hr 25yr-24hr Rainfall=9.20"

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Summary for Reach 9R: RN4C

[55] Hint: Peak inflow is 104% of Manning's capacity

[81] Warning: Exceeded Pond 8P by 0.45' @ 19.35 hrs

Inflow Area = 210.700 ac, 0.00% Impervious, Inflow Depth > 3.92" for 25yr-24hr event
Inflow = 42.85 cfs @ 18.82 hrs, Volume= 68.879 af
Outflow = 42.84 cfs @ 19.08 hrs, Volume= 68.420 af, Atten= 0%, Lag= 15.7 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-40.00 hrs, dt= 0.05 hrs

Max. Velocity= 1.87 fps, Min. Travel Time= 8.9 min

Avg. Velocity= 1.43 fps, Avg. Travel Time= 11.7 min

Peak Storage= 22,927 cf @ 18.93 hrs

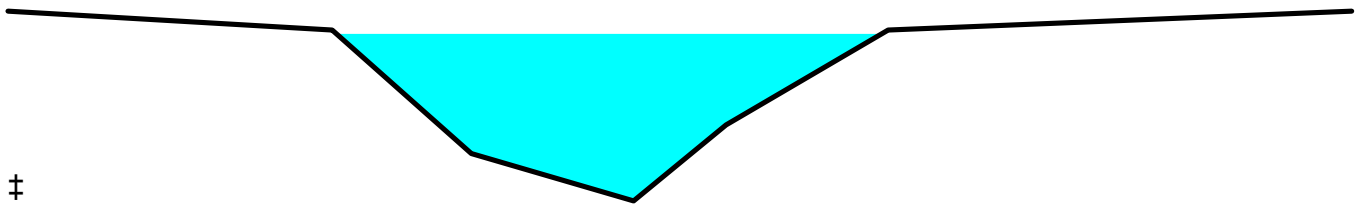
Average Depth at Peak Storage= 1.76'

Bank-Full Depth= 2.00' Flow Area= 32.0 sf, Capacity= 41.26 cfs

Custom cross-section, Length= 1,000.0' Slope= 0.0060 '/'

Constant n= 0.060

Inlet Invert= 54.00', Outlet Invert= 48.00'



Offset (feet)	Elevation (feet)	Chan.Depth (feet)
0.00	50.40	0.00
14.00	50.20	0.20
20.00	48.90	1.50
27.00	48.40	2.00
31.00	49.20	1.20
38.00	50.20	0.20
58.00	50.40	0.00

Depth (feet)	End Area (sq-ft)	Perim. (feet)	Storage (cubic-feet)	Discharge (cfs)
0.00	0.0	0.0	0	0.00
0.50	2.4	9.6	2,375	1.80
0.80	5.7	12.5	5,658	6.39
1.80	23.9	24.3	23,850	45.18
2.00	32.0	58.3	32,050	41.26

Existing - Part 2

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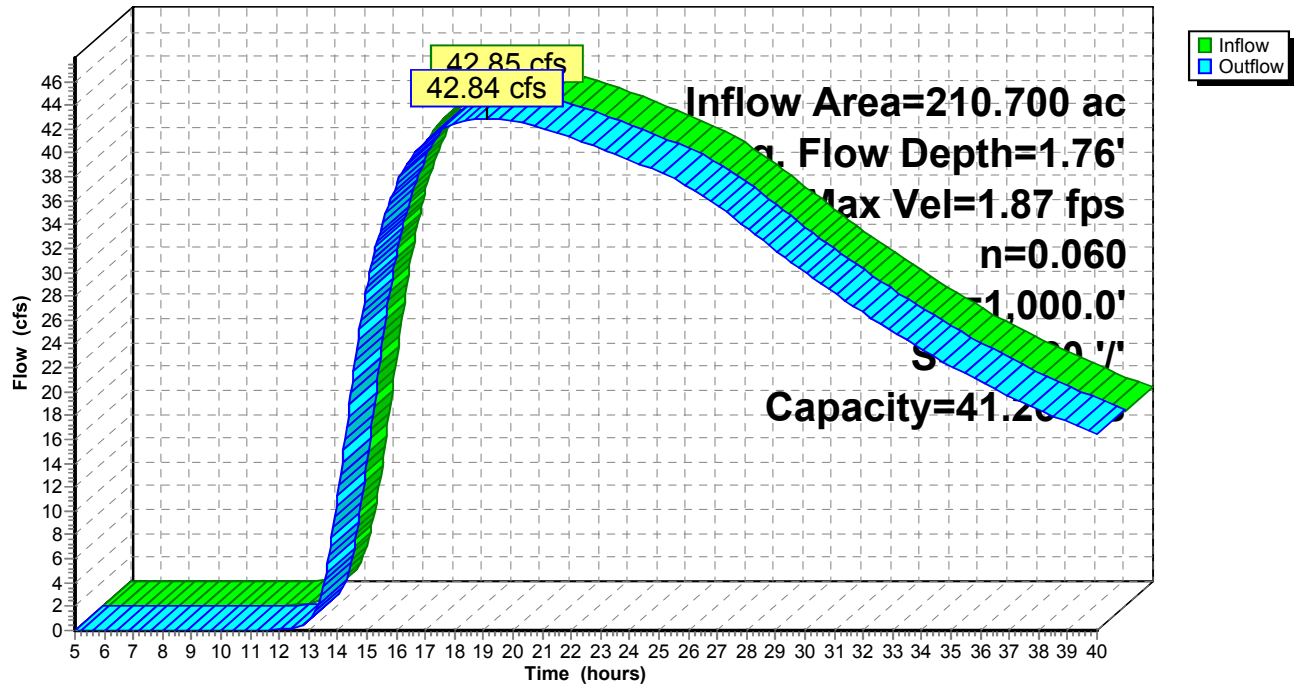
Type II 24-hr 25yr-24hr Rainfall=9.20"

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Reach 9R: RN4C

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Type II 24-hr 25yr-24hr Rainfall=9.20"

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Summary for Reach 13R: RN4B3

[85] Warning: Oscillations may require Finer Routing>1

[81] Warning: Exceeded Pond 12P by 0.94' @ 18.50 hrs

[81] Warning: Exceeded Pond 16P by 4.78' @ 21.05 hrs

Inflow Area = 61.200 ac, 0.00% Impervious, Inflow Depth > 26.79" for 25yr-24hr event
Inflow = 121.70 cfs @ 16.30 hrs, Volume= 136.618 af
Outflow = 117.11 cfs @ 18.46 hrs, Volume= 133.394 af, Atten= 4%, Lag= 129.6 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-40.00 hrs, dt= 0.05 hrs

Max. Velocity= 1.35 fps, Min. Travel Time= 55.1 min

Avg. Velocity= 0.87 fps, Avg. Travel Time= 85.1 min

Peak Storage= 480,433 cf @ 17.54 hrs

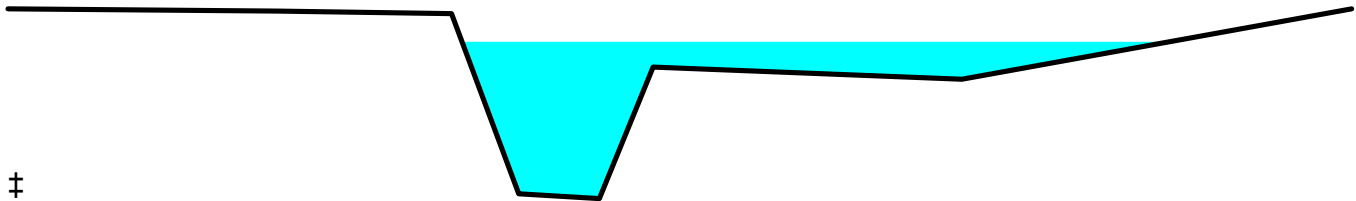
Average Depth at Peak Storage= 6.44'

Bank-Full Depth= 7.80' Flow Area= 192.0 sf, Capacity= 206.00 cfs

Custom cross-section, Length= 4,459.0' Slope= 0.0004 '/' (105 Elevation Intervals)

Constant n= 0.040

Inlet Invert= 33.70', Outlet Invert= 32.00'



Offset (feet)	Elevation (feet)	Chan.Depth (feet)
0.00	40.90	0.00
20.00	40.80	0.10
33.00	40.70	0.20
38.00	33.30	7.60
44.00	33.10	7.80
48.00	38.50	2.40
71.00	38.00	2.90
100.00	40.90	0.00

Depth (feet)	End Area (sq-ft)	Perim. (feet)	Storage (cubic-feet)	Discharge (cfs)
0.00	0.0	0.0	0	0.00
0.20	0.6	6.3	2,741	0.10
4.90	45.2	17.8	201,348	60.99
5.40	58.7	47.0	261,900	49.41
7.60	175.9	71.8	784,338	231.89
7.70	183.1	85.8	816,443	220.15
7.80	192.0	106.8	856,351	206.00

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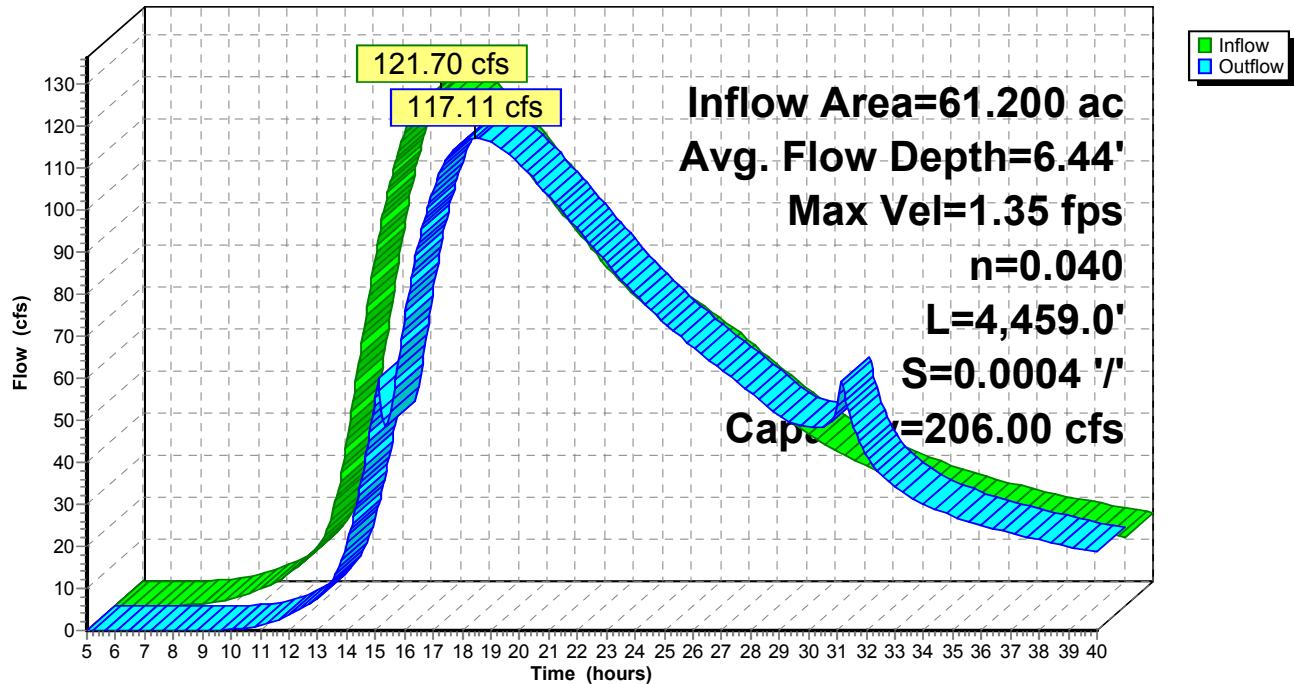
Type II 24-hr 25yr-24hr Rainfall=9.20"

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Reach 13R: RN4B3

Hydrograph



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Type II 24-hr 25yr-24hr Rainfall=9.20"

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Summary for Reach 14R: REQUAL

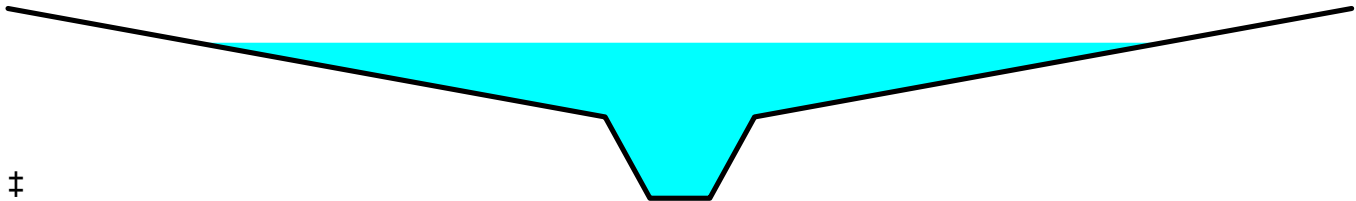
[81] Warning: Exceeded Pond 12P by 0.95' @ 26.65 hrs

Inflow Area = 522.100 ac, 0.00% Impervious, Inflow Depth > 2.50" for 25yr-24hr event
Inflow = 97.45 cfs @ 16.86 hrs, Volume= 108.656 af
Outflow = 69.79 cfs @ 26.89 hrs, Volume= 87.873 af, Atten= 28%, Lag= 601.9 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-40.00 hrs, dt= 0.05 hrs
Max. Velocity= 0.29 fps, Min. Travel Time= 289.9 min
Avg. Velocity= 0.24 fps, Avg. Travel Time= 347.7 min

Peak Storage= 1,232,657 cf @ 22.06 hrs
Average Depth at Peak Storage= 5.74'
Bank-Full Depth= 7.00' Flow Area= 442.0 sf, Capacity= 148.55 cfs

Custom cross-section, Length= 5,000.0' Slope= 0.0001 '/' (101 Elevation Intervals)
Constant n= 0.080
Inlet Invert= 34.00', Outlet Invert= 33.50'



Offset (feet)	Elevation (feet)	Chan.Depth (feet)
0.00	41.00	0.00
80.00	37.00	4.00
86.00	34.00	7.00
94.00	34.00	7.00
100.00	37.00	4.00
180.00	41.00	0.00

Depth (feet)	End Area (sq-ft)	Perim. (feet)	Storage (cubic-feet)	Discharge (cfs)
0.00	0.0	8.0	0	0.00
3.00	42.0	21.4	210,000	12.22
7.00	442.0	181.6	2,210,000	148.55

Existing - Part 2

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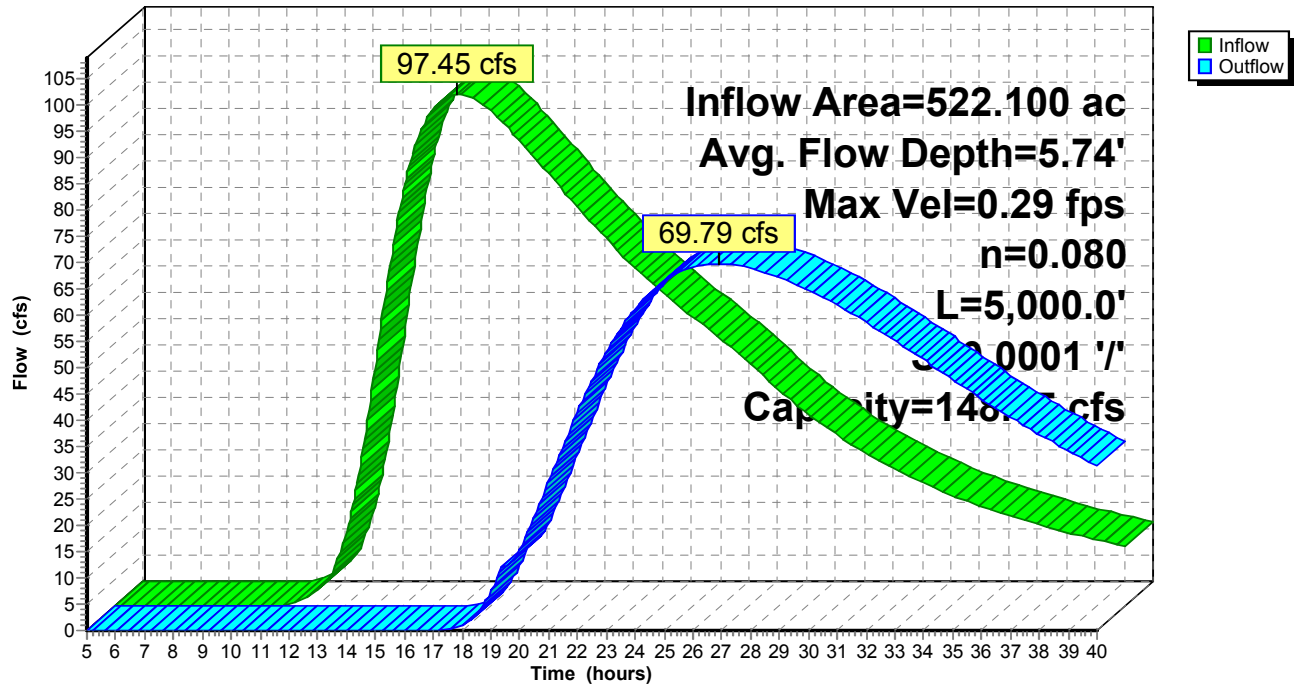
Type II 24-hr 25yr-24hr Rainfall=9.20"

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Reach 14R: REQUAL

Hydrograph



Existing - Part 2

Type II 24-hr 25yr-24hr Rainfall=9.20"

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Summary for Pond 8P: Wetland Storage - BN4C

Inflow Area = 210.700 ac, 0.00% Impervious, Inflow Depth = 6.26" for 25yr-24hr event
Inflow = 362.83 cfs @ 13.67 hrs, Volume= 109.932 af
Outflow = 42.85 cfs @ 18.82 hrs, Volume= 68.879 af, Atten= 88%, Lag= 309.1 min
Primary = 42.85 cfs @ 18.82 hrs, Volume= 68.879 af

Routing by Stor-Ind method, Time Span= 5.00-40.00 hrs, dt= 0.05 hrs
Peak Elev= 55.31' @ 18.82 hrs Surf.Area= 106.635 ac Storage= 77.986 af

Plug-Flow detention time= 693.6 min calculated for 68.879 af (63% of inflow)
Center-of-Mass det. time= 576.7 min (1,508.6 - 931.9)

Volume	Invert	Avail.Storage	Storage Description
#1	54.00'	377.100 af	Custom Stage Data (Prismatic) Listed below (Recalc)
Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
54.00	29.500	0.000	0.000
55.00	71.600	50.550	50.550
56.00	185.400	128.500	179.050
57.00	210.700	198.050	377.100

Device	Routing	Invert	Outlet Devices
#1	Primary	54.00'	Custom Weir/Orifice, Cv= 2.62 (C= 3.28) Head (feet) 0.00 0.60 1.80 2.00 Width (feet) 0.00 11.00 24.00 58.00

Primary OutFlow Max=42.84 cfs @ 18.82 hrs HW=55.31' (Free Discharge)
↑1=Custom Weir/Orifice (Weir Controls 42.84 cfs @ 3.10 fps)

Existing - Part 2

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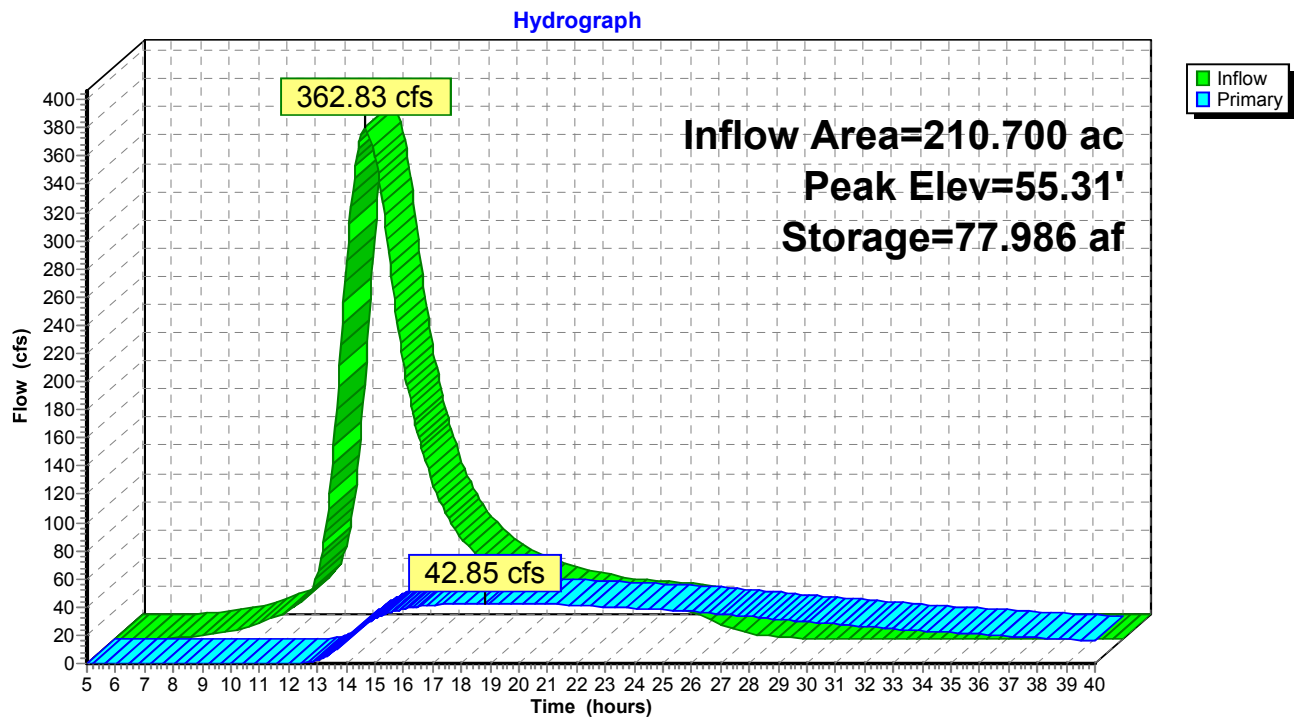
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Type II 24-hr 25yr-24hr Rainfall=9.20"

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Pond 8P: Wetland Storage - BN4C



Existing - Part 2

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Type II 24-hr 25yr-24hr Rainfall=9.20"

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Summary for Pond 12P: NN4B3

Inflow Area = 522.100 ac, 0.00% Impervious, Inflow Depth > 5.01" for 25yr-24hr event
 Inflow = 442.45 cfs @ 14.15 hrs, Volume= 217.938 af
 Outflow = 176.56 cfs @ 16.86 hrs, Volume= 209.683 af, Atten= 60%, Lag= 162.6 min
 Primary = 97.45 cfs @ 16.86 hrs, Volume= 108.656 af
 Secondary = 79.11 cfs @ 16.86 hrs, Volume= 101.028 af

Routing by Stor-Ind method, Time Span= 5.00-40.00 hrs, dt= 0.05 hrs
 Peak Elev= 39.23' @ 16.86 hrs Surf.Area= 61.124 ac Storage= 71.932 af

Plug-Flow detention time= 278.3 min calculated for 209.384 af (96% of inflow)
 Center-of-Mass det. time= 235.2 min (1,376.3 - 1,141.1)

Volume	Invert	Avail.Storage	Storage Description
#1	37.00'	1,299.525 af	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
37.00	0.000	0.000	0.000
37.50	9.300	2.325	2.325
38.00	34.300	10.900	13.225
39.00	56.100	45.200	58.425
40.00	77.900	67.000	125.425
42.00	109.000	186.900	312.325
44.00	149.500	258.500	570.825
46.00	180.600	330.100	900.925
48.00	218.000	398.600	1,299.525

Device	Routing	Invert	Outlet Devices
#1	Primary	37.30'	To REQUAL, Cv= 2.62 (C= 3.28) Head (feet) 0.00 3.00 7.00 Width (feet) 8.00 20.00 180.00
#2	Secondary	37.00'	To RN4B3, Cv= 2.62 (C= 3.28) Head (feet) 0.00 5.00 Width (feet) 6.00 13.00

Primary OutFlow Max=97.40 cfs @ 16.86 hrs HW=39.23' (Free Discharge)

↑1=To REQUAL (Weir Controls 97.40 cfs @ 4.25 fps)

Secondary OutFlow Max=79.08 cfs @ 16.86 hrs HW=39.23' (Free Discharge)

↑2=To RN4B3 (Weir Controls 79.08 cfs @ 4.69 fps)

Existing - Part 2

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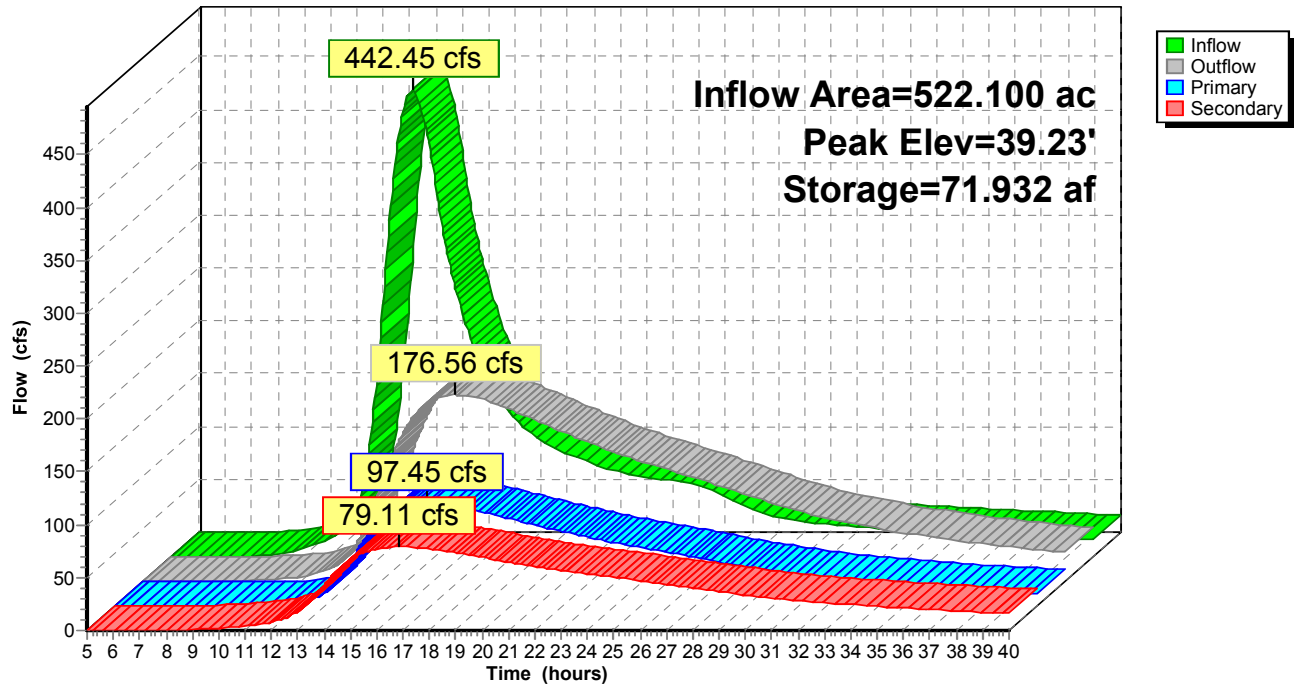
Type II 24-hr 25yr-24hr Rainfall=9.20"

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Pond 12P: NN4B3

Hydrograph



Existing - Part 2

Type II 24-hr 25yr-24hr Rainfall=9.20"

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Summary for Pond 16P: Wetland Storage BN4B1

Inflow Area = 61.200 ac, 0.00% Impervious, Inflow Depth > 7.01" for 25yr-24hr event
Inflow = 129.02 cfs @ 13.46 hrs, Volume= 35.728 af
Outflow = 45.25 cfs @ 15.24 hrs, Volume= 35.591 af, Atten= 65%, Lag= 106.6 min
Primary = 45.25 cfs @ 15.24 hrs, Volume= 35.591 af

Routing by Stor-Ind method, Time Span= 5.00-40.00 hrs, dt= 0.05 hrs
Peak Elev= 35.60' @ 15.24 hrs Surf.Area= 23.012 ac Storage= 15.953 af

Plug-Flow detention time= 227.7 min calculated for 35.540 af (99% of inflow)
Center-of-Mass det. time= 225.7 min (1,128.2 - 902.5)

Volume	Invert	Avail.Storage	Storage Description
#1	34.00'	175.900 af	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
34.00	2.400	0.000	0.000
35.00	9.800	6.100	6.100
36.00	31.800	20.800	26.900
37.00	46.500	39.150	66.050
38.00	56.300	51.400	117.450
39.00	60.600	58.450	175.900

Device	Routing	Invert	Outlet Devices
#1	Primary	34.00'	Custom Weir/Orifice, Cv= 2.62 (C= 3.28) Head (feet) 0.00 7.00 Width (feet) 6.00 15.00

Primary OutFlow Max=45.25 cfs @ 15.24 hrs HW=35.60' (Free Discharge)
↑1=Custom Weir/Orifice (Weir Controls 45.25 cfs @ 4.02 fps)

Existing - Part 2

Prepared by Black & Veatch

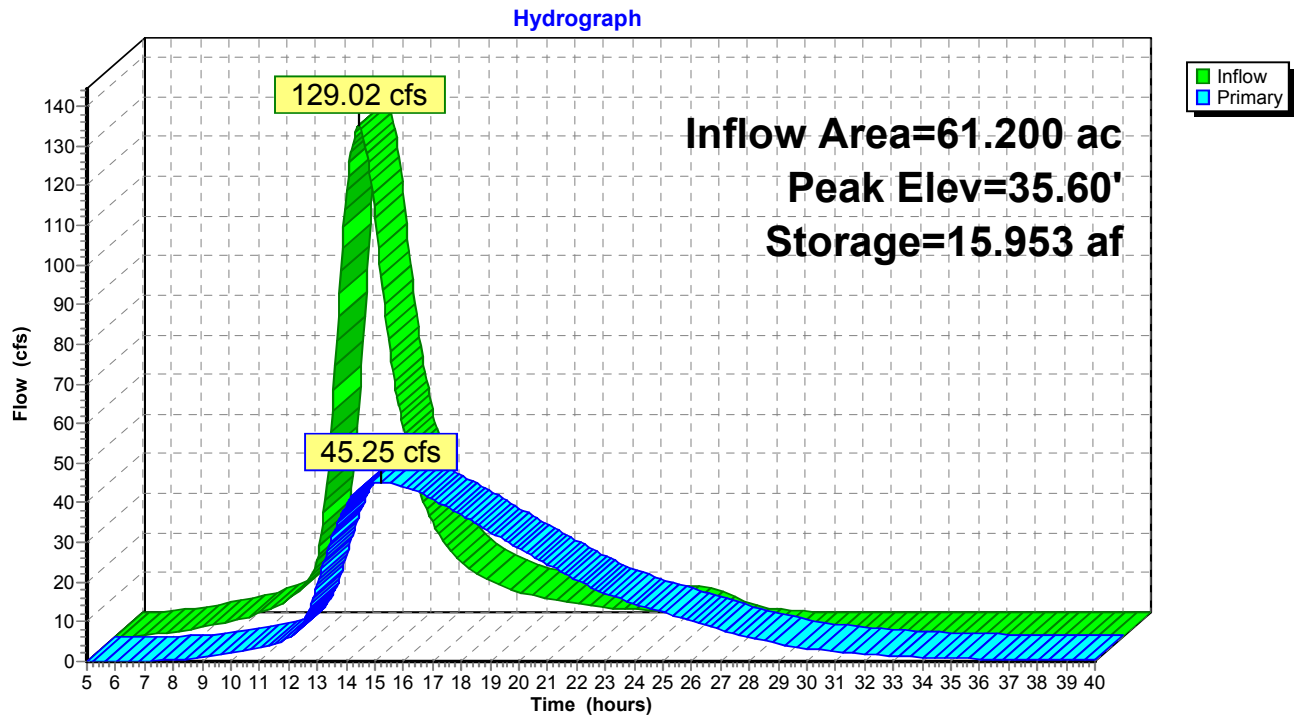
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Type II 24-hr 25yr-24hr Rainfall=9.20"

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Pond 16P: Wetland Storage BN4B1



Existing - Part 2

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Type II 24-hr 25yr-24hr Rainfall=9.20"

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Summary for Link 17L: NN4B1

Inflow Area = 61.200 ac, 0.00% Impervious, Inflow Depth > 26.16" for 25yr-24hr event

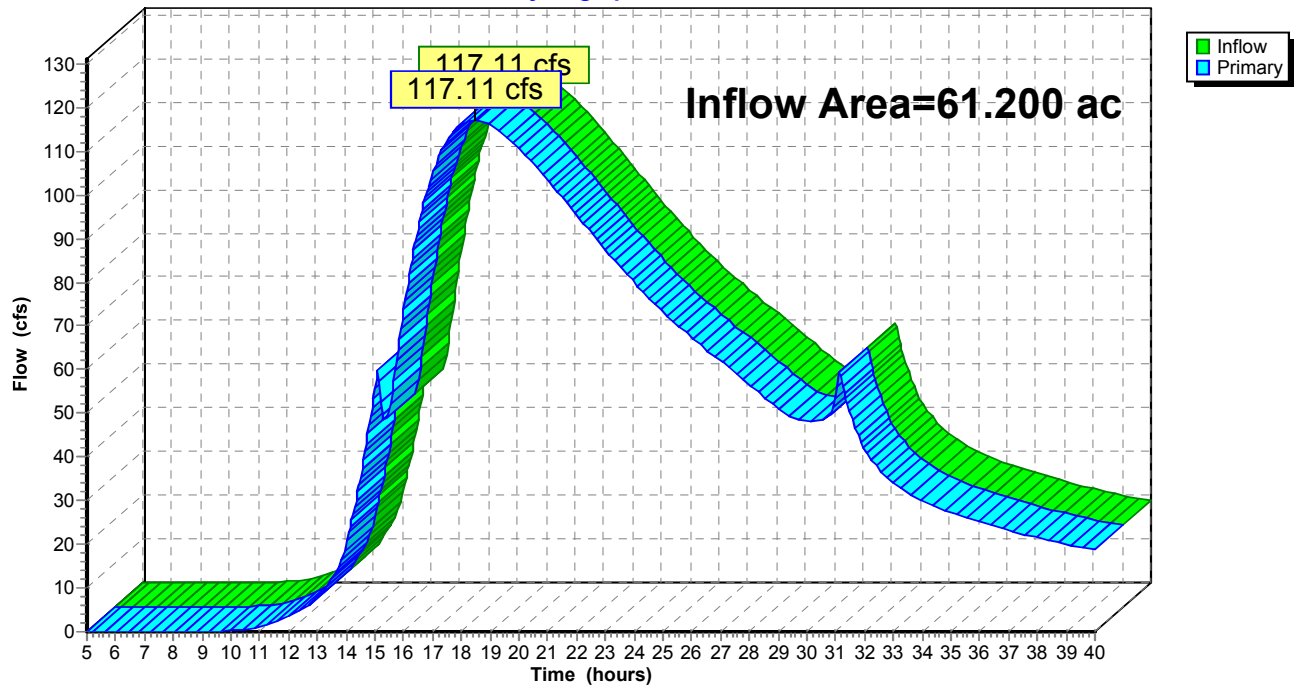
Inflow = 117.11 cfs @ 18.46 hrs, Volume= 133.394 af

Primary = 117.11 cfs @ 18.46 hrs, Volume= 133.394 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-40.00 hrs, dt= 0.05 hrs

Link 17L: NN4B1

Hydrograph



Existing - Part 2

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Type II 24-hr 25yr-24hr Rainfall=9.20"

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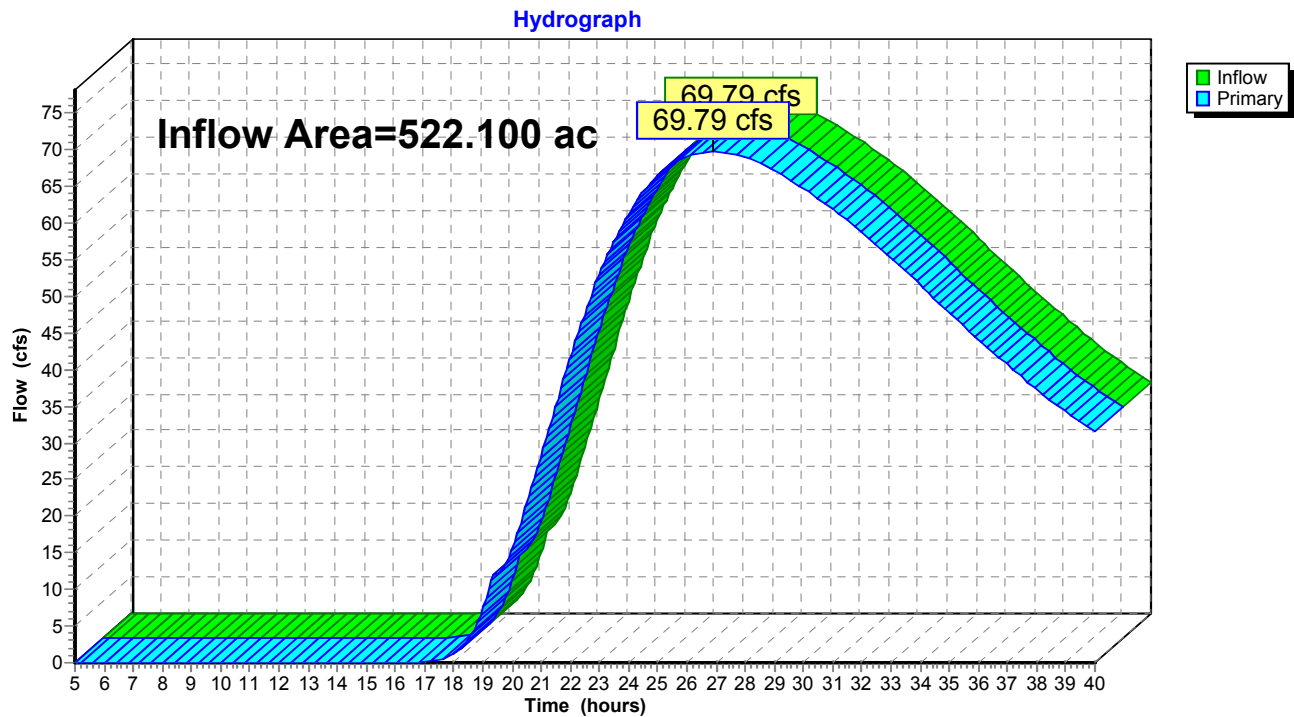
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Summary for Link 18L: To BE14A

Inflow Area = 522.100 ac, 0.00% Impervious, Inflow Depth > 2.02" for 25yr-24hr event
Inflow = 69.79 cfs @ 26.89 hrs, Volume= 87.873 af
Primary = 69.79 cfs @ 26.89 hrs, Volume= 87.873 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-40.00 hrs, dt= 0.05 hrs

Link 18L: To BE14A




 Client Name FPL Page 1 of 21

 Project Name Okeechobee Clean Energy Center Project No. 185922

 Calculation Title Post-Development Stormwater Analysis

 Calculation No./File No. 58.5406.1102

 Verification Method: ☒ Check and Review ☐ Alternate Calculations

Objective: The objective of this calculation is to determine the post development – operation phase site storm water management system design for the Florida Power & Light (FPL) Company's Okeechobee Clean Energy Project (Project).

Unverified Assumptions Requiring Subsequent Verification

No.	Assumption	Verified By	Date

Refer to Page ____ of this calculation for additional assumptions.

This Section Used for Software-Generated Calculations

 Program Name/Number HydroCAD / ICPR Version 10.00 / 3.10

 Standard B&V Application Used? ☒ Yes ☐ No

If no, list approved deviation permit number below and attach approved deviation permit.

Review and Approval

Rev	Prepared By	Date	Verified By	Date	Approved By	Date
0	Steven Williams	4/28/15	J C Barranco, Jr	4/29/215	J C Barranco, Jr	4/29/15
1	O Jankauskaite	7/24/15	J C Barranco, Jr	7/24/15	J C Barranco, Jr	7/24/15
2	O Jankauskaite	8/20/15	J C Barranco, Jr	8/20/15	J C Barranco, Jr	
3	O Jankauskaite	9/01/15	J C Barranco, Jr	9/01/15	J C Barranco, Jr	
4	O Jankauskaite	9/22/15	J C Barranco, Jr	9/22/15	J C Barranco, Jr	

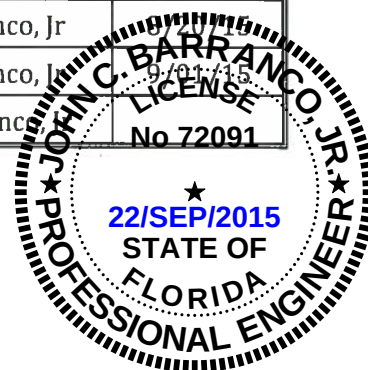


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Owner: FPL
Plant: Okeechobee Clean Energy Center
Project No. 185922
File No. 58.5406.1102
Title: Post-Development Stormwater
Analysis

Prepared by: O Jankauskaite
Date: 09/01/15
Verified by: J C Barranco
Date: 09/02/15
Page No. 3 of 21
Template Rev: 0

1.0 Purpose

The objective of this calculation is to determine the post development - operation phase site storm water management system design for the Florida Power & Light (FPL) Company's Okeechobee Clean Energy Center Project (Project). The purpose of this hydrologic model is to meet the pre vs post flow requirements defined in Reference 2.1.

2.0 References

- 2.1 St. Johns River Water Management District, Permit Information Manual. October 1, 2013
- 2.2 B&V Dwg Number 185922-DS-1104, "Proposed Stormwater Management Plan"
- 2.3 Hydrology - Wanner Quantity and Quality Control. Wanielista, Martin.
- 2.4 Ardaman & Associates report titled "Subsurface Exploration, Florida Power & Light Okeechobee Clean Energy Center", March 27, 2015
- 2.5 Google Earth
- 2.6 AutoCAD Civil 3D 2014
- 2.7 St Johns River Water Management District, Publication SJ-88-33. May, 1988

3.0 Conclusions

- 3.1 The post-condition flow rate for outfall CP-1 was calculated to be 534.00 cfs. The pre-condition flow rate for outfall CP-1 was calculated to be 541.37 cfs. The post-condition flow rate for outfall NN4B1 was calculated to be 108.55 cfs. The pre-condition flow rate for outfall NN4B1 was calculated to be 117.11 cfs. Therefore, the ponds and outlet structures were designed to meet the pre vs. post flow requirements from Reference 2.1.
- 3.2 Pond 4-1's PPV_{actual} is greater than $PPV_{required}$, and the pond mean depth is between 2 and 8 feet, which is within the provisions of Reference 2.1.
- 3.3 Pond 4-2's PPV_{actual} is greater than $PPV_{required}$, and the pond mean depth is between 2 and 8 feet, which is within the provisions of Reference 2.1.
- 3.4 The actual treatment volume is greater than the required treatment volume for Pond 4-1 and Pond 4-2.
- 3.5 Half of the actual treatment volume is discharged within the required 24 to 30 hours.
- 3.6 The length to width ratio is 1.67:1 for Pond 4-1. It is less than 2:1 due to space constraints
- 3.7 The length to width ratio is 2.05 for Pond 4-2. This meets the requirements of reference 2.1

4.0 Procedure/Methodology of Design

4.1 25-year, 24-hour Model

Using the existing conditions HydroCAD file as the base, the proposed conditions HydroCAD model was created. Following the guidelines of Reference 2.1, the ponds were designed such that the proposed 25-year, 24-hour flow rate is less than the existing 25-year, 24-hour flow rate at concentration point, CP-1.

4.2 100-year, 96-hour Model

The 100-year, 96-hour storm event was modeled to determine the elevation of the site.

4.3 The $PPV_{required}$ will be calculated by using the following equation: $PPV = (DA * c * R * RT) / (WS * CF)$. (Reference 2.1)

4.4 The Mean Depth will be calculated by using the following equation: $MD = PPV / Ar$. (Reference 2.1)

4.5 The design treatment volume is the greater of the following: (Reference 2.1)

- (a) one inch of runoff over the drainage area
- (b) 2.5 inches times the impervious area (excluding water bodies)

4.6 The drawdown of the treatment volume must occur per the requirements in Reference 2.1. Using the example drawdown calculation for a wet detention pond in Reference 2.1, the orifices for the outlet structures for Pond 4-1 and Pond 4-2 were designed to draw down 1/2 the treatment volume between 24 and 30 hours.

4.7 The length to width ratio for the wet detention ponds must be at a minimum 2:1 per the requirements in Reference 2.1. The width was taken as the north/south distance of the basins. The length was taken as the east/west distance.

5.0 Assumptions

none

6.0 Definitions of Units and Constants

CN_{roof} := 98
CN_{gravelgranite} := 85
CN_{grass} := 75
CN_{pond} := 98
CN_{pave} := 98
CN_{gravellime} := 91

PPV = Permanent Pool Volume
T_c = Time of Concentration
MD = Mean Depth
CN = Curve Number
ft = Feet
yr = Year
hr = Hour
cfs = Cubic Feet Per Second

7.0 Analysis/Solution

- 7.1 Composite Curve Number
- 7.2 Summary of Surfacing
- 7.3 Summary of HydroCAD inputs for Proposed Hydrology Model
- 7.4 Summary of results for Proposed Hydrology Model
- 7.5 $PPV_{actual} > PPV_{required}$
- 7.6 MD is between 2 and 8 feet
- 7.7 Design Treatment Volume
- 7.8 Orifice Design for Drawdown
- 7.9 Length to Width Ratio

7.0 Analysis

General Drainage Design Criteria

Applicable Regulations:

The project to be developed is located in Okeechobee, FL hence the storm water management system (SWMS) is governed by Environmental Resource Permitting (ERP) (Chapter 62-330, F.A.C.) and the Florida Department of Environmental Protection (FDEP) regulations for Storm Water Discharge (Chapter 62-25, F.A.C.). According to these regulations, the rules of the local water management district are adopted by reference for FDEP ERP requirements. Volume II and portions of Volume I are adopted by reference in chapter 62-330, F.A.C., and are therefore rules of the (FDEP). In accordance with paragraph 373.4131(2)(a), F.S. (2012), they are also rules of the District. The storm water management regulations for the Project site location in Okeechobee County is administered by St Johns River Water Management District (SJRWMD). Thus, the SWMS for this project will be designed to meet or exceed the criteria set forth in the SJRWMD ERP Information Manual, Volume I and Volume II.

7.1 Composite Curve Number

7.1.1 BE4-1

Aroof1 := 0acre (Reference 2.2)
Agravelgranite1 := 13.23acre (Reference 2.2)
Agrass1 := 42.03acre (Reference 2.2)
Apond1 := 8.87acre (Reference 2.2)
Apave1 := 1.25acre (Reference 2.2)
Agravellime1 := 18.77acre (Reference 2.2)

$$A_{total1} := A_{roof1} + A_{gravelgranite1} + A_{grass1} + A_{pond1} + A_{gravellime1} + A_{pave1}$$

$$A_{total1} = 84.15 \text{ acre}$$

Existing Weighted Curve Number

$$CN1 := \frac{(Agravelgranite1 \cdot CN_{gravelgranite} + A_{grass1} \cdot CN_{grass} + A_{pond1} \cdot CN_{pond} + Agravellime1 \cdot CN_{gravellime} + Apave1 \cdot CN_{pave})}{A_{total1}}$$

$$CN1 = 83$$

7.1.2 BE4-2

Aroof2 := 6.64acre (Reference 2.2)
Agravelgranite2 := 0acre (Reference 2.2)
Agrass2 := 41.5acre (Reference 2.2)
Apond2 := 9.59acre (Reference 2.2)
Apave2 := 6.09acre (Reference 2.2)
Agravellime2 := 12.18acre (Reference 2.2)

$$A_{total2} := A_{roof2} + A_{gravelgranite2} + A_{grass2} + A_{pond2} + A_{gravellime2} + A_{pave2}$$

$$A_{total2} = 76 \text{ acre}$$

Existing Weighted Curve Number

$$CN2 := \frac{(A_{roof2} \cdot CN_{roof} + A_{grass2} \cdot CN_{grass} + A_{pond2} \cdot CN_{pond} + Agravellime2 \cdot CN_{gravellime} + Apave2 \cdot CN_{pave})}{A_{total2}}$$

$$CN2 = 84$$

7.2 Surfacing Summary

Table 1

POST DEVELOPMENT SURFACING SUMMARY				
CONTRIBUTING SUB BASIN	TOTAL AREA AND PERCENT PERVIOUS & IMPERVIOUS			OUTFALL
	ACRE	PERCENT PERVIOUS	PERCENT IMPERVIOUS	
*BE 3	22.95	100%	0%	CP-1
BE 4	40.27	100%	0%	NN4B1
BE 4-1	84.15	50%	50%	CP-1
BE 4-2	76.00	55%	45%	CP-1
BE 4-3	35.80	100%	0%	CP-1
*BE 5	51.65	100%	0%	CP-1
*BE 7	19.50	100%	0%	CP-1
*BE 8	102.23	100%	0%	CP-1
*BE 9	101.50	100%	0%	CP-1
*BE 10	76.00	100%	0%	CP-1
*BE 11	79.80	100%	0%	CP-1
*BE 12	66.40	100%	0%	CP-1
*BE 13	112.30	100%	0%	CP-1
*BE 14A	499.20	100%	0%	CP-1
*BE 14B	333.70	100%	0%	CP-1
*BN 4C	210.70	100%	0%	CP-1 / NN4B1
*BN 4B1B	311.40	100%	0%	CP-1 / NN4B1
*BN 4B1	61.20	100%	0%	NN4B1
TOTAL CONTRIBUTING BASIN	2284.75	96.6%	3.4%	-

Table 2

OUTFALL	POST DEVELOPMENT FLOW RATE TO OUTFALL	PRE DEVELOPMENT FLOW RATE TO OUTFALL
	CFS	CFS
CP-1	534.00	541.37
NN4B1	108.55	117.11

NOTE 1. CONTRIBUTING BASINS ARE BASINS THAT CONTRIBUTE RUNOFF TO THE EXISTING OUTFALLS

NOTE 2. "*" INDICATED THAT SUB-BASIN SURFACING IS UNCHANGED FROM PRE DEVELOPMENT CONDITION. NO MODIFICATION TO EXISTING STOMRWATER SYSTEM IS NECESSARY

7.3 Summary of HydroCAD inputs for Proposed Hydrology Model

See the results in Attachment 3 for a flow diagram of the model.

7.3.1 General Inputs:

Rainfall: 9.2 inches (25-yr, 24-hr), 15 inches (100-yr, 96-hr)

Storm Type: Type II 24-hr

Unit Hydrograph: SCS

7.3.2 Basin Information:

7.3.2.1 BE-3

Area = 22.95 Acres

CN = 76

Tc = 138 minutes

7.3.2.2 BE-4

Area = 40.27 Acres

CN = 74

Tc = 83.4 minutes (See worksheet in Attachment 4)

7.3.2.3 BE4-1

Area = 84.15 Acres

CN = 83

Tc = 71.3 minutes (See worksheet in Attachment 4)

7.3.2.4 BE4-2

Area = 76 Acres

CN = 85

Tc = 71.8 minutes (See worksheet in Attachment 4)

7.3.2.5 BE-5

Area = 51.65 Acres

CN = 76

Tc = 103 minutes

7.3.2.6 BE4-3

Area = 35.80 Acres

CN = 74

Tc = 43.3 minutes (See worksheet in Attachment 4)

7.3.3 Detention Pond Summary:

7.3.3.1 Wet Pond 4-1

Storage:

<u>Elevation</u>	<u>Surface Area</u>
(ft)	(acres)
26.00	8.87
27.00	9.05
28.00	9.22
29.00	9.40
30.00	9.57
31.00	9.74
32.00	9.91
33.00	10.08
34.00	10.25
35.00	10.42
36.00	10.59

Outlets:

1. Orifice

Invert: 30.00 ft
Quantity: 3
Diameter: 7.25 inches

2. V-Notch Weir

Invert: 31.50 ft
Notch Angle: 90 degrees

3. Overflow Into Top of Structure

Invert: 32.50 ft
Width: 1 foot
Length: 8 feet

Pond Starting Elevation: 30.00 ft



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Prepared by: O Jankauskaite
Date: 09/01/15
Verified by: J C Barranco
Date: 09/02/15
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7.3.3.2 Wet Pond 4-2

Storage:

<u>Elevation</u>	<u>Surface Area</u>
(ft)	(acres)
29.00	9.59
30.00	9.78
31.00	9.96
32.00	10.14
33.00	10.32
34.00	10.50
35.00	10.68
36.00	10.86
37.00	11.04
38.00	11.22
39.00	11.40

Outlets:

1. Orifice

Invert: 31.00 ft
Quantity: 3
Diameter: 7.25 inches

2. V-Notch Weir

Invert: 32.50 ft
Notch Angle: 90 degrees

3. Overflow Weir

Invert: 33.50 ft
Length: 8 feet
Width: 1 foot

Pond Starting Elevation: 31.00 ft

7.3.3.3 Dry Pond BE4-3

The ditch that directed flow around the orange groves at drainage area BN4B1B is planned to be backfilled. This ditch directed flow both north and south. To handle the offsite flow a ditch/pond will be added for drainage area BE4-3. The information for the pond can be seen below.

Storage:

<u>Elevation</u> (ft)	<u>Surface Area</u> (acres)
30.00	0.31
31.00	3.13
32.00	6.23
33.00	12.95
34.00	13.60
35.00	14.25

Outlets:

1. Orifice
Invert: 30.00 ft
Quantity: 1
Diameter: 24 inches
2. Overflow Weir
Invert: 33.00 ft
Crest Length: 25 ft
Crest Breadth: 10.0 ft

Pond Starting Elevation: 30.00 ft

7.3.3.4 Dry Pond BE4

To handle the offsite flow a ditch/pond will be added for drainage area BE4. The information for the pond can be seen below.

Storage:

<u>Elevation</u> (ft)	<u>Surface Area</u> (acres)
31.00	0.83
32.00	1.66
33.00	2.49
34.00	3.32
35.00	4.14

Outlets:

1. Orifice
Invert: 31.00 ft
Quantity: 1
Diameter: 12 inches
2. Overflow Weir
Invert: 34.00 ft
Crest Length: 25 ft
Crest Breadth: 10.0 ft

Pond Starting Elevation: 31.00 ft

7.4 Summary of Results

See the results in Appendix A for more information.

7.4.1 Proposed Conditions

Peak Flow at CP-1 = 534.00 cfs (25-yr, 24-hr)

Peak Flow at NN4B1 = 108.55 cfs (25-year, 24-hr)

Peak elevation of Pond 4-1: 33.33 ft (25-yr, 24-hr), 34.39 ft (100-yr, 96-hr)

Peak elevation of Pond 4-2: 34.15 ft (25-yr, 24-hr), 35.13 ft (100-yr, 96-hr)

Peak elevation of Pond BE4-3: 34.19 ft (25-yr, 24-hr), 34.91 ft (100-yr, 96-hr)

Peak elevation of Pond BE4: 35.13 ft (25-yr, 24-hr), 35.54 ft (100-year, 96-hr)

$$7.5 \text{ PPV}_{\text{actual}} > \text{PPV}_{\text{required}}$$

7.5.1 Pond 4-1

Runoff Coefficient

A1 = Grass Area	A1 := 50.9acre	(Reference 2.3)
A2 = Pavement Area	A2 := 1.25acre	(Reference 2.3)
A3 = Gravel - Limestone Area	A3 := 18.77acre	(Reference 2.3)
A4 = Gravel - Granite Area	A4 := 13.23acre	(Reference 2.3)
C1 = Grass Coefficient	C1 := 0.45	(Reference 2.3)
C2 = Pavement Coefficient	C2 := 0.95	(Reference 2.3)
C3 = Gravel - Limestone Coefficient	C3 := 0.90	(Reference 2.3)
C4 = Gravel - Granite Coefficient	C4 := 0.75	(Reference 2.3)

$$C := \left[\frac{(A1 \cdot C1 + A2 \cdot C2 + A3 \cdot C3 + A4 \cdot C4)}{A1 + A2 + A3 + A4} \right]$$

$$C = 0.6$$

PPV Required

DA = Drainage Area

$$DA := A1 + A2 + A3 + A4 \quad DA = 84.15\text{-acre}$$

RT = Residence Time

The residence time for Basin #2 must be multiplied by 1.5 as a littoral zone alternative (Reference 2.1).

$$RT := 14\text{day} \cdot 1.5 \\ RT = 21\text{-day}$$

WS = Length of wet season

$$WS := 153\text{day} \quad (\text{Reference 2.1})$$

Rdepth = Wet season rainfall depth

$$Rdepth := 32\text{in} \quad (\text{Reference 2.1})$$

CF = Conversion Factor

$$CF := \frac{12\text{in}}{\text{ft}}$$

PPV_{required} = Permanent Pool Volume

$$\text{PPV}_{\text{required}} := \frac{(DA \cdot C \cdot Rdepth \cdot RT)}{(WS \cdot CF)} \quad (\text{Reference 2.1})$$

$$\text{PPV}_{\text{required}} = 18.63\text{ft} \cdot \text{acre}$$

PPV actual is the volume between the bottom of the pond elevation and the control elevation (5ft)

PPV_{actual} := 20.82acre·ft

PPV_{actual} ≥ PPV_{required}

Mean Depth (MD)

Ap = area at control elevation (5ft)

Ap := 9.57acre

MD := $\frac{PPV_{actual}}{A_p}$

MD = 2.176ft

MD is between 2 and 8 as required by Reference 2.1 pg. 20-5

7.5.2 Pond 4-2

Runoff Coefficient

A1 = Grass Area

A1 := 51.09acre

(Reference 2.3)

A2 = Pavement Area

A2 := 6.09acre

(Reference 2.3)

A3 = Gravel - Limestone Area

A3 := 18.82acre

(Reference 2.3)

A4 = Gravel - Granite Area

A4 := 0acre

(Reference 2.3)

C1 = Grass Coefficient

C1 := 0.45

(Reference 2.3)

C2 = Pavement Coefficient

C2 := 0.95

(Reference 2.3)

C3 = Gravel - Limestone Coefficient

C3 := 0.90

(Reference 2.3)

C4 = Gravel - Granite Coefficient

C4 := 0.75

(Reference 2.3)

$$C := \left[\frac{(A1 \cdot C1 + A2 \cdot C2 + A3 \cdot C3 + A4 \cdot C4)}{A1 + A2 + A3 + A4} \right]$$

C = 0.6

PPV Required

DA = Drainage Area

DA := A1 + A2 + A3 + A4

DA = 76-acre

RT = Residence Time

RT := 14day·1.5

The residence time for Basin #2 must be multiplied by 1.5 as a littoral zone alternative (Reference 2.1).

RT = 21·day

WS = Length of wet season

WS := 153day

Rdepth = Wet season rainfall depth

Rdepth := 32in

CF = Conversion Factor

$$CF := \frac{12 \text{ in}}{\text{ft}}$$

PPV_{required} = Permanent Pool Volume

$$PPV_{\text{required}} := \frac{(DA \cdot C \cdot R_{\text{depth}} \cdot RT)}{(WS \cdot CF)} *$$

$$PPV_{\text{required}} = 16.73 \text{ ft} \cdot \text{acre}$$

PPV actual is the volume between the bottom of the pond elevation and the control elevation (5ft)

$$PPV_{\text{actual}} := 21.0 \text{ acre} \cdot \text{ft}$$

$$PPV_{\text{actual}} \geq PPV_{\text{required}}$$

7.6 Mean Depth

Mean Depth (MD)

A_p = area at control elevation (5ft)

$$A_p := 10.14 \text{ acre}$$

$$MD := \frac{PPV_{\text{actual}}}{A_p}$$

$$MD = 2.071 \text{ ft}$$

MD is between 2 and 8 as required by Reference 2.1

7.7 Design Treatment Volume

7.7.1 Pond 4-1

Treatment Volume option (a)

TV = one inch of runoff over the drainage area

DA = Drainage Area

$$DA := 84.15 \text{ acre}$$

CF = Conversion Factor

$$CF := 12 \frac{\text{in}}{\text{ft}}$$

RO = Runoff

$$RO := 1 \text{ in}$$

$$TV := \left(RO \cdot \frac{DA}{CF} \right) \quad TV = 7.01 \text{ ft} \cdot \text{acre}$$

Treatment Volume option (b)

$$TV = 2.5 \text{ in} \cdot IA$$

IA = Impervious Area

A1 = Pavement Area

$$A1 := 1.25 \text{ acre}$$

A2 = Gravel - Limestone Area

$$A2 := 18.77 \text{ acre}$$

A3 = Gravel - Granite

$$A3 := 13.23 \text{ acre}$$

$$IA := A1 + A2 + A3$$

$$IA = 33.25 \text{ acre}$$

RO1 = Impervious Runoff

$$RO1 := 2.5 \text{ in}$$

$$TV := RO1 \cdot \frac{IA}{CF}$$

$$TV = 6.927 \text{ ft} \cdot \text{acre}$$

$$TV_{\text{required}} = 6.927 \text{ acre}$$

$$TV_{\text{actual}} = 14.57 \text{ acre} \cdot \text{ft}, \text{ therefore } TV_{\text{actual}} > TV_{\text{required}}$$

7.7.2 Pond 4-2

Treatment Volume option (a)

TV = one inch of runoff over the drainage area

DA = Drainage Area

$$DA := 7 \text{ acre}$$

CF = Conversion Factor

$$CF := 12 \frac{\text{in}}{\text{ft}}$$

RO = Runoff

$$RO := 1 \text{ in}$$



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$$TVa := \left(RO \cdot \frac{DA}{CF} \right)$$

$$TVa = 0.58 \text{ ft} \cdot \text{acre}$$

Treatment Volume option (b)

$$TV = 2.5 \text{ in} \cdot IA$$

IA = Impervious Area

A1 = Pavement Area

$$A1 := 6.09 \text{ acre}$$

A2 = Gravel - Limestone Area

$$A2 := 18.82 \text{ acre}$$

A3 = Gravel - Granite

$$A3 := 0 \text{ acre}$$

$$IA := A1 + A2 + A3$$

$$IA = 24.91 \cdot \text{acre}$$

RO1 = Impervious Runoff

$$RO1 := 2.5 \text{ in}$$

$$TVb := RO1 \cdot \frac{IA}{CF}$$

$$TVb = 5.19 \text{ ft} \cdot \text{acre}$$

$$TV_{\text{required}} = 5.19 \text{ acre}$$

$$TV_{\text{actual}} = 15.17 \text{ acre} \cdot \text{ft}, \text{ therefore } TV_{\text{actual}} > TV_{\text{required}}$$

7.8 Drawdown of half the actual treatment volume in 24 to 30 hours

7.8.1 Pond 4-1

Orifice Design					
The orifice design is in accordance with the methodology of Reference 2.1					
$Q = \frac{TV}{2t * C.F.}$					
Where:					
t = Recovery time - must be between 24 and 30 hours. (Reference 2.1)					
= 29.9 hrs					
C.F. = 3600 s/hr					
TV = 14.57 acre-ft = 634669.2 ft ³					
Q = 2.948110368 cfs					
$h = (h_1 + h_2)/2 \quad A = \frac{Q}{c(2gh)^{0.5}} \quad D = (4 * A / \pi)^{0.5}$					
h ₁ = change in elevation between the top of the treatment volume and the flowline					
h ₂ = change in elevation between 1/2 the treatment volume and the flowline					
A = Area of the orifice					
D = Diameter of the orifice					
c = orifice coefficient = 0.6					
Iteration 1					
h ₁ = 31.5 - 30 = 1.5 h ₂ = 30.75 - 30 = 0.75 ft					
h = (1.5 + 0.75)/2 = 1.125 ft					
A = 0.577262429 ft ²					
D = 0.857317533 ft					
= 10.2878104 in					
Iteration 2					
F _{lnew} = 0.5D = 0.257 ft					
Continue with iterations until F _{lold} = F _{lnew}					
h ₁ (ft)	h ₂ (ft)	head h(ft)	Area A(ft ²)	Diameter D(ft)	Flow line FL(ft)
1.500	0.750	1.125	0.577	0.857	0.429
1.071	0.321	0.696	0.734	0.967	0.483
1.017	0.267	0.642	0.764	0.986	0.493
1.007	0.257	0.632	0.770	0.990	0.495
1.005	0.255	0.630	0.772	0.991	0.496

A =	0.77	ft^2			
Dia=	0.99	ft			
Radius =	5.95	inches			
Flowline =	0.50	ft			
Use a 3-7.25 inch inside diameter orifices					
Check on recovery time -			A=	0.860051895	ft^2
Q = TV/(2t*C.F.)			Q =	3.286451594	cfs
t=	26.82178559	hrs	TV = 14.57	acre-ft	
			CF= 3600	s/h	
26.82 hrs is between the required 24 and 30 hours					

7.8.2 Pond 4-2

<u>Orifice Design</u>			
The orifice design is in accordance with the methodology of Reference 2.1.			
Q =	$\frac{TV}{2t * C.F.}$		
Where:			
t =	Recovery time - must be between 24 and 30 hours. (Reference 2.1)		
=	29.9 hrs		
C.F.=	3600 s/hr		
TV =	15.17 acre-ft =	660805.2 ft ³	
Q =	3.06951505 cfs		
h = (h1+h2)/2	A = $\frac{Q}{c(2gh)^{.5}}$	D = $(4*A/\pi)^{.5}$	
h1 = change in elevation between the top of the treatment volume and the flowline			
h2 = change in elevation between 1/2 the treatment volume and the flowline			
A = Area of the orifice			
D = Diameter of the orifice			
c = orifice coefficient = 0.6			
<u>Iteration 1</u>			
h1 =	32.5-31 = 1.5	h2 =	31.75-31 = 0.75 ft
h =	(1.5+0.75)/2 =		1.125 ft
A =	0.60103439 ft ²		
D=	0.874791834 ft		
=	10.49750201 in		

Iteration 2

$$F_{\text{new}} = 0.5D = 0.257 \text{ ft}$$

Continue with iterations until $F_{old} = F_{new}$

		head	Area	Diameter	Flow line
h1(ft)	h2(ft)	h(ft)	A(ft^2)	D(ft)	FL(ft)
1.500	0.750	1.125	0.601	0.875	0.437
1.063	0.313	0.688	0.769	0.989	0.495
1.005	0.255	0.630	0.803	1.011	0.506
0.994	0.244	0.619	0.810	1.016	0.508
0.992	0.242	0.617	0.811	1.016	0.508

A =	0.81	ft ²
-----	------	-----------------

Dia=	1.02 ft
------	---------

Radius =	6.10 inches
----------	-------------

Flowline =	0.51 ft
------------	---------

Use a 3-7.25 inch inside diameter orifices

Check on recovery time -

A=	0.860051895	ft^2
----	-------------	------

$$Q = TV/(2t \cdot C.F.)$$

Q =	3.253448554 cfs
-----	-----------------

t=	28.20960543	hrs
----	-------------	-----

TV = 15.17	acre-ft
------------	---------

$$CF = 3600$$

	s/h
--	-----

28.21 hrs is between the required 24 and 30 hours

7.9 Length to Width Ratio

The length for Pond 4-1 is 943 ft. The width for Pond 4-1 is 563 ft. The L:W ratio for Pond 4-1 is 1.67. It is not above the 2:1 threshold as there is not sufficient space to lengthen the pond.

The length for Pond 4-2 is 957 ft. The width for Pond 4-2 is 467 ft. The L:W ratio for Pond 4-2 is 2.05. It meets the minimum criteria of reference 2.1.

Although the width to length ratio does not meet the 2:1 requirement for Pond 4-1, the pond still exceeds by almost twice the minimum treatment volume requirements and the point discharge in to the pond is located on the opposite side of the outfall structure to maximize treatment time; therefore there is sufficient residence time.



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Attachments



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Attachment 1

Rainfall Maps

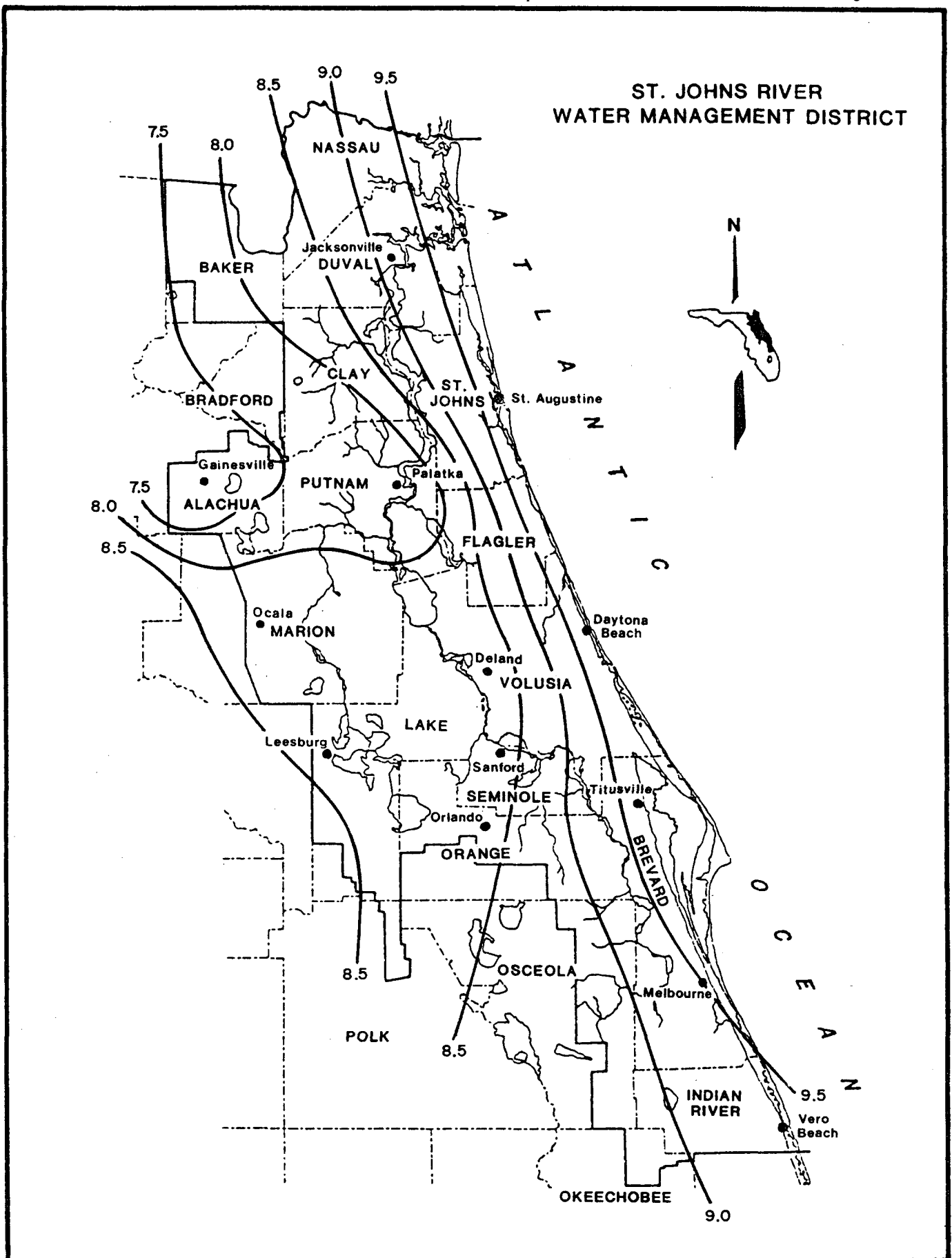


Figure 7. 25-Year 24-Hour Maximum Rainfall for Northeast Florida, Inches.

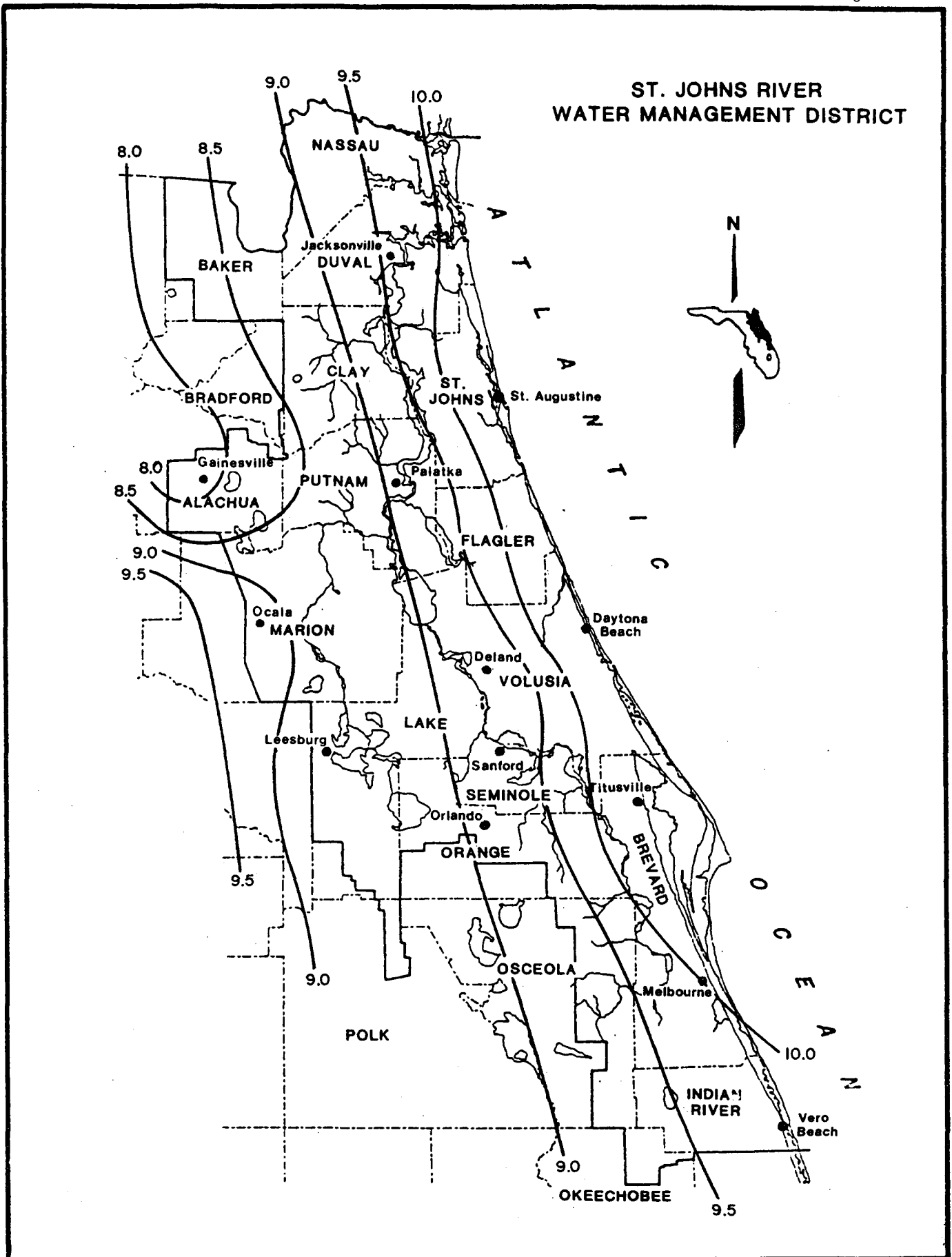


Figure 12. 10-Year 96-Hour Maximum Rainfall for Northeast Florida, Inches.



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Attachment 2

Basin Sketch



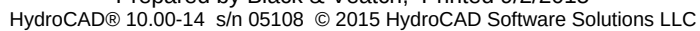
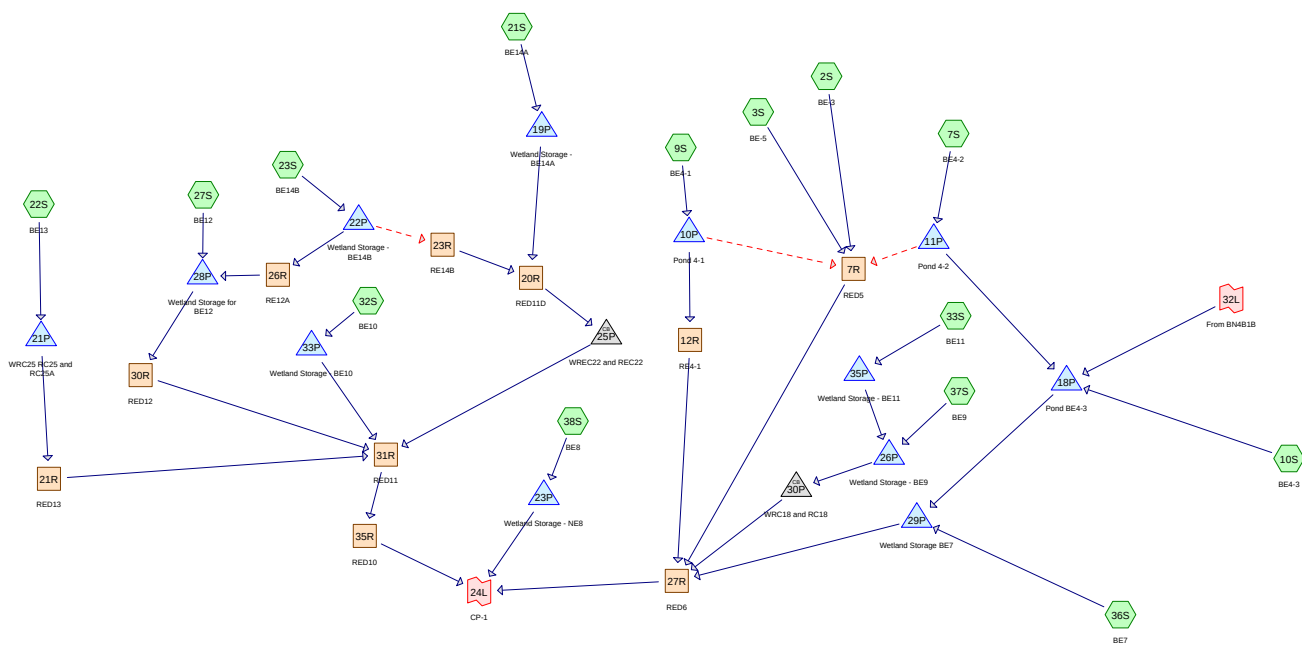


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Attachment 3
HydroCAD Files



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Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
196.220	76	(2S, 3S, 36S, 38S)
76.000	85	(7S)
84.150	83	(9S)
35.180	74	(10S)
1,014.200	73	(21S, 23S, 33S, 37S)
254.700	75	(22S, 27S, 32S)
1,660.450	75	TOTAL AREA

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Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
0.000	HSG C	
0.000	HSG D	
1,660.450	Other	2S, 3S, 7S, 9S, 10S, 21S, 22S, 23S, 27S, 32S, 33S, 36S, 37S, 38S
1,660.450		TOTAL AREA

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Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	0.000	0.000	0.000	1,660.450	1,660.450		2S, 3S, 7S, 9S, 10S, 21S, 22S, 23S, 27S, 32S, 33S, 36S, 37S, 38S
0.000	0.000	0.000	0.000	1,660.450	1,660.450	TOTAL AREA	

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Pipe Listing (all nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Diam/Width (inches)	Height (inches)	Inside-Fill (inches)
1	21P	32.04	31.39	23.0	0.0283	0.024	36.0	0.0	0.0
2	21P	30.01	29.99	29.0	0.0007	0.024	8.0	0.0	0.0
3	22P	36.00	34.30	23.0	0.0739	0.024	24.0	0.0	0.0
4	23P	29.63	28.90	29.0	0.0252	0.024	24.0	0.0	0.0
5	25P	27.24	27.18	40.0	0.0015	0.024	72.0	0.0	0.0
6	26P	29.62	29.07	34.0	0.0162	0.024	36.0	0.0	0.0
7	28P	28.87	28.68	20.0	0.0095	0.024	36.0	0.0	0.0
8	30P	29.42	29.26	17.0	0.0094	0.024	36.0	0.0	0.0
9	35P	29.17	28.74	29.0	0.0148	0.024	36.0	0.0	0.0

Proposed-1

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Time span=0.00-96.00 hrs, dt=0.05 hrs, 1921 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment2S: BE-3	Runoff Area=22.950 ac 0.00% Impervious Runoff Depth=6.26" Tc=138.0 min CN=76 Runoff=41.07 cfs 11.974 af
Subcatchment3S: BE-5	Runoff Area=51.540 ac 0.00% Impervious Runoff Depth=6.26" Tc=103.0 min CN=76 Runoff=115.08 cfs 26.891 af
Subcatchment7S: BE4-2	Runoff Area=76.000 ac 0.00% Impervious Runoff Depth=7.38" Flow Length=2,844' Slope=0.0050 '/' Tc=71.8 min CN=85 Runoff=257.49 cfs 46.714 af
Subcatchment9S: BE4-1	Runoff Area=84.150 ac 0.00% Impervious Runoff Depth=7.13" Flow Length=2,809' Slope=0.0050 '/' Tc=71.3 min CN=83 Runoff=278.73 cfs 49.994 af
Subcatchment10S: BE4-3	Runoff Area=35.180 ac 0.00% Impervious Runoff Depth=6.01" Flow Length=3,797' Tc=43.3 min CN=74 Runoff=142.57 cfs 17.624 af
Subcatchment21S: BE14A	Runoff Area=499.200 ac 0.00% Impervious Runoff Depth=5.89" Tc=152.0 min CN=73 Runoff=776.61 cfs 244.888 af
Subcatchment22S: BE13	Runoff Area=112.300 ac 0.00% Impervious Runoff Depth=6.14" Tc=153.0 min CN=75 Runoff=181.39 cfs 57.426 af
Subcatchment23S: BE14B	Runoff Area=333.700 ac 0.00% Impervious Runoff Depth=5.89" Tc=152.0 min CN=73 Runoff=519.14 cfs 163.700 af
Subcatchment27S: BE12	Runoff Area=66.400 ac 0.00% Impervious Runoff Depth=6.14" Tc=122.0 min CN=75 Runoff=127.86 cfs 33.954 af
Subcatchment32S: BE10	Runoff Area=76.000 ac 0.00% Impervious Runoff Depth=6.14" Tc=102.0 min CN=75 Runoff=167.85 cfs 38.863 af
Subcatchment33S: BE11	Runoff Area=79.800 ac 0.00% Impervious Runoff Depth=5.89" Tc=74.0 min CN=73 Runoff=215.12 cfs 39.147 af
Subcatchment36S: BE7	Runoff Area=19.500 ac 0.00% Impervious Runoff Depth=6.26" Tc=155.0 min CN=76 Runoff=31.88 cfs 10.174 af
Subcatchment37S: BE9	Runoff Area=101.500 ac 0.00% Impervious Runoff Depth=5.89" Tc=156.0 min CN=73 Runoff=154.95 cfs 49.792 af
Subcatchment38S: BE8	Runoff Area=102.230 ac 0.00% Impervious Runoff Depth=6.26" Tc=125.0 min CN=76 Runoff=197.18 cfs 53.338 af
Reach 7R: RED5	Avg. Flow Depth=4.44' Max Vel=2.48 fps Inflow=151.70 cfs 38.865 af n=0.050 L=680.0' S=0.0029 '/' Capacity=684.90 cfs Outflow=151.20 cfs 38.865 af
Reach 12R: RE4-1	Avg. Flow Depth=2.40' Max Vel=1.48 fps Inflow=39.94 cfs 46.668 af n=0.060 L=883.0' S=0.0023 '/' Capacity=334.11 cfs Outflow=39.83 cfs 46.614 af

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Reach 20R:	Avg. Flow Depth=796,349,792,711,180.00' Max Vel=1.12 fps Inflow=382.83 cfs 331.265 af n=0.070 L=2,100.0' S=0.0007 ' Capacity=69.98 cfs Outflow=76.75 cfs 10.123 af
Reach 21R: RED13	Avg. Flow Depth=1.58' Max Vel=0.88 fps Inflow=37.04 cfs 57.196 af n=0.060 L=1,750.0' S=0.0011 ' Capacity=135.42 cfs Outflow=36.97 cfs 57.149 af
Reach 23R: RE14B	Avg. Flow Depth=2.45' Max Vel=4.55 fps Inflow=94.26 cfs 86.377 af n=0.050 L=80.0' S=0.0125 ' Capacity=357.03 cfs Outflow=94.26 cfs 86.377 af
Reach 26R: RE12A	Avg. Flow Depth=9.75' Max Vel=2.85 fps Inflow=366.45 cfs 77.323 af n=0.060 L=1,600.0' S=0.0022 ' Capacity=195.11 cfs Outflow=360.63 cfs 77.323 af
Reach 27R: RED6	Avg. Flow Depth=5.44' Max Vel=3.60 fps Inflow=340.95 cfs 361.511 af n=0.035 L=2,300.0' S=0.0015 ' Capacity=389.01 cfs Outflow=338.37 cfs 361.303 af
Reach 30R: RED12	Avg. Flow Depth=2.21' Max Vel=3.89 fps Inflow=63.27 cfs 111.277 af n=0.035 L=400.0' S=0.0075 ' Capacity=762.50 cfs Outflow=63.27 cfs 111.277 af
Reach 31R: RED11	Avg. Flow Depth=10.91' Max Vel=0.74 fps Inflow=219.44 cfs 217.413 af n=0.035 L=1,600.0' S=0.0001 ' Capacity=69.61 cfs Outflow=196.09 cfs 217.367 af
Reach 35R: RED10	Avg. Flow Depth=6.46' Max Vel=1.75 fps Inflow=196.09 cfs 217.367 af n=0.035 L=1,400.0' S=0.0004 ' Capacity=182.27 cfs Outflow=193.58 cfs 217.345 af
Pond 10P: Pond 4-1	Peak Elev=33.33' Storage=69.741 af Inflow=278.73 cfs 49.994 af Outflow=39.94 cfs 46.668 af
Pond 11P: Pond 4-2	Peak Elev=34.16' Storage=51.959 af Inflow=257.49 cfs 46.714 af Outflow=27.89 cfs 42.755 af
Pond 18P: Pond BE4-3	Peak Elev=34.19' Storage=31.888 af Inflow=151.17 cfs 177.608 af Outflow=114.54 cfs 177.093 af
Pond 19P: Wetland Storage - BE14A	Peak Elev=37.96' Storage=101.414 af Inflow=776.61 cfs 244.888 af Outflow=298.25 cfs 244.888 af
Pond 21P: WRC25 RC25 and RC25A	Peak Elev=35.22' Storage=33.351 af Inflow=181.39 cfs 57.426 af Outflow=37.04 cfs 57.196 af
Pond 22P: Wetland Storage - BE14B	Peak Elev=38.37' Storage=39.747 af Inflow=519.14 cfs 163.700 af Primary=366.45 cfs 77.323 af Secondary=94.26 cfs 86.377 af Outflow=460.71 cfs 163.700 af
Pond 23P: Wetland Storage - NE8	Peak Elev=31.84' Storage=39.741 af Inflow=197.18 cfs 53.338 af Outflow=13.13 cfs 53.336 af
Pond 25P: WREC22 and REC22	Peak Elev=31.23' Inflow=76.75 cfs 10.123 af Outflow=76.75 cfs 10.123 af
Pond 26P: Wetland Storage - BE9	Peak Elev=34.29' Storage=20.410 af Inflow=234.41 cfs 88.927 af Outflow=181.76 cfs 88.927 af
Pond 28P: Wetland Storage for BE12	Peak Elev=35.91' Storage=67.987 af Inflow=422.98 cfs 111.277 af Outflow=63.27 cfs 111.277 af

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Type II 24-hr 25yr-24hr Rainfall=9.20"

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Pond 29P: Wetland Storage BE7

Peak Elev=33.01' Storage=8.493 af Inflow=118.70 cfs 187.267 af
Outflow=116.29 cfs 187.105 af

Pond 30P: WRC18 and RC18

Peak Elev=34.78' Inflow=181.76 cfs 88.927 af
Outflow=181.76 cfs 88.927 af

Pond 33P: Wetland Storage - BE10

Peak Elev=31.77' Storage=9.253 af Inflow=167.85 cfs 38.863 af
Outflow=108.42 cfs 38.863 af

Pond 35P: Wetland Storage - BE11

Peak Elev=34.13' Storage=15.636 af Inflow=215.12 cfs 39.147 af
Outflow=79.68 cfs 39.135 af

Link 24L: CP-1

Inflow=534.00 cfs 631.985 af
Primary=534.00 cfs 631.985 af

Link

25yr-24hr Primary Outflow Imported from Proposed - Part 2~Link 18L.hce Inflow=97.45 cfs 117.229 af
Area= 522.100 ac Primary=97.45 cfs 117.229 af

Total Runoff Area = 1,660.450 ac Runoff Volume = 844.479 af Average Runoff Depth = 6.10"
100.00% Pervious = 1,660.450 ac 0.00% Impervious = 0.000 ac

Proposed-1

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Type II 24-hr 25yr-24hr Rainfall=9.20"

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Summary for Subcatchment 2S: BE-3

Runoff = 41.07 cfs @ 13.63 hrs, Volume= 11.974 af, Depth= 6.26"

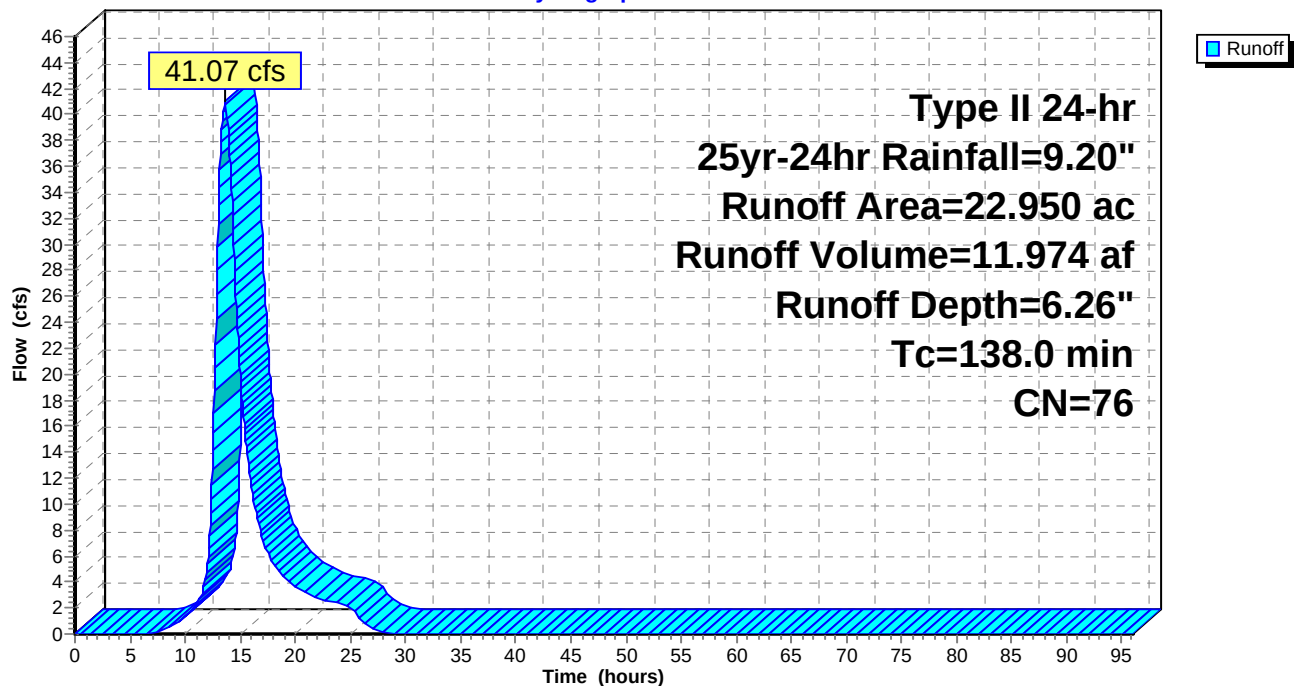
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Type II 24-hr 25yr-24hr Rainfall=9.20"

Area (ac)	CN	Description
* 22.950	76	
22.950		100.00% Pervious Area

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

Subcatchment 2S: BE-3

Hydrograph



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Type II 24-hr 25yr-24hr Rainfall=9.20"

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Summary for Subcatchment 3S: BE-5

Runoff = 115.08 cfs @ 13.16 hrs, Volume= 26.891 af, Depth= 6.26"

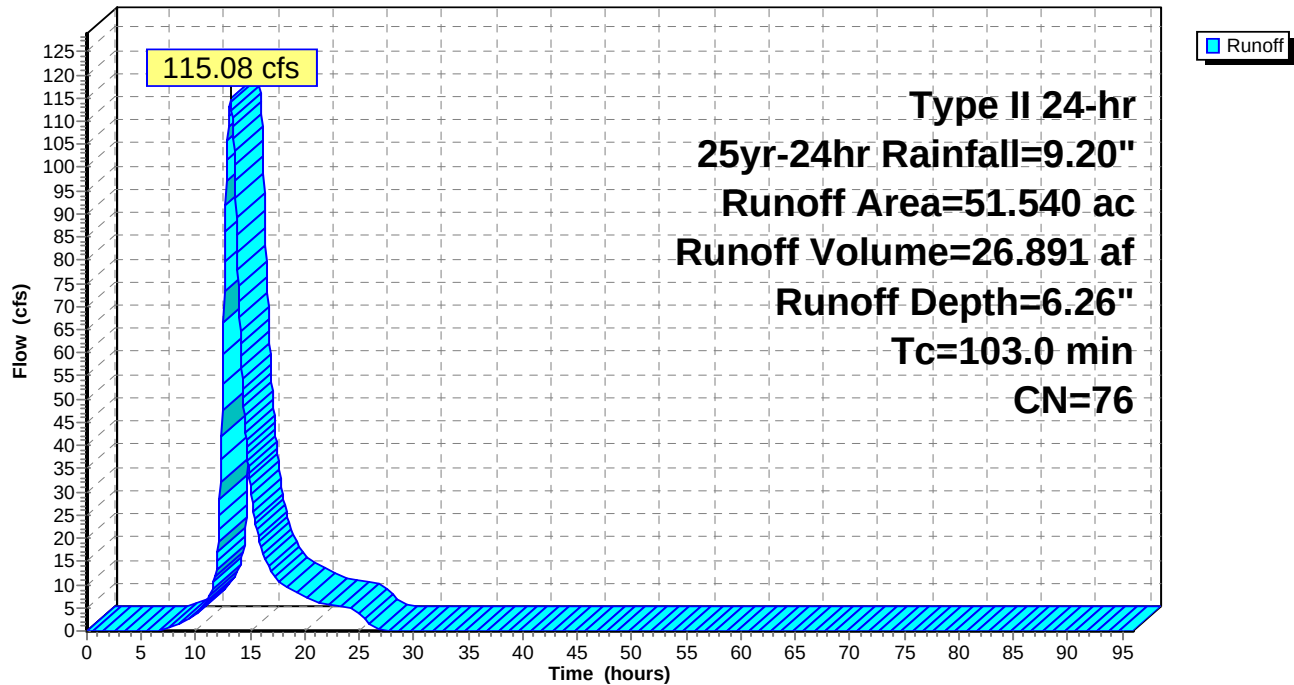
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Type II 24-hr 25yr-24hr Rainfall=9.20"

Area (ac)	CN	Description
* 51.540	76	
51.540		100.00% Pervious Area

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

Subcatchment 3S: BE-5

Hydrograph



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Type II 24-hr 25yr-24hr Rainfall=9.20"

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Summary for Subcatchment 7S: BE4-2

Runoff = 257.49 cfs @ 12.74 hrs, Volume= 46.714 af, Depth= 7.38"

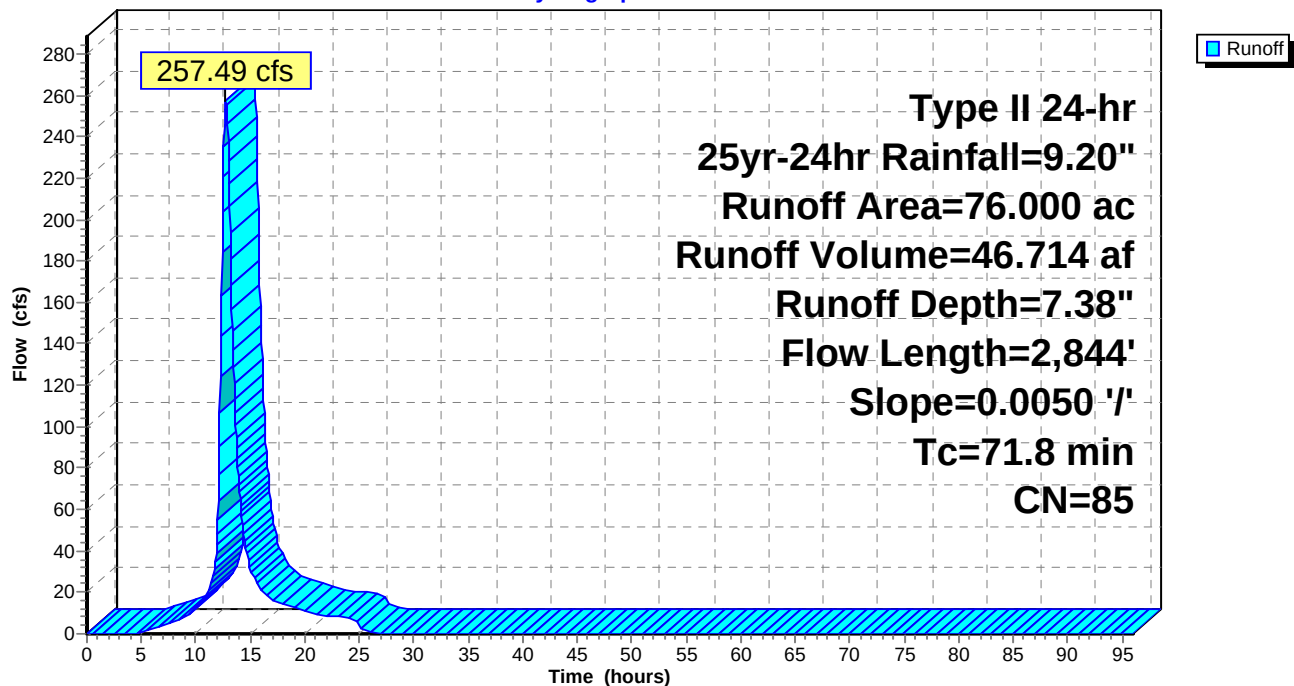
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Type II 24-hr 25yr-24hr Rainfall=9.20"

Area (ac)	CN	Description
* 76.000	85	
76.000		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
34.3	300	0.0050	0.15		Sheet Flow, Grass: Short n= 0.150 P2= 4.58"
37.5	2,544		1.13		Direct Entry,
71.8	2,844	Total			

Subcatchment 7S: BE4-2

Hydrograph



Proposed-1

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Type II 24-hr 25yr-24hr Rainfall=9.20"

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Summary for Subcatchment 9S: BE4-1

Runoff = 278.73 cfs @ 12.75 hrs, Volume= 49.994 af, Depth= 7.13"

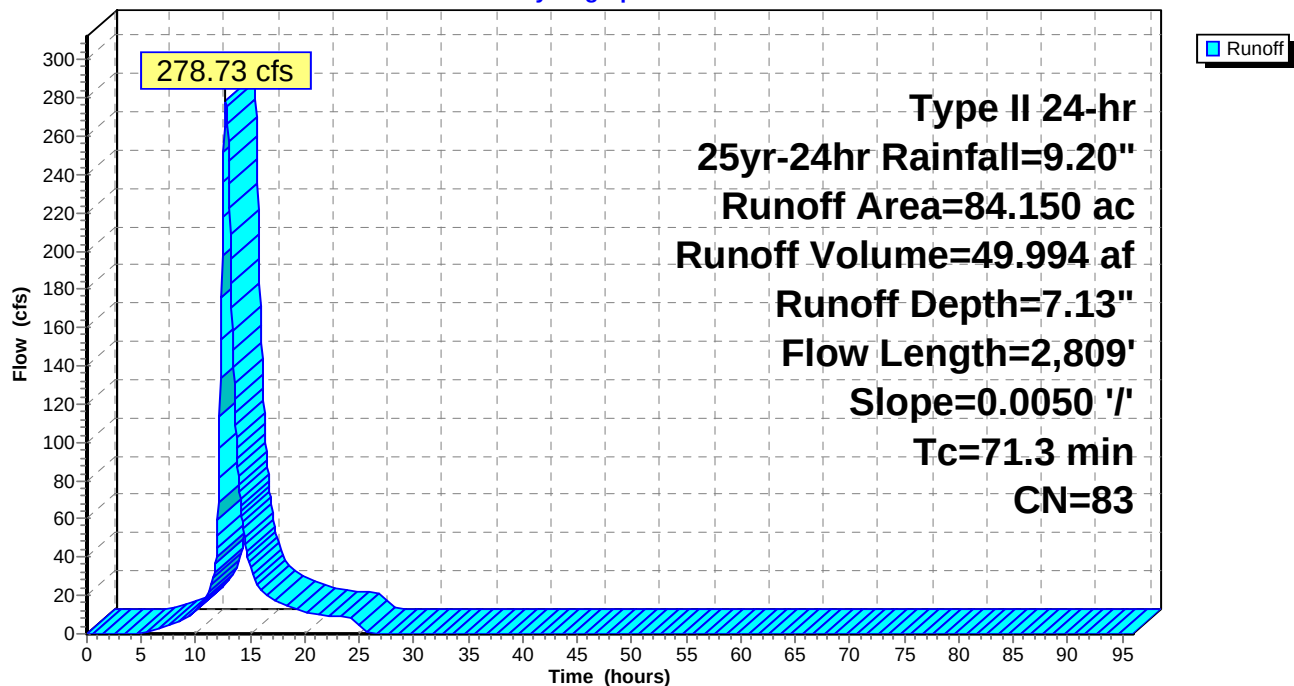
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Type II 24-hr 25yr-24hr Rainfall=9.20"

Area (ac)	CN	Description
* 84.150	83	
84.150		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
34.3	300	0.0050	0.15		Sheet Flow, Grass: Short n= 0.150 P2= 4.58"
37.0	2,509		1.13		Direct Entry,
71.3	2,809	Total			

Subcatchment 9S: BE4-1

Hydrograph



Proposed-1

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Type II 24-hr 25yr-24hr Rainfall=9.20"

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Summary for Subcatchment 10S: BE4-3

Runoff = 142.57 cfs @ 12.40 hrs, Volume= 17.624 af, Depth= 6.01"

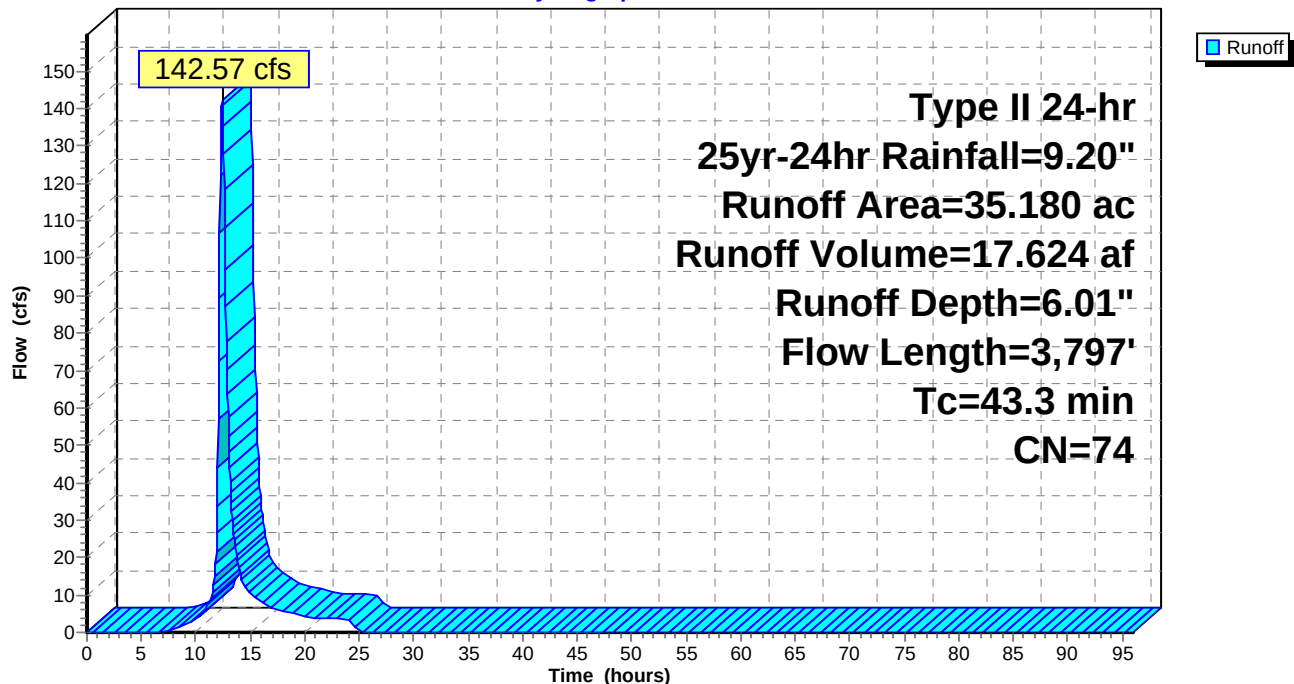
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Type II 24-hr 25yr-24hr Rainfall=9.20"

Area (ac)	CN	Description
* 35.180	74	
35.180		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.9	200	0.0050	0.28		Sheet Flow, Cultivated: Residue<=20% n= 0.060 P2= 4.58"
7.2	86	0.0008	0.20		Shallow Concentrated Flow, Short Grass Pasture Kv= 7.0 fps
24.2	3,511	0.0008	2.41	237.12	Channel Flow, Area= 98.2 sf Perim= 43.4' r= 2.26' n= 0.030
43.3	3,797	Total			

Subcatchment 10S: BE4-3

Hydrograph



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Type II 24-hr 25yr-24hr Rainfall=9.20"

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Summary for Subcatchment 21S: BE14A

Runoff = 776.61 cfs @ 13.84 hrs, Volume= 244.888 af, Depth= 5.89"

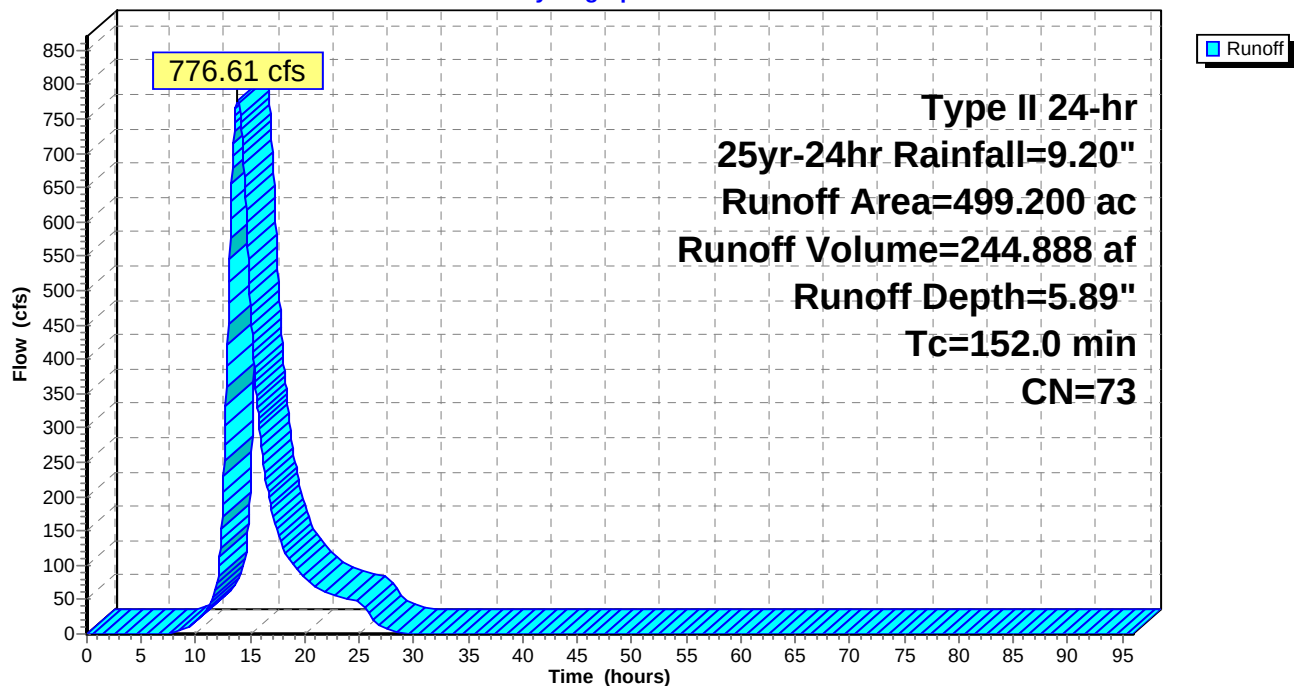
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Type II 24-hr 25yr-24hr Rainfall=9.20"

Area (ac)	CN	Description
* 499.200	73	
499.200		100.00% Pervious Area

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

Subcatchment 21S: BE14A

Hydrograph



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Type II 24-hr 25yr-24hr Rainfall=9.20"

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Summary for Subcatchment 22S: BE13

Runoff = 181.39 cfs @ 13.78 hrs, Volume= 57.426 af, Depth= 6.14"

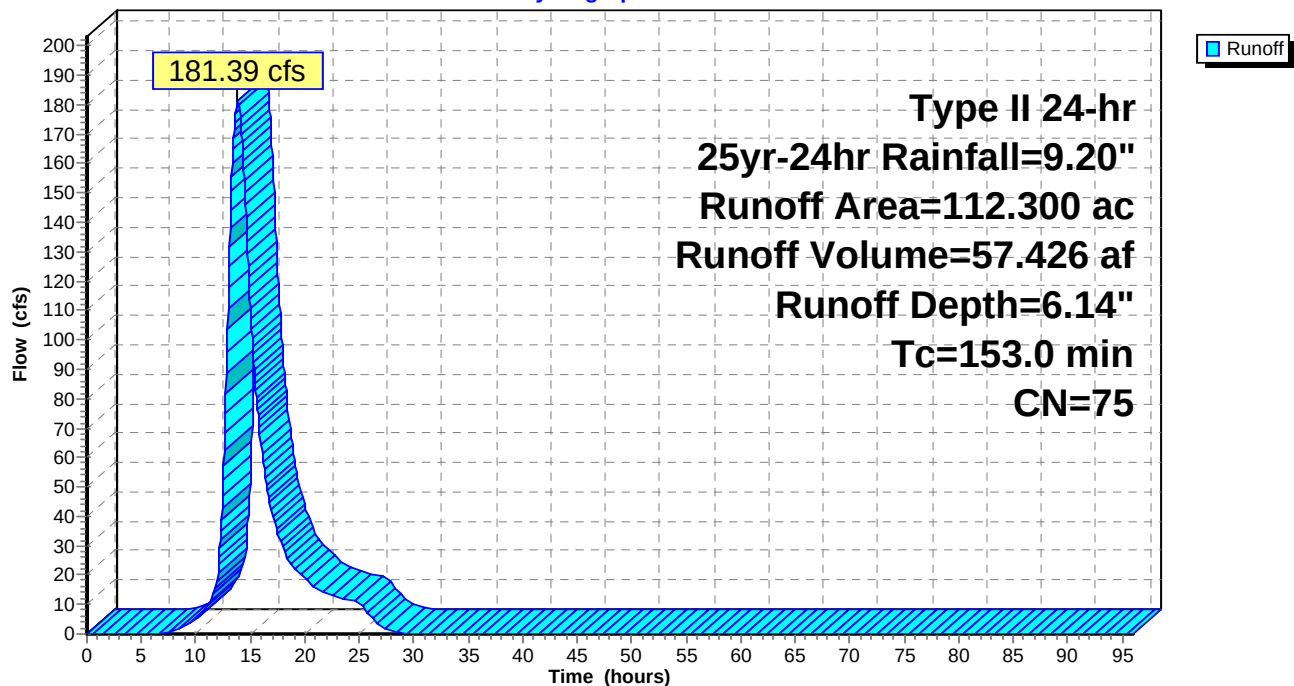
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Type II 24-hr 25yr-24hr Rainfall=9.20"

Area (ac)	CN	Description
* 112.300	75	
112.300		100.00% Pervious Area

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

Subcatchment 22S: BE13

Hydrograph



Proposed-1

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Type II 24-hr 25yr-24hr Rainfall=9.20"

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Summary for Subcatchment 23S: BE14B

Runoff = 519.14 cfs @ 13.84 hrs, Volume= 163.700 af, Depth= 5.89"

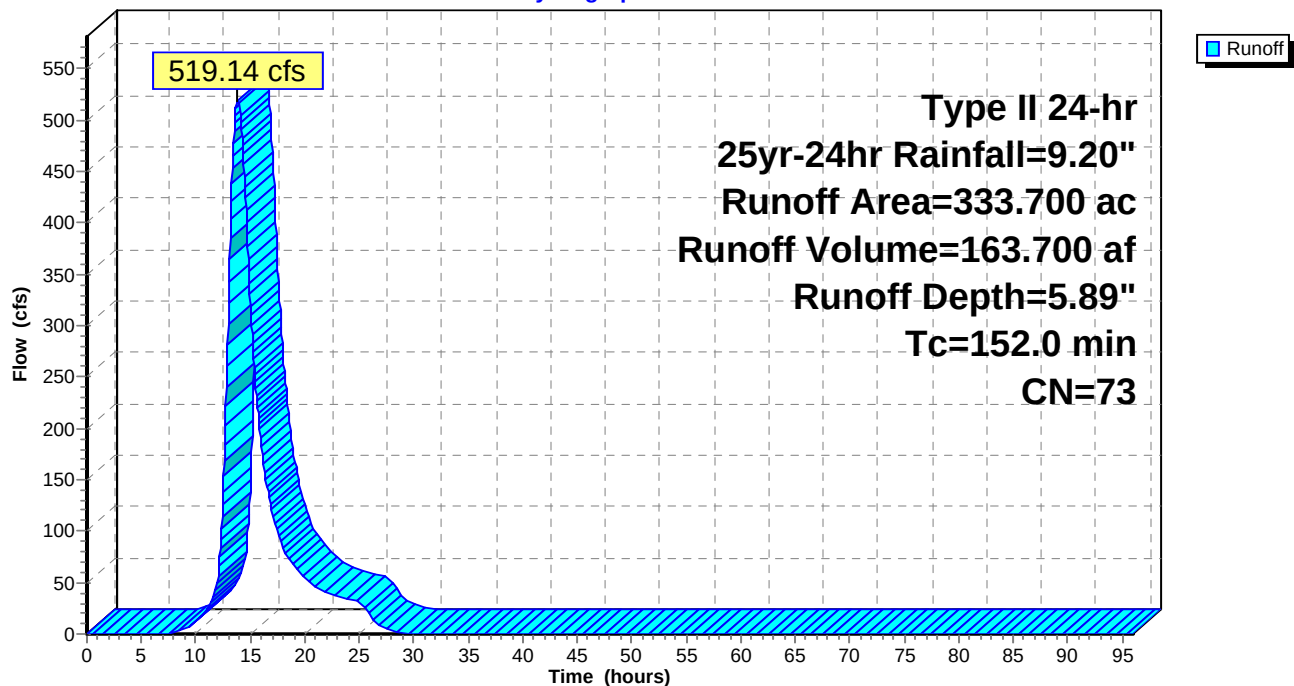
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Type II 24-hr 25yr-24hr Rainfall=9.20"

Area (ac)	CN	Description
* 333.700	73	
333.700		100.00% Pervious Area

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

Subcatchment 23S: BE14B

Hydrograph



Proposed-1

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Type II 24-hr 25yr-24hr Rainfall=9.20"

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Summary for Subcatchment 27S: BE12

Runoff = 127.86 cfs @ 13.41 hrs, Volume= 33.954 af, Depth= 6.14"

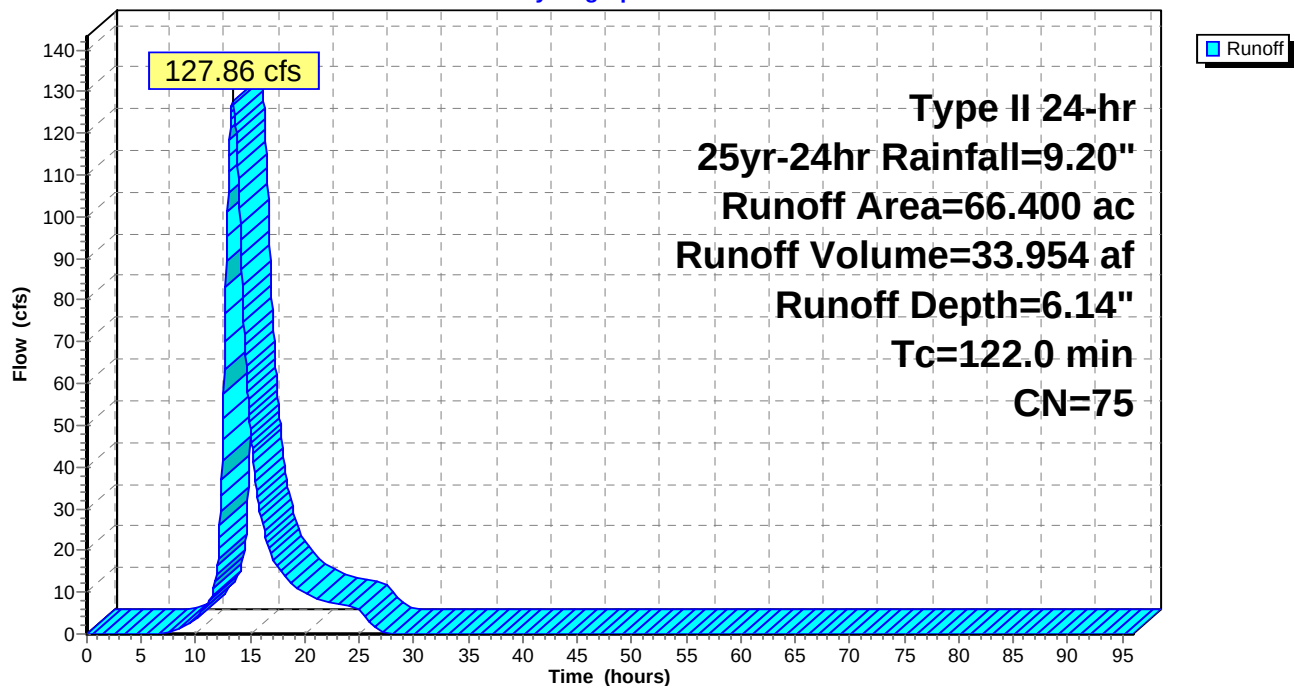
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Type II 24-hr 25yr-24hr Rainfall=9.20"

Area (ac)	CN	Description
* 66.400	75	
66.400		100.00% Pervious Area

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

Subcatchment 27S: BE12

Hydrograph



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Type II 24-hr 25yr-24hr Rainfall=9.20"

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Summary for Subcatchment 32S: BE10

Runoff = 167.85 cfs @ 13.16 hrs, Volume= 38.863 af, Depth= 6.14"

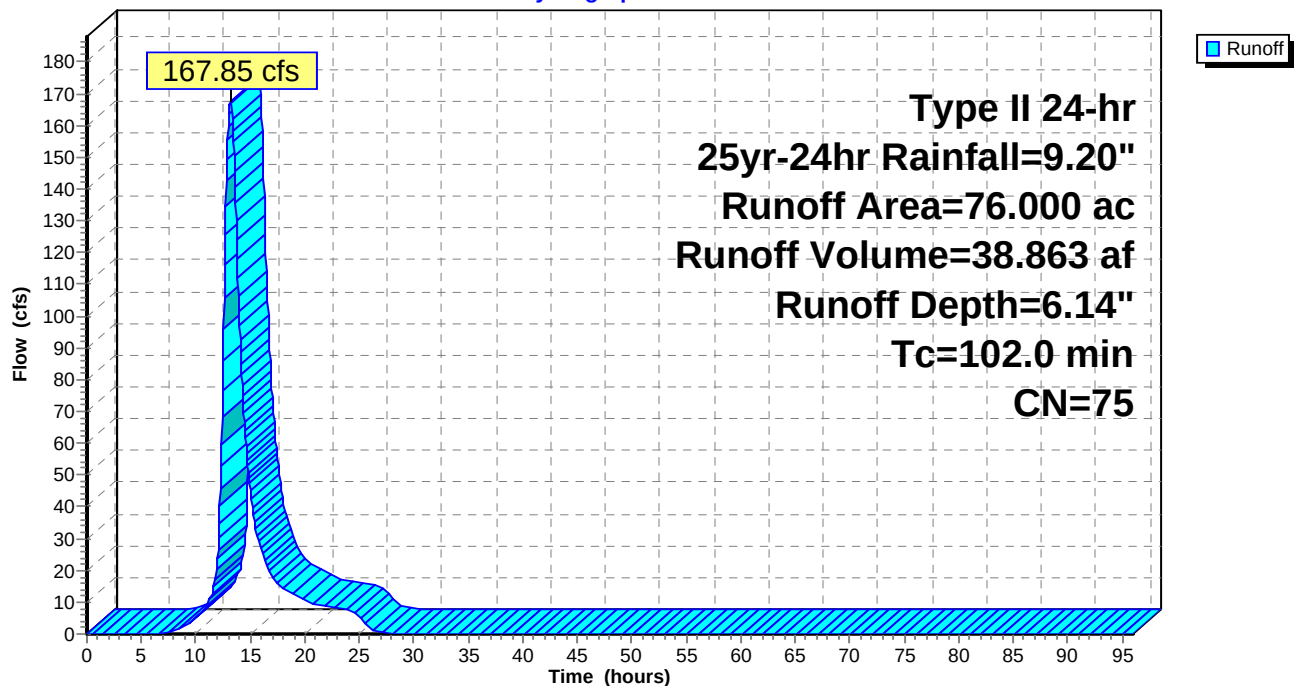
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Type II 24-hr 25yr-24hr Rainfall=9.20"

Area (ac)	CN	Description
* 76.000	75	
76.000		100.00% Pervious Area

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

Subcatchment 32S: BE10

Hydrograph



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Type II 24-hr 25yr-24hr Rainfall=9.20"

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Summary for Subcatchment 33S: BE11

Runoff = 215.12 cfs @ 12.78 hrs, Volume= 39.147 af, Depth= 5.89"

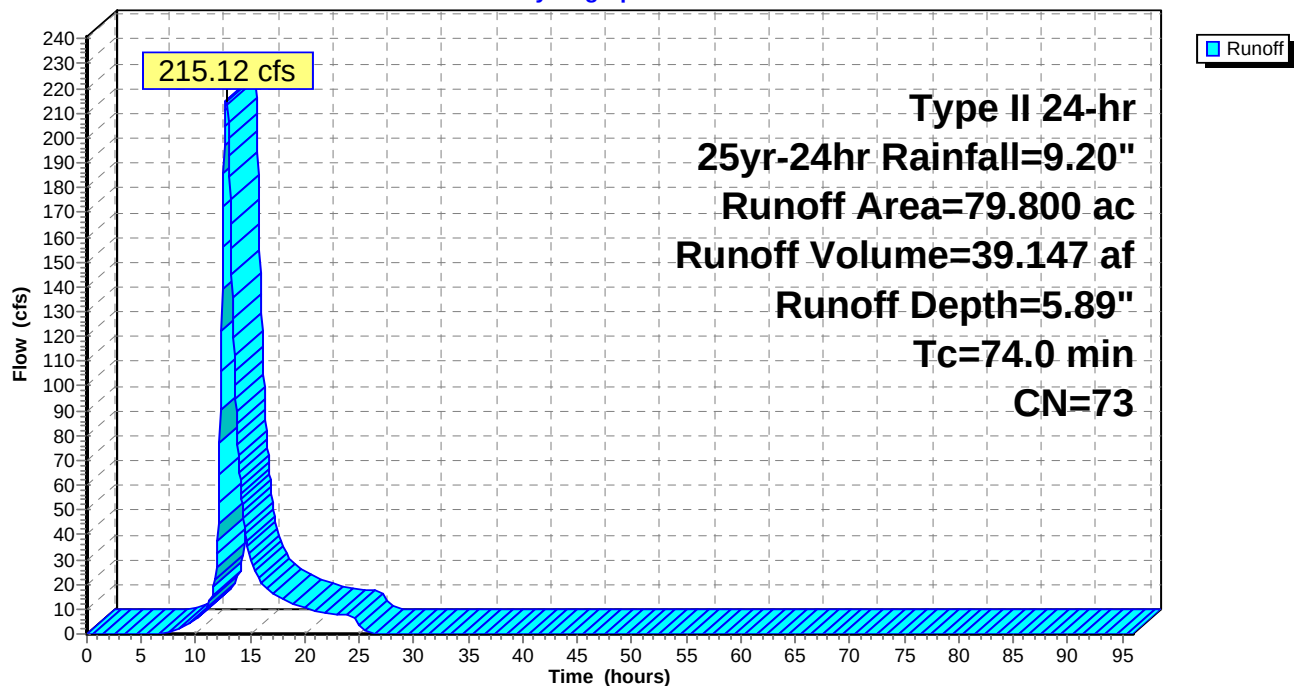
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Type II 24-hr 25yr-24hr Rainfall=9.20"

Area (ac)	CN	Description
* 79.800	73	
79.800		100.00% Pervious Area

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

Subcatchment 33S: BE11

Hydrograph



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Type II 24-hr 25yr-24hr Rainfall=9.20"

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Summary for Subcatchment 36S: BE7

Runoff = 31.88 cfs @ 13.90 hrs, Volume= 10.174 af, Depth= 6.26"

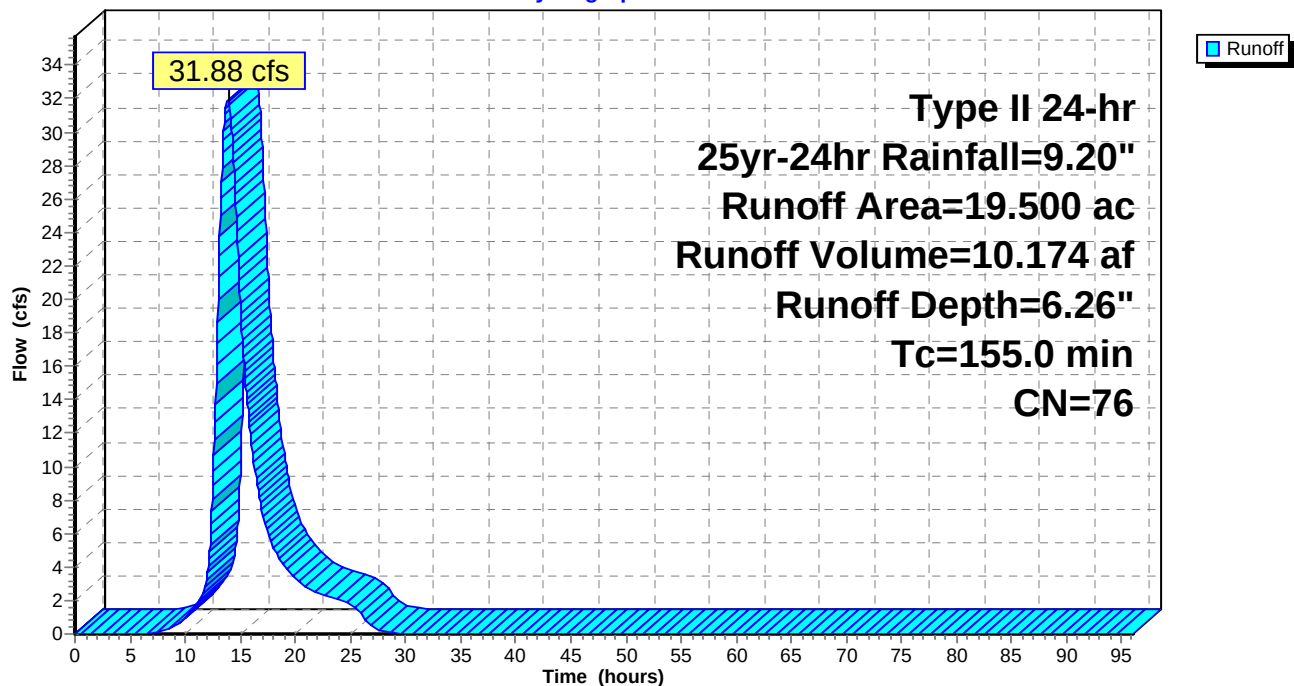
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Type II 24-hr 25yr-24hr Rainfall=9.20"

Area (ac)	CN	Description
* 19.500	76	
19.500		100.00% Pervious Area

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

Subcatchment 36S: BE7

Hydrograph



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Type II 24-hr 25yr-24hr Rainfall=9.20"

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Summary for Subcatchment 37S: BE9

Runoff = 154.95 cfs @ 13.89 hrs, Volume= 49.792 af, Depth= 5.89"

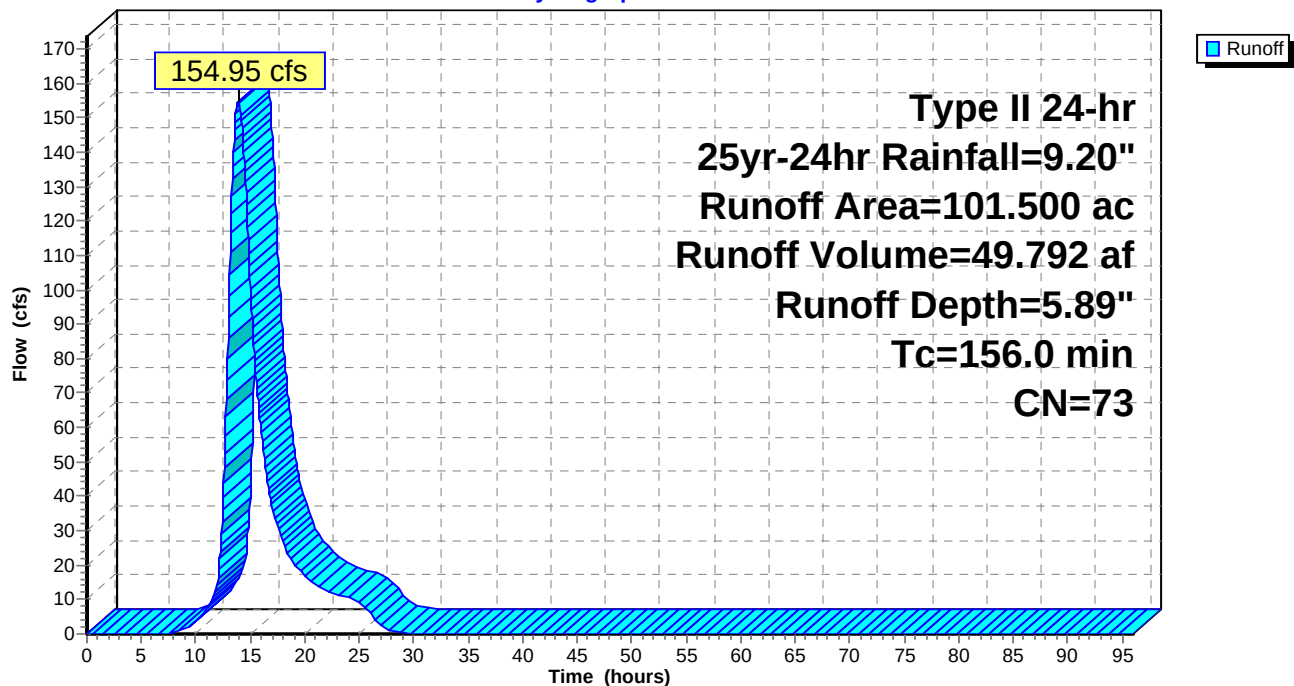
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Type II 24-hr 25yr-24hr Rainfall=9.20"

Area (ac)	CN	Description
* 101.500	73	
101.500		100.00% Pervious Area

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

Subcatchment 37S: BE9

Hydrograph



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Type II 24-hr 25yr-24hr Rainfall=9.20"

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Summary for Subcatchment 38S: BE8

Runoff = 197.18 cfs @ 13.45 hrs, Volume= 53.338 af, Depth= 6.26"

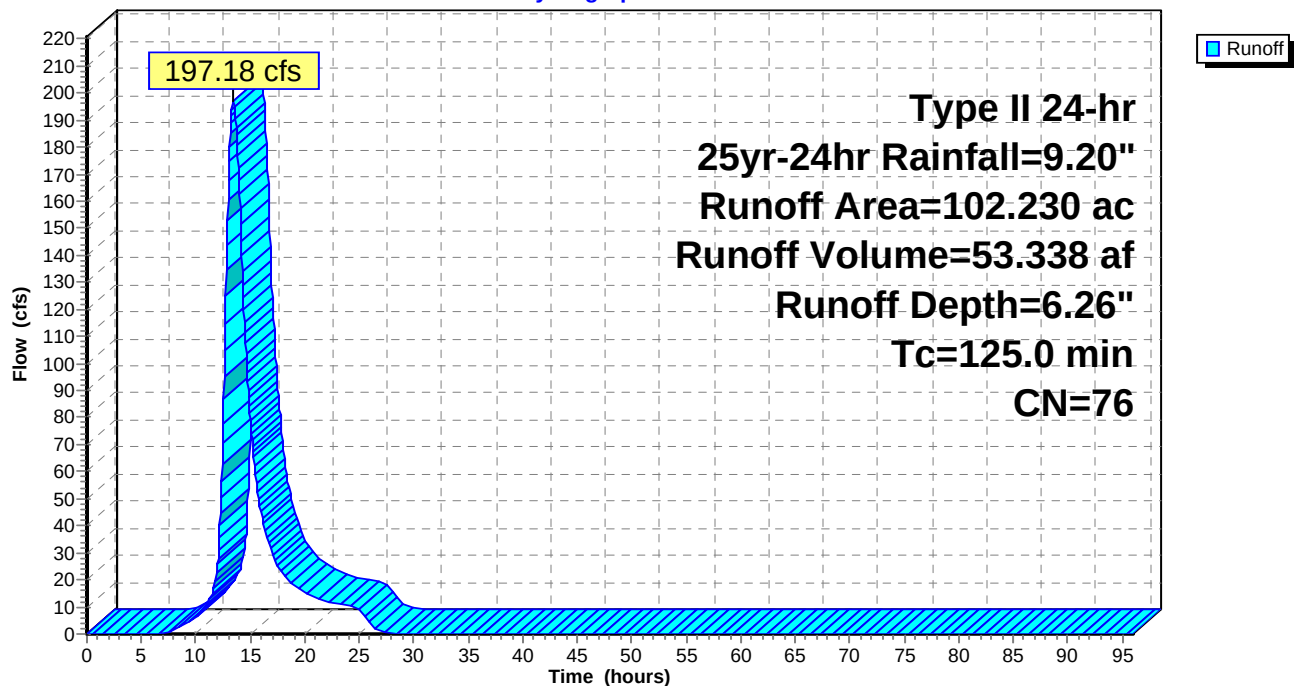
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Type II 24-hr 25yr-24hr Rainfall=9.20"

Area (ac)	CN	Description
* 102.230	76	
102.230		100.00% Pervious Area

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

Subcatchment 38S: BE8

Hydrograph



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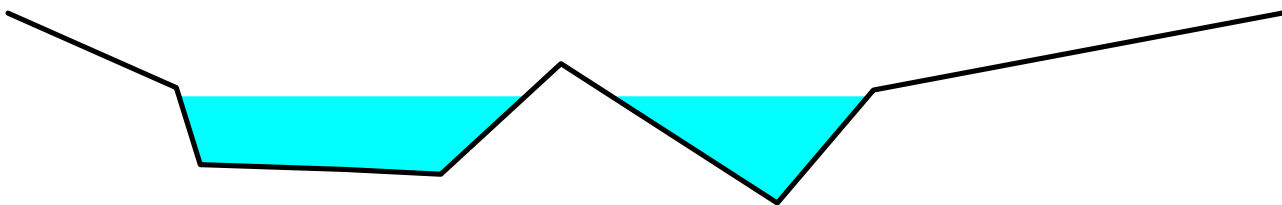
Summary for Reach 7R: RED5

Inflow Area = 74.490 ac, 0.00% Impervious, Inflow Depth = 6.26" for 25yr-24hr event
Inflow = 151.70 cfs @ 13.22 hrs, Volume= 38.865 af
Outflow = 151.20 cfs @ 13.37 hrs, Volume= 38.865 af, Atten= 0%, Lag= 9.1 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.48 fps, Min. Travel Time= 4.6 min
Avg. Velocity= 0.86 fps, Avg. Travel Time= 13.1 min

Peak Storage= 41,391 cf @ 13.30 hrs
Average Depth at Peak Storage= 4.44'
Bank-Full Depth= 7.90' Flow Area= 196.7 sf, Capacity= 684.90 cfs

Custom cross-section, Length= 680.0' Slope= 0.0029 '/' (106 Elevation Intervals)
Constant n= 0.050
Inlet Invert= 27.00', Outlet Invert= 25.00'



Offset (feet)	Elevation (feet)	Chan.Depth (feet)
0.00	34.30	0.00
7.00	31.20	3.10
8.00	28.00	6.30
14.00	27.80	6.50
18.00	27.60	6.70
23.00	32.20	2.10
32.00	26.40	7.90
36.00	31.10	3.20
53.00	34.30	0.00

Depth (feet)	End Area (sq-ft)	Perim. (feet)	Storage (cubic-feet)	Discharge (cfs)
0.00	0.0	0.0	0	0.00
1.20	1.7	3.8	1,176	1.65
1.40	2.8	8.7	1,888	2.09
1.60	5.0	15.7	3,375	3.72
4.70	67.5	33.3	45,899	174.34
4.80	70.1	34.3	47,699	182.33
5.80	102.1	45.4	69,457	282.47
7.90	196.7	62.0	133,790	684.90

Proposed-1

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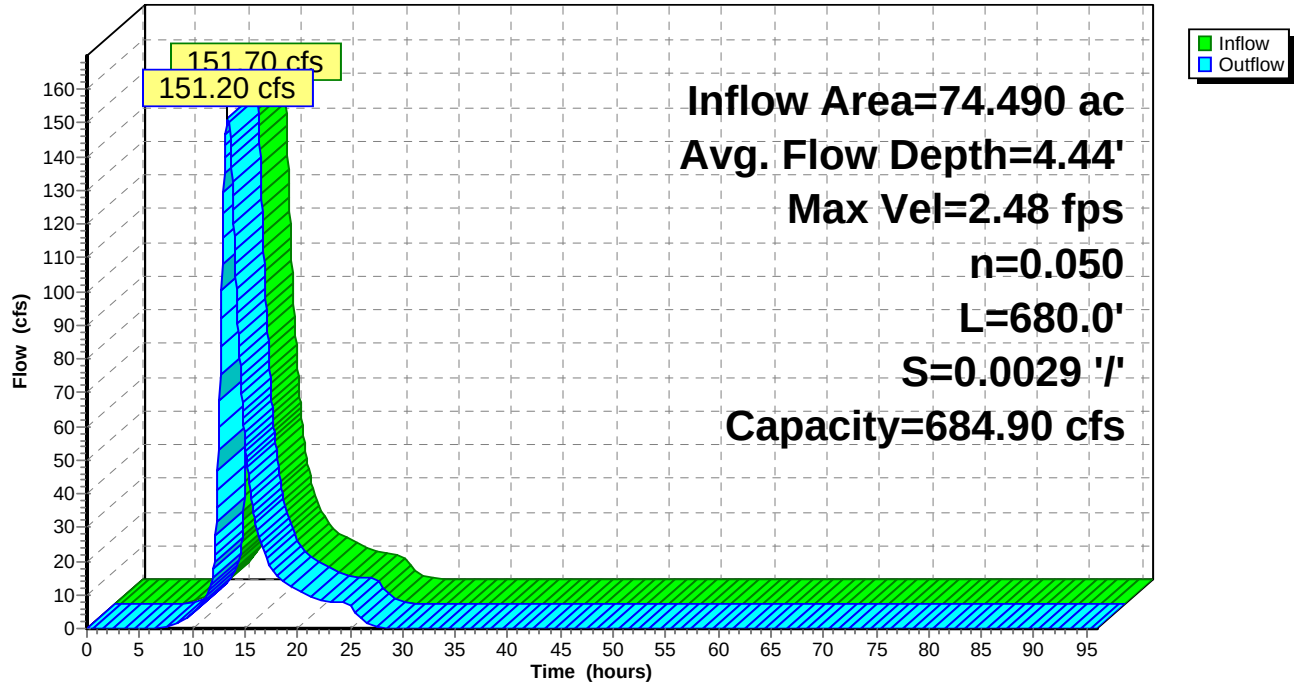
Type II 24-hr 25yr-24hr Rainfall=9.20"

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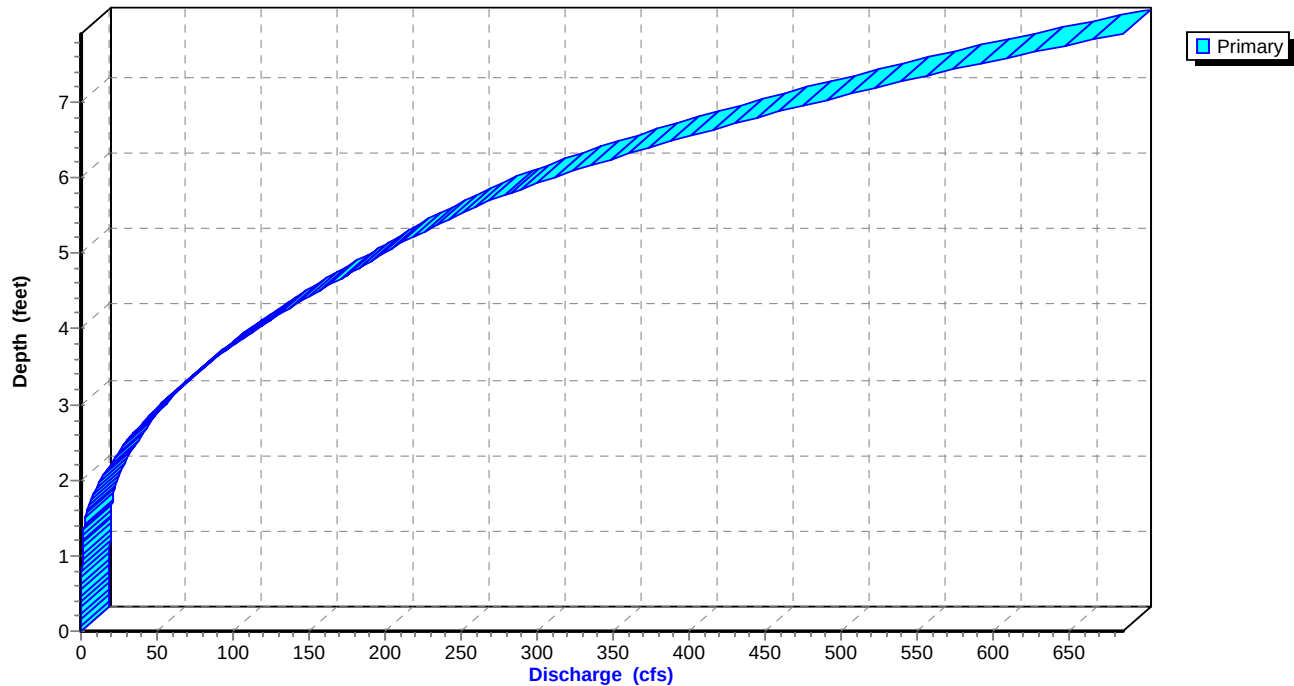
Reach 7R: RED5

Hydrograph



Reach 7R: RED5

Stage-Discharge



Proposed-1

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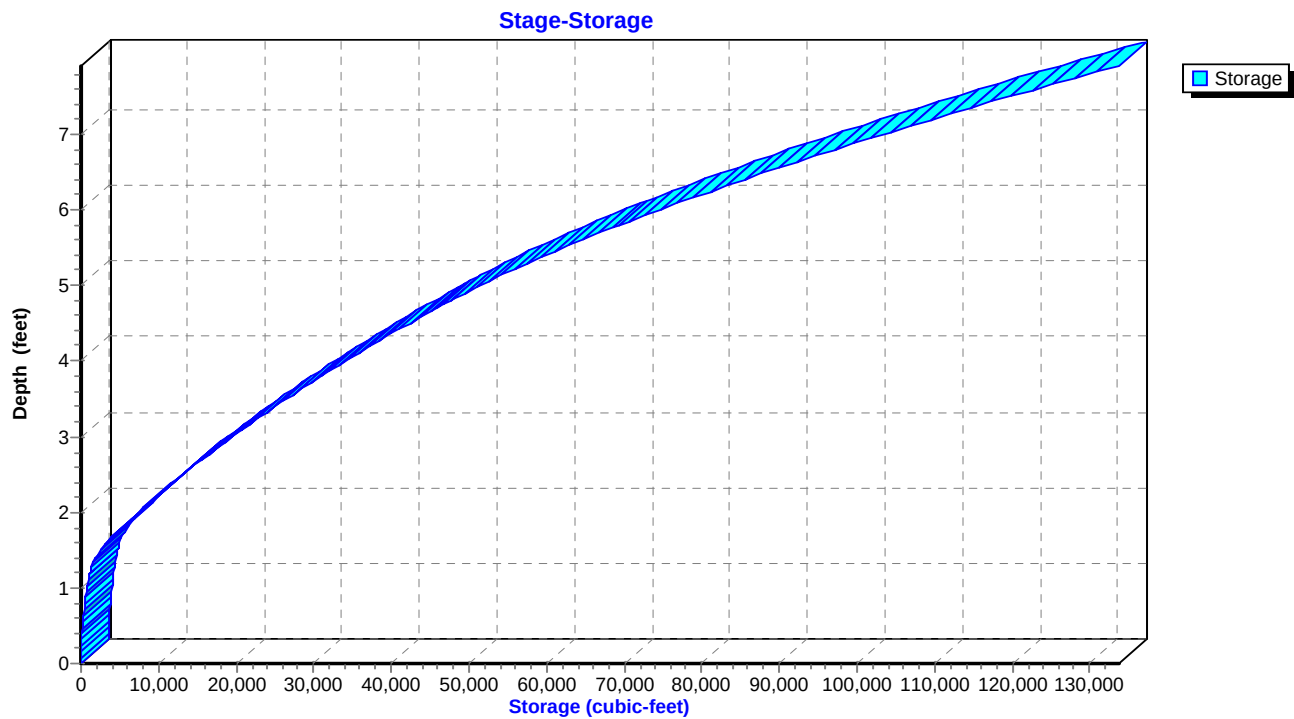
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Type II 24-hr 25yr-24hr Rainfall=9.20"

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Reach 7R: RED5



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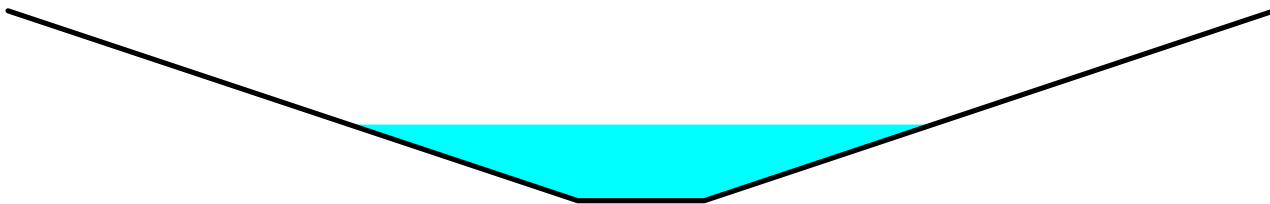
Summary for Reach 12R: RE4-1

Inflow Area = 84.150 ac, 0.00% Impervious, Inflow Depth > 6.65" for 25yr-24hr event
Inflow = 39.94 cfs @ 14.74 hrs, Volume= 46.668 af
Outflow = 39.83 cfs @ 15.05 hrs, Volume= 46.614 af, Atten= 0%, Lag= 18.4 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.48 fps, Min. Travel Time= 10.0 min
Avg. Velocity = 0.79 fps, Avg. Travel Time= 18.6 min

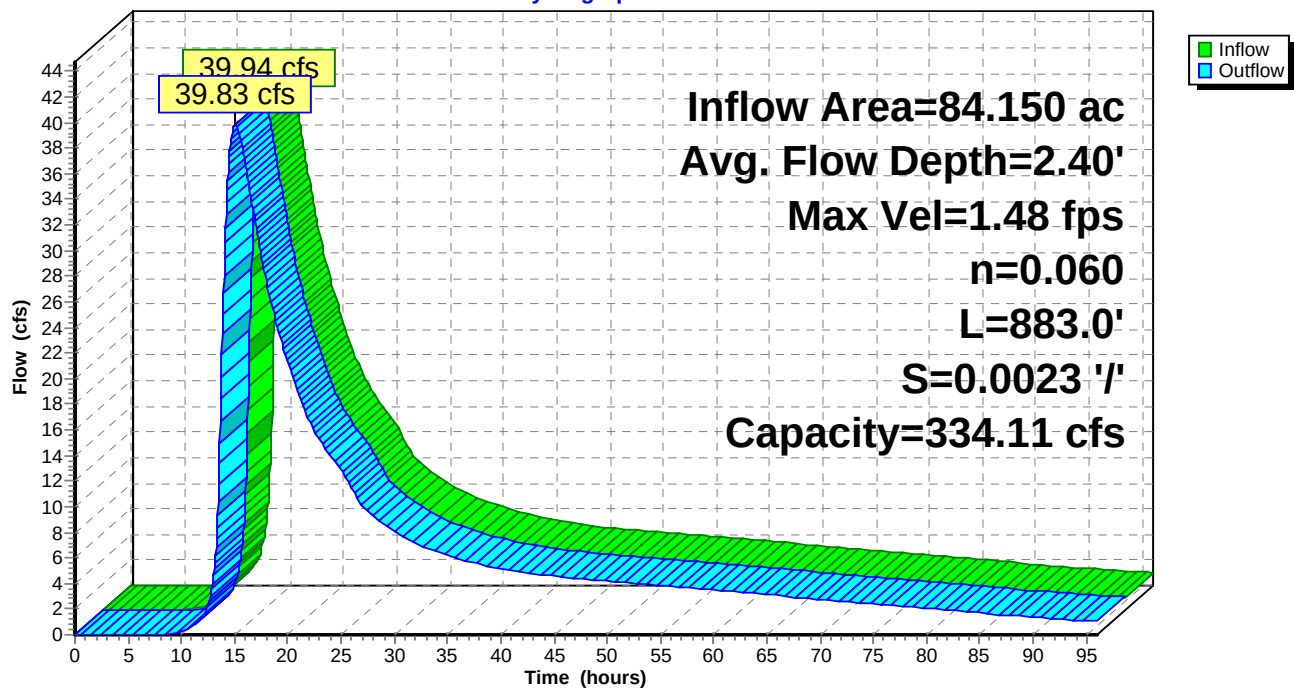
Peak Storage= 23,801 cf @ 14.88 hrs
Average Depth at Peak Storage= 2.40'
Bank-Full Depth= 6.00' Flow Area= 132.0 sf, Capacity= 334.11 cfs

4.00' x 6.00' deep channel, n= 0.060
Side Slope Z-value= 3.0 '/' Top Width= 40.00'
Length= 883.0' Slope= 0.0023 '/'
Inlet Invert= 30.00', Outlet Invert= 28.00'



Reach 12R: RE4-1

Hydrograph



Proposed-1

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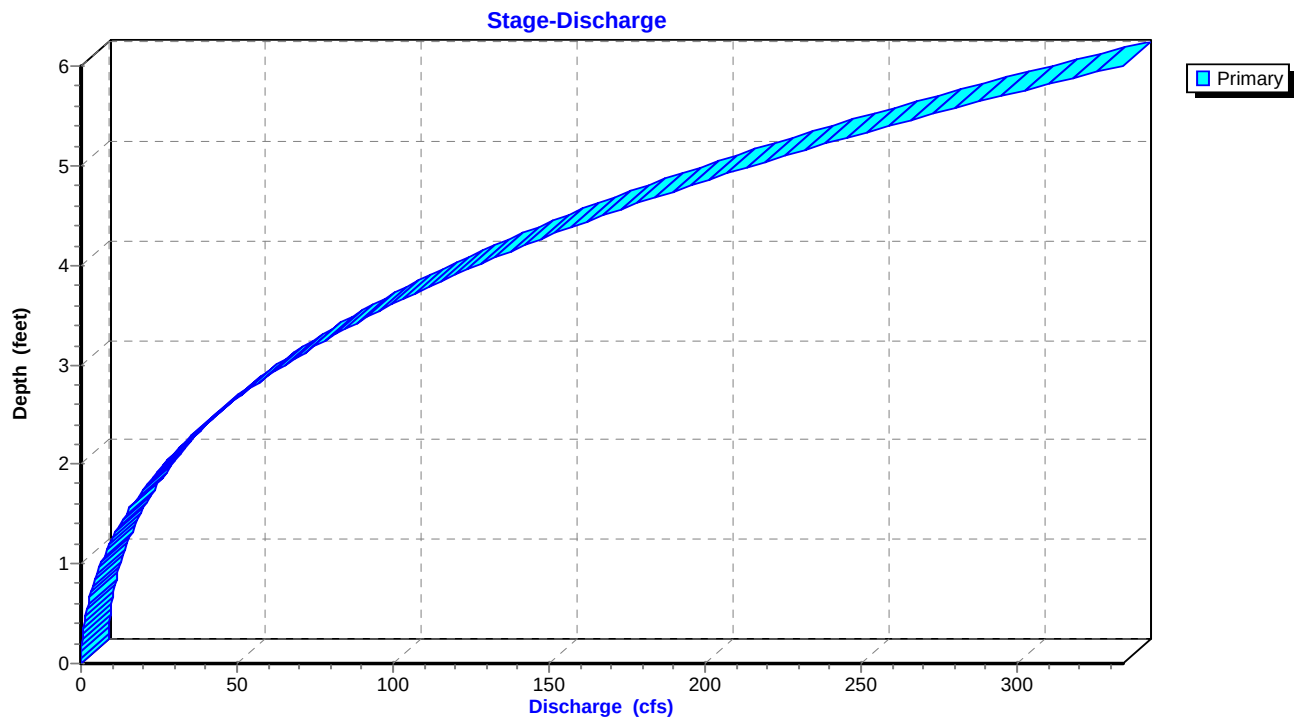
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Type II 24-hr 25yr-24hr Rainfall=9.20"

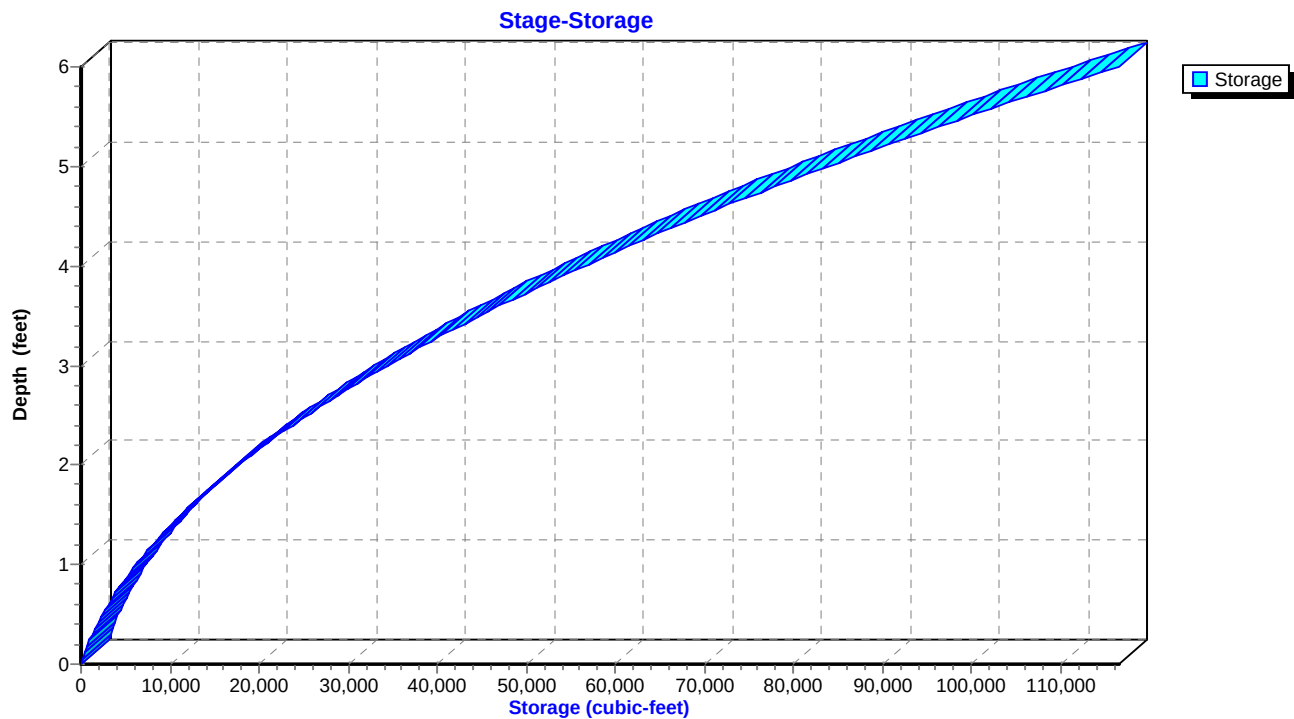
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Reach 12R: RE4-1



Reach 12R: RE4-1



Proposed-1

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Type II 24-hr 25yr-24hr Rainfall=9.20"

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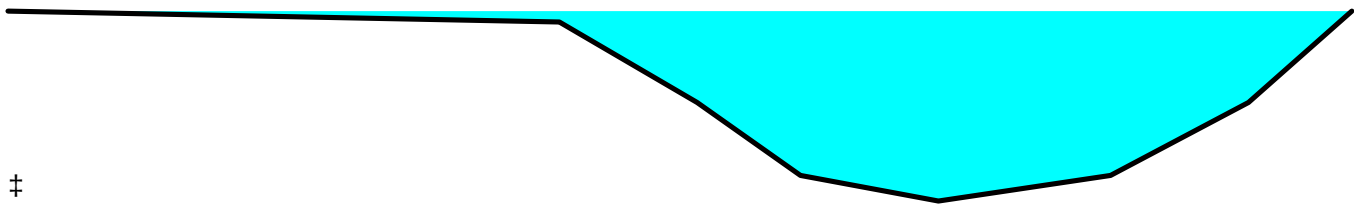
Summary for Reach 20R: RED11D

Inflow Area = 499.200 ac, 0.00% Impervious, Inflow Depth = 7.96" for 25yr-24hr event
Inflow = 382.83 cfs @ 15.58 hrs, Volume= 331.265 af
Outflow = 76.75 cfs @ 13.37 hrs, Volume= 10.123 af, Atten= 80%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.12 fps, Min. Travel Time= 31.2 min
Avg. Velocity= -0.16 fps, Avg. Travel Time= 0.0 min

Peak Storage= 6.28499005882514E19 cf @ 96.00 hrs
Average Depth at Peak Storage= 796,349,792,711,180.00'
Bank-Full Depth= 5.20' Flow Area= 79.9 sf, Capacity= 69.98 cfs

Custom cross-section, Length= 2,100.0' Slope= 0.0007 '/' (102 Elevation Intervals)
Constant n= 0.070
Inlet Invert= 31.00', Outlet Invert= 29.50'



Offset (feet)	Elevation (feet)	Chan.Depth (feet)
0.00	36.00	0.00
16.00	35.70	0.30
20.00	33.50	2.50
23.00	31.50	4.50
27.00	30.80	5.20
32.00	31.50	4.50
36.00	33.50	2.50
39.00	36.00	0.00

Depth (feet)	End Area (sq-ft)	Perim. (feet)	Storage (cubic-feet)	Discharge (cfs)
0.00	0.0	0.0	0	0.00
0.70	3.1	9.1	6,615	0.88
2.70	28.1	17.2	59,116	22.19
4.90	70.7	25.2	148,373	79.73
5.20	79.9	41.7	167,790	69.98

Proposed-1

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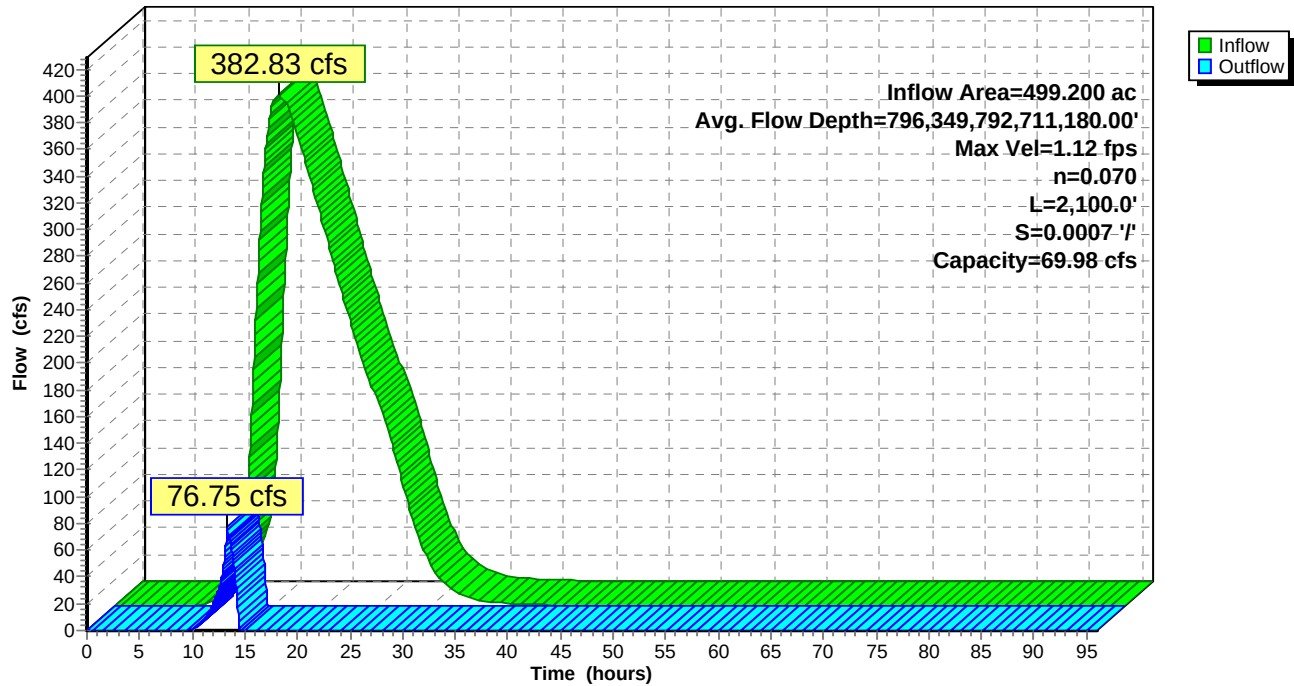
Type II 24-hr 25yr-24hr Rainfall=9.20"

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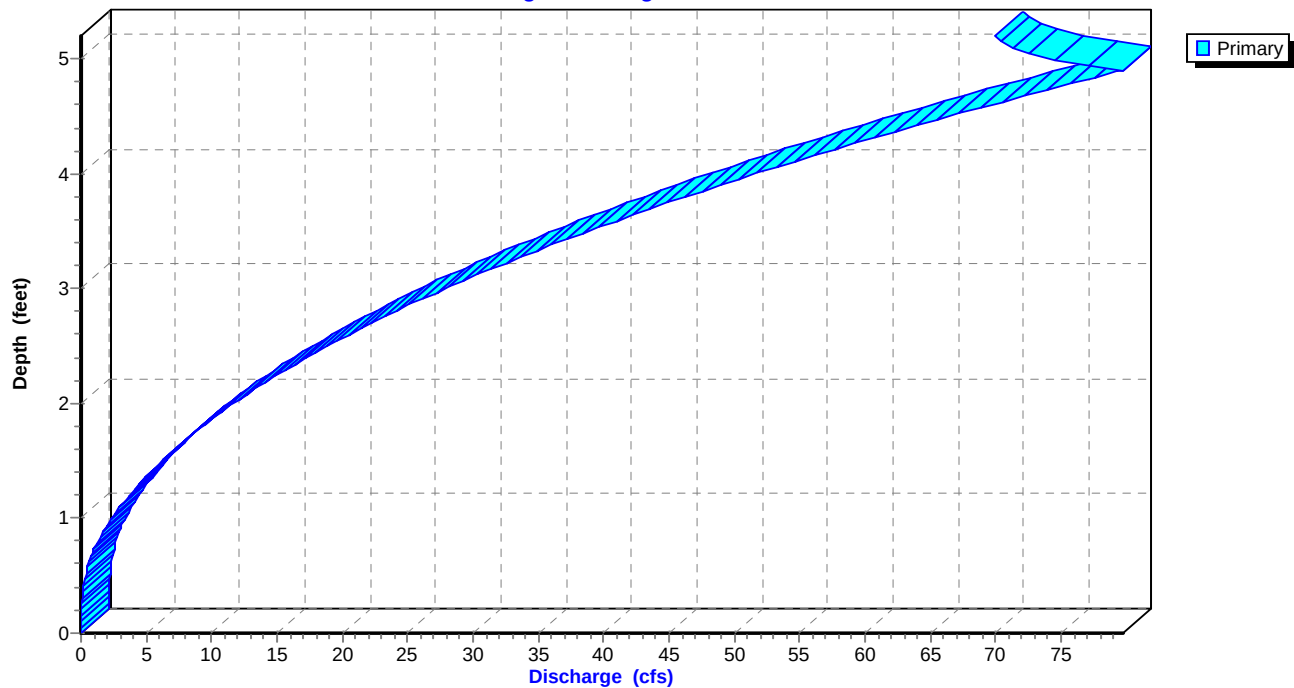
Reach 20R: RED11D

Hydrograph



Reach 20R: RED11D

Stage-Discharge



Proposed-1

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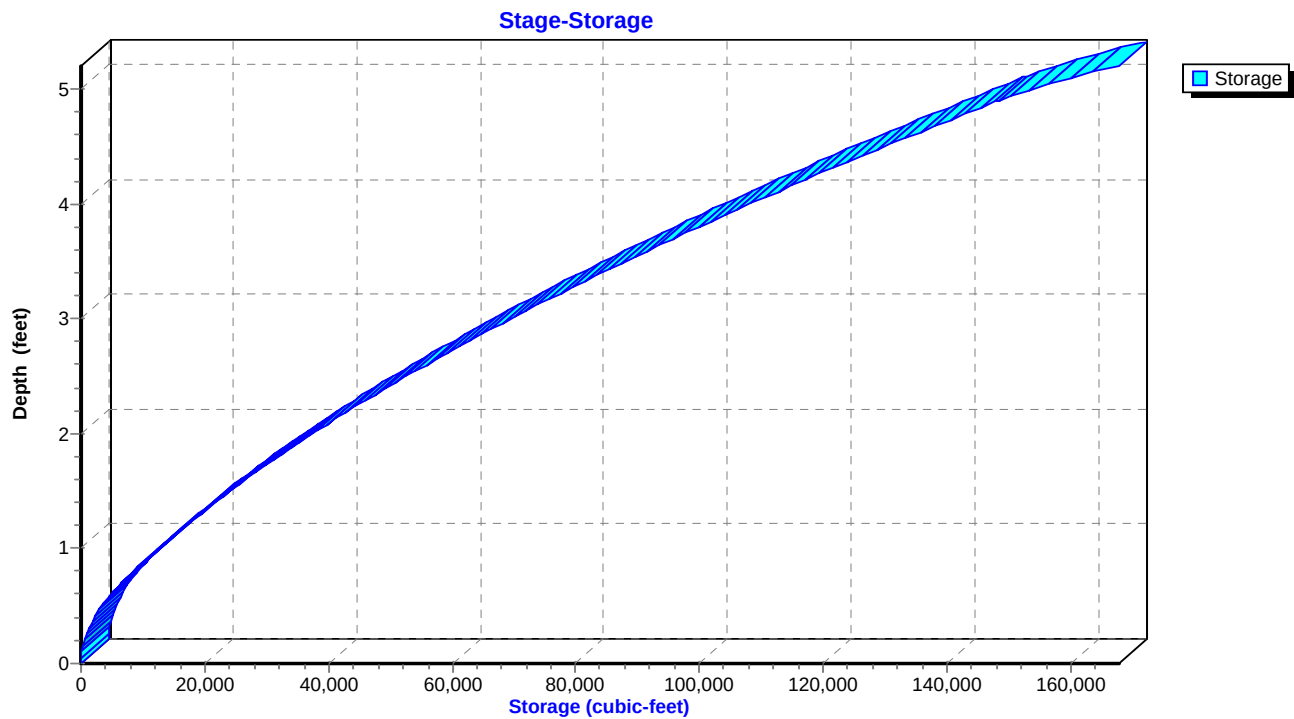
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Reach 20R: RED11D



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Summary for Reach 21R: RED13

Inflow Area = 112.300 ac, 0.00% Impervious, Inflow Depth > 6.11" for 25yr-24hr event
Inflow = 37.04 cfs @ 17.26 hrs, Volume= 57.196 af
Outflow = 36.97 cfs @ 18.34 hrs, Volume= 57.149 af, Atten= 0%, Lag= 64.7 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Max. Velocity= 0.88 fps, Min. Travel Time= 33.0 min
Avg. Velocity= 0.39 fps, Avg. Travel Time= 74.4 min

Peak Storage= 73,219 cf @ 17.79 hrs
Average Depth at Peak Storage= 1.58'
Bank-Full Depth= 2.90' Flow Area= 107.0 sf, Capacity= 135.42 cfs

Custom cross-section, Length= 1,750.0' Slope= 0.0011 '/' (103 Elevation Intervals)
Constant n= 0.060
Inlet Invert= 30.60', Outlet Invert= 28.60'



Offset (feet)	Elevation (feet)	Chan.Depth (feet)
0.00	33.60	0.00
14.00	30.80	2.80
25.00	30.70	2.90
34.00	30.80	2.80
39.00	31.90	1.70
53.00	32.80	0.80
57.00	33.60	0.00

Depth (feet)	End Area (sq-ft)	Perim. (feet)	Storage (cubic-feet)	Discharge (cfs)
0.00	0.0	0.0	0	0.00
0.10	1.0	20.0	1,750	0.11
1.20	28.8	30.7	50,356	23.06
2.10	64.5	49.3	112,962	64.64
2.90	107.0	57.5	187,163	135.42

Proposed-1

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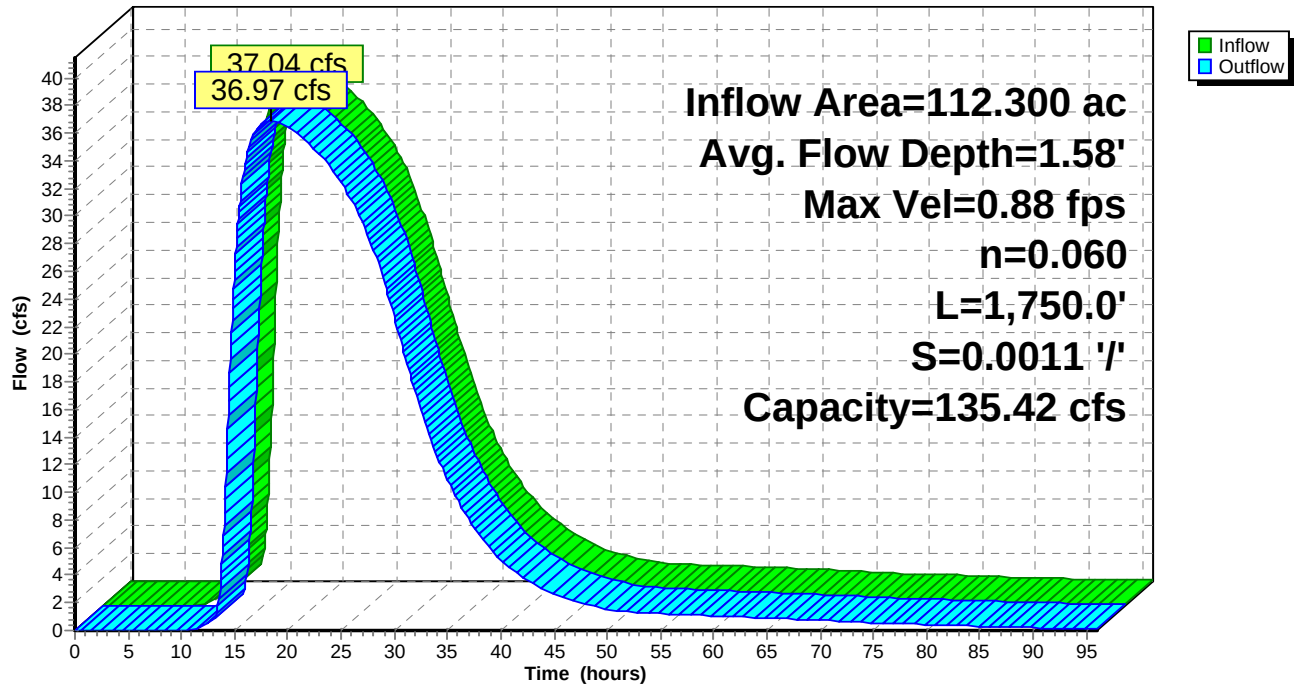
Type II 24-hr 25yr-24hr Rainfall=9.20"

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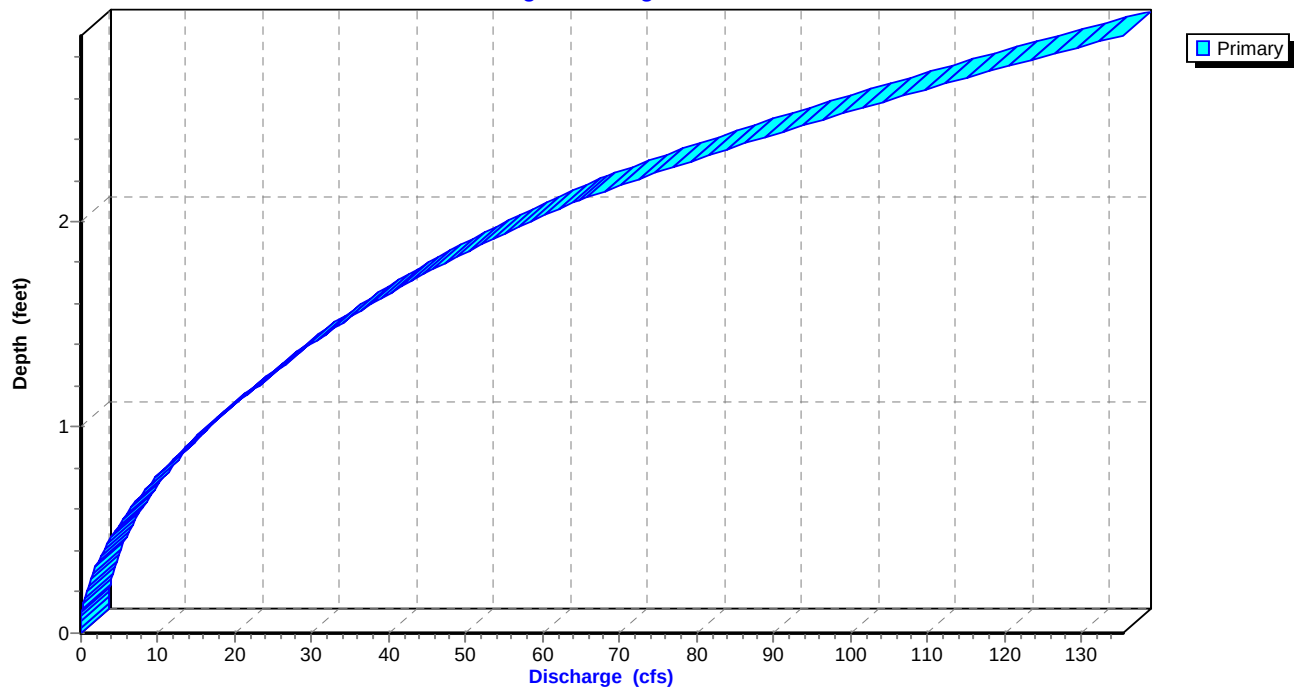
Reach 21R: RED13

Hydrograph



Reach 21R: RED13

Stage-Discharge



Proposed-1

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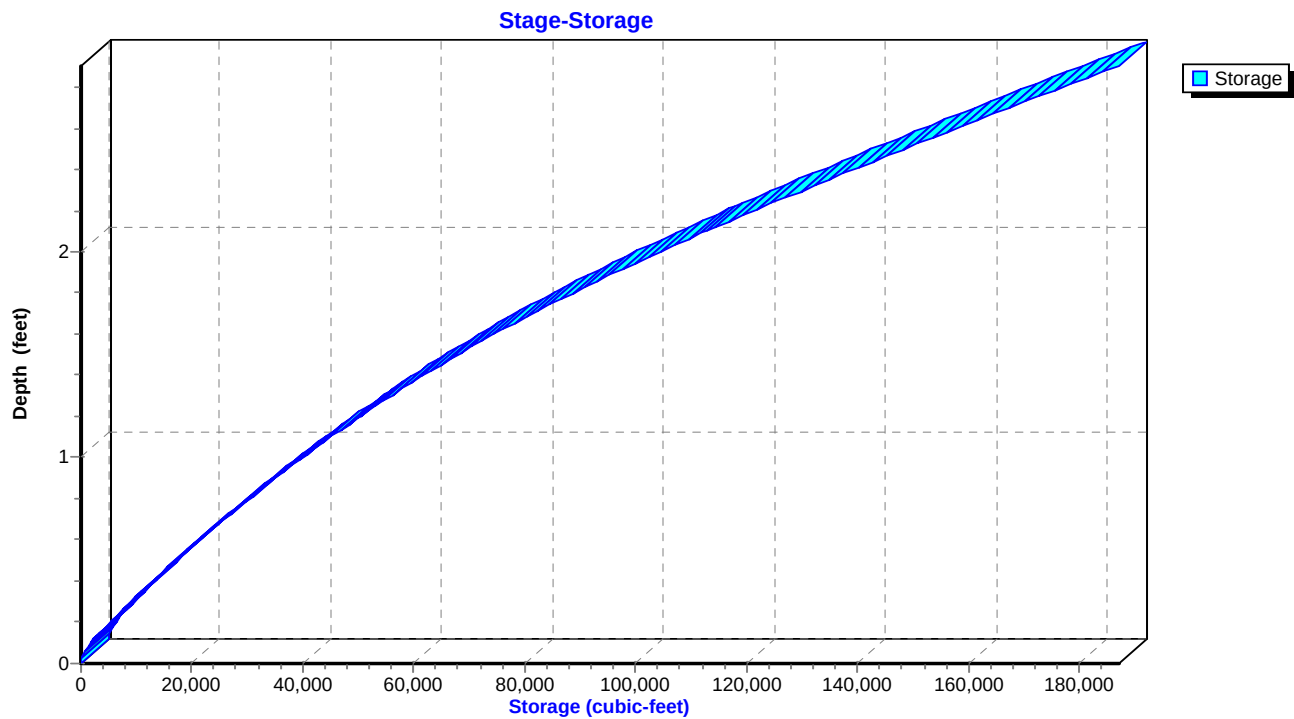
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Reach 21R: RED13



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Type II 24-hr 25yr-24hr Rainfall=9.20"

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Summary for Reach 23R: RE14B

Inflow = 94.26 cfs @ 14.38 hrs, Volume= 86.377 af
Outflow = 94.26 cfs @ 14.39 hrs, Volume= 86.377 af, Atten= 0%, Lag= 0.5 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Max. Velocity= 4.55 fps, Min. Travel Time= 0.3 min
Avg. Velocity= 1.30 fps, Avg. Travel Time= 1.0 min

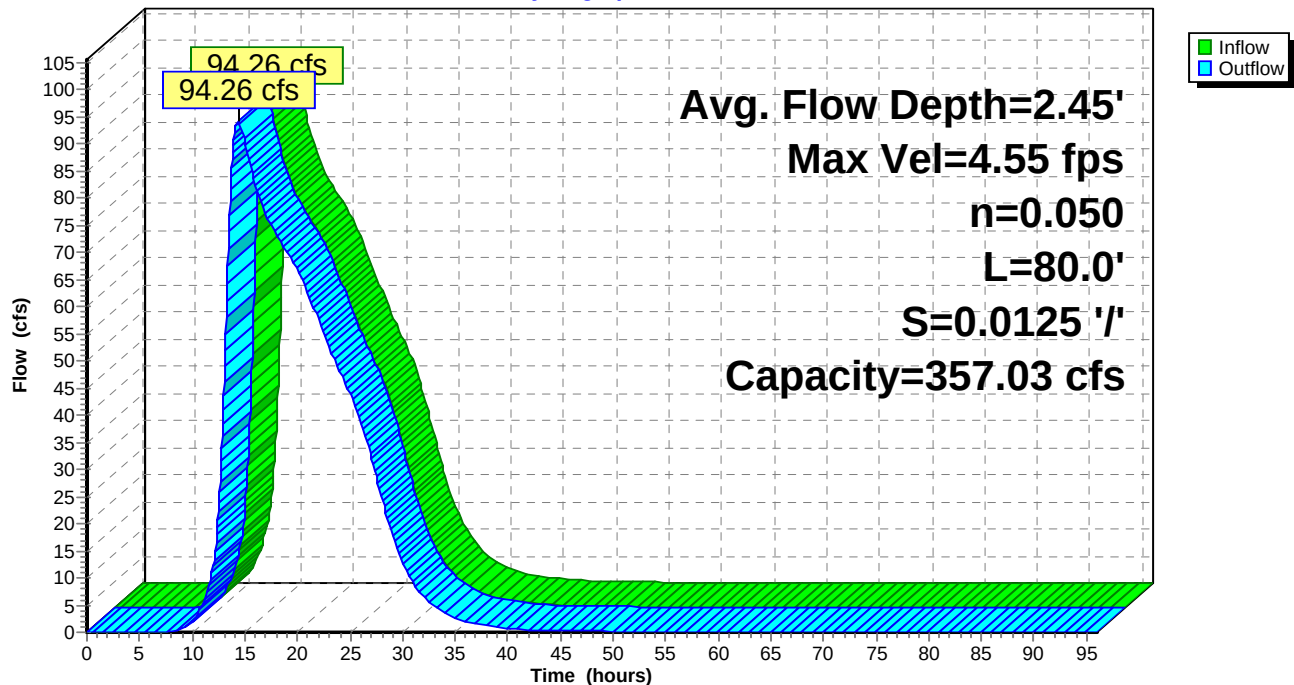
Peak Storage= 1,658 cf @ 14.38 hrs
Average Depth at Peak Storage= 2.45'
Bank-Full Depth= 5.00' Flow Area= 55.0 sf, Capacity= 357.03 cfs

6.00' x 5.00' deep channel, n= 0.050
Side Slope Z-value= 1.0 '/' Top Width= 16.00'
Length= 80.0' Slope= 0.0125 '/'
Inlet Invert= 36.00', Outlet Invert= 35.00'



Reach 23R: RE14B

Hydrograph



Proposed-1

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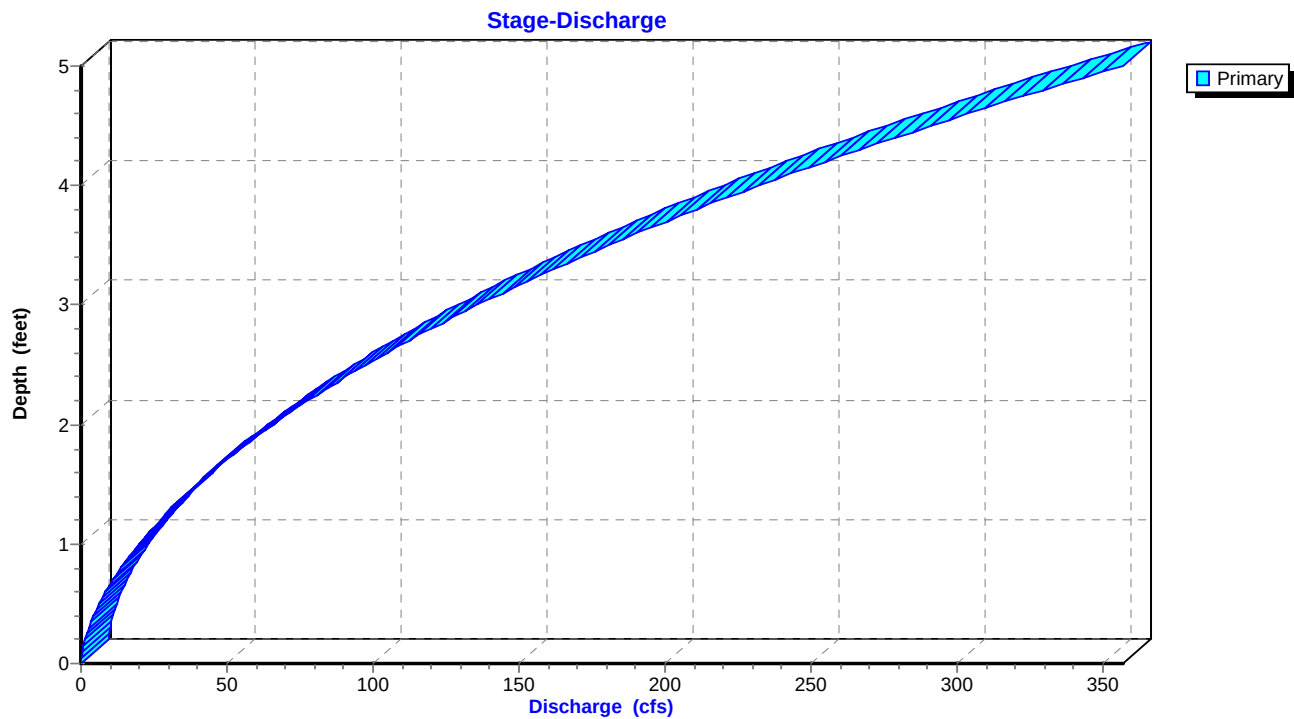
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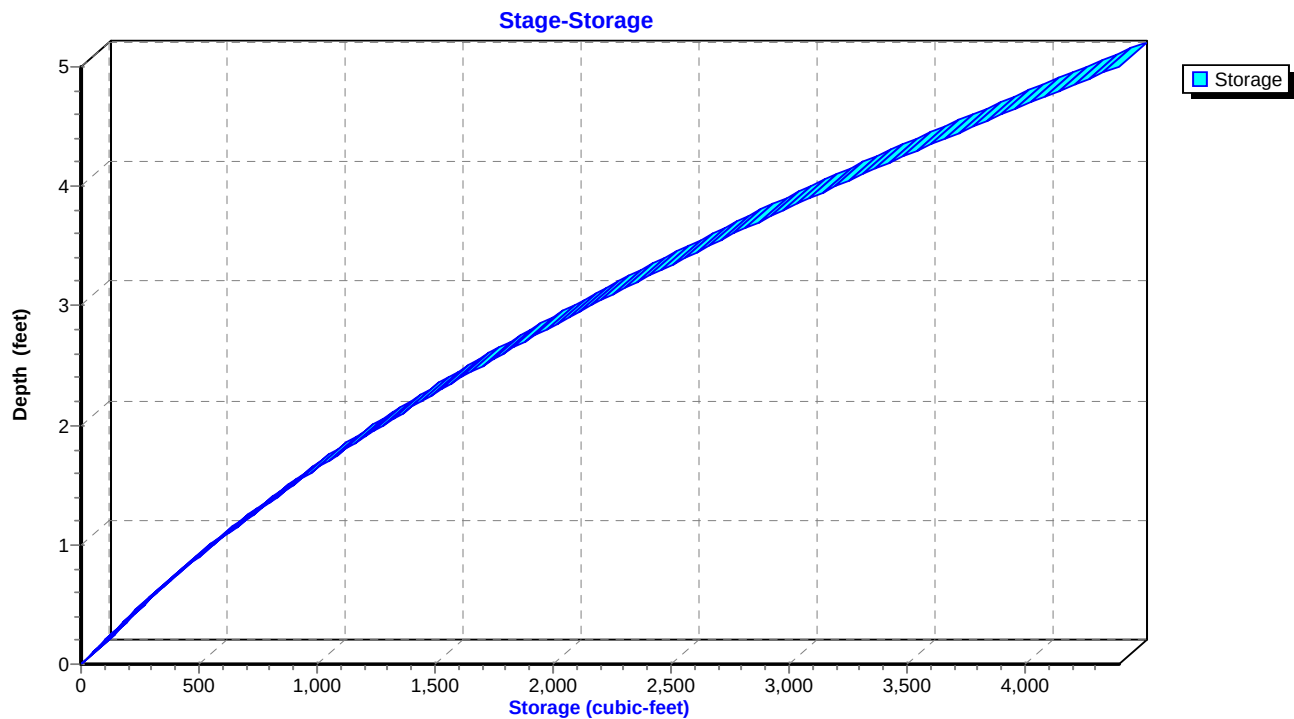
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Reach 23R: RE14B



Reach 23R: RE14B



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Type II 24-hr 25yr-24hr Rainfall=9.20"

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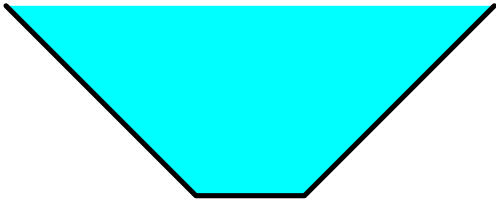
Summary for Reach 26R: RE12A

Inflow Area = 333.700 ac, 0.00% Impervious, Inflow Depth = 2.78" for 25yr-24hr event
Inflow = 366.45 cfs @ 14.38 hrs, Volume= 77.323 af
Outflow = 360.63 cfs @ 14.68 hrs, Volume= 77.323 af, Atten= 2%, Lag= 18.3 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.85 fps, Min. Travel Time= 9.3 min
Avg. Velocity= 0.48 fps, Avg. Travel Time= 56.1 min

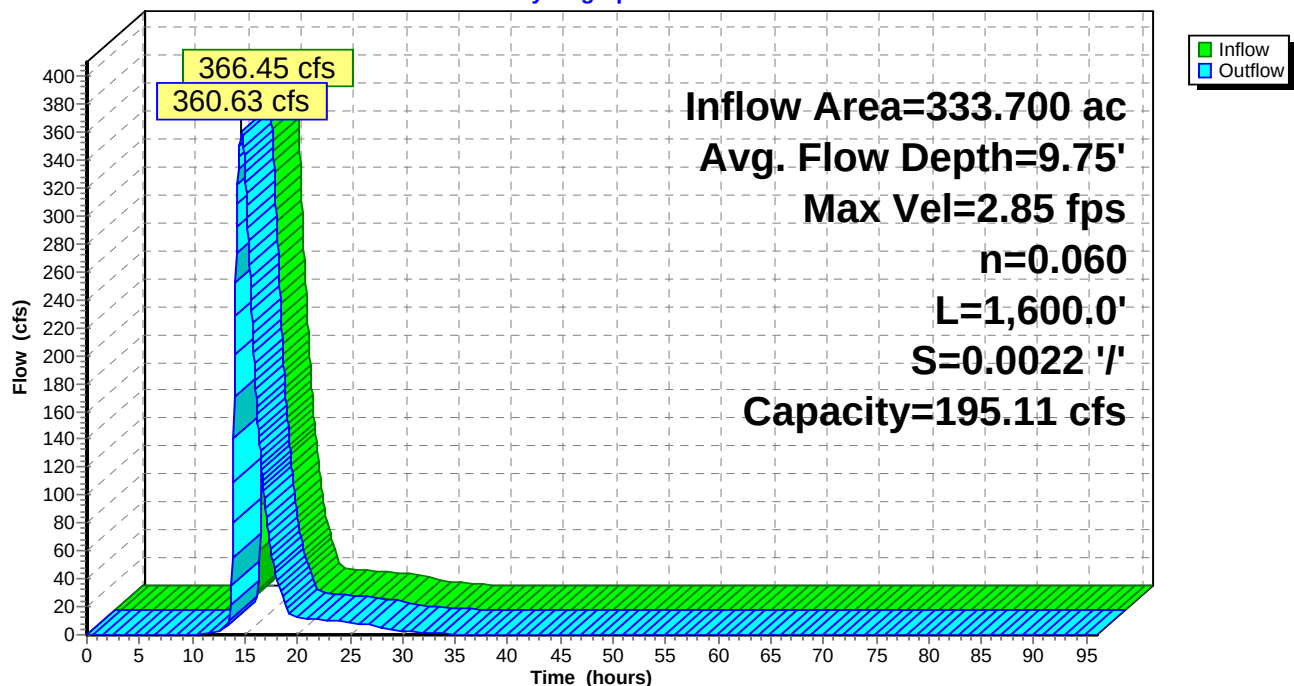
Peak Storage= 202,157 cf @ 14.53 hrs
Average Depth at Peak Storage= 9.75'
Bank-Full Depth= 7.00' Flow Area= 77.0 sf, Capacity= 195.11 cfs

4.00' x 7.00' deep channel, n= 0.060
Side Slope Z-value= 1.0 '/' Top Width= 18.00'
Length= 1,600.0' Slope= 0.0022 '/'
Inlet Invert= 31.50', Outlet Invert= 28.00'



Reach 26R: RE12A

Hydrograph



Proposed-1

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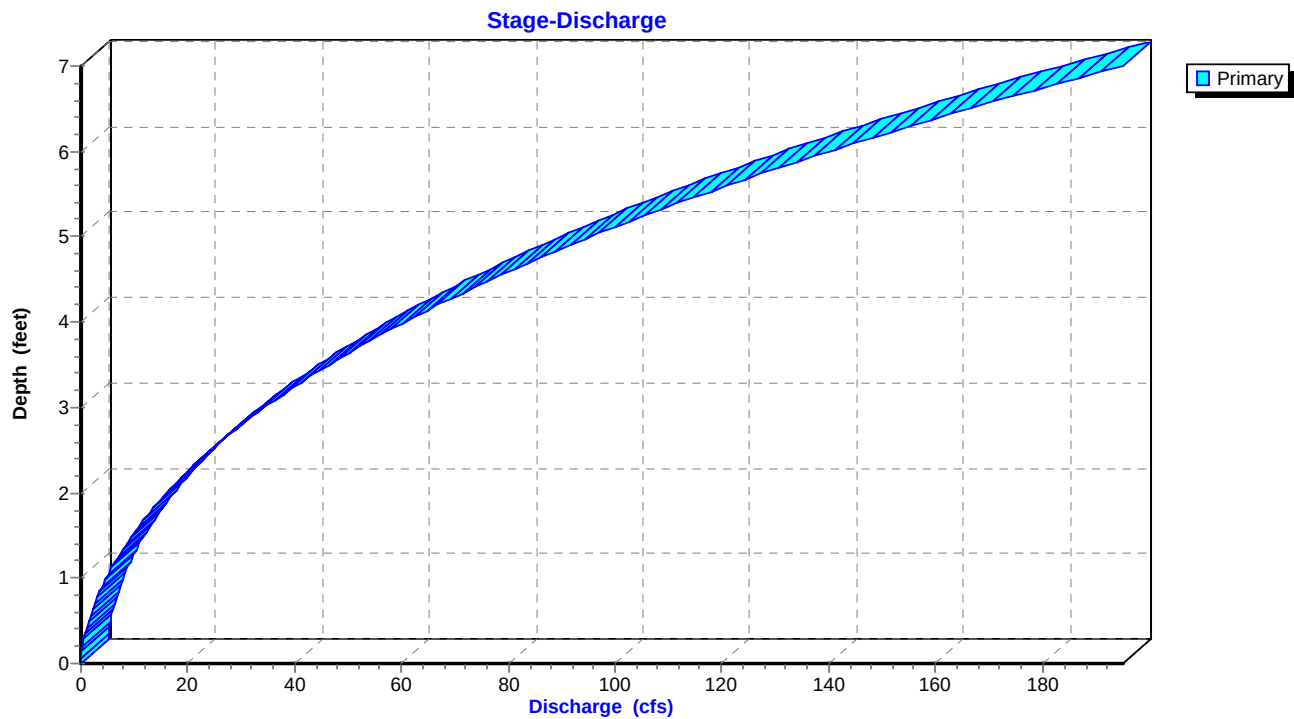
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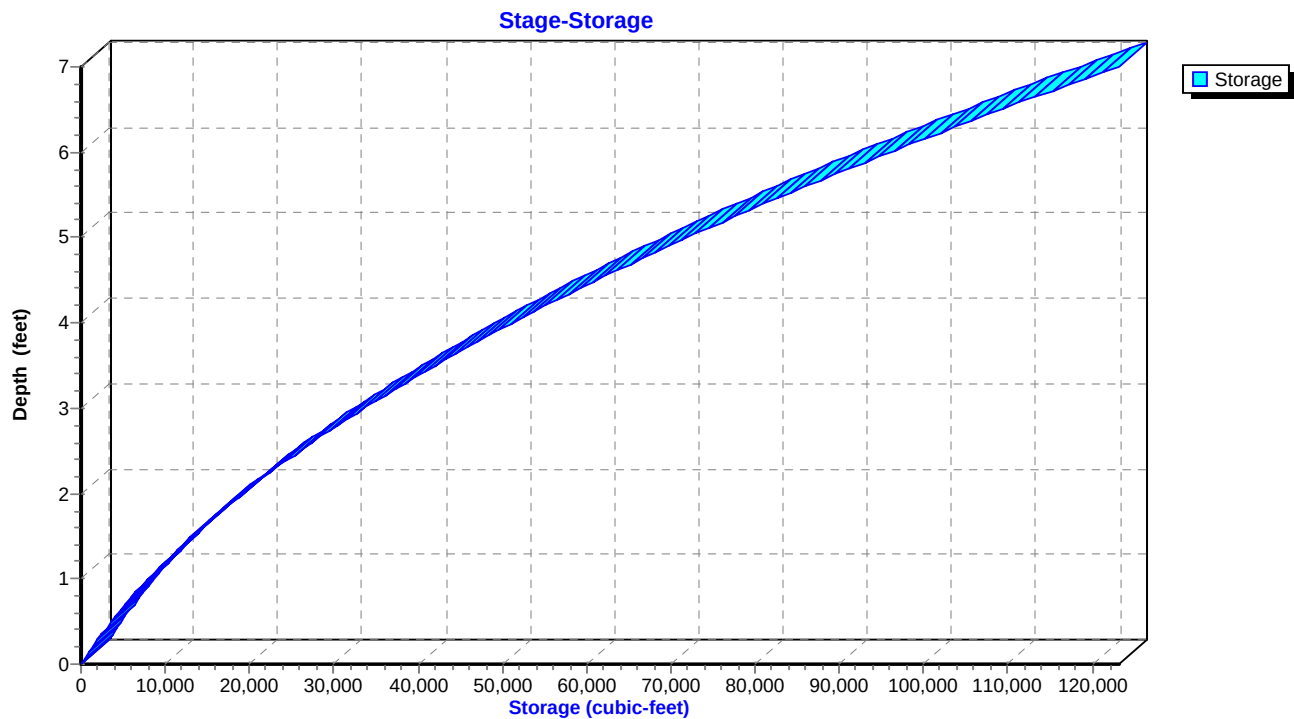
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Reach 26R: RE12A



Reach 26R: RE12A



Proposed-1

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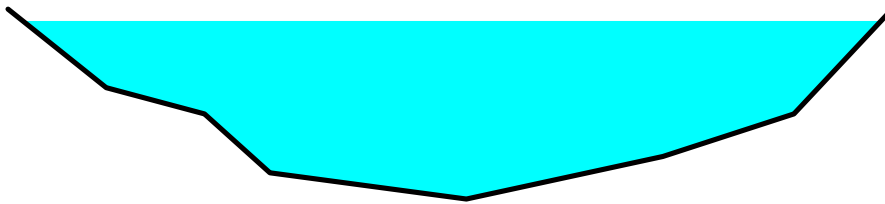
Summary for Reach 27R: RED6

Inflow Area = 992.720 ac, 0.00% Impervious, Inflow Depth > 4.37" for 25yr-24hr event
Inflow = 340.95 cfs @ 14.47 hrs, Volume= 361.511 af
Outflow = 338.37 cfs @ 14.79 hrs, Volume= 361.303 af, Atten= 1%, Lag= 19.4 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Max. Velocity= 3.60 fps, Min. Travel Time= 10.6 min
Avg. Velocity= 1.62 fps, Avg. Travel Time= 23.6 min

Peak Storage= 216,243 cf @ 14.61 hrs
Average Depth at Peak Storage= 5.44'
Bank-Full Depth= 5.80' Flow Area= 103.7 sf, Capacity= 389.01 cfs

Custom cross-section, Length= 2,300.0' Slope= 0.0015 '/' (104 Elevation Intervals)
Constant n= 0.035
Inlet Invert= 29.50', Outlet Invert= 26.00'



Offset (feet)	Elevation (feet)	Chan.Depth (feet)
0.00	31.00	0.00
3.00	28.60	2.40
6.00	27.80	3.20
8.00	26.00	5.00
14.00	25.20	5.80
20.00	26.50	4.50
24.00	27.80	3.20
27.00	31.00	0.00

Depth (feet)	End Area (sq-ft)	Perim. (feet)	Storage (cubic-feet)	Discharge (cfs)
0.00	0.0	0.0	0	0.00
0.80	3.9	9.8	8,917	3.45
1.30	9.4	12.9	21,709	12.67
2.60	29.3	19.1	67,390	64.57
3.40	45.2	23.3	103,960	116.48
5.80	103.7	30.4	238,510	389.01

Proposed-1

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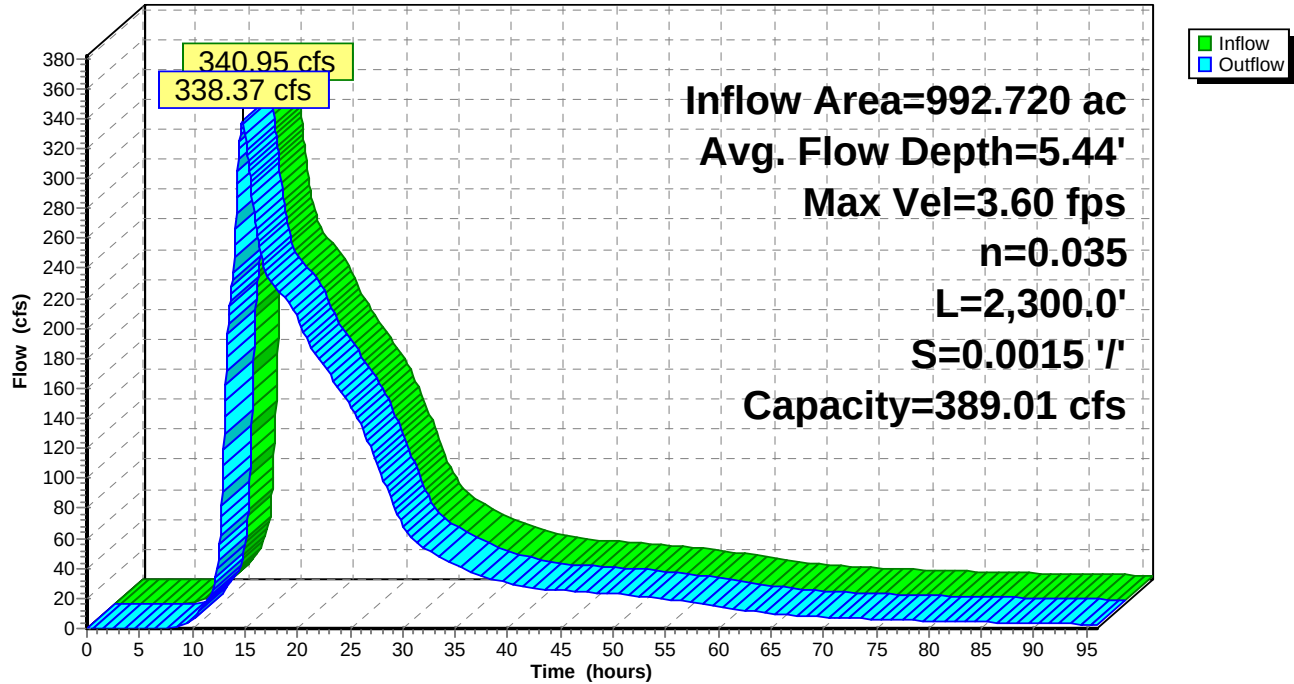
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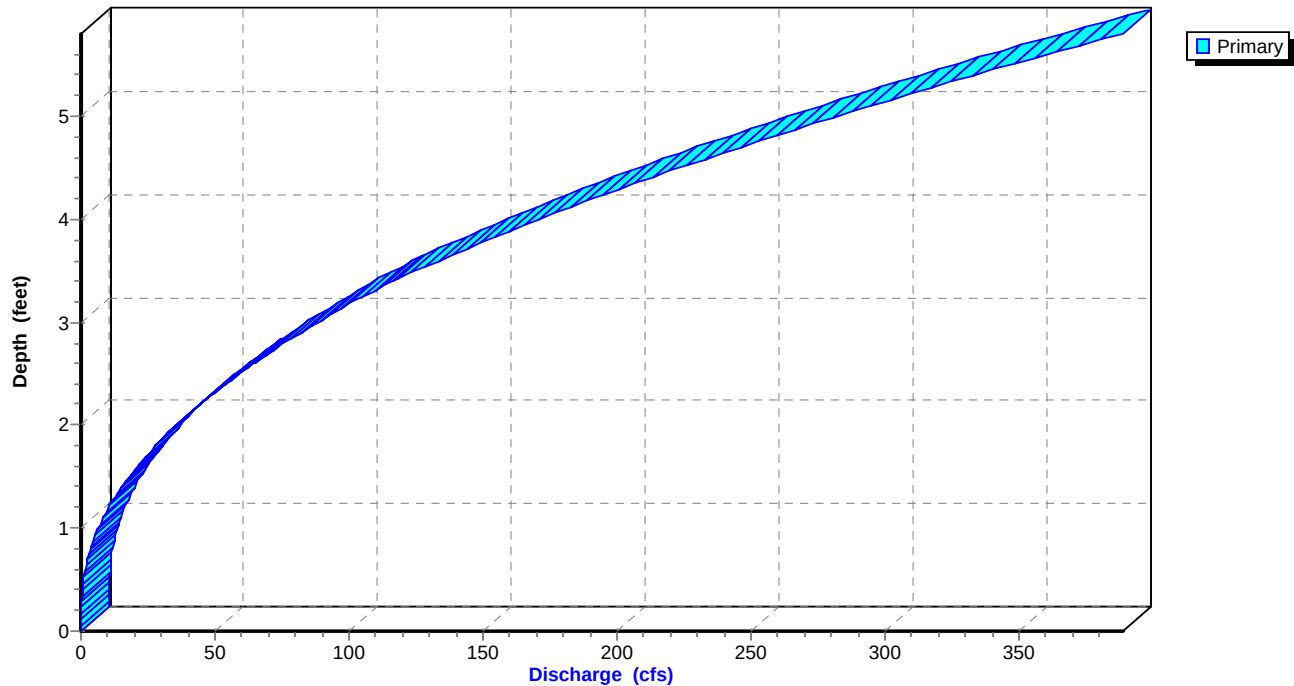
Reach 27R: RED6

Hydrograph



Reach 27R: RED6

Stage-Discharge



Proposed-1

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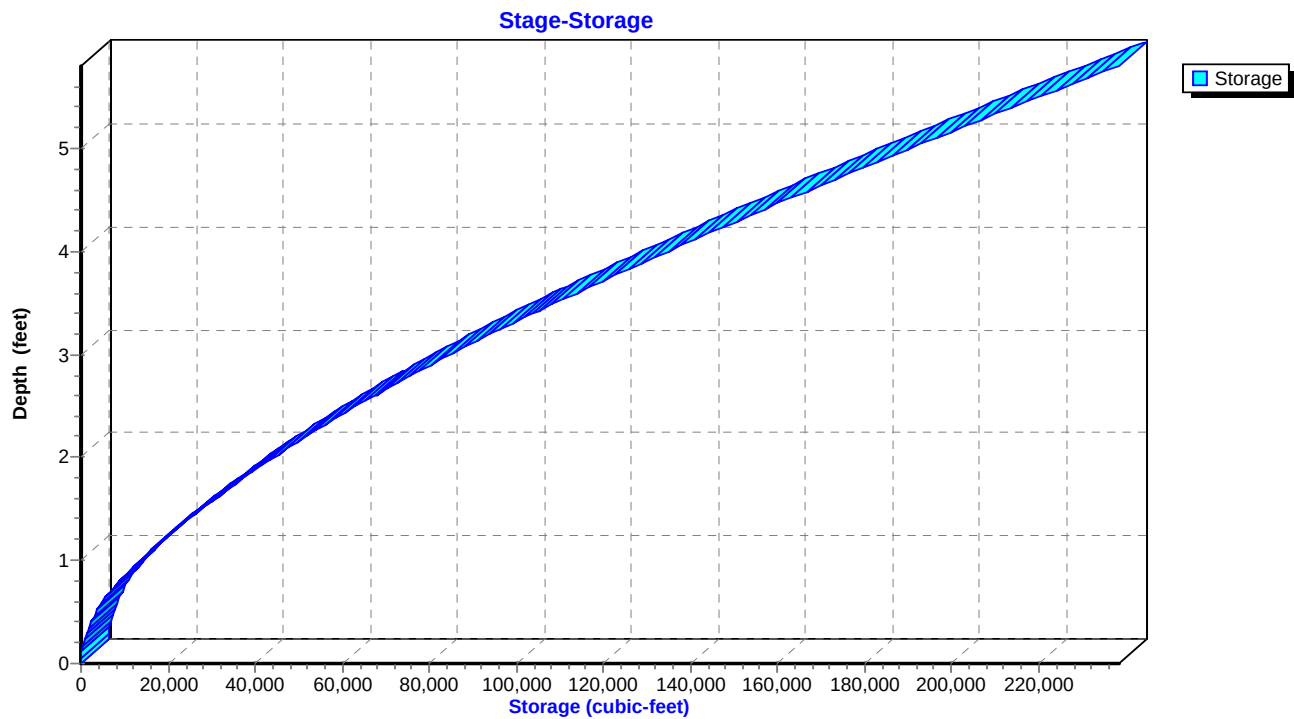
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Reach 27R: RED6



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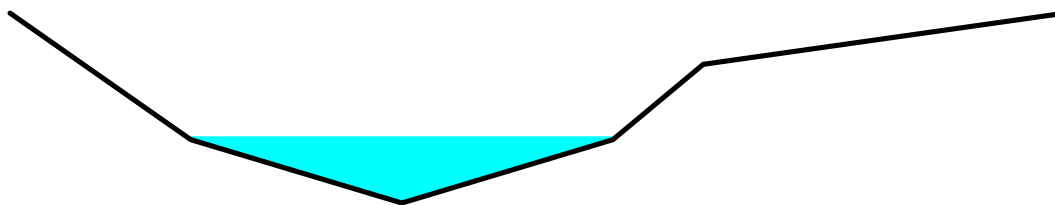
Summary for Reach 30R: RED12

Inflow Area = 400.100 ac, 0.00% Impervious, Inflow Depth = 3.34" for 25yr-24hr event
Inflow = 63.27 cfs @ 17.79 hrs, Volume= 111.277 af
Outflow = 63.27 cfs @ 17.84 hrs, Volume= 111.277 af, Atten= 0%, Lag= 2.9 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Max. Velocity= 3.89 fps, Min. Travel Time= 1.7 min
Avg. Velocity= 1.43 fps, Avg. Travel Time= 4.7 min

Peak Storage= 6,512 cf @ 17.81 hrs
Average Depth at Peak Storage= 2.21'
Bank-Full Depth= 6.30' Flow Area= 105.1 sf, Capacity= 762.50 cfs

Custom cross-section, Length= 400.0' Slope= 0.0075 '/' (101 Elevation Intervals)
Constant n= 0.035
Inlet Invert= 28.60', Outlet Invert= 25.60'



Offset (feet)	Elevation (feet)	Chan.Depth (feet)
0.00	31.90	0.00
6.00	27.70	4.20
13.00	25.60	6.30
20.00	27.70	4.20
23.00	30.20	1.70
35.00	31.90	0.00

Depth (feet)	End Area (sq-ft)	Perim. (feet)	Storage (cubic-feet)	Discharge (cfs)
0.00	0.0	0.0	0	0.00
2.10	14.7	14.6	5,880	54.26
4.60	57.9	22.9	23,166	395.43
6.30	105.1	38.0	42,060	762.50

Proposed-1

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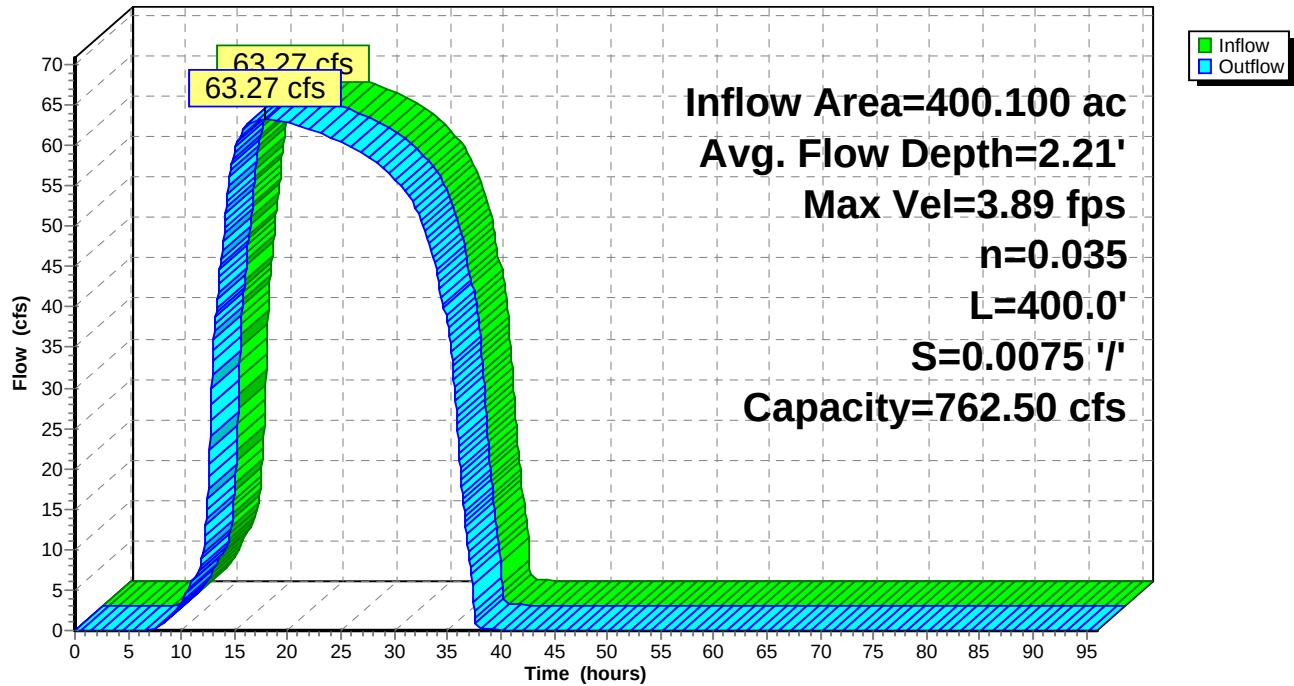
Type II 24-hr 25yr-24hr Rainfall=9.20"

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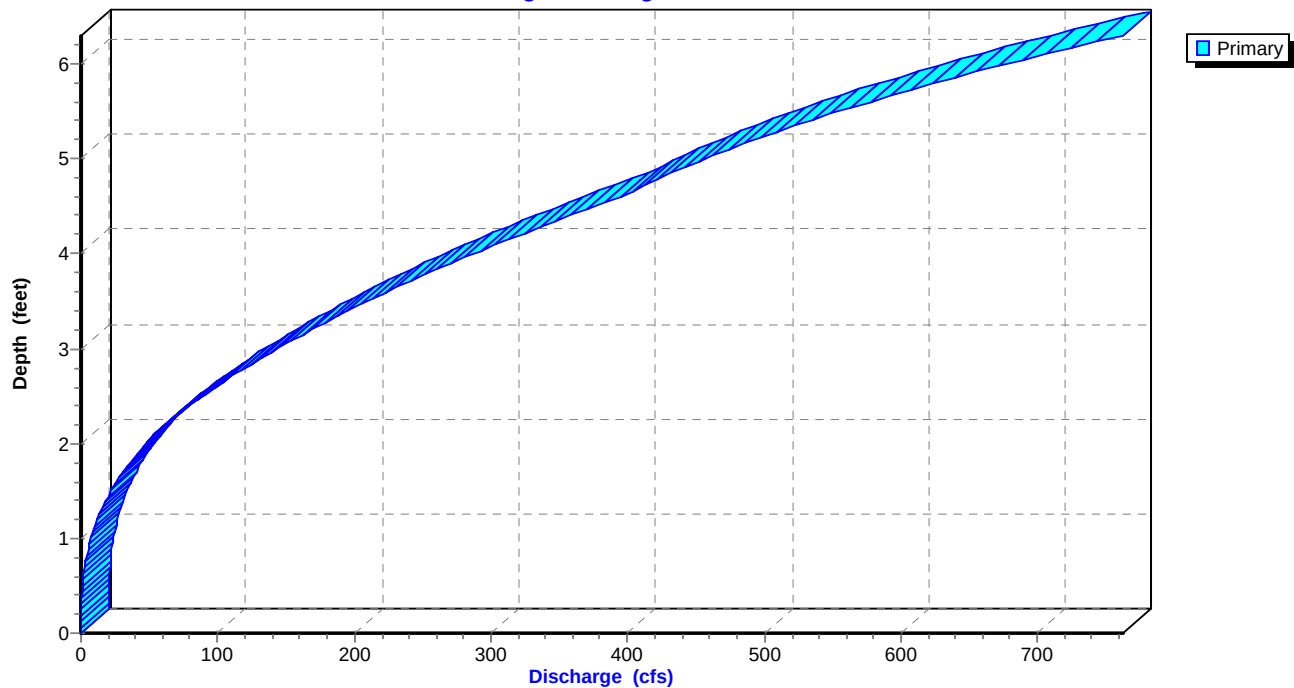
Reach 30R: RED12

Hydrograph



Reach 30R: RED12

Stage-Discharge



Proposed-1

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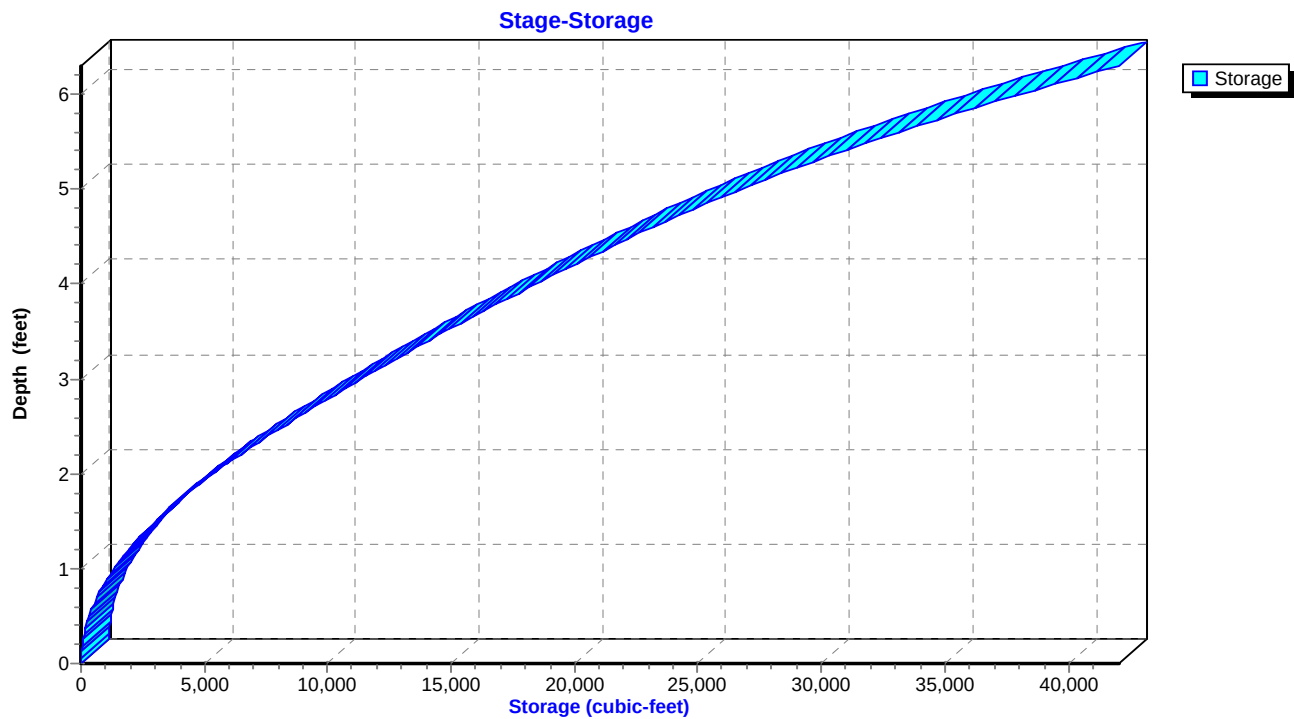
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Reach 30R: RED12



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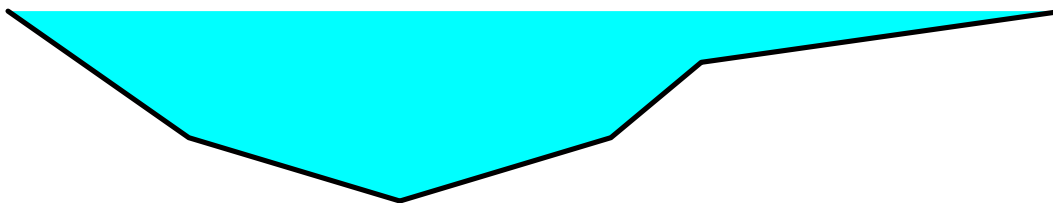
Summary for Reach 31R: RED11

Inflow Area = 1,087.600 ac, 0.00% Impervious, Inflow Depth > 2.40" for 25yr-24hr event
Inflow = 219.44 cfs @ 13.66 hrs, Volume= 217.413 af
Outflow = 196.09 cfs @ 14.86 hrs, Volume= 217.367 af, Atten= 11%, Lag= 71.9 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Max. Velocity= 0.74 fps, Min. Travel Time= 36.1 min
Avg. Velocity= 0.36 fps, Avg. Travel Time= 74.5 min

Peak Storage= 424,298 cf @ 14.26 hrs
Average Depth at Peak Storage= 10.91'
Bank-Full Depth= 6.30' Flow Area= 105.1 sf, Capacity= 69.61 cfs

Custom cross-section, Length= 1,600.0' Slope= 0.0001 '/' (101 Elevation Intervals)
Constant n= 0.035
Inlet Invert= 25.60', Outlet Invert= 25.50'



Offset (feet)	Elevation (feet)	Chan.Depth (feet)
0.00	31.90	0.00
6.00	27.70	4.20
13.00	25.60	6.30
20.00	27.70	4.20
23.00	30.20	1.70
35.00	31.90	0.00

Depth (feet)	End Area (sq-ft)	Perim. (feet)	Storage (cubic-feet)	Discharge (cfs)
0.00	0.0	0.0	0	0.00
2.10	14.7	14.6	23,520	4.95
4.60	57.9	22.9	92,663	36.10
6.30	105.1	38.0	168,240	69.61

Proposed-1

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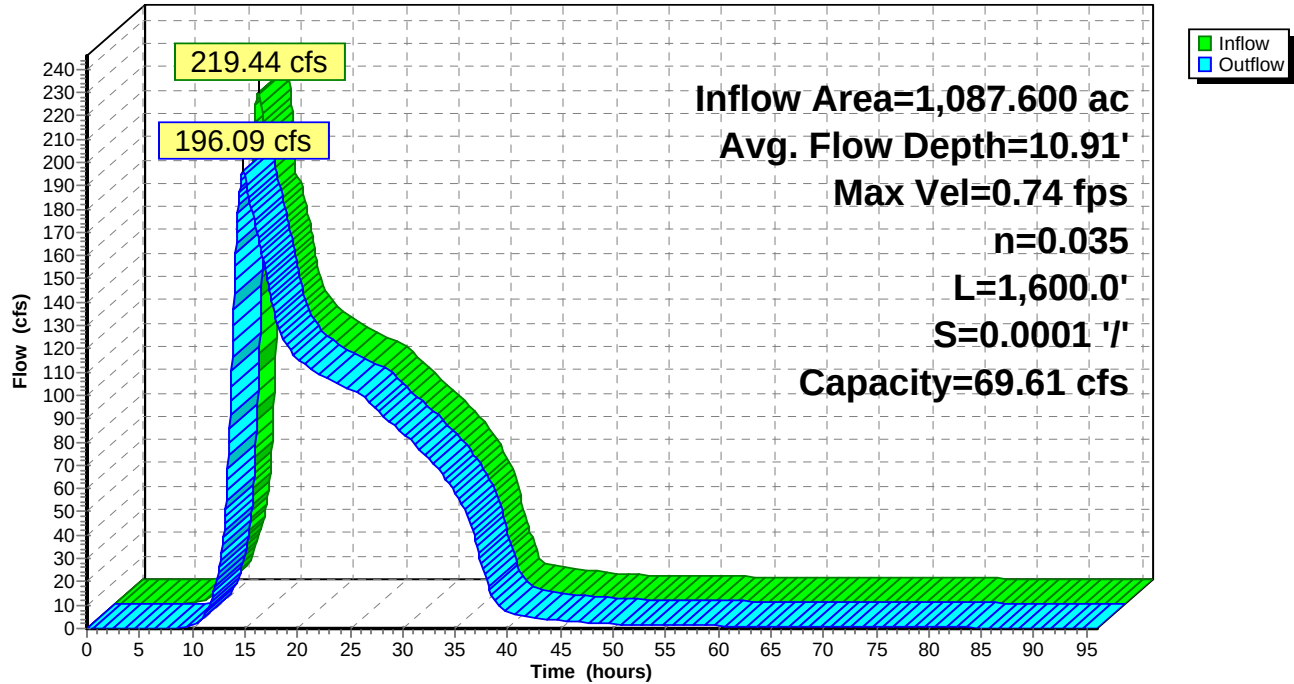
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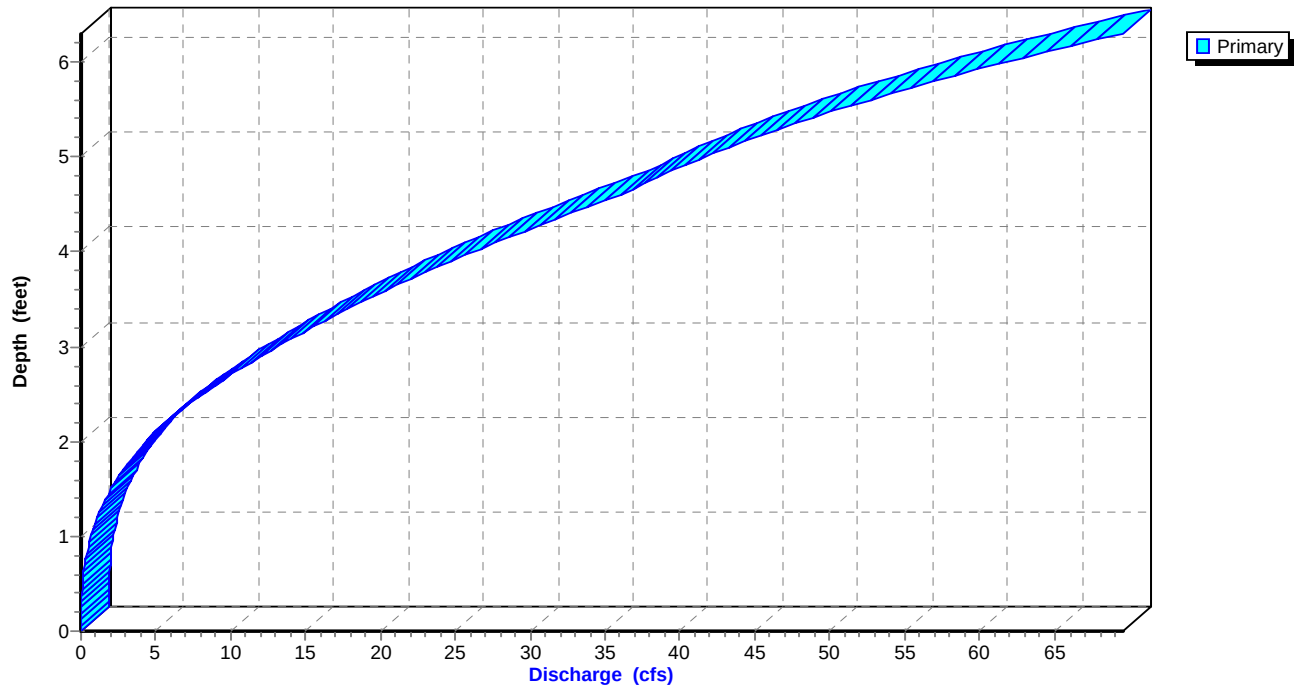
Reach 31R: RED11

Hydrograph



Reach 31R: RED11

Stage-Discharge



Proposed-1

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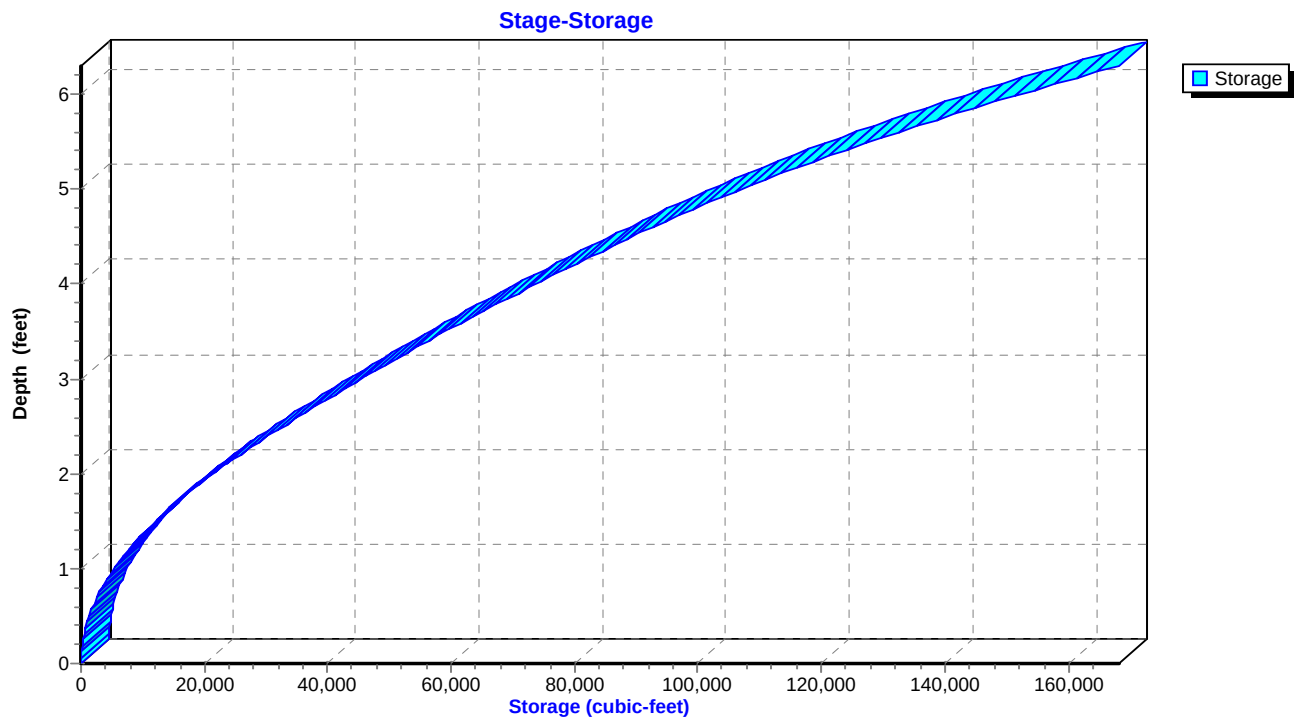
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Reach 31R: RED11



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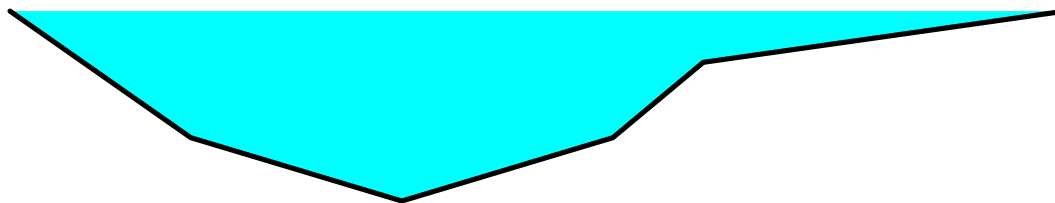
Summary for Reach 35R: RED10

Inflow Area = 1,087.600 ac, 0.00% Impervious, Inflow Depth > 2.40" for 25yr-24hr event
Inflow = 196.09 cfs @ 14.86 hrs, Volume= 217.367 af
Outflow = 193.58 cfs @ 15.27 hrs, Volume= 217.345 af, Atten= 1%, Lag= 24.8 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.75 fps, Min. Travel Time= 13.3 min
Avg. Velocity= 0.79 fps, Avg. Travel Time= 29.7 min

Peak Storage= 154,891 cf @ 15.05 hrs
Average Depth at Peak Storage= 6.46'
Bank-Full Depth= 6.30' Flow Area= 105.1 sf, Capacity= 182.27 cfs

Custom cross-section, Length= 1,400.0' Slope= 0.0004 '/' (101 Elevation Intervals)
Constant n= 0.035
Inlet Invert= 26.20', Outlet Invert= 25.60'



Offset (feet)	Elevation (feet)	Chan.Depth (feet)
0.00	31.90	0.00
6.00	27.70	4.20
13.00	25.60	6.30
20.00	27.70	4.20
23.00	30.20	1.70
35.00	31.90	0.00

Depth (feet)	End Area (sq-ft)	Perim. (feet)	Storage (cubic-feet)	Discharge (cfs)
0.00	0.0	0.0	0	0.00
2.10	14.7	14.6	20,580	12.97
4.60	57.9	22.9	81,080	94.53
6.30	105.1	38.0	147,210	182.27

Proposed-1

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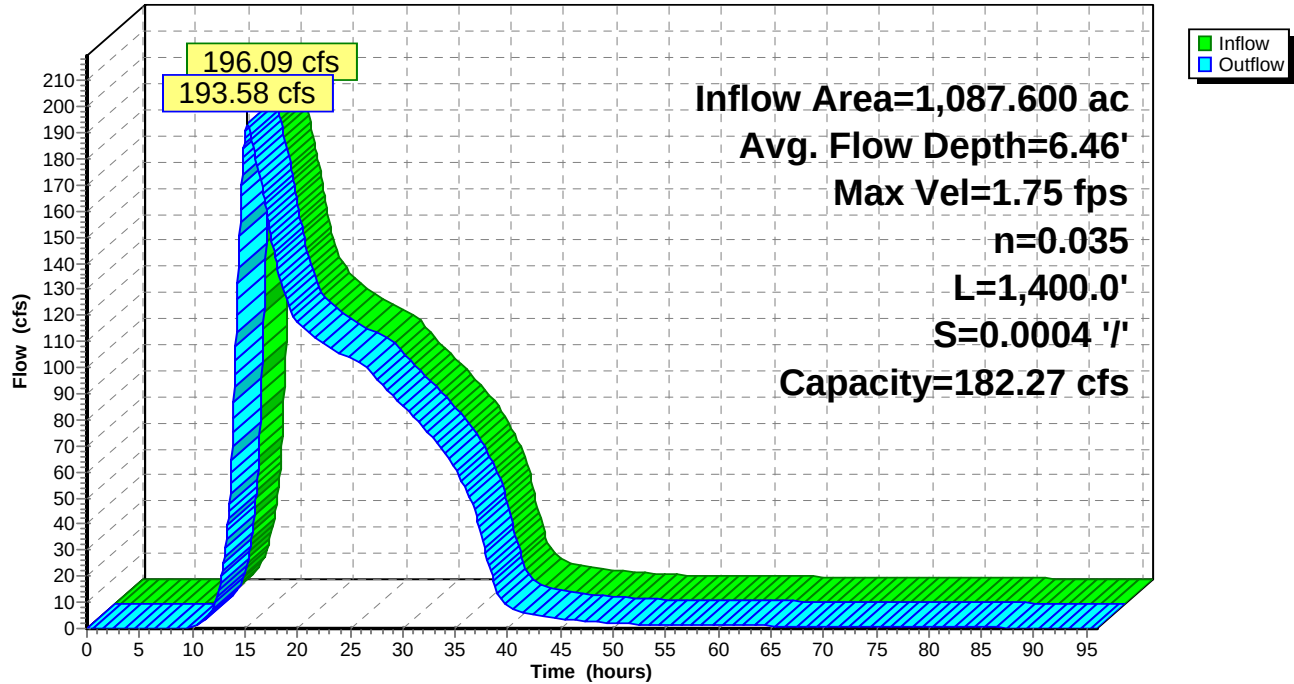
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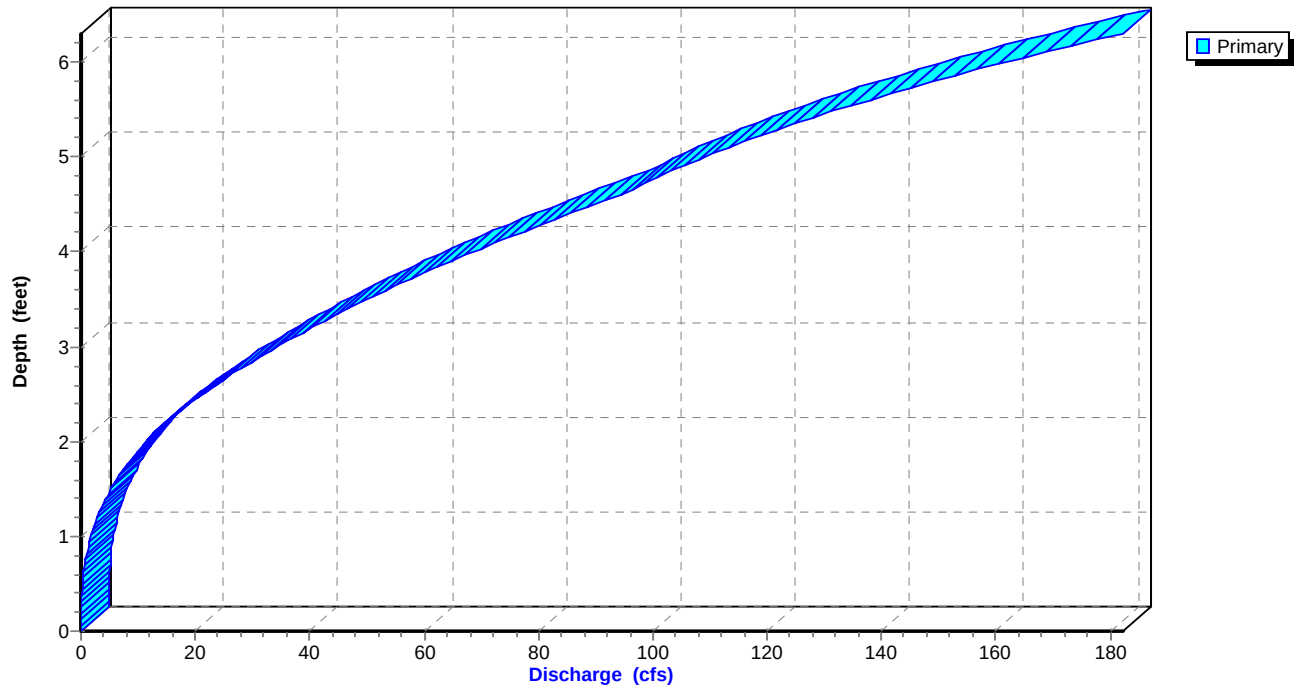
Reach 35R: RED10

Hydrograph



Reach 35R: RED10

Stage-Discharge



Proposed-1

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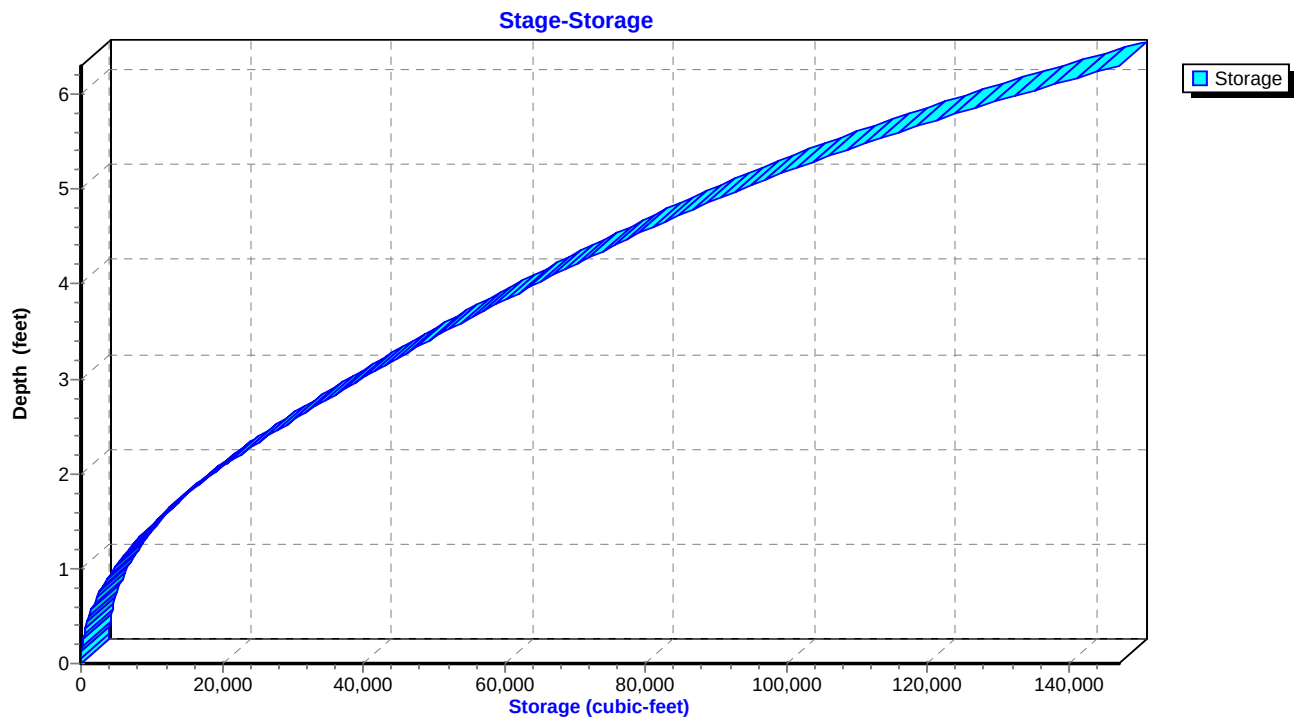
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Reach 35R: RED10



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Summary for Pond 10P: Pond 4-1

Inflow Area = 84.150 ac, 0.00% Impervious, Inflow Depth = 7.13" for 25yr-24hr event
Inflow = 278.73 cfs @ 12.75 hrs, Volume= 49.994 af
Outflow = 39.94 cfs @ 14.74 hrs, Volume= 46.668 af, Atten= 86%, Lag= 119.7 min
Primary = 39.94 cfs @ 14.74 hrs, Volume= 46.668 af

Routing by Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Starting Elev= 30.00' Surf.Area= 9.570 ac Storage= 36.890 af
Peak Elev= 33.33' @ 14.74 hrs Surf.Area= 10.137 ac Storage= 69.741 af (32.851 af above start)

Plug-Flow detention time= 3,409.6 min calculated for 9.773 af (20% of inflow)
Center-of-Mass det. time= 1,137.3 min (1,985.5 - 848.2)

Volume	Invert	Avail.Storage	Storage Description
#1	26.00'	97.370 af	Custom Stage Data (Prismatic) Listed below (Recalc)
Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
26.00	8.870	0.000	0.000
27.00	9.050	8.960	8.960
28.00	9.220	9.135	18.095
29.00	9.400	9.310	27.405
30.00	9.570	9.485	36.890
31.00	9.740	9.655	46.545
32.00	9.910	9.825	56.370
33.00	10.080	9.995	66.365
34.00	10.250	10.165	76.530
35.00	10.420	10.335	86.865
36.00	10.590	10.505	97.370

Device	Routing	Invert	Outlet Devices
#1	Primary	30.00'	7.2" Vert. Orifice/Grate X 3.00 C= 0.600
#2	Primary	31.50'	90.0 deg x 0.5' long Sharp-Crested Vee/Trap Weir Cv= 2.50 (C= 3.13)
#3	Primary	32.50'	8.0' long x 1.0' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 Coef. (English) 2.69 2.72 2.75 2.85 2.98 3.08 3.20 3.28 3.31 3.30 3.31 3.32

Primary OutFlow Max=39.88 cfs @ 14.74 hrs HW=33.33' (Free Discharge)

- 1=Orifice/Grate (Orifice Controls 7.11 cfs @ 8.39 fps)
- 2=Sharp-Crested Vee/Trap Weir (Weir Controls 15.27 cfs @ 3.57 fps)
- 3=Broad-Crested Rectangular Weir (Weir Controls 17.50 cfs @ 2.62 fps)

Proposed-1

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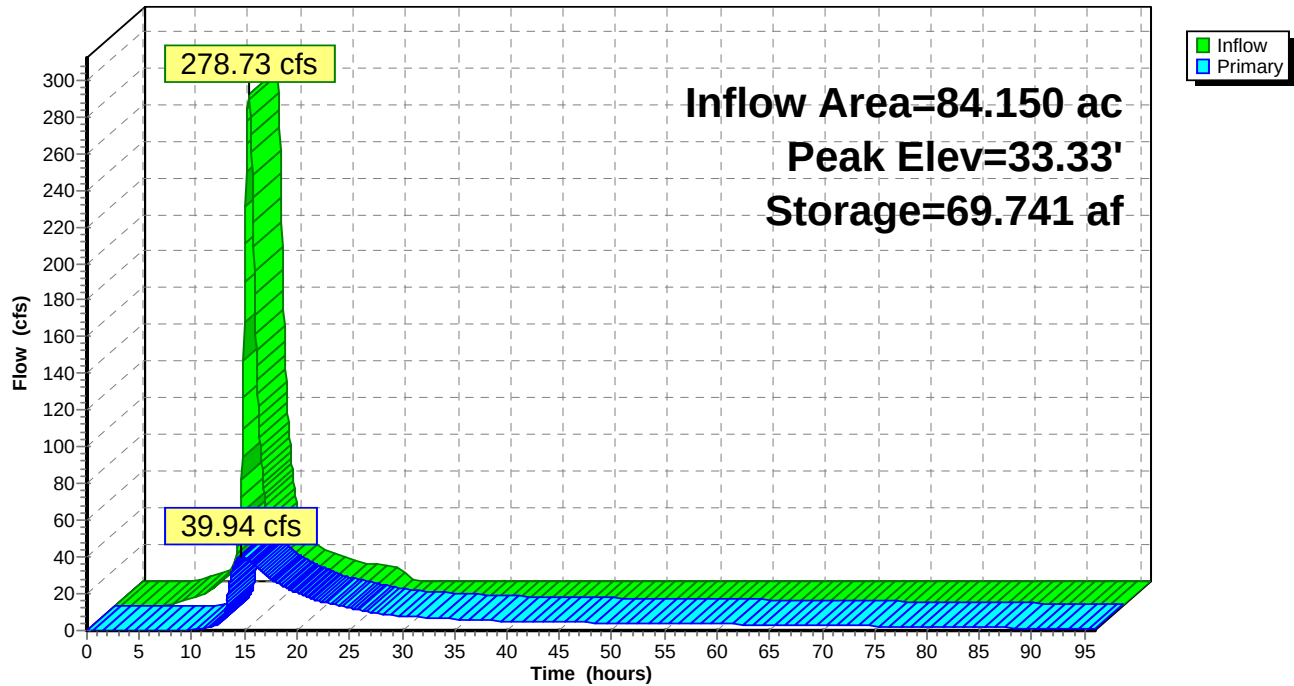
Type II 24-hr 25yr-24hr Rainfall=9.20"

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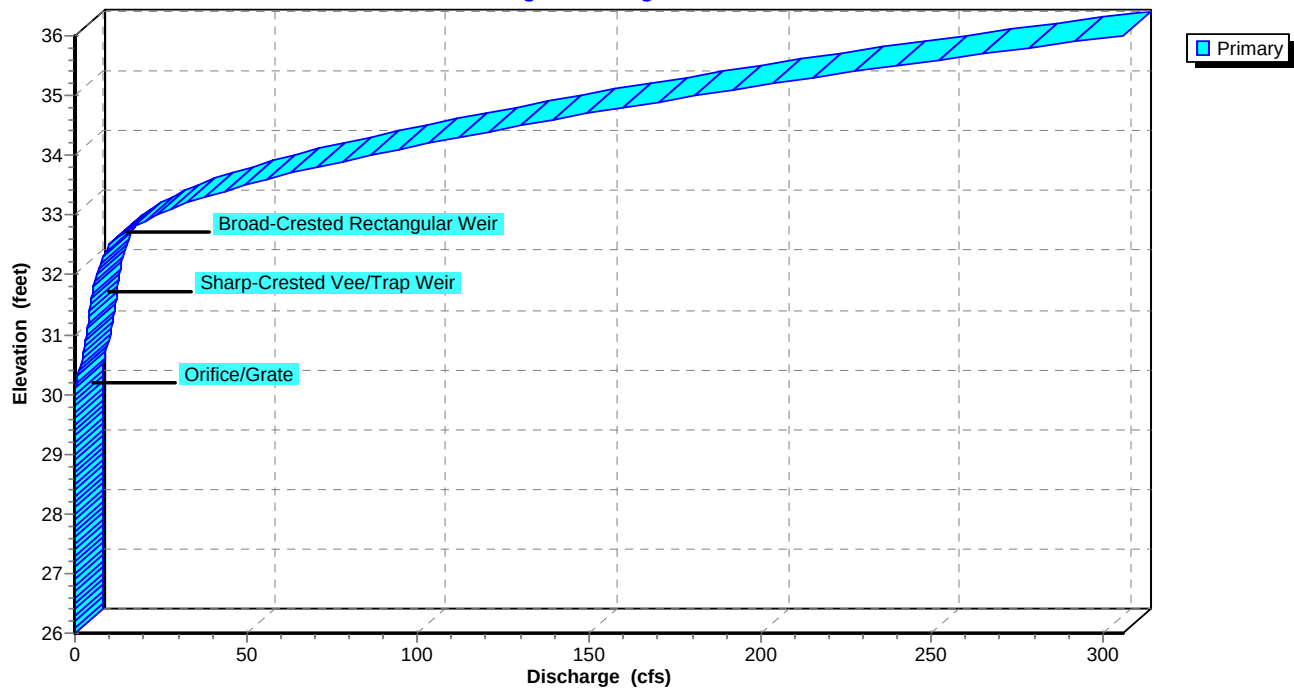
Pond 10P: Pond 4-1

Hydrograph



Pond 10P: Pond 4-1

Stage-Discharge



Proposed-1

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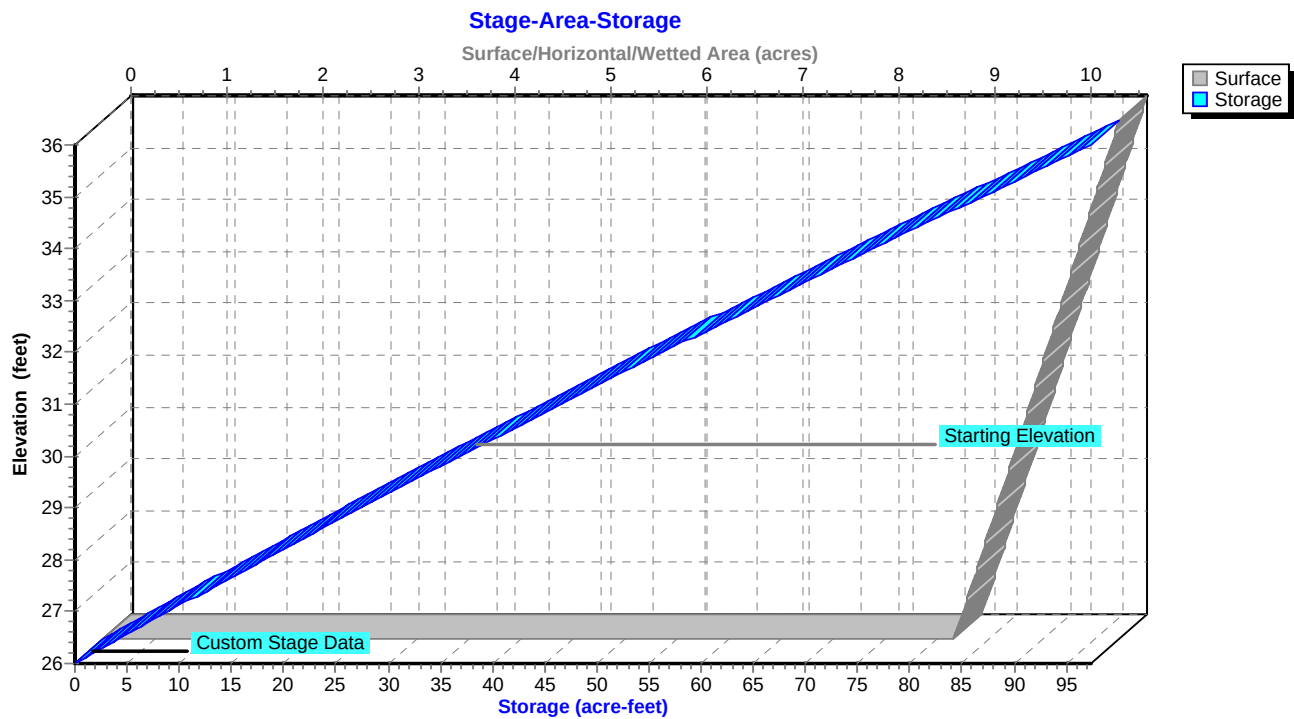
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Pond 10P: Pond 4-1



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Summary for Pond 11P: Pond 4-2

Inflow Area = 76.000 ac, 0.00% Impervious, Inflow Depth = 7.38" for 25yr-24hr event
Inflow = 257.49 cfs @ 12.74 hrs, Volume= 46.714 af
Outflow = 27.89 cfs @ 15.26 hrs, Volume= 42.755 af, Atten= 89%, Lag= 151.6 min
Primary = 27.89 cfs @ 15.26 hrs, Volume= 42.755 af

Routing by Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Starting Elev= 31.00' Surf.Area= 9.960 ac Storage= 19.555 af
Peak Elev= 34.16' @ 15.26 hrs Surf.Area= 10.529 ac Storage= 51.959 af (32.404 af above start)

Plug-Flow detention time= 2,347.7 min calculated for 23.200 af (50% of inflow)
Center-of-Mass det. time= 1,322.4 min (2,165.9 - 843.5)

Volume	Invert	Avail.Storage	Storage Description
#1	29.00'	104.995 af	Custom Stage Data (Prismatic) Listed below (Recalc)
Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
29.00	9.590	0.000	0.000
30.00	9.780	9.685	9.685
31.00	9.960	9.870	19.555
32.00	10.140	10.050	29.605
33.00	10.320	10.230	39.835
34.00	10.500	10.410	50.245
35.00	10.680	10.590	60.835
36.00	10.860	10.770	71.605
37.00	11.040	10.950	82.555
38.00	11.220	11.130	93.685
39.00	11.400	11.310	104.995

Device	Routing	Invert	Outlet Devices
#1	Primary	31.00'	7.2" Vert. Orifice/Grate X 3.00 C= 0.600
#2	Primary	32.50'	90.0 deg Sharp-Crested Vee/Trap Weir Cv= 2.50 (C= 3.13)
#3	Primary	33.50'	8.0' long x 1.0' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 Coef. (English) 2.69 2.72 2.75 2.85 2.98 3.08 3.20 3.28 3.31 3.30 3.31 3.32

Primary OutFlow Max=27.84 cfs @ 15.26 hrs HW=34.16' (Free Discharge)

- 1=Orifice/Grate (Orifice Controls 6.91 cfs @ 8.15 fps)
- 2=Sharp-Crested Vee/Trap Weir (Weir Controls 8.92 cfs @ 3.22 fps)
- 3=Broad-Crested Rectangular Weir (Weir Controls 12.01 cfs @ 2.26 fps)

Proposed-1

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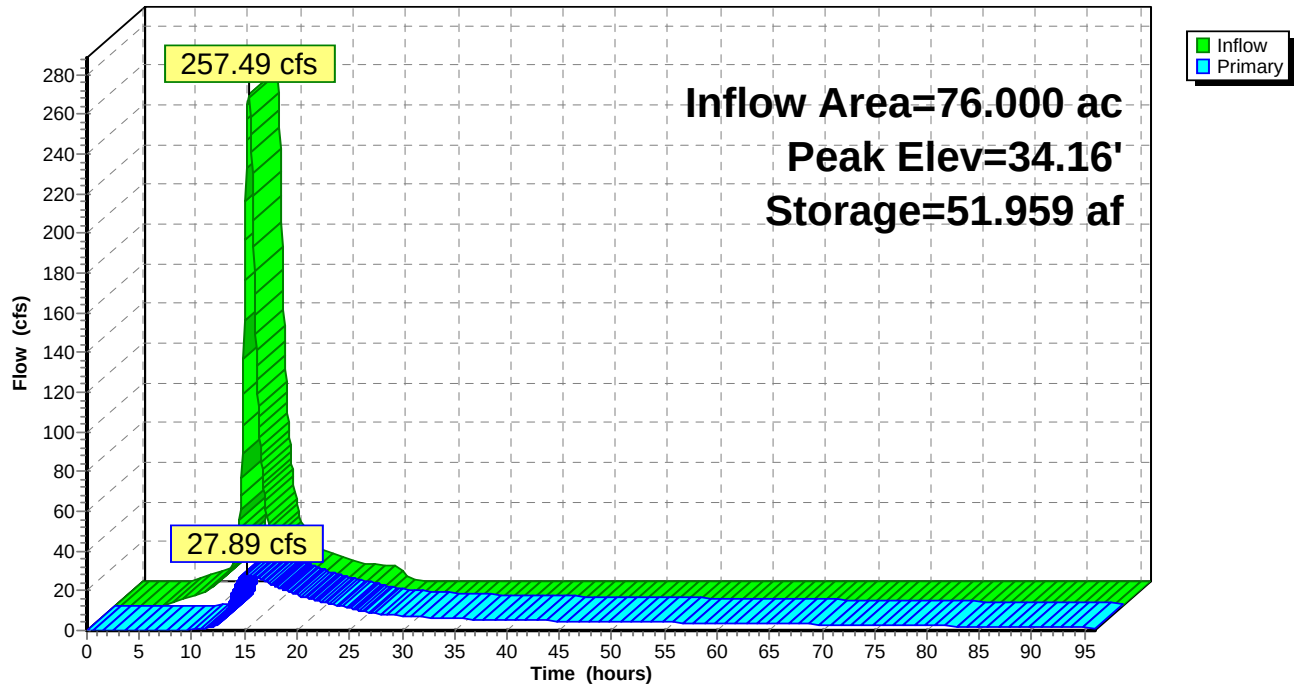
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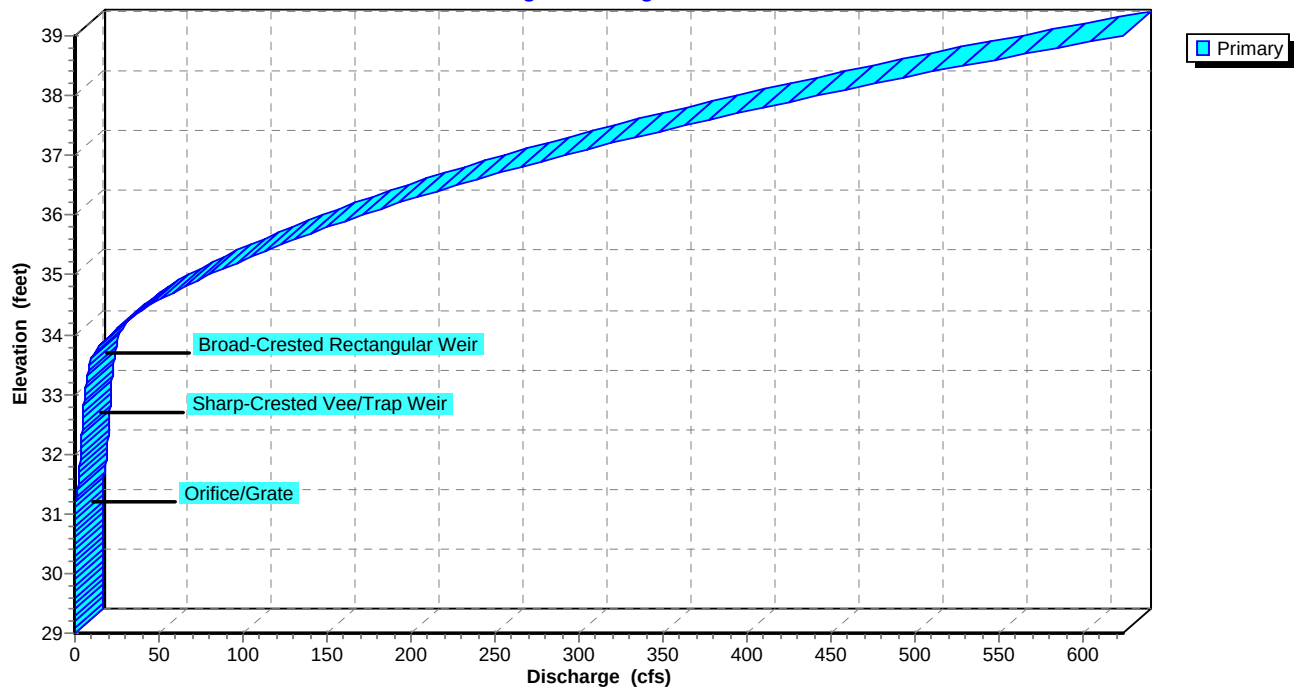
Pond 11P: Pond 4-2

Hydrograph



Pond 11P: Pond 4-2

Stage-Discharge



Proposed-1

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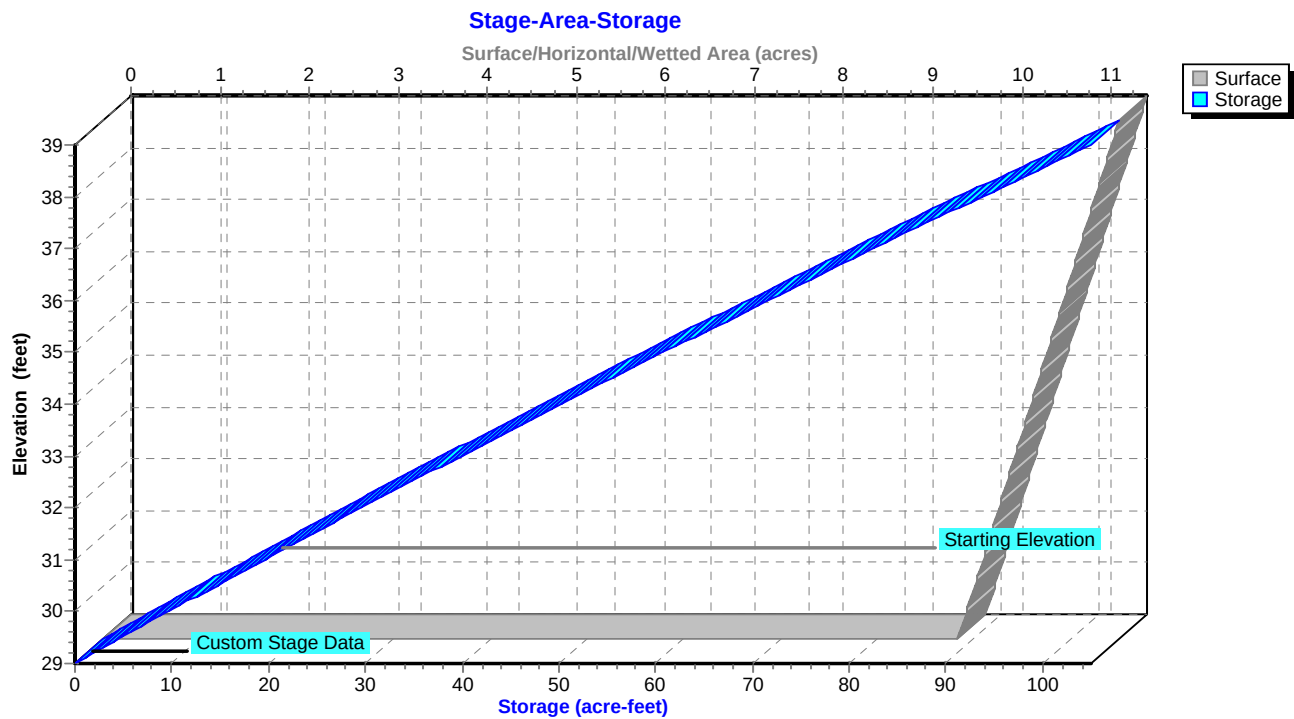
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Pond 11P: Pond 4-2



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Type II 24-hr 25yr-24hr Rainfall=9.20"

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Summary for Pond 18P: Pond BE4-3

Inflow Area = 633.280 ac, 0.00% Impervious, Inflow Depth > 3.37" for 25yr-24hr event
Inflow = 151.17 cfs @ 12.41 hrs, Volume= 177.608 af
Outflow = 114.54 cfs @ 18.93 hrs, Volume= 177.093 af, Atten= 24%, Lag= 391.0 min
Primary = 114.54 cfs @ 18.93 hrs, Volume= 177.093 af

Routing by Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs / 3
Peak Elev= 34.19' @ 18.93 hrs Surf.Area= 13.727 ac Storage= 31.888 af

Plug-Flow detention time= 302.5 min calculated for 177.000 af (100% of inflow)
Center-of-Mass det. time= 290.7 min (1,867.3 - 1,576.6)

Volume	Invert	Avail.Storage	Storage Description
#1	30.00'	43.195 af	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
30.00	0.310	0.000	0.000
31.00	3.130	1.720	1.720
32.00	6.230	4.680	6.400
33.00	12.950	9.590	15.990
34.00	13.600	13.275	29.265
35.00	14.260	13.930	43.195

Device	Routing	Invert	Outlet Devices
#1	Primary	33.00'	25.0' long x 10.0' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64
#2	Primary	30.00'	24.0" Vert. Orifice/Grate C= 0.600

Primary OutFlow Max=114.53 cfs @ 18.93 hrs HW=34.19' (Free Discharge)

1=Broad-Crested Rectangular Weir (Weir Controls 87.51 cfs @ 2.94 fps)
2=Orifice/Grate (Orifice Controls 27.03 cfs @ 8.60 fps)

Proposed-1

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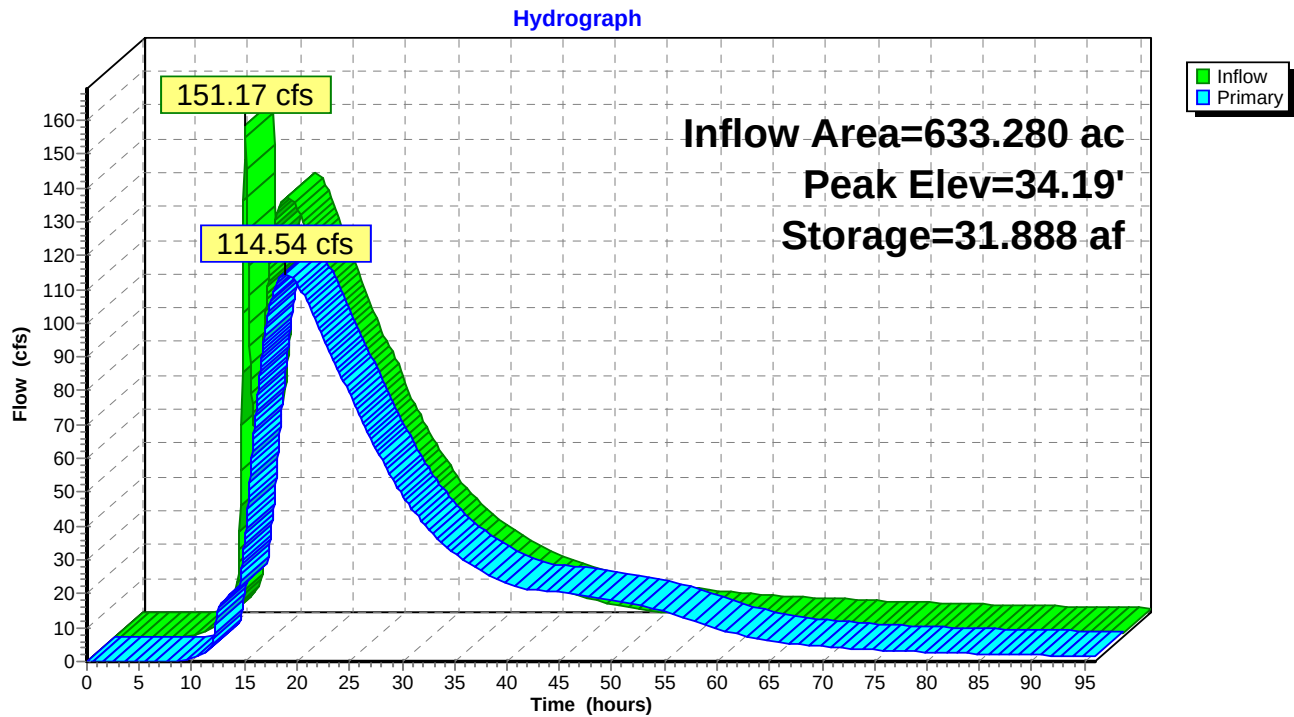
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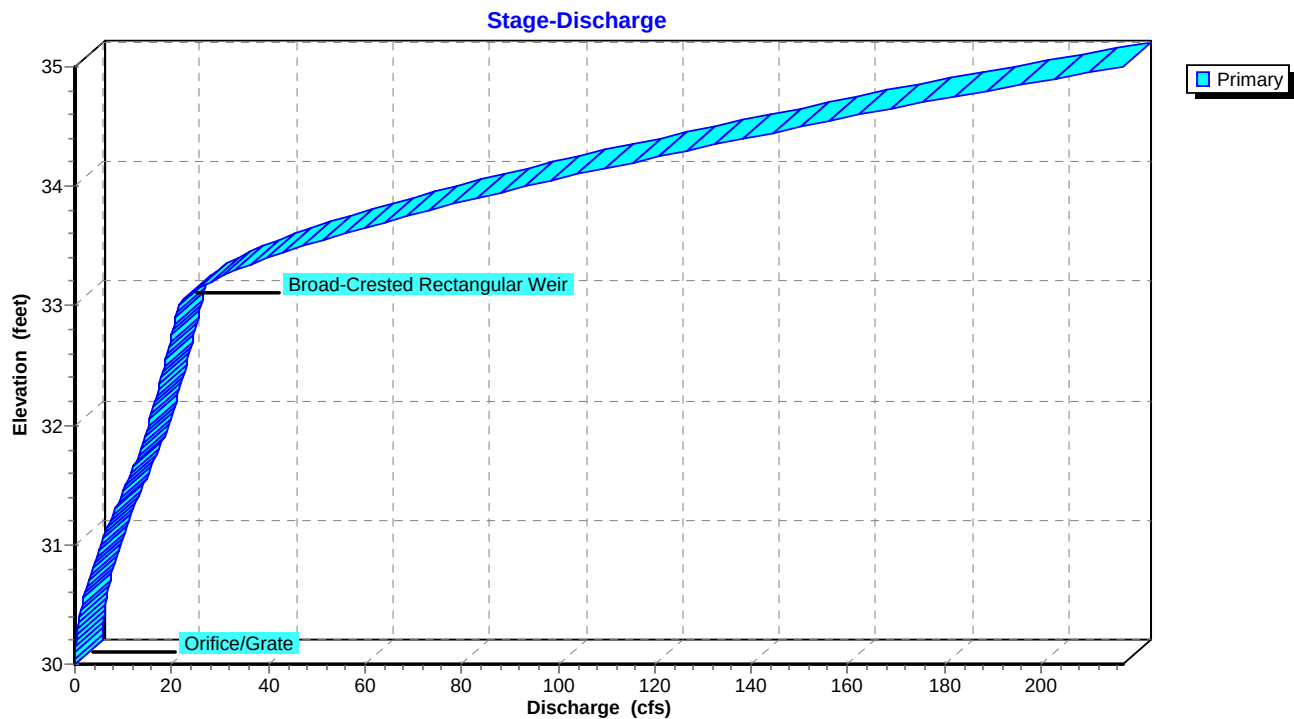
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Pond 18P: Pond BE4-3



Pond 18P: Pond BE4-3



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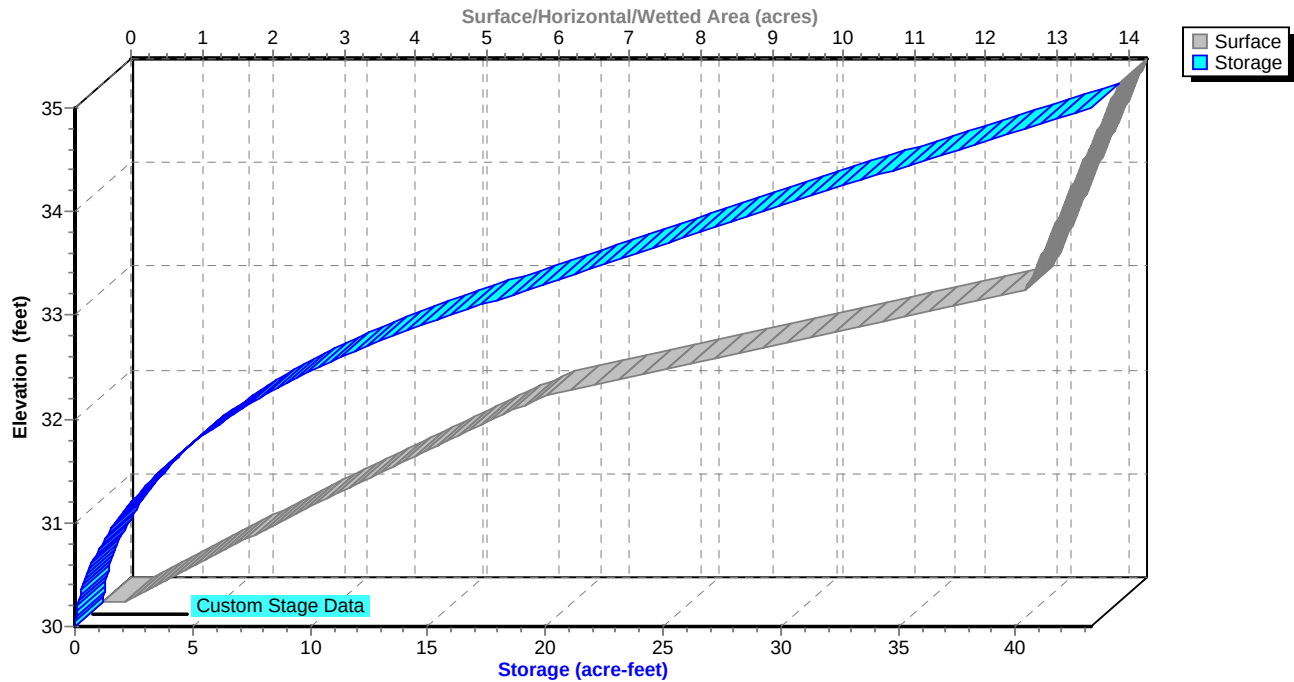
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Pond 18P: Pond BE4-3

Stage-Area-Storage



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Summary for Pond 19P: Wetland Storage - BE14A

Inflow Area = 499.200 ac, 0.00% Impervious, Inflow Depth = 5.89" for 25yr-24hr event
Inflow = 776.61 cfs @ 13.84 hrs, Volume= 244.888 af
Outflow = 298.25 cfs @ 15.85 hrs, Volume= 244.888 af, Atten= 62%, Lag= 120.2 min
Primary = 298.25 cfs @ 15.85 hrs, Volume= 244.888 af

Routing by Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Peak Elev= 37.96' @ 15.85 hrs Surf.Area= 78.380 ac Storage= 101.414 af

Plug-Flow detention time= 205.2 min calculated for 244.888 af (100% of inflow)
Center-of-Mass det. time= 204.4 min (1,150.1 - 945.7)

Volume	Invert	Avail.Storage	Storage Description
#1	34.00'	988.550 af	Custom Stage Data (Prismatic) Listed below (Recalc)
Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
34.00	0.000	0.000	0.000
35.00	5.000	2.500	2.500
36.00	15.000	10.000	12.500
37.00	44.900	29.950	42.450
38.00	79.900	62.400	104.850
40.00	144.800	224.700	329.550
44.00	184.700	659.000	988.550

Device	Routing	Invert	Outlet Devices
#1	Primary	34.00'	Custom Weir/Orifice, Cv= 2.62 (C= 3.28) Head (feet) 0.00 0.70 2.70 5.10 Width (feet) 0.00 9.00 16.00 33.00

Primary OutFlow Max=298.17 cfs @ 15.85 hrs HW=37.96' (Free Discharge)

↑**1=Custom Weir/Orifice** (Weir Controls 298.17 cfs @ 5.54 fps)

Proposed-1

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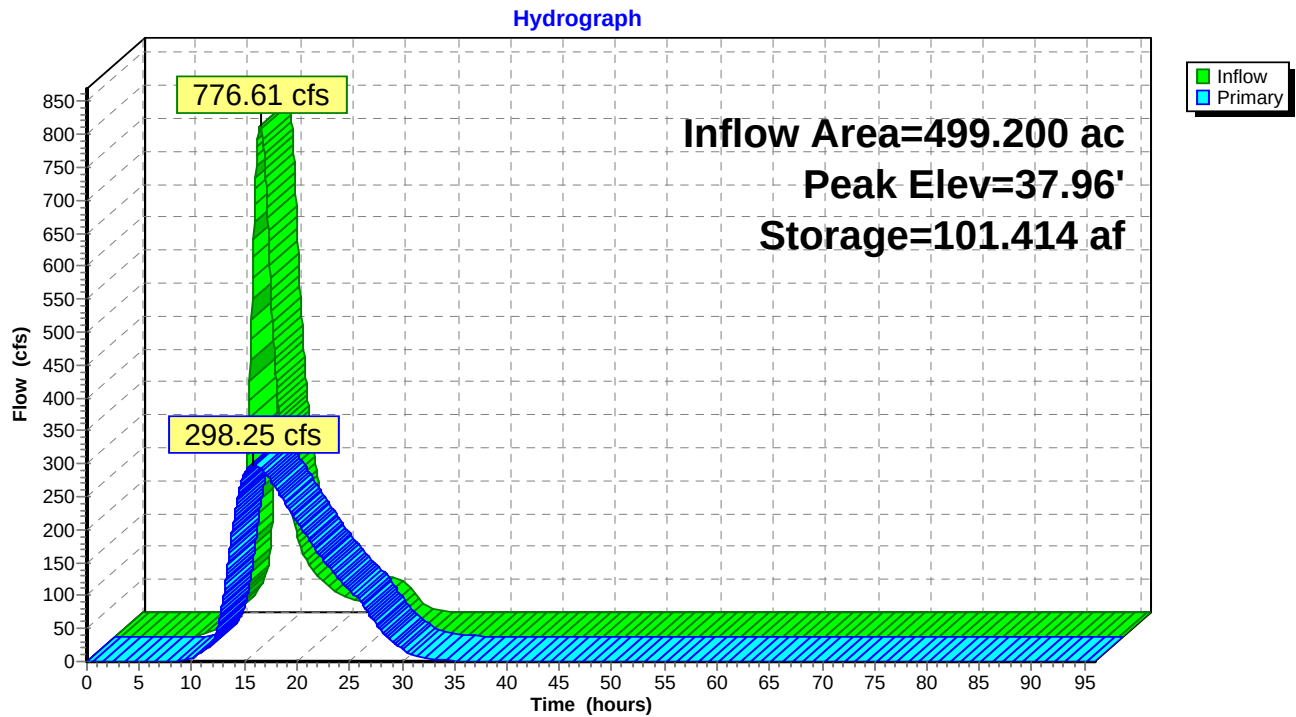
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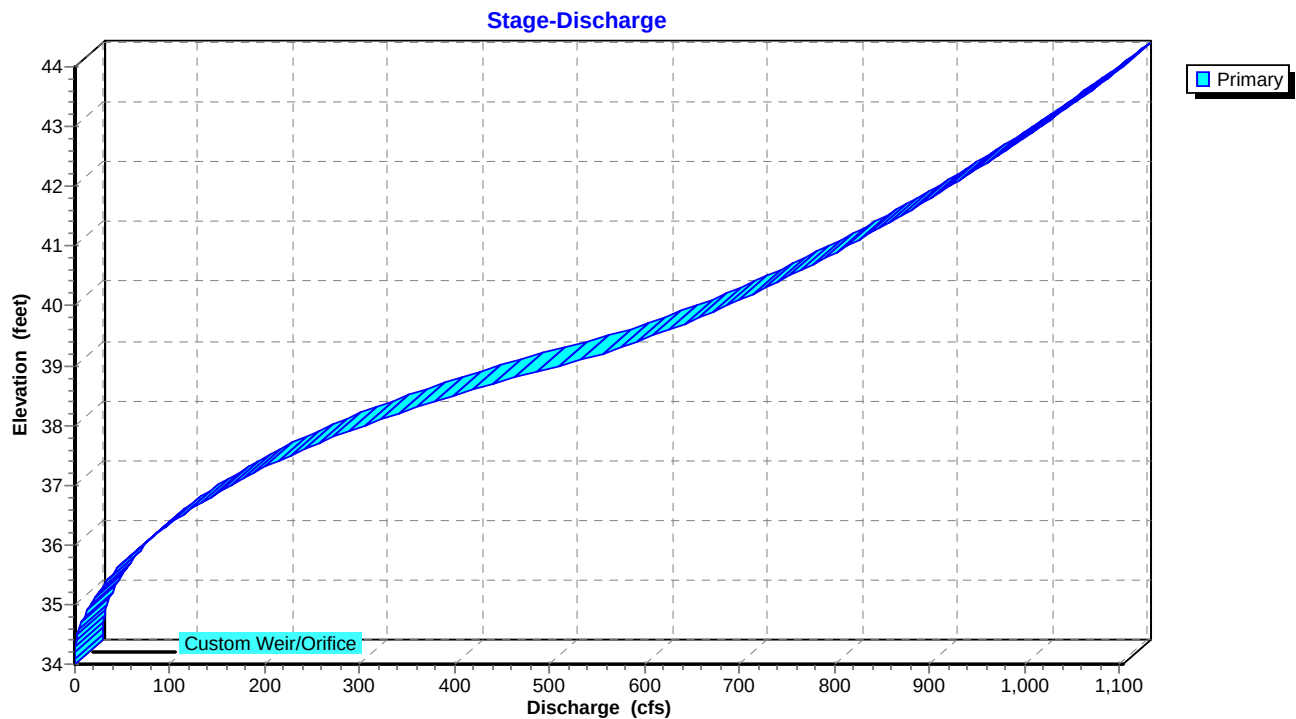
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Pond 19P: Wetland Storage - BE14A



Pond 19P: Wetland Storage - BE14A



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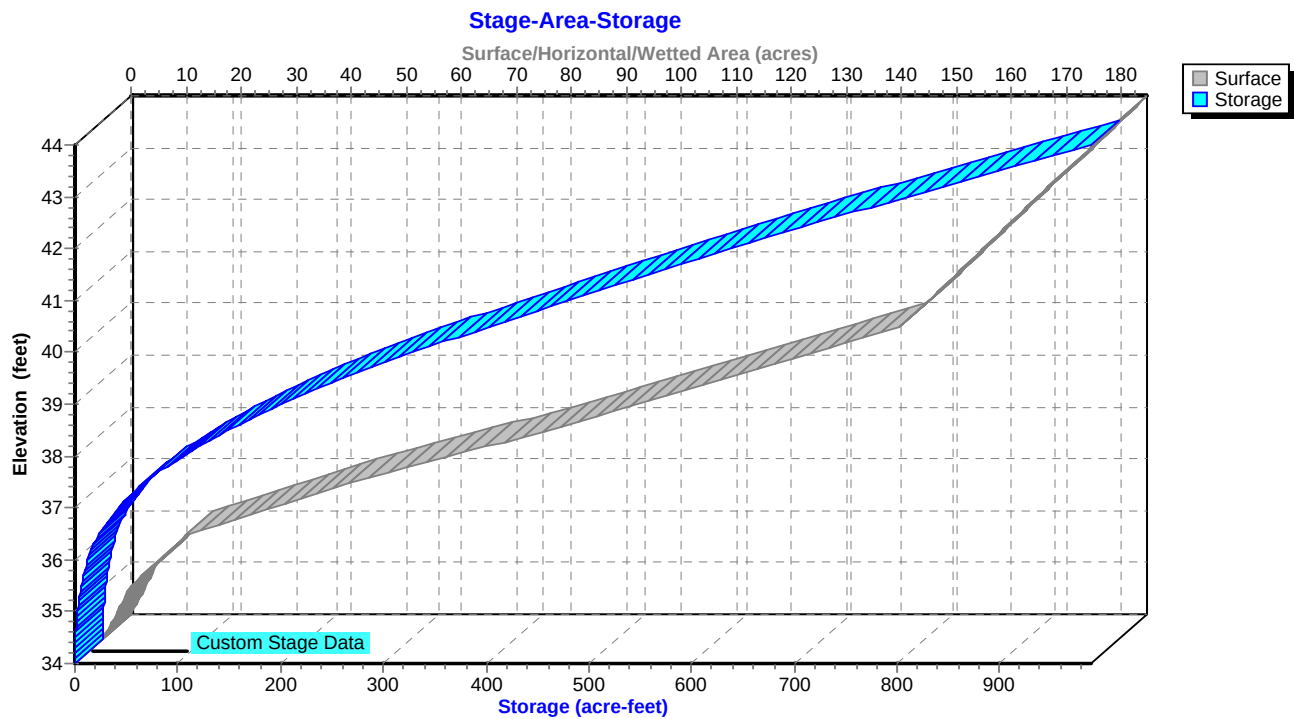
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Type II 24-hr 25yr-24hr Rainfall=9.20"

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Pond 19P: Wetland Storage - BE14A



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Summary for Pond 21P: WRC25 RC25 and RC25A

Inflow Area = 112.300 ac, 0.00% Impervious, Inflow Depth = 6.14" for 25yr-24hr event
Inflow = 181.39 cfs @ 13.78 hrs, Volume= 57.426 af
Outflow = 37.04 cfs @ 17.26 hrs, Volume= 57.196 af, Atten= 80%, Lag= 208.4 min
Primary = 37.04 cfs @ 17.26 hrs, Volume= 57.196 af

Routing by Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Peak Elev= 35.22' @ 17.26 hrs Surf.Area= 24.469 ac Storage= 33.351 af

Plug-Flow detention time= 594.5 min calculated for 57.196 af (100% of inflow)
Center-of-Mass det. time= 591.6 min (1,533.2 - 941.6)

Volume	Invert	Avail.Storage	Storage Description
#1	30.00'	100.550 af	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
30.00	0.600	0.000	0.000
31.00	1.100	0.850	0.850
32.00	1.700	1.400	2.250
33.00	5.600	3.650	5.900
34.00	9.000	7.300	13.200
35.00	21.300	15.150	28.350
36.00	35.800	28.550	56.900
37.00	51.500	43.650	100.550

Device	Routing	Invert	Outlet Devices
#1	Primary	36.00'	264.0' long Sharp-Crested Rectangular Weir 2 End Contraction(s)
#2	Primary	32.04'	36.0" Round Culvert L= 23.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 32.04' / 31.39' S= 0.0283 '/ Cc= 0.900 n= 0.024, Flow Area= 7.07 sf
#3	Primary	30.01'	8.0" Round Culvert L= 29.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 30.01' / 29.99' S= 0.0007 '/ Cc= 0.900 n= 0.024, Flow Area= 0.35 sf

Primary OutFlow Max=37.04 cfs @ 17.26 hrs HW=35.22' (Free Discharge)

1=Sharp-Crested Rectangular Weir (Controls 0.00 cfs)
2=Culvert (Inlet Controls 34.81 cfs @ 4.92 fps)
3=Culvert (Barrel Controls 2.23 cfs @ 6.38 fps)

Proposed-1

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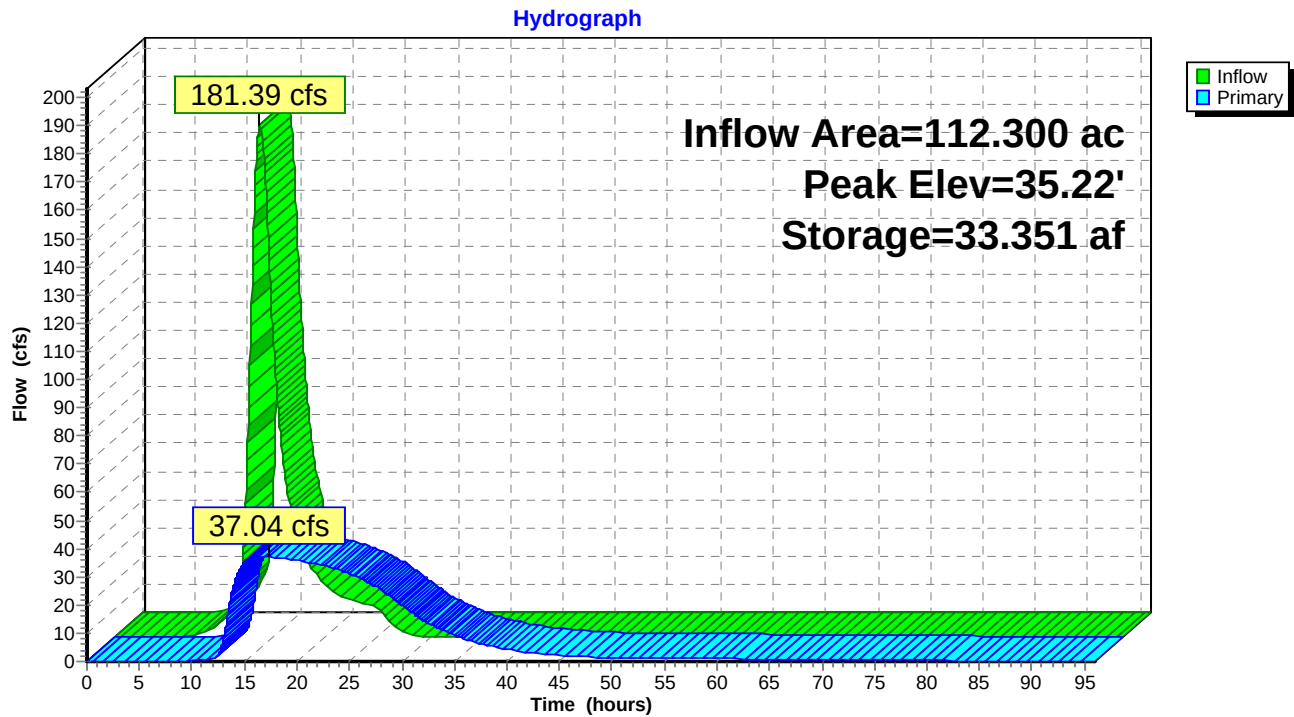
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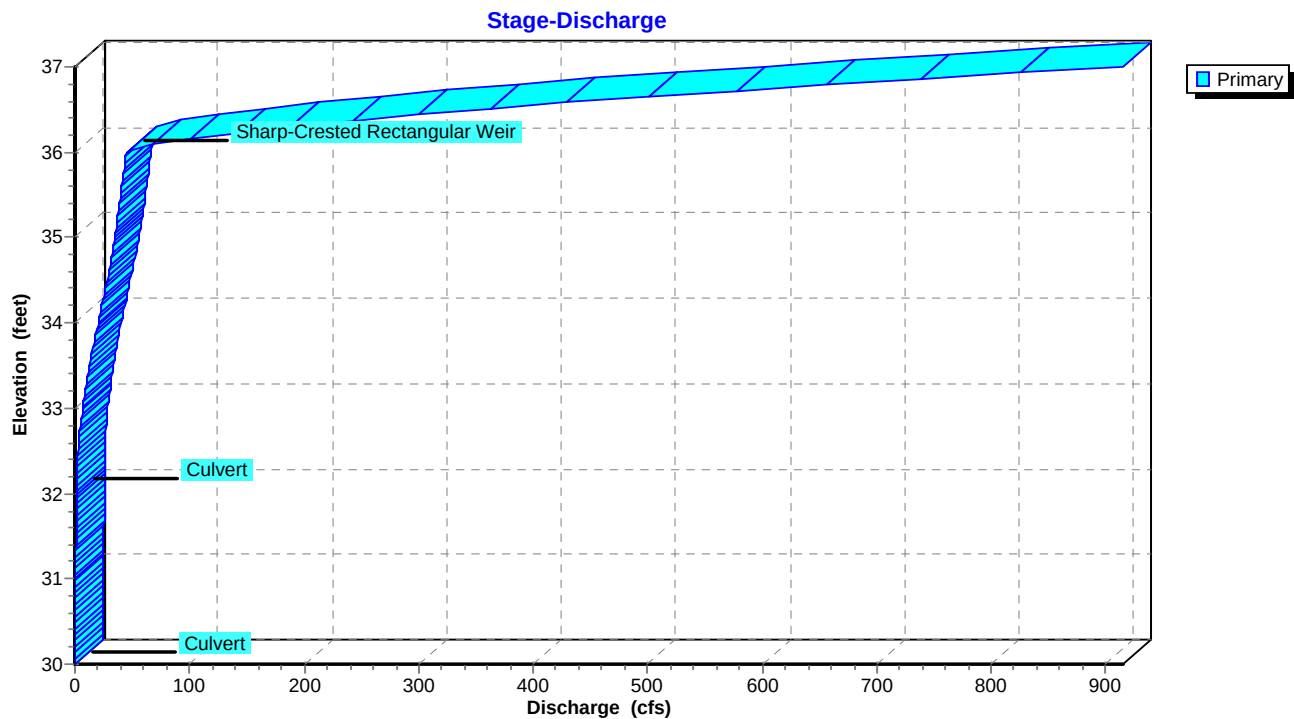
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Pond 21P: WRC25 RC25 and RC25A



Pond 21P: WRC25 RC25 and RC25A



Proposed-1

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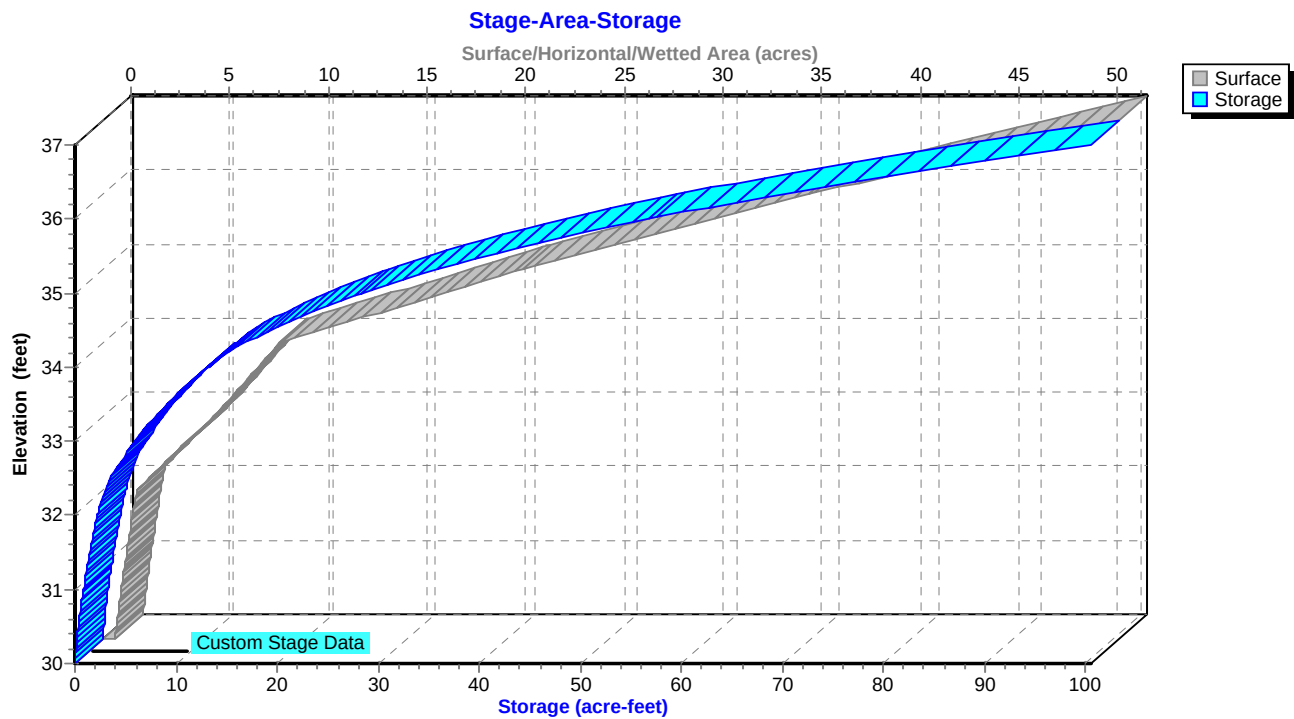
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Pond 21P: WRC25 RC25 and RC25A



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Summary for Pond 22P: Wetland Storage - BE14B

Inflow Area = 333.700 ac, 0.00% Impervious, Inflow Depth = 5.89" for 25yr-24hr event
 Inflow = 519.14 cfs @ 13.84 hrs, Volume= 163.700 af
 Outflow = 460.71 cfs @ 14.38 hrs, Volume= 163.700 af, Atten= 11%, Lag= 32.2 min
 Primary = 366.45 cfs @ 14.38 hrs, Volume= 77.323 af
 Secondary = 94.26 cfs @ 14.38 hrs, Volume= 86.377 af

Routing by Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
 Peak Elev= 38.37' @ 14.38 hrs Surf.Area= 41.090 ac Storage= 39.747 af

Plug-Flow detention time= 140.7 min calculated for 163.615 af (100% of inflow)
 Center-of-Mass det. time= 141.5 min (1,087.1 - 945.7)

Volume	Invert	Avail.Storage	Storage Description
#1	36.00'	583.850 af	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
36.00	3.300	0.000	0.000
37.00	10.000	6.650	6.650
38.00	30.000	20.000	26.650
39.00	60.100	45.050	71.700
40.00	83.400	71.750	143.450
42.00	110.100	193.500	336.950
44.00	136.800	246.900	583.850

Device	Routing	Invert	Outlet Devices
#1	Primary	38.00'	480.0' long Sharp-Crested Rectangular Weir 2 End Contraction(s)
#2	Primary	36.00'	24.0" Round Culvert L= 23.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 36.00' / 34.30' S= 0.0739 '/' Cc= 0.900 n= 0.024, Flow Area= 3.14 sf
#3	Secondary	36.00'	Custom Weir/Orifice, Cv= 2.62 (C= 3.28) Head (feet) 0.00 1.00 5.00 Width (feet) 6.00 8.00 16.00

Primary OutFlow Max=364.78 cfs @ 14.38 hrs HW=38.37' (Free Discharge)

↑ **1=Sharp-Crested Rectangular Weir** (Weir Controls 350.82 cfs @ 1.98 fps)
 ↓ **2=Culvert** (Inlet Controls 13.97 cfs @ 4.45 fps)

Secondary OutFlow Max=94.23 cfs @ 14.38 hrs HW=38.37' (Free Discharge)

↑ **3=Custom Weir/Orifice** (Weir Controls 94.23 cfs @ 4.75 fps)

Proposed-1

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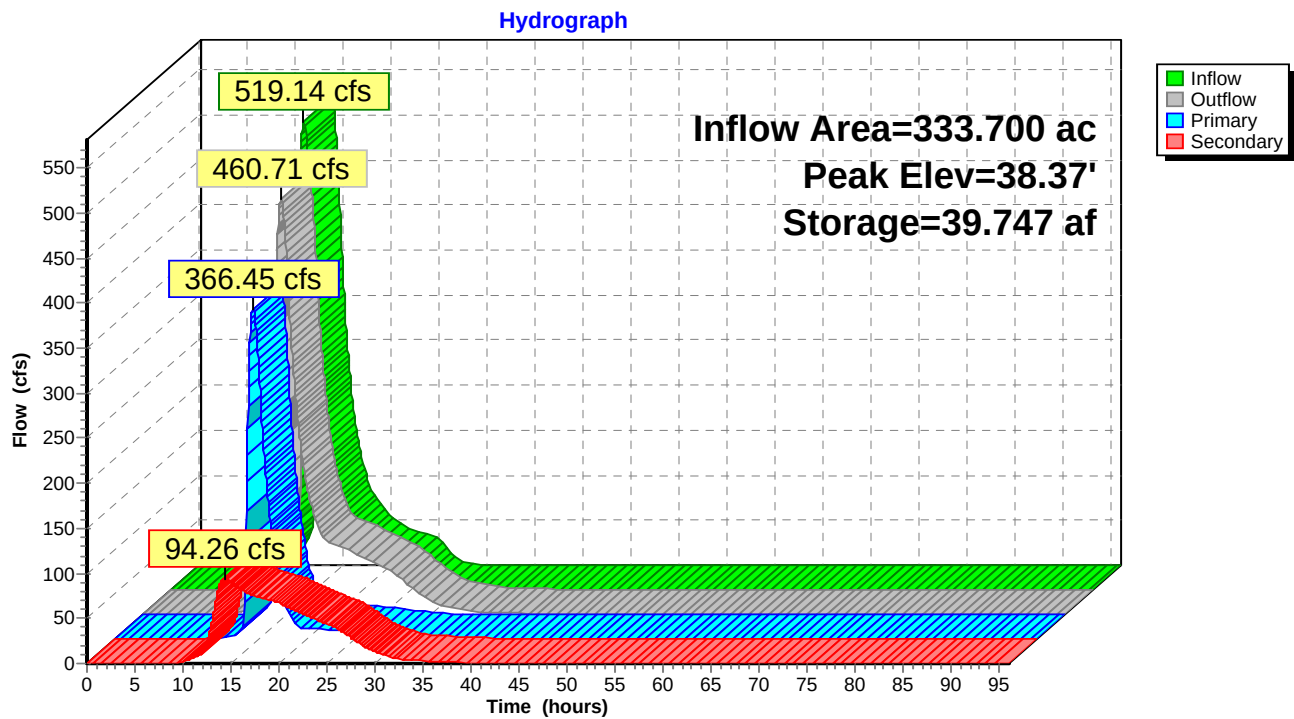
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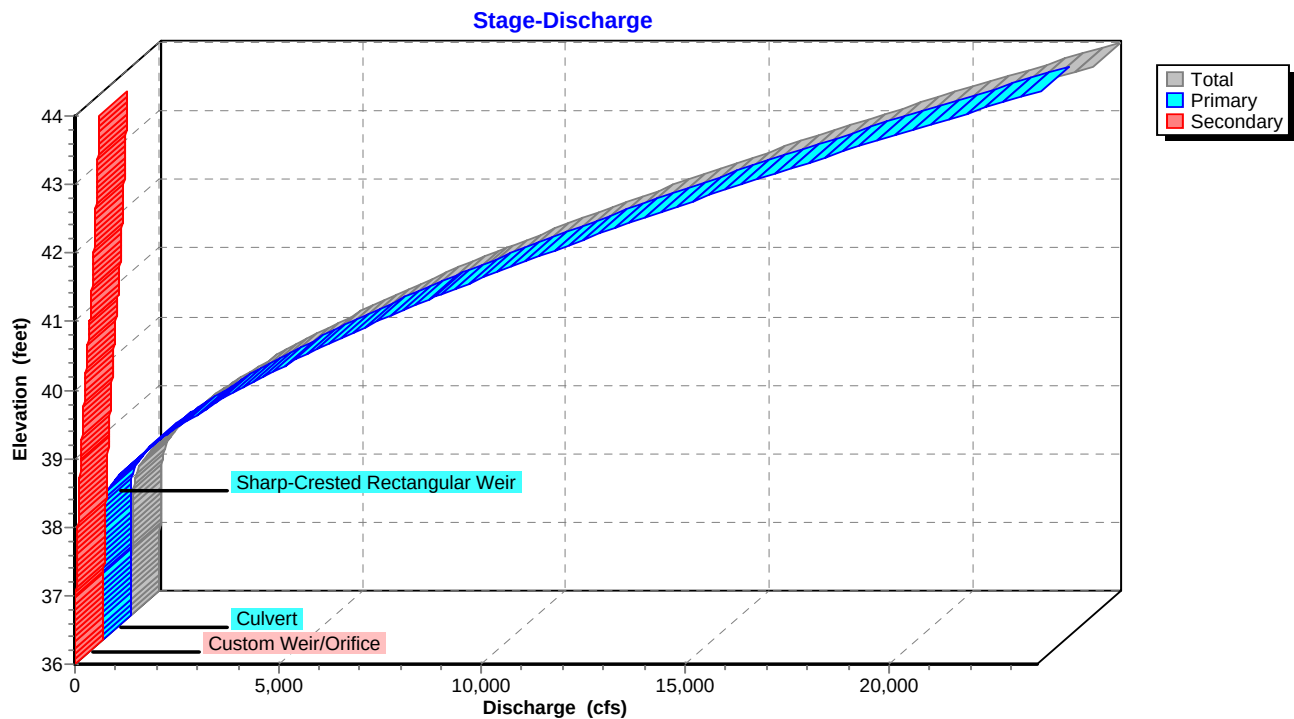
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Pond 22P: Wetland Storage - BE14B



Pond 22P: Wetland Storage - BE14B



Proposed-1

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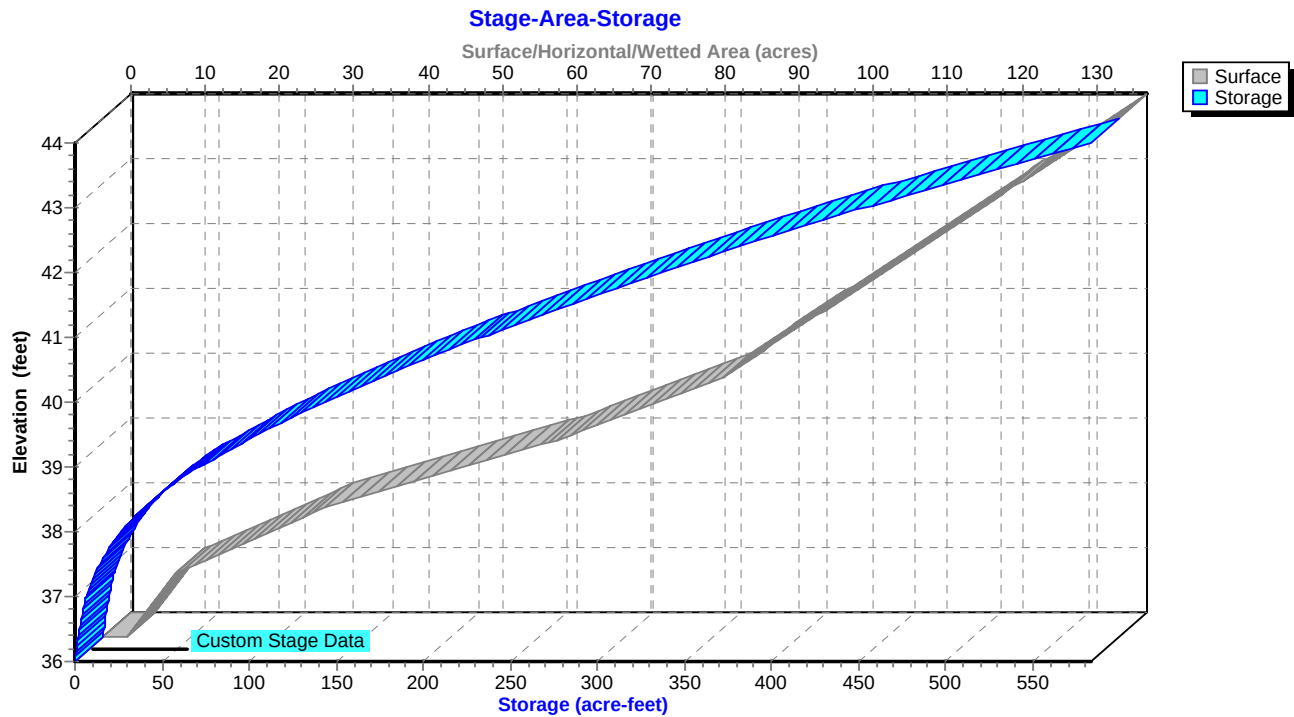
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Type II 24-hr 25yr-24hr Rainfall=9.20"

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Pond 22P: Wetland Storage - BE14B



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Type II 24-hr 25yr-24hr Rainfall=9.20"

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Summary for Pond 23P: Wetland Storage - NE8

Inflow Area = 102.230 ac, 0.00% Impervious, Inflow Depth = 6.26" for 25yr-24hr event
Inflow = 197.18 cfs @ 13.45 hrs, Volume= 53.338 af
Outflow = 13.13 cfs @ 21.16 hrs, Volume= 53.336 af, Atten= 93%, Lag= 462.7 min
Primary = 13.13 cfs @ 21.16 hrs, Volume= 53.336 af

Routing by Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Peak Elev= 31.84' @ 21.16 hrs Surf.Area= 58.577 ac Storage= 39.741 af

Plug-Flow detention time= 1,500.1 min calculated for 53.336 af (100% of inflow)
Center-of-Mass det. time= 1,500.1 min (2,413.3 - 913.2)

Volume	Invert	Avail.Storage	Storage Description
#1	30.00'	219.000 af	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
30.00	1.900	0.000	0.000
31.00	15.500	8.700	8.700
32.00	66.900	41.200	49.900
33.00	87.200	77.050	126.950
34.00	96.900	92.050	219.000

Device	Routing	Invert	Outlet Devices
#1	Primary	33.50'	600.0' long Sharp-Crested Rectangular Weir 2 End Contraction(s)
#2	Primary	29.63'	24.0" Round Culvert L= 29.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 29.63' / 28.90' S= 0.0252 ' /' Cc= 0.900 n= 0.024, Flow Area= 3.14 sf

Primary OutFlow Max=13.13 cfs @ 21.16 hrs HW=31.84' (Free Discharge)

1=Sharp-Crested Rectangular Weir (Controls 0.00 cfs)
2=Culvert (Inlet Controls 13.13 cfs @ 4.18 fps)

Proposed-1

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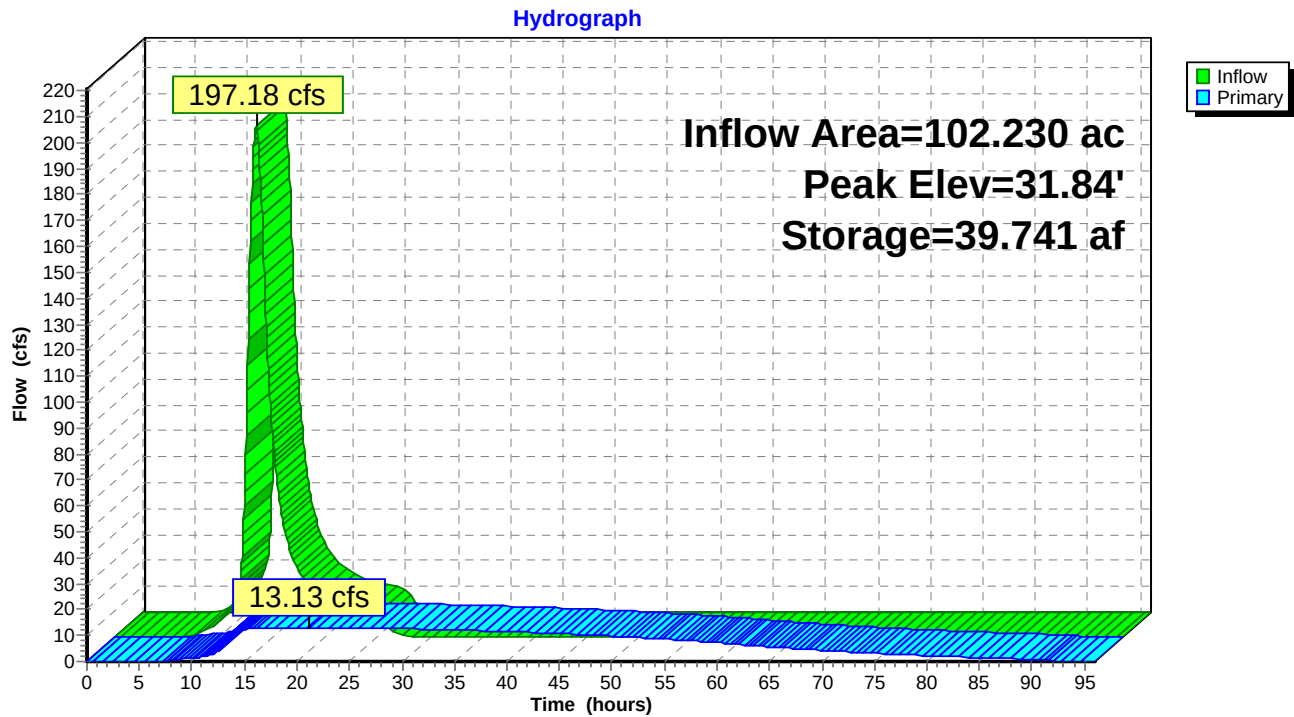
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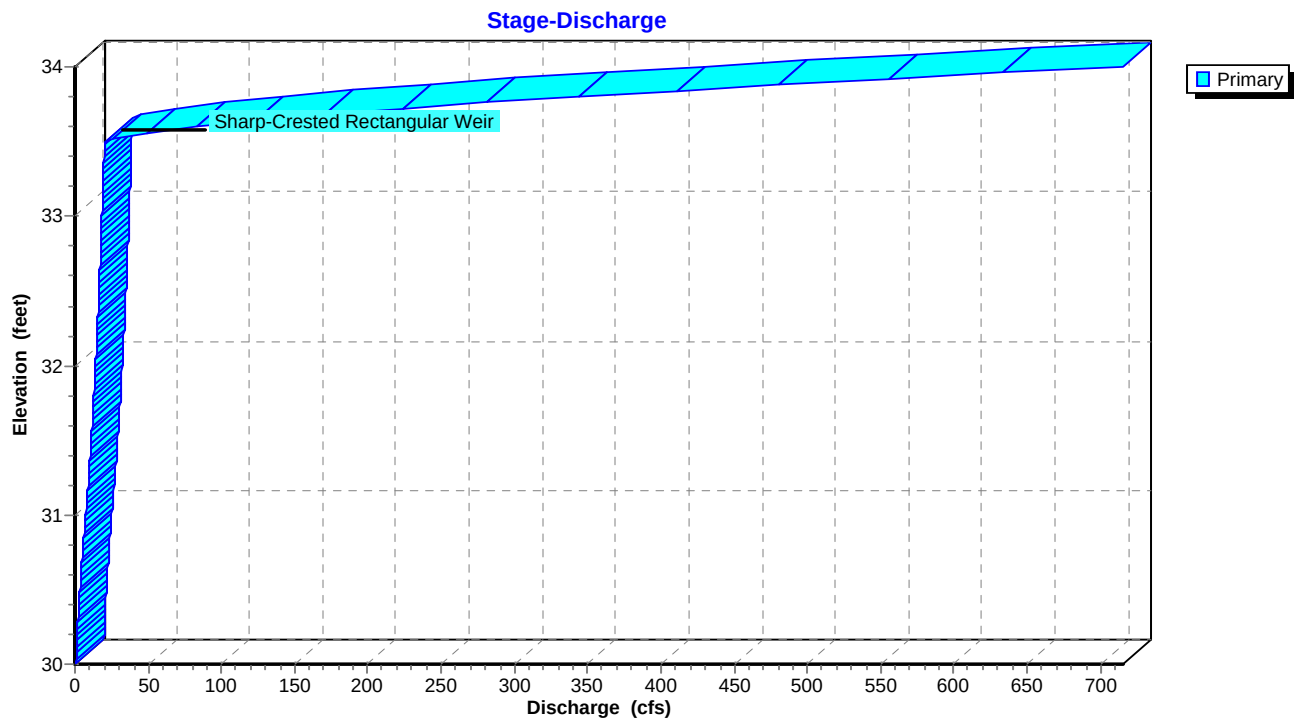
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Pond 23P: Wetland Storage - NE8



Pond 23P: Wetland Storage - NE8



Proposed-1

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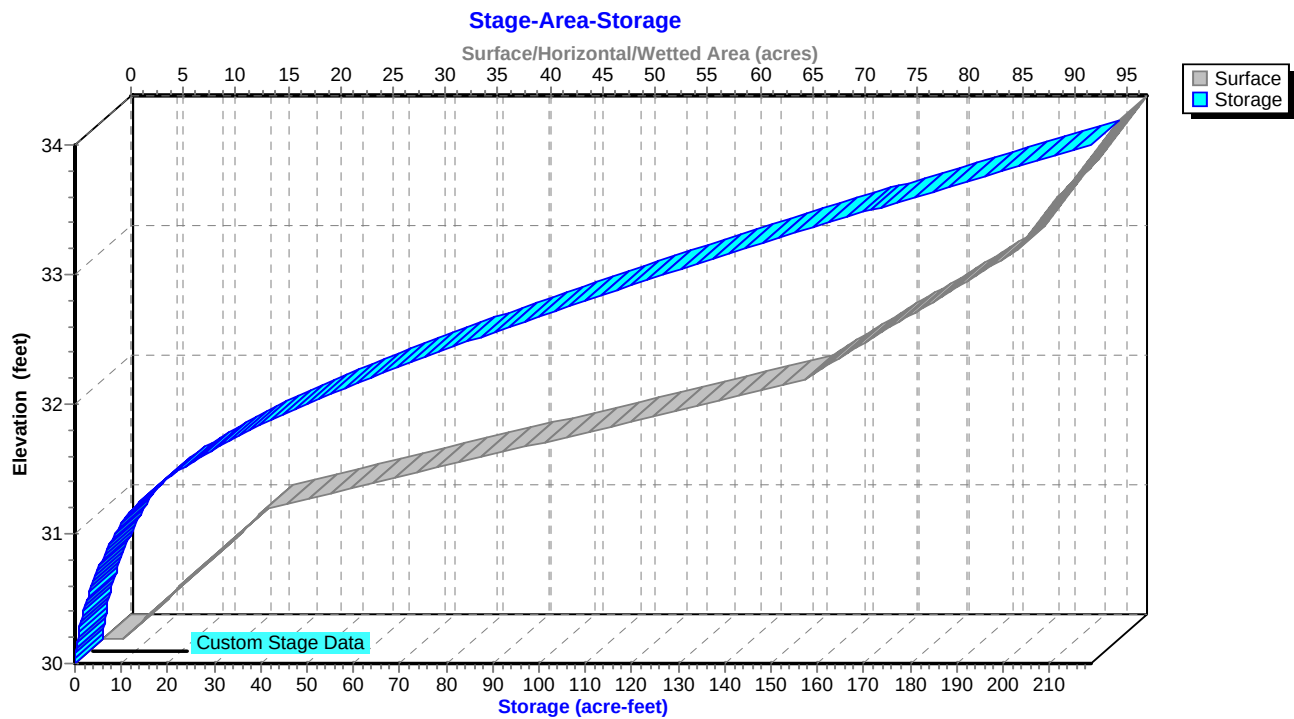
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Pond 23P: Wetland Storage - NE8



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Summary for Pond 25P: WREC22 and REC22

Inflow Area = 499.200 ac, 0.00% Impervious, Inflow Depth = 0.24" for 25yr-24hr event
Inflow = 76.75 cfs @ 13.37 hrs, Volume= 10.123 af
Outflow = 76.75 cfs @ 13.37 hrs, Volume= 10.123 af, Atten= 0%, Lag= 0.0 min
Primary = 76.75 cfs @ 13.37 hrs, Volume= 10.123 af

Routing by Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Peak Elev= 31.23' @ 13.37 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	36.00'	240.0' long Sharp-Crested Rectangular Weir 2 End Contraction(s) 72.0" Round Culvert L= 40.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 27.24' / 27.18' S= 0.0015 ' / ' Cc= 0.900 n= 0.024, Flow Area= 28.27 sf
#2	Primary	27.24'	

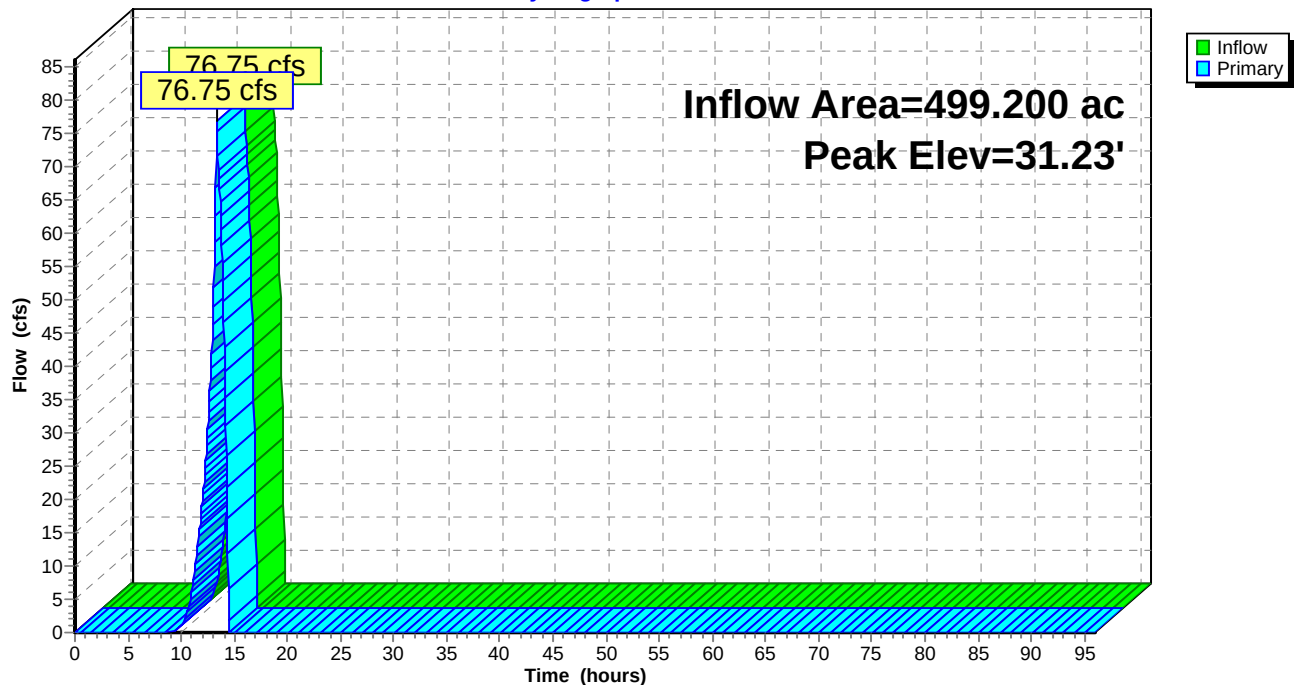
Primary OutFlow Max=76.07 cfs @ 13.37 hrs HW=31.21' (Free Discharge)

1=Sharp-Crested Rectangular Weir (Controls 0.00 cfs)

2=Culvert (Barrel Controls 76.07 cfs @ 5.43 fps)

Pond 25P: WREC22 and REC22

Hydrograph



Proposed-1

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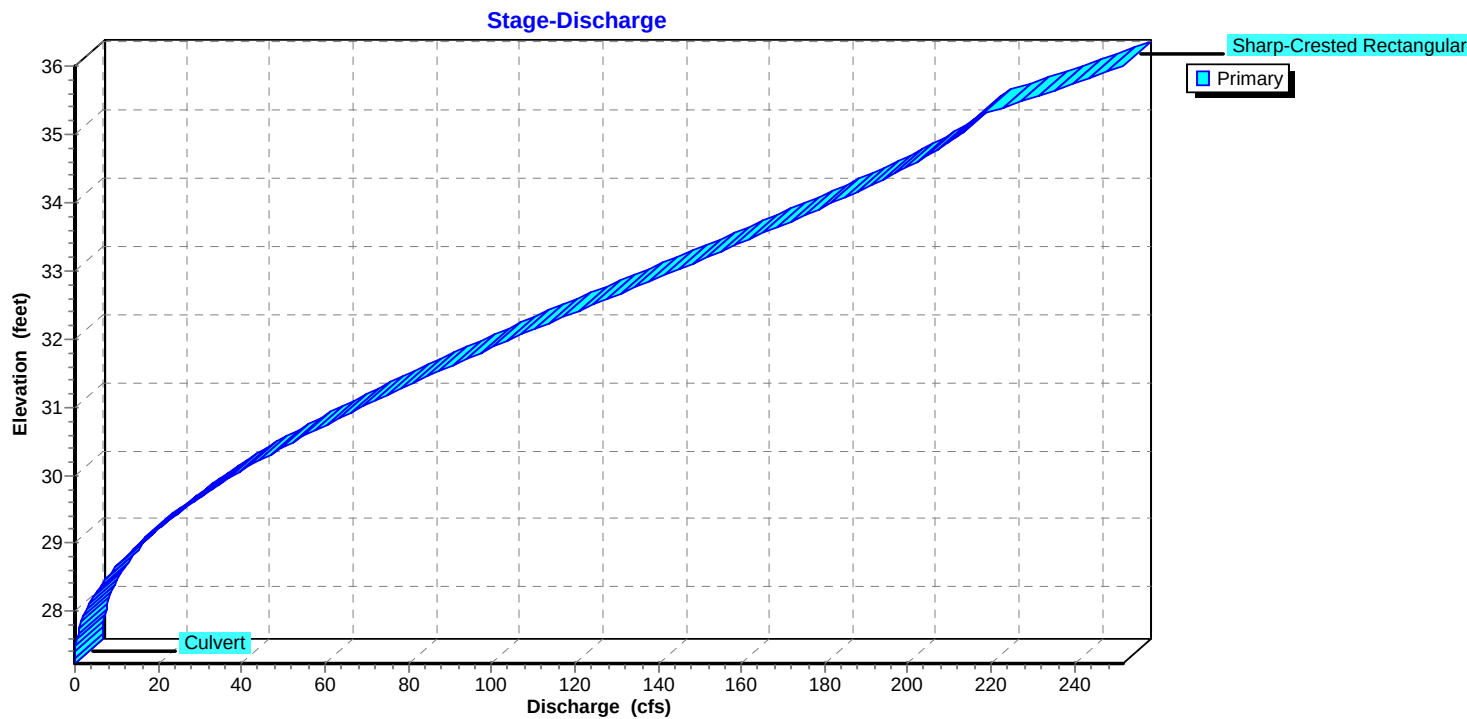
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Type II 24-hr 25yr-24hr Rainfall=9.20"

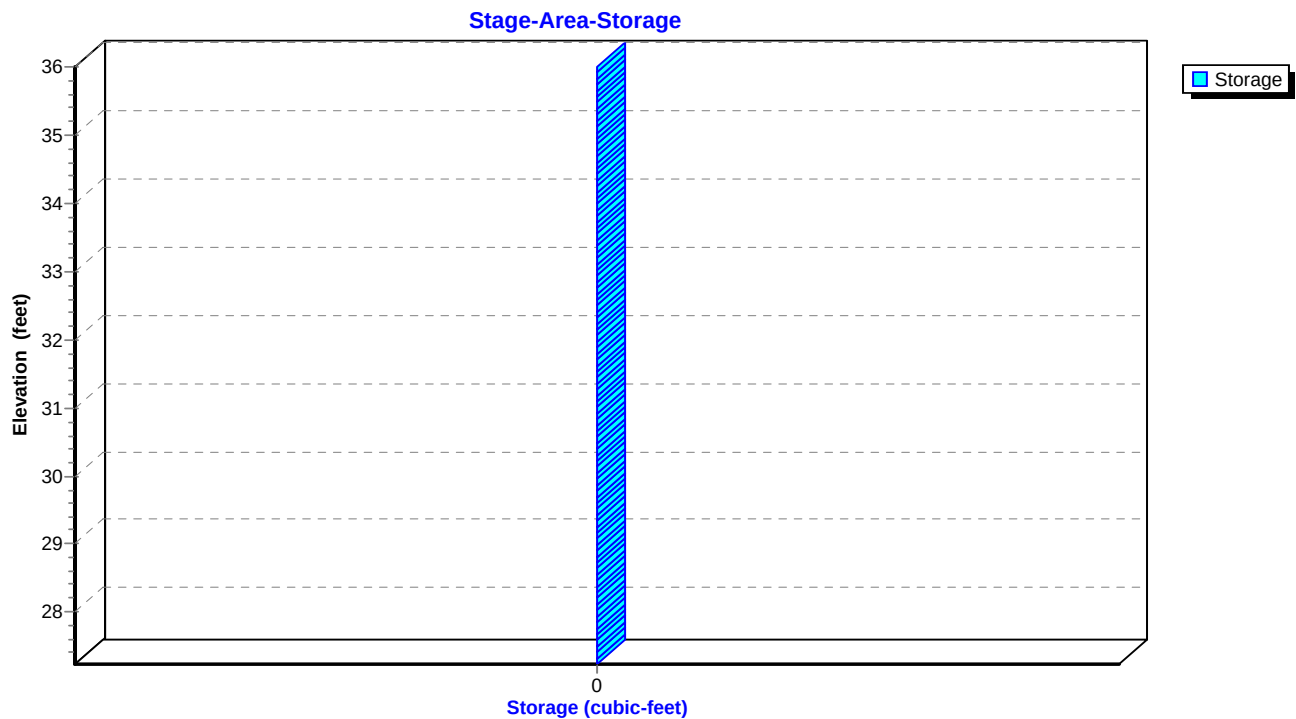
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Pond 25P: WREC22 and REC22



Pond 25P: WREC22 and REC22



Proposed-1

Type II 24-hr 25yr-24hr Rainfall=9.20"

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Summary for Pond 26P: Wetland Storage - BE9

Inflow Area = 181.300 ac, 0.00% Impervious, Inflow Depth = 5.89" for 25yr-24hr event
Inflow = 234.41 cfs @ 13.85 hrs, Volume= 88.927 af
Outflow = 181.76 cfs @ 14.65 hrs, Volume= 88.927 af, Atten= 22%, Lag= 48.3 min
Primary = 181.76 cfs @ 14.65 hrs, Volume= 88.927 af

Routing by Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Peak Elev= 34.29' @ 14.65 hrs Surf.Area= 28.451 ac Storage= 20.410 af

Plug-Flow detention time= 132.1 min calculated for 88.881 af (100% of inflow)
Center-of-Mass det. time= 132.0 min (1,106.0 - 974.0)

Volume	Invert	Avail.Storage	Storage Description
#1	30.00'	141.150 af	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
30.00	0.000	0.000	0.000
31.00	1.000	0.500	0.500
32.00	2.000	1.500	2.000
33.00	6.100	4.050	6.050
34.00	11.200	8.650	14.700
35.00	71.100	41.150	55.850
36.00	99.500	85.300	141.150

Device	Routing	Invert	Outlet Devices
#1	Primary	34.00'	264.0' long Sharp-Crested Rectangular Weir 2 End Contraction(s)
#2	Primary	29.62'	36.0" Round Culvert L= 34.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 29.62' / 29.07' S= 0.0162 '/' Cc= 0.900 n= 0.024, Flow Area= 7.07 sf

Primary OutFlow Max=181.20 cfs @ 14.65 hrs HW=34.29' (Free Discharge)

1=Sharp-Crested Rectangular Weir (Weir Controls 133.38 cfs @ 1.75 fps)
2=Culvert (Inlet Controls 47.82 cfs @ 6.77 fps)

Proposed-1

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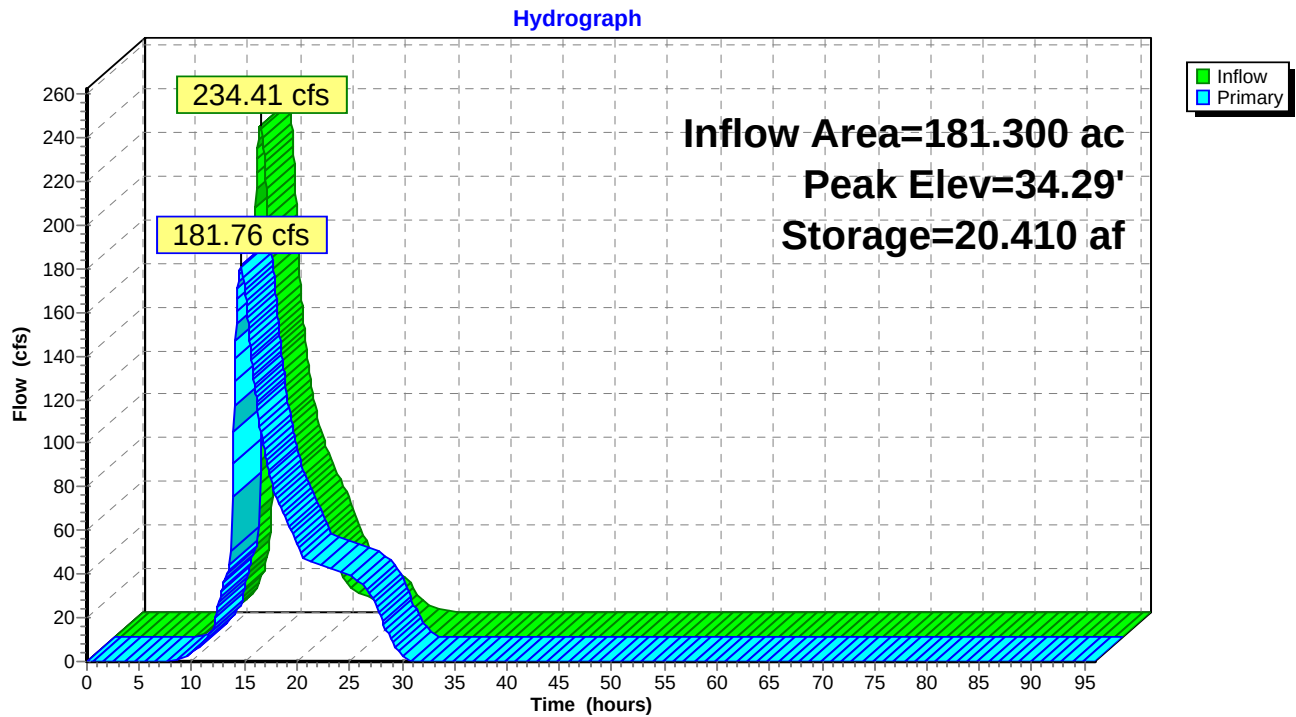
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Type II 24-hr 25yr-24hr Rainfall=9.20"

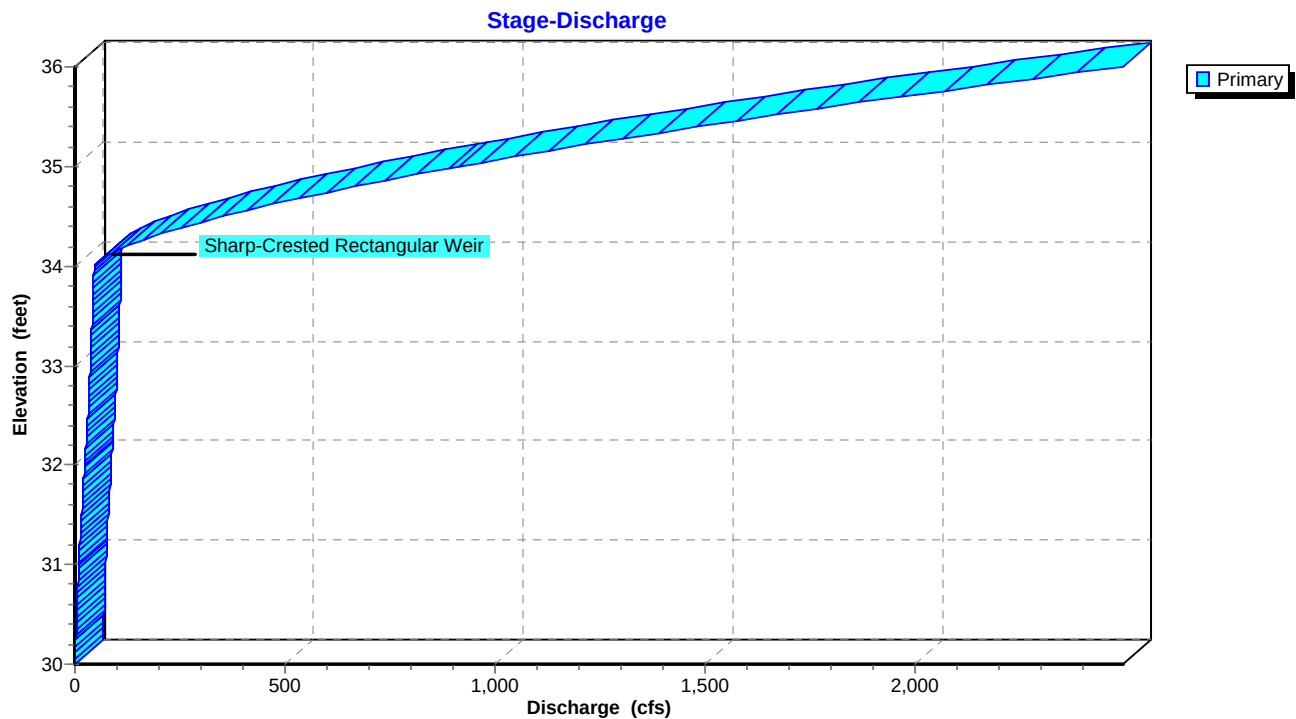
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Pond 26P: Wetland Storage - BE9



Pond 26P: Wetland Storage - BE9



Proposed-1

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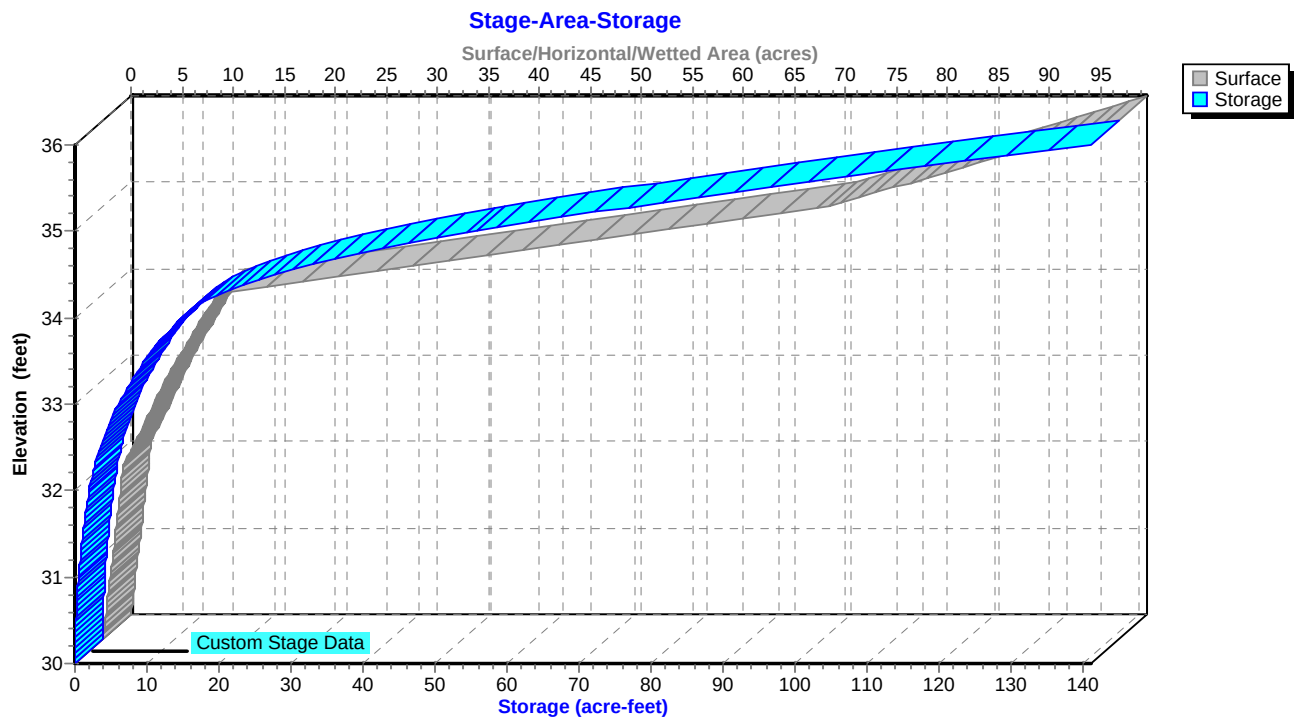
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Type II 24-hr 25yr-24hr Rainfall=9.20"

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Pond 26P: Wetland Storage - BE9



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Type II 24-hr 25yr-24hr Rainfall=9.20"

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Summary for Pond 28P: Wetland Storage for BE12

Inflow Area = 400.100 ac, 0.00% Impervious, Inflow Depth = 3.34" for 25yr-24hr event
Inflow = 422.98 cfs @ 14.61 hrs, Volume= 111.277 af
Outflow = 63.27 cfs @ 17.79 hrs, Volume= 111.277 af, Atten= 85%, Lag= 190.9 min
Primary = 63.27 cfs @ 17.79 hrs, Volume= 111.277 af

Routing by Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Starting Elev= 29.00' Surf.Area= 0.000 ac Storage= 0.000 af
Peak Elev= 35.91' @ 17.79 hrs Surf.Area= 54.695 ac Storage= 67.987 af
Flood Elev= 37.00' Surf.Area= 57.400 ac Storage= 130.200 af

Plug-Flow detention time= 465.2 min calculated for 111.277 af (100% of inflow)
Center-of-Mass det. time= 465.2 min (1,427.6 - 962.4)

Volume	Invert	Avail.Storage	Storage Description
#1	30.00'	130.200 af	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
30.00	0.600	0.000	0.000
31.00	1.200	0.900	0.900
32.00	1.900	1.550	2.450
33.00	6.200	4.050	6.500
34.00	8.600	7.400	13.900
35.00	25.900	17.250	31.150
36.00	57.400	41.650	72.800
37.00	57.400	57.400	130.200

Device	Routing	Invert	Outlet Devices
#1	Primary	36.00'	600.0' long Sharp-Crested Rectangular Weir 2 End Contraction(s)
#2	Primary	28.87'	36.0" Round Culvert L= 20.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 28.87' / 28.68' S= 0.0095 '/' Cc= 0.900 n= 0.024, Flow Area= 7.07 sf

Primary OutFlow Max=63.27 cfs @ 17.79 hrs HW=35.91' (Free Discharge)

1=Sharp-Crested Rectangular Weir (Controls 0.00 cfs)

2=Culvert (Inlet Controls 63.27 cfs @ 8.95 fps)

Proposed-1

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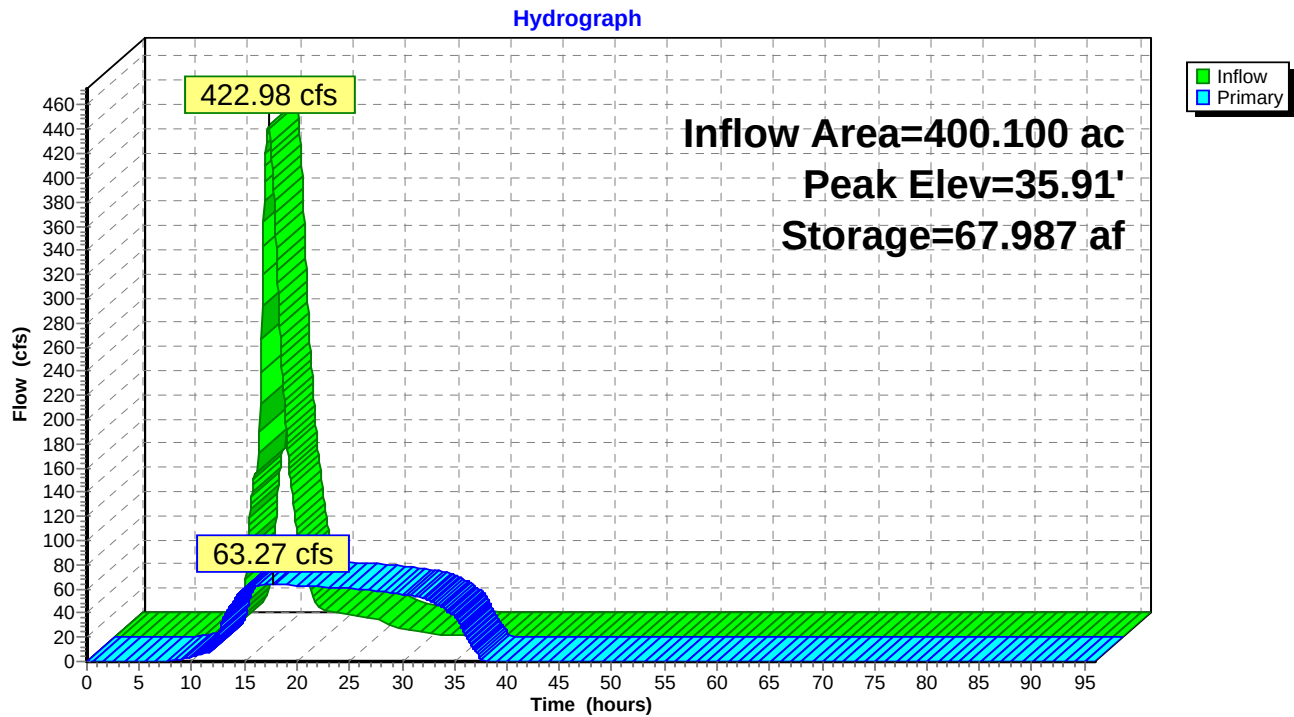
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Type II 24-hr 25yr-24hr Rainfall=9.20"

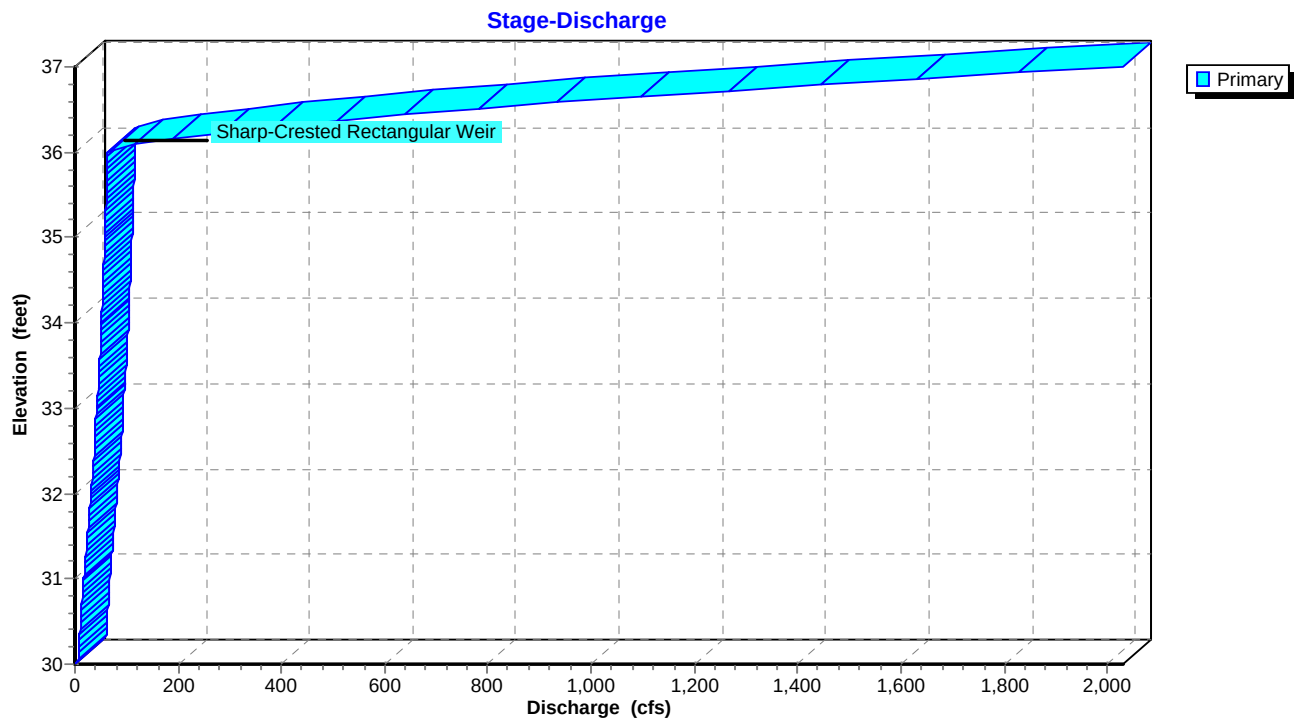
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Pond 28P: Wetland Storage for BE12



Pond 28P: Wetland Storage for BE12



Proposed-1

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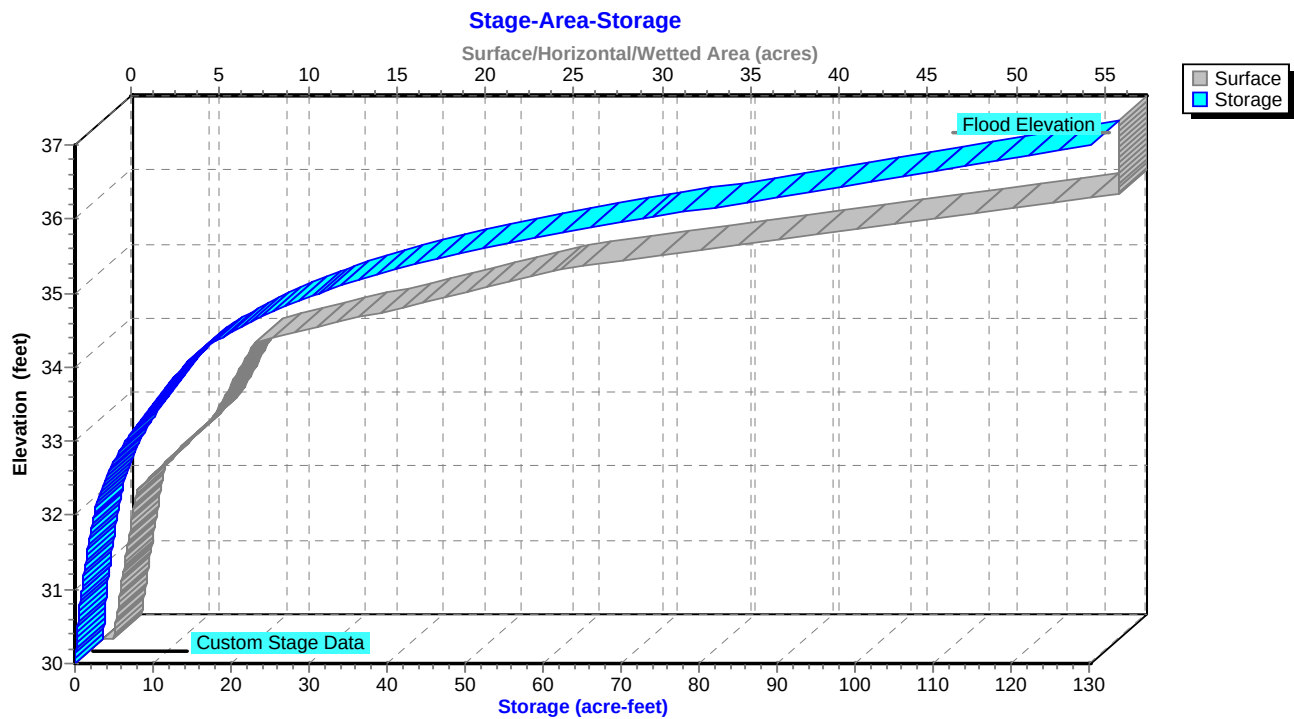
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Type II 24-hr 25yr-24hr Rainfall=9.20"

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Pond 28P: Wetland Storage for BE12



Proposed-1

Type II 24-hr 25yr-24hr Rainfall=9.20"

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Summary for Pond 29P: Wetland Storage BE7

Inflow Area = 652.780 ac, 0.00% Impervious, Inflow Depth > 3.44" for 25yr-24hr event
Inflow = 118.70 cfs @ 18.78 hrs, Volume= 187.267 af
Outflow = 116.29 cfs @ 19.75 hrs, Volume= 187.105 af, Atten= 2%, Lag= 58.0 min
Primary = 116.29 cfs @ 19.75 hrs, Volume= 187.105 af

Routing by Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Peak Elev= 33.01' @ 19.75 hrs Surf.Area= 6.429 ac Storage= 8.493 af

Plug-Flow detention time= 55.5 min calculated for 187.008 af (100% of inflow)
Center-of-Mass det. time= 52.2 min (1,869.2 - 1,817.0)

Volume	Invert	Avail.Storage	Storage Description
#1	31.00'	53.350 af	Custom Stage Data (Prismatic) Listed below (Recalc)
Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
31.00	1.000	0.000	0.000
32.00	4.700	2.850	2.850
33.00	6.400	5.550	8.400
34.00	8.400	7.400	15.800
35.00	9.800	9.100	24.900
36.00	14.000	11.900	36.800
37.00	19.100	16.550	53.350

Device	Routing	Invert	Outlet Devices
#1	Primary	31.00'	Custom Weir/Orifice, Cv= 2.62 (C= 3.28) Head (feet) 0.00 1.00 5.00 Width (feet) 10.00 13.00 25.00

Primary OutFlow Max=116.28 cfs @ 19.75 hrs HW=33.01' (Free Discharge)

↑**1=Custom Weir/Orifice** (Weir Controls 116.28 cfs @ 4.43 fps)

Proposed-1

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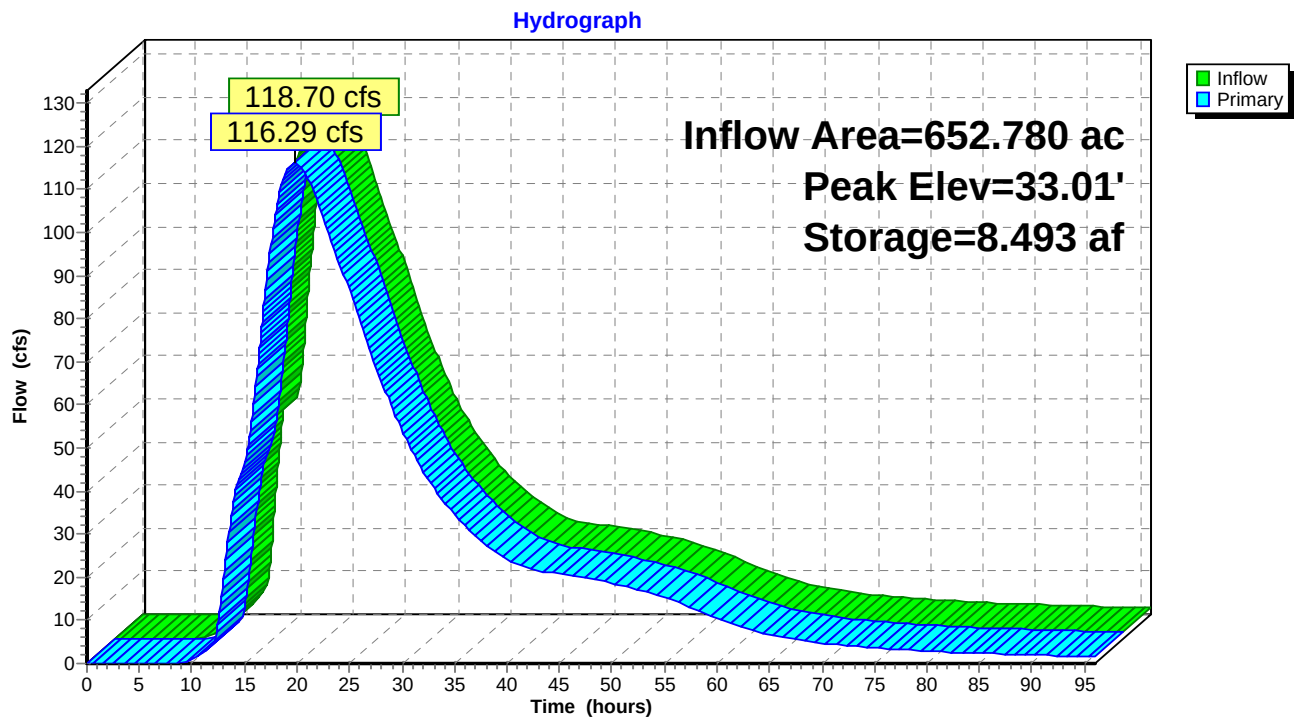
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Type II 24-hr 25yr-24hr Rainfall=9.20"

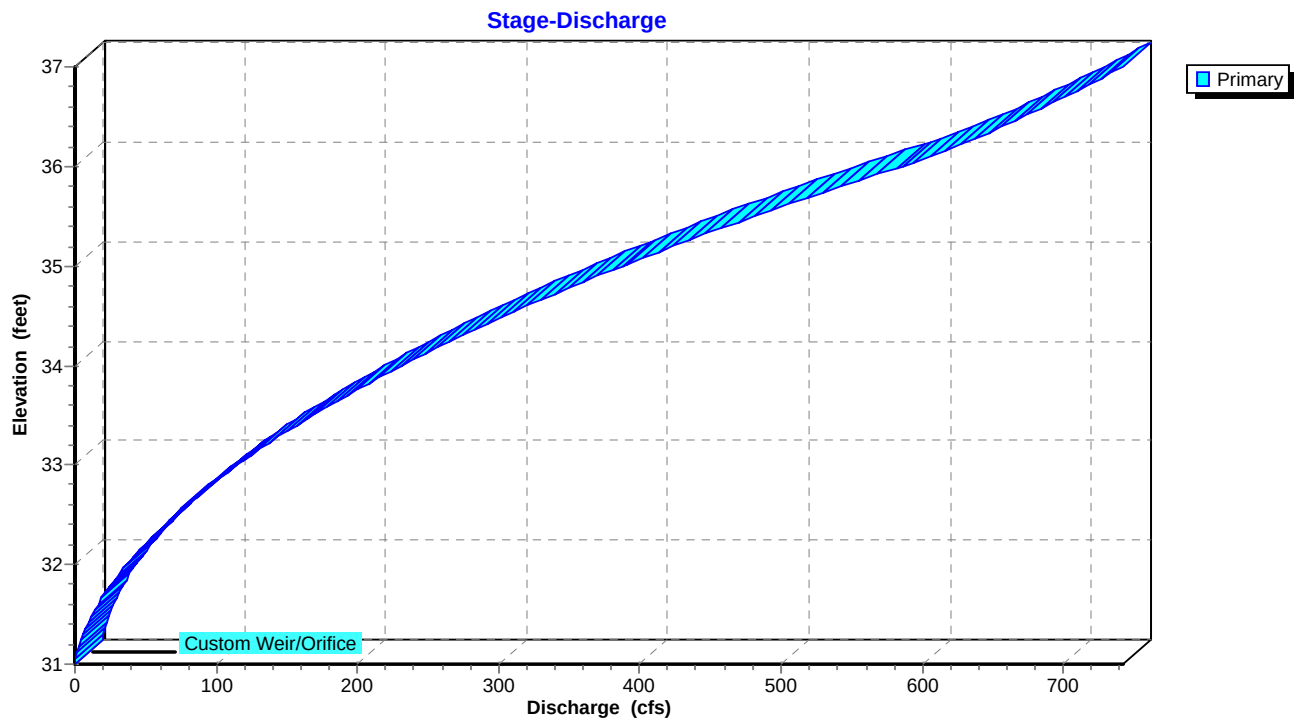
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Pond 29P: Wetland Storage BE7



Pond 29P: Wetland Storage BE7



Proposed-1

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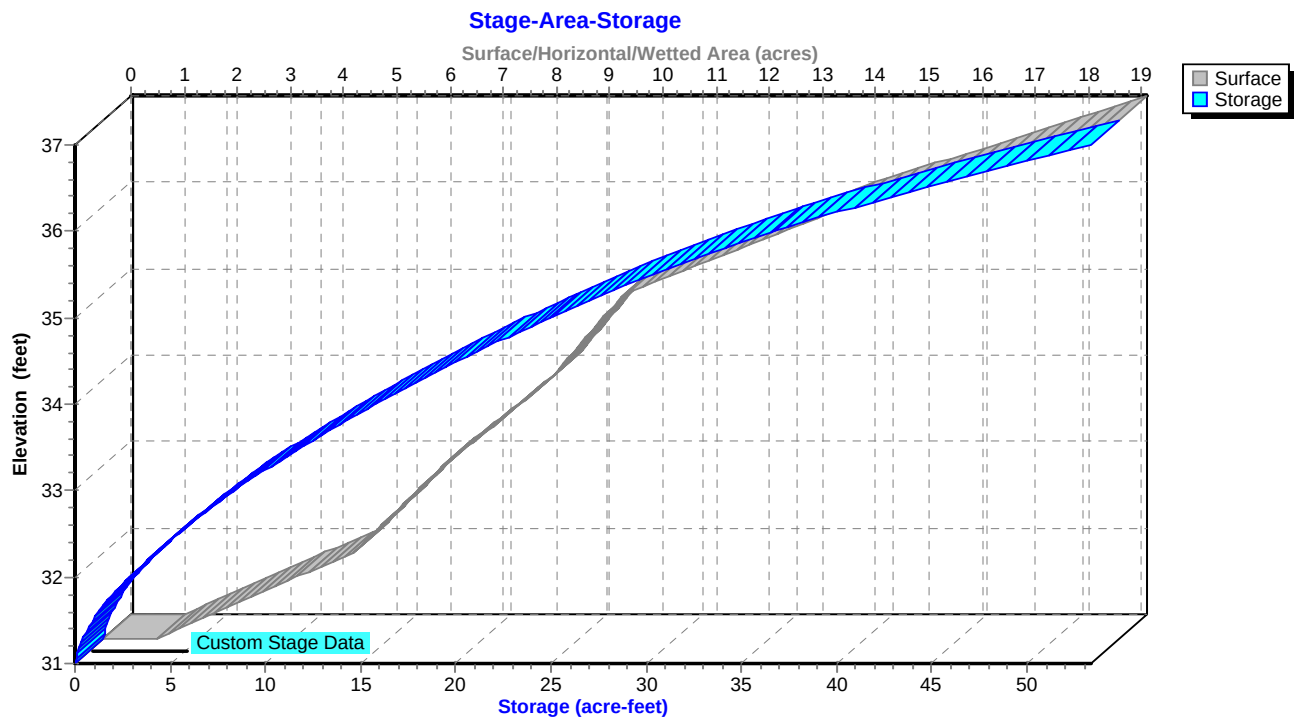
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Type II 24-hr 25yr-24hr Rainfall=9.20"

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Pond 29P: Wetland Storage BE7



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Type II 24-hr 25yr-24hr Rainfall=9.20"

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Summary for Pond 30P: WRC18 and RC18

Inflow Area = 181.300 ac, 0.00% Impervious, Inflow Depth = 5.89" for 25yr-24hr event
Inflow = 181.76 cfs @ 14.65 hrs, Volume= 88.927 af
Outflow = 181.76 cfs @ 14.65 hrs, Volume= 88.927 af, Atten= 0%, Lag= 0.0 min
Primary = 181.76 cfs @ 14.65 hrs, Volume= 88.927 af

Routing by Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Peak Elev= 34.78' @ 14.65 hrs

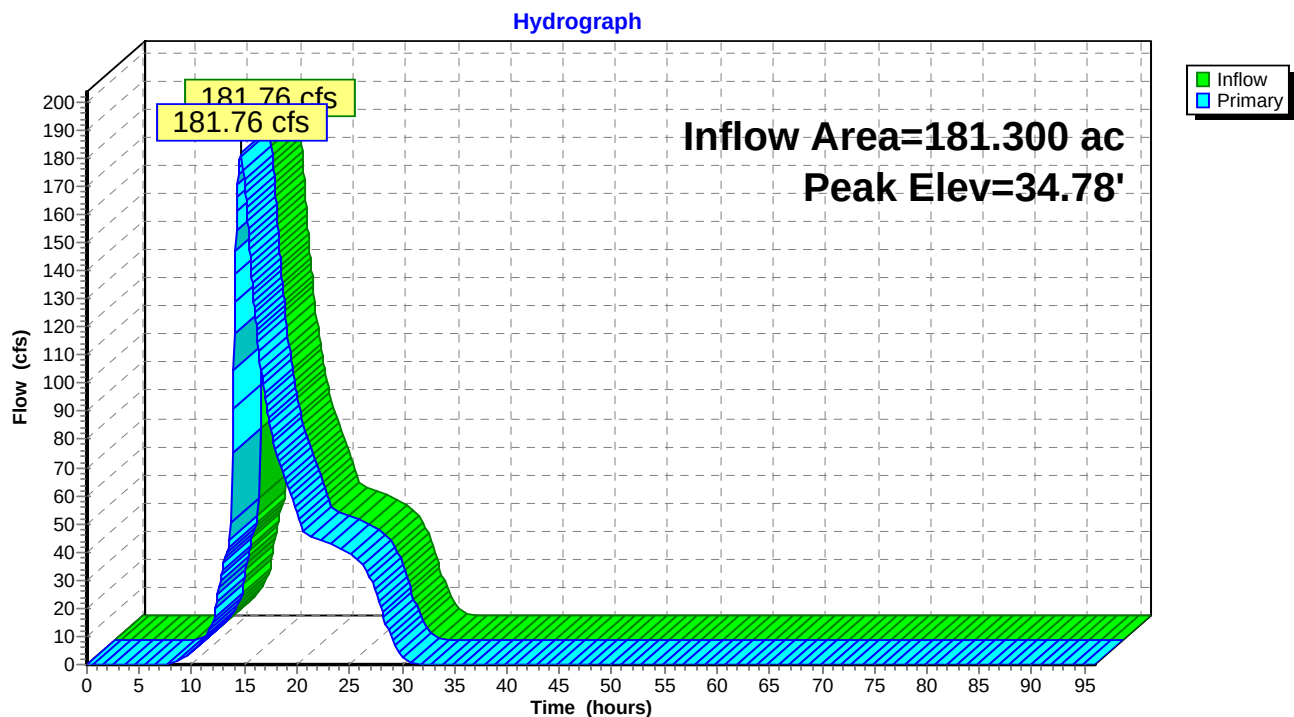
Device	Routing	Invert	Outlet Devices
#1	Primary	34.50'	264.0' long Sharp-Crested Rectangular Weir 2 End Contraction(s) 36.0" Round Culvert L= 17.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 29.42' / 29.26' S= 0.0094 ' S= 0.0094 ' Cc= 0.900 n= 0.024, Flow Area= 7.07 sf
#2	Primary	29.42'	

Primary OutFlow Max=181.35 cfs @ 14.65 hrs HW=34.78' (Free Discharge)

1=Sharp-Crested Rectangular Weir (Weir Controls 128.55 cfs @ 1.73 fps)

2=Culvert (Inlet Controls 52.80 cfs @ 7.47 fps)

Pond 30P: WRC18 and RC18



Proposed-1

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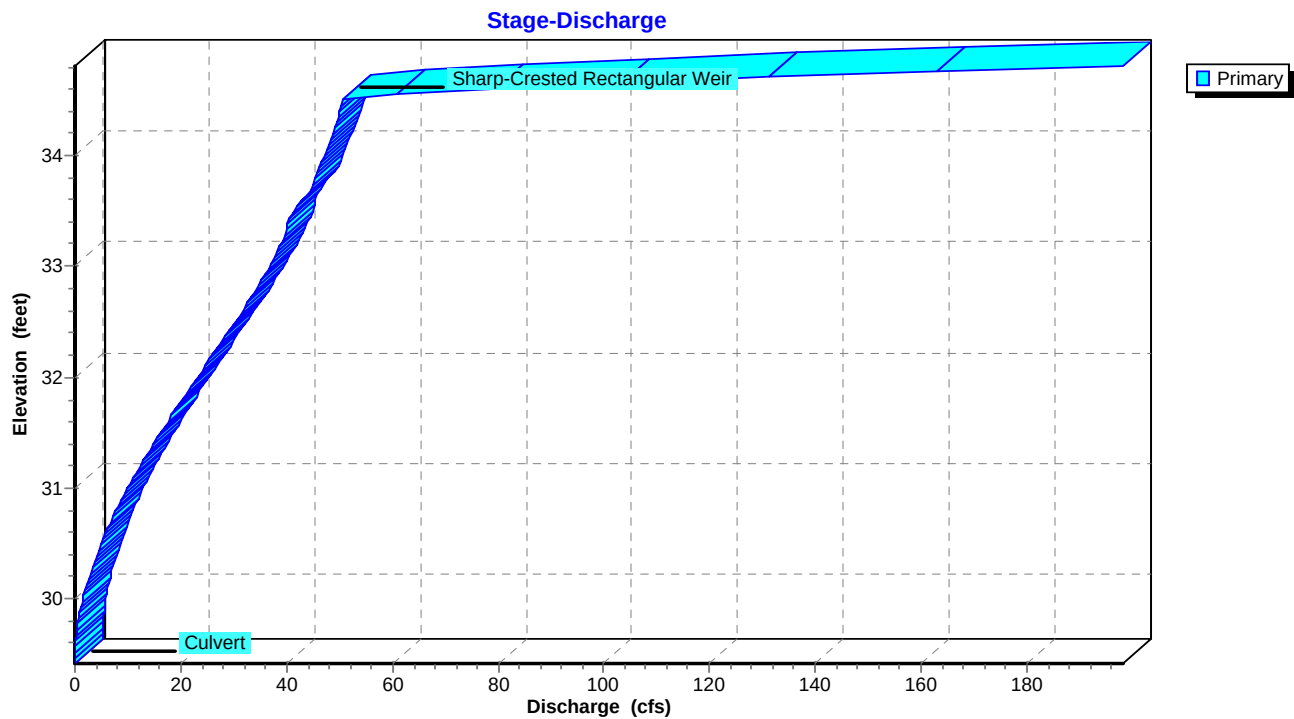
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Type II 24-hr 25yr-24hr Rainfall=9.20"

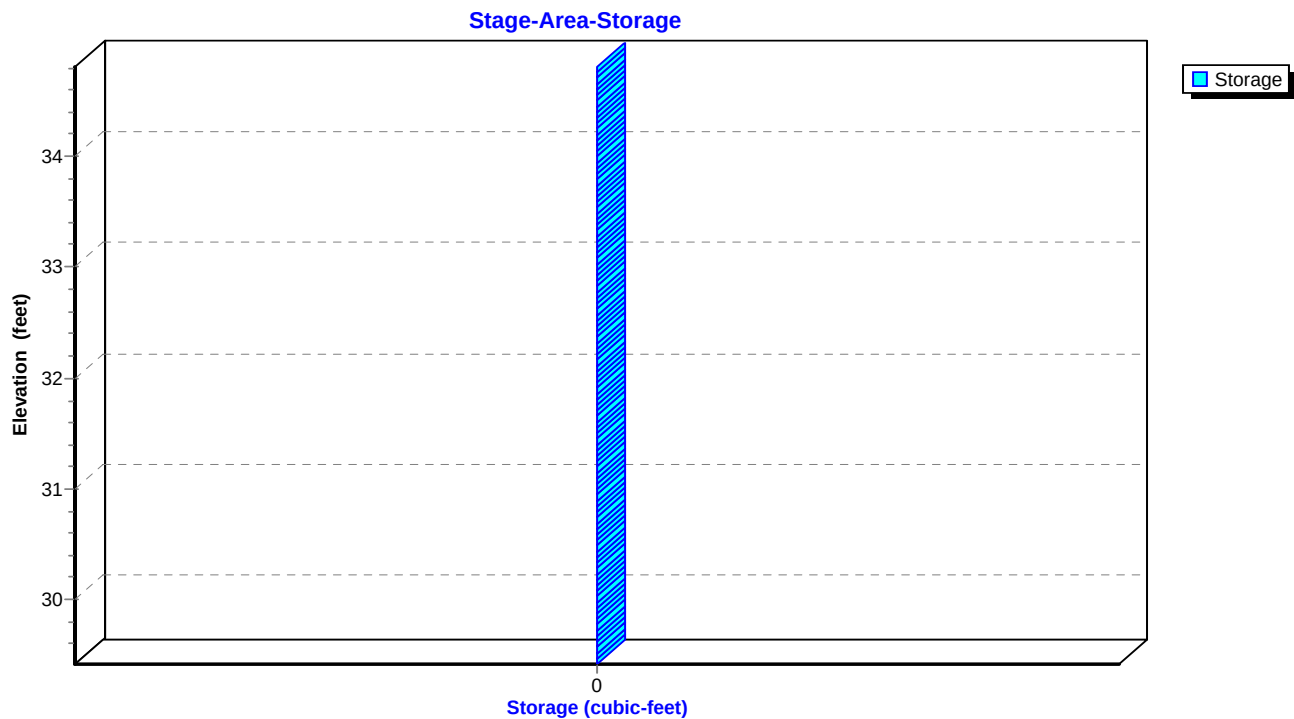
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Pond 30P: WRC18 and RC18



Pond 30P: WRC18 and RC18



Proposed-1

Type II 24-hr 25yr-24hr Rainfall=9.20"

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Summary for Pond 33P: Wetland Storage - BE10

Inflow Area = 76.000 ac, 0.00% Impervious, Inflow Depth = 6.14" for 25yr-24hr event
 Inflow = 167.85 cfs @ 13.16 hrs, Volume= 38.863 af
 Outflow = 108.42 cfs @ 13.88 hrs, Volume= 38.863 af, Atten= 35%, Lag= 43.5 min
 Primary = 108.42 cfs @ 13.88 hrs, Volume= 38.863 af

Routing by Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
 Peak Elev= 31.77' @ 13.88 hrs Surf.Area= 12.745 ac Storage= 9.253 af

Plug-Flow detention time= 60.4 min calculated for 38.843 af (100% of inflow)
 Center-of-Mass det. time= 60.7 min (955.3 - 894.6)

Volume	Invert	Avail.Storage	Storage Description
#1	30.00'	147.400 af	Custom Stage Data (Prismatic) Listed below (Recalc)
Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
30.00	2.200	0.000	0.000
31.00	3.700	2.950	2.950
32.00	15.500	9.600	12.550
33.00	31.800	23.650	36.200
34.00	59.100	45.450	81.650
35.00	72.400	65.750	147.400

Device	Routing	Invert	Outlet Devices
#1	Primary	30.00'	Custom Weir/Orifice, Cv= 2.62 (C= 3.28) Head (feet) 0.00 1.00 5.00 Width (feet) 12.00 15.00 26.00

Primary OutFlow Max=108.39 cfs @ 13.88 hrs HW=31.77' (Free Discharge)
 1=Custom Weir/Orifice (Weir Controls 108.39 cfs @ 4.20 fps)

Proposed-1

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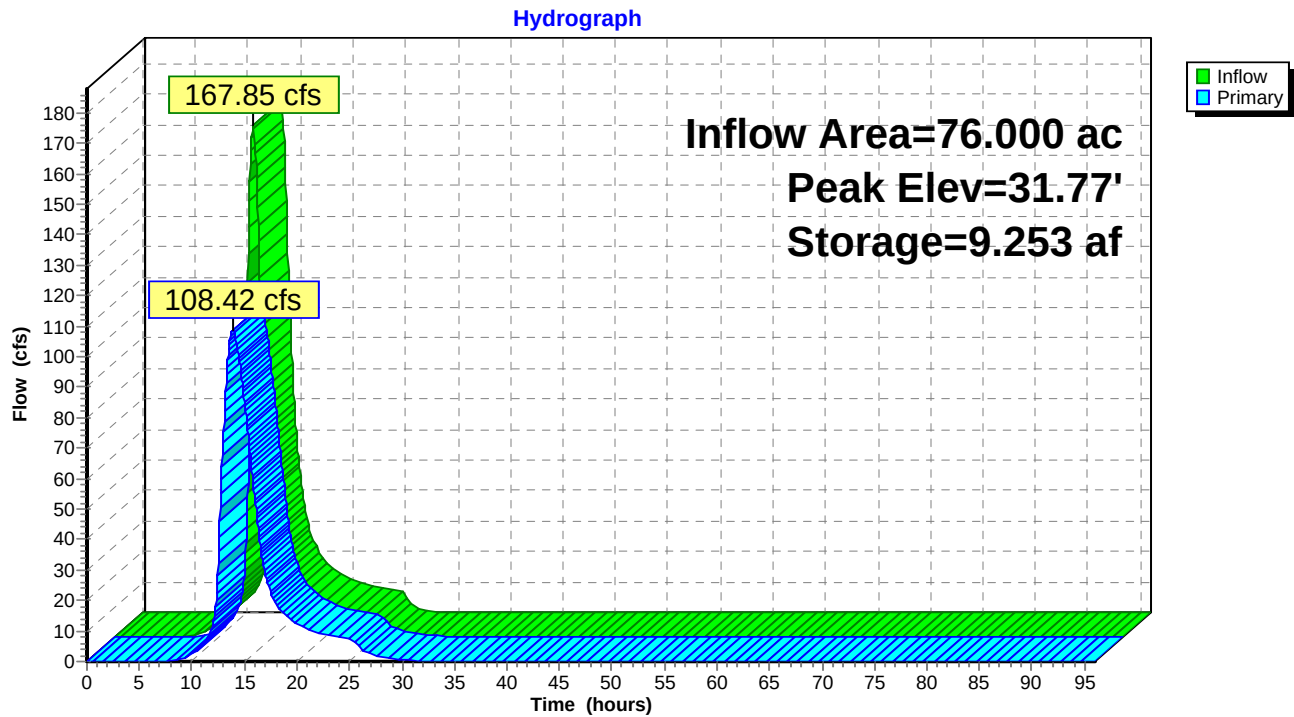
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Type II 24-hr 25yr-24hr Rainfall=9.20"

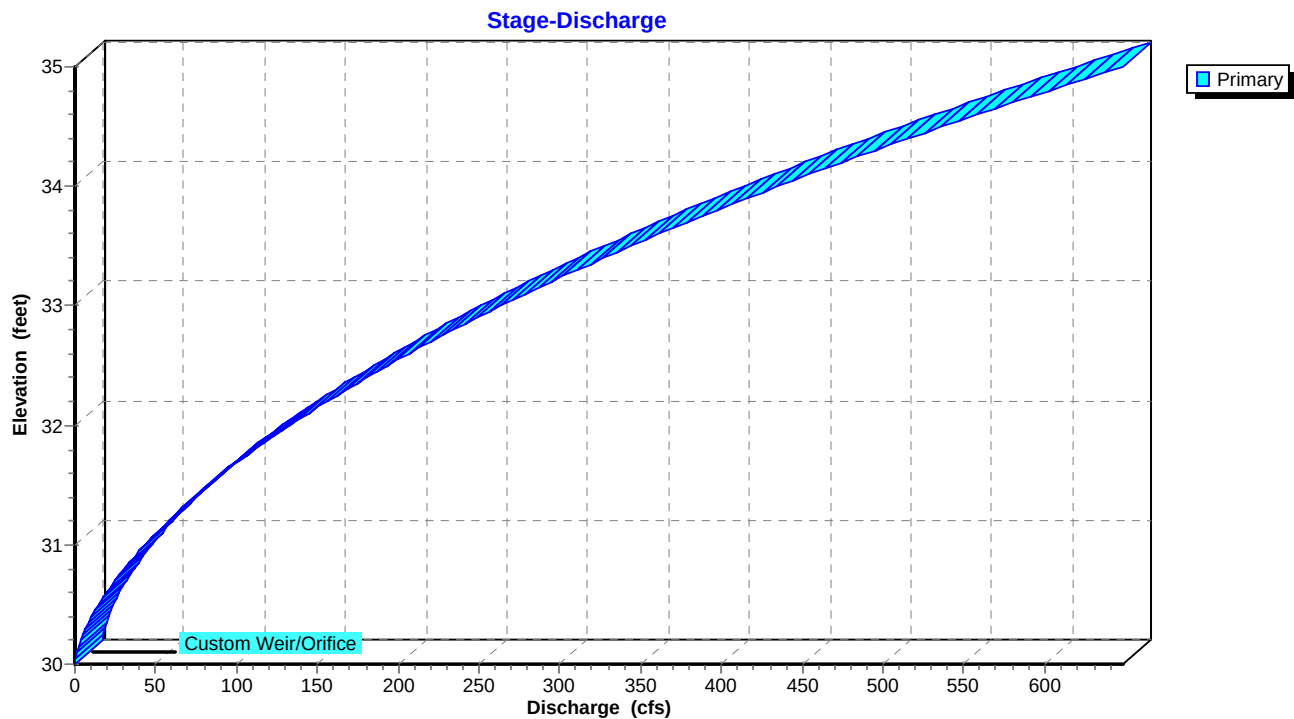
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Pond 33P: Wetland Storage - BE10



Pond 33P: Wetland Storage - BE10



Proposed-1

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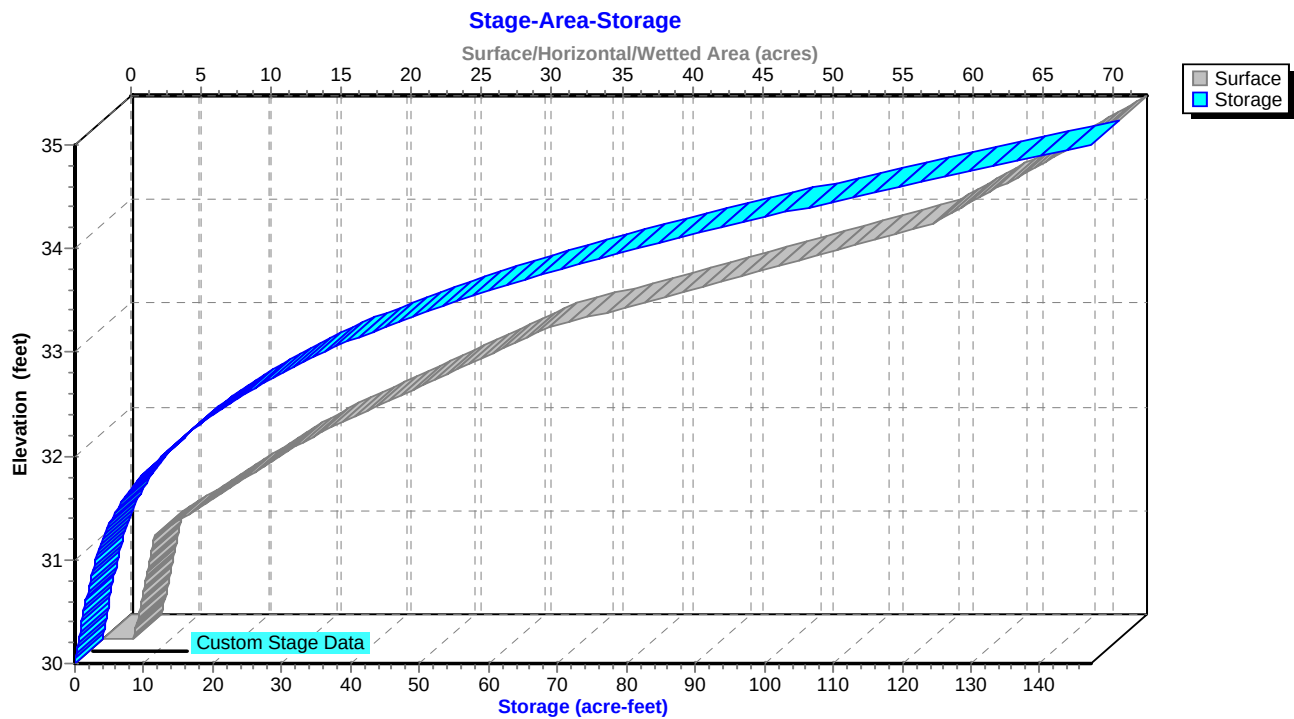
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Type II 24-hr 25yr-24hr Rainfall=9.20"

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Pond 33P: Wetland Storage - BE10



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Type II 24-hr 25yr-24hr Rainfall=9.20"

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Summary for Pond 35P: Wetland Storage - BE11

Inflow Area = 79.800 ac, 0.00% Impervious, Inflow Depth = 5.89" for 25yr-24hr event
Inflow = 215.12 cfs @ 12.78 hrs, Volume= 39.147 af
Outflow = 79.68 cfs @ 13.81 hrs, Volume= 39.135 af, Atten= 63%, Lag= 61.6 min
Primary = 79.68 cfs @ 13.81 hrs, Volume= 39.135 af

Routing by Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Peak Elev= 34.13' @ 13.81 hrs Surf.Area= 15.702 ac Storage= 15.636 af

Plug-Flow detention time= 133.5 min calculated for 39.135 af (100% of inflow)
Center-of-Mass det. time= 132.5 min (1,005.2 - 872.7)

Volume	Invert	Avail.Storage	Storage Description
#1	29.00'	111.000 af	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
29.00	0.000	0.000	0.000
30.00	0.800	0.400	0.400
31.00	0.800	0.800	1.200
32.00	2.400	1.600	2.800
33.00	4.800	3.600	6.400
34.00	10.400	7.600	14.000
35.00	52.700	31.550	45.550
36.00	78.200	65.450	111.000

Device	Routing	Invert	Outlet Devices
#1	Primary	34.00'	264.0' long x 10.0' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64
#2	Primary	29.17'	36.0" Round Culvert L= 29.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 29.17' / 28.74' S= 0.0148 '/' Cc= 0.900 n= 0.024, Flow Area= 7.07 sf

Primary OutFlow Max=79.09 cfs @ 13.81 hrs HW=34.13' (Free Discharge)

1=Broad-Crested Rectangular Weir (Weir Controls 29.15 cfs @ 0.88 fps)

2=Culvert (Inlet Controls 49.95 cfs @ 7.07 fps)

Proposed-1

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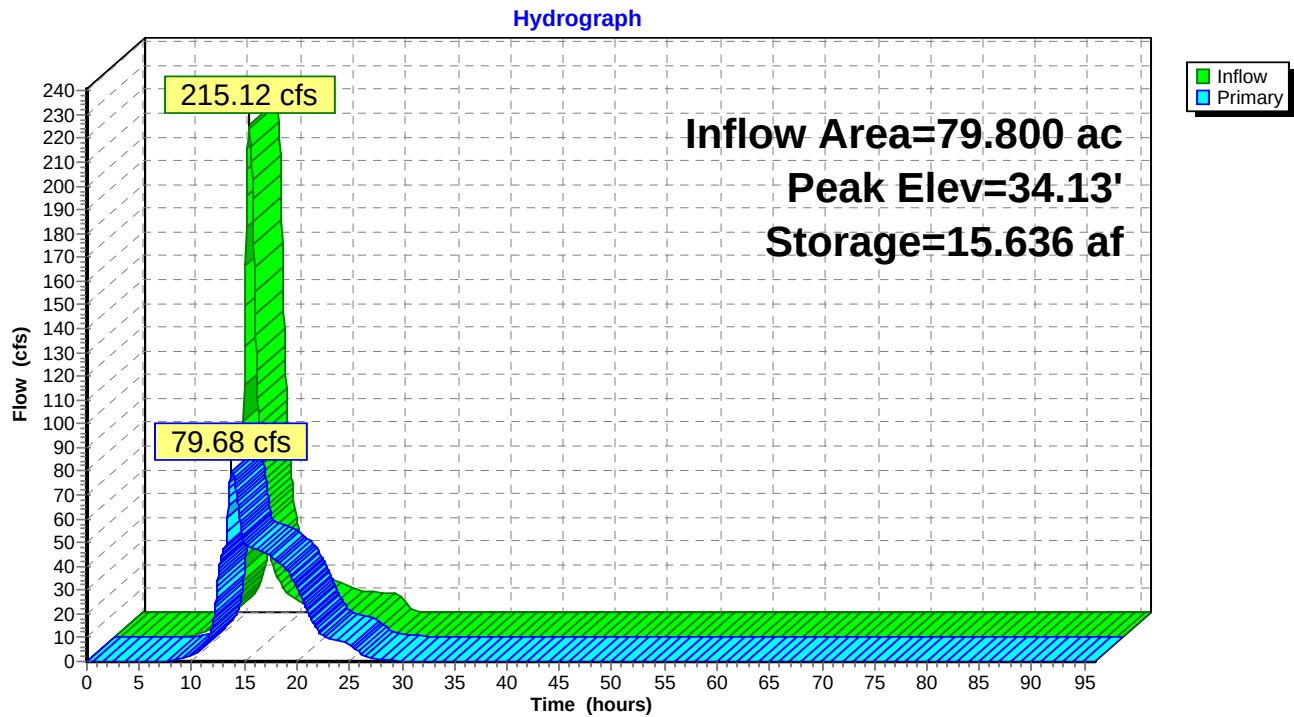
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Type II 24-hr 25yr-24hr Rainfall=9.20"

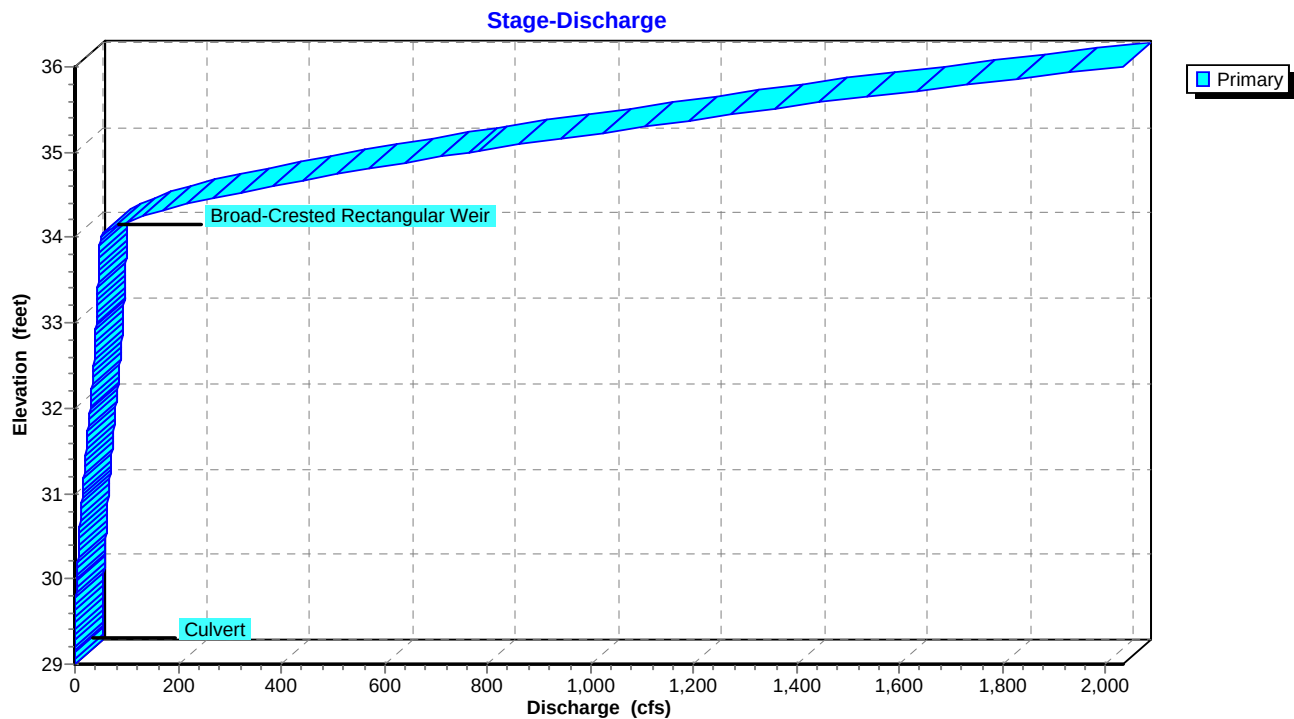
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Pond 35P: Wetland Storage - BE11



Pond 35P: Wetland Storage - BE11



Proposed-1

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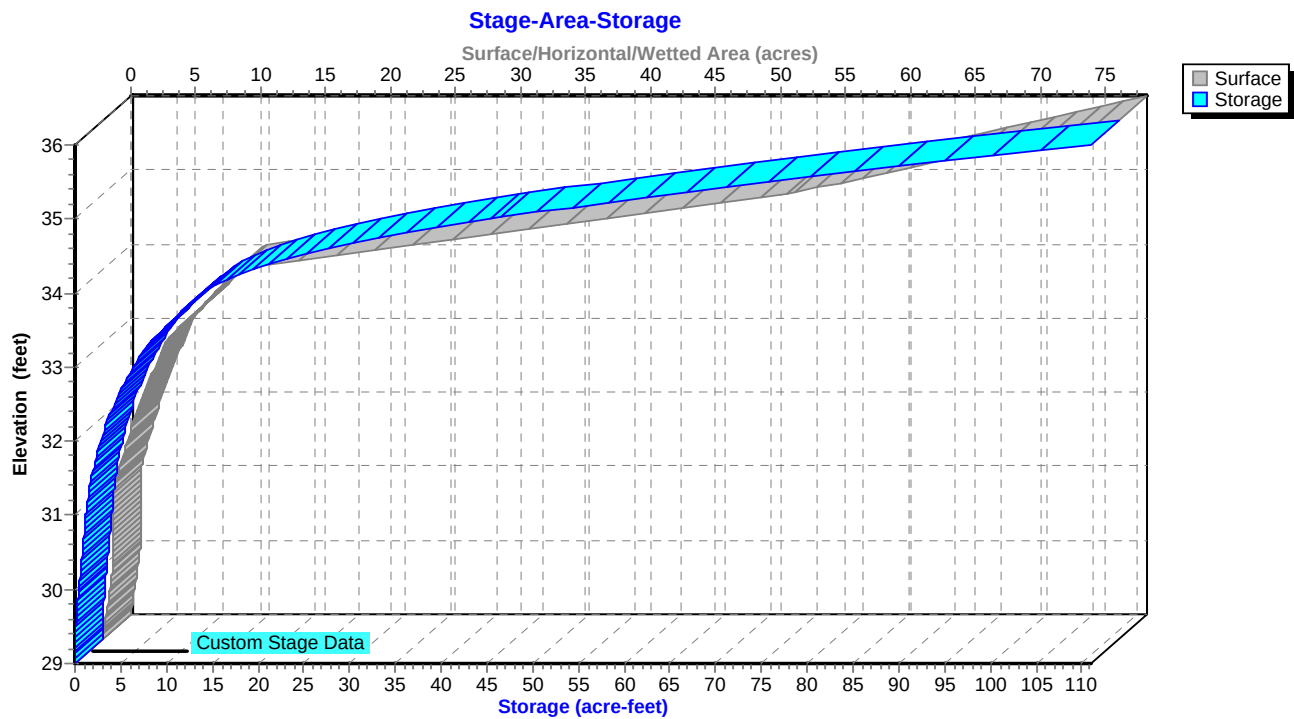
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Type II 24-hr 25yr-24hr Rainfall=9.20"

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Pond 35P: Wetland Storage - BE11



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Type II 24-hr 25yr-24hr Rainfall=9.20"

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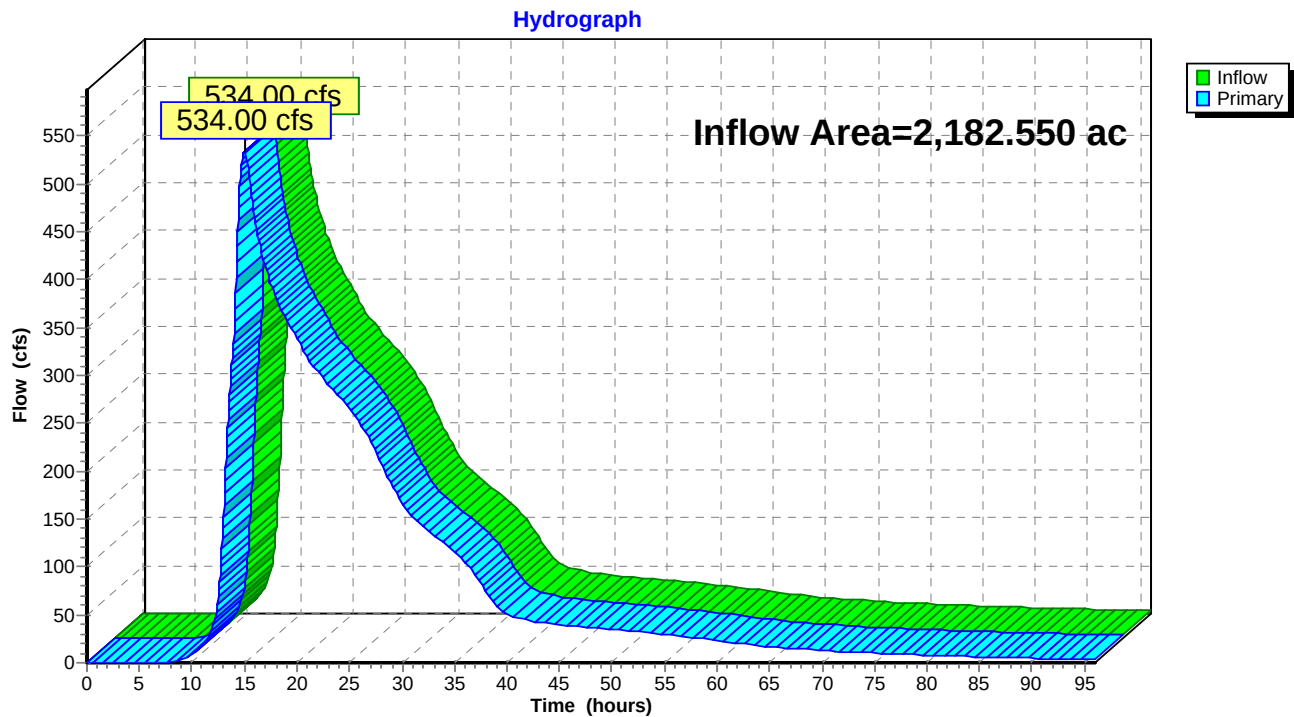
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Summary for Link 24L: CP-1

Inflow Area = 2,182.550 ac, 0.00% Impervious, Inflow Depth > 3.47" for 25yr-24hr event
Inflow = 534.00 cfs @ 14.98 hrs, Volume= 631.985 af
Primary = 534.00 cfs @ 14.98 hrs, Volume= 631.985 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs

Link 24L: CP-1



Proposed-1

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Type II 24-hr 25yr-24hr Rainfall=9.20"

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Summary for Link 32L: From BN4B1B

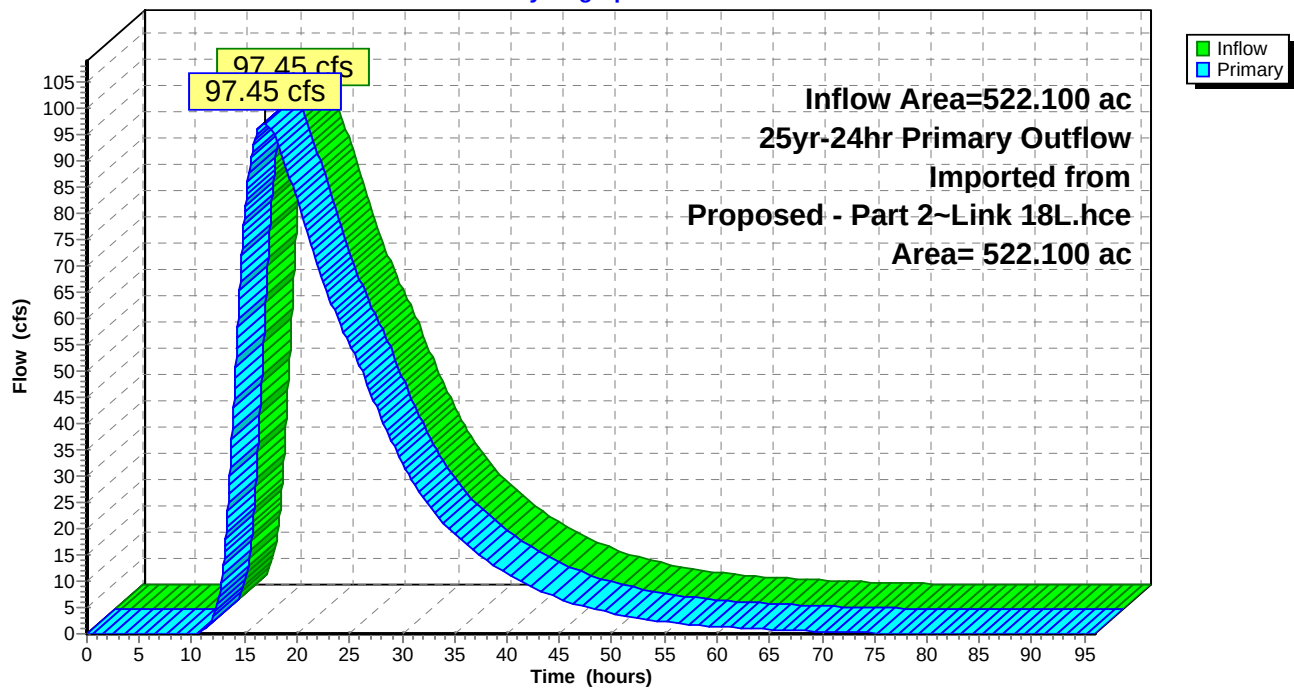
Inflow Area = 522.100 ac, 0.00% Impervious, Inflow Depth = 2.69" for 25yr-24hr event
Inflow = 97.45 cfs @ 16.86 hrs, Volume= 117.229 af
Primary = 97.45 cfs @ 16.86 hrs, Volume= 117.229 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs

25yr-24hr Primary Outflow Imported from Proposed - Part 2~Link 18L.hce

Link 32L: From BN4B1B

Hydrograph



Proposed-1

SJRWMD 96-hr tenth 100-yr96hr Rainfall=15.00"

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Time span=0.00-96.00 hrs, dt=0.05 hrs, 1921 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment2S: BE-3	Runoff Area=22.950 ac 0.00% Impervious Runoff Depth>11.65" Tc=138.0 min CN=76 Runoff=54.97 cfs 22.274 af
Subcatchment3S: BE-5	Runoff Area=51.540 ac 0.00% Impervious Runoff Depth>11.68" Tc=103.0 min CN=76 Runoff=153.42 cfs 50.168 af
Subcatchment7S: BE4-2	Runoff Area=76.000 ac 0.00% Impervious Runoff Depth>13.00" Flow Length=2,844' Slope=0.0050 '/' Tc=71.8 min CN=85 Runoff=314.26 cfs 82.347 af
Subcatchment9S: BE4-1	Runoff Area=84.150 ac 0.00% Impervious Runoff Depth>12.73" Flow Length=2,809' Slope=0.0050 '/' Tc=71.3 min CN=83 Runoff=345.39 cfs 89.235 af
Subcatchment10S: BE4-3	Runoff Area=35.180 ac 0.00% Impervious Runoff Depth>11.44" Flow Length=3,797' Tc=43.3 min CN=74 Runoff=190.05 cfs 33.528 af
Subcatchment21S: BE14A	Runoff Area=499.200 ac 0.00% Impervious Runoff Depth>11.18" Tc=152.0 min CN=73 Runoff=1,081.09 cfs 465.008 af
Subcatchment22S: BE13	Runoff Area=112.300 ac 0.00% Impervious Runoff Depth>11.48" Tc=153.0 min CN=75 Runoff=246.81 cfs 107.449 af
Subcatchment23S: BE14B	Runoff Area=333.700 ac 0.00% Impervious Runoff Depth>11.18" Tc=152.0 min CN=73 Runoff=722.68 cfs 310.844 af
Subcatchment27S: BE12	Runoff Area=66.400 ac 0.00% Impervious Runoff Depth>11.51" Tc=122.0 min CN=75 Runoff=173.11 cfs 63.699 af
Subcatchment32S: BE10	Runoff Area=76.000 ac 0.00% Impervious Runoff Depth>11.53" Tc=102.0 min CN=75 Runoff=226.46 cfs 73.031 af
Subcatchment33S: BE11	Runoff Area=79.800 ac 0.00% Impervious Runoff Depth>11.25" Tc=74.0 min CN=73 Runoff=295.54 cfs 74.836 af
Subcatchment36S: BE7	Runoff Area=19.500 ac 0.00% Impervious Runoff Depth>11.63" Tc=155.0 min CN=76 Runoff=42.91 cfs 18.898 af
Subcatchment37S: BE9	Runoff Area=101.500 ac 0.00% Impervious Runoff Depth>11.17" Tc=156.0 min CN=73 Runoff=216.13 cfs 94.515 af
Subcatchment38S: BE8	Runoff Area=102.230 ac 0.00% Impervious Runoff Depth>11.66" Tc=125.0 min CN=76 Runoff=264.20 cfs 99.326 af
Reach 7R: RED5	Avg. Flow Depth=5.04' Max Vel=2.63 fps Inflow=202.96 cfs 72.442 af n=0.050 L=680.0' S=0.0029 '/' Capacity=684.90 cfs Outflow=201.87 cfs 72.323 af
Reach 12R: RE4-1	Avg. Flow Depth=3.90' Max Vel=1.96 fps Inflow=120.40 cfs 68.849 af n=0.060 L=883.0' S=0.0023 '/' Capacity=334.11 cfs Outflow=119.86 cfs 68.628 af

Proposed-1

SJRWMD 96-hr tenth 100-yr96hr Rainfall=15.00"

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Reach 20R: RED11D	Avg. Flow Depth=27,153,146.62' Max Vel=1.13 fps Inflow=496.16 cfs 620.508 af n=0.070 L=2,100.0' S=0.0007 ' Capacity=69.98 cfs Outflow=79.39 cfs 88.976 af
Reach 21R: RED13	Avg. Flow Depth=1.72' Max Vel=0.92 fps Inflow=43.60 cfs 99.693 af n=0.060 L=1,750.0' S=0.0011 ' Capacity=135.42 cfs Outflow=43.56 cfs 98.543 af
Reach 23R: RE14B	Avg. Flow Depth=2.59' Max Vel=4.68 fps Inflow=103.99 cfs 160.383 af n=0.050 L=80.0' S=0.0125 ' Capacity=357.03 cfs Outflow=103.99 cfs 160.364 af
Reach 26R: RE12A	Avg. Flow Depth=13.30' Max Vel=3.02 fps Inflow=580.10 cfs 145.061 af n=0.060 L=1,600.0' S=0.0022 ' Capacity=195.11 cfs Outflow=574.00 cfs 144.878 af
Reach 27R: RED6	Avg. Flow Depth=7.74' Max Vel=4.27 fps Inflow=669.56 cfs 614.889 af n=0.035 L=2,300.0' S=0.0015 ' Capacity=389.01 cfs Outflow=666.30 cfs 612.641 af
Reach 30R: RED12	Avg. Flow Depth=4.52' Max Vel=6.76 fps Inflow=380.74 cfs 208.433 af n=0.035 L=400.0' S=0.0075 ' Capacity=762.50 cfs Outflow=380.53 cfs 208.393 af
Reach 31R: RED11	Avg. Flow Depth=20.00' Max Vel=0.77 fps Inflow=510.27 cfs 468.364 af n=0.035 L=1,600.0' S=0.0001 ' Capacity=69.61 cfs Outflow=445.73 cfs 465.663 af
Reach 35R: RED10	Avg. Flow Depth=9.88' Max Vel=1.92 fps Inflow=445.73 cfs 465.663 af n=0.035 L=1,400.0' S=0.0004 ' Capacity=182.27 cfs Outflow=439.78 cfs 464.542 af
Pond 10P: Pond 4-1	Peak Elev=34.39' Storage=80.570 af Inflow=345.39 cfs 89.235 af Outflow=120.40 cfs 68.849 af
Pond 11P: Pond 4-2	Peak Elev=35.13' Storage=62.250 af Inflow=314.26 cfs 82.347 af Outflow=90.94 cfs 60.254 af
Pond 18P: Pond BE4-3	Peak Elev=34.91' Storage=41.941 af Inflow=223.15 cfs 310.335 af Outflow=204.40 cfs 289.871 af
Pond 19P: Wetland Storage - BE14A	Peak Elev=38.54' Storage=152.430 af Inflow=1,081.09 cfs 465.008 af Outflow=406.51 cfs 460.143 af
Pond 21P: WRC25 RC25 and RC25A	Peak Elev=35.89' Storage=53.138 af Inflow=246.81 cfs 107.449 af Outflow=43.60 cfs 99.693 af
Pond 22P: Wetland Storage - BE14B	Peak Elev=38.51' Storage=45.669 af Inflow=722.68 cfs 310.844 af Primary=580.10 cfs 145.061 af Secondary=103.99 cfs 160.383 af Outflow=684.10 cfs 305.444 af
Pond 23P: Wetland Storage - NE8	Peak Elev=32.18' Storage=62.315 af Inflow=264.20 cfs 99.326 af Outflow=14.87 cfs 52.000 af
Pond 25P: WREC22 and REC22	Peak Elev=31.30' Inflow=79.39 cfs 88.976 af Outflow=79.39 cfs 88.976 af
Pond 26P: Wetland Storage - BE9	Peak Elev=34.45' Storage=25.715 af Inflow=371.22 cfs 168.811 af Outflow=307.68 cfs 168.125 af
Pond 28P: Wetland Storage for BE12	Peak Elev=36.30' Storage=89.754 af Inflow=675.18 cfs 208.577 af Outflow=380.74 cfs 208.433 af

Proposed-1

SJRWMD 96-hr tenth 100-yr96hr Rainfall=15.00"

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Pond 29P: Wetland Storage BE7

Peak Elev=33.83' Storage=14.425 af Inflow=213.48 cfs 308.769 af
Outflow=209.26 cfs 305.814 af

Pond 30P: WRC18 and RC18

Peak Elev=34.94' Inflow=307.68 cfs 168.125 af
Outflow=307.68 cfs 168.125 af

Pond 33P: Wetland Storage - BE10

Peak Elev=32.05' Storage=13.401 af Inflow=226.46 cfs 73.031 af
Outflow=139.01 cfs 72.453 af

Pond 35P: Wetland Storage - BE11

Peak Elev=34.31' Storage=19.141 af Inflow=295.54 cfs 74.836 af
Outflow=164.06 cfs 74.296 af

Link 24L: CP-1

Inflow=853.93 cfs 1,129.183 af
Primary=853.93 cfs 1,129.183 af

Link

100-yr96hr Primary Outflow Imported from Proposed - Part 2~Link 18L.hce Inflow=157.48 cfs 216.552 af
Area= 522.100 ac Primary=157.48 cfs 216.552 af

Total Runoff Area = 1,660.450 ac Runoff Volume = 1,585.157 af Average Runoff Depth = 11.46"
100.00% Pervious = 1,660.450 ac 0.00% Impervious = 0.000 ac

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Summary for Subcatchment 2S: BE-3

Runoff = 54.97 cfs @ 61.55 hrs, Volume= 22.274 af, Depth>11.65"

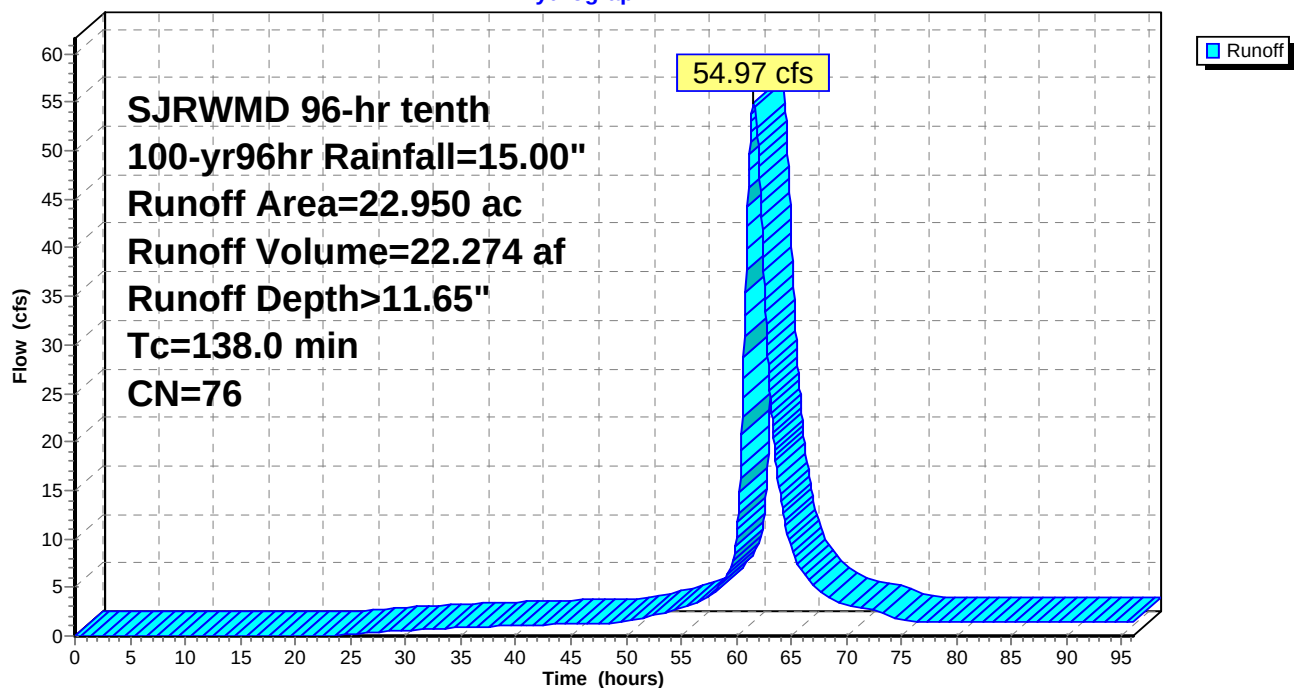
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
SJRWMD 96-hr tenth 100-yr96hr Rainfall=15.00"

Area (ac)	CN	Description
* 22.950	76	
22.950		100.00% Pervious Area

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

Subcatchment 2S: BE-3

Hydrograph



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SJRWMD 96-hr tenth 100-yr96hr Rainfall=15.00"

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Summary for Subcatchment 3S: BE-5

Runoff = 153.42 cfs @ 61.14 hrs, Volume= 50.168 af, Depth>11.68"

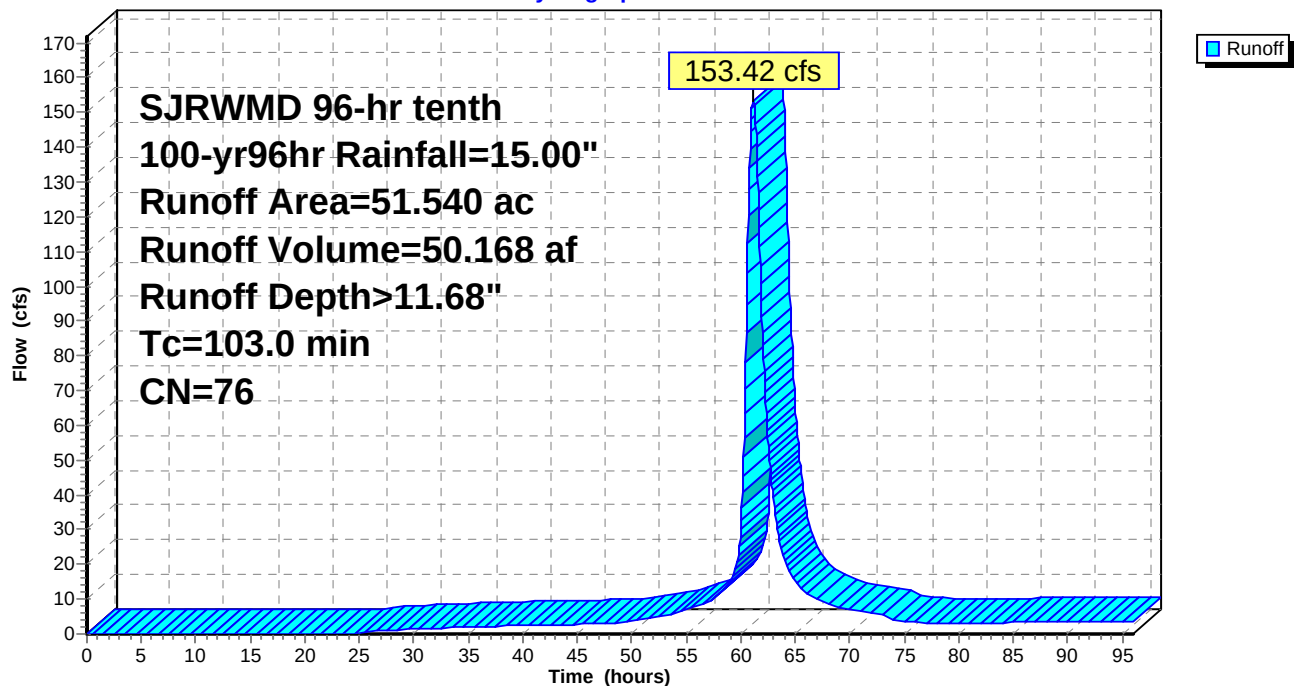
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
SJRWMD 96-hr tenth 100-yr96hr Rainfall=15.00"

Area (ac)	CN	Description
* 51.540	76	
51.540		100.00% Pervious Area

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

Subcatchment 3S: BE-5

Hydrograph



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SJRWMD 96-hr tenth 100-yr96hr Rainfall=15.00"

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Summary for Subcatchment 7S: BE4-2

Runoff = 314.26 cfs @ 60.72 hrs, Volume= 82.347 af, Depth>13.00"

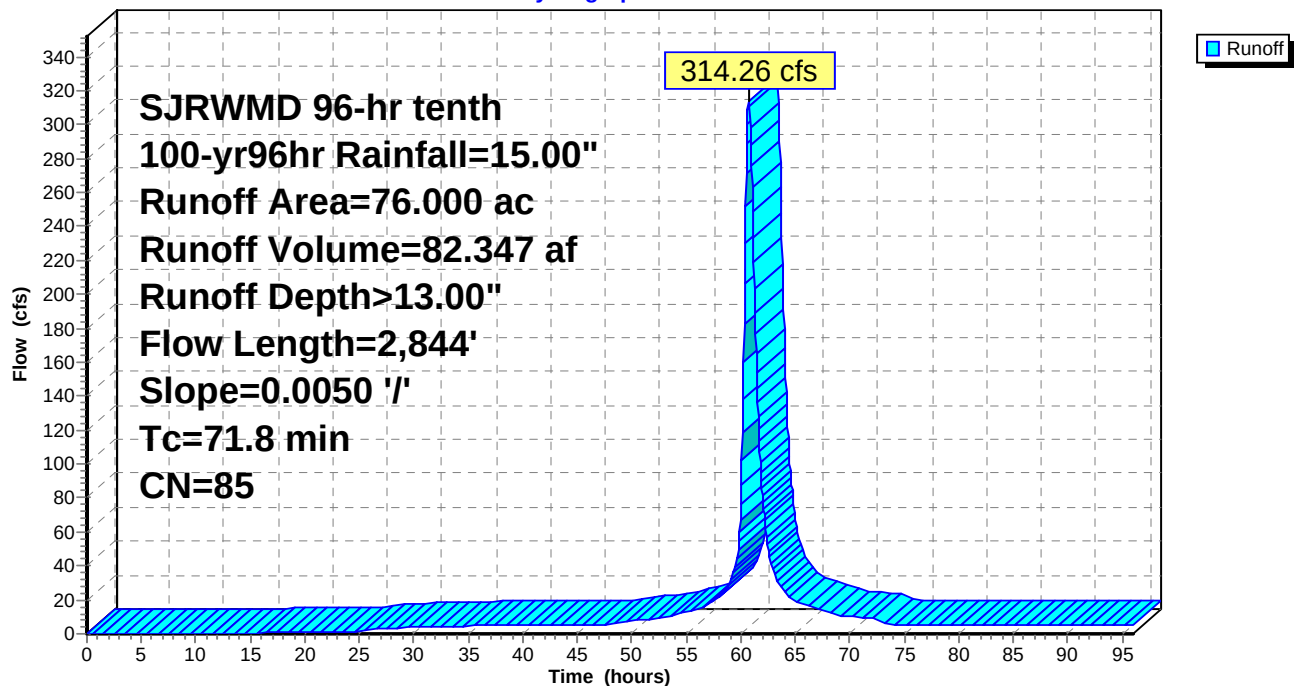
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
SJRWMD 96-hr tenth 100-yr96hr Rainfall=15.00"

Area (ac)	CN	Description
* 76.000	85	
76.000		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
34.3	300	0.0050	0.15		Sheet Flow, Grass: Short n= 0.150 P2= 4.58"
37.5	2,544		1.13		Direct Entry,
71.8	2,844	Total			

Subcatchment 7S: BE4-2

Hydrograph



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SJRWMD 96-hr tenth 100-yr96hr Rainfall=15.00"

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Summary for Subcatchment 9S: BE4-1

Runoff = 345.39 cfs @ 60.74 hrs, Volume= 89.235 af, Depth>12.73"

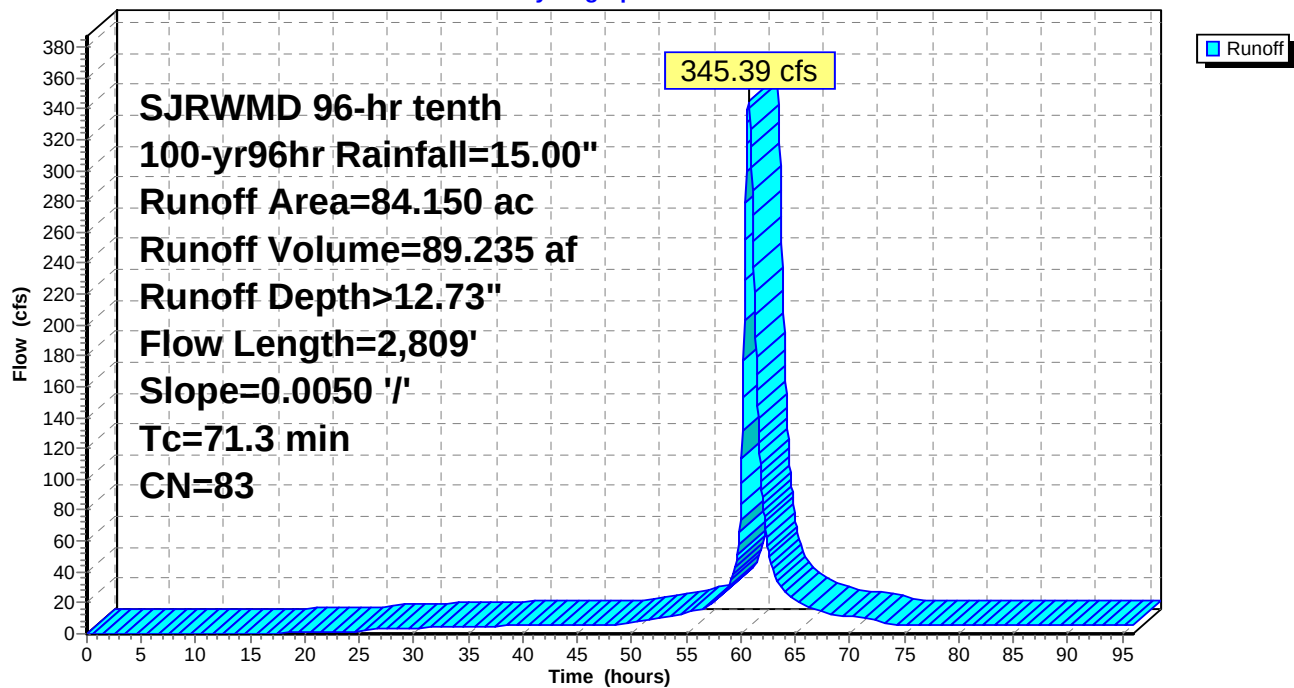
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
SJRWMD 96-hr tenth 100-yr96hr Rainfall=15.00"

Area (ac)	CN	Description
* 84.150	83	
84.150		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
34.3	300	0.0050	0.15		Sheet Flow, Grass: Short n= 0.150 P2= 4.58"
37.0	2,509		1.13		Direct Entry,
71.3	2,809	Total			

Subcatchment 9S: BE4-1

Hydrograph



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SJRWMD 96-hr tenth 100-yr96hr Rainfall=15.00"

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Summary for Subcatchment 10S: BE4-3

Runoff = 190.05 cfs @ 60.39 hrs, Volume= 33.528 af, Depth>11.44"

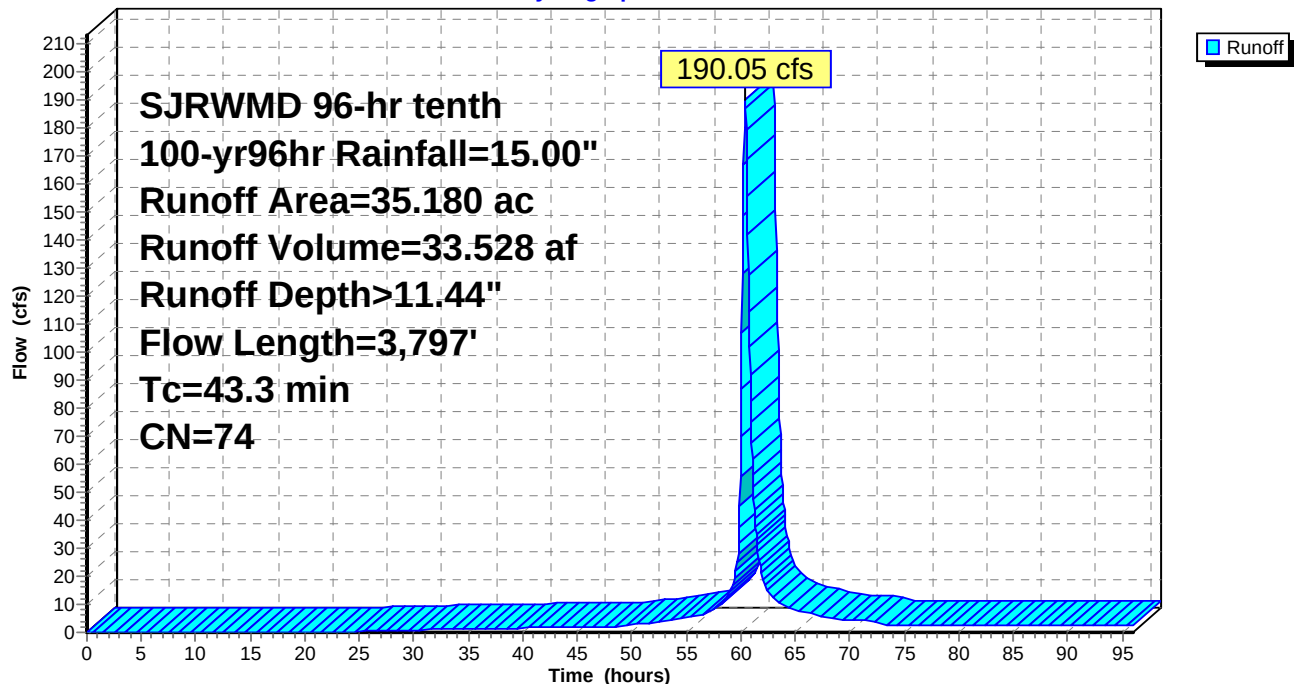
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
SJRWMD 96-hr tenth 100-yr96hr Rainfall=15.00"

Area (ac)	CN	Description
* 35.180	74	
35.180		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.9	200	0.0050	0.28		Sheet Flow, Cultivated: Residue<=20% n= 0.060 P2= 4.58"
7.2	86	0.0008	0.20		Shallow Concentrated Flow, Short Grass Pasture Kv= 7.0 fps
24.2	3,511	0.0008	2.41	237.12	Channel Flow, Area= 98.2 sf Perim= 43.4' r= 2.26' n= 0.030
43.3	3,797	Total			

Subcatchment 10S: BE4-3

Hydrograph



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SJRWMD 96-hr tenth 100-yr96hr Rainfall=15.00"

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Summary for Subcatchment 21S: BE14A

Runoff = 1,081.09 cfs @ 61.78 hrs, Volume= 465.008 af, Depth>11.18"

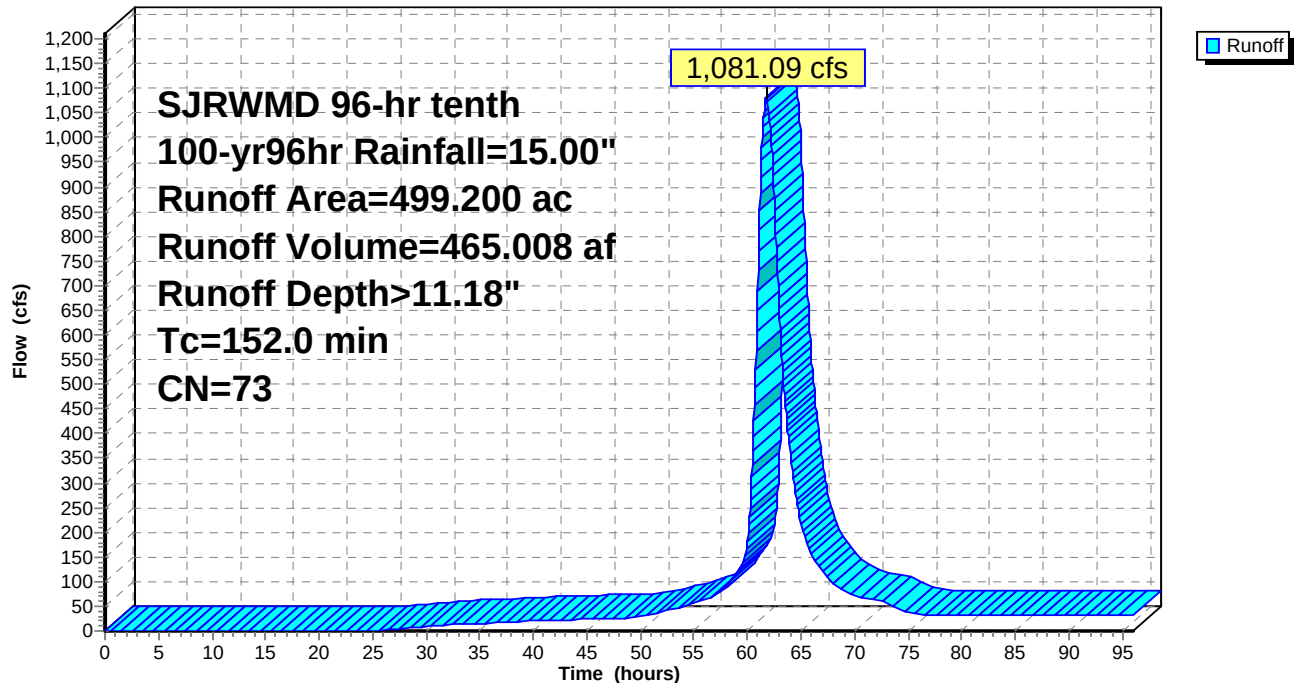
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
SJRWMD 96-hr tenth 100-yr96hr Rainfall=15.00"

Area (ac)	CN	Description
* 499.200	73	
499.200		100.00% Pervious Area

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

Subcatchment 21S: BE14A

Hydrograph



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SJRWMD 96-hr tenth 100-yr96hr Rainfall=15.00"

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Summary for Subcatchment 22S: BE13

Runoff = 246.81 cfs @ 61.73 hrs, Volume= 107.449 af, Depth>11.48"

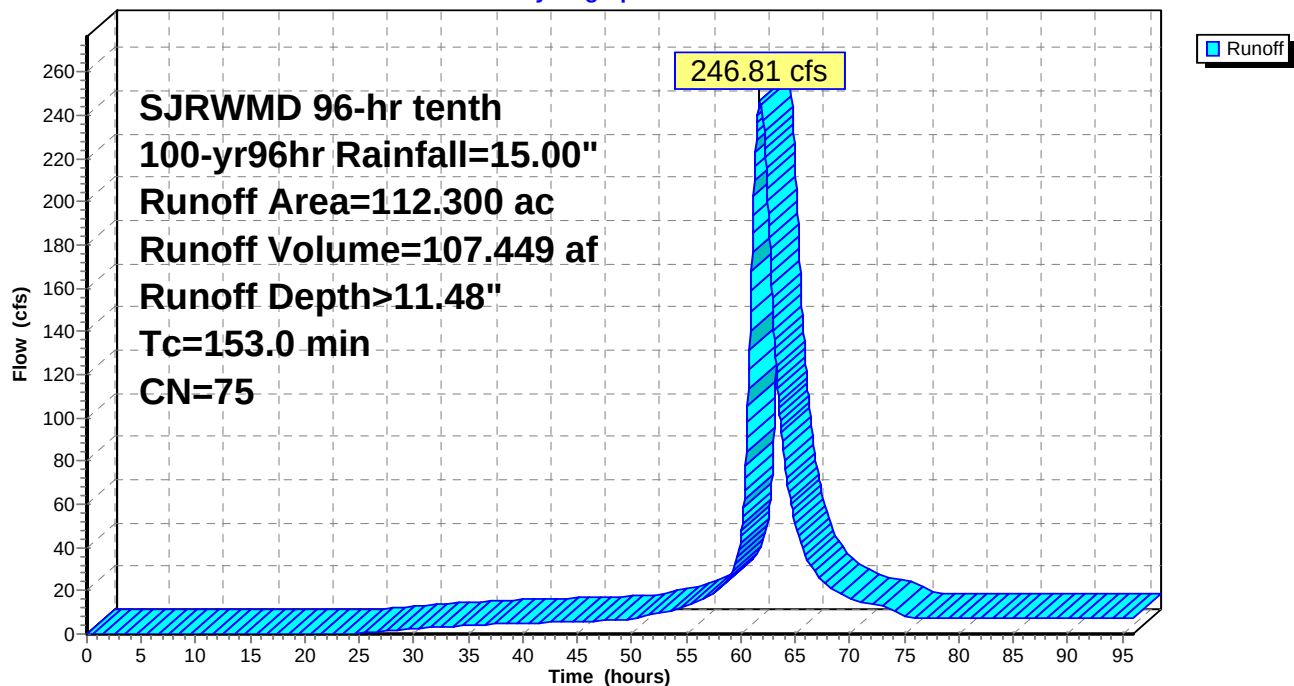
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
SJRWMD 96-hr tenth 100-yr96hr Rainfall=15.00"

Area (ac)	CN	Description
* 112.300	75	
112.300		100.00% Pervious Area

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

Subcatchment 22S: BE13

Hydrograph



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SJRWMD 96-hr tenth 100-yr96hr Rainfall=15.00"

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Summary for Subcatchment 23S: BE14B

Runoff = 722.68 cfs @ 61.78 hrs, Volume= 310.844 af, Depth>11.18"

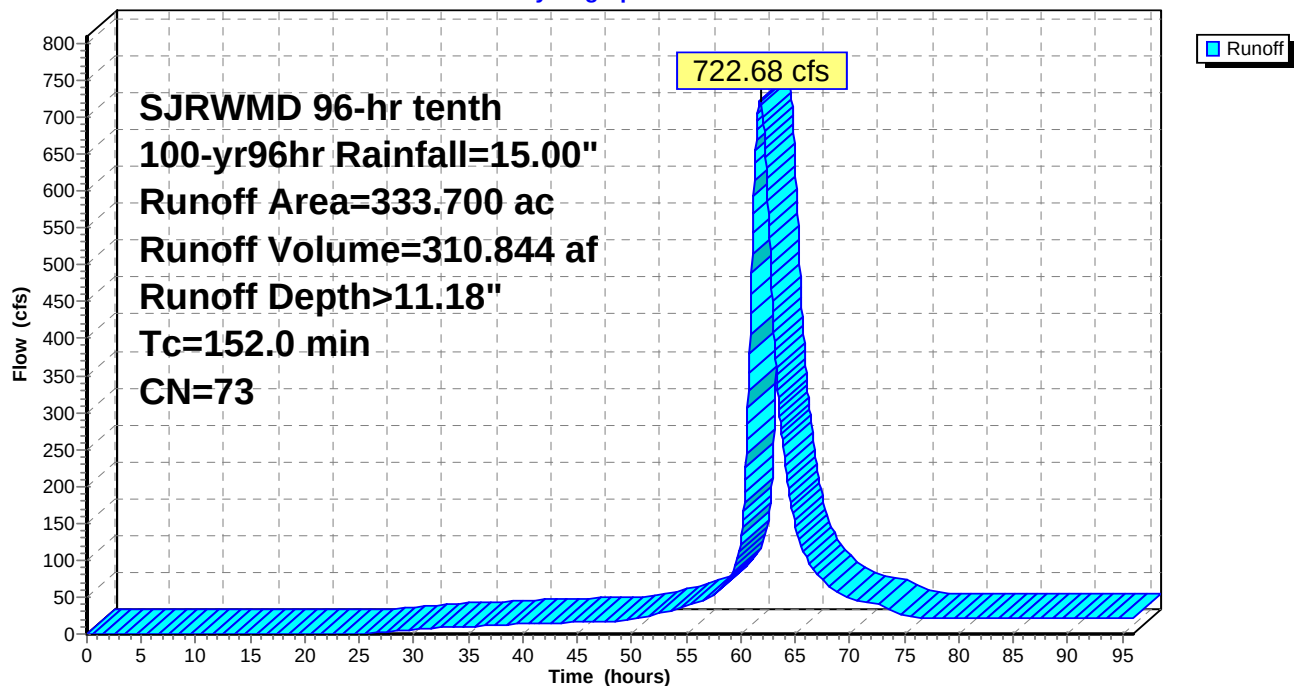
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
SJRWMD 96-hr tenth 100-yr96hr Rainfall=15.00"

Area (ac)	CN	Description
* 333.700	73	
333.700		100.00% Pervious Area

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

Subcatchment 23S: BE14B

Hydrograph



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SJRWMD 96-hr tenth 100-yr96hr Rainfall=15.00"

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Summary for Subcatchment 27S: BE12

Runoff = 173.11 cfs @ 61.39 hrs, Volume= 63.699 af, Depth>11.51"

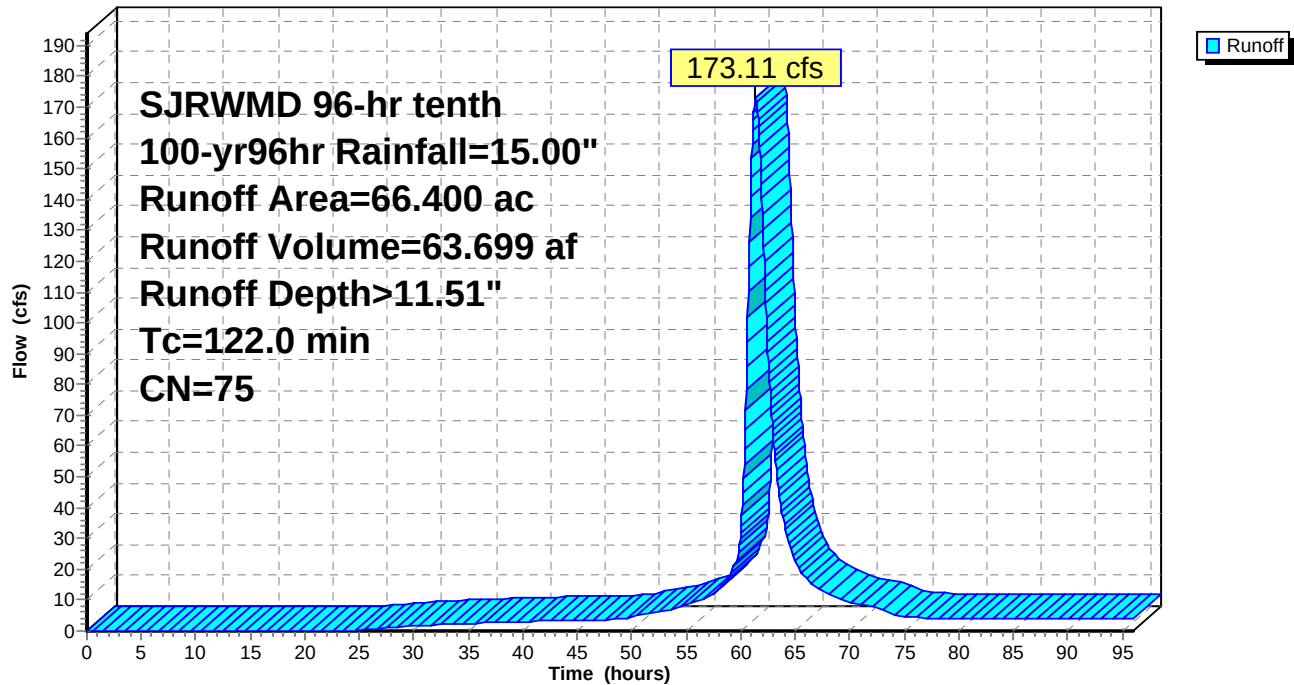
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
SJRWMD 96-hr tenth 100-yr96hr Rainfall=15.00"

Area (ac)	CN	Description
* 66.400	75	
66.400		100.00% Pervious Area

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

Subcatchment 27S: BE12

Hydrograph



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Summary for Subcatchment 32S: BE10

Runoff = 226.46 cfs @ 61.11 hrs, Volume= 73.031 af, Depth>11.53"

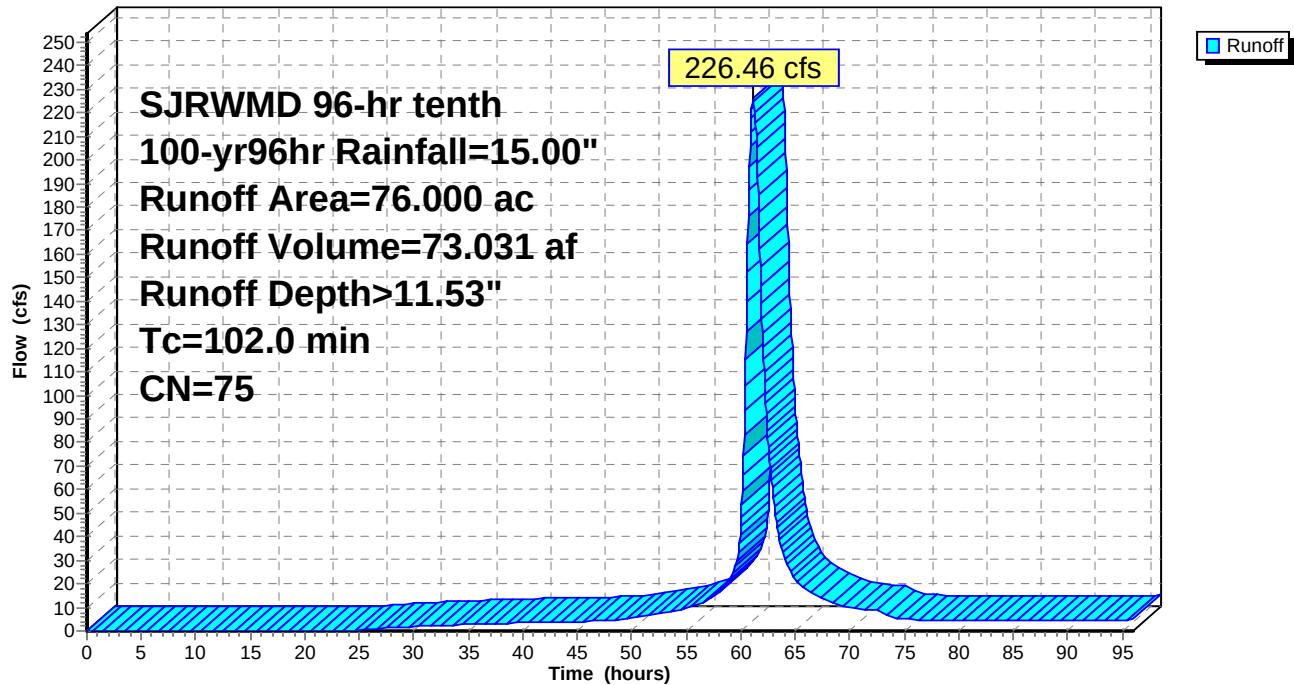
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
SJRWMD 96-hr tenth 100-yr96hr Rainfall=15.00"

Area (ac)	CN	Description
* 76.000	75	
76.000		100.00% Pervious Area

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

Subcatchment 32S: BE10

Hydrograph



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SJRWMD 96-hr tenth 100-yr96hr Rainfall=15.00"

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Summary for Subcatchment 33S: BE11

Runoff = 295.54 cfs @ 60.76 hrs, Volume= 74.836 af, Depth>11.25"

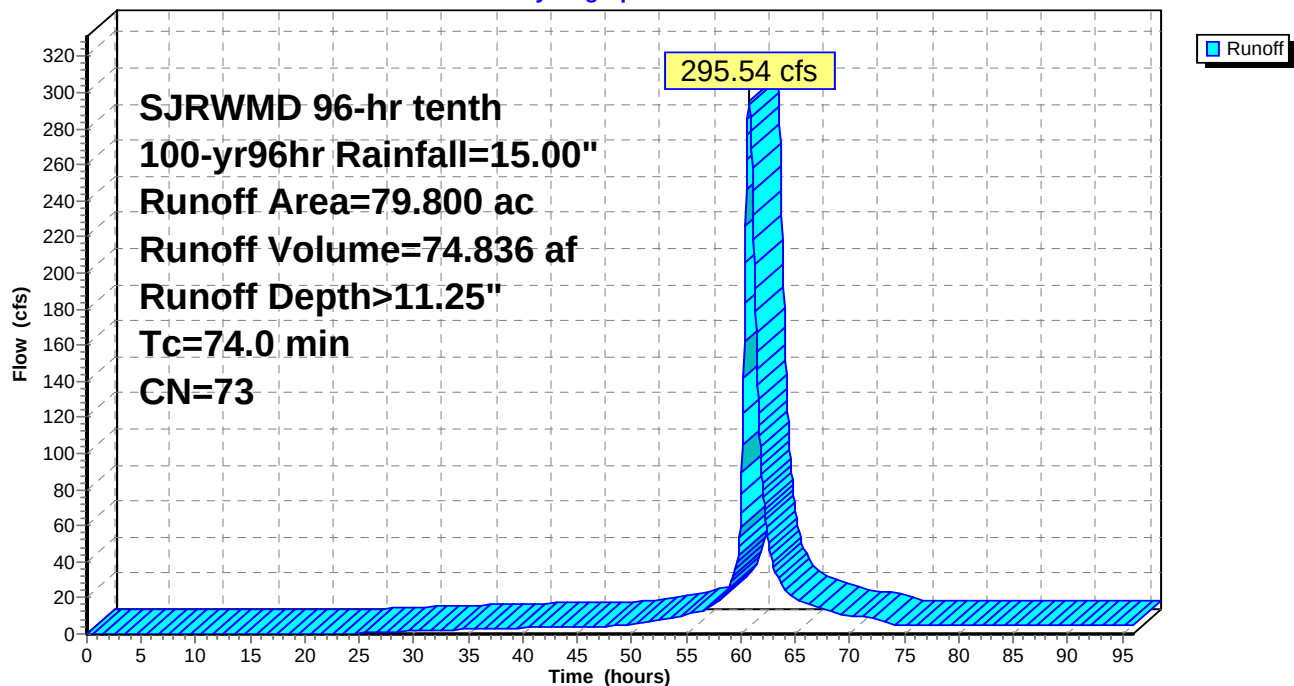
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
SJRWMD 96-hr tenth 100-yr96hr Rainfall=15.00"

Area (ac)	CN	Description
* 79.800	73	
79.800		100.00% Pervious Area

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

Subcatchment 33S: BE11

Hydrograph



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SJRWMD 96-hr tenth 100-yr96hr Rainfall=15.00"

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Summary for Subcatchment 36S: BE7

Runoff = 42.91 cfs @ 61.81 hrs, Volume= 18.898 af, Depth>11.63"

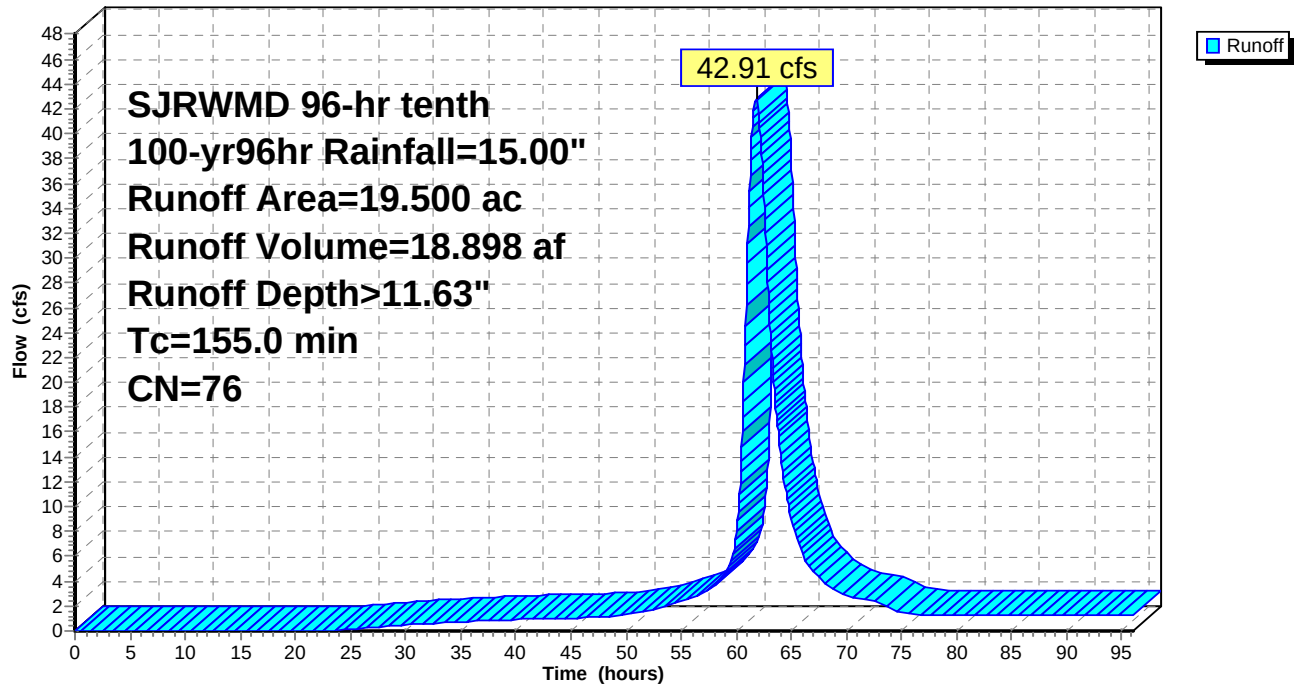
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
SJRWMD 96-hr tenth 100-yr96hr Rainfall=15.00"

Area (ac)	CN	Description
* 19.500	76	
19.500		100.00% Pervious Area

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

Subcatchment 36S: BE7

Hydrograph



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SJRWMD 96-hr tenth 100-yr96hr Rainfall=15.00"

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Summary for Subcatchment 37S: BE9

Runoff = 216.13 cfs @ 61.84 hrs, Volume= 94.515 af, Depth>11.17"

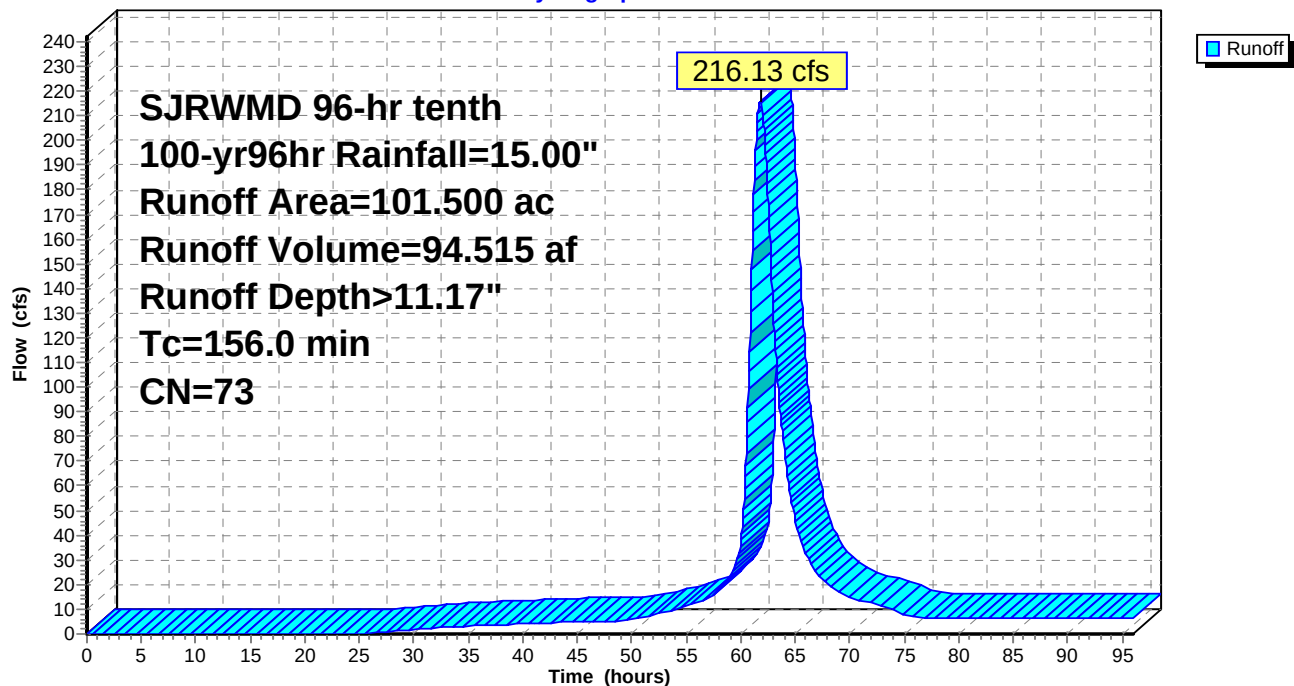
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
SJRWMD 96-hr tenth 100-yr96hr Rainfall=15.00"

Area (ac)	CN	Description
* 101.500	73	
101.500		100.00% Pervious Area

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

Subcatchment 37S: BE9

Hydrograph



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SJRWMD 96-hr tenth 100-yr96hr Rainfall=15.00"

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Summary for Subcatchment 38S: BE8

Runoff = 264.20 cfs @ 61.40 hrs, Volume= 99.326 af, Depth>11.66"

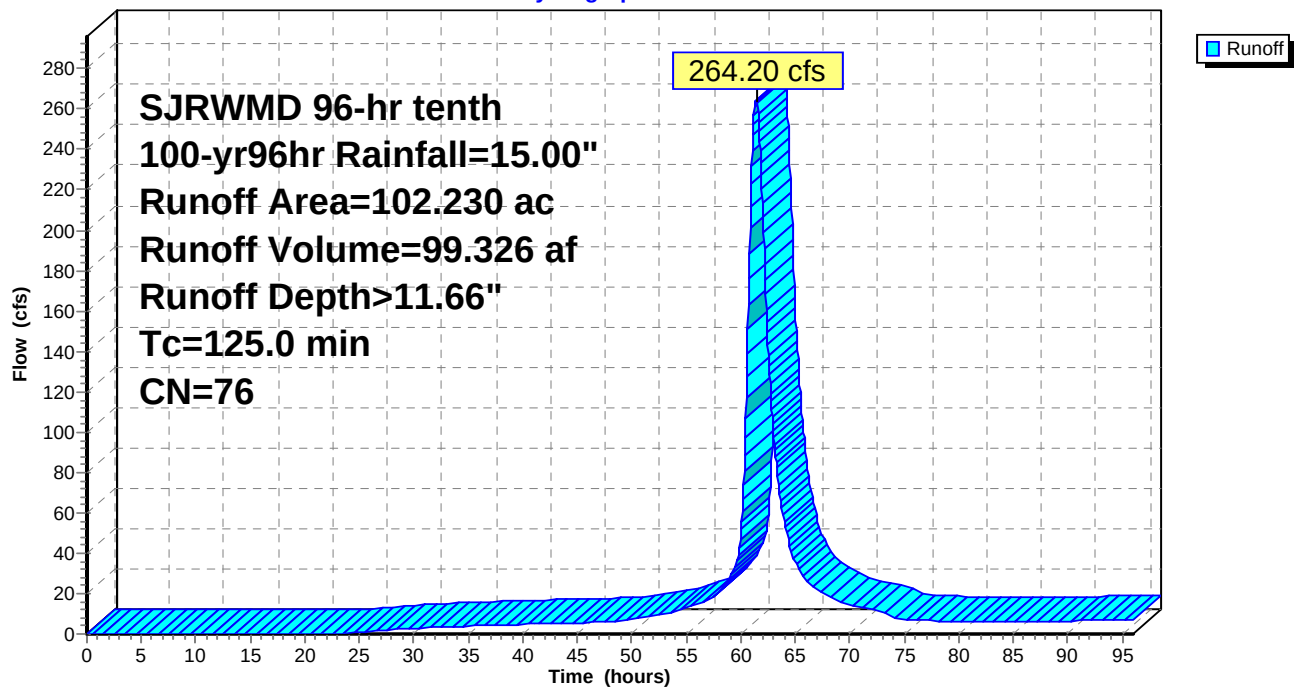
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
SJRWMD 96-hr tenth 100-yr96hr Rainfall=15.00"

Area (ac)	CN	Description
* 102.230	76	
102.230		100.00% Pervious Area

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

Subcatchment 38S: BE8

Hydrograph



Proposed-1

SJRWMD 96-hr tenth 100-yr96hr Rainfall=15.00"

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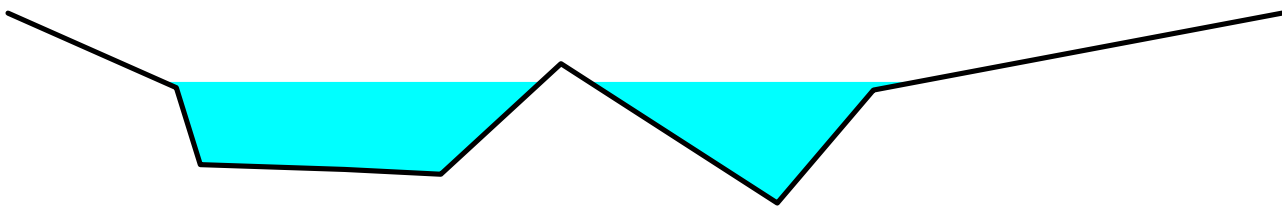
Summary for Reach 7R: RED5

Inflow Area = 74.490 ac, 0.00% Impervious, Inflow Depth > 11.67" for 100-yr96hr event
Inflow = 202.96 cfs @ 61.22 hrs, Volume= 72.442 af
Outflow = 201.87 cfs @ 61.36 hrs, Volume= 72.323 af, Atten= 1%, Lag= 8.2 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.63 fps, Min. Travel Time= 4.3 min
Avg. Velocity= 0.92 fps, Avg. Travel Time= 12.3 min

Peak Storage= 52,269 cf @ 61.29 hrs
Average Depth at Peak Storage= 5.04'
Bank-Full Depth= 7.90' Flow Area= 196.7 sf, Capacity= 684.90 cfs

Custom cross-section, Length= 680.0' Slope= 0.0029 '/' (106 Elevation Intervals)
Constant n= 0.050
Inlet Invert= 27.00', Outlet Invert= 25.00'



Offset (feet)	Elevation (feet)	Chan.Depth (feet)
0.00	34.30	0.00
7.00	31.20	3.10
8.00	28.00	6.30
14.00	27.80	6.50
18.00	27.60	6.70
23.00	32.20	2.10
32.00	26.40	7.90
36.00	31.10	3.20
53.00	34.30	0.00

Depth (feet)	End Area (sq-ft)	Perim. (feet)	Storage (cubic-feet)	Discharge (cfs)
0.00	0.0	0.0	0	0.00
1.20	1.7	3.8	1,176	1.65
1.40	2.8	8.7	1,888	2.09
1.60	5.0	15.7	3,375	3.72
4.70	67.5	33.3	45,899	174.34
4.80	70.1	34.3	47,699	182.33
5.80	102.1	45.4	69,457	282.47
7.90	196.7	62.0	133,790	684.90

Proposed-1

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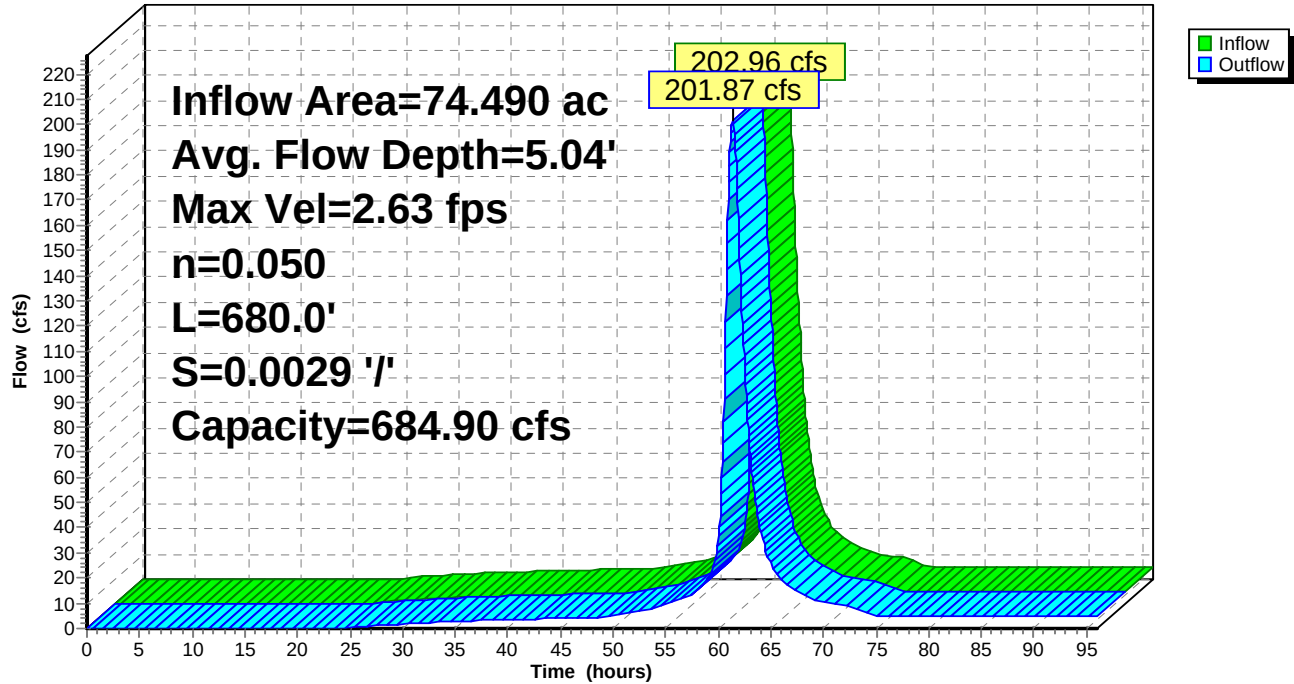
SJRWMD 96-hr tenth 100-yr96hr Rainfall=15.00"

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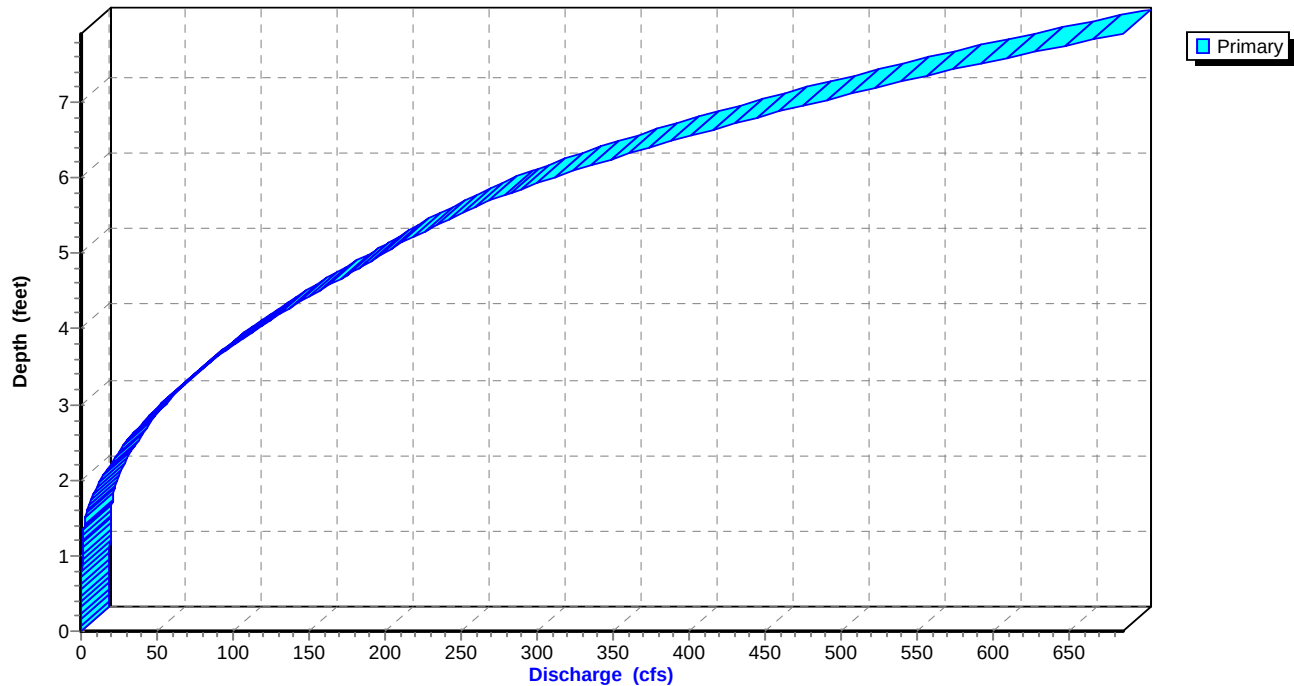
Reach 7R: RED5

Hydrograph



Reach 7R: RED5

Stage-Discharge



Proposed-1

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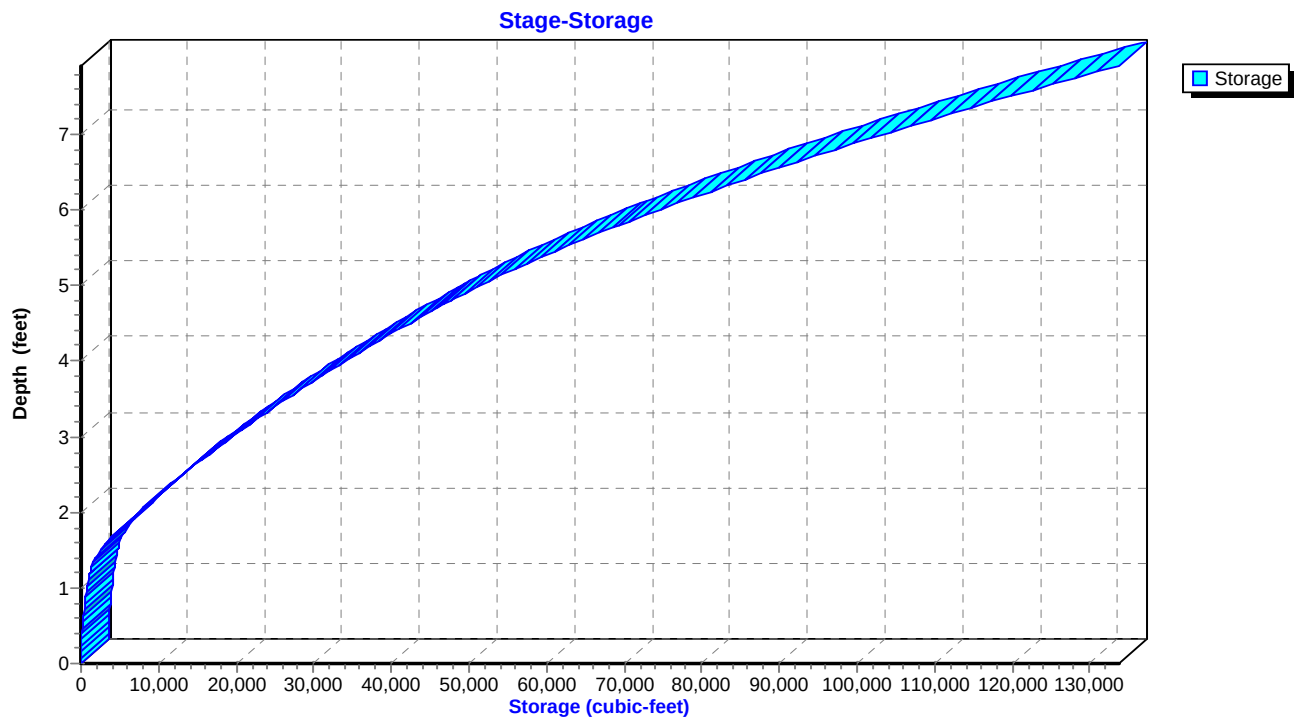
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SJRWMD 96-hr tenth 100-yr96hr Rainfall=15.00"

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Reach 7R: RED5



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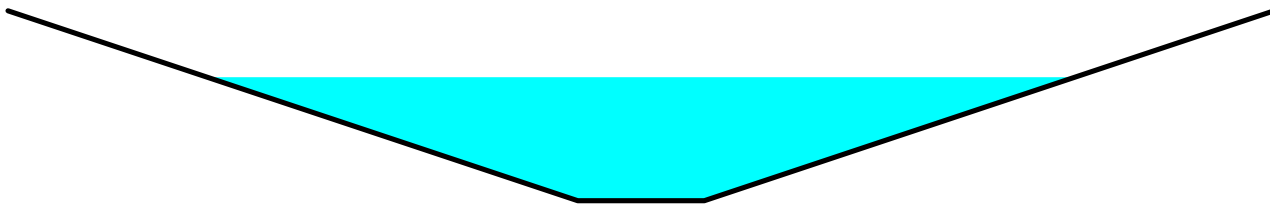
Summary for Reach 12R: RE4-1

Inflow Area = 84.150 ac, 0.00% Impervious, Inflow Depth > 9.82" for 100-yr96hr event
Inflow = 120.40 cfs @ 61.72 hrs, Volume= 68.849 af
Outflow = 119.86 cfs @ 61.95 hrs, Volume= 68.628 af, Atten= 0%, Lag= 14.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.96 fps, Min. Travel Time= 7.5 min
Avg. Velocity = 0.77 fps, Avg. Travel Time= 19.0 min

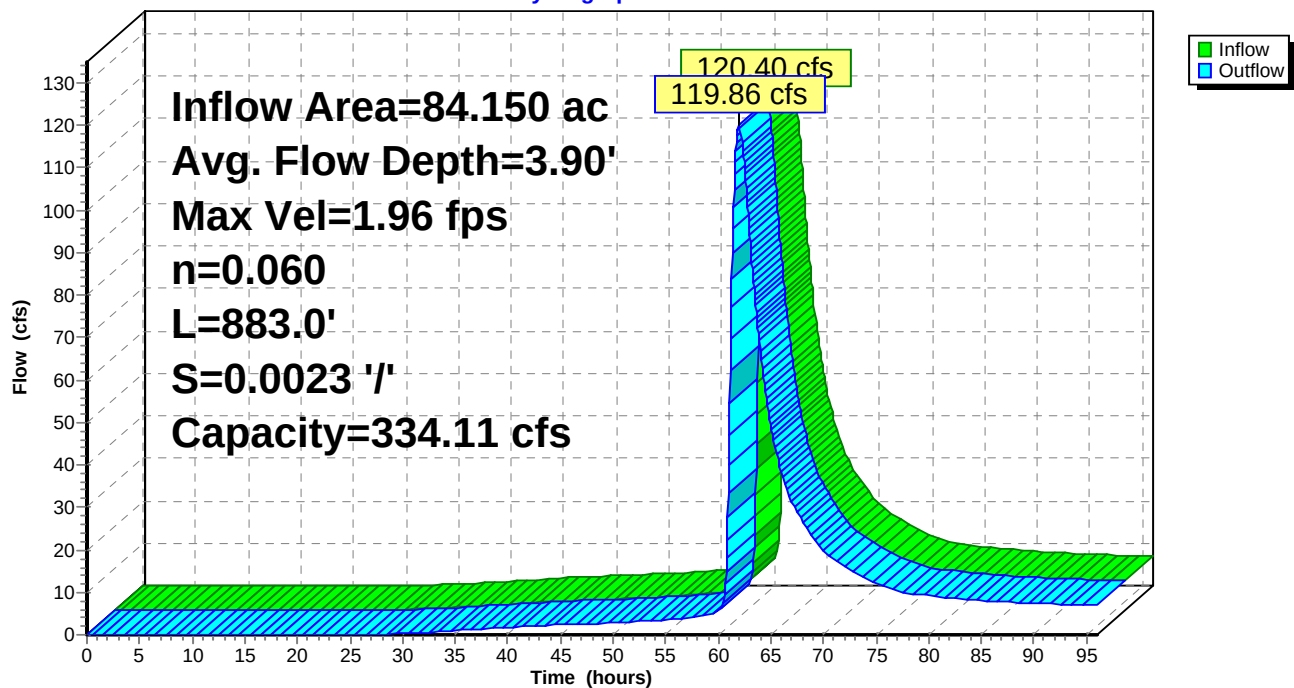
Peak Storage= 54,129 cf @ 61.83 hrs
Average Depth at Peak Storage= 3.90'
Bank-Full Depth= 6.00' Flow Area= 132.0 sf, Capacity= 334.11 cfs

4.00' x 6.00' deep channel, n= 0.060
Side Slope Z-value= 3.0 '/' Top Width= 40.00'
Length= 883.0' Slope= 0.0023 '/'
Inlet Invert= 30.00', Outlet Invert= 28.00'



Reach 12R: RE4-1

Hydrograph



Proposed-1

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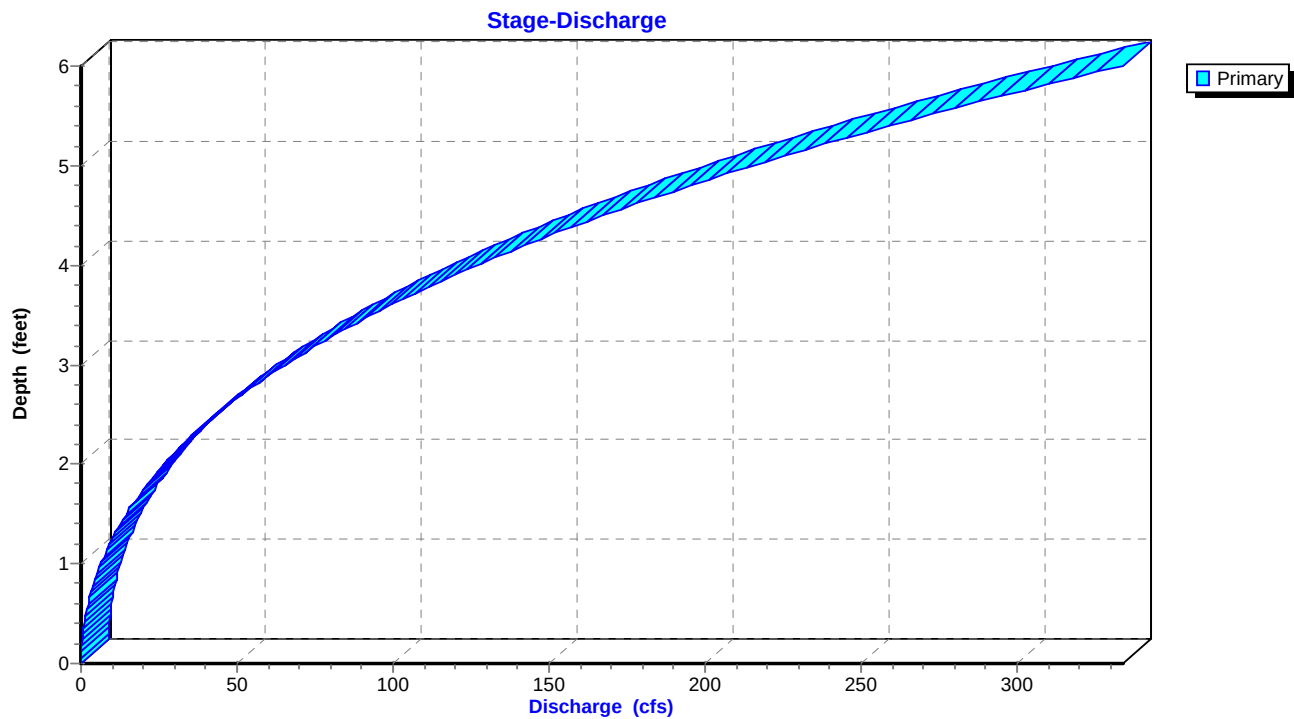
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SJRWMD 96-hr tenth 100-yr96hr Rainfall=15.00"

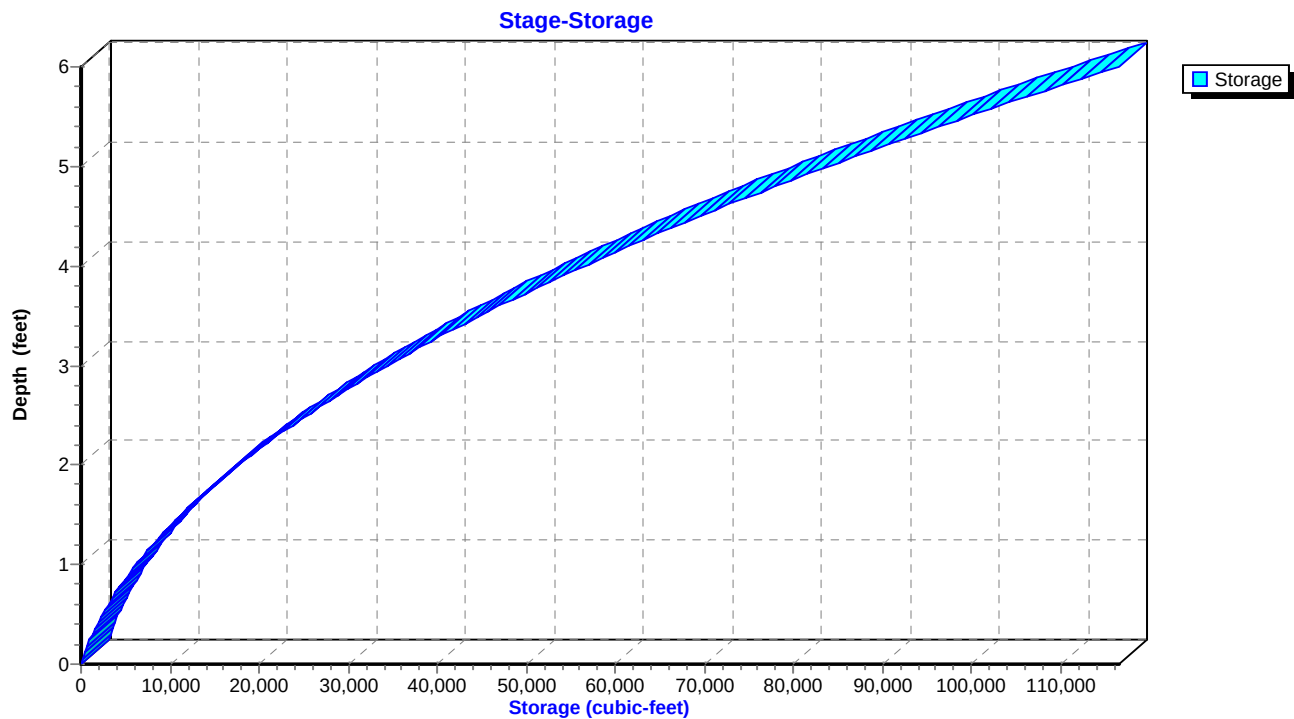
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Reach 12R: RE4-1



Reach 12R: RE4-1



Proposed-1

SJRWMD 96-hr tenth 100-yr96hr Rainfall=15.00"

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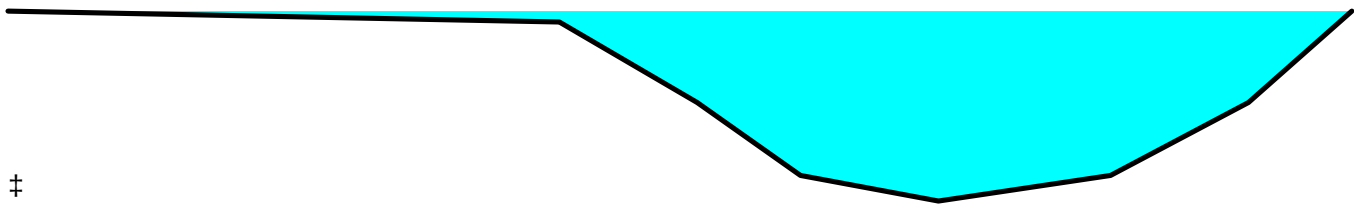
Summary for Reach 20R: RED11D

Inflow Area = 499.200 ac, 0.00% Impervious, Inflow Depth > 14.92" for 100-yr96hr event
Inflow = 496.16 cfs @ 63.50 hrs, Volume= 620.508 af
Outflow = 79.39 cfs @ 57.27 hrs, Volume= 88.976 af, Atten= 84%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.13 fps, Min. Travel Time= 31.0 min
Avg. Velocity= 0.26 fps, Avg. Travel Time= 136.6 min

Peak Storage= 2,142,993,428,351 cf @ 96.00 hrs
Average Depth at Peak Storage= 27,153,146.62'
Bank-Full Depth= 5.20' Flow Area= 79.9 sf, Capacity= 69.98 cfs

Custom cross-section, Length= 2,100.0' Slope= 0.0007 '/' (102 Elevation Intervals)
Constant n= 0.070
Inlet Invert= 31.00', Outlet Invert= 29.50'



Offset (feet)	Elevation (feet)	Chan.Depth (feet)
0.00	36.00	0.00
16.00	35.70	0.30
20.00	33.50	2.50
23.00	31.50	4.50
27.00	30.80	5.20
32.00	31.50	4.50
36.00	33.50	2.50
39.00	36.00	0.00

Depth (feet)	End Area (sq-ft)	Perim. (feet)	Storage (cubic-feet)	Discharge (cfs)
0.00	0.0	0.0	0	0.00
0.70	3.1	9.1	6,615	0.88
2.70	28.1	17.2	59,116	22.19
4.90	70.7	25.2	148,373	79.73
5.20	79.9	41.7	167,790	69.98

Proposed-1

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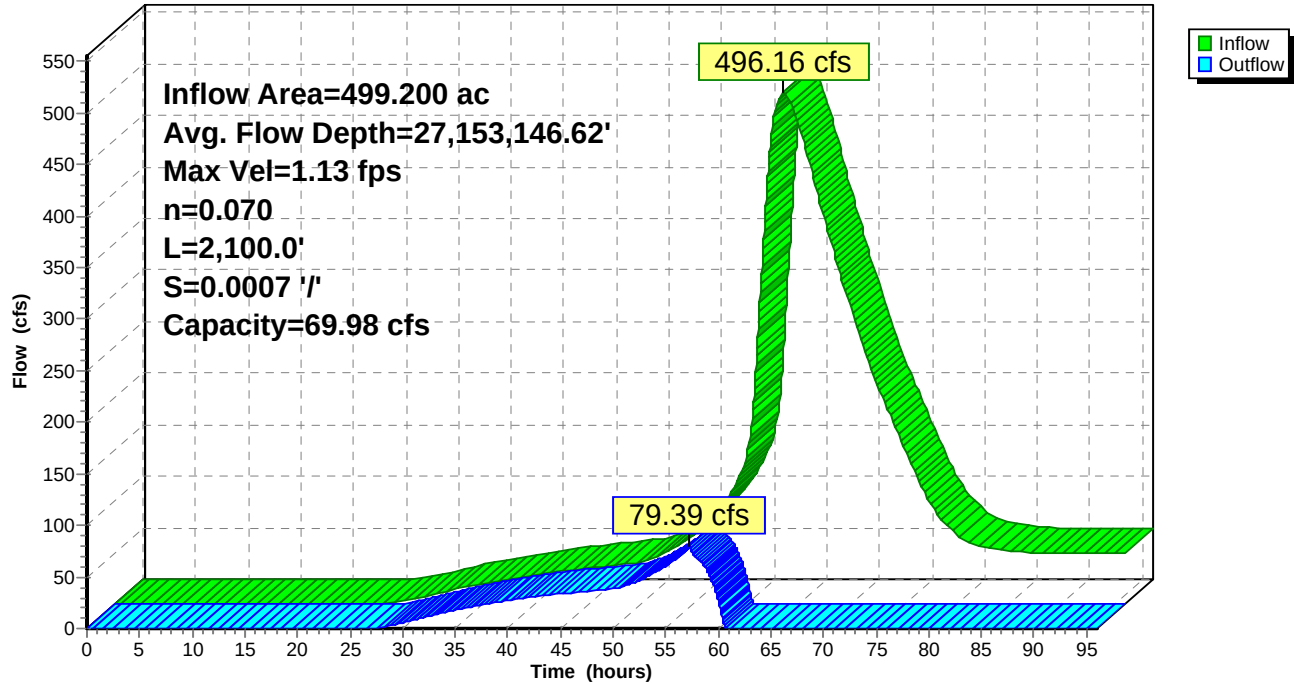
SJRWMD 96-hr tenth 100-yr96hr Rainfall=15.00"

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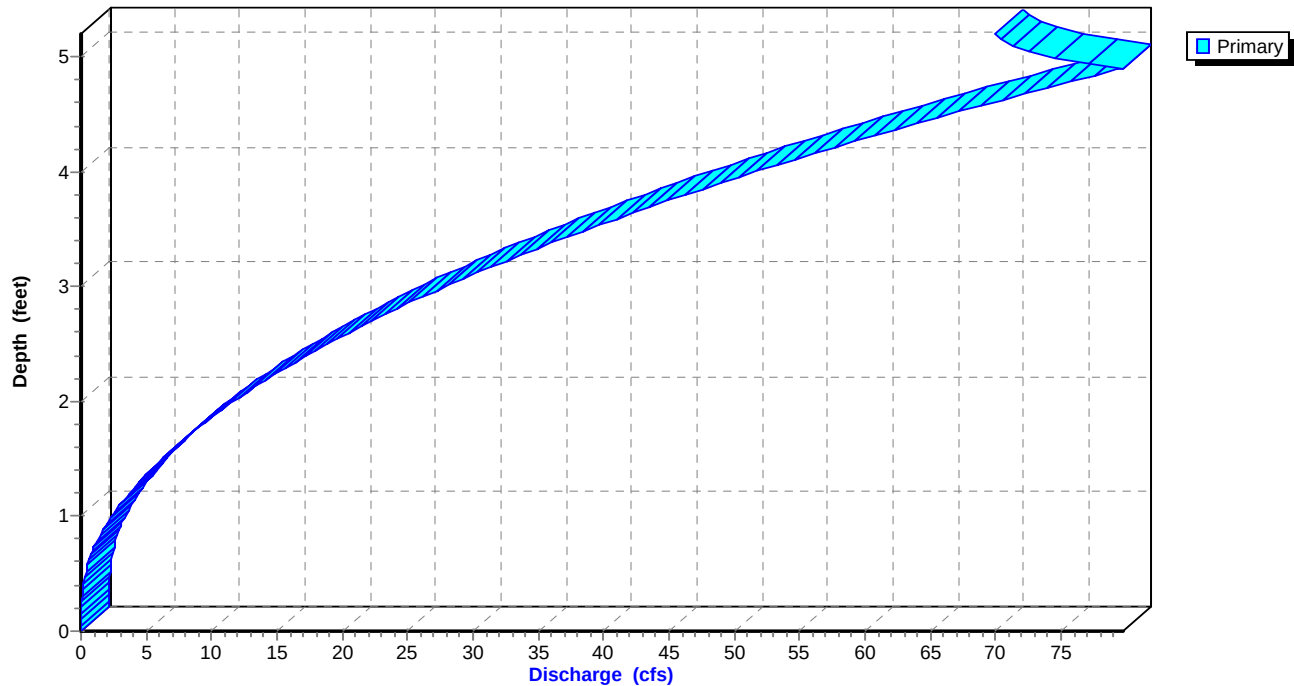
Reach 20R: RED11D

Hydrograph



Reach 20R: RED11D

Stage-Discharge



Proposed-1

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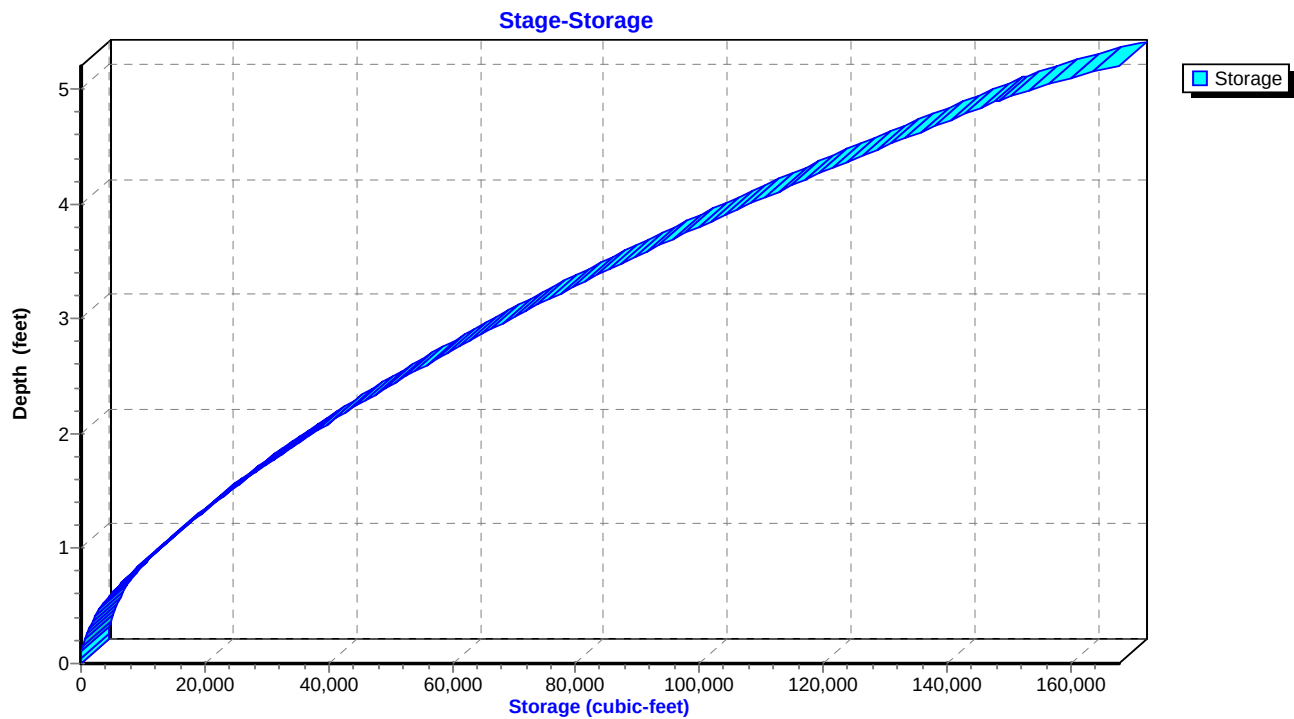
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SJRWMD 96-hr tenth 100-yr96hr Rainfall=15.00"

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Reach 20R: RED11D



Proposed-1

SJRWMD 96-hr tenth 100-yr96hr Rainfall=15.00"

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Summary for Reach 21R: RED13

Inflow Area = 112.300 ac, 0.00% Impervious, Inflow Depth > 10.65" for 100-yr96hr event
Inflow = 43.60 cfs @ 65.39 hrs, Volume= 99.693 af
Outflow = 43.56 cfs @ 66.42 hrs, Volume= 98.543 af, Atten= 0%, Lag= 61.8 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Max. Velocity= 0.92 fps, Min. Travel Time= 31.8 min
Avg. Velocity= 0.57 fps, Avg. Travel Time= 51.2 min

Peak Storage= 83,216 cf @ 65.89 hrs
Average Depth at Peak Storage= 1.72'
Bank-Full Depth= 2.90' Flow Area= 107.0 sf, Capacity= 135.42 cfs

Custom cross-section, Length= 1,750.0' Slope= 0.0011 '/' (103 Elevation Intervals)
Constant n= 0.060
Inlet Invert= 30.60', Outlet Invert= 28.60'



Offset (feet)	Elevation (feet)	Chan.Depth (feet)
0.00	33.60	0.00
14.00	30.80	2.80
25.00	30.70	2.90
34.00	30.80	2.80
39.00	31.90	1.70
53.00	32.80	0.80
57.00	33.60	0.00

Depth (feet)	End Area (sq-ft)	Perim. (feet)	Storage (cubic-feet)	Discharge (cfs)
0.00	0.0	0.0	0	0.00
0.10	1.0	20.0	1,750	0.11
1.20	28.8	30.7	50,356	23.06
2.10	64.5	49.3	112,962	64.64
2.90	107.0	57.5	187,163	135.42

Proposed-1

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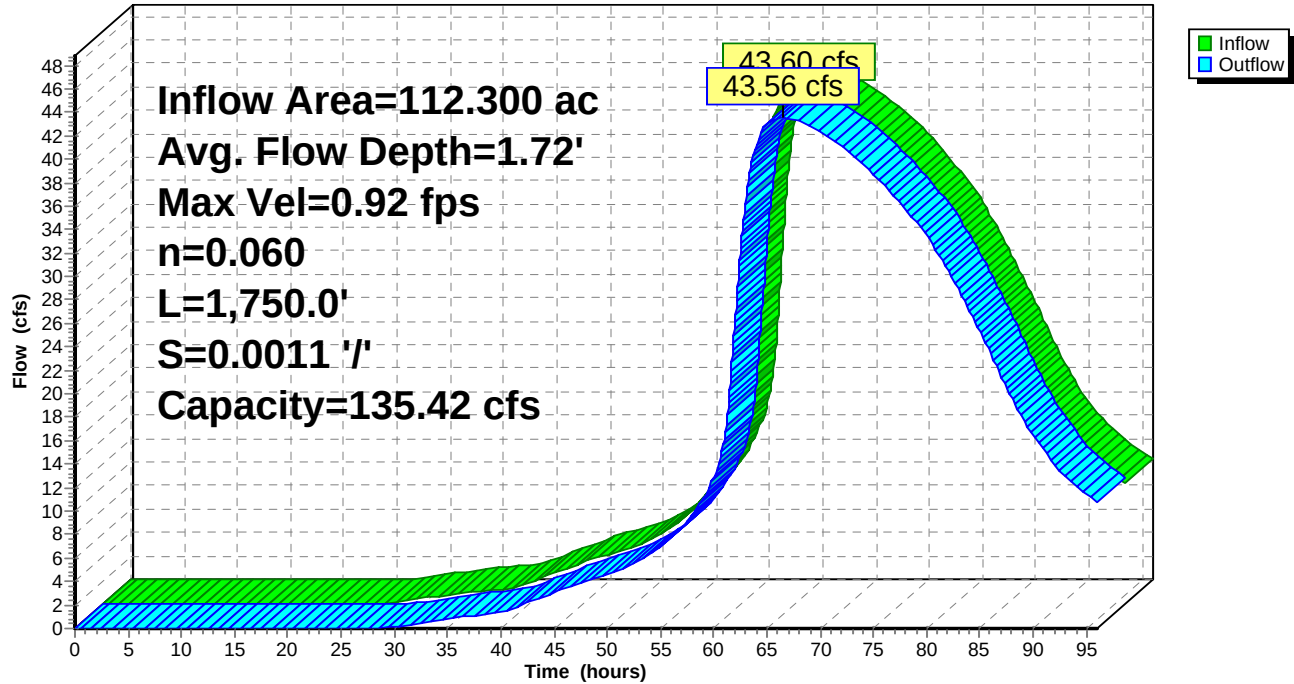
SJRWMD 96-hr tenth 100-yr96hr Rainfall=15.00"

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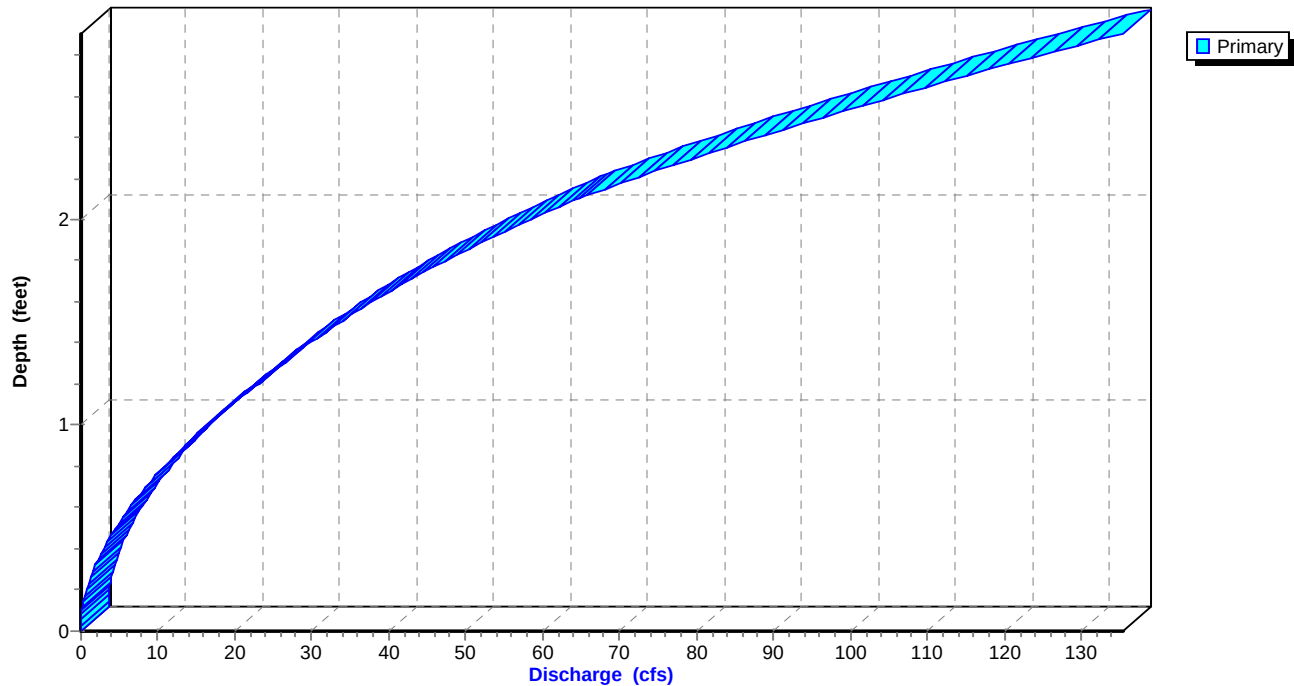
Reach 21R: RED13

Hydrograph



Reach 21R: RED13

Stage-Discharge



Proposed-1

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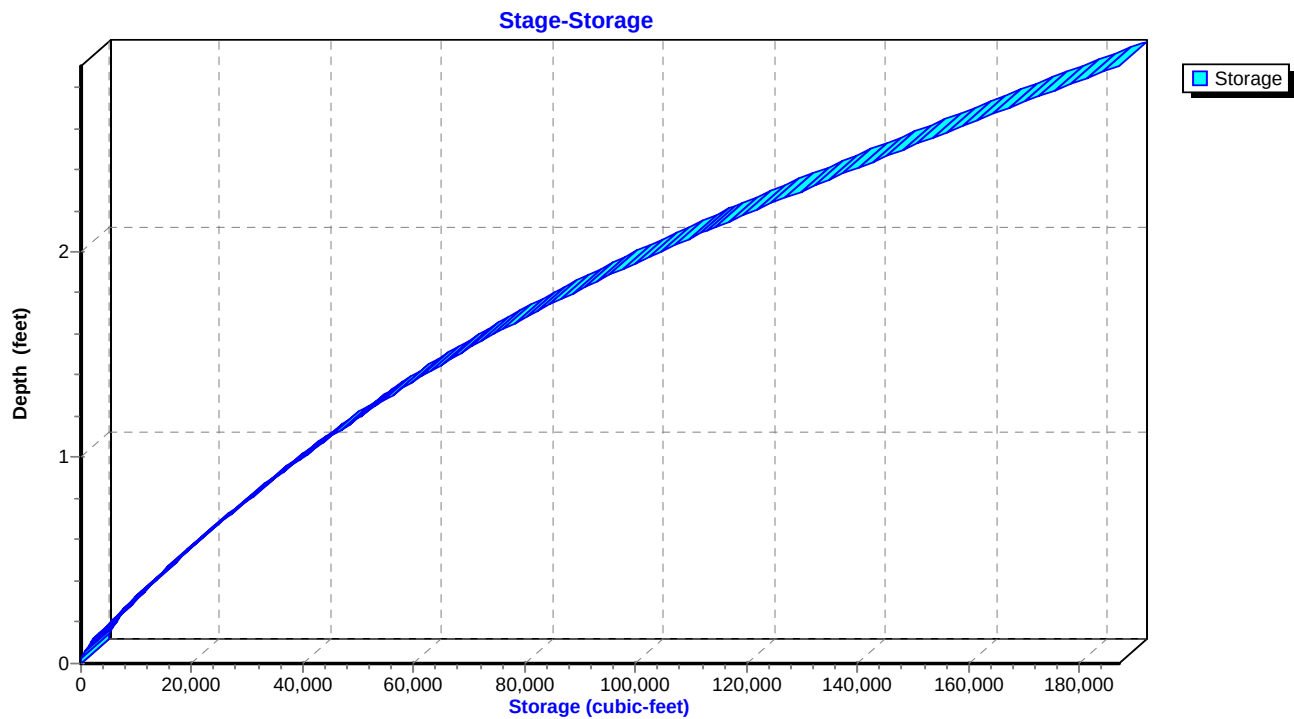
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SJRWMD 96-hr tenth 100-yr96hr Rainfall=15.00"

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Reach 21R: RED13



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SJRWMD 96-hr tenth 100-yr96hr Rainfall=15.00"

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Summary for Reach 23R: RE14B

Inflow = 103.99 cfs @ 62.13 hrs, Volume= 160.383 af
Outflow = 103.99 cfs @ 62.14 hrs, Volume= 160.364 af, Atten= 0%, Lag= 0.5 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Max. Velocity= 4.68 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 2.71 fps, Avg. Travel Time= 0.5 min

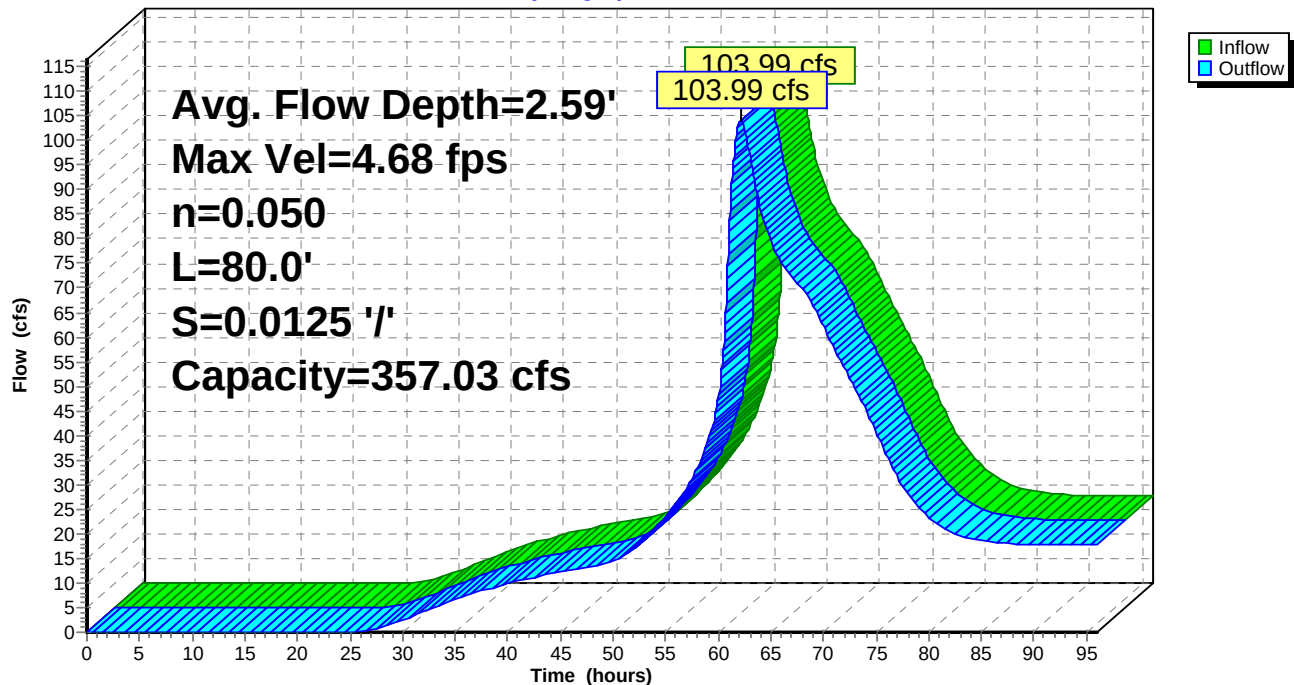
Peak Storage= 1,779 cf @ 62.14 hrs
Average Depth at Peak Storage= 2.59'
Bank-Full Depth= 5.00' Flow Area= 55.0 sf, Capacity= 357.03 cfs

6.00' x 5.00' deep channel, n= 0.050
Side Slope Z-value= 1.0 '/' Top Width= 16.00'
Length= 80.0' Slope= 0.0125 '/'
Inlet Invert= 36.00', Outlet Invert= 35.00'



Reach 23R: RE14B

Hydrograph



Proposed-1

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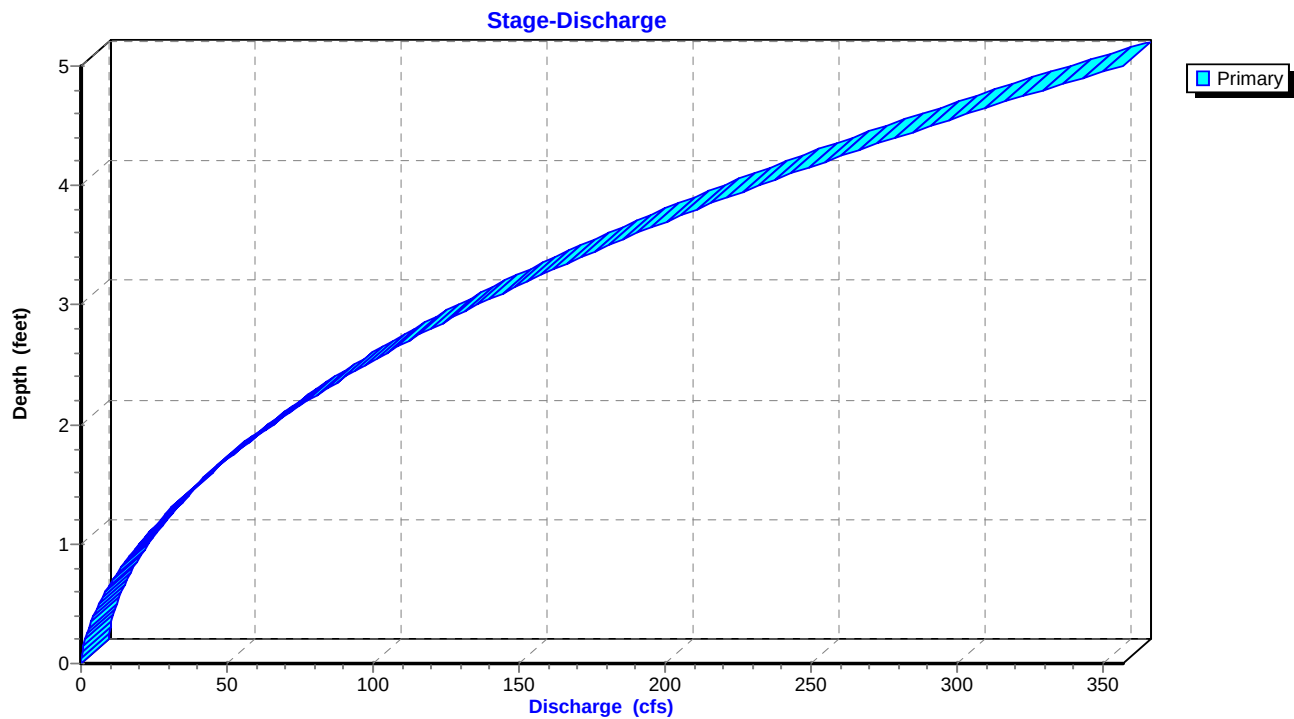
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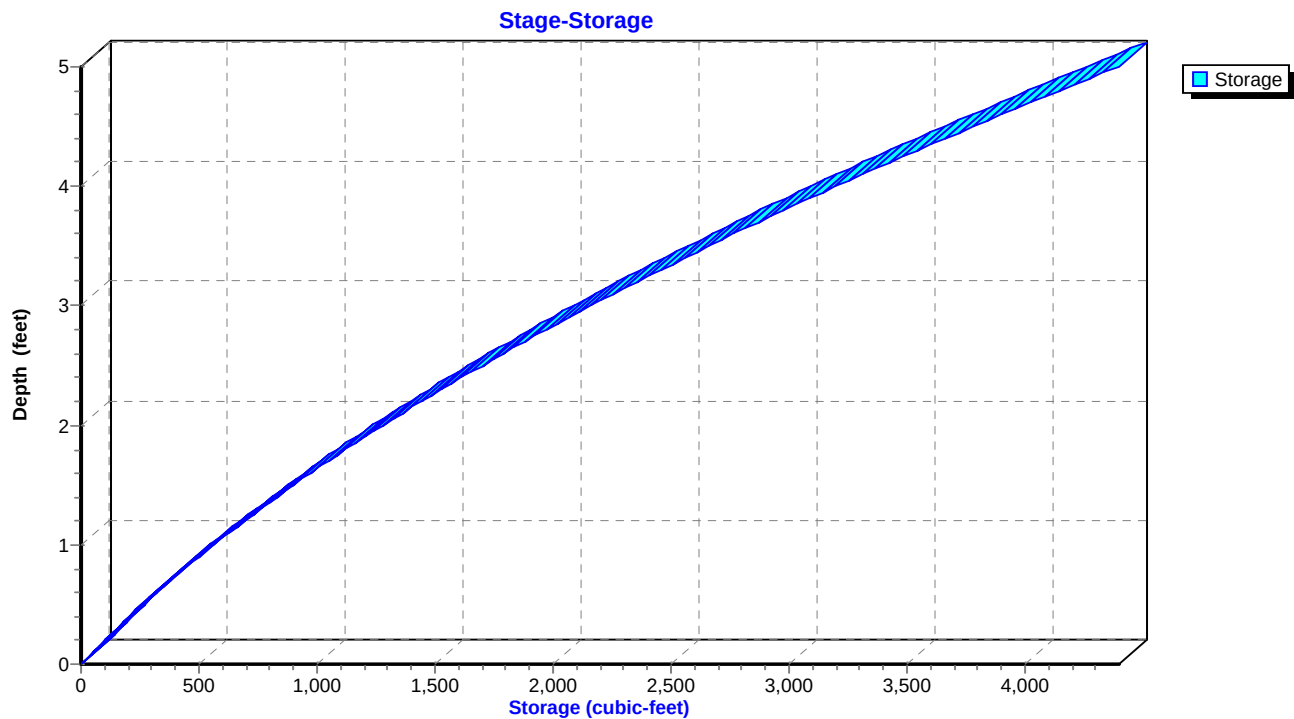
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Reach 23R: RE14B



Reach 23R: RE14B



Proposed-1

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SJRWMD 96-hr tenth 100-yr96hr Rainfall=15.00"

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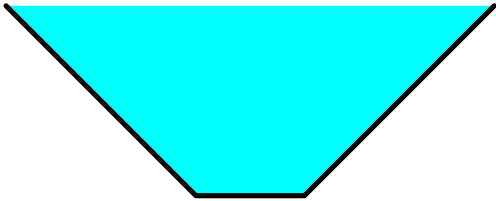
Summary for Reach 26R: RE12A

Inflow Area = 333.700 ac, 0.00% Impervious, Inflow Depth > 5.22" for 100-yr96hr event
Inflow = 580.10 cfs @ 62.13 hrs, Volume= 145.061 af
Outflow = 574.00 cfs @ 62.42 hrs, Volume= 144.878 af, Atten= 1%, Lag= 17.4 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Max. Velocity= 3.02 fps, Min. Travel Time= 8.8 min
Avg. Velocity= 0.92 fps, Avg. Travel Time= 29.1 min

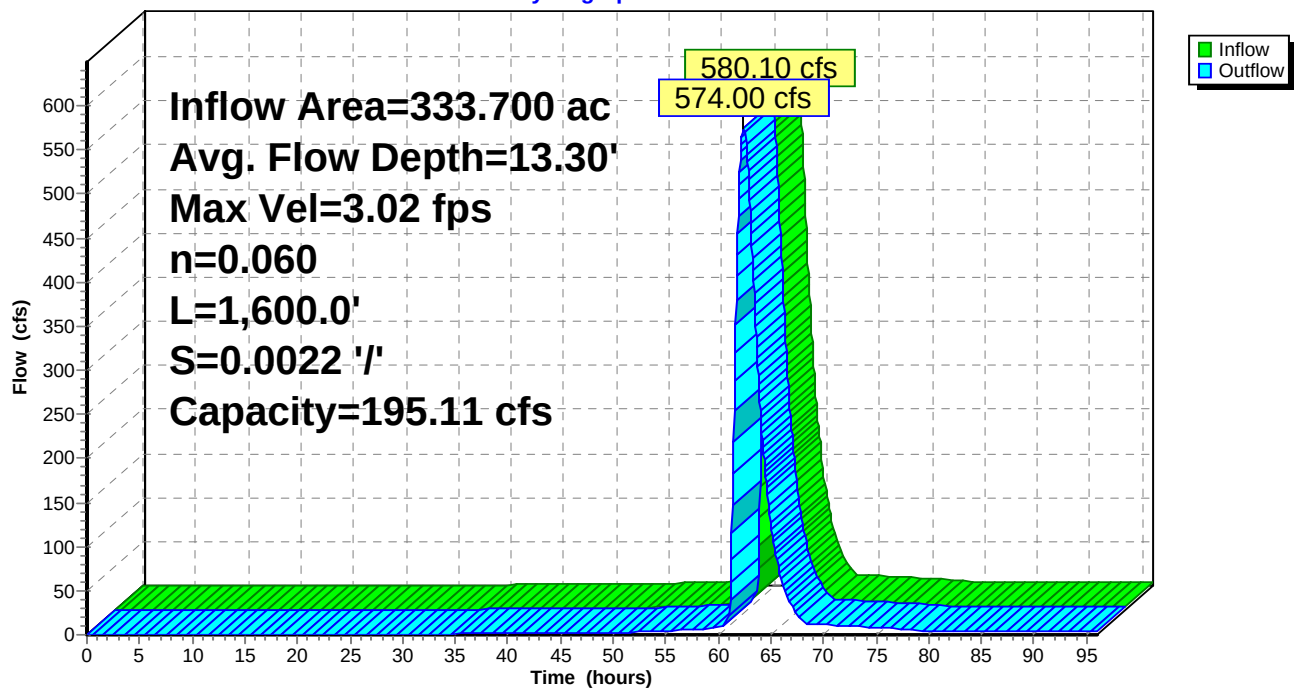
Peak Storage= 303,880 cf @ 62.28 hrs
Average Depth at Peak Storage= 13.30'
Bank-Full Depth= 7.00' Flow Area= 77.0 sf, Capacity= 195.11 cfs

4.00' x 7.00' deep channel, n= 0.060
Side Slope Z-value= 1.0 '/' Top Width= 18.00'
Length= 1,600.0' Slope= 0.0022 '/'
Inlet Invert= 31.50', Outlet Invert= 28.00'



Reach 26R: RE12A

Hydrograph



Proposed-1

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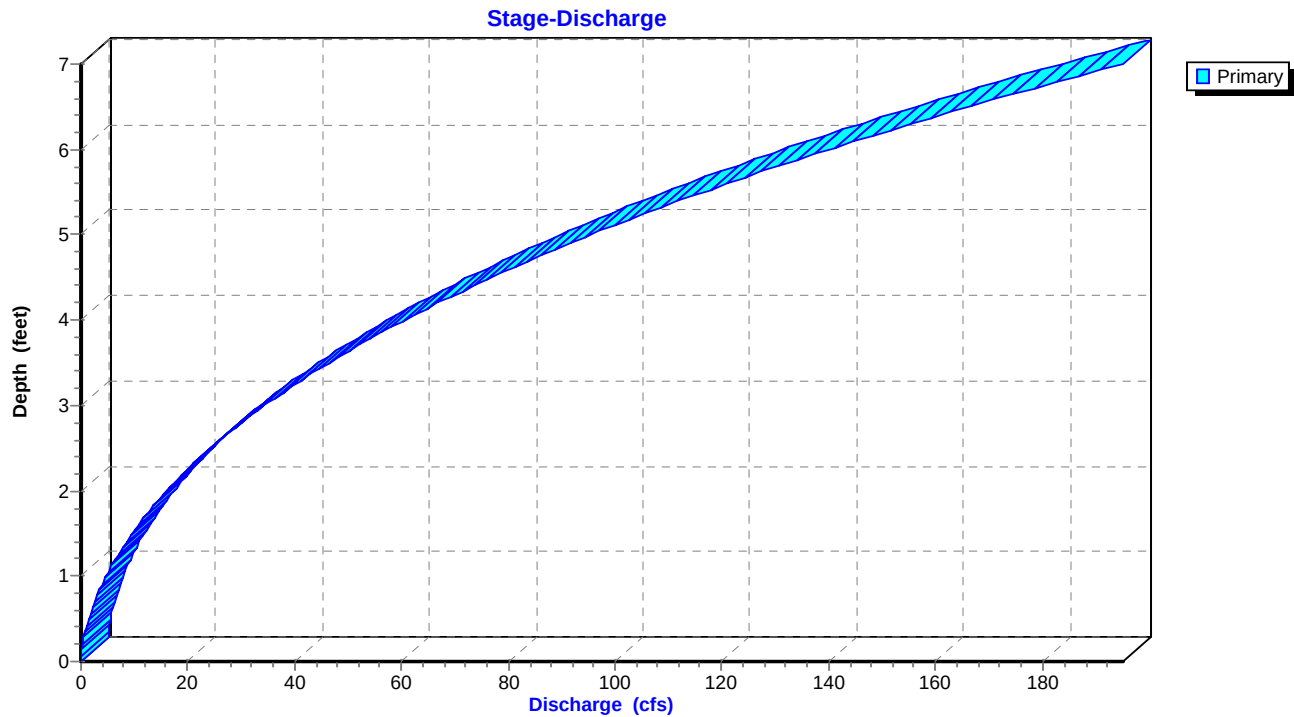
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SJRWMD 96-hr tenth 100-yr96hr Rainfall=15.00"

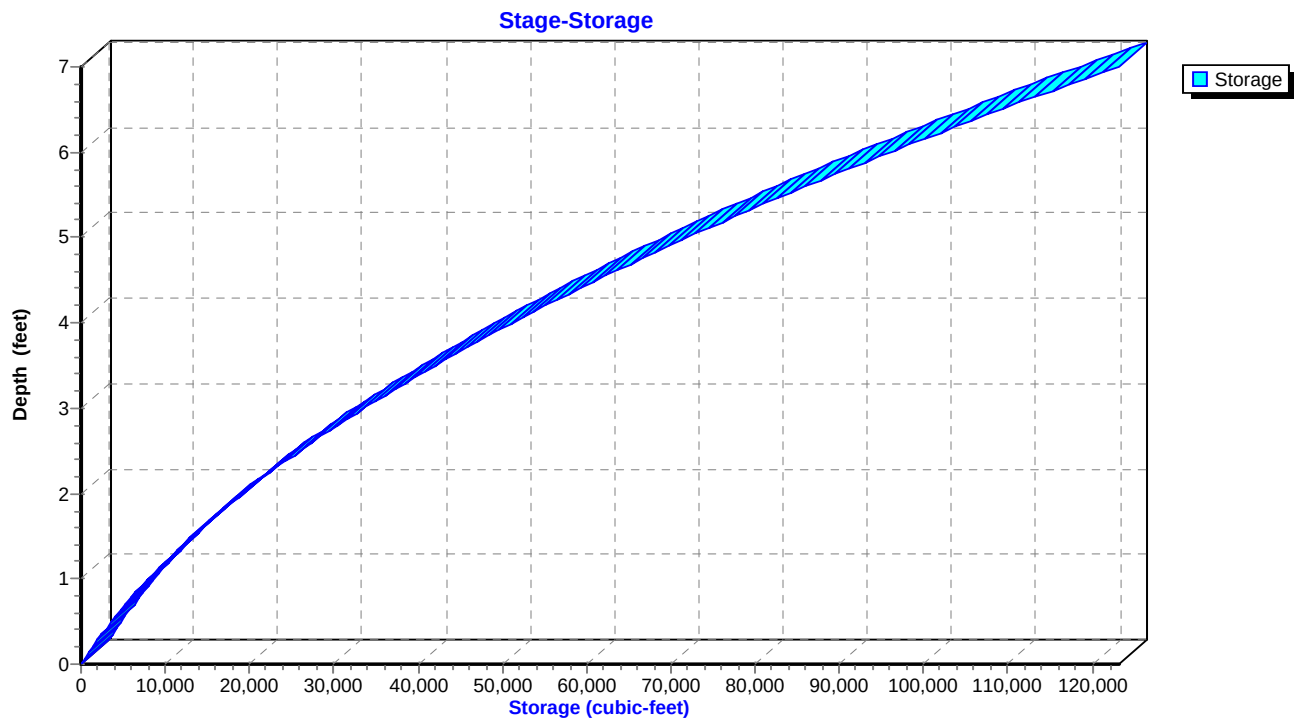
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Reach 26R: RE12A



Reach 26R: RE12A



Proposed-1

SJRWMD 96-hr tenth 100-yr96hr Rainfall=15.00"

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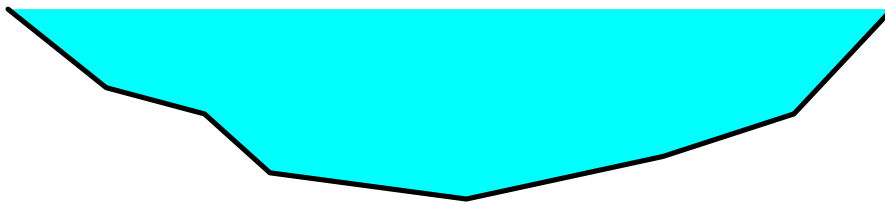
Summary for Reach 27R: RED6

Inflow Area = 992.720 ac, 0.00% Impervious, Inflow Depth > 7.43" for 100-yr96hr event
Inflow = 669.56 cfs @ 62.05 hrs, Volume= 614.889 af
Outflow = 666.30 cfs @ 62.34 hrs, Volume= 612.641 af, Atten= 0%, Lag= 17.5 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Max. Velocity= 4.27 fps, Min. Travel Time= 9.0 min
Avg. Velocity= 1.90 fps, Avg. Travel Time= 20.2 min

Peak Storage= 358,859 cf @ 62.19 hrs
Average Depth at Peak Storage= 7.74'
Bank-Full Depth= 5.80' Flow Area= 103.7 sf, Capacity= 389.01 cfs

Custom cross-section, Length= 2,300.0' Slope= 0.0015 '/' (104 Elevation Intervals)
Constant n= 0.035
Inlet Invert= 29.50', Outlet Invert= 26.00'



Offset (feet)	Elevation (feet)	Chan.Depth (feet)
0.00	31.00	0.00
3.00	28.60	2.40
6.00	27.80	3.20
8.00	26.00	5.00
14.00	25.20	5.80
20.00	26.50	4.50
24.00	27.80	3.20
27.00	31.00	0.00

Depth (feet)	End Area (sq-ft)	Perim. (feet)	Storage (cubic-feet)	Discharge (cfs)
0.00	0.0	0.0	0	0.00
0.80	3.9	9.8	8,917	3.45
1.30	9.4	12.9	21,709	12.67
2.60	29.3	19.1	67,390	64.57
3.40	45.2	23.3	103,960	116.48
5.80	103.7	30.4	238,510	389.01

Proposed-1

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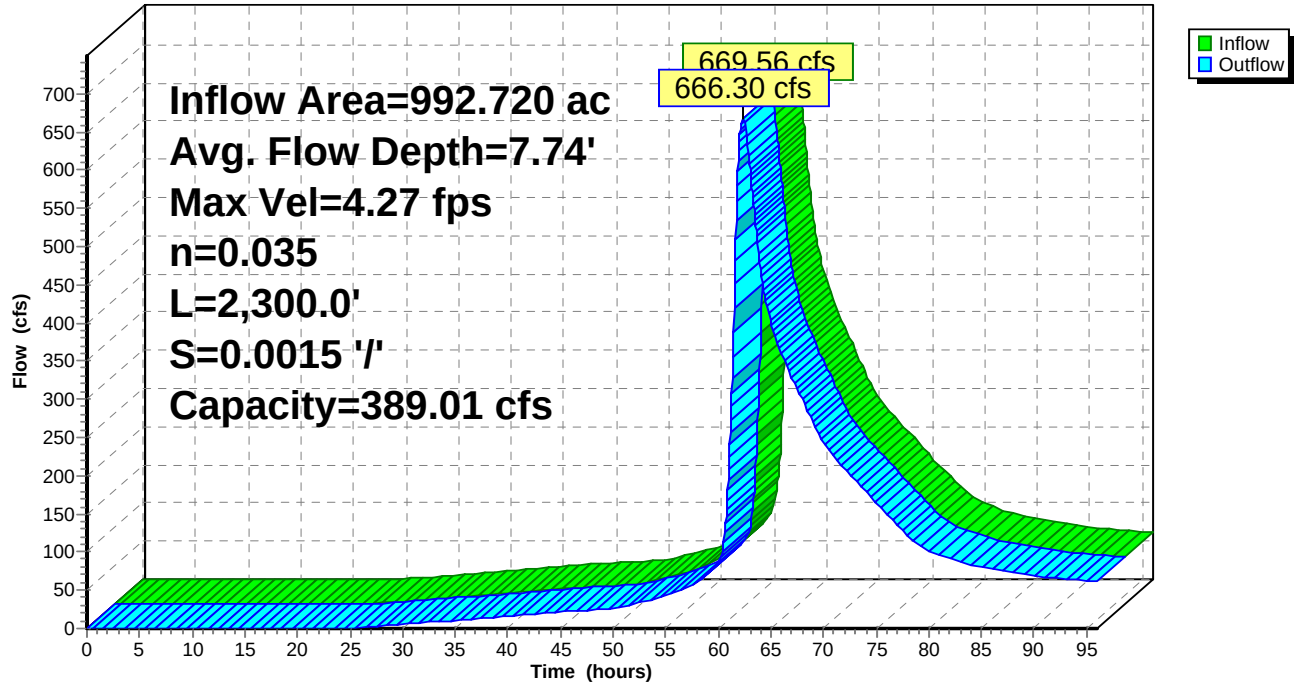
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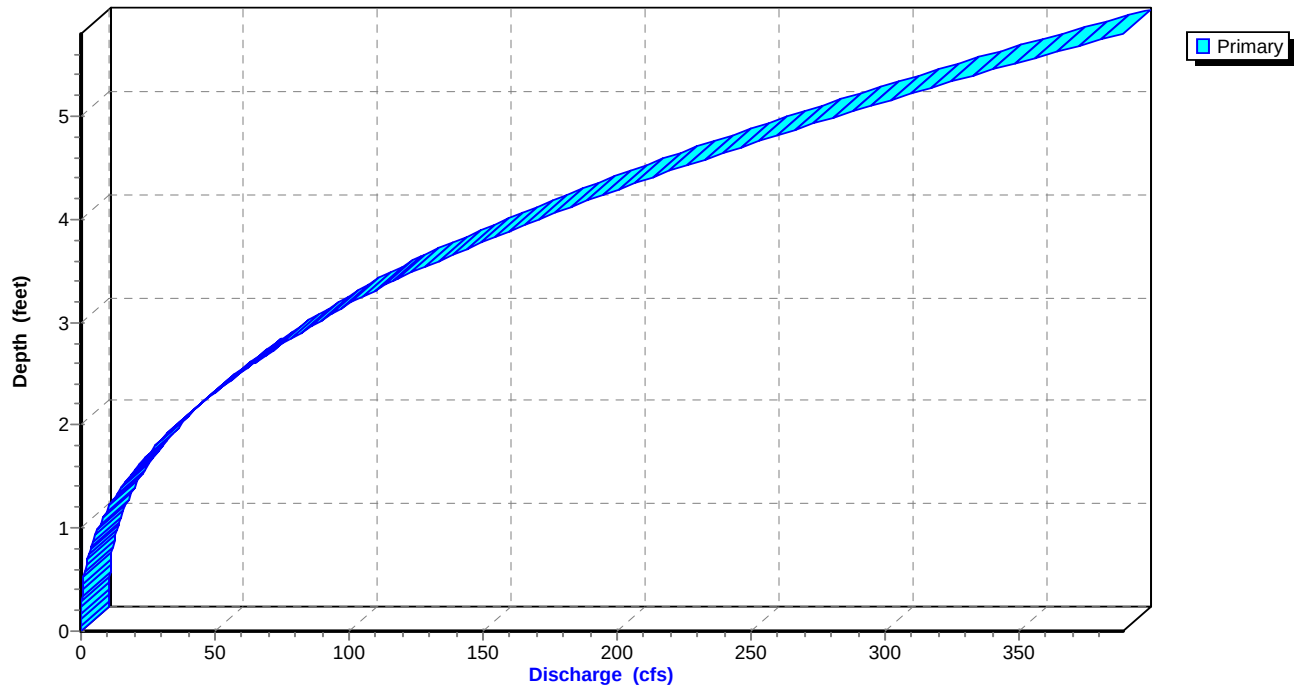
Reach 27R: RED6

Hydrograph



Reach 27R: RED6

Stage-Discharge



Proposed-1

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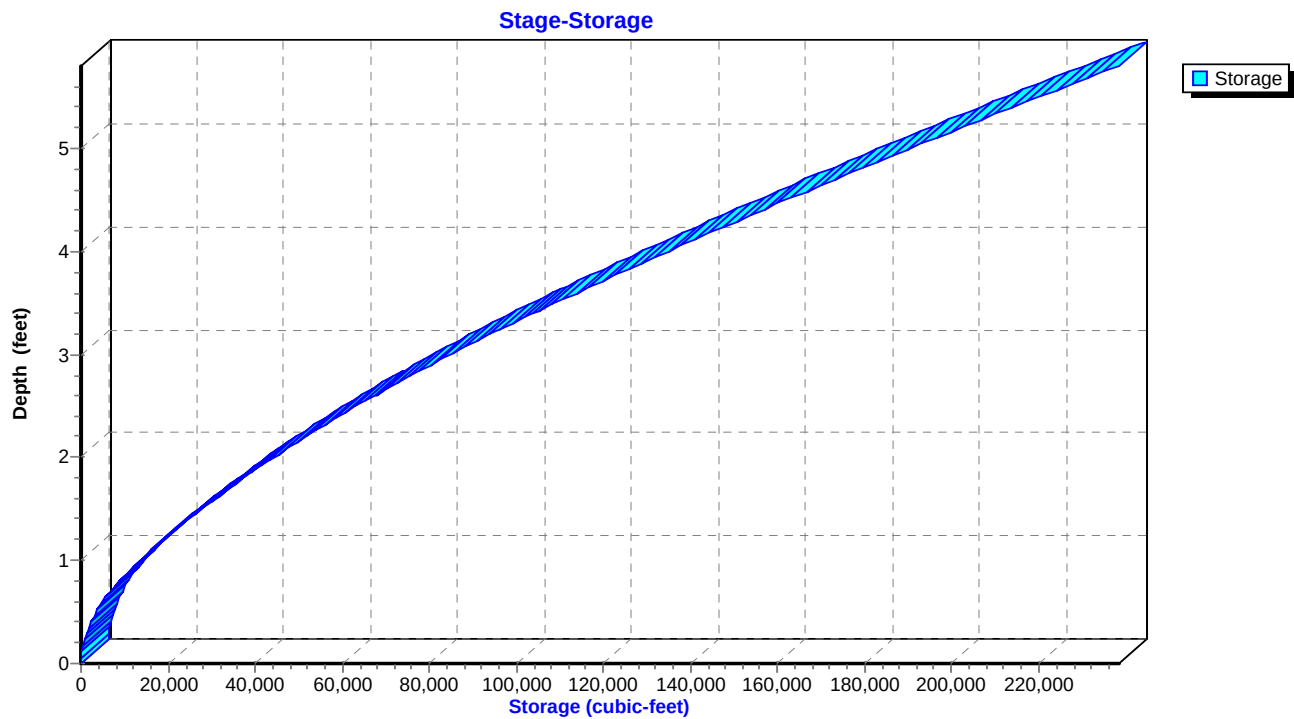
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Reach 27R: RED6



Proposed-1

SJRWMD 96-hr tenth 100-yr96hr Rainfall=15.00"

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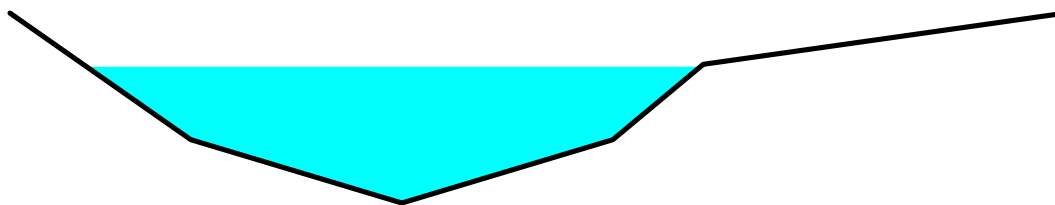
Summary for Reach 30R: RED12

Inflow Area = 400.100 ac, 0.00% Impervious, Inflow Depth > 6.25" for 100-yr96hr event
Inflow = 380.74 cfs @ 63.60 hrs, Volume= 208.433 af
Outflow = 380.53 cfs @ 63.63 hrs, Volume= 208.393 af, Atten= 0%, Lag= 1.7 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Max. Velocity= 6.76 fps, Min. Travel Time= 1.0 min
Avg. Velocity= 2.67 fps, Avg. Travel Time= 2.5 min

Peak Storage= 22,542 cf @ 63.61 hrs
Average Depth at Peak Storage= 4.52'
Bank-Full Depth= 6.30' Flow Area= 105.1 sf, Capacity= 762.50 cfs

Custom cross-section, Length= 400.0' Slope= 0.0075 '/' (101 Elevation Intervals)
Constant n= 0.035
Inlet Invert= 28.60', Outlet Invert= 25.60'



Offset (feet)	Elevation (feet)	Chan.Depth (feet)
0.00	31.90	0.00
6.00	27.70	4.20
13.00	25.60	6.30
20.00	27.70	4.20
23.00	30.20	1.70
35.00	31.90	0.00

Depth (feet)	End Area (sq-ft)	Perim. (feet)	Storage (cubic-feet)	Discharge (cfs)
0.00	0.0	0.0	0	0.00
2.10	14.7	14.6	5,880	54.26
4.60	57.9	22.9	23,166	395.43
6.30	105.1	38.0	42,060	762.50

Proposed-1

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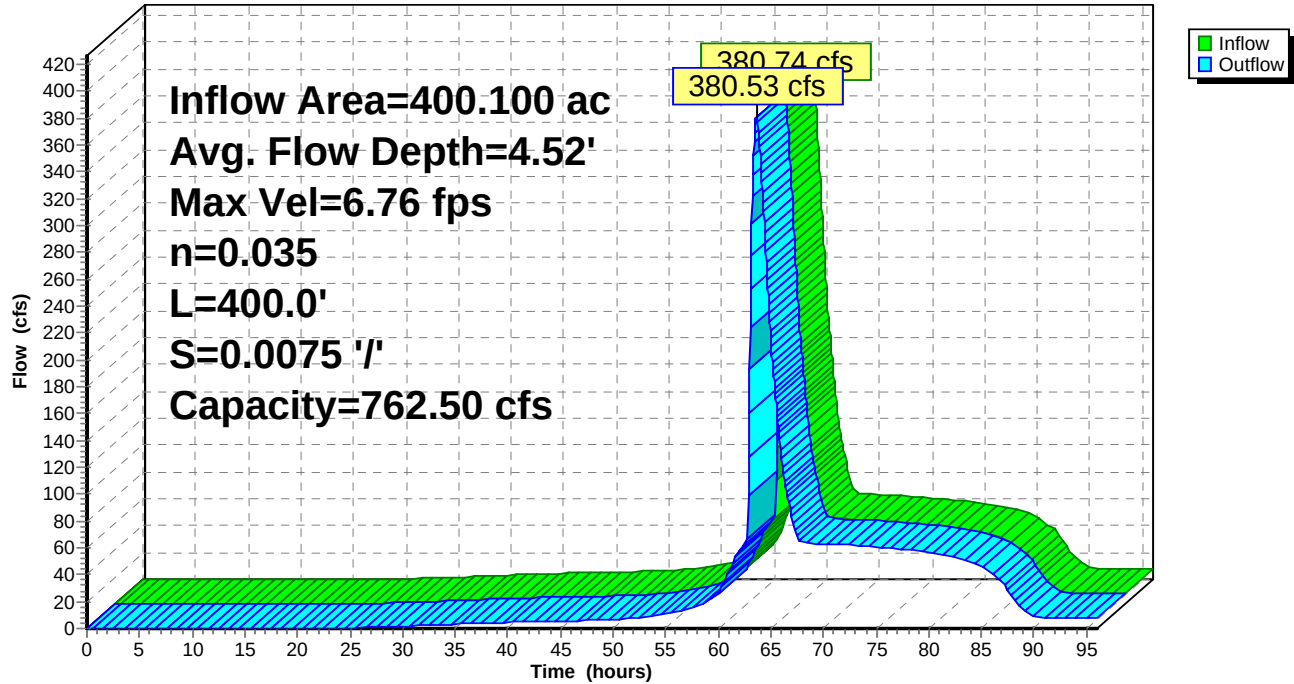
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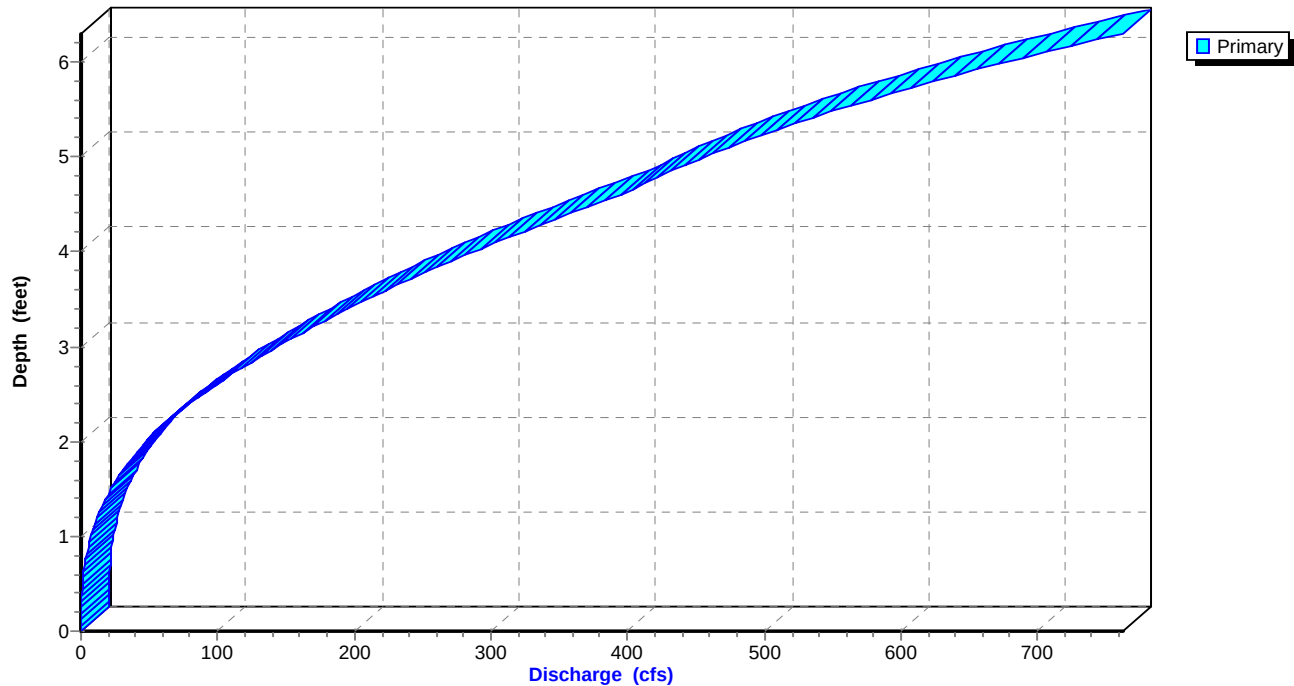
Reach 30R: RED12

Hydrograph



Reach 30R: RED12

Stage-Discharge



Proposed-1

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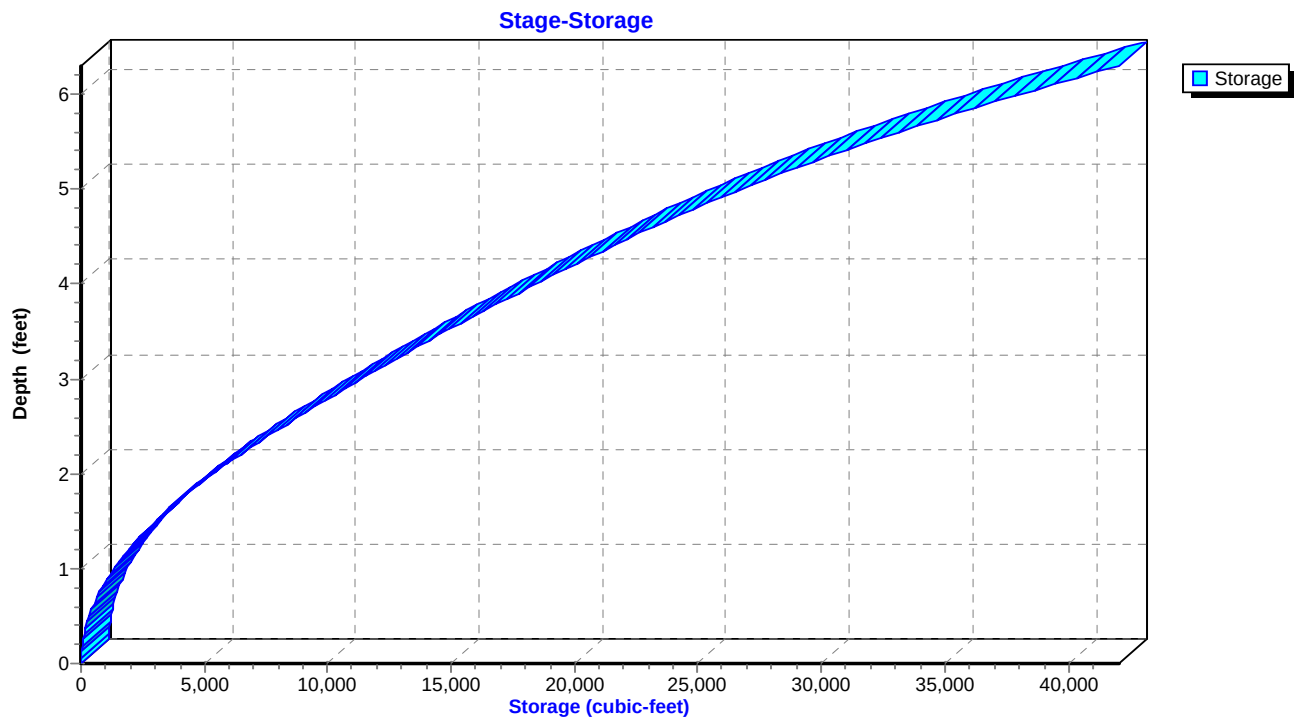
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Reach 30R: RED12



Proposed-1

SJRWMD 96-hr tenth 100-yr96hr Rainfall=15.00"

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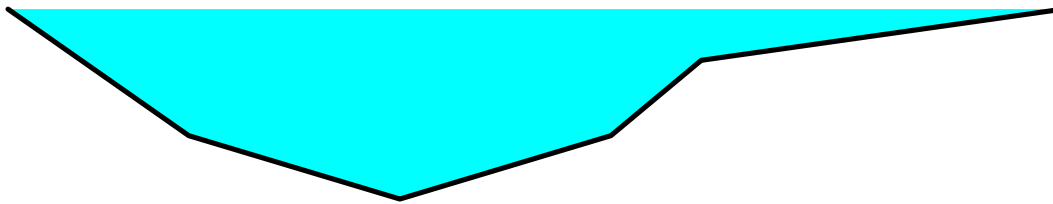
Summary for Reach 31R: RED11

Inflow Area = 1,087.600 ac, 0.00% Impervious, Inflow Depth > 5.17" for 100-yr96hr event
Inflow = 510.27 cfs @ 63.57 hrs, Volume= 468.364 af
Outflow = 445.73 cfs @ 64.72 hrs, Volume= 465.663 af, Atten= 13%, Lag= 68.6 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Max. Velocity= 0.77 fps, Min. Travel Time= 34.8 min
Avg. Velocity= 0.58 fps, Avg. Travel Time= 46.1 min

Peak Storage= 929,832 cf @ 64.14 hrs
Average Depth at Peak Storage= 20.00'
Bank-Full Depth= 6.30' Flow Area= 105.1 sf, Capacity= 69.61 cfs

Custom cross-section, Length= 1,600.0' Slope= 0.0001 '/' (101 Elevation Intervals)
Constant n= 0.035
Inlet Invert= 25.60', Outlet Invert= 25.50'



Offset (feet)	Elevation (feet)	Chan.Depth (feet)
0.00	31.90	0.00
6.00	27.70	4.20
13.00	25.60	6.30
20.00	27.70	4.20
23.00	30.20	1.70
35.00	31.90	0.00

Depth (feet)	End Area (sq-ft)	Perim. (feet)	Storage (cubic-feet)	Discharge (cfs)
0.00	0.0	0.0	0	0.00
2.10	14.7	14.6	23,520	4.95
4.60	57.9	22.9	92,663	36.10
6.30	105.1	38.0	168,240	69.61

Proposed-1

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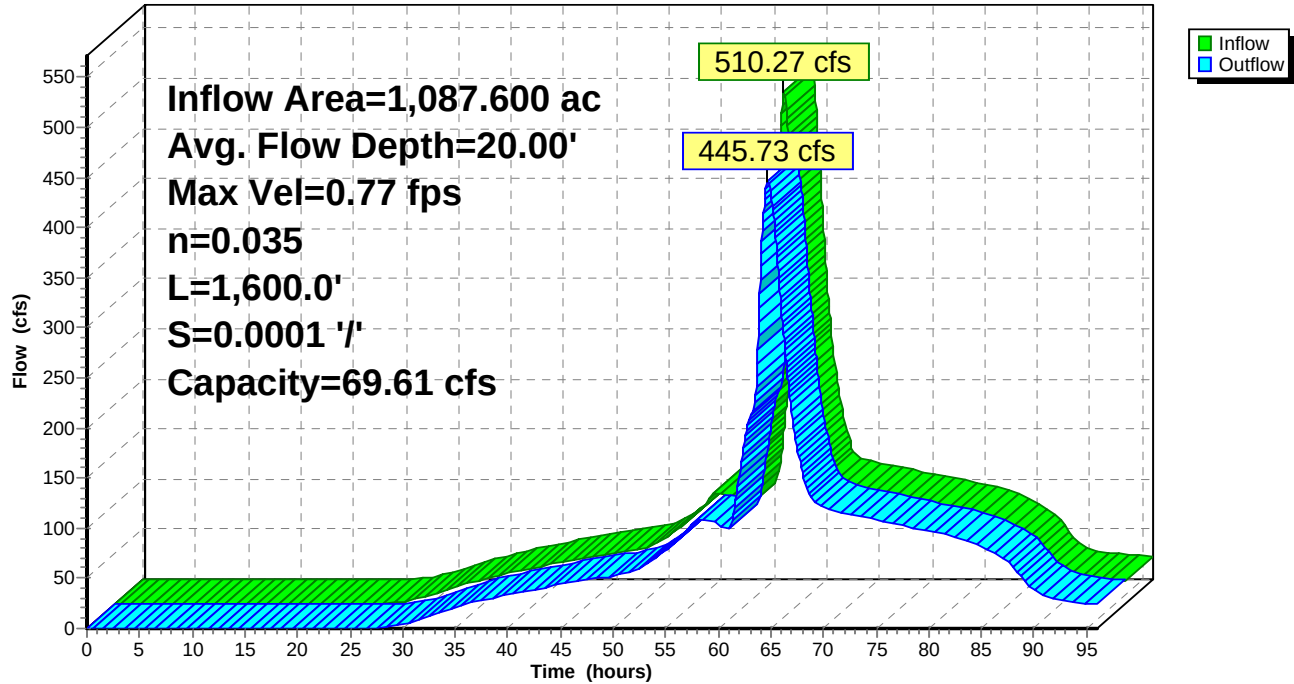
SJRWMD 96-hr tenth 100-yr96hr Rainfall=15.00"

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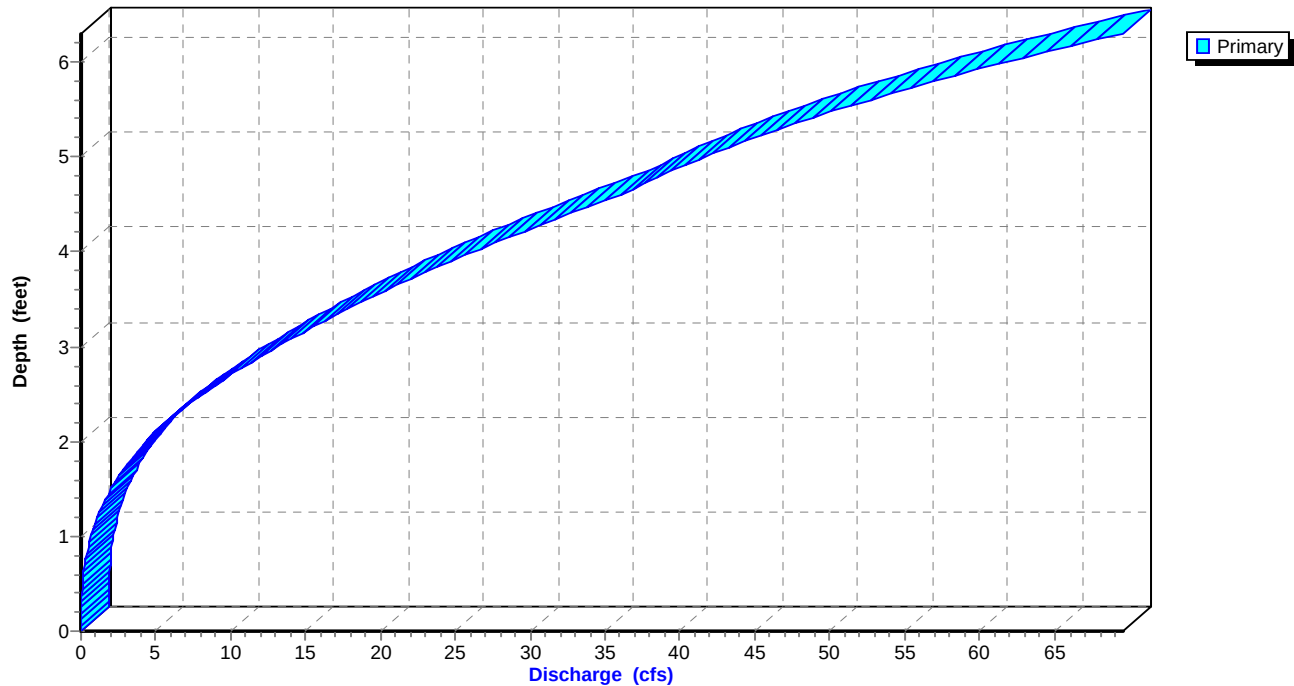
Reach 31R: RED11

Hydrograph



Reach 31R: RED11

Stage-Discharge



Proposed-1

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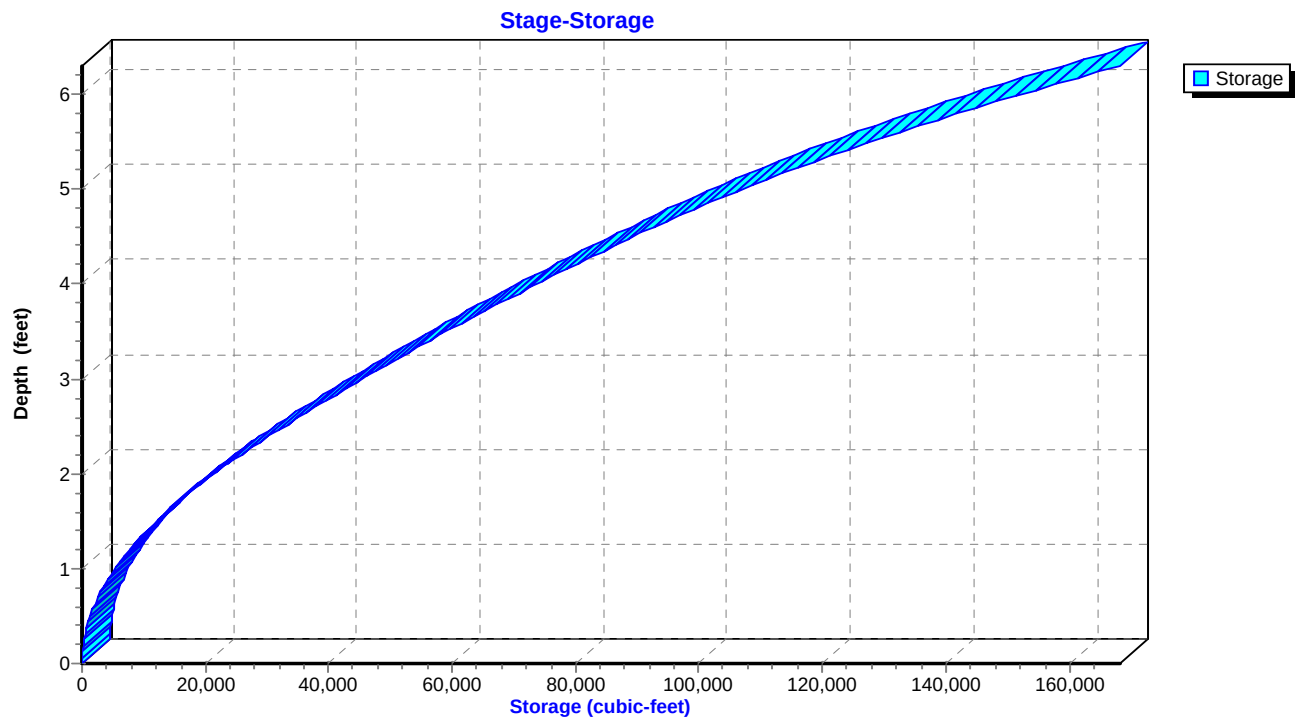
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Reach 31R: RED11



Proposed-1

SJRWMD 96-hr tenth 100-yr96hr Rainfall=15.00"

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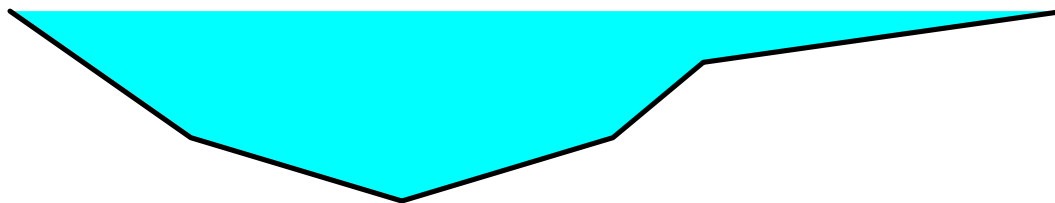
Summary for Reach 35R: RED10

Inflow Area = 1,087.600 ac, 0.00% Impervious, Inflow Depth > 5.14" for 100-yr96hr event
Inflow = 445.73 cfs @ 64.72 hrs, Volume= 465.663 af
Outflow = 439.78 cfs @ 65.12 hrs, Volume= 464.542 af, Atten= 1%, Lag= 24.4 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.92 fps, Min. Travel Time= 12.2 min
Avg. Velocity= 1.28 fps, Avg. Travel Time= 18.2 min

Peak Storage= 321,416 cf @ 64.92 hrs
Average Depth at Peak Storage= 9.88'
Bank-Full Depth= 6.30' Flow Area= 105.1 sf, Capacity= 182.27 cfs

Custom cross-section, Length= 1,400.0' Slope= 0.0004 '/' (101 Elevation Intervals)
Constant n= 0.035
Inlet Invert= 26.20', Outlet Invert= 25.60'



Offset (feet)	Elevation (feet)	Chan.Depth (feet)
0.00	31.90	0.00
6.00	27.70	4.20
13.00	25.60	6.30
20.00	27.70	4.20
23.00	30.20	1.70
35.00	31.90	0.00

Depth (feet)	End Area (sq-ft)	Perim. (feet)	Storage (cubic-feet)	Discharge (cfs)
0.00	0.0	0.0	0	0.00
2.10	14.7	14.6	20,580	12.97
4.60	57.9	22.9	81,080	94.53
6.30	105.1	38.0	147,210	182.27

Proposed-1

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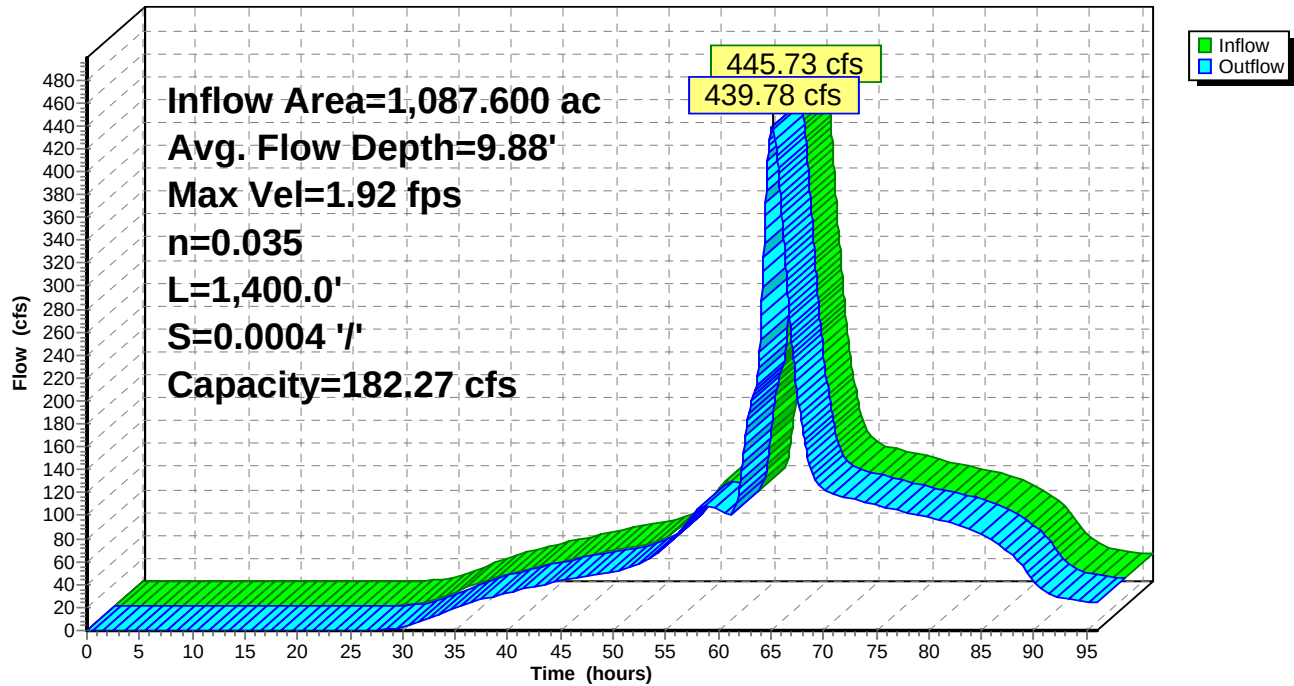
SJRWMD 96-hr tenth 100-yr96hr Rainfall=15.00"

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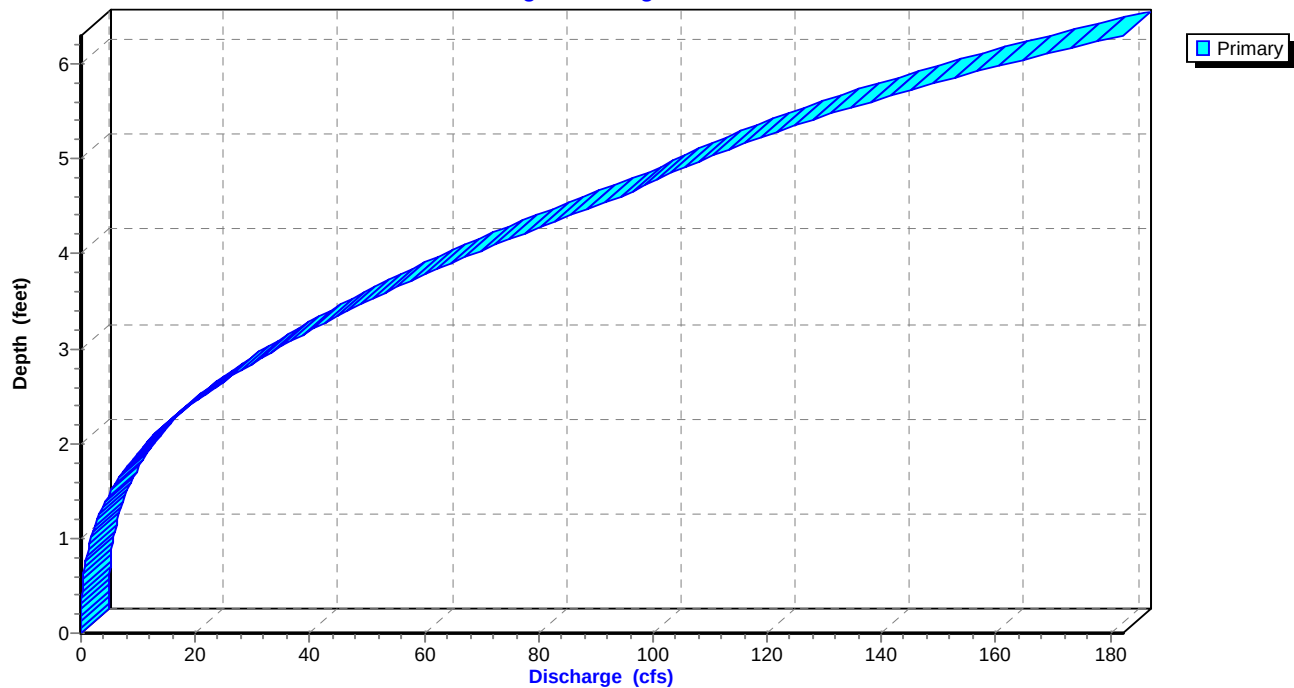
Reach 35R: RED10

Hydrograph



Reach 35R: RED10

Stage-Discharge



Proposed-1

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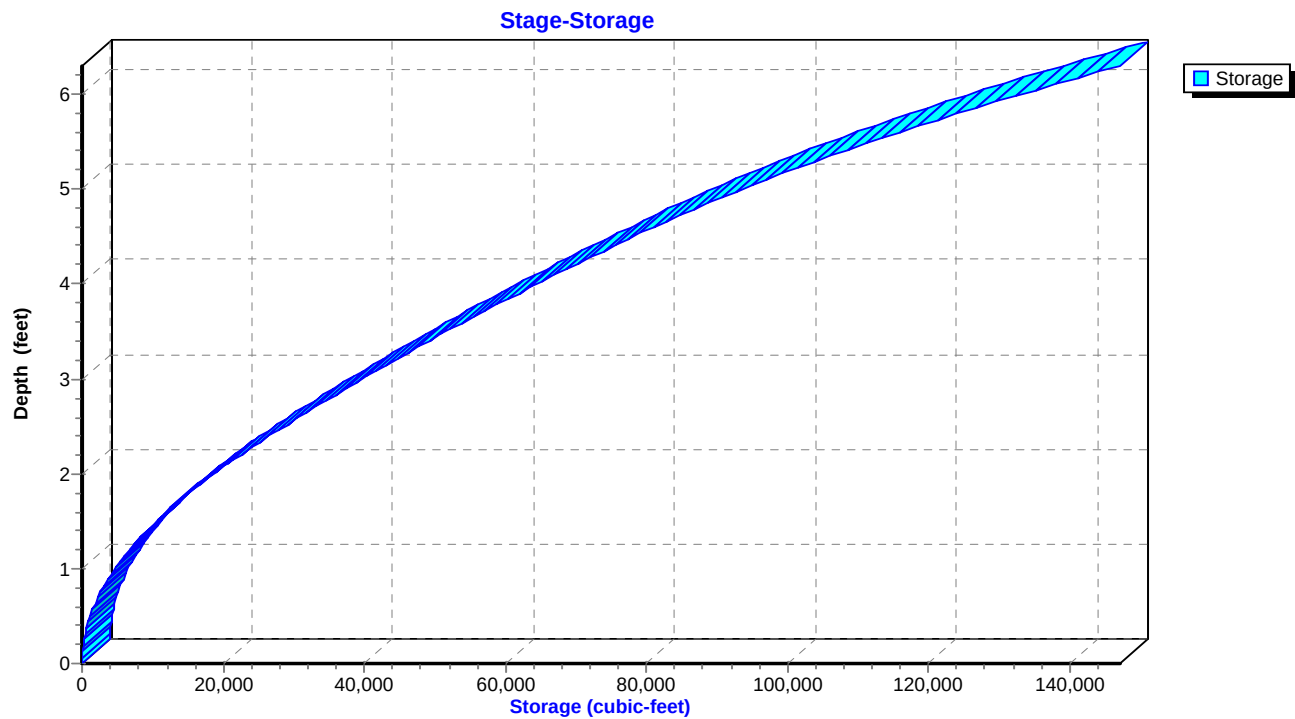
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SJRWMD 96-hr tenth 100-yr96hr Rainfall=15.00"

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Reach 35R: RED10



Proposed-1

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Summary for Pond 10P: Pond 4-1

Inflow Area = 84.150 ac, 0.00% Impervious, Inflow Depth > 12.73" for 100-yr96hr event
Inflow = 345.39 cfs @ 60.74 hrs, Volume= 89.235 af
Outflow = 120.40 cfs @ 61.72 hrs, Volume= 68.849 af, Atten= 65%, Lag= 58.9 min
Primary = 120.40 cfs @ 61.72 hrs, Volume= 68.849 af

Routing by Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Starting Elev= 30.00' Surf.Area= 9.570 ac Storage= 36.890 af
Peak Elev= 34.39' @ 61.72 hrs Surf.Area= 10.317 ac Storage= 80.570 af (43.680 af above start)

Plug-Flow detention time= 1,492.9 min calculated for 31.942 af (36% of inflow)
Center-of-Mass det. time= 388.3 min (4,062.0 - 3,673.7)

Volume	Invert	Avail.Storage	Storage Description
#1	26.00'	97.370 af	Custom Stage Data (Prismatic) Listed below (Recalc)
Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
26.00	8.870	0.000	0.000
27.00	9.050	8.960	8.960
28.00	9.220	9.135	18.095
29.00	9.400	9.310	27.405
30.00	9.570	9.485	36.890
31.00	9.740	9.655	46.545
32.00	9.910	9.825	56.370
33.00	10.080	9.995	66.365
34.00	10.250	10.165	76.530
35.00	10.420	10.335	86.865
36.00	10.590	10.505	97.370

Device	Routing	Invert	Outlet Devices
#1	Primary	30.00'	7.2" Vert. Orifice/Grate X 3.00 C= 0.600
#2	Primary	31.50'	90.0 deg x 0.5' long Sharp-Crested Vee/Trap Weir Cv= 2.50 (C= 3.13)
#3	Primary	32.50'	8.0' long x 1.0' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 Coef. (English) 2.69 2.72 2.75 2.85 2.98 3.08 3.20 3.28 3.31 3.30 3.31 3.32

Primary OutFlow Max=120.36 cfs @ 61.72 hrs HW=34.39' (Free Discharge)

- 1=Orifice/Grate (Orifice Controls 8.26 cfs @ 9.74 fps)
- 2=Sharp-Crested Vee/Trap Weir (Weir Controls 43.26 cfs @ 4.41 fps)
- 3=Broad-Crested Rectangular Weir (Weir Controls 68.84 cfs @ 4.55 fps)

Proposed-1

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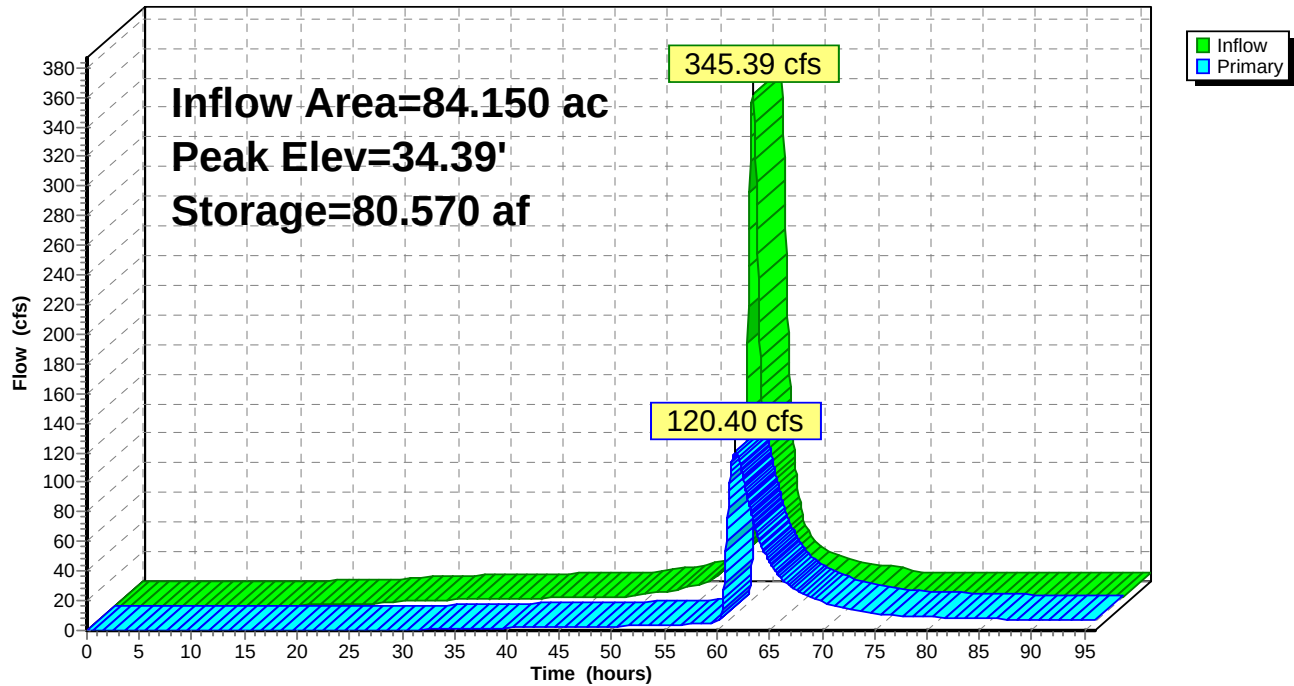
SJRWMD 96-hr tenth 100-yr96hr Rainfall=15.00"

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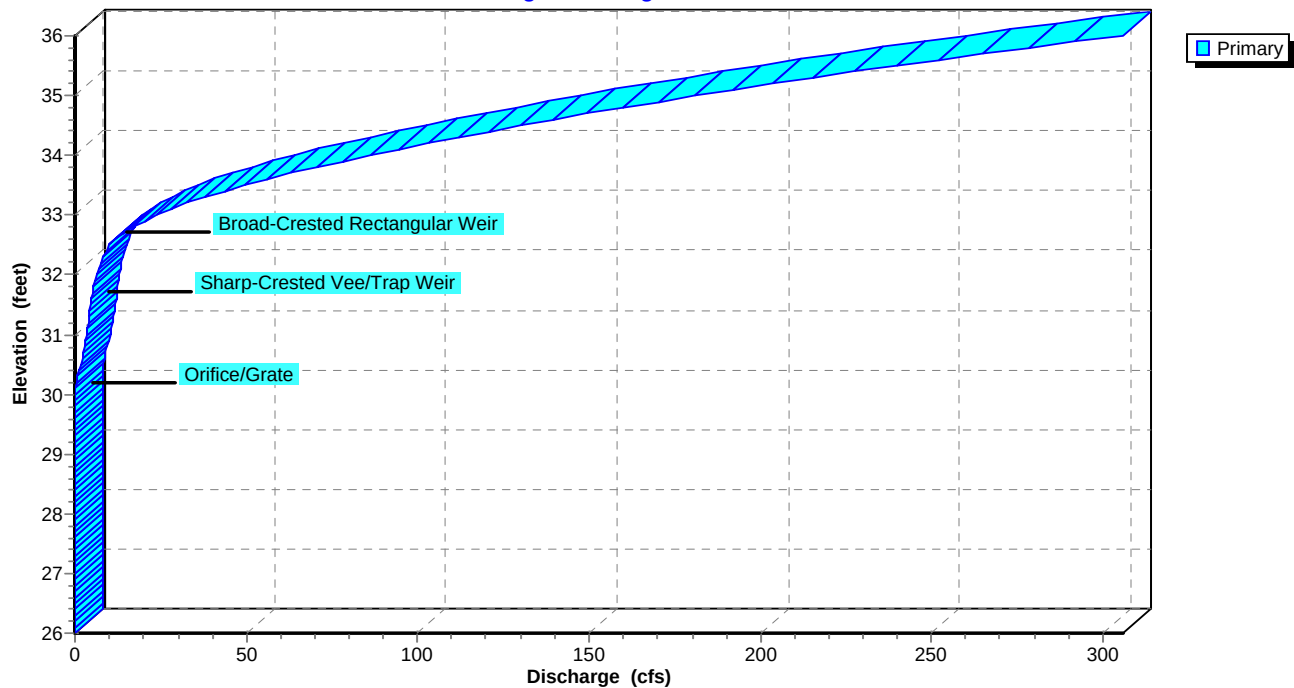
Pond 10P: Pond 4-1

Hydrograph



Pond 10P: Pond 4-1

Stage-Discharge



Proposed-1

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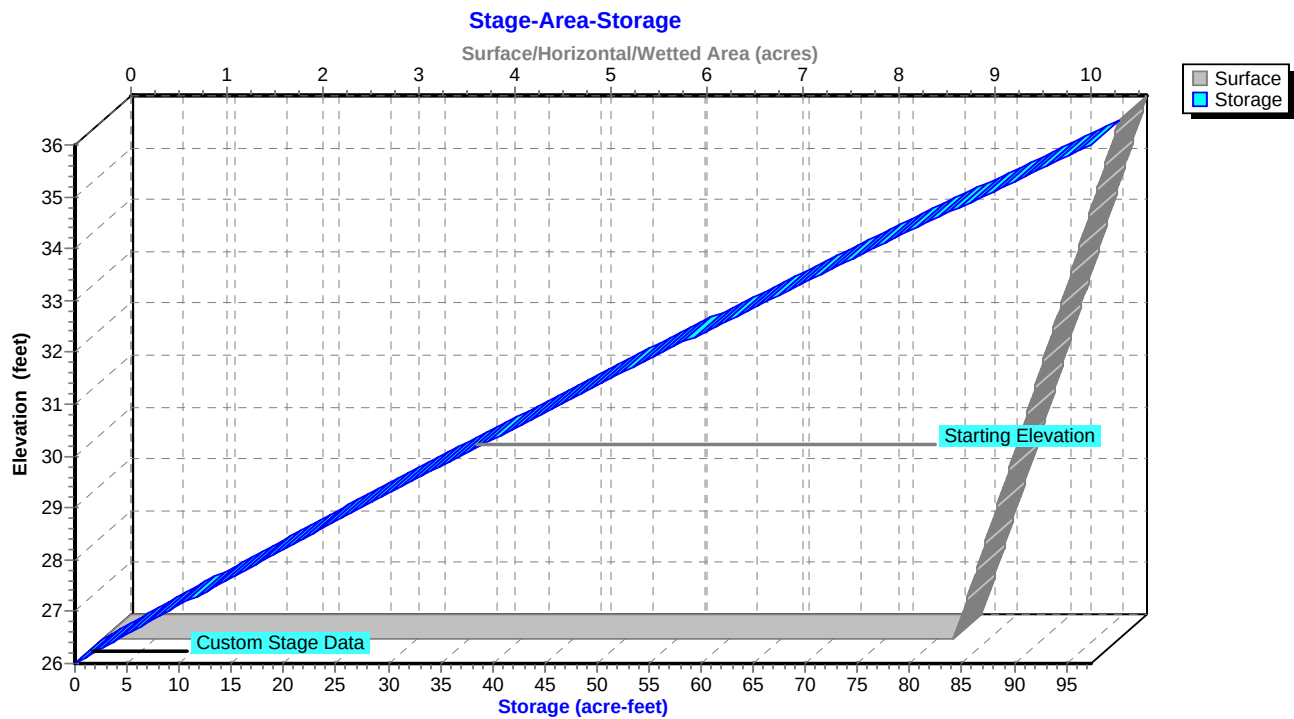
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SJRWMD 96-hr tenth 100-yr96hr Rainfall=15.00"

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Pond 10P: Pond 4-1



Proposed-1

SJRWMD 96-hr tenth 100-yr96hr Rainfall=15.00"

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Summary for Pond 11P: Pond 4-2

Inflow Area = 76.000 ac, 0.00% Impervious, Inflow Depth > 13.00" for 100-yr96hr event
Inflow = 314.26 cfs @ 60.72 hrs, Volume= 82.347 af
Outflow = 90.94 cfs @ 61.89 hrs, Volume= 60.254 af, Atten= 71%, Lag= 70.2 min
Primary = 90.94 cfs @ 61.89 hrs, Volume= 60.254 af

Routing by Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Starting Elev= 31.00' Surf.Area= 9.960 ac Storage= 19.555 af
Peak Elev= 35.13' @ 61.89 hrs Surf.Area= 10.704 ac Storage= 62.250 af (42.695 af above start)

Plug-Flow detention time= 1,176.9 min calculated for 40.699 af (49% of inflow)
Center-of-Mass det. time= 429.7 min (4,083.8 - 3,654.1)

Volume	Invert	Avail.Storage	Storage Description
#1	29.00'	104.995 af	Custom Stage Data (Prismatic) Listed below (Recalc)
Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
29.00	9.590	0.000	0.000
30.00	9.780	9.685	9.685
31.00	9.960	9.870	19.555
32.00	10.140	10.050	29.605
33.00	10.320	10.230	39.835
34.00	10.500	10.410	50.245
35.00	10.680	10.590	60.835
36.00	10.860	10.770	71.605
37.00	11.040	10.950	82.555
38.00	11.220	11.130	93.685
39.00	11.400	11.310	104.995

Device	Routing	Invert	Outlet Devices
#1	Primary	31.00'	7.2" Vert. Orifice/Grate X 3.00 C= 0.600
#2	Primary	32.50'	90.0 deg Sharp-Crested Vee/Trap Weir Cv= 2.50 (C= 3.13)
#3	Primary	33.50'	8.0' long x 1.0' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 Coef. (English) 2.69 2.72 2.75 2.85 2.98 3.08 3.20 3.28 3.31 3.30 3.31 3.32

Primary OutFlow Max=90.90 cfs @ 61.89 hrs HW=35.13' (Free Discharge)

- 1=Orifice/Grate (Orifice Controls 8.00 cfs @ 9.43 fps)
- 2=Sharp-Crested Vee/Trap Weir (Weir Controls 28.10 cfs @ 4.06 fps)
- 3=Broad-Crested Rectangular Weir (Weir Controls 54.80 cfs @ 4.20 fps)

Proposed-1

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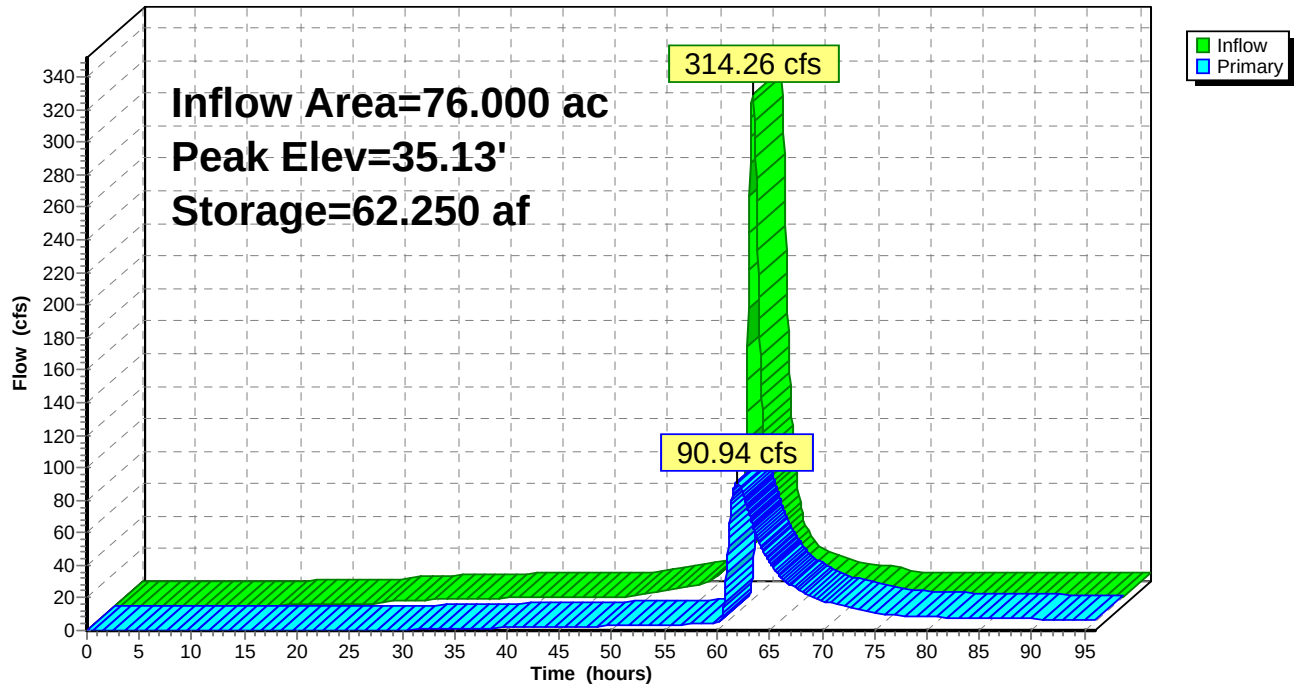
SJRWMD 96-hr tenth 100-yr96hr Rainfall=15.00"

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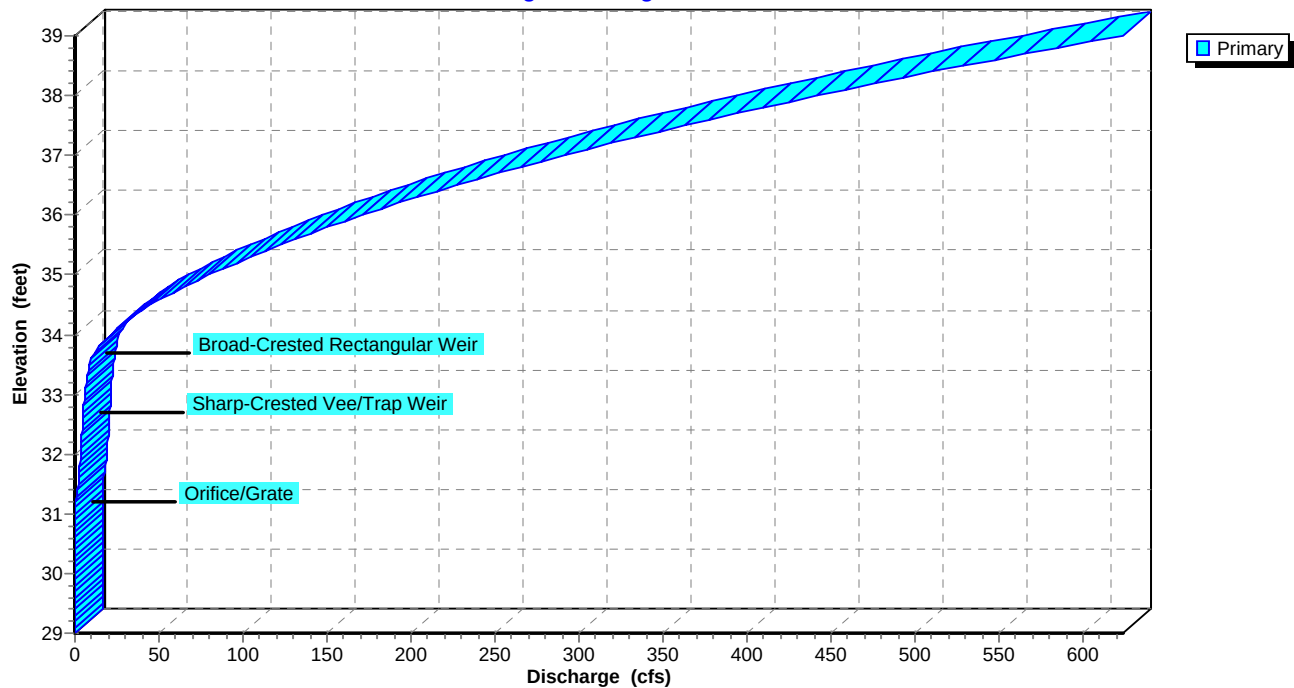
Pond 11P: Pond 4-2

Hydrograph



Pond 11P: Pond 4-2

Stage-Discharge



Proposed-1

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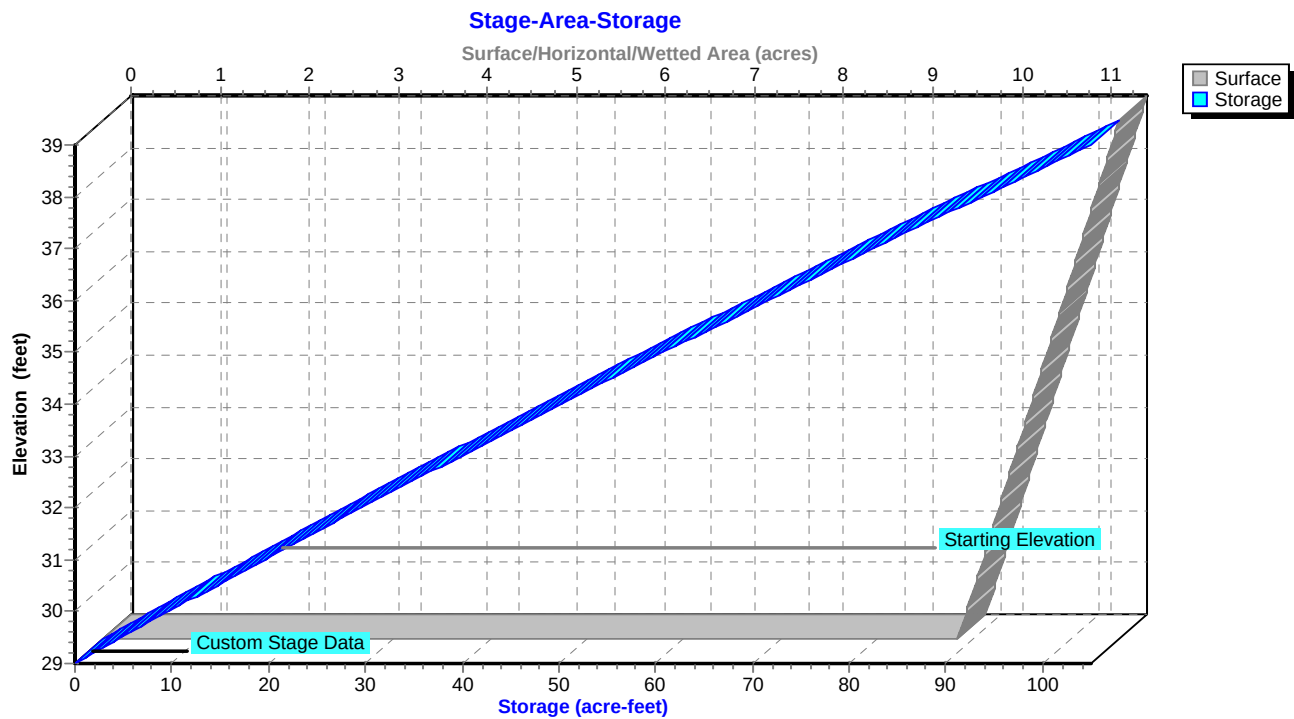
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Pond 11P: Pond 4-2



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Summary for Pond 18P: Pond BE4-3

Inflow Area = 633.280 ac, 0.00% Impervious, Inflow Depth > 5.88" for 100-yr96hr event
Inflow = 223.15 cfs @ 60.40 hrs, Volume= 310.335 af
Outflow = 204.40 cfs @ 65.12 hrs, Volume= 289.871 af, Atten= 8%, Lag= 283.1 min
Primary = 204.40 cfs @ 65.12 hrs, Volume= 289.871 af

Routing by Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs / 3
Peak Elev= 34.91' @ 65.12 hrs Surf.Area= 14.202 ac Storage= 41.941 af

Plug-Flow detention time= 212.7 min calculated for 289.871 af (93% of inflow)
Center-of-Mass det. time= 116.9 min (4,313.3 - 4,196.4)

Volume	Invert	Avail.Storage	Storage Description
#1	30.00'	43.195 af	Custom Stage Data (Prismatic) Listed below (Recalc)
Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
30.00	0.310	0.000	0.000
31.00	3.130	1.720	1.720
32.00	6.230	4.680	6.400
33.00	12.950	9.590	15.990
34.00	13.600	13.275	29.265
35.00	14.260	13.930	43.195

Device	Routing	Invert	Outlet Devices
#1	Primary	33.00'	25.0' long x 10.0' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64
#2	Primary	30.00'	24.0" Vert. Orifice/Grate C= 0.600

Primary OutFlow Max=204.39 cfs @ 65.12 hrs HW=34.91' (Free Discharge)

1=Broad-Crested Rectangular Weir (Weir Controls 174.47 cfs @ 3.65 fps)
2=Orifice/Grate (Orifice Controls 29.92 cfs @ 9.52 fps)

Proposed-1

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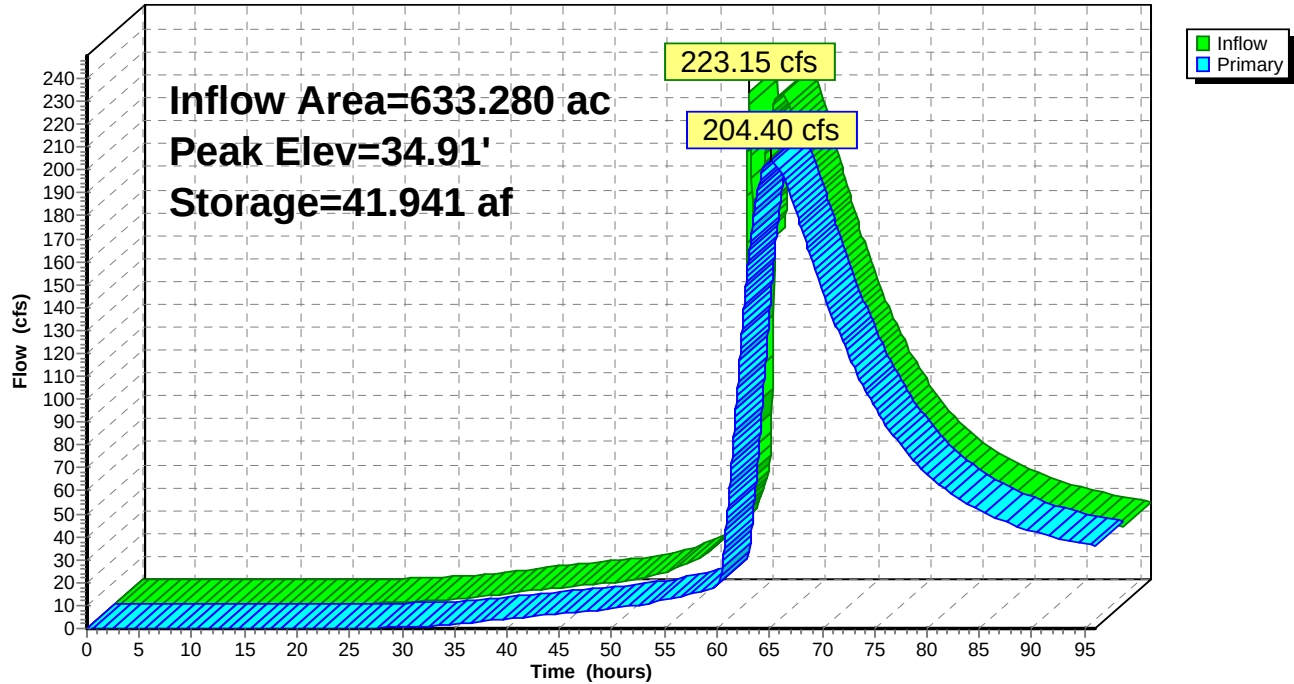
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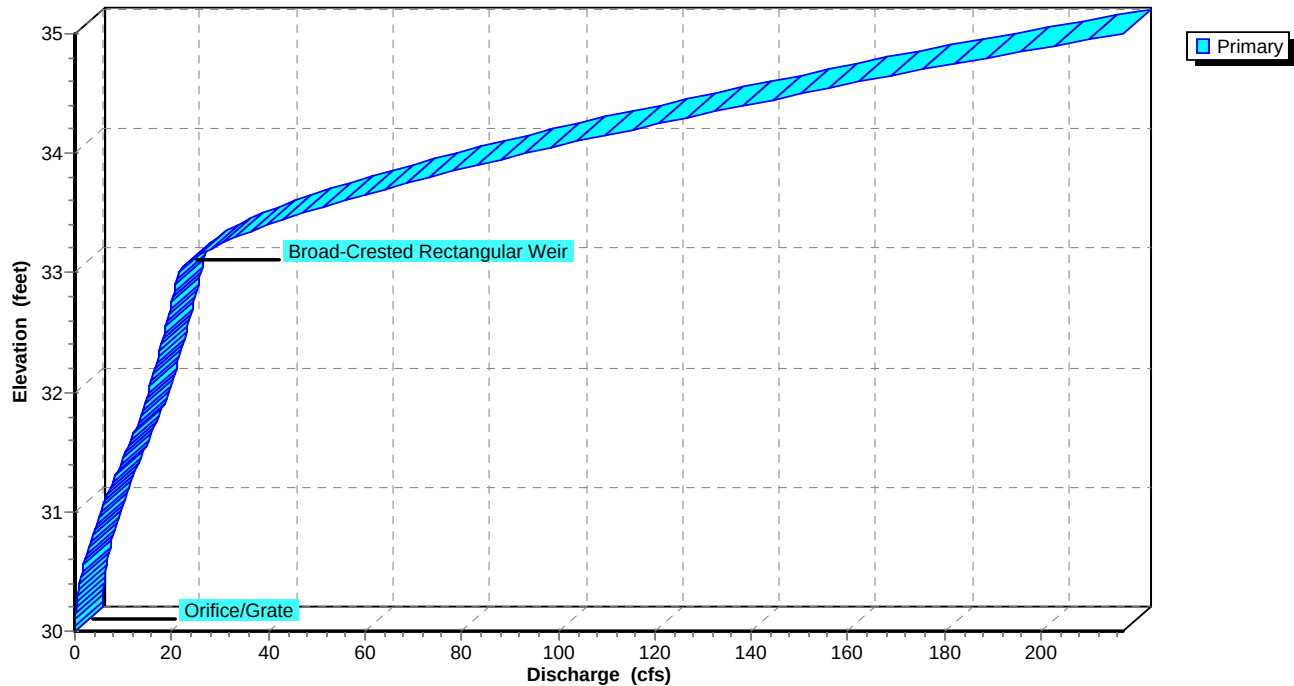
Pond 18P: Pond BE4-3

Hydrograph



Pond 18P: Pond BE4-3

Stage-Discharge



Proposed-1

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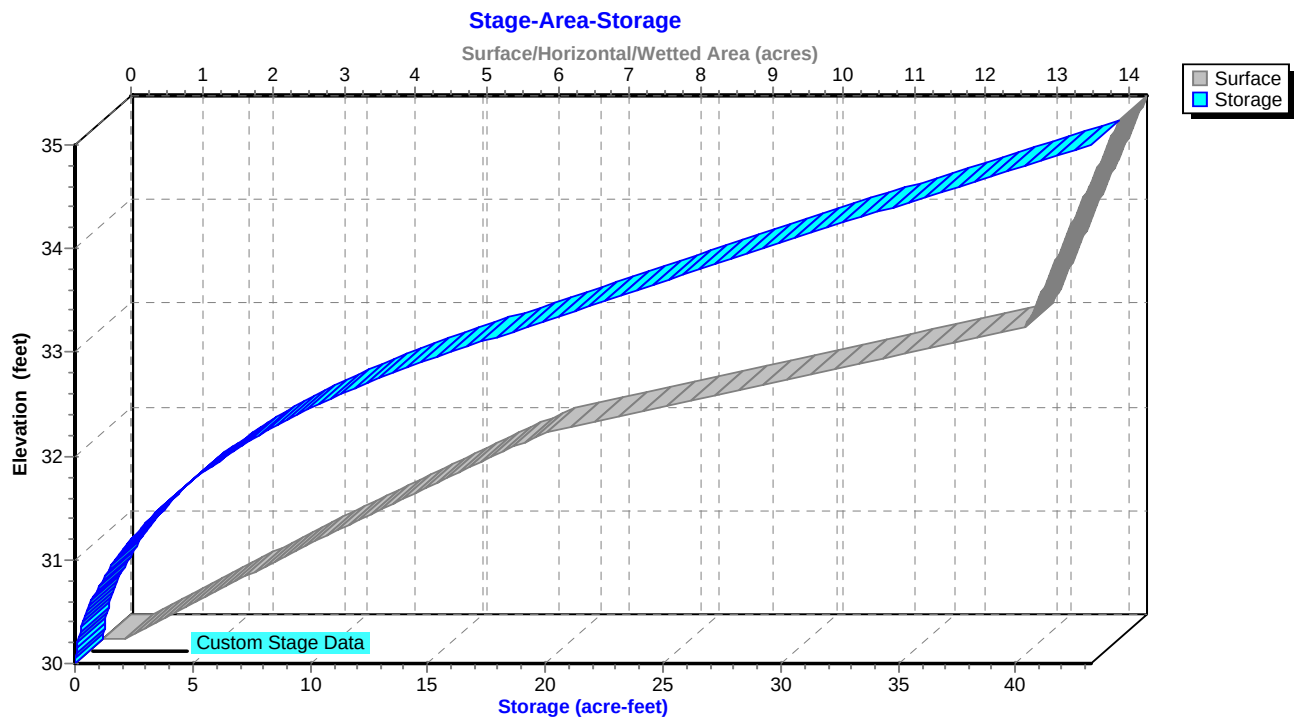
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Pond 18P: Pond BE4-3



Proposed-1

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Summary for Pond 19P: Wetland Storage - BE14A

Inflow Area = 499.200 ac, 0.00% Impervious, Inflow Depth > 11.18" for 100-yr96hr event
Inflow = 1,081.09 cfs @ 61.78 hrs, Volume= 465.008 af
Outflow = 406.51 cfs @ 63.75 hrs, Volume= 460.143 af, Atten= 62%, Lag= 117.9 min
Primary = 406.51 cfs @ 63.75 hrs, Volume= 460.143 af

Routing by Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Peak Elev= 38.54' @ 63.75 hrs Surf.Area= 97.324 ac Storage= 152.430 af

Plug-Flow detention time= 199.9 min calculated for 460.143 af (99% of inflow)
Center-of-Mass det. time= 180.0 min (4,003.0 - 3,823.0)

Volume	Invert	Avail.Storage	Storage Description
#1	34.00'	988.550 af	Custom Stage Data (Prismatic) Listed below (Recalc)
Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
34.00	0.000	0.000	0.000
35.00	5.000	2.500	2.500
36.00	15.000	10.000	12.500
37.00	44.900	29.950	42.450
38.00	79.900	62.400	104.850
40.00	144.800	224.700	329.550
44.00	184.700	659.000	988.550

Device	Routing	Invert	Outlet Devices
#1	Primary	34.00'	Custom Weir/Orifice, Cv= 2.62 (C= 3.28) Head (feet) 0.00 0.70 2.70 5.10 Width (feet) 0.00 9.00 16.00 33.00

Primary OutFlow Max=406.43 cfs @ 63.75 hrs HW=38.54' (Free Discharge)
↑**1=Custom Weir/Orifice** (Weir Controls 406.43 cfs @ 5.85 fps)

Proposed-1

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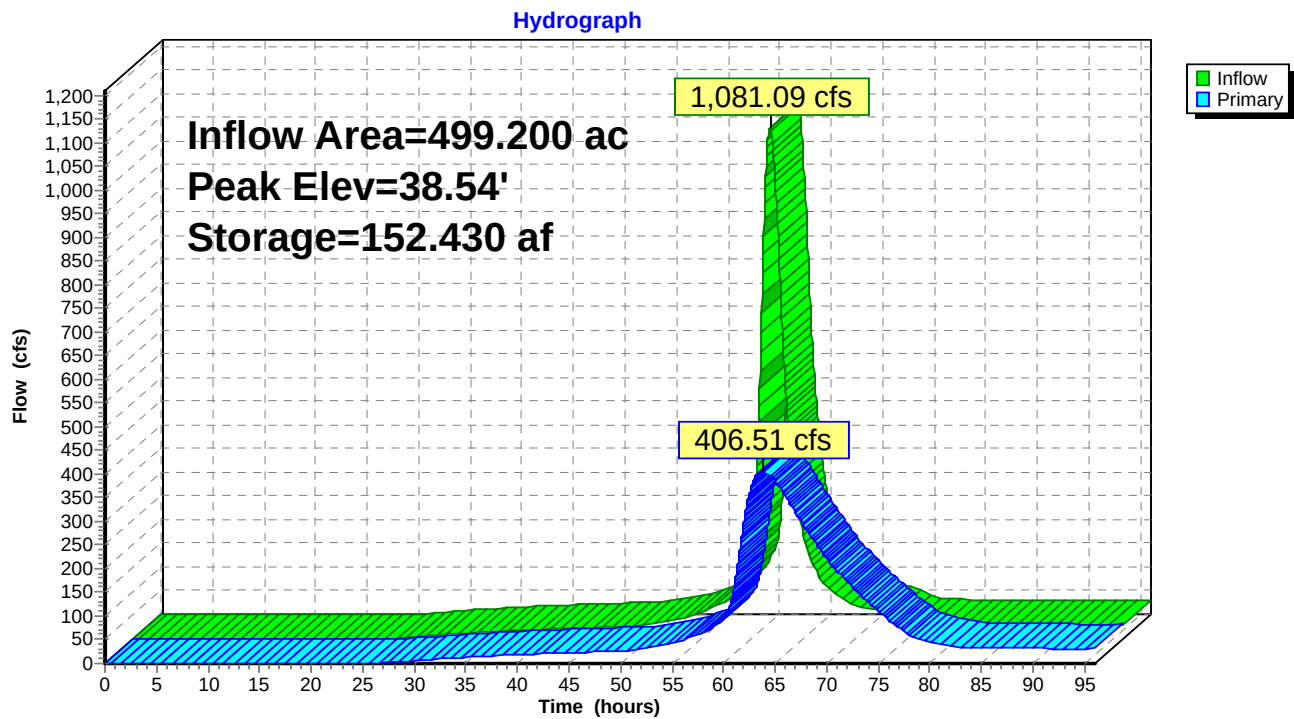
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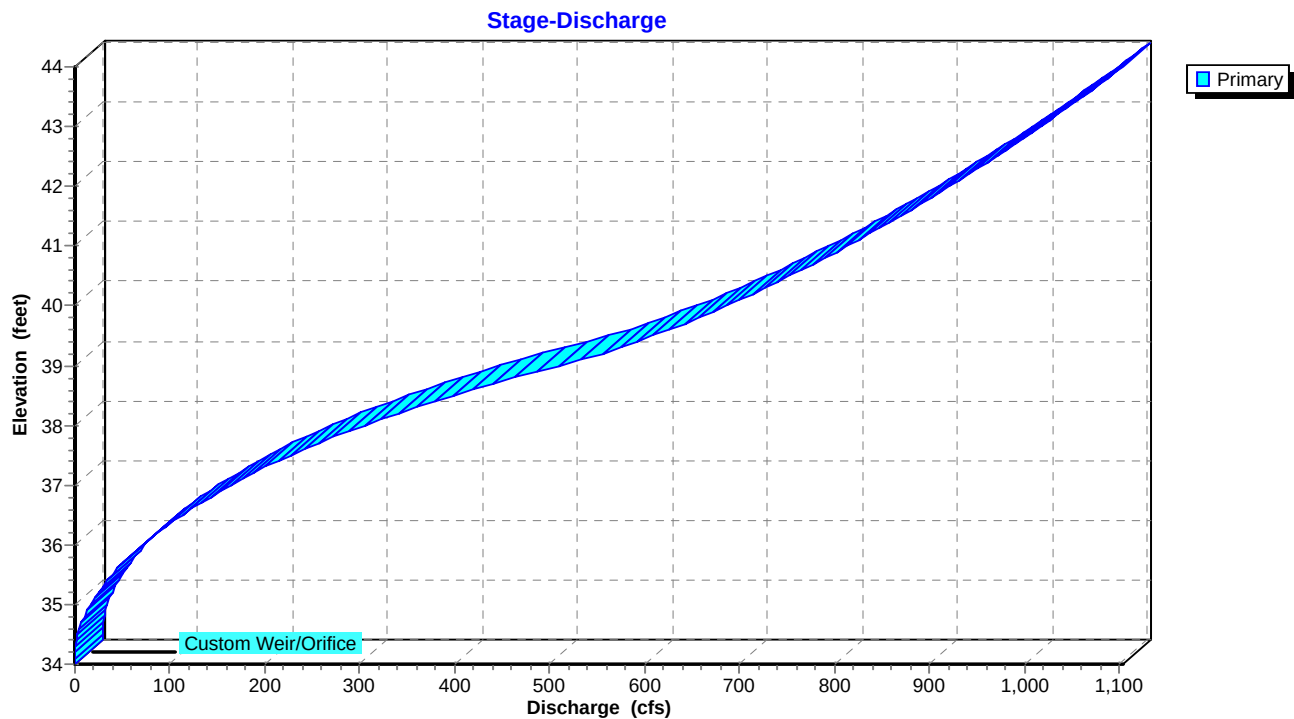
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Pond 19P: Wetland Storage - BE14A



Pond 19P: Wetland Storage - BE14A



Proposed-1

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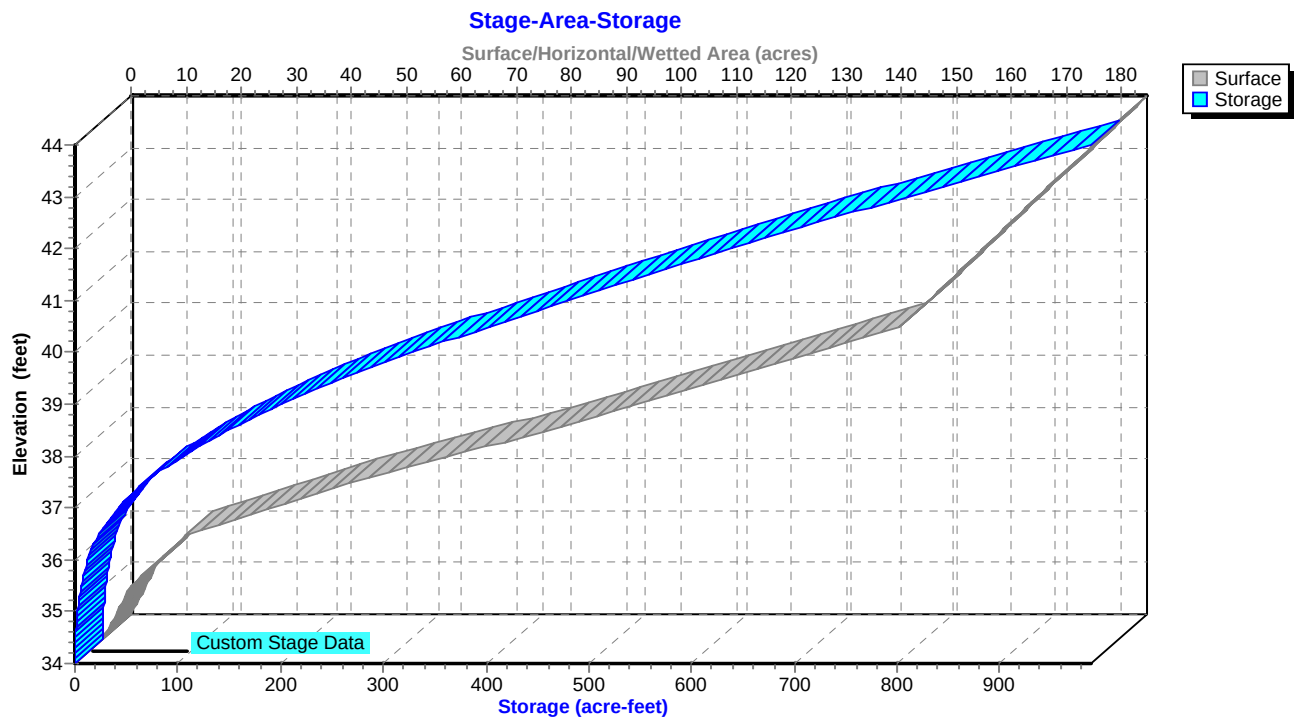
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SJRWMD 96-hr tenth 100-yr96hr Rainfall=15.00"

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Pond 19P: Wetland Storage - BE14A



Proposed-1

SJRWMD 96-hr tenth 100-yr96hr Rainfall=15.00"

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Summary for Pond 21P: WRC25 RC25 and RC25A

Inflow Area = 112.300 ac, 0.00% Impervious, Inflow Depth > 11.48" for 100-yr96hr event
Inflow = 246.81 cfs @ 61.73 hrs, Volume= 107.449 af
Outflow = 43.60 cfs @ 65.39 hrs, Volume= 99.693 af, Atten= 82%, Lag= 219.7 min
Primary = 43.60 cfs @ 65.39 hrs, Volume= 99.693 af

Routing by Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Peak Elev= 35.89' @ 65.39 hrs Surf.Area= 34.242 ac Storage= 53.138 af

Plug-Flow detention time= 645.7 min calculated for 99.693 af (93% of inflow)
Center-of-Mass det. time= 524.5 min (4,331.9 - 3,807.4)

Volume	Invert	Avail.Storage	Storage Description
#1	30.00'	100.550 af	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
30.00	0.600	0.000	0.000
31.00	1.100	0.850	0.850
32.00	1.700	1.400	2.250
33.00	5.600	3.650	5.900
34.00	9.000	7.300	13.200
35.00	21.300	15.150	28.350
36.00	35.800	28.550	56.900
37.00	51.500	43.650	100.550

Device	Routing	Invert	Outlet Devices
#1	Primary	36.00'	264.0' long Sharp-Crested Rectangular Weir 2 End Contraction(s)
#2	Primary	32.04'	36.0" Round Culvert L= 23.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 32.04' / 31.39' S= 0.0283 '/ Cc= 0.900 n= 0.024, Flow Area= 7.07 sf
#3	Primary	30.01'	8.0" Round Culvert L= 29.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 30.01' / 29.99' S= 0.0007 '/ Cc= 0.900 n= 0.024, Flow Area= 0.35 sf

Primary OutFlow Max=43.60 cfs @ 65.39 hrs HW=35.89' (Free Discharge)

1=Sharp-Crested Rectangular Weir (Controls 0.00 cfs)
2=Culvert (Inlet Controls 41.21 cfs @ 5.83 fps)
3=Culvert (Barrel Controls 2.38 cfs @ 6.83 fps)

Proposed-1

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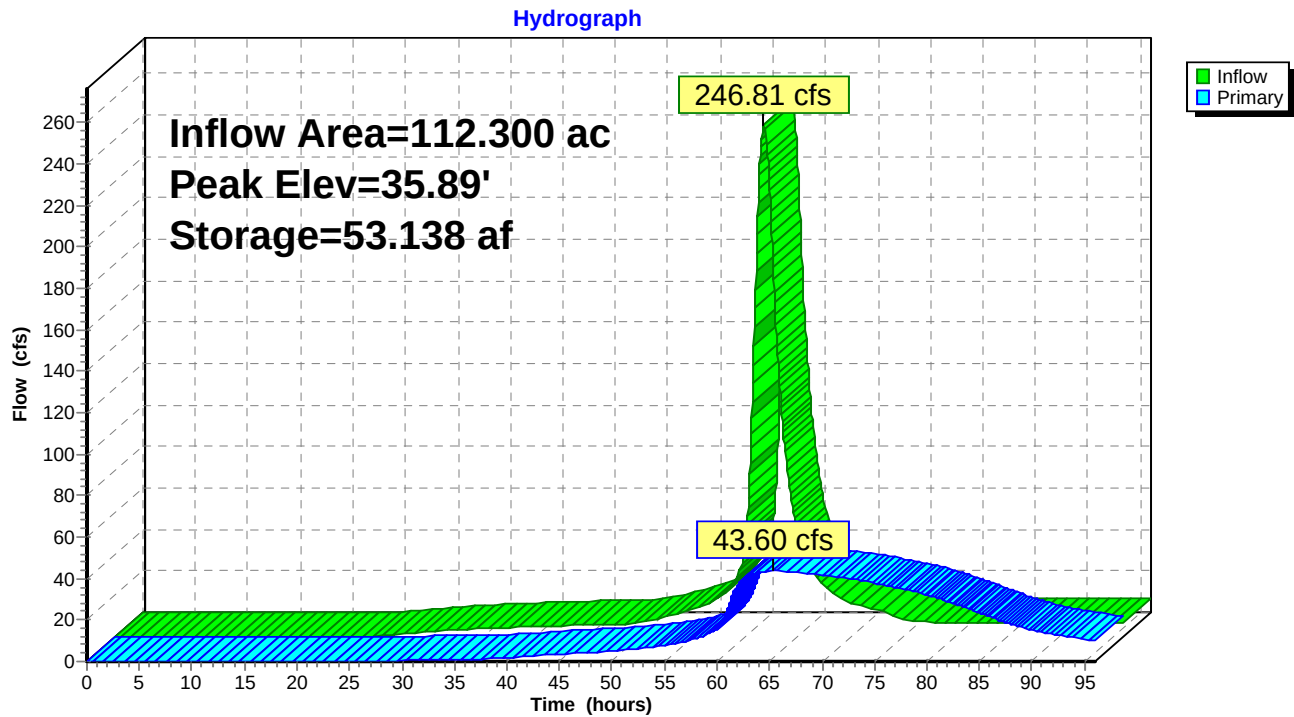
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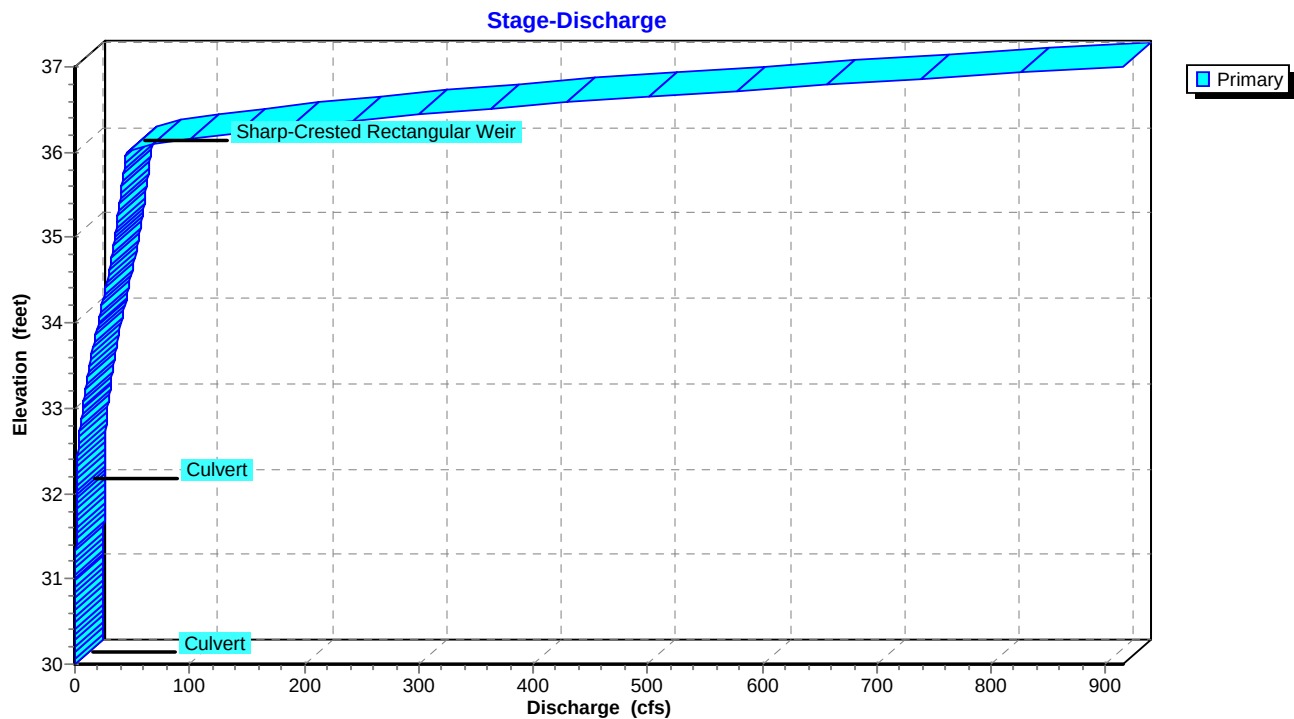
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Pond 21P: WRC25 RC25 and RC25A



Pond 21P: WRC25 RC25 and RC25A



Proposed-1

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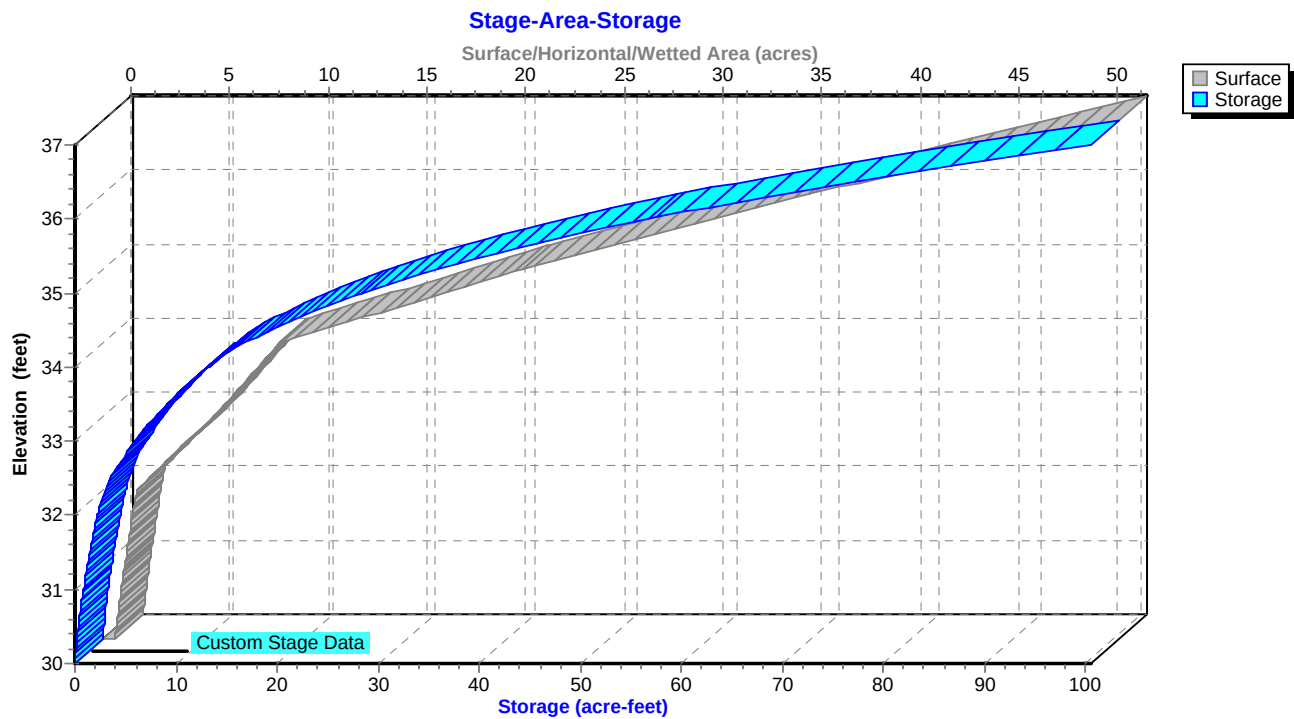
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Pond 21P: WRC25 RC25 and RC25A



Proposed-1

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Summary for Pond 22P: Wetland Storage - BE14B

Inflow Area = 333.700 ac, 0.00% Impervious, Inflow Depth > 11.18" for 100-yr96hr event
Inflow = 722.68 cfs @ 61.78 hrs, Volume= 310.844 af
Outflow = 684.10 cfs @ 62.13 hrs, Volume= 305.444 af, Atten= 5%, Lag= 21.1 min
Primary = 580.10 cfs @ 62.13 hrs, Volume= 145.061 af
Secondary = 103.99 cfs @ 62.13 hrs, Volume= 160.383 af

Routing by Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Peak Elev= 38.51' @ 62.13 hrs Surf.Area= 45.221 ac Storage= 45.669 af

Plug-Flow detention time= 131.7 min calculated for 305.285 af (98% of inflow)
Center-of-Mass det. time= 99.2 min (3,922.2 - 3,823.0)

Volume	Invert	Avail.Storage	Storage Description
#1	36.00'	583.850 af	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
36.00	3.300	0.000	0.000
37.00	10.000	6.650	6.650
38.00	30.000	20.000	26.650
39.00	60.100	45.050	71.700
40.00	83.400	71.750	143.450
42.00	110.100	193.500	336.950
44.00	136.800	246.900	583.850

Device	Routing	Invert	Outlet Devices
#1	Primary	38.00'	480.0' long Sharp-Crested Rectangular Weir 2 End Contraction(s)
#2	Primary	36.00'	24.0" Round Culvert L= 23.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 36.00' / 34.30' S= 0.0739 '/' Cc= 0.900 n= 0.024, Flow Area= 3.14 sf
#3	Secondary	36.00'	Custom Weir/Orifice, Cv= 2.62 (C= 3.28) Head (feet) 0.00 1.00 5.00 Width (feet) 6.00 8.00 16.00

Primary OutFlow Max=578.79 cfs @ 62.13 hrs HW=38.51' (Free Discharge)

↑ **1=Sharp-Crested Rectangular Weir** (Weir Controls 564.13 cfs @ 2.33 fps)
↓ **2=Culvert** (Inlet Controls 14.65 cfs @ 4.66 fps)

Secondary OutFlow Max=103.97 cfs @ 62.13 hrs HW=38.51' (Free Discharge)

↑ **3=Custom Weir/Orifice** (Weir Controls 103.97 cfs @ 4.88 fps)

Proposed-1

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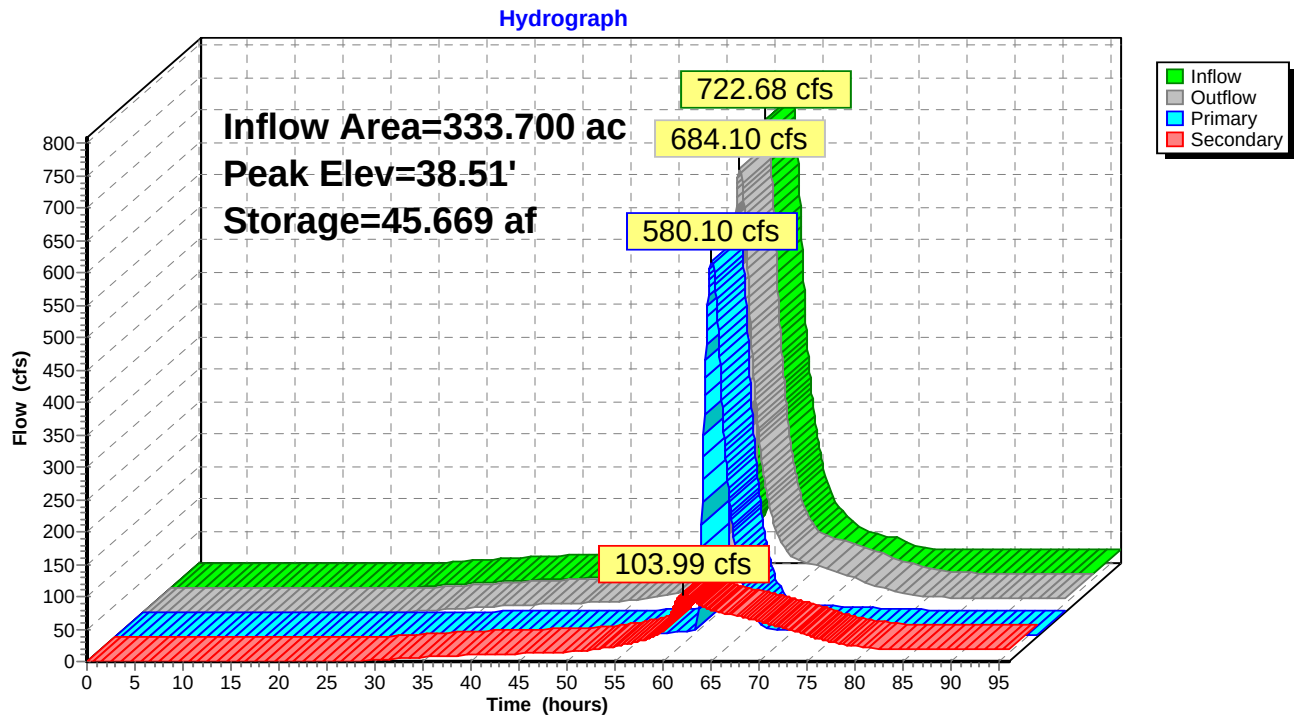
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SJRWMD 96-hr tenth 100-yr96hr Rainfall=15.00"

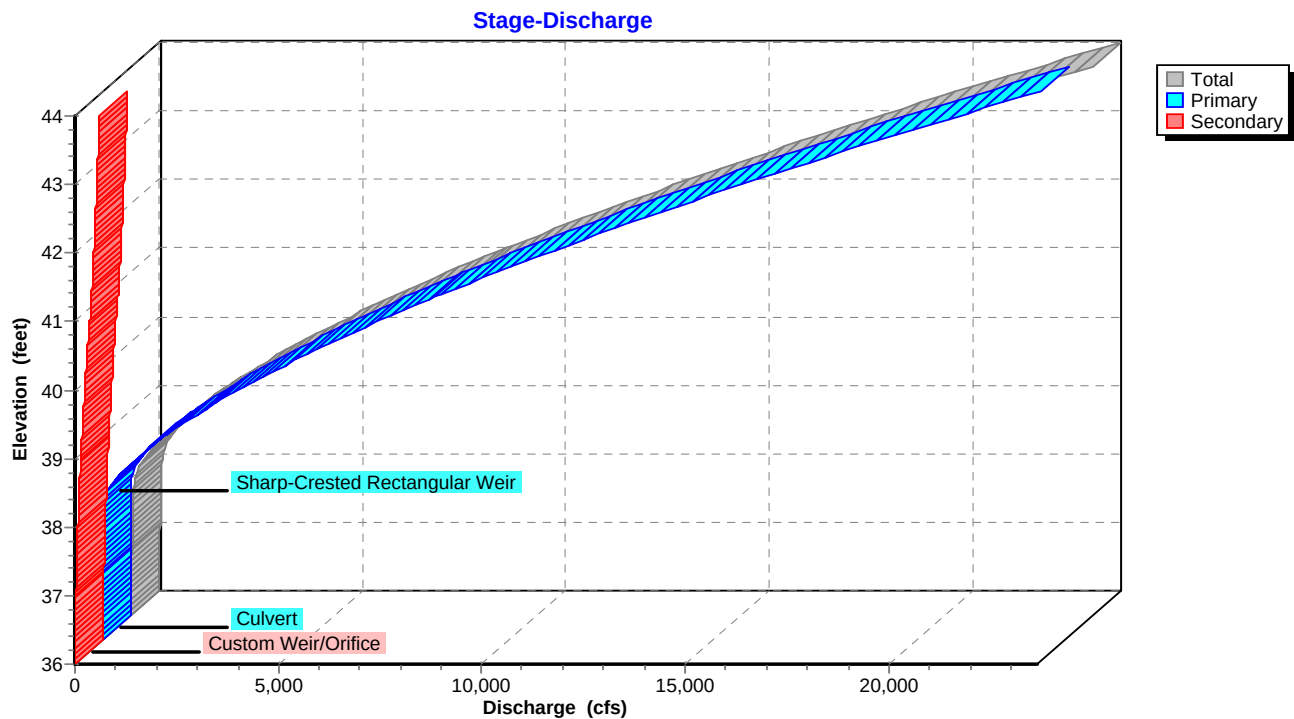
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Pond 22P: Wetland Storage - BE14B



Pond 22P: Wetland Storage - BE14B



Proposed-1

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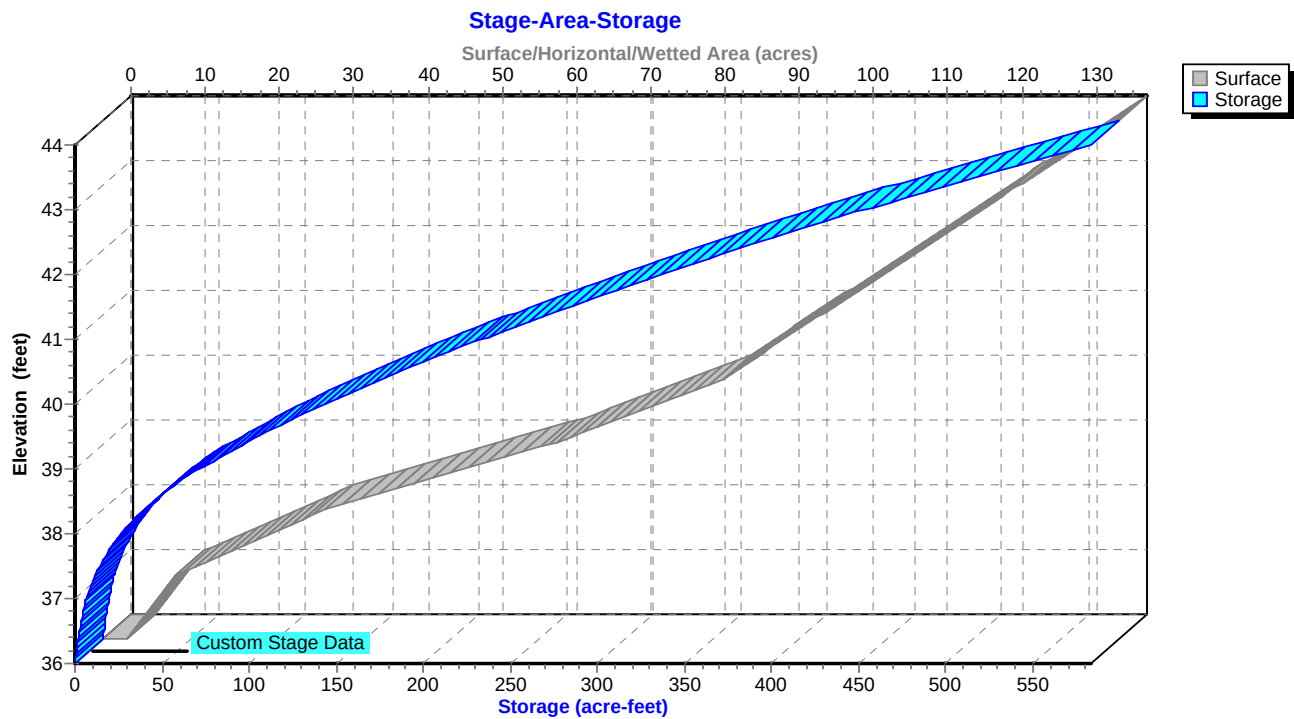
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Pond 22P: Wetland Storage - BE14B



Proposed-1

SJRWMD 96-hr tenth 100-yr96hr Rainfall=15.00"

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Summary for Pond 23P: Wetland Storage - NE8

Inflow Area = 102.230 ac, 0.00% Impervious, Inflow Depth > 11.66" for 100-yr96hr event
Inflow = 264.20 cfs @ 61.40 hrs, Volume= 99.326 af
Outflow = 14.87 cfs @ 69.49 hrs, Volume= 52.000 af, Atten= 94%, Lag= 485.2 min
Primary = 14.87 cfs @ 69.49 hrs, Volume= 52.000 af

Routing by Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Peak Elev= 32.18' @ 69.49 hrs Surf.Area= 70.567 ac Storage= 62.315 af

Plug-Flow detention time= 962.1 min calculated for 52.000 af (52% of inflow)
Center-of-Mass det. time= 573.6 min (4,351.0 - 3,777.4)

Volume	Invert	Avail.Storage	Storage Description
#1	30.00'	219.000 af	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
30.00	1.900	0.000	0.000
31.00	15.500	8.700	8.700
32.00	66.900	41.200	49.900
33.00	87.200	77.050	126.950
34.00	96.900	92.050	219.000

Device	Routing	Invert	Outlet Devices
#1	Primary	33.50'	600.0' long Sharp-Crested Rectangular Weir 2 End Contraction(s)
#2	Primary	29.63'	24.0" Round Culvert L= 29.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 29.63' / 28.90' S= 0.0252 ' /' Cc= 0.900 n= 0.024, Flow Area= 3.14 sf

Primary OutFlow Max=14.87 cfs @ 69.49 hrs HW=32.18' (Free Discharge)

1=Sharp-Crested Rectangular Weir (Controls 0.00 cfs)
2=Culvert (Inlet Controls 14.87 cfs @ 4.73 fps)

Proposed-1

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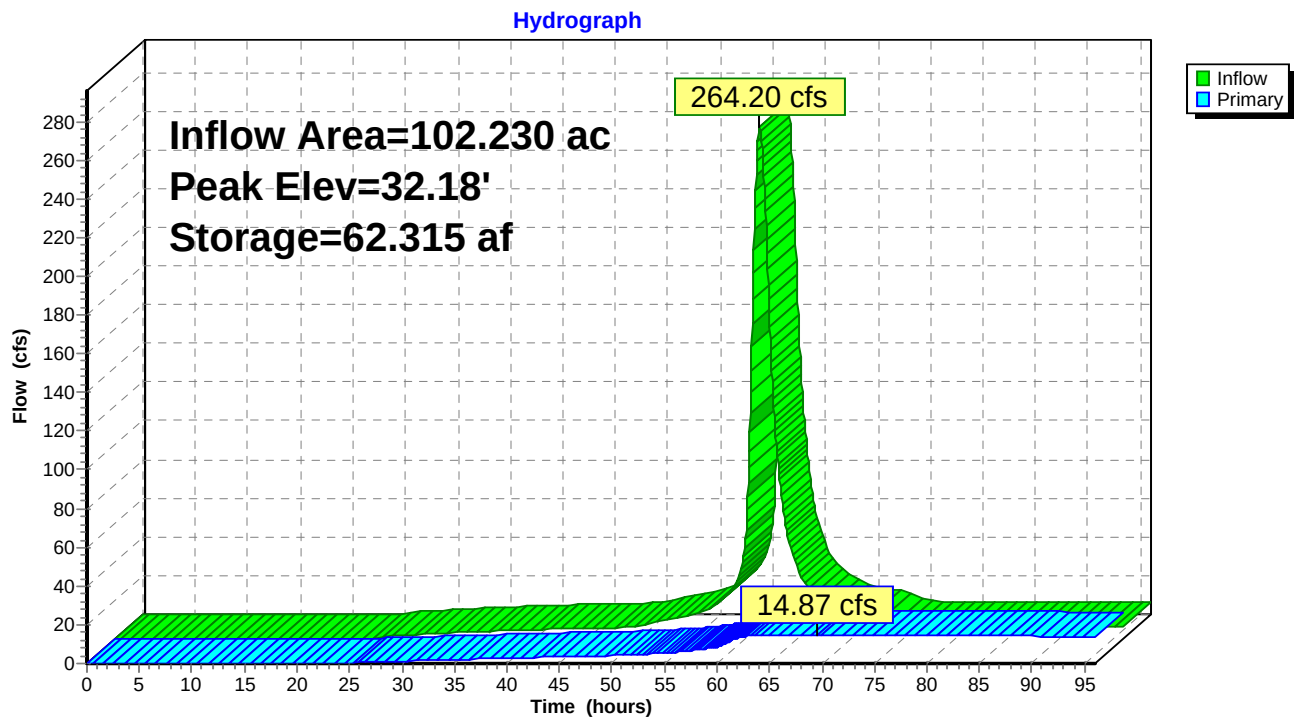
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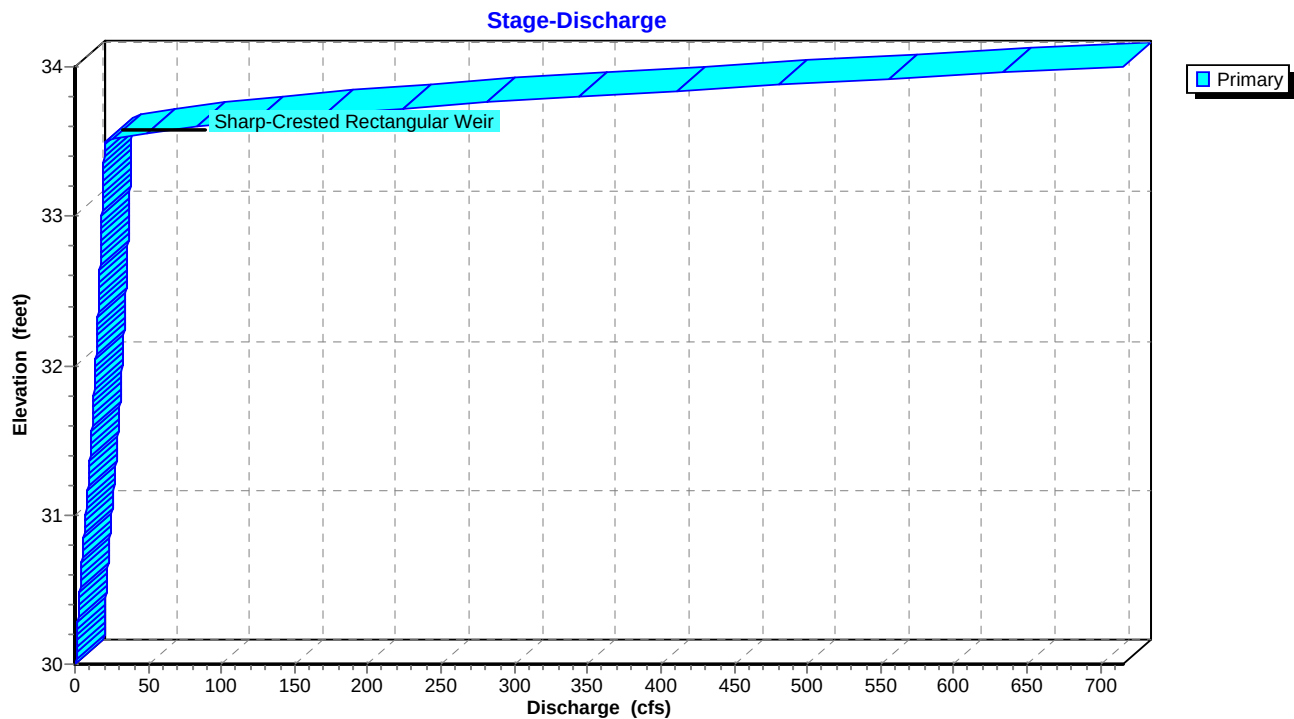
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Pond 23P: Wetland Storage - NE8



Pond 23P: Wetland Storage - NE8



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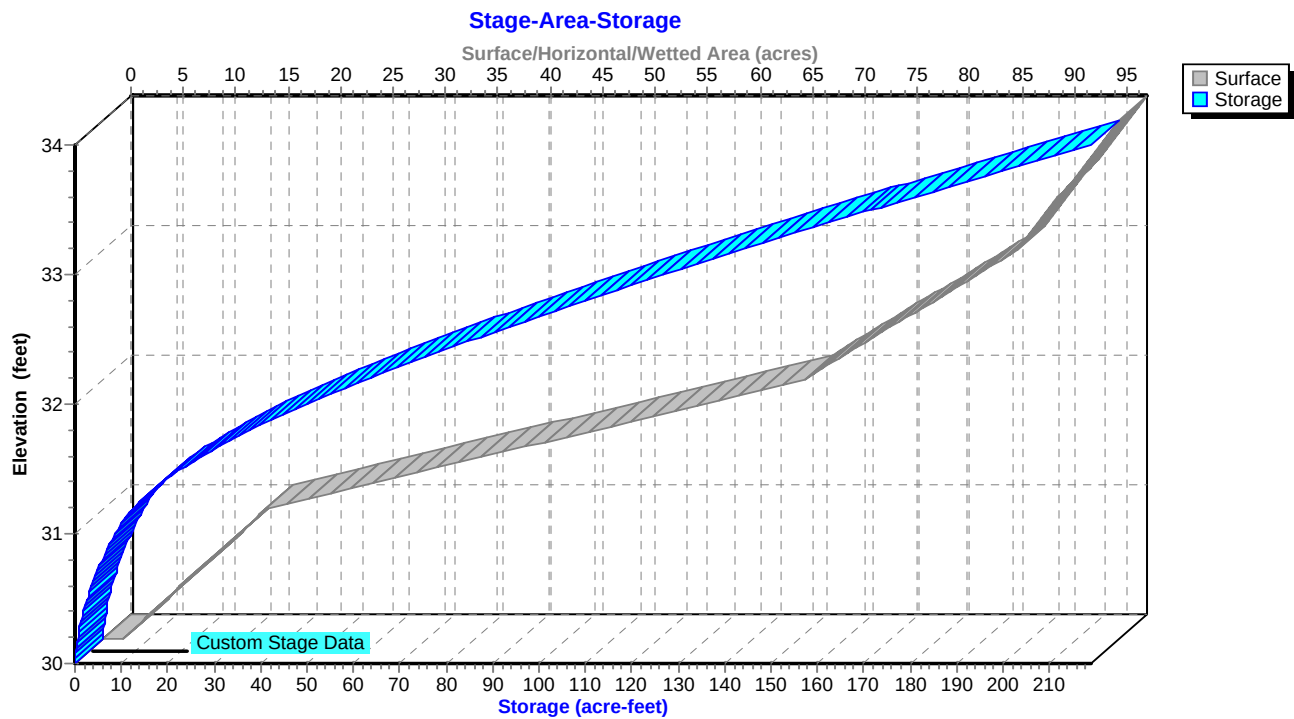
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Pond 23P: Wetland Storage - NE8



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Summary for Pond 25P: WREC22 and REC22

Inflow Area = 499.200 ac, 0.00% Impervious, Inflow Depth = 2.14" for 100-yr96hr event
Inflow = 79.39 cfs @ 57.27 hrs, Volume= 88.976 af
Outflow = 79.39 cfs @ 57.27 hrs, Volume= 88.976 af, Atten= 0%, Lag= 0.0 min
Primary = 79.39 cfs @ 57.27 hrs, Volume= 88.976 af

Routing by Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Peak Elev= 31.30' @ 57.27 hrs

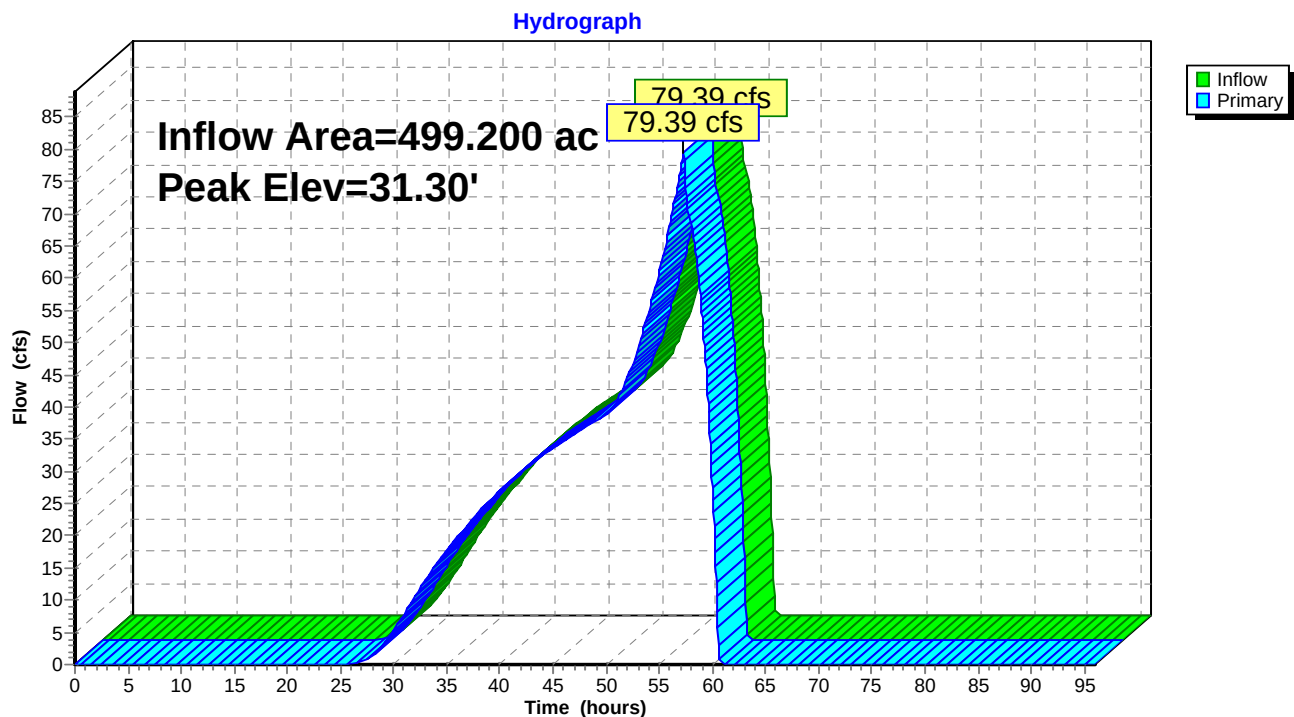
Device	Routing	Invert	Outlet Devices
#1	Primary	36.00'	240.0' long Sharp-Crested Rectangular Weir 2 End Contraction(s) 72.0" Round Culvert L= 40.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 27.24' / 27.18' S= 0.0015 ' / ' Cc= 0.900 n= 0.024, Flow Area= 28.27 sf
#2	Primary	27.24'	

Primary OutFlow Max=79.32 cfs @ 57.27 hrs HW=31.30' (Free Discharge)

1=Sharp-Crested Rectangular Weir (Controls 0.00 cfs)

2=Culvert (Barrel Controls 79.32 cfs @ 5.50 fps)

Pond 25P: WREC22 and REC22



Proposed-1

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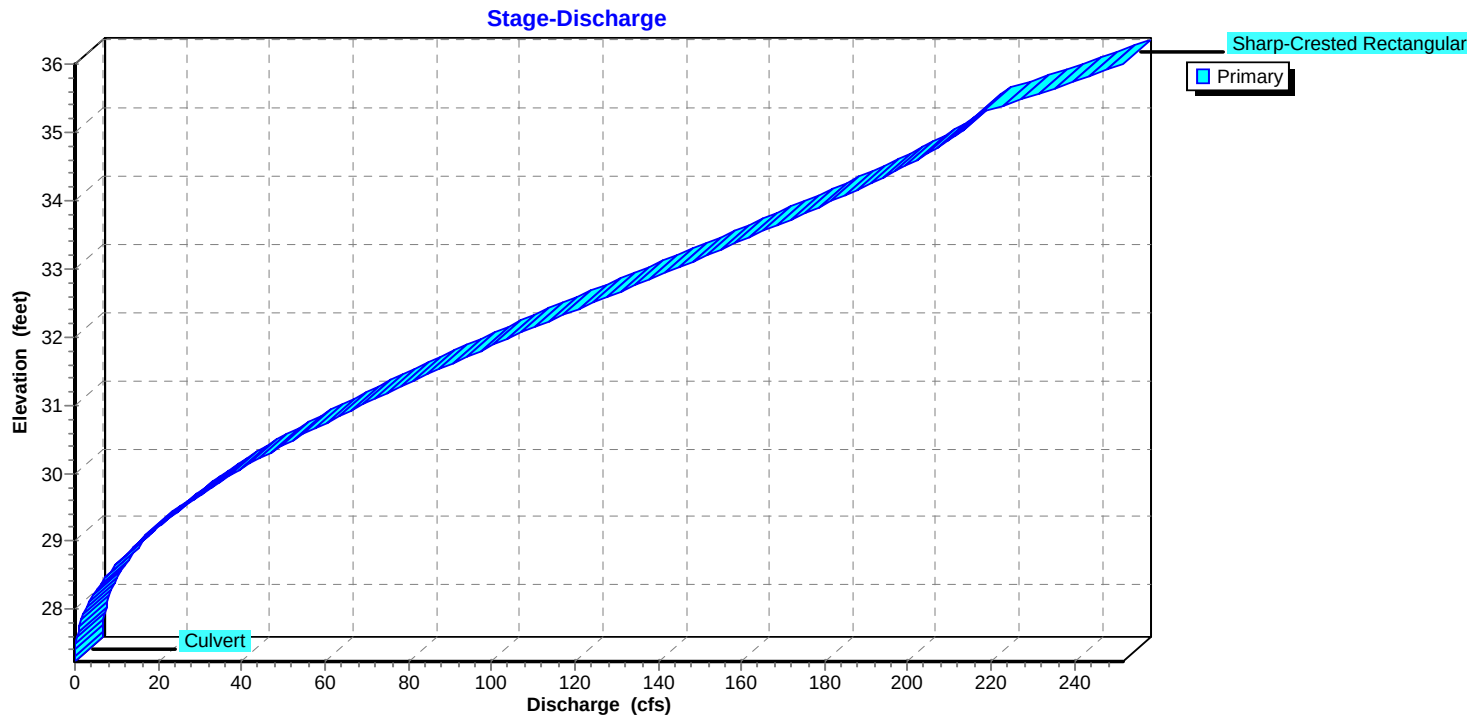
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SJRWMD 96-hr tenth 100-yr96hr Rainfall=15.00"

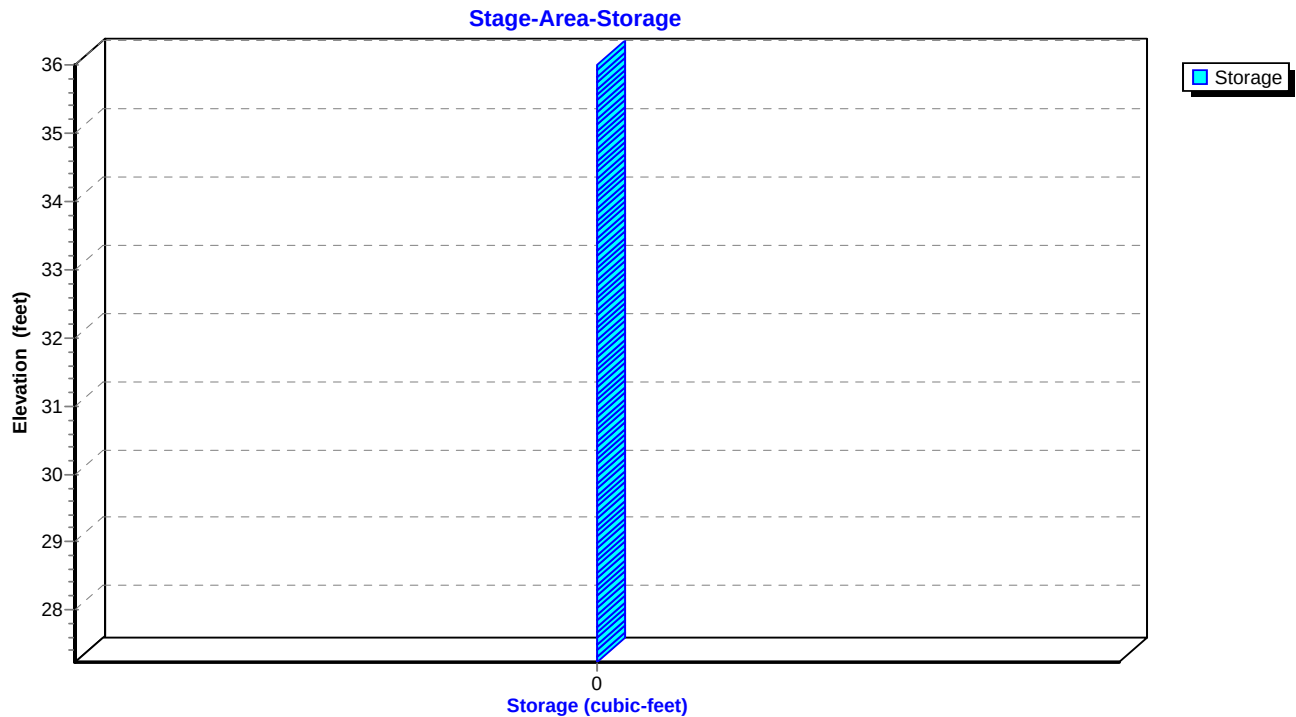
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Pond 25P: WREC22 and REC22



Pond 25P: WREC22 and REC22



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SJRWMD 96-hr tenth 100-yr96hr Rainfall=15.00"

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Summary for Pond 26P: Wetland Storage - BE9

Inflow Area = 181.300 ac, 0.00% Impervious, Inflow Depth > 11.17" for 100-yr96hr event
Inflow = 371.22 cfs @ 61.55 hrs, Volume= 168.811 af
Outflow = 307.68 cfs @ 62.22 hrs, Volume= 168.125 af, Atten= 17%, Lag= 40.5 min
Primary = 307.68 cfs @ 62.22 hrs, Volume= 168.125 af

Routing by Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Peak Elev= 34.45' @ 62.22 hrs Surf.Area= 38.014 ac Storage= 25.715 af

Plug-Flow detention time= 96.7 min calculated for 168.125 af (100% of inflow)
Center-of-Mass det. time= 89.0 min (3,927.3 - 3,838.3)

Volume	Invert	Avail.Storage	Storage Description
#1	30.00'	141.150 af	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
30.00	0.000	0.000	0.000
31.00	1.000	0.500	0.500
32.00	2.000	1.500	2.000
33.00	6.100	4.050	6.050
34.00	11.200	8.650	14.700
35.00	71.100	41.150	55.850
36.00	99.500	85.300	141.150

Device	Routing	Invert	Outlet Devices
#1	Primary	34.00'	264.0' long Sharp-Crested Rectangular Weir 2 End Contraction(s)
#2	Primary	29.62'	36.0" Round Culvert L= 34.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 29.62' / 29.07' S= 0.0162 '/' Cc= 0.900 n= 0.024, Flow Area= 7.07 sf

Primary OutFlow Max=307.40 cfs @ 62.22 hrs HW=34.45' (Free Discharge)

1=Sharp-Crested Rectangular Weir (Weir Controls 258.39 cfs @ 2.19 fps)
2=Culvert (Inlet Controls 49.01 cfs @ 6.93 fps)

Proposed-1

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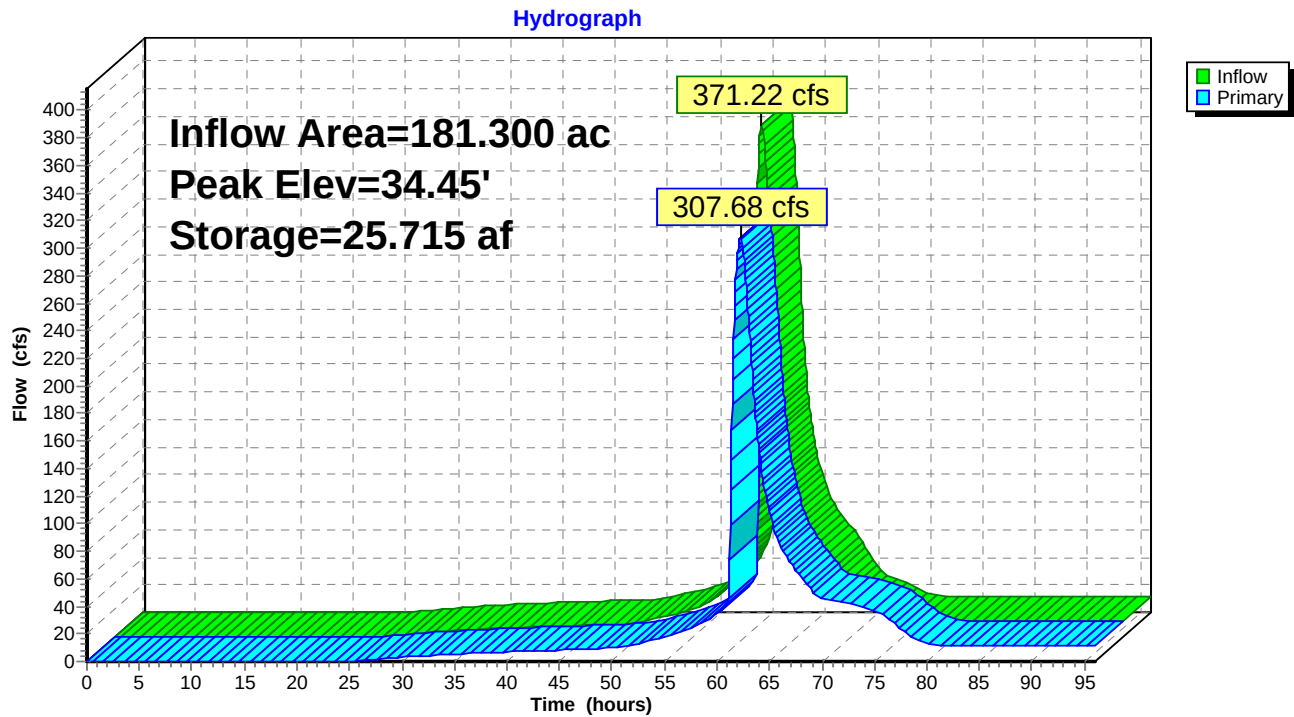
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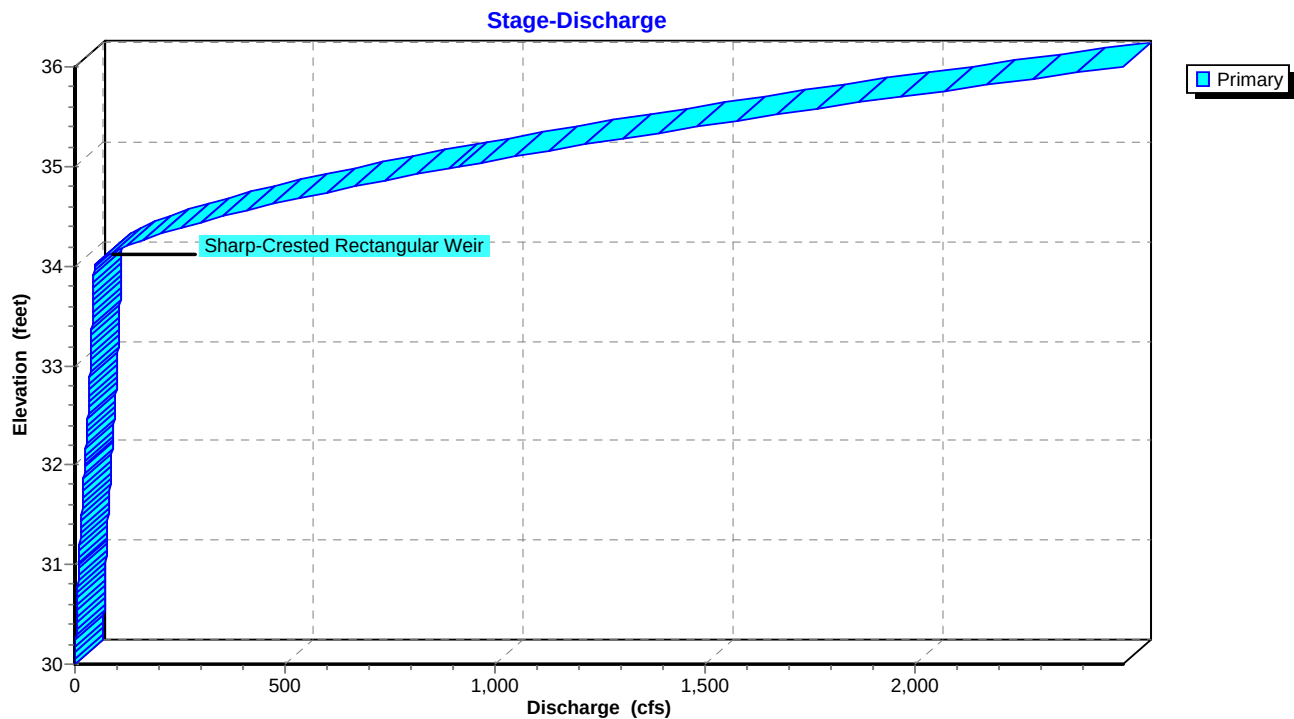
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Pond 26P: Wetland Storage - BE9



Pond 26P: Wetland Storage - BE9



Proposed-1

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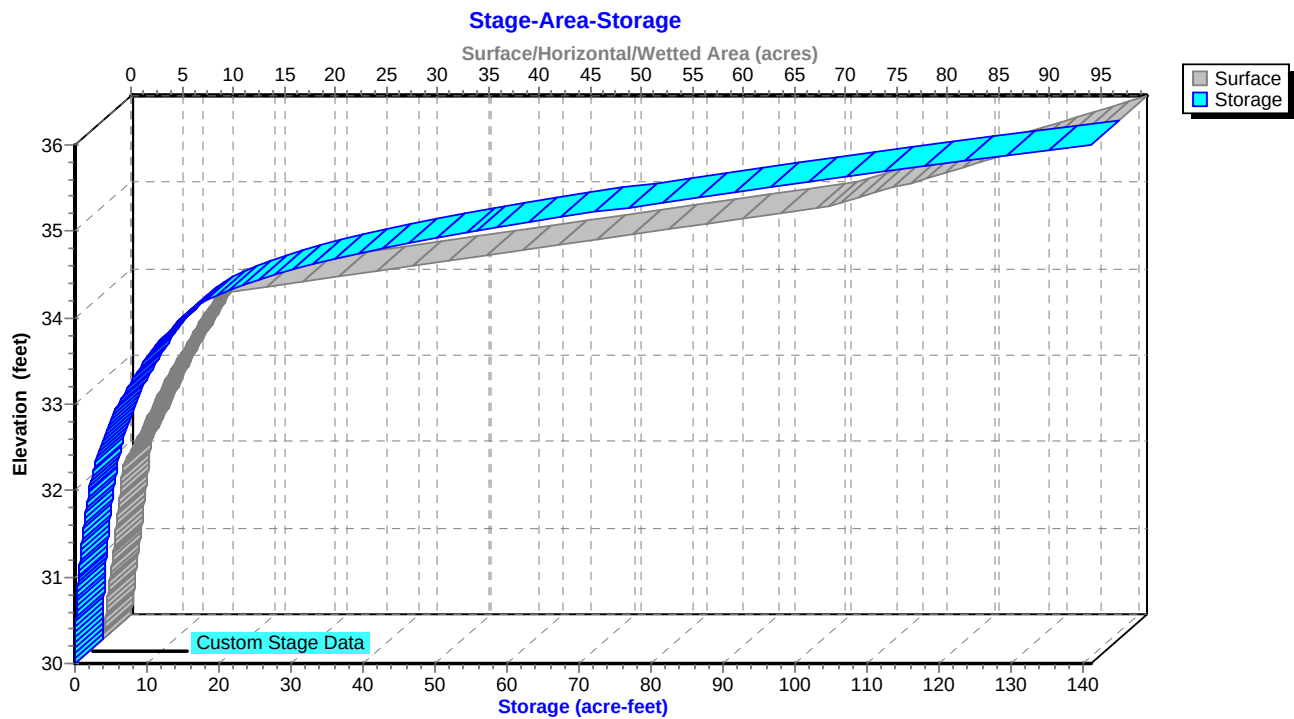
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Pond 26P: Wetland Storage - BE9



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Summary for Pond 28P: Wetland Storage for BE12

Inflow Area = 400.100 ac, 0.00% Impervious, Inflow Depth > 6.26" for 100-yr96hr event
Inflow = 675.18 cfs @ 62.29 hrs, Volume= 208.577 af
Outflow = 380.74 cfs @ 63.60 hrs, Volume= 208.433 af, Atten= 44%, Lag= 78.5 min
Primary = 380.74 cfs @ 63.60 hrs, Volume= 208.433 af

Routing by Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Starting Elev= 29.00' Surf.Area= 0.000 ac Storage= 0.000 af
Peak Elev= 36.30' @ 63.60 hrs Surf.Area= 57.400 ac Storage= 89.754 af
Flood Elev= 37.00' Surf.Area= 57.400 ac Storage= 130.200 af

Plug-Flow detention time= 345.7 min calculated for 208.325 af (100% of inflow)
Center-of-Mass det. time= 344.2 min (4,167.8 - 3,823.5)

Volume	Invert	Avail.Storage	Storage Description
#1	30.00'	130.200 af	Custom Stage Data (Prismatic) Listed below (Recalc)
Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
30.00	0.600	0.000	0.000
31.00	1.200	0.900	0.900
32.00	1.900	1.550	2.450
33.00	6.200	4.050	6.500
34.00	8.600	7.400	13.900
35.00	25.900	17.250	31.150
36.00	57.400	41.650	72.800
37.00	57.400	57.400	130.200

Device	Routing	Invert	Outlet Devices
#1	Primary	36.00'	600.0' long Sharp-Crested Rectangular Weir 2 End Contraction(s)
#2	Primary	28.87'	36.0" Round Culvert L= 20.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 28.87' / 28.68' S= 0.0095 '/' Cc= 0.900 n= 0.024, Flow Area= 7.07 sf

Primary OutFlow Max=380.30 cfs @ 63.60 hrs HW=36.30' (Free Discharge)
 1=Sharp-Crested Rectangular Weir (Weir Controls 314.89 cfs @ 1.78 fps)
 2=Culvert (Inlet Controls 65.41 cfs @ 9.25 fps)

Proposed-1

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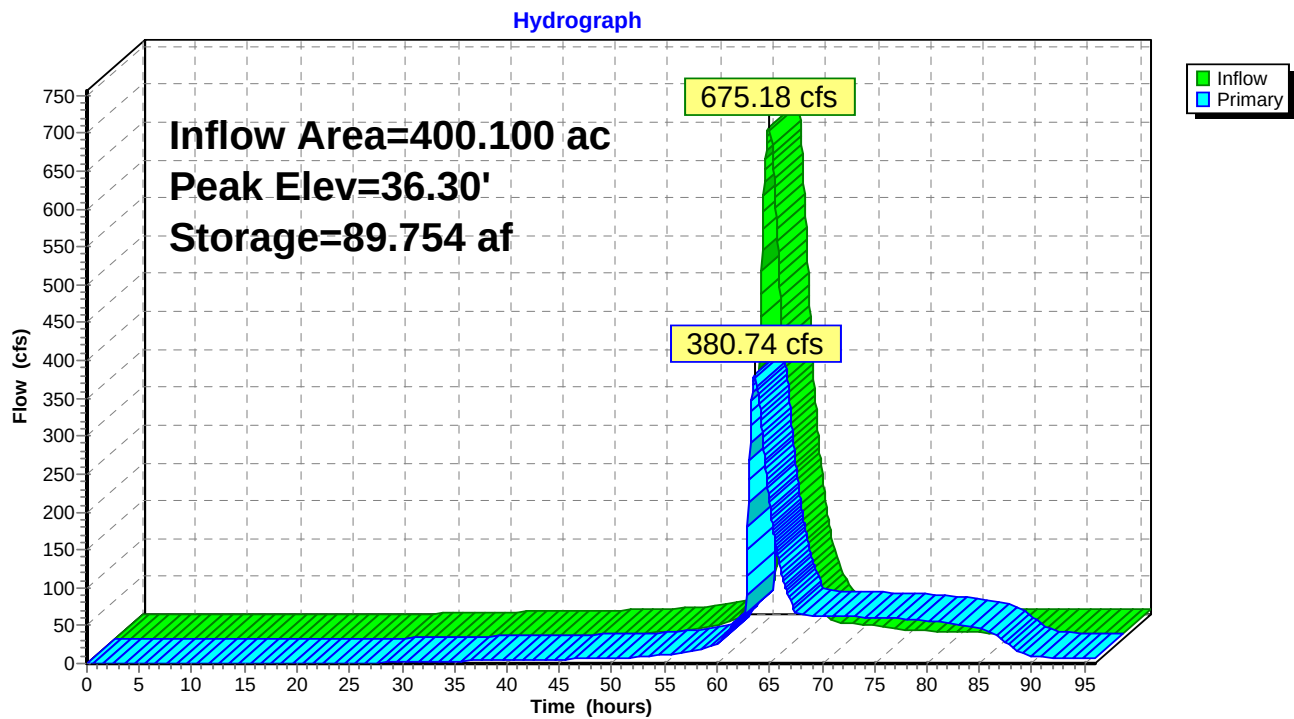
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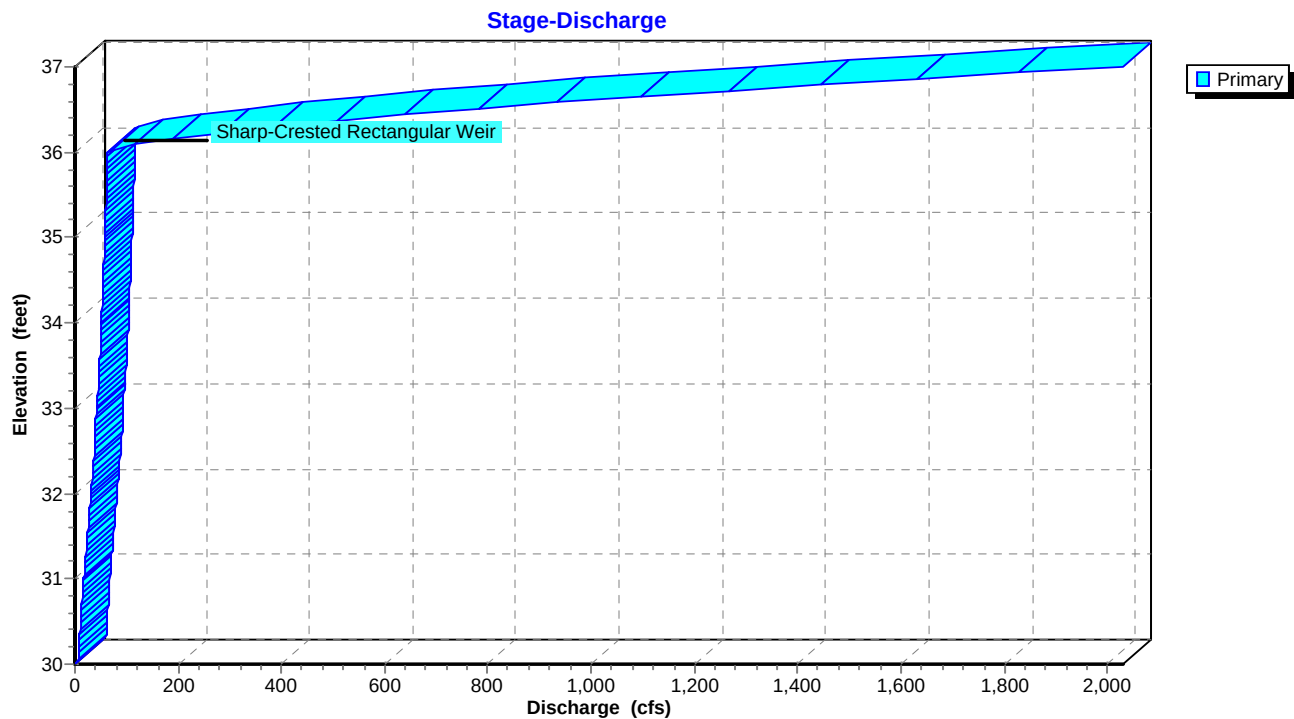
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Pond 28P: Wetland Storage for BE12



Pond 28P: Wetland Storage for BE12



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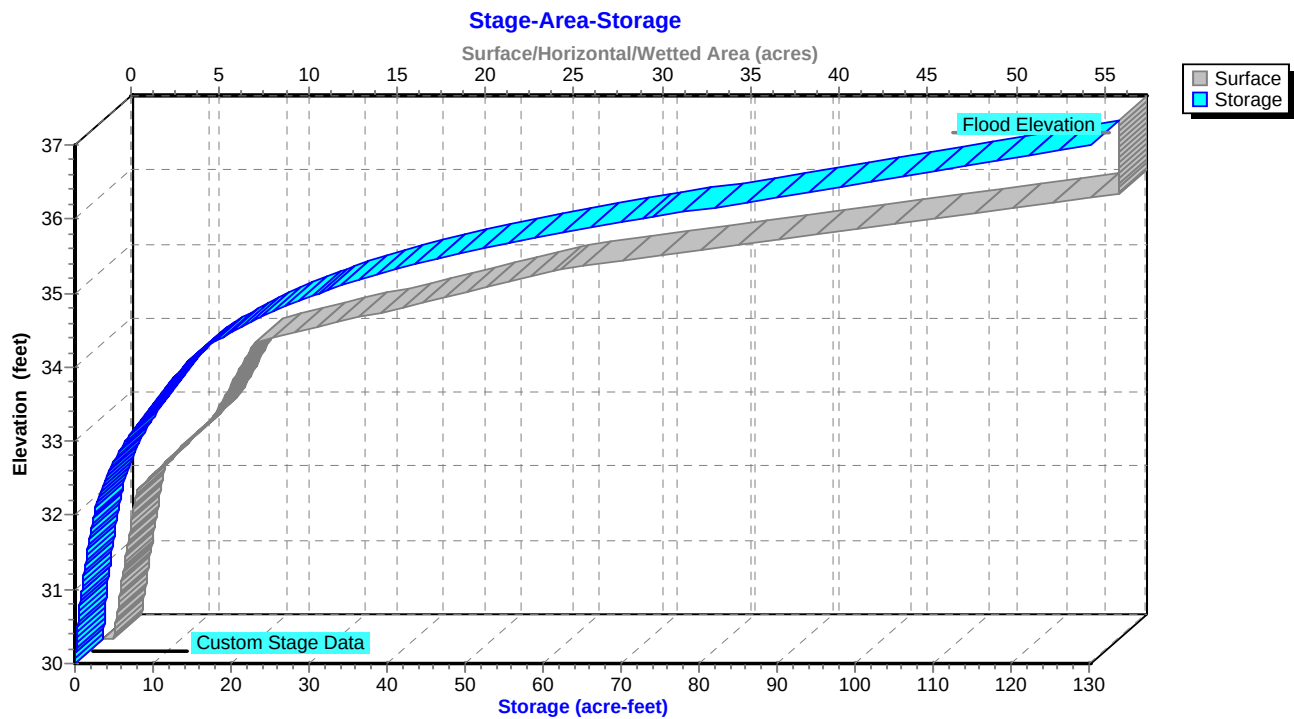
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SJRWMD 96-hr tenth 100-yr96hr Rainfall=15.00"

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Pond 28P: Wetland Storage for BE12



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SJRWMD 96-hr tenth 100-yr96hr Rainfall=15.00"

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Summary for Pond 29P: Wetland Storage BE7

Inflow Area = 652.780 ac, 0.00% Impervious, Inflow Depth > 5.68" for 100-yr96hr event
Inflow = 213.48 cfs @ 64.84 hrs, Volume= 308.769 af
Outflow = 209.26 cfs @ 65.71 hrs, Volume= 305.814 af, Atten= 2%, Lag= 52.2 min
Primary = 209.26 cfs @ 65.71 hrs, Volume= 305.814 af

Routing by Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Peak Elev= 33.83' @ 65.71 hrs Surf.Area= 8.066 ac Storage= 14.425 af

Plug-Flow detention time= 53.0 min calculated for 305.655 af (99% of inflow)
Center-of-Mass det. time= 39.0 min (4,320.9 - 4,281.9)

Volume	Invert	Avail.Storage	Storage Description
#1	31.00'	53.350 af	Custom Stage Data (Prismatic) Listed below (Recalc)
Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
31.00	1.000	0.000	0.000
32.00	4.700	2.850	2.850
33.00	6.400	5.550	8.400
34.00	8.400	7.400	15.800
35.00	9.800	9.100	24.900
36.00	14.000	11.900	36.800
37.00	19.100	16.550	53.350

Device	Routing	Invert	Outlet Devices
#1	Primary	31.00'	Custom Weir/Orifice, Cv= 2.62 (C= 3.28) Head (feet) 0.00 1.00 5.00 Width (feet) 10.00 13.00 25.00

Primary OutFlow Max=209.25 cfs @ 65.71 hrs HW=33.83' (Free Discharge)

↑**1=Custom Weir/Orifice** (Weir Controls 209.25 cfs @ 5.18 fps)

Proposed-1

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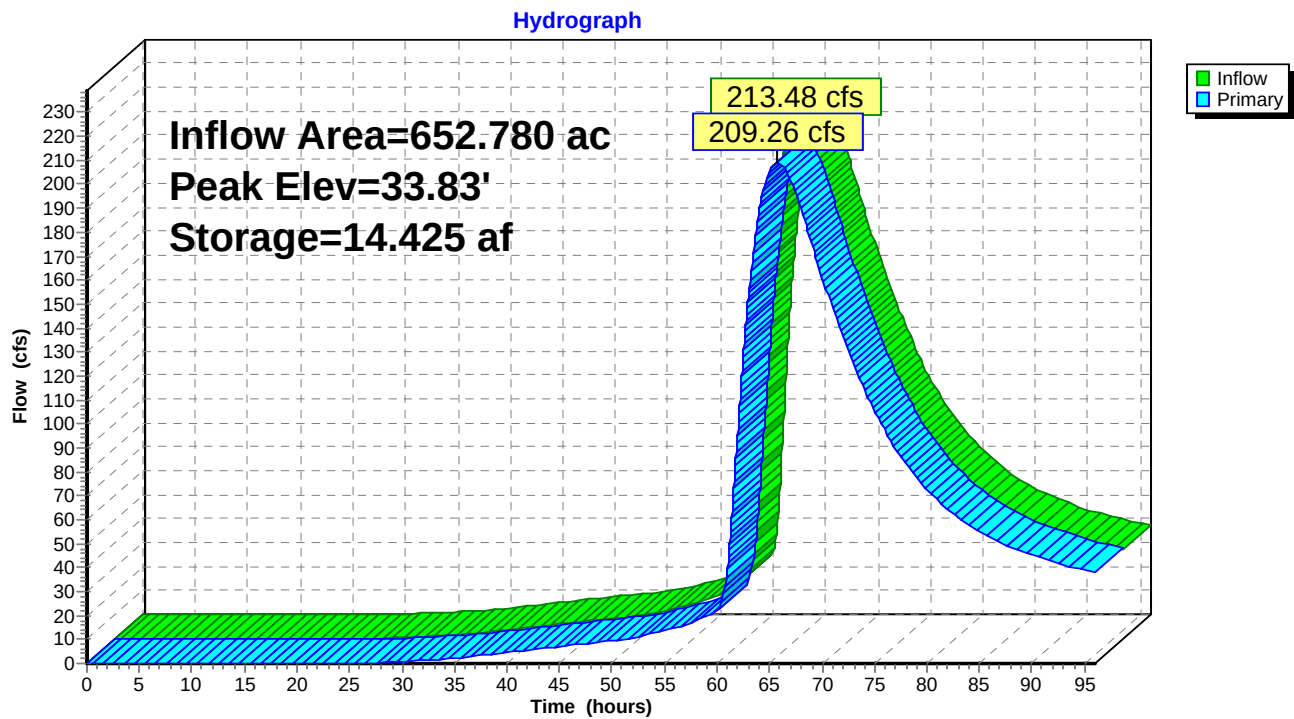
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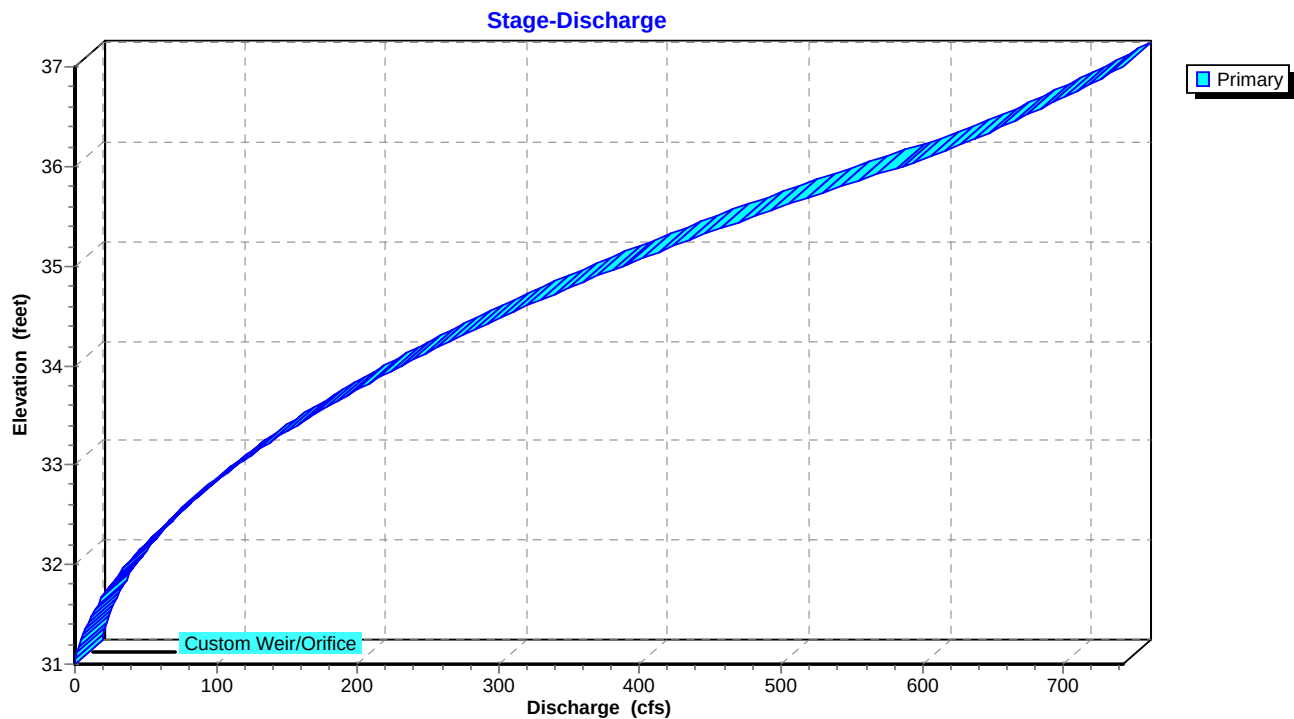
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Pond 29P: Wetland Storage BE7



Pond 29P: Wetland Storage BE7



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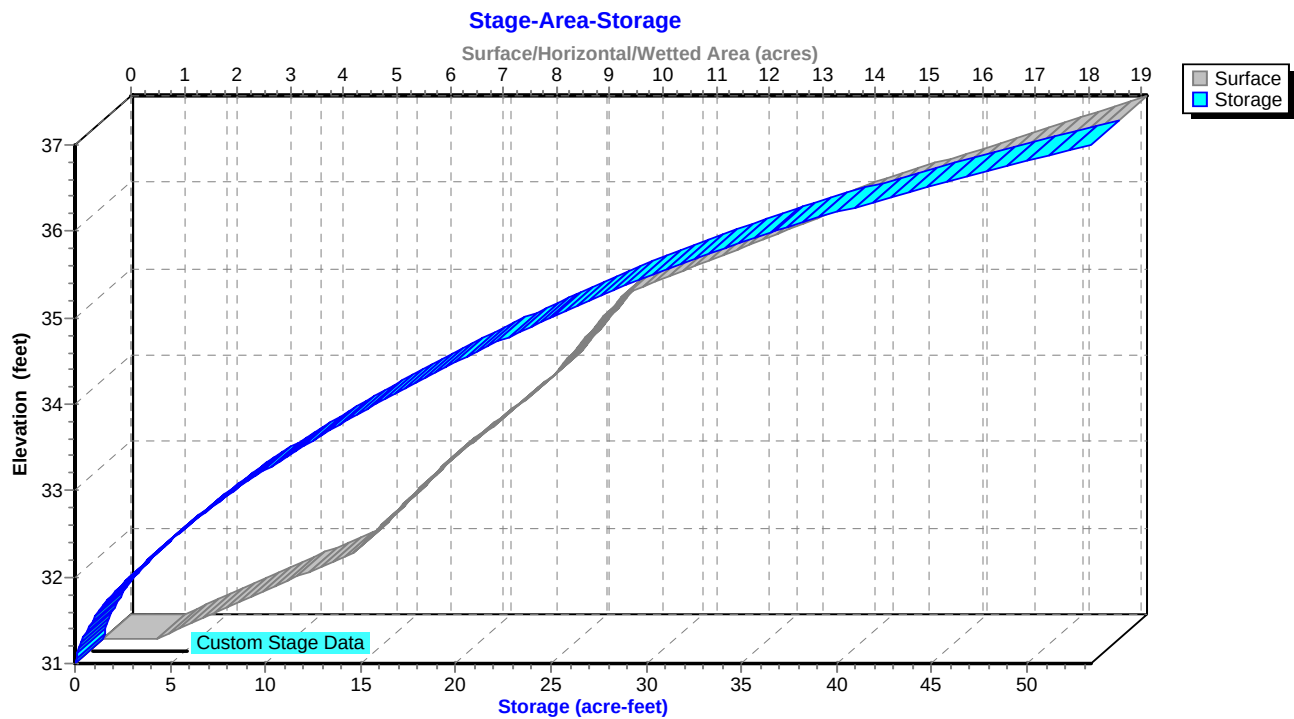
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Pond 29P: Wetland Storage BE7



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Summary for Pond 30P: WRC18 and RC18

Inflow Area = 181.300 ac, 0.00% Impervious, Inflow Depth > 11.13" for 100-yr96hr event
Inflow = 307.68 cfs @ 62.22 hrs, Volume= 168.125 af
Outflow = 307.68 cfs @ 62.22 hrs, Volume= 168.125 af, Atten= 0%, Lag= 0.0 min
Primary = 307.68 cfs @ 62.22 hrs, Volume= 168.125 af

Routing by Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Peak Elev= 34.94' @ 62.22 hrs

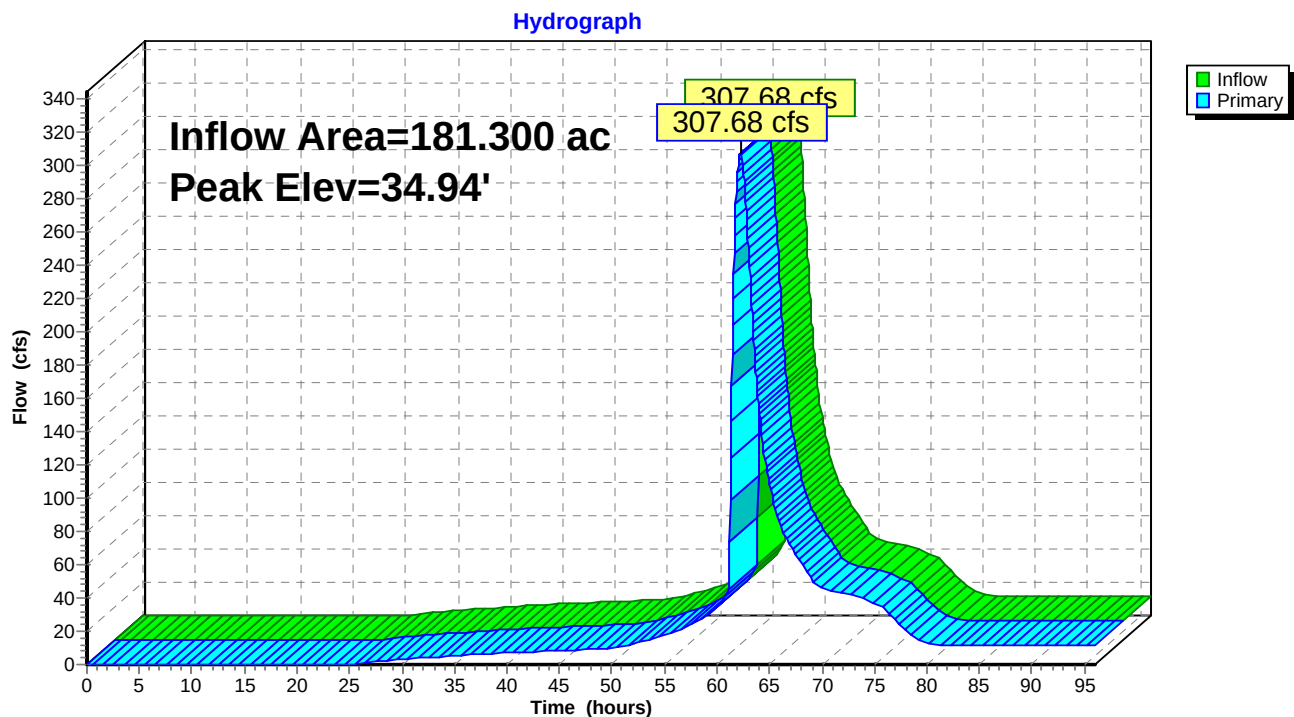
Device	Routing	Invert	Outlet Devices
#1	Primary	34.50'	264.0' long Sharp-Crested Rectangular Weir 2 End Contraction(s) 36.0" Round Culvert L= 17.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 29.42' / 29.26' S= 0.0094 ' S= 0.0094 ' Cc= 0.900 n= 0.024, Flow Area= 7.07 sf
#2	Primary	29.42'	

Primary OutFlow Max=307.32 cfs @ 62.22 hrs HW=34.94' (Free Discharge)

1=Sharp-Crested Rectangular Weir (Weir Controls 253.44 cfs @ 2.17 fps)

2=Culvert (Inlet Controls 53.89 cfs @ 7.62 fps)

Pond 30P: WRC18 and RC18



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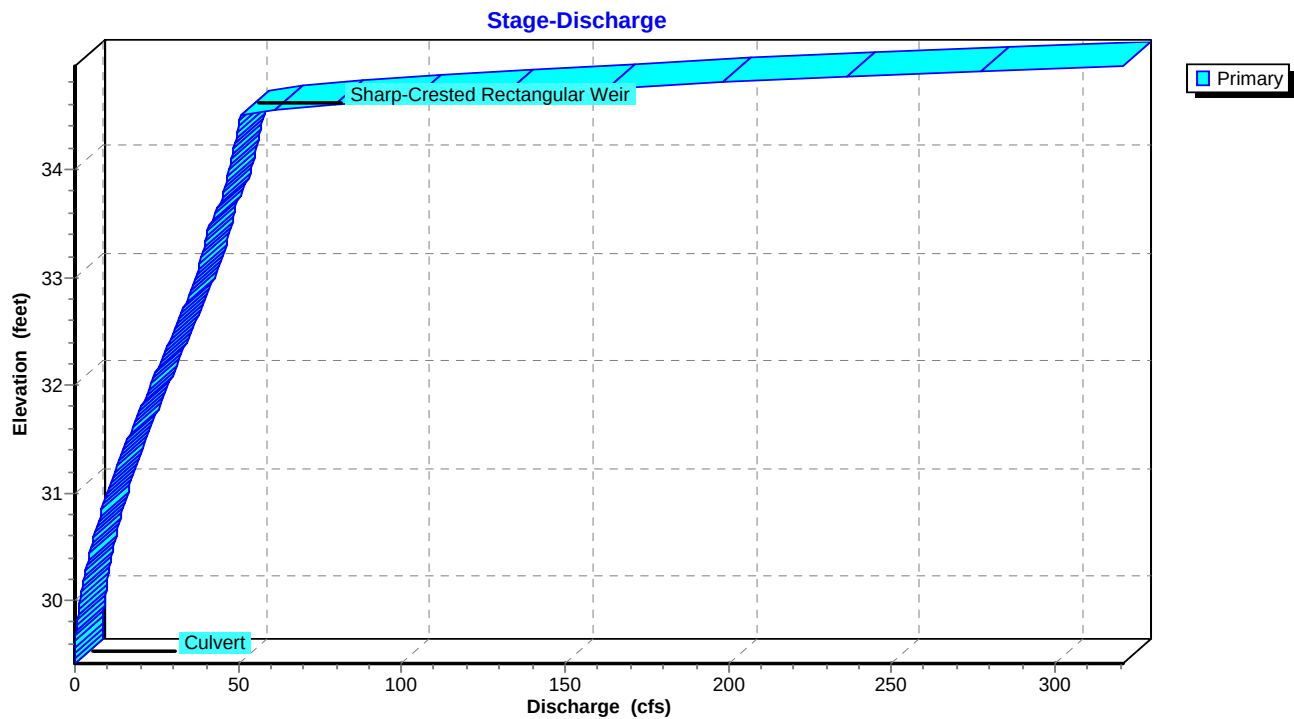
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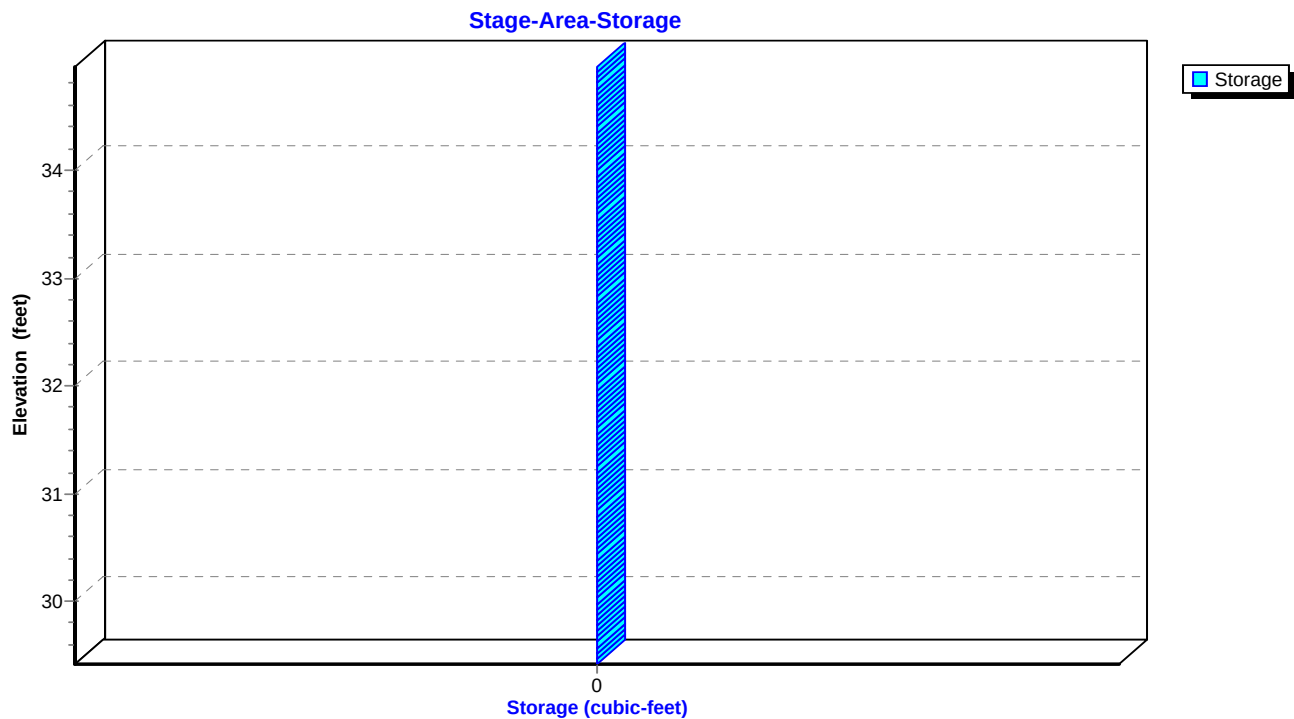
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Pond 30P: WRC18 and RC18



Pond 30P: WRC18 and RC18



Proposed-1

SJRWMD 96-hr tenth 100-yr96hr Rainfall=15.00"

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Summary for Pond 33P: Wetland Storage - BE10

Inflow Area = 76.000 ac, 0.00% Impervious, Inflow Depth > 11.53" for 100-yr96hr event
Inflow = 226.46 cfs @ 61.11 hrs, Volume= 73.031 af
Outflow = 139.01 cfs @ 61.90 hrs, Volume= 72.453 af, Atten= 39%, Lag= 47.7 min
Primary = 139.01 cfs @ 61.90 hrs, Volume= 72.453 af

Routing by Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Peak Elev= 32.05' @ 61.90 hrs Surf.Area= 16.371 ac Storage= 13.401 af

Plug-Flow detention time= 68.3 min calculated for 72.415 af (99% of inflow)
Center-of-Mass det. time= 52.8 min (3,821.4 - 3,768.6)

Volume	Invert	Avail.Storage	Storage Description
#1	30.00'	147.400 af	Custom Stage Data (Prismatic) Listed below (Recalc)
Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
30.00	2.200	0.000	0.000
31.00	3.700	2.950	2.950
32.00	15.500	9.600	12.550
33.00	31.800	23.650	36.200
34.00	59.100	45.450	81.650
35.00	72.400	65.750	147.400

Device	Routing	Invert	Outlet Devices
#1	Primary	30.00'	Custom Weir/Orifice, Cv= 2.62 (C= 3.28) Head (feet) 0.00 1.00 5.00 Width (feet) 12.00 15.00 26.00

Primary OutFlow Max=139.00 cfs @ 61.90 hrs HW=32.05' (Free Discharge)
↑1=Custom Weir/Orifice (Weir Controls 139.00 cfs @ 4.51 fps)

Proposed-1

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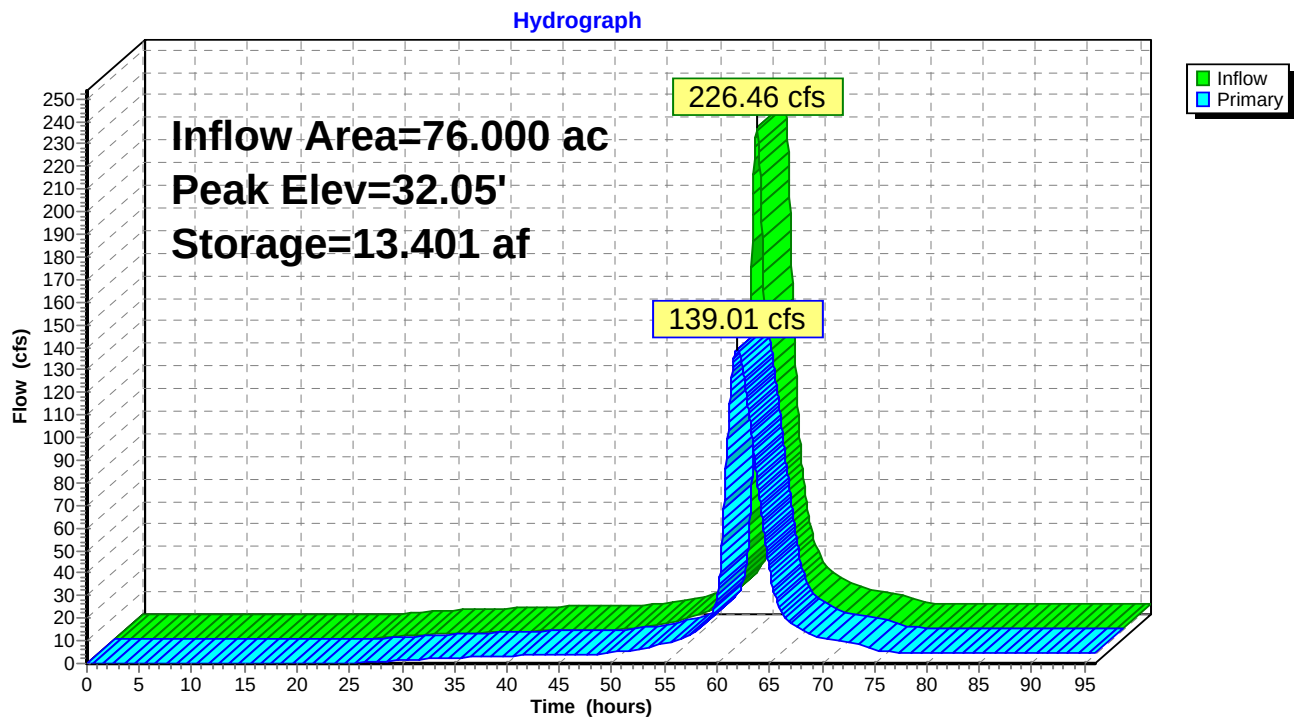
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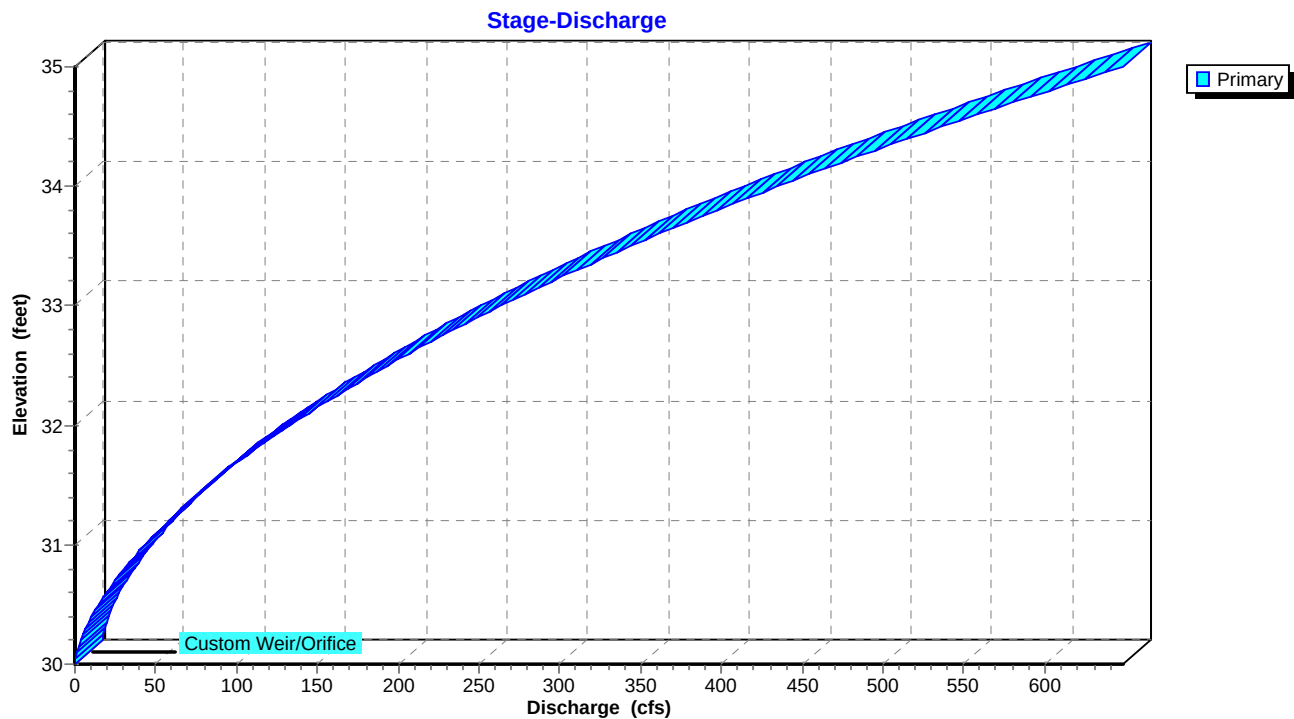
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Pond 33P: Wetland Storage - BE10



Pond 33P: Wetland Storage - BE10



Proposed-1

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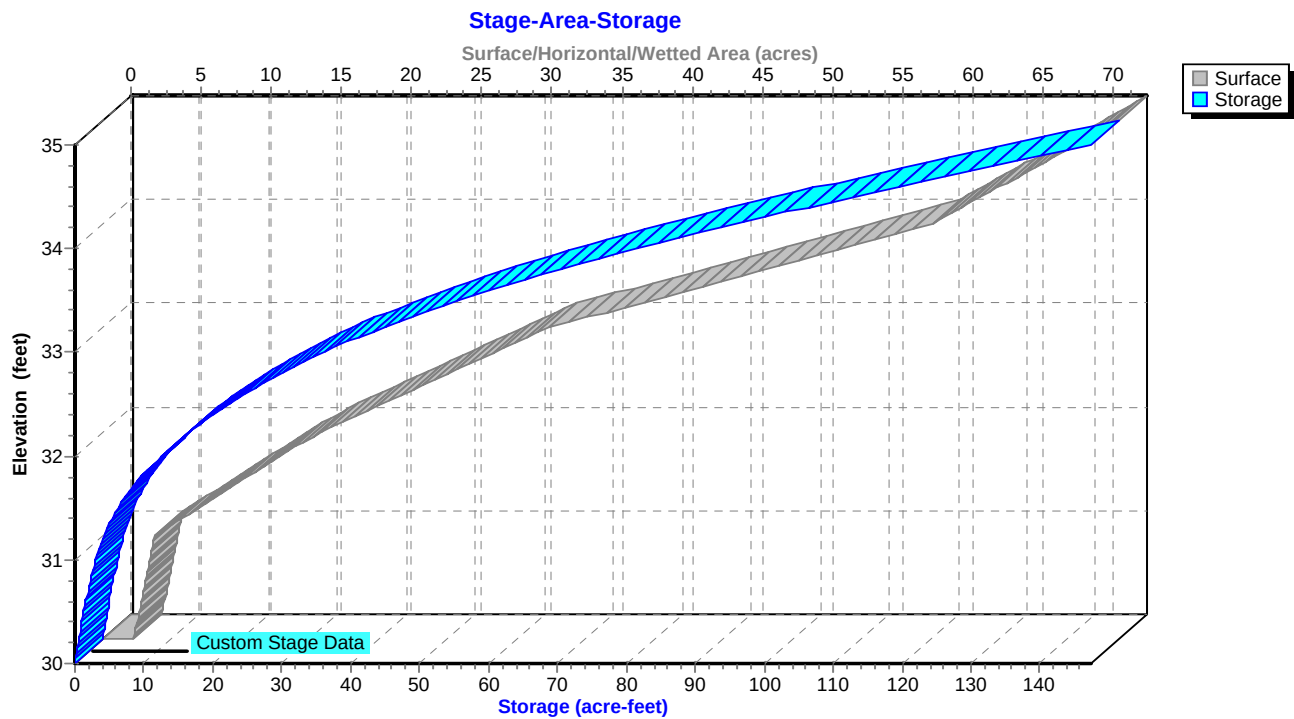
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SJRWMD 96-hr tenth 100-yr96hr Rainfall=15.00"

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Pond 33P: Wetland Storage - BE10



Proposed-1

SJRWMD 96-hr tenth 100-yr96hr Rainfall=15.00"

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Summary for Pond 35P: Wetland Storage - BE11

Inflow Area = 79.800 ac, 0.00% Impervious, Inflow Depth > 11.25" for 100-yr96hr event
Inflow = 295.54 cfs @ 60.76 hrs, Volume= 74.836 af
Outflow = 164.06 cfs @ 61.42 hrs, Volume= 74.296 af, Atten= 44%, Lag= 39.0 min
Primary = 164.06 cfs @ 61.42 hrs, Volume= 74.296 af

Routing by Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Peak Elev= 34.31' @ 61.42 hrs Surf.Area= 23.303 ac Storage= 19.141 af

Plug-Flow detention time= 105.4 min calculated for 74.296 af (99% of inflow)
Center-of-Mass det. time= 91.2 min (3,854.8 - 3,763.7)

Volume	Invert	Avail.Storage	Storage Description
#1	29.00'	111.000 af	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
29.00	0.000	0.000	0.000
30.00	0.800	0.400	0.400
31.00	0.800	0.800	1.200
32.00	2.400	1.600	2.800
33.00	4.800	3.600	6.400
34.00	10.400	7.600	14.000
35.00	52.700	31.550	45.550
36.00	78.200	65.450	111.000

Device	Routing	Invert	Outlet Devices
#1	Primary	34.00'	264.0' long x 10.0' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64
#2	Primary	29.17'	36.0" Round Culvert L= 29.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 29.17' / 28.74' S= 0.0148 '/' Cc= 0.900 n= 0.024, Flow Area= 7.07 sf

Primary OutFlow Max=163.49 cfs @ 61.42 hrs HW=34.30' (Free Discharge)

1=Broad-Crested Rectangular Weir (Weir Controls 112.26 cfs @ 1.40 fps)

2=Culvert (Inlet Controls 51.23 cfs @ 7.25 fps)

Proposed-1

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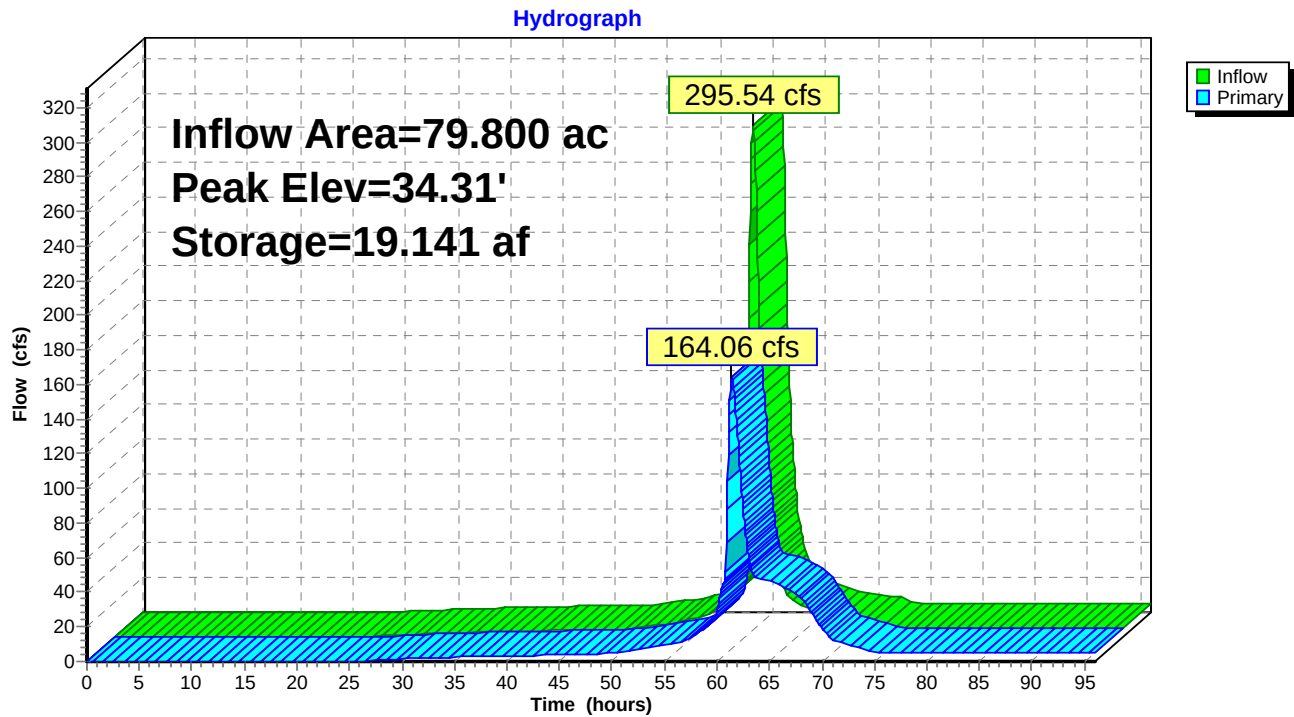
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SJRWMD 96-hr tenth 100-yr96hr Rainfall=15.00"

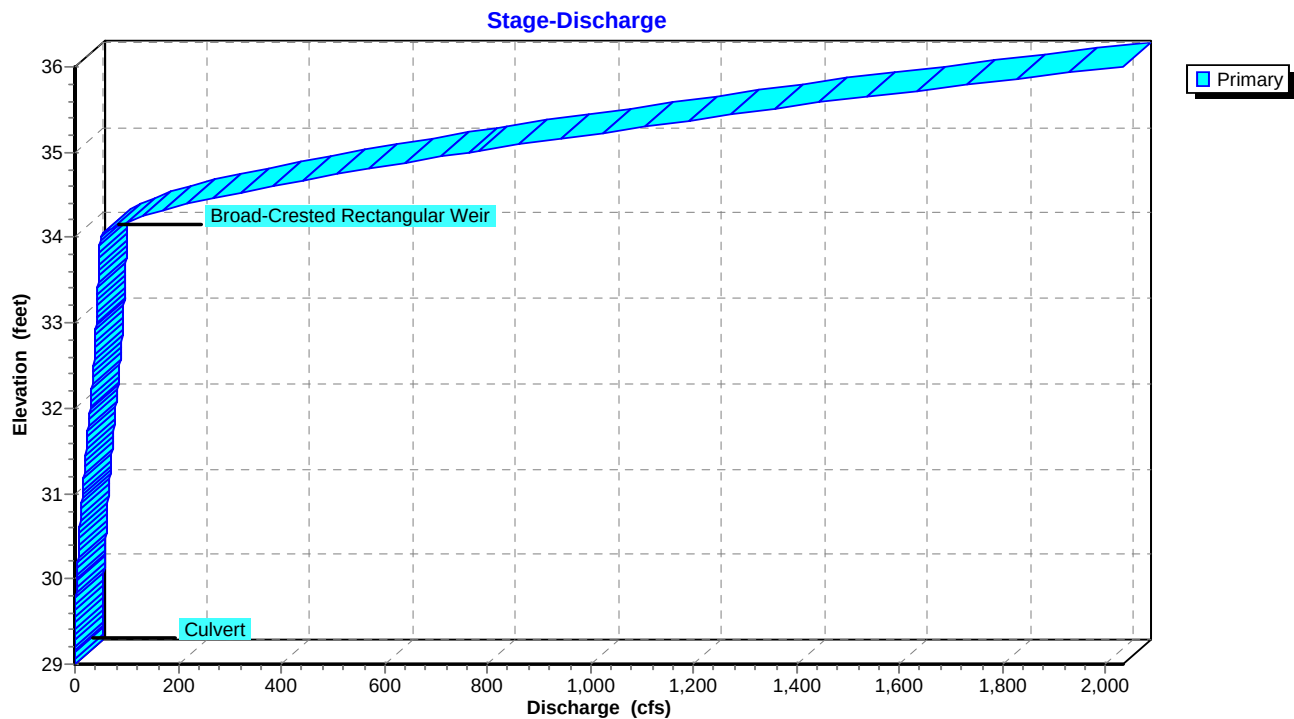
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Pond 35P: Wetland Storage - BE11



Pond 35P: Wetland Storage - BE11



Proposed-1

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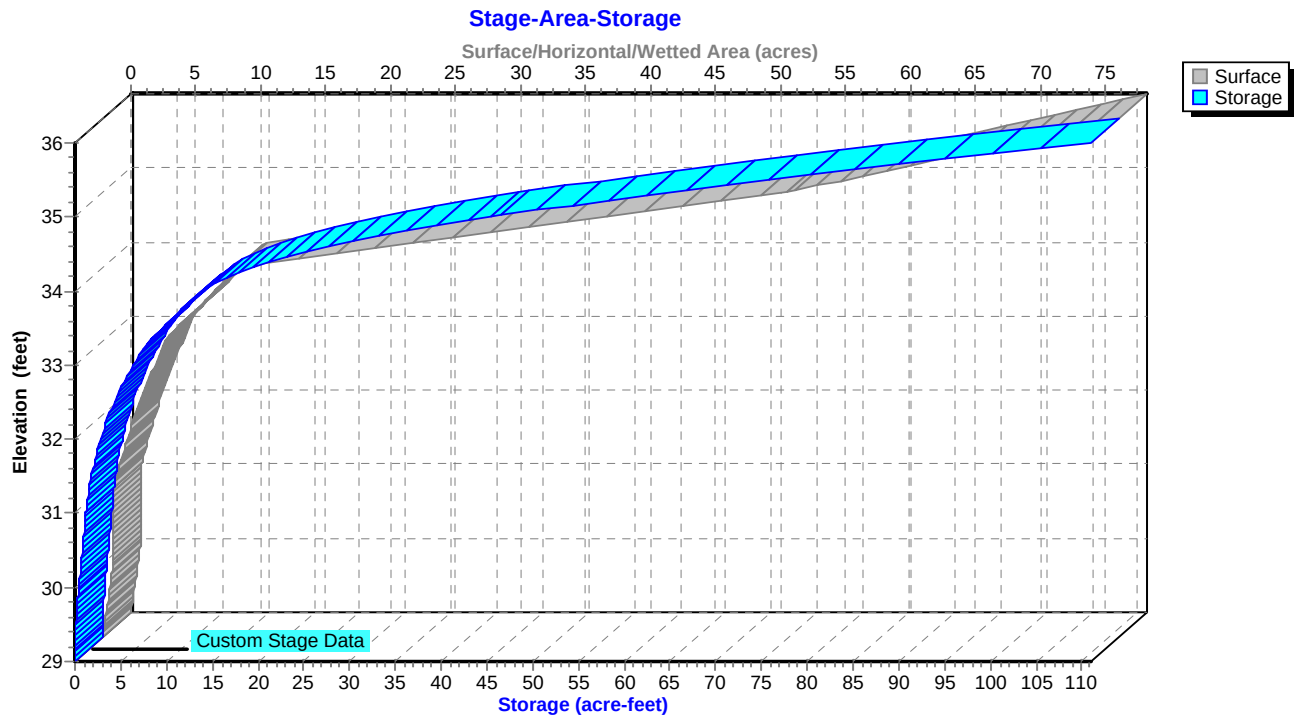
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SJRWMD 96-hr tenth 100-yr96hr Rainfall=15.00"

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Pond 35P: Wetland Storage - BE11



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SJRWMD 96-hr tenth 100-yr96hr Rainfall=15.00"

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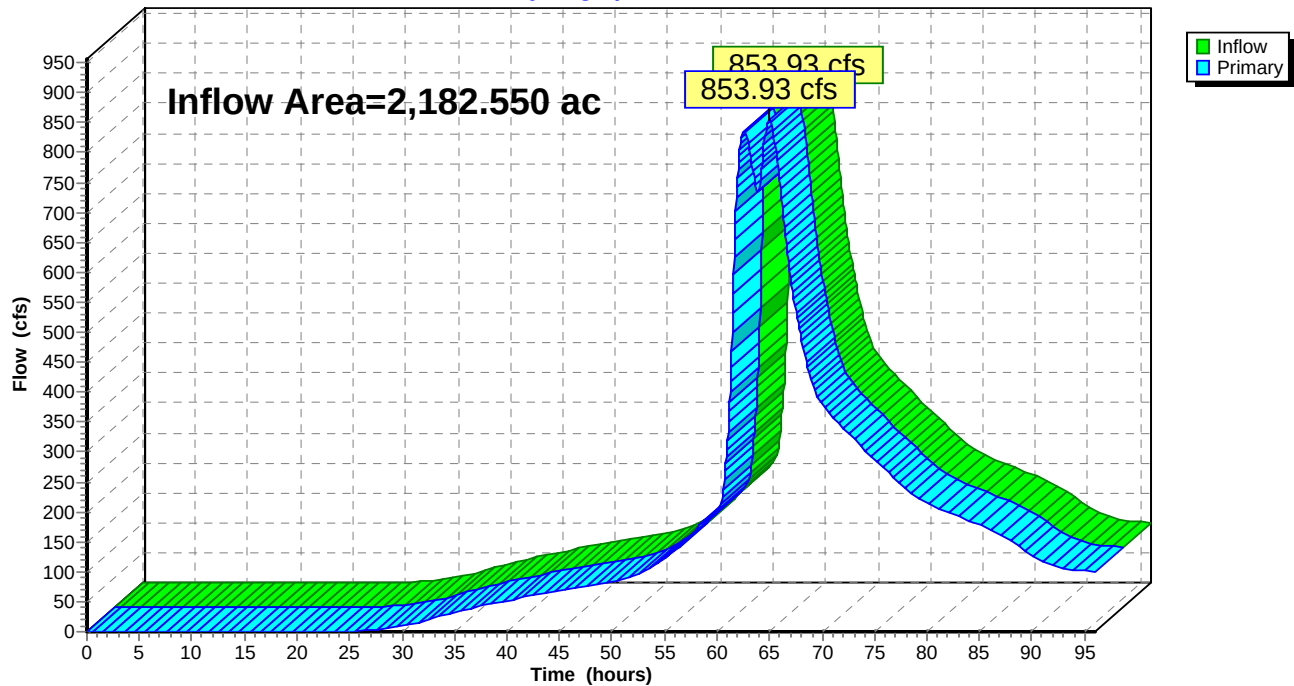
Summary for Link 24L: CP-1

Inflow Area = 2,182.550 ac, 0.00% Impervious, Inflow Depth > 6.21" for 100-yr96hr event
Inflow = 853.93 cfs @ 64.97 hrs, Volume= 1,129.183 af
Primary = 853.93 cfs @ 64.97 hrs, Volume= 1,129.183 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs

Link 24L: CP-1

Hydrograph



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SJRWMD 96-hr tenth 100-yr96hr Rainfall=15.00"

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Summary for Link 32L: From BN4B1B

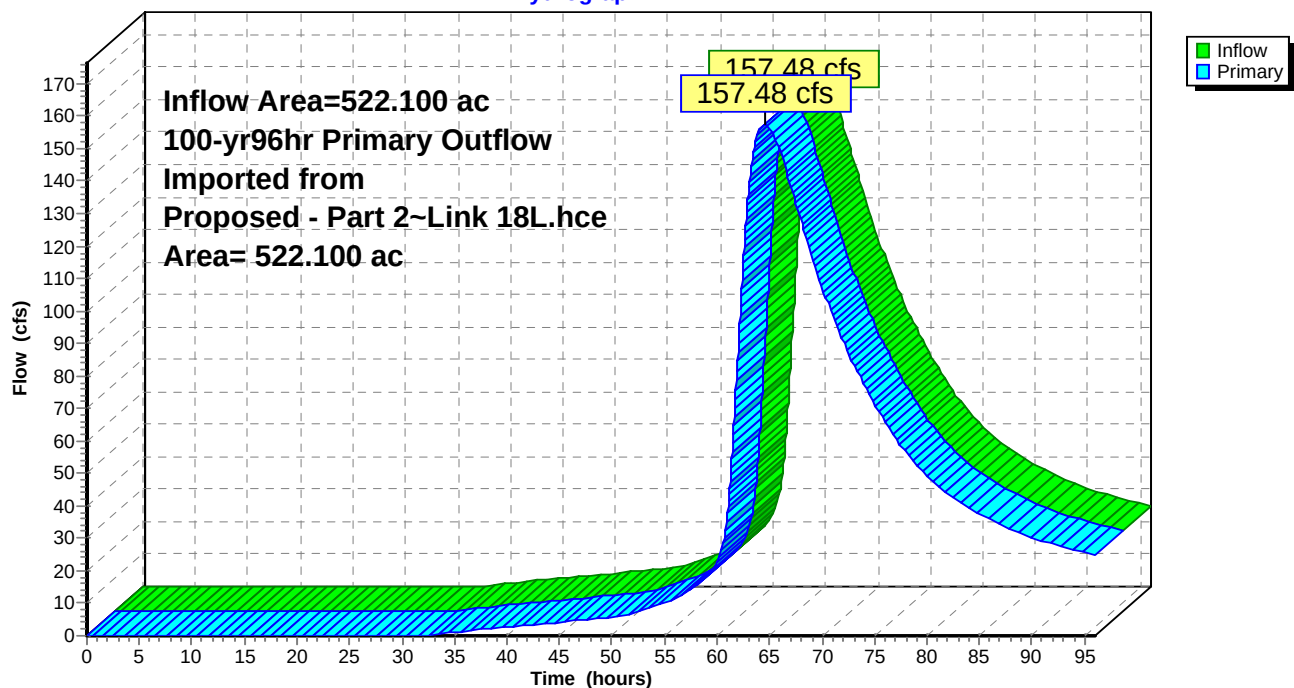
Inflow Area = 522.100 ac, 0.00% Impervious, Inflow Depth > 4.98" for 100-yr96hr event
Inflow = 157.48 cfs @ 64.54 hrs, Volume= 216.552 af
Primary = 157.48 cfs @ 64.54 hrs, Volume= 216.552 af, Atten= 0%, Lag= 0.0 min

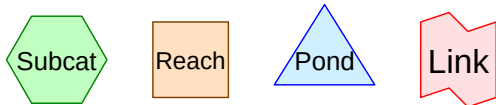
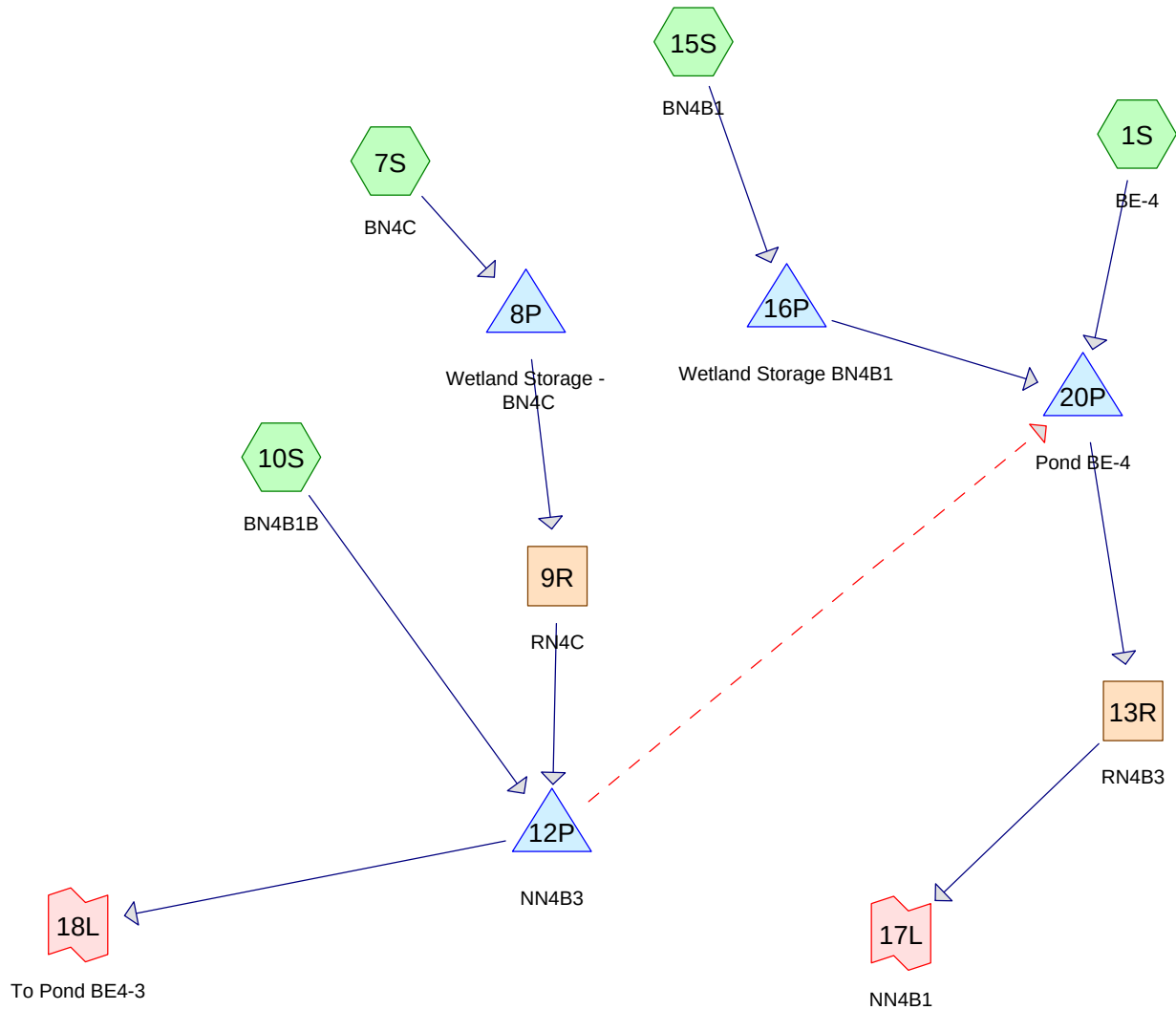
Primary outflow = Inflow, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs

100-yr96hr Primary Outflow Imported from Proposed - Part 2~Link 18L.hce

Link 32L: From BN4B1B

Hydrograph





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Page 2

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
40.270	74	(1S)
210.700	76	(7S)
311.400	72	(10S)
61.200	82	(15S)
623.570	74	TOTAL AREA

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Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
0.000	HSG C	
0.000	HSG D	
623.570	Other	1S, 7S, 10S, 15S
623.570		TOTAL AREA

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Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	0.000	0.000	0.000	623.570	623.570		1S, 7S, 10S, 15S
0.000	0.000	0.000	0.000	623.570	623.570	TOTAL AREA	

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Pipe Listing (all nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Diam/Width (inches)	Height (inches)	Inside-Fill (inches)
1	20P	31.00	30.50	50.0	0.0100	0.024	12.0	0.0	0.0

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Type II 24-hr 25yr-24hr Rainfall=9.20"

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Time span=5.00-96.00 hrs, dt=0.05 hrs, 1821 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment1S: BE-4	Runoff Area=40.270 ac 0.00% Impervious Runoff Depth=6.01" Flow Length=5,044' Tc=83.4 min CN=74 Runoff=101.35 cfs 20.174 af
Subcatchment7S: BN4C	Runoff Area=210.700 ac 0.00% Impervious Runoff Depth=6.26" Tc=144.6 min CN=76 Runoff=362.83 cfs 109.932 af
Subcatchment10S: BN4B1B	Runoff Area=311.400 ac 0.00% Impervious Runoff Depth=5.76" Tc=174.4 min CN=72 Runoff=428.53 cfs 149.518 af
Subcatchment15S: BN4B1	Runoff Area=61.200 ac 0.00% Impervious Runoff Depth>7.01" Tc=127.6 min CN=82 Runoff=129.02 cfs 35.728 af
Reach 9R: RN4C	Avg. Flow Depth=1.76' Max Vel=1.87 fps Inflow=42.85 cfs 96.177 af n=0.060 L=1,000.0' S=0.0060 '/' Capacity=41.26 cfs Outflow=42.84 cfs 96.094 af
Reach 13R: RN4B3	Avg. Flow Depth=6.33' Max Vel=1.34 fps Inflow=117.91 cfs 168.243 af n=0.040 L=4,459.0' S=0.0004 '/' Capacity=206.00 cfs Outflow=108.55 cfs 167.373 af
Pond 8P: Wetland Storage - BN4C	Peak Elev=55.31' Storage=77.986 af Inflow=362.83 cfs 109.932 af Outflow=42.85 cfs 96.177 af
Pond 12P: NN4B3	Peak Elev=39.23' Storage=71.932 af Inflow=442.45 cfs 245.612 af Primary=97.45 cfs 117.229 af Secondary=79.11 cfs 127.884 af Outflow=176.56 cfs 245.113 af
Pond 16P: Wetland Storage BN4B1	Peak Elev=35.60' Storage=15.953 af Inflow=129.02 cfs 35.728 af Outflow=45.25 cfs 35.728 af
Pond 20P: Pond BE-4	Peak Elev=35.13' Storage=9.955 af Inflow=138.70 cfs 183.786 af Outflow=117.91 cfs 168.243 af
Link 17L: NN4B1	Inflow=108.55 cfs 167.373 af Primary=108.55 cfs 167.373 af
Link 18L: To Pond BE4-3	Inflow=97.45 cfs 117.229 af Primary=97.45 cfs 117.229 af

Total Runoff Area = 623.570 ac Runoff Volume = 315.352 af Average Runoff Depth = 6.07"
100.00% Pervious = 623.570 ac 0.00% Impervious = 0.000 ac

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Type II 24-hr 25yr-24hr Rainfall=9.20"

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Summary for Subcatchment 1S: BE-4

Runoff = 101.35 cfs @ 12.91 hrs, Volume= 20.174 af, Depth= 6.01"

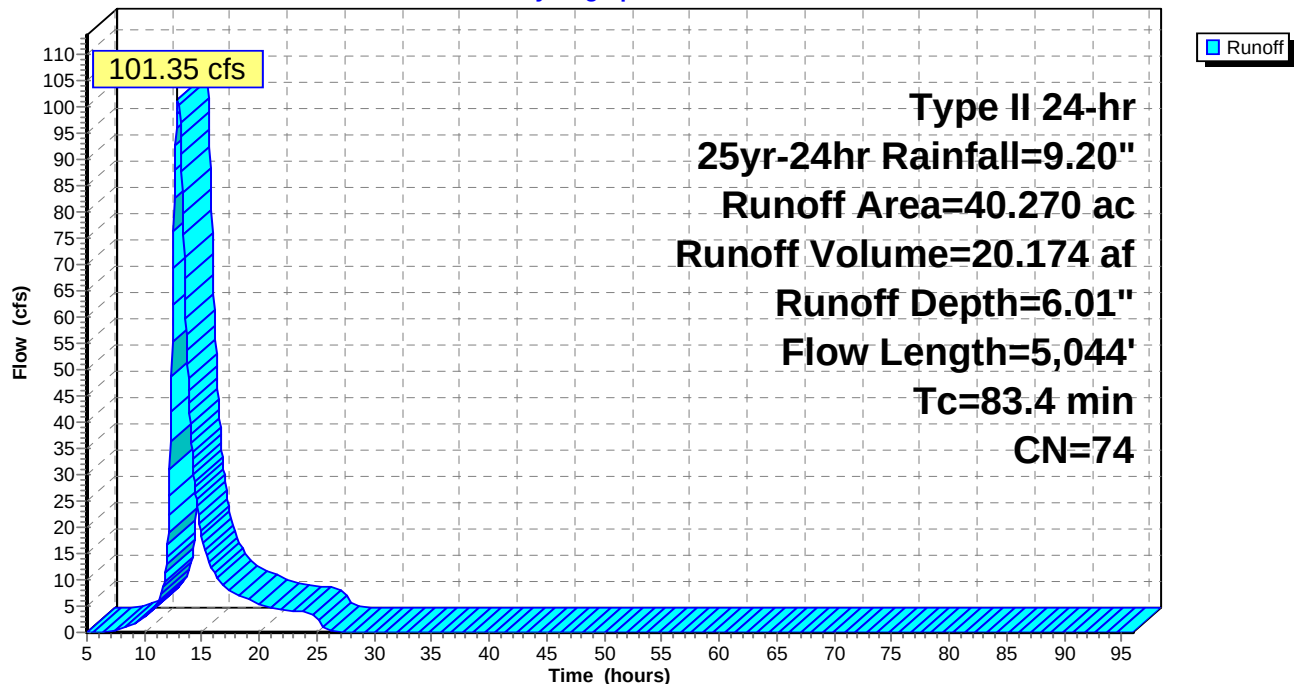
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-96.00 hrs, dt= 0.05 hrs
Type II 24-hr 25yr-24hr Rainfall=9.20"

Area (ac)	CN	Description
* 40.270	74	
40.270		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.9	200	0.0050	0.28		Sheet Flow, Cultivated: Residue<=20% n= 0.060 P2= 4.58"
47.9	1,422	0.0050	0.49		Shallow Concentrated Flow, Short Grass Pasture Kv= 7.0 fps
23.6	3,422	0.0008	2.41	237.12	Channel Flow, Area= 98.2 sf Perim= 43.4' r= 2.26' n= 0.030
83.4	5,044	Total			

Subcatchment 1S: BE-4

Hydrograph



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Type II 24-hr 25yr-24hr Rainfall=9.20"

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Summary for Subcatchment 7S: BN4C

Runoff = 362.83 cfs @ 13.67 hrs, Volume= 109.932 af, Depth= 6.26"

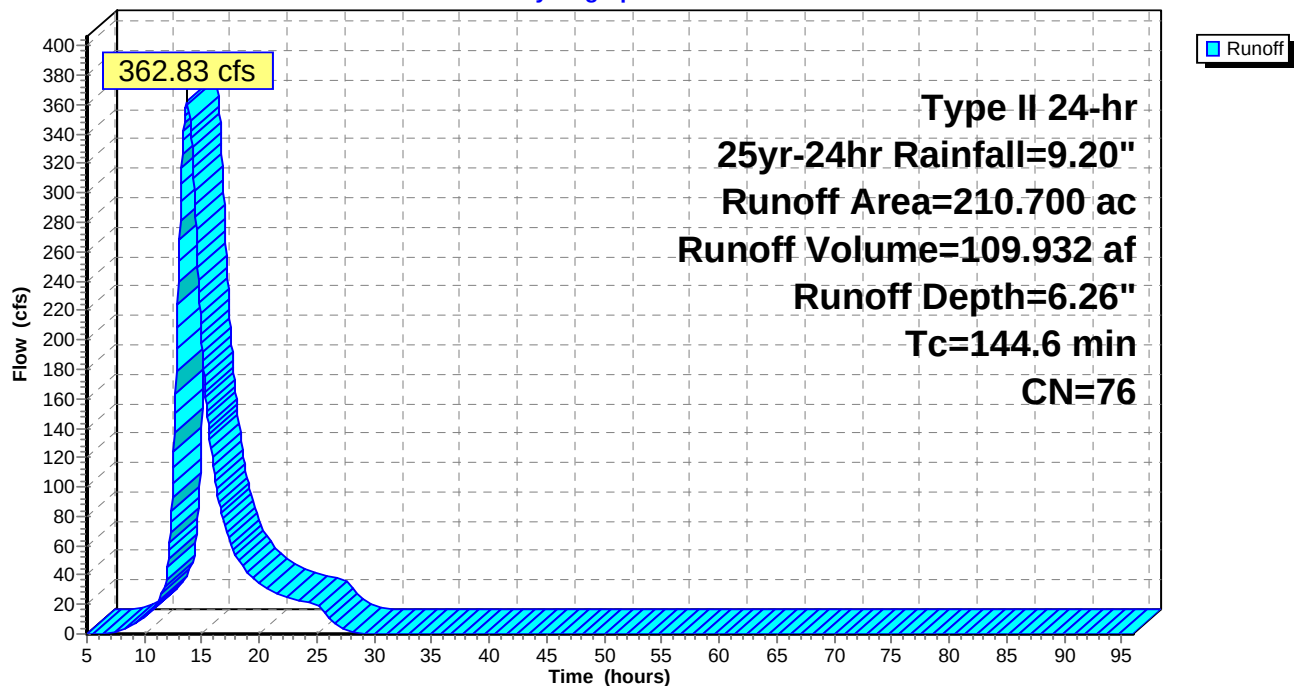
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-96.00 hrs, dt= 0.05 hrs
Type II 24-hr 25yr-24hr Rainfall=9.20"

Area (ac)	CN	Description
* 210.700	76	
210.700		100.00% Pervious Area

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

Subcatchment 7S: BN4C

Hydrograph



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Type II 24-hr 25yr-24hr Rainfall=9.20"

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Summary for Subcatchment 10S: BN4B1B

Runoff = 428.53 cfs @ 14.13 hrs, Volume= 149.518 af, Depth= 5.76"

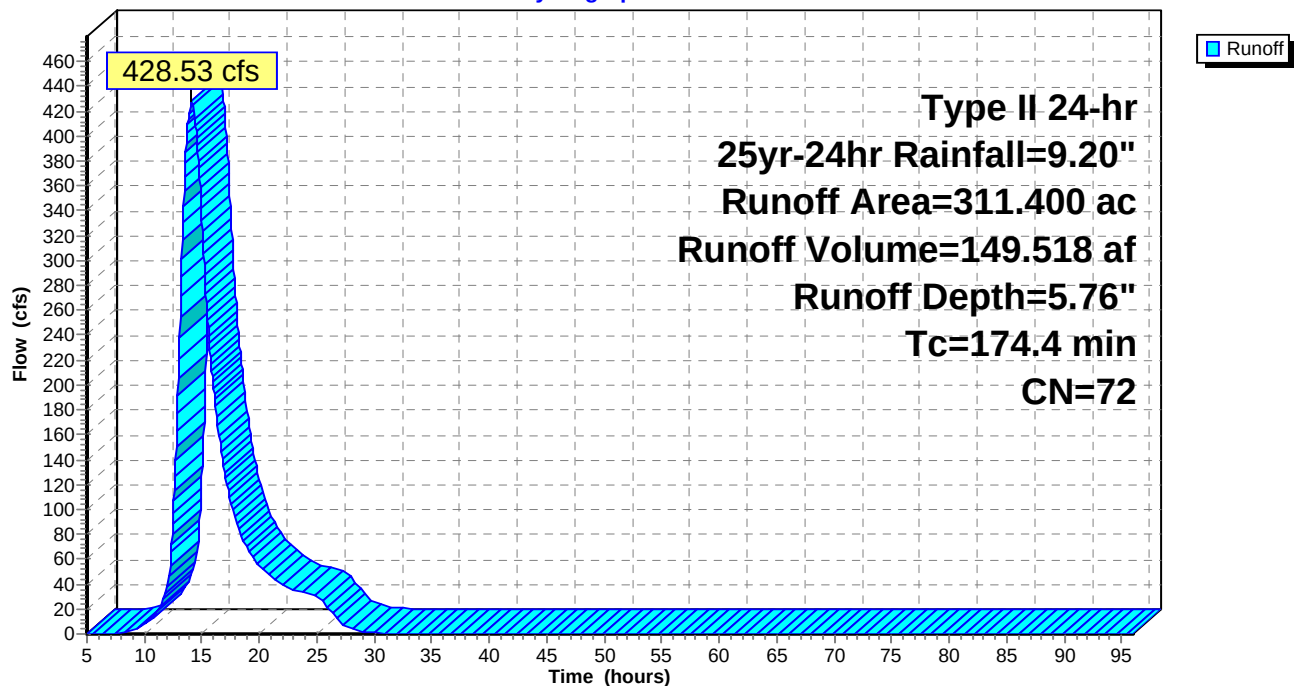
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-96.00 hrs, dt= 0.05 hrs
Type II 24-hr 25yr-24hr Rainfall=9.20"

Area (ac)	CN	Description
* 311.400	72	
311.400		100.00% Pervious Area

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

Subcatchment 10S: BN4B1B

Hydrograph



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Type II 24-hr 25yr-24hr Rainfall=9.20"

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Summary for Subcatchment 15S: BN4B1

Runoff = 129.02 cfs @ 13.46 hrs, Volume= 35.728 af, Depth> 7.01"

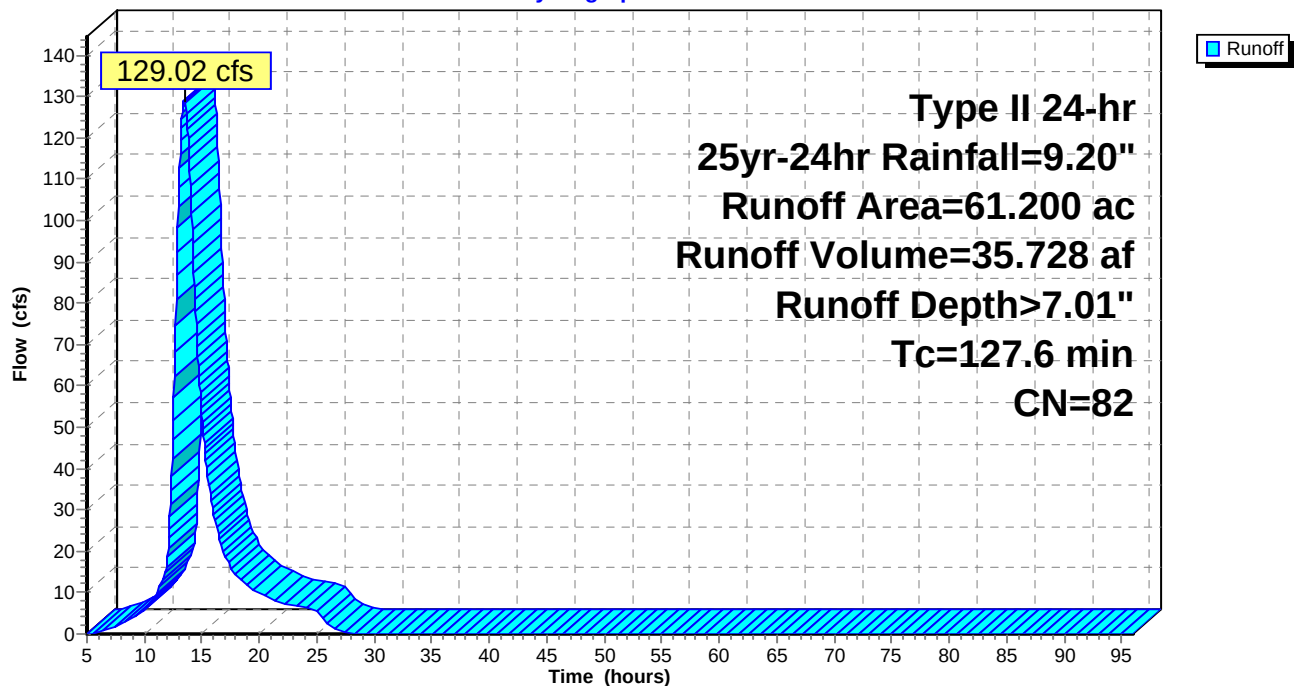
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-96.00 hrs, dt= 0.05 hrs
Type II 24-hr 25yr-24hr Rainfall=9.20"

Area (ac)	CN	Description
* 61.200	82	
61.200		100.00% Pervious Area

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

Subcatchment 15S: BN4B1

Hydrograph



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Type II 24-hr 25yr-24hr Rainfall=9.20"

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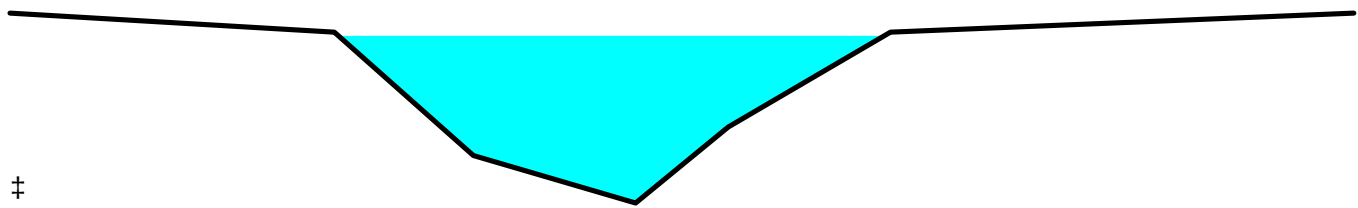
Summary for Reach 9R: RN4C

Inflow Area = 210.700 ac, 0.00% Impervious, Inflow Depth > 5.48" for 25yr-24hr event
Inflow = 42.85 cfs @ 18.82 hrs, Volume= 96.177 af
Outflow = 42.84 cfs @ 19.08 hrs, Volume= 96.094 af, Atten= 0%, Lag= 15.7 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-96.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.87 fps, Min. Travel Time= 8.9 min
Avg. Velocity= 1.19 fps, Avg. Travel Time= 14.0 min

Peak Storage= 22,927 cf @ 18.93 hrs
Average Depth at Peak Storage= 1.76'
Bank-Full Depth= 2.00' Flow Area= 32.0 sf, Capacity= 41.26 cfs

Custom cross-section, Length= 1,000.0' Slope= 0.0060 '/
Constant n= 0.060
Inlet Invert= 54.00', Outlet Invert= 48.00'



Offset (feet)	Elevation (feet)	Chan.Depth (feet)
0.00	50.40	0.00
14.00	50.20	0.20
20.00	48.90	1.50
27.00	48.40	2.00
31.00	49.20	1.20
38.00	50.20	0.20
58.00	50.40	0.00

Depth (feet)	End Area (sq-ft)	Perim. (feet)	Storage (cubic-feet)	Discharge (cfs)
0.00	0.0	0.0	0	0.00
0.50	2.4	9.6	2,375	1.80
0.80	5.7	12.5	5,658	6.39
1.80	23.9	24.3	23,850	45.18
2.00	32.0	58.3	32,050	41.26

Proposed - Part 2

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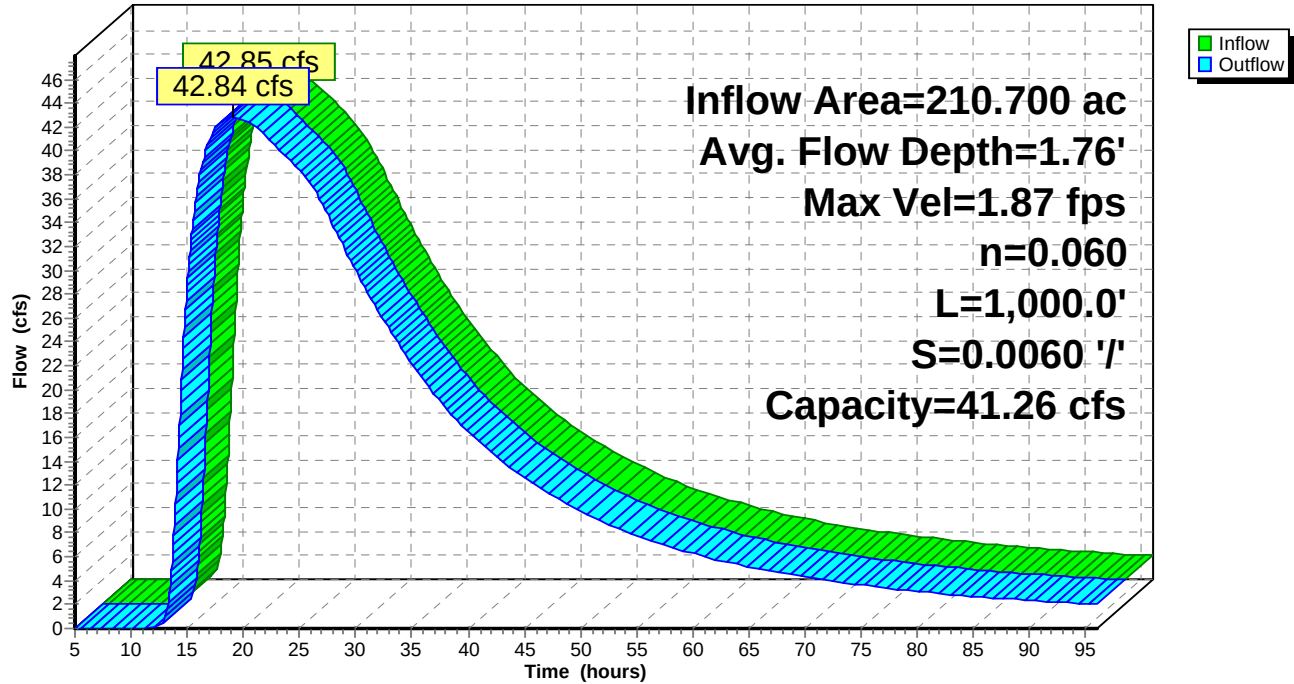
Type II 24-hr 25yr-24hr Rainfall=9.20"

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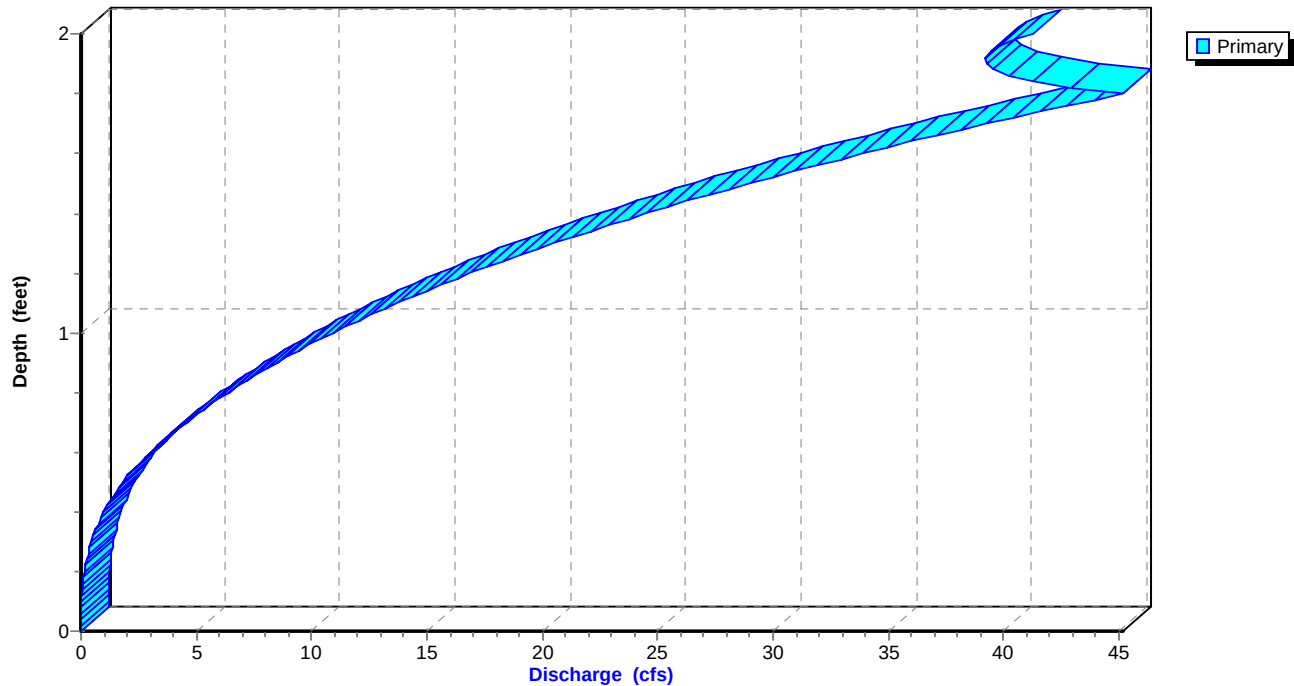
Reach 9R: RN4C

Hydrograph



Reach 9R: RN4C

Stage-Discharge



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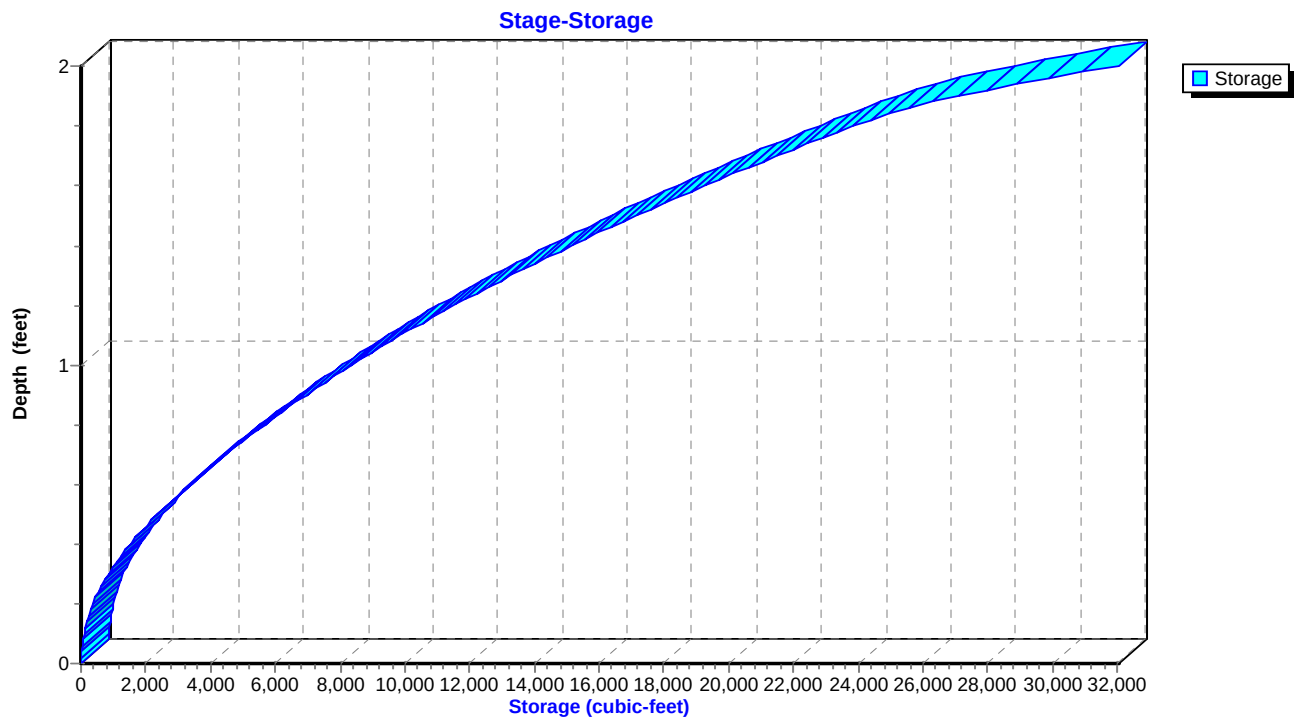
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Type II 24-hr 25yr-24hr Rainfall=9.20"

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Reach 9R: RN4C



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Type II 24-hr 25yr-24hr Rainfall=9.20"

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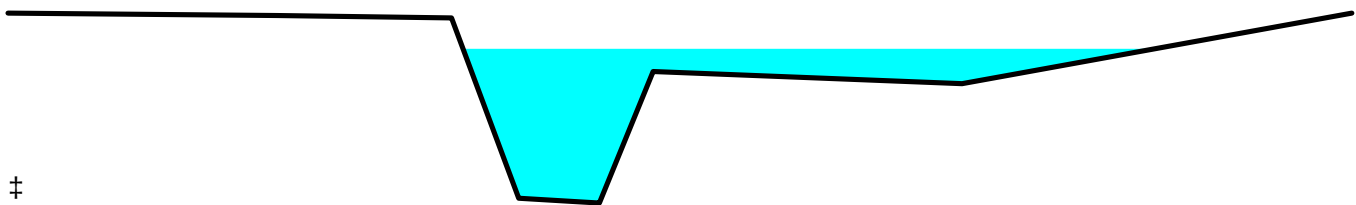
Summary for Reach 13R: RN4B3

Inflow Area = 101.470 ac, 0.00% Impervious, Inflow Depth > 19.90" for 25yr-24hr event
Inflow = 117.91 cfs @ 13.27 hrs, Volume= 168.243 af
Outflow = 108.55 cfs @ 17.87 hrs, Volume= 167.373 af, Atten= 8%, Lag= 276.2 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-96.00 hrs, dt= 0.05 hrs / 4
Max. Velocity= 1.34 fps, Min. Travel Time= 55.4 min
Avg. Velocity= 0.76 fps, Avg. Travel Time= 97.9 min

Peak Storage= 455,200 cf @ 16.95 hrs
Average Depth at Peak Storage= 6.33'
Bank-Full Depth= 7.80' Flow Area= 192.0 sf, Capacity= 206.00 cfs

Custom cross-section, Length= 4,459.0' Slope= 0.0004 '/' (105 Elevation Intervals)
Constant n= 0.040
Inlet Invert= 31.00', Outlet Invert= 29.30'



Offset (feet)	Elevation (feet)	Chan.Depth (feet)
0.00	40.90	0.00
20.00	40.80	0.10
33.00	40.70	0.20
38.00	33.30	7.60
44.00	33.10	7.80
48.00	38.50	2.40
71.00	38.00	2.90
100.00	40.90	0.00

Depth (feet)	End Area (sq-ft)	Perim. (feet)	Storage (cubic-feet)	Discharge (cfs)
0.00	0.0	0.0	0	0.00
0.20	0.6	6.3	2,741	0.10
4.90	45.2	17.8	201,348	60.99
5.40	58.7	47.0	261,900	49.41
7.60	175.9	71.8	784,338	231.89
7.70	183.1	85.8	816,443	220.15
7.80	192.0	106.8	856,351	206.00

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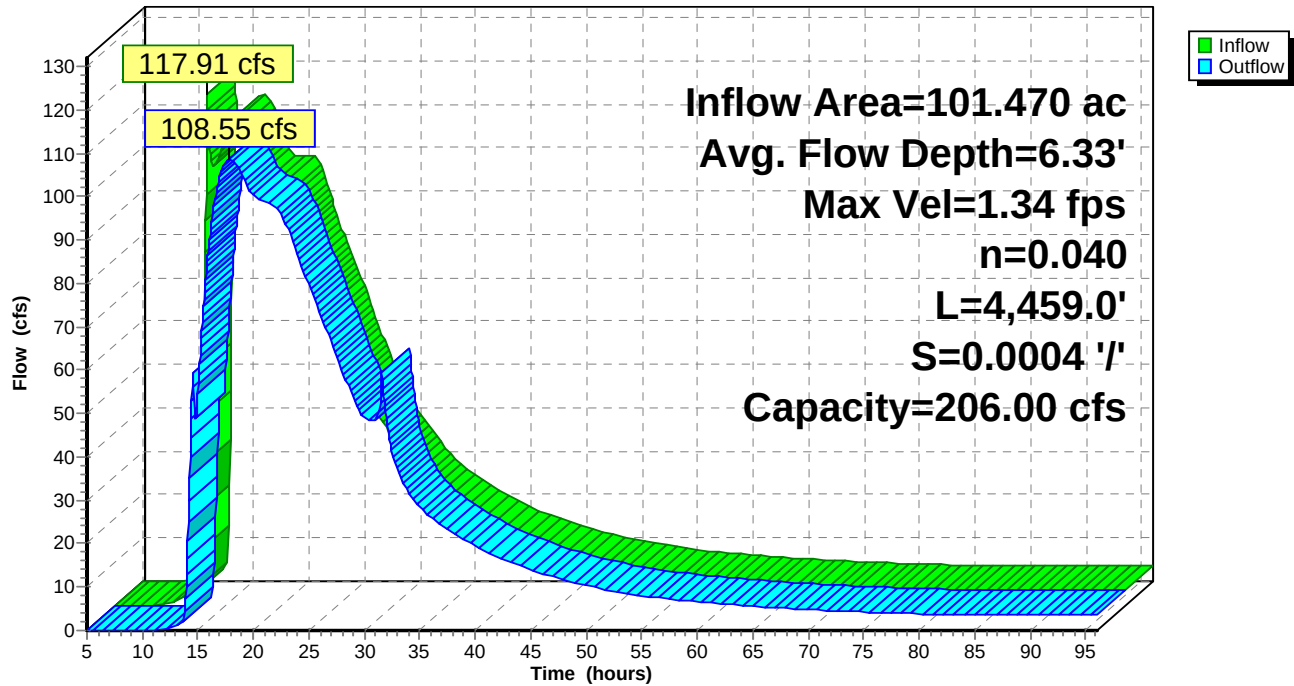
Type II 24-hr 25yr-24hr Rainfall=9.20"

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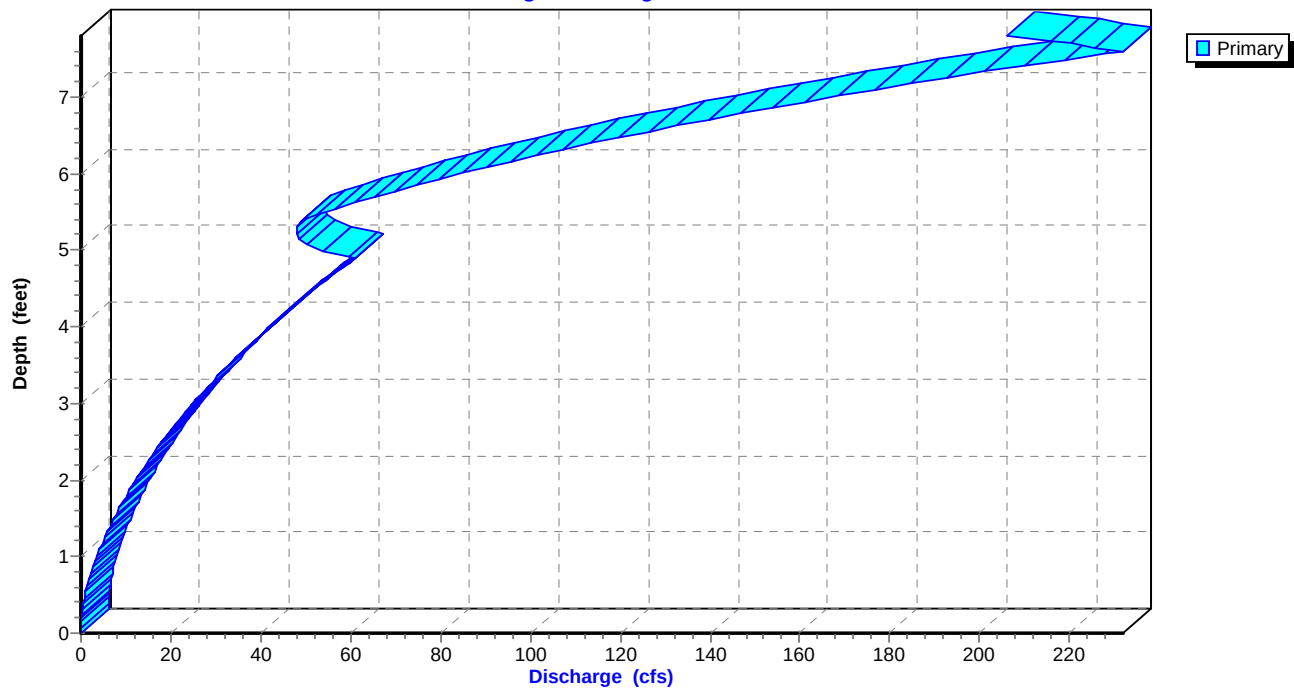
Reach 13R: RN4B3

Hydrograph



Reach 13R: RN4B3

Stage-Discharge



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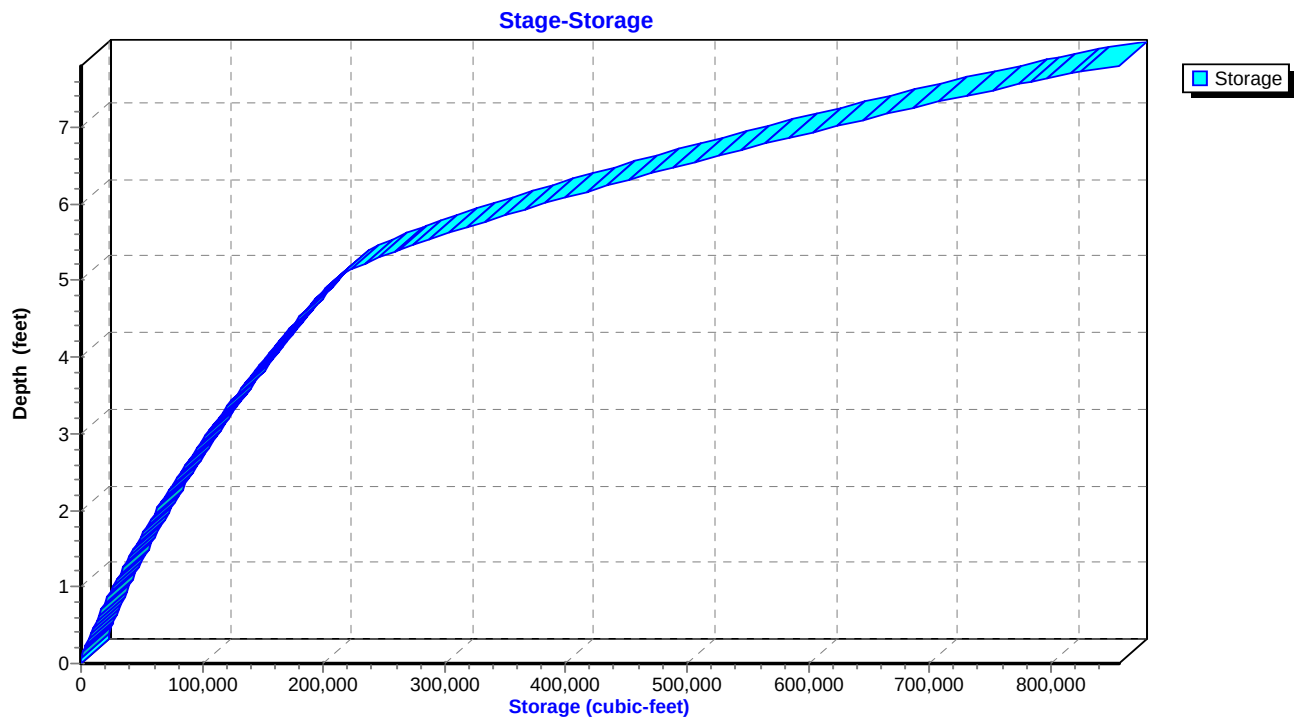
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Type II 24-hr 25yr-24hr Rainfall=9.20"

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Reach 13R: RN4B3



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Type II 24-hr 25yr-24hr Rainfall=9.20"

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Summary for Pond 8P: Wetland Storage - BN4C

Inflow Area = 210.700 ac, 0.00% Impervious, Inflow Depth = 6.26" for 25yr-24hr event
 Inflow = 362.83 cfs @ 13.67 hrs, Volume= 109.932 af
 Outflow = 42.85 cfs @ 18.82 hrs, Volume= 96.177 af, Atten= 88%, Lag= 309.1 min
 Primary = 42.85 cfs @ 18.82 hrs, Volume= 96.177 af

Routing by Stor-Ind method, Time Span= 5.00-96.00 hrs, dt= 0.05 hrs
 Peak Elev= 55.31' @ 18.82 hrs Surf.Area= 106.635 ac Storage= 77.986 af

Plug-Flow detention time= 1,204.7 min calculated for 96.124 af (87% of inflow)
 Center-of-Mass det. time= 1,145.3 min (2,077.2 - 931.9)

Volume	Invert	Avail.Storage	Storage Description
#1	54.00'	377.100 af	Custom Stage Data (Prismatic) Listed below (Recalc)
Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
54.00	29.500	0.000	0.000
55.00	71.600	50.550	50.550
56.00	185.400	128.500	179.050
57.00	210.700	198.050	377.100

Device	Routing	Invert	Outlet Devices
#1	Primary	54.00'	Custom Weir/Orifice, Cv= 2.62 (C= 3.28) Head (feet) 0.00 0.60 1.80 2.00 Width (feet) 0.00 11.00 24.00 58.00

Primary OutFlow Max=42.84 cfs @ 18.82 hrs HW=55.31' (Free Discharge)
 ↑1=Custom Weir/Orifice (Weir Controls 42.84 cfs @ 3.10 fps)

Proposed - Part 2

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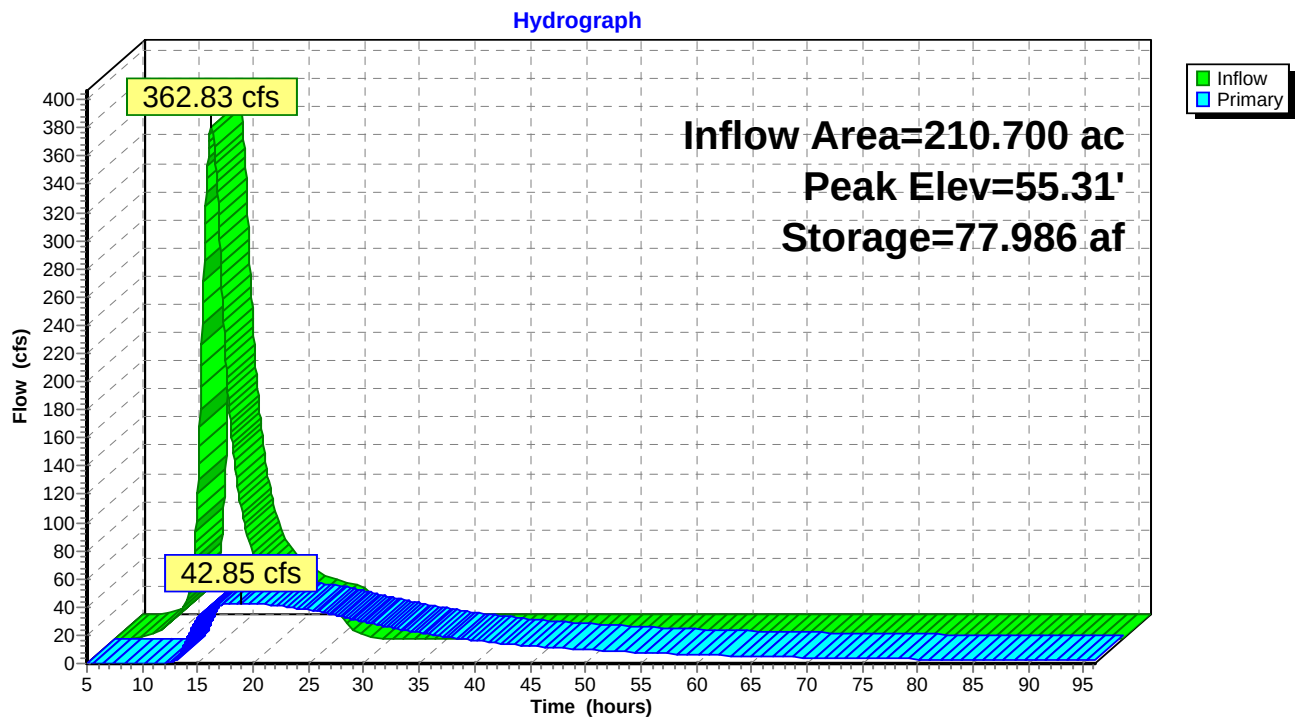
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Type II 24-hr 25yr-24hr Rainfall=9.20"

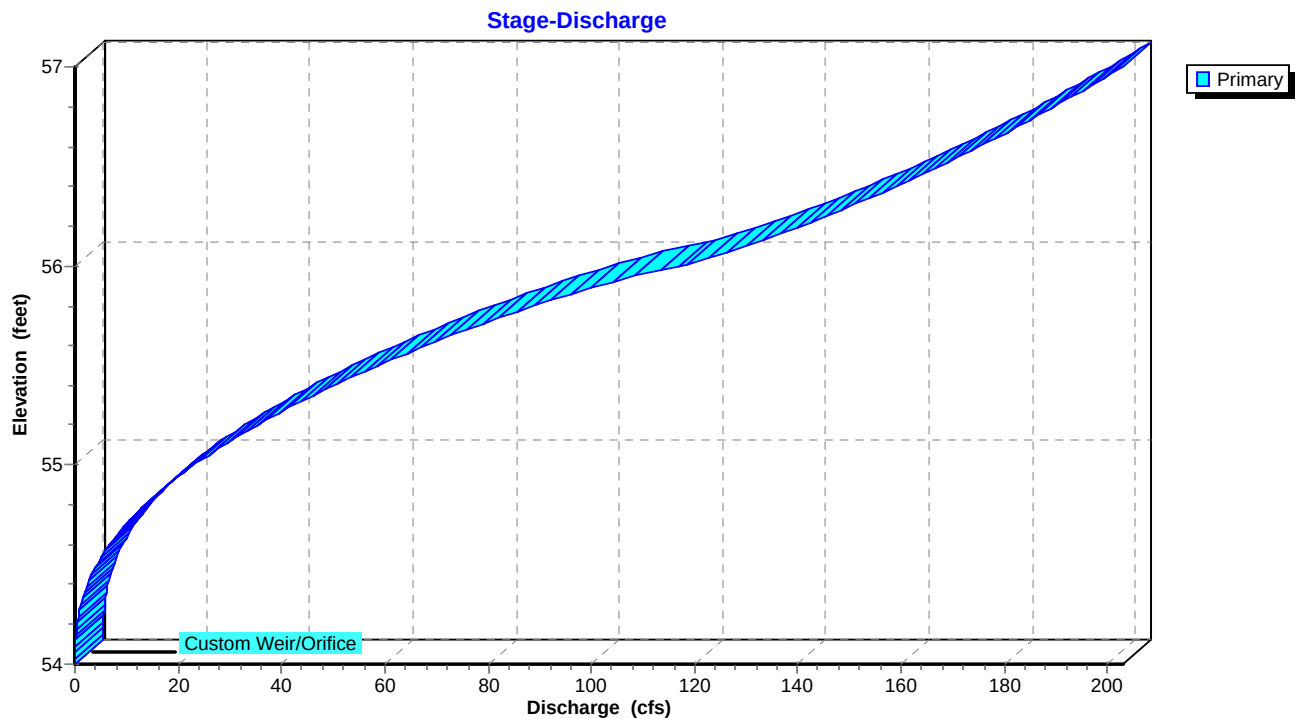
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Pond 8P: Wetland Storage - BN4C



Pond 8P: Wetland Storage - BN4C



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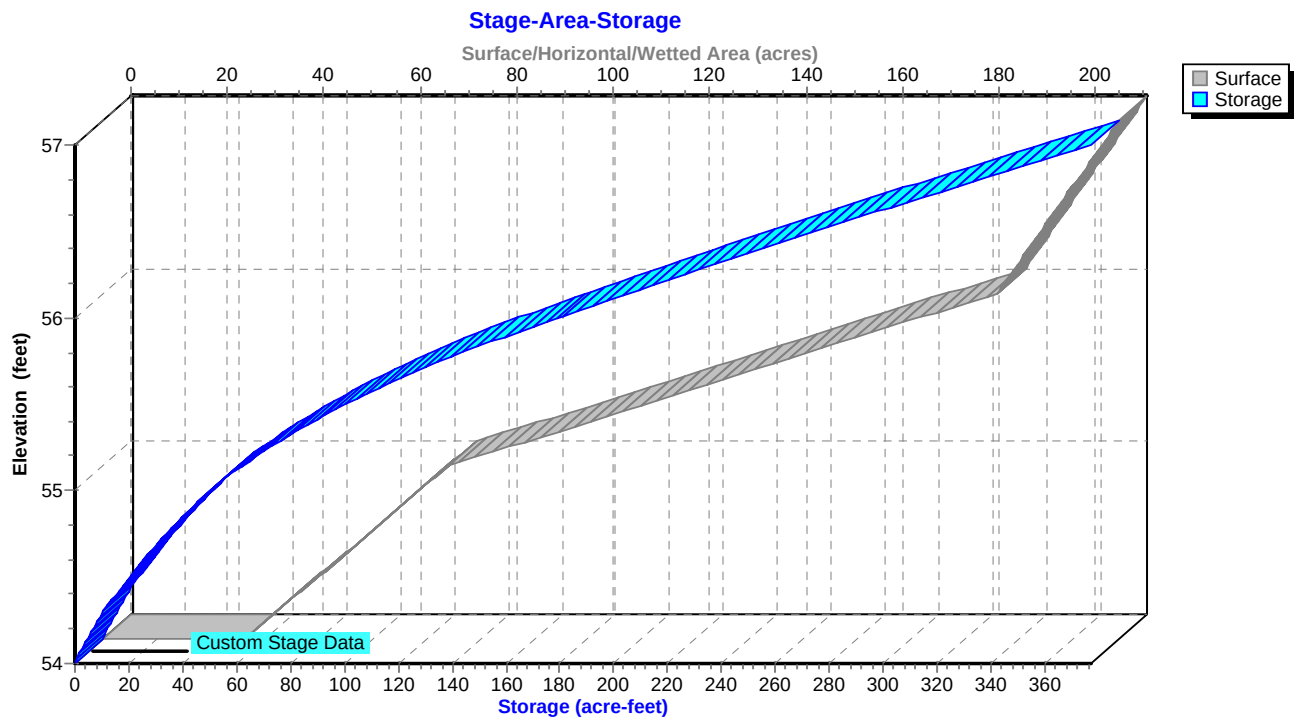
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Type II 24-hr 25yr-24hr Rainfall=9.20"

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Pond 8P: Wetland Storage - BN4C



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Summary for Pond 12P: NN4B3

Inflow Area = 522.100 ac, 0.00% Impervious, Inflow Depth > 5.65" for 25yr-24hr event
 Inflow = 442.45 cfs @ 14.15 hrs, Volume= 245.612 af
 Outflow = 176.56 cfs @ 16.86 hrs, Volume= 245.113 af, Atten= 60%, Lag= 162.6 min
 Primary = 97.45 cfs @ 16.86 hrs, Volume= 117.229 af
 Secondary = 79.11 cfs @ 16.86 hrs, Volume= 127.884 af

Routing by Stor-Ind method, Time Span= 5.00-96.00 hrs, dt= 0.05 hrs
 Peak Elev= 39.23' @ 16.86 hrs Surf.Area= 61.124 ac Storage= 71.932 af

Plug-Flow detention time= 270.4 min calculated for 244.979 af (100% of inflow)
 Center-of-Mass det. time= 261.7 min (1,669.7 - 1,408.0)

Volume	Invert	Avail.Storage	Storage Description
#1	37.00'	1,299.525 af	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
37.00	0.000	0.000	0.000
37.50	9.300	2.325	2.325
38.00	34.300	10.900	13.225
39.00	56.100	45.200	58.425
40.00	77.900	67.000	125.425
42.00	109.000	186.900	312.325
44.00	149.500	258.500	570.825
46.00	180.600	330.100	900.925
48.00	218.000	398.600	1,299.525

Device	Routing	Invert	Outlet Devices
#1	Primary	37.30'	To REQUAL, Cv= 2.62 (C= 3.28) Head (feet) 0.00 3.00 7.00 Width (feet) 8.00 20.00 180.00
#2	Secondary	37.00'	To RN4B3, Cv= 2.62 (C= 3.28) Head (feet) 0.00 5.00 Width (feet) 6.00 13.00

Primary OutFlow Max=97.40 cfs @ 16.86 hrs HW=39.23' (Free Discharge)

↑**1=To REQUAL** (Weir Controls 97.40 cfs @ 4.25 fps)

Secondary OutFlow Max=79.08 cfs @ 16.86 hrs HW=39.23' (Free Discharge)

↑**2=To RN4B3** (Weir Controls 79.08 cfs @ 4.69 fps)

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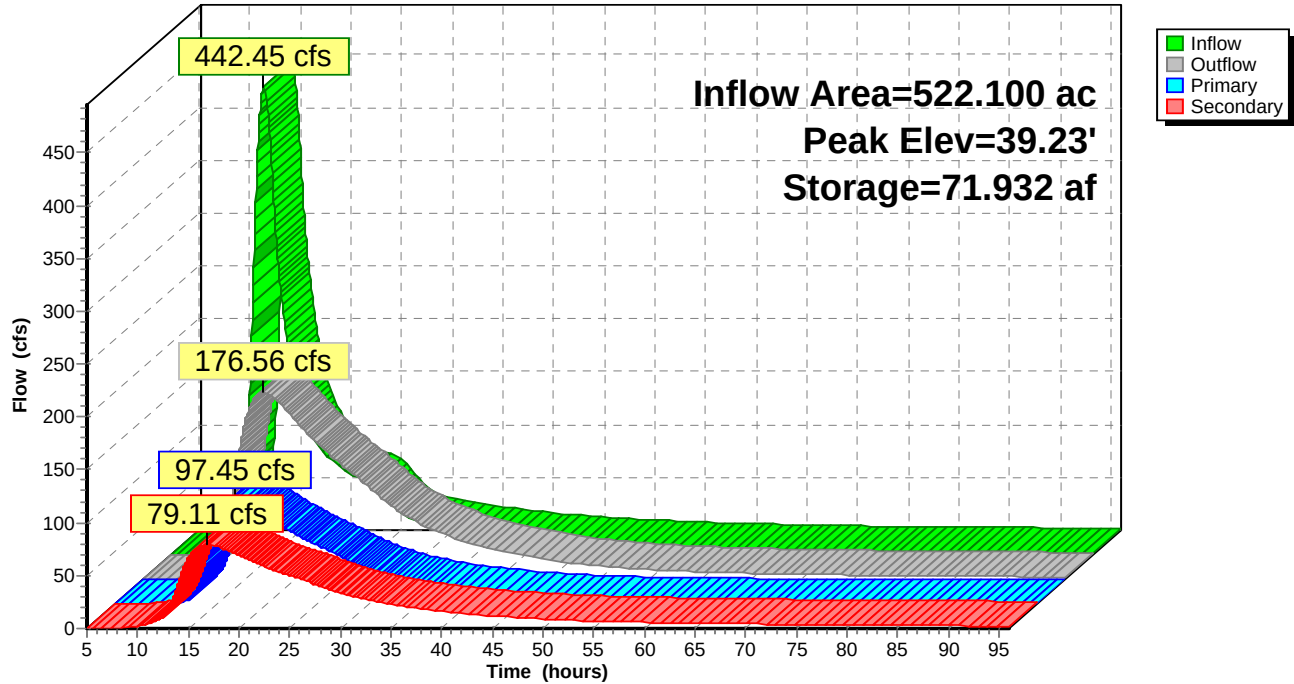
Type II 24-hr 25yr-24hr Rainfall=9.20"

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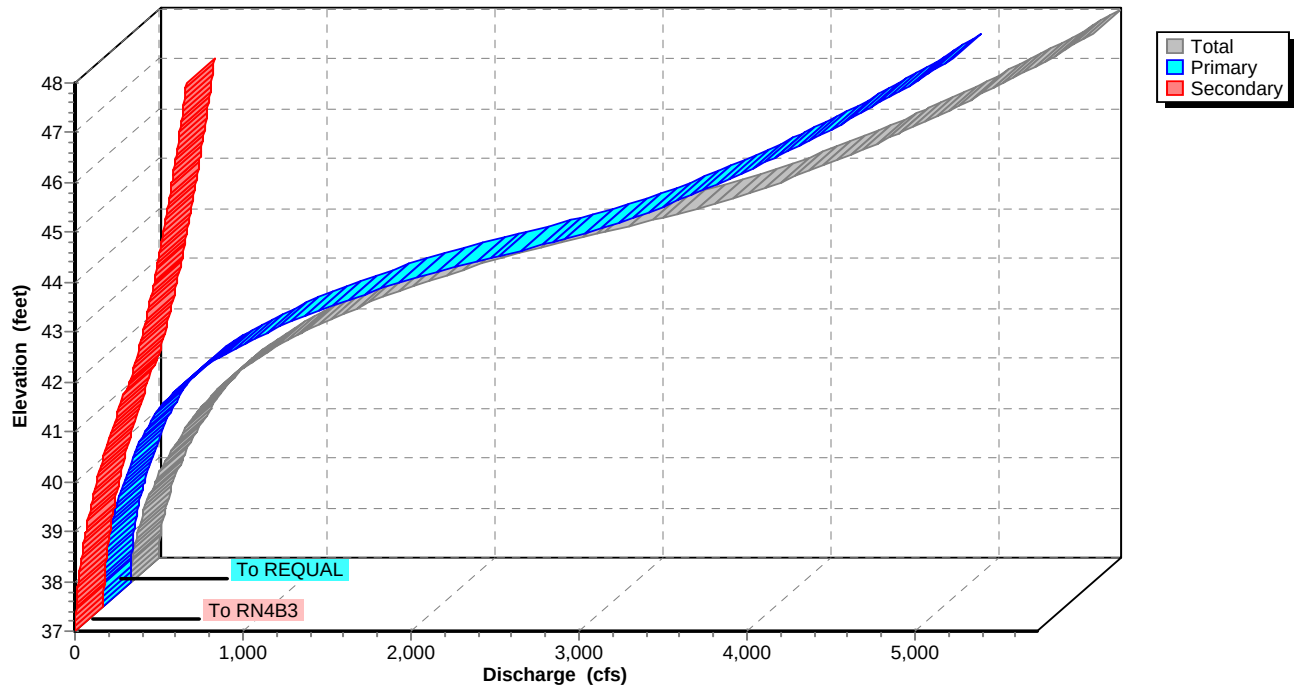
Pond 12P: NN4B3

Hydrograph



Pond 12P: NN4B3

Stage-Discharge



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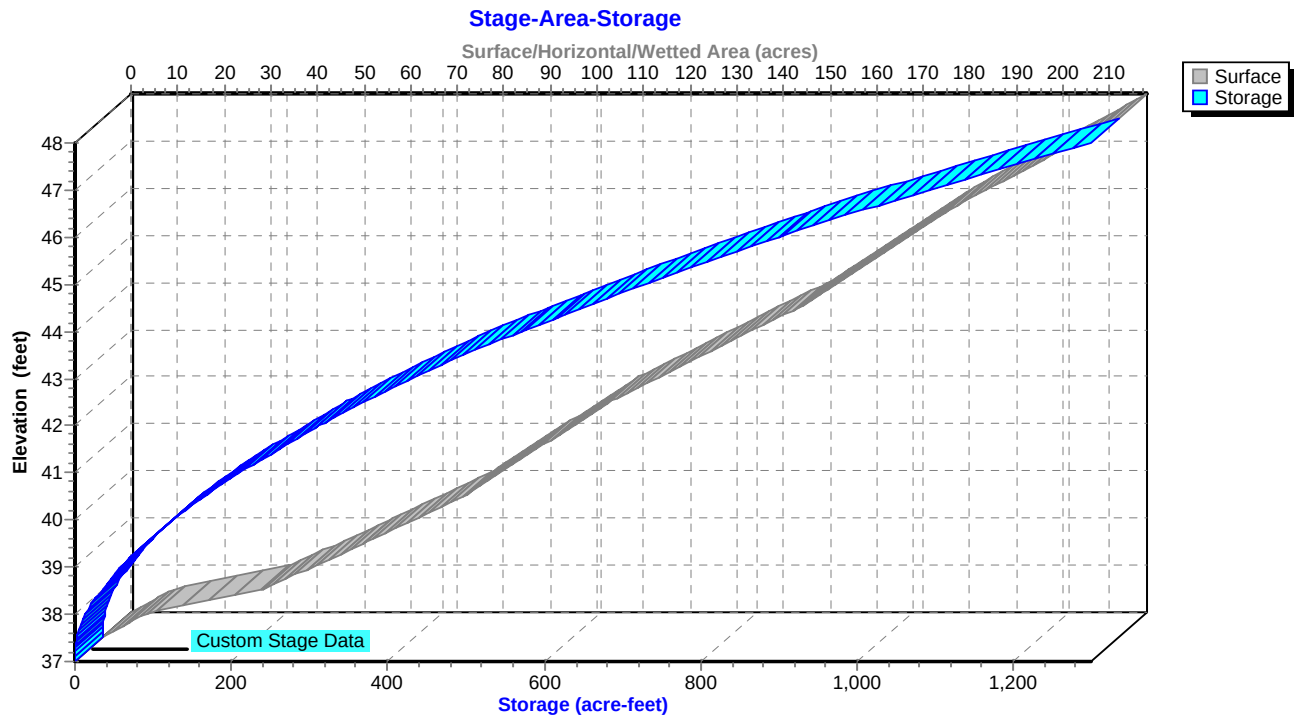
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Type II 24-hr 25yr-24hr Rainfall=9.20"

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Pond 12P: NN4B3



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Type II 24-hr 25yr-24hr Rainfall=9.20"

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Summary for Pond 16P: Wetland Storage BN4B1

Inflow Area = 61.200 ac, 0.00% Impervious, Inflow Depth > 7.01" for 25yr-24hr event
Inflow = 129.02 cfs @ 13.46 hrs, Volume= 35.728 af
Outflow = 45.25 cfs @ 15.24 hrs, Volume= 35.728 af, Atten= 65%, Lag= 106.6 min
Primary = 45.25 cfs @ 15.24 hrs, Volume= 35.728 af

Routing by Stor-Ind method, Time Span= 5.00-96.00 hrs, dt= 0.05 hrs
Peak Elev= 35.60' @ 15.24 hrs Surf.Area= 23.012 ac Storage= 15.953 af

Plug-Flow detention time= 231.2 min calculated for 35.709 af (100% of inflow)
Center-of-Mass det. time= 232.1 min (1,134.6 - 902.5)

Volume	Invert	Avail.Storage	Storage Description
#1	34.00'	175.900 af	Custom Stage Data (Prismatic) Listed below (Recalc)
Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
34.00	2.400	0.000	0.000
35.00	9.800	6.100	6.100
36.00	31.800	20.800	26.900
37.00	46.500	39.150	66.050
38.00	56.300	51.400	117.450
39.00	60.600	58.450	175.900

Device	Routing	Invert	Outlet Devices
#1	Primary	34.00'	Custom Weir/Orifice, Cv= 2.62 (C= 3.28) Head (feet) 0.00 7.00 Width (feet) 6.00 15.00

Primary OutFlow Max=45.25 cfs @ 15.24 hrs HW=35.60' (Free Discharge)
↑1=Custom Weir/Orifice (Weir Controls 45.25 cfs @ 4.02 fps)

Proposed - Part 2

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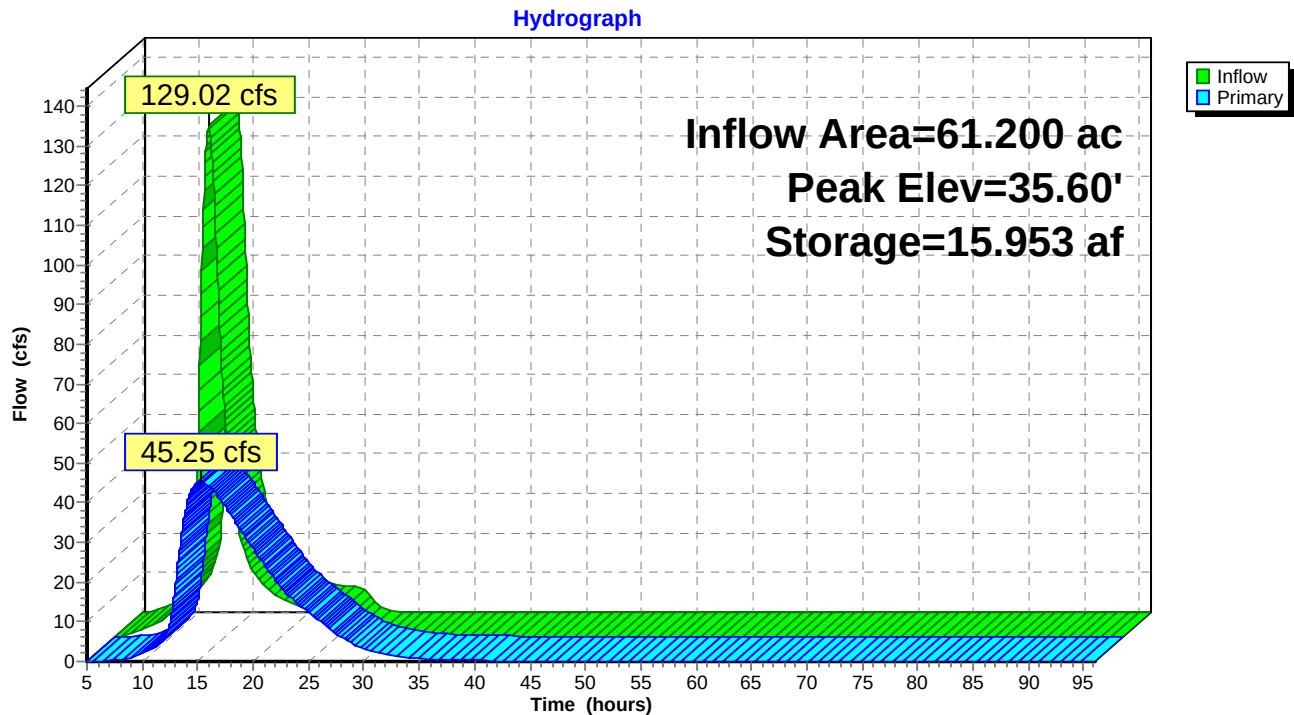
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Type II 24-hr 25yr-24hr Rainfall=9.20"

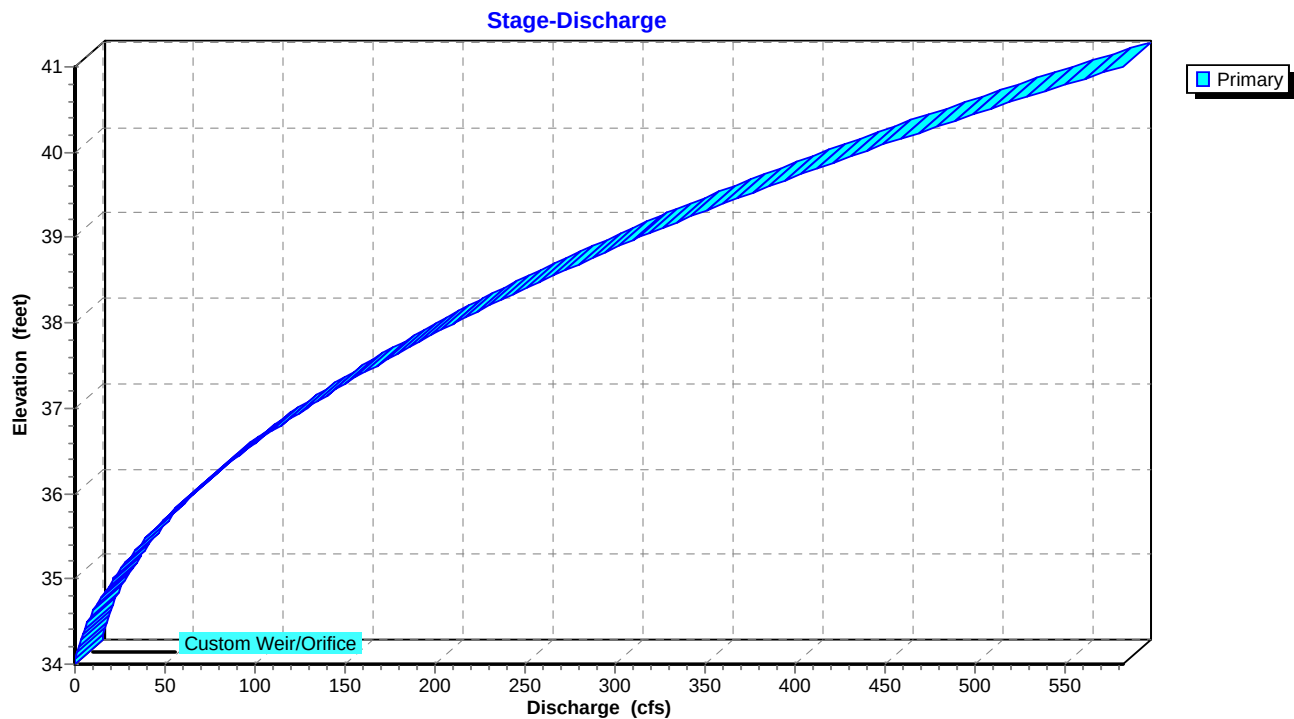
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Pond 16P: Wetland Storage BN4B1



Pond 16P: Wetland Storage BN4B1



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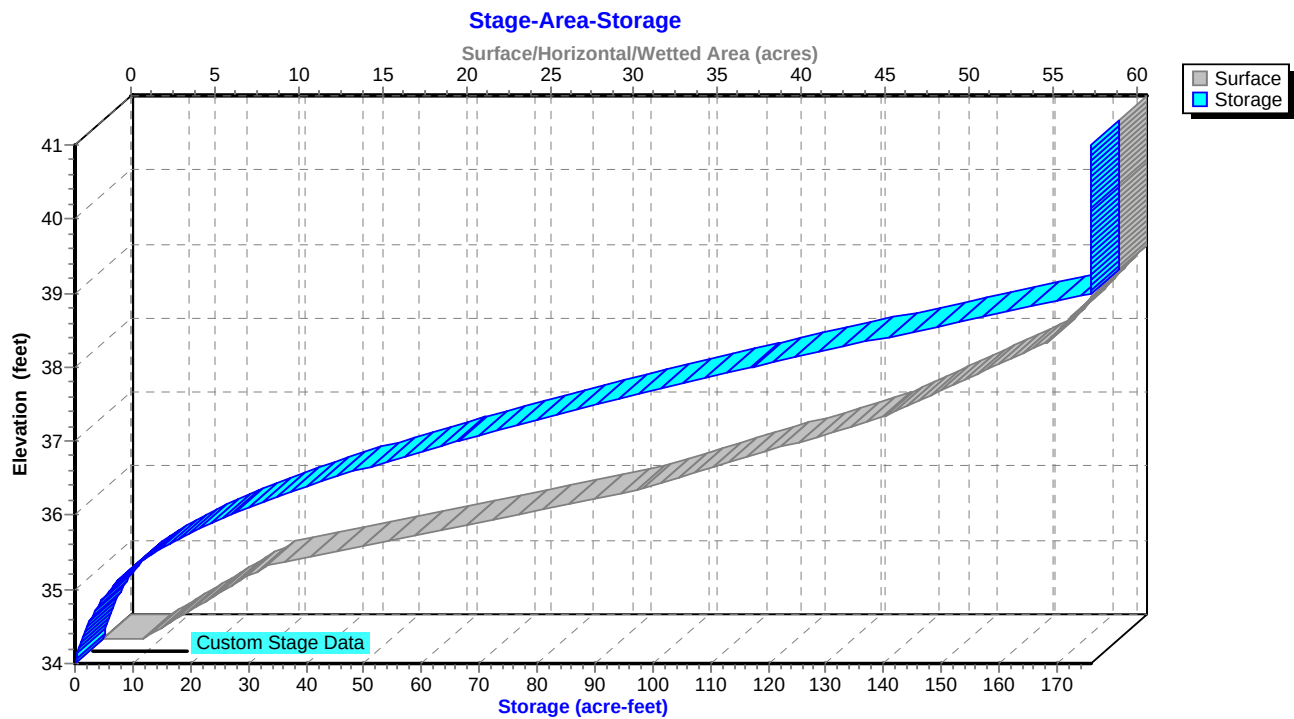
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Type II 24-hr 25yr-24hr Rainfall=9.20"

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Pond 16P: Wetland Storage BN4B1



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Type II 24-hr 25yr-24hr Rainfall=9.20"

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Summary for Pond 20P: Pond BE-4

Inflow Area = 101.470 ac, 0.00% Impervious, Inflow Depth > 21.73" for 25yr-24hr event
Inflow = 138.70 cfs @ 13.08 hrs, Volume= 183.786 af
Outflow = 117.91 cfs @ 13.27 hrs, Volume= 168.243 af, Atten= 15%, Lag= 11.5 min
Primary = 117.91 cfs @ 13.27 hrs, Volume= 168.243 af

Routing by Stor-Ind method, Time Span= 5.00-96.00 hrs, dt= 0.05 hrs / 4
Peak Elev= 35.13' @ 13.27 hrs Surf.Area= 4.140 ac Storage= 9.955 af

Plug-Flow detention time= 363.2 min calculated for 168.243 af (92% of inflow)
Center-of-Mass det. time= 125.5 min (1,730.5 - 1,604.9)

Volume	Invert	Avail.Storage	Storage Description
#1	31.00'	9.955 af	Custom Stage Data (Prismatic) Listed below (Recalc)
Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
31.00	0.830	0.000	0.000
32.00	1.660	1.245	1.245
33.00	2.490	2.075	3.320
34.00	3.320	2.905	6.225
35.00	4.140	3.730	9.955

Device	Routing	Invert	Outlet Devices
#1	Primary	31.00'	12.0" Round Culvert L= 50.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 31.00' / 30.50' S= 0.0100 '/' Cc= 0.900 n= 0.024, Flow Area= 0.79 sf
#2	Primary	34.00'	35.0' long x 10.0' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64

Primary OutFlow Max=115.15 cfs @ 13.27 hrs HW=35.12' (Free Discharge)

1=Culvert (Barrel Controls 4.45 cfs @ 5.67 fps)

2=Broad-Crested Rectangular Weir (Weir Controls 110.70 cfs @ 2.84 fps)

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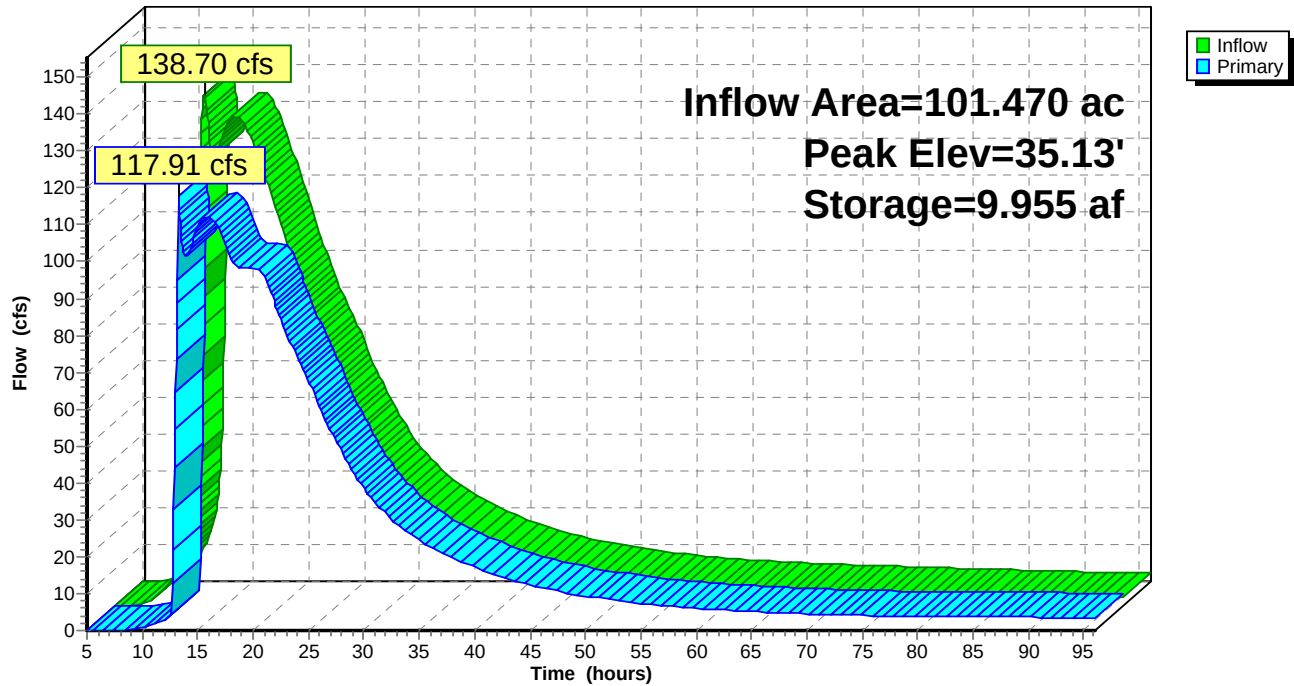
Type II 24-hr 25yr-24hr Rainfall=9.20"

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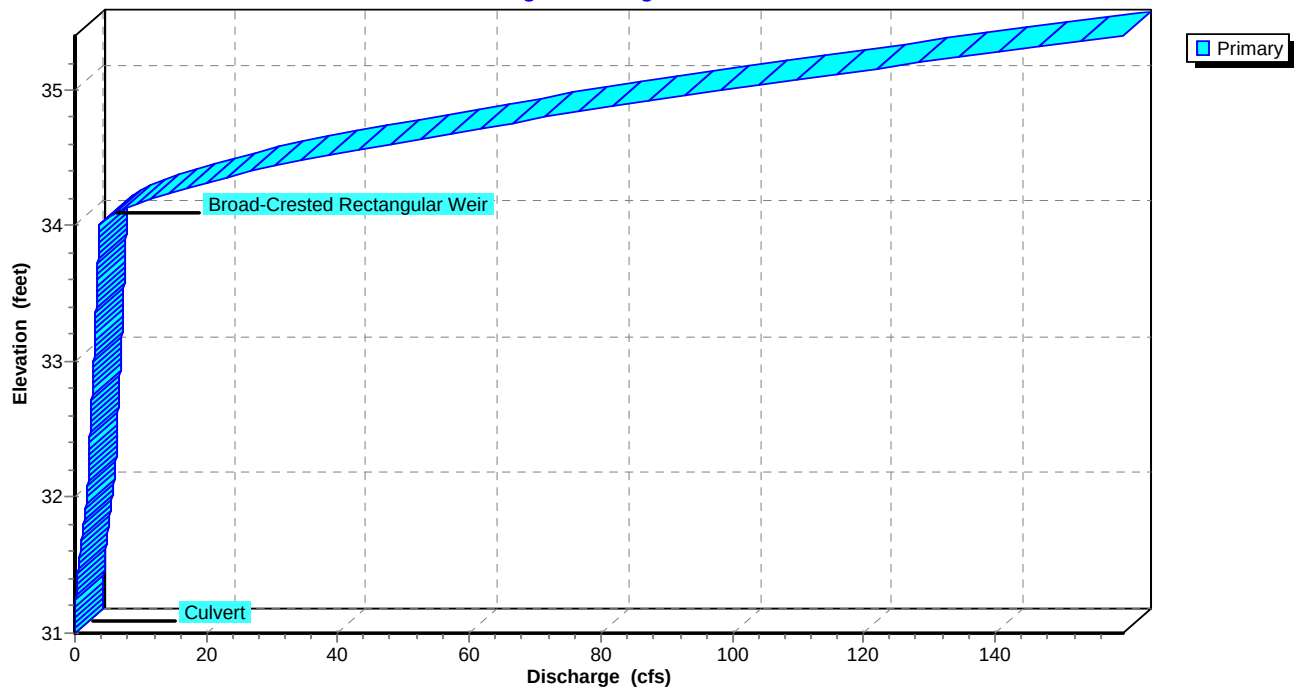
Pond 20P: Pond BE-4

Hydrograph



Pond 20P: Pond BE-4

Stage-Discharge



Proposed - Part 2

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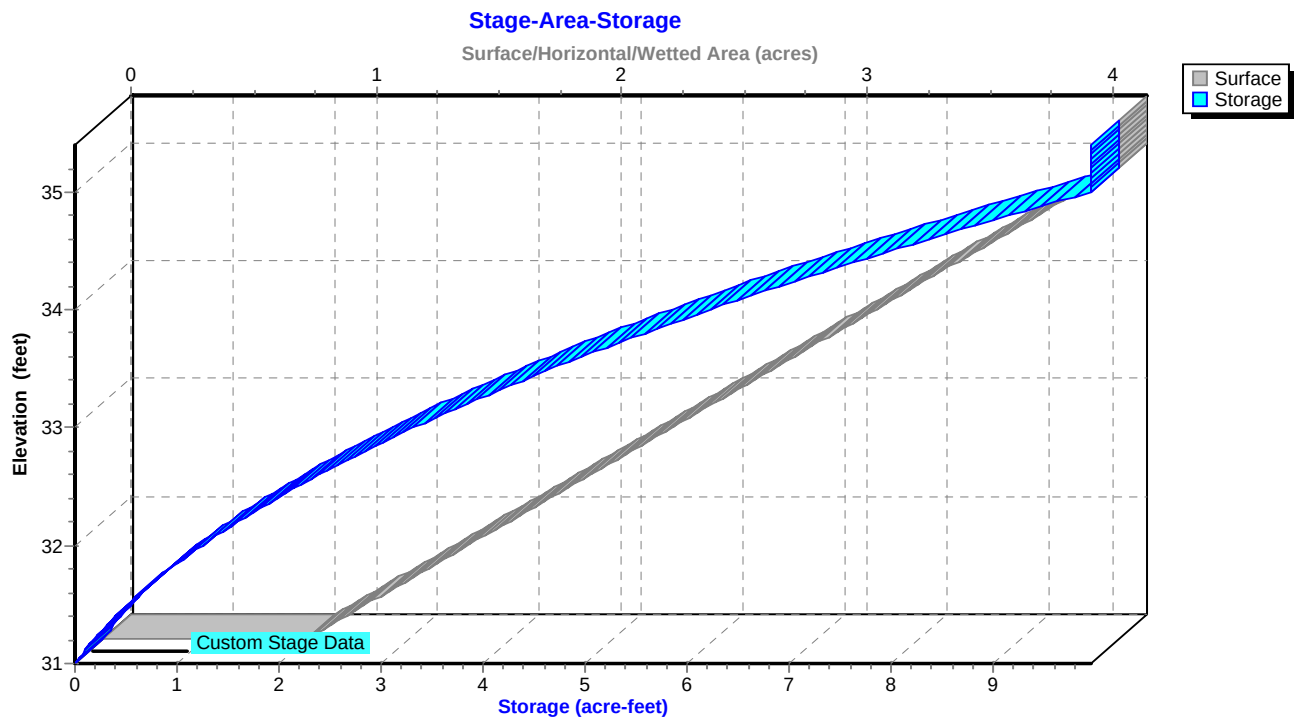
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Type II 24-hr 25yr-24hr Rainfall=9.20"

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Pond 20P: Pond BE-4



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Type II 24-hr 25yr-24hr Rainfall=9.20"

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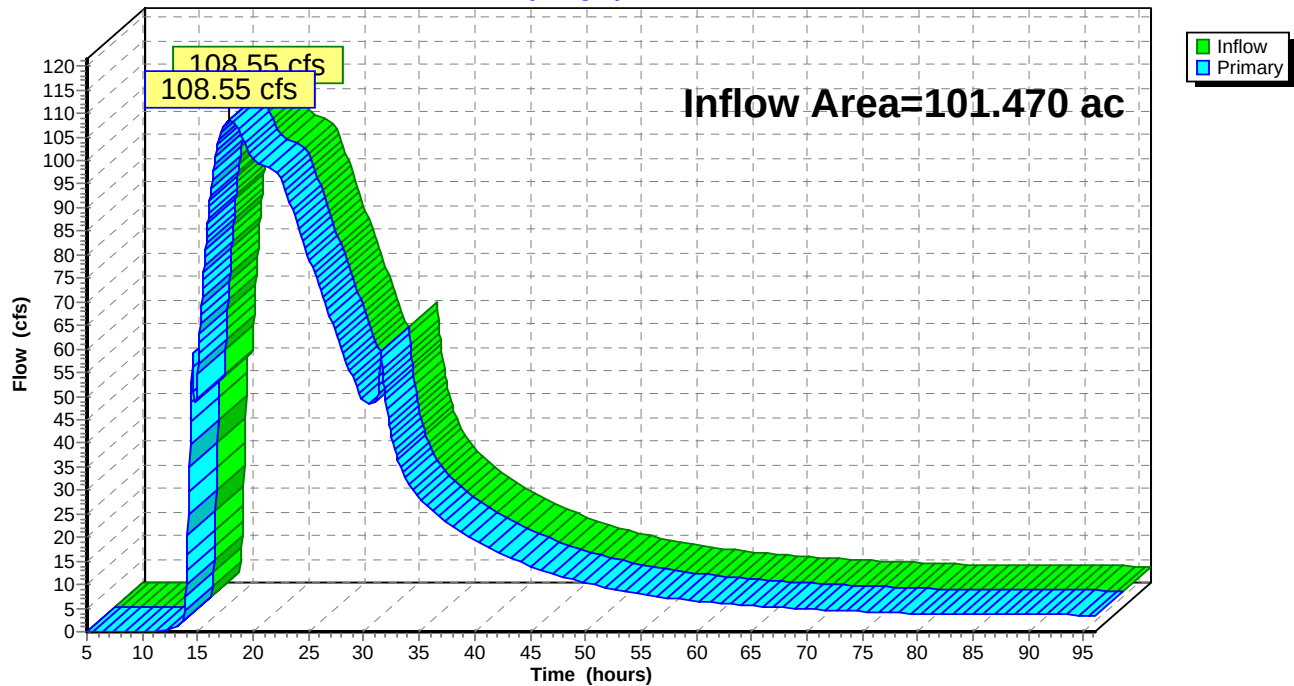
Summary for Link 17L: NN4B1

Inflow Area = 101.470 ac, 0.00% Impervious, Inflow Depth > 19.79" for 25yr-24hr event
Inflow = 108.55 cfs @ 17.87 hrs, Volume= 167.373 af
Primary = 108.55 cfs @ 17.87 hrs, Volume= 167.373 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-96.00 hrs, dt= 0.05 hrs

Link 17L: NN4B1

Hydrograph



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Type II 24-hr 25yr-24hr Rainfall=9.20"

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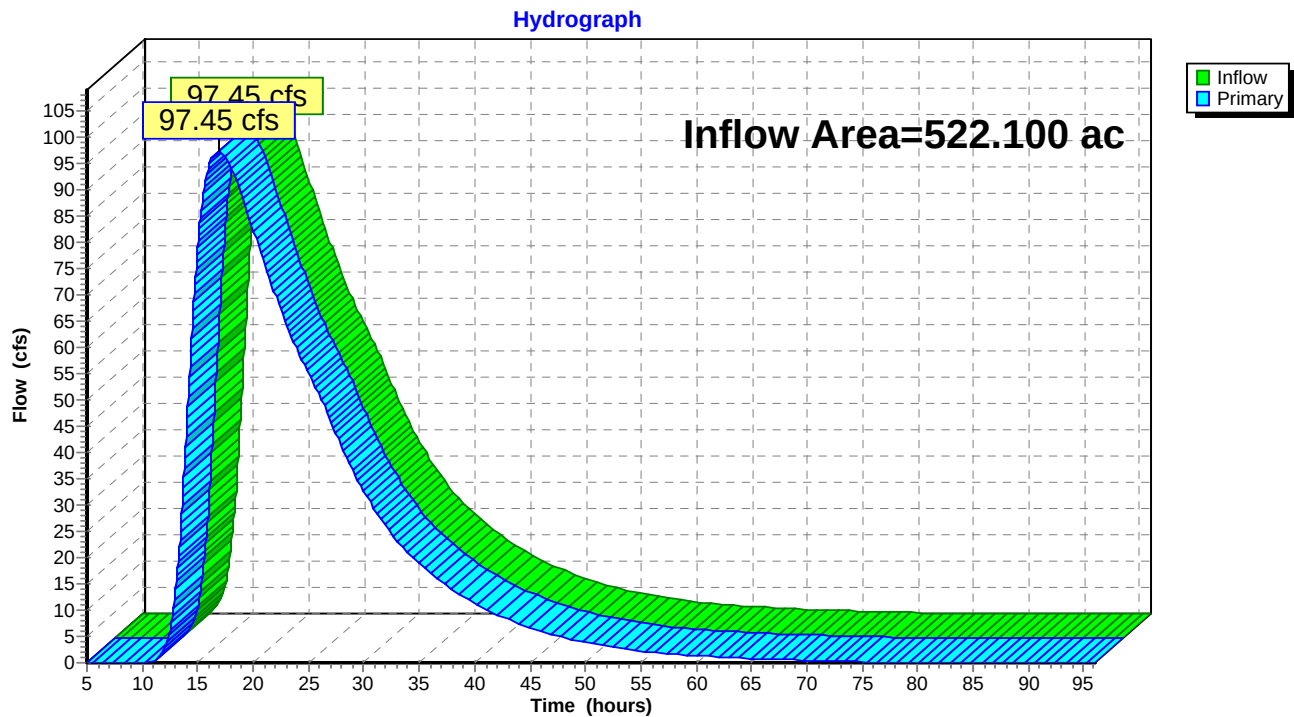
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Summary for Link 18L: To Pond BE4-3

Inflow Area = 522.100 ac, 0.00% Impervious, Inflow Depth = 2.69" for 25yr-24hr event
Inflow = 97.45 cfs @ 16.86 hrs, Volume= 117.229 af
Primary = 97.45 cfs @ 16.86 hrs, Volume= 117.229 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-96.00 hrs, dt= 0.05 hrs

Link 18L: To Pond BE4-3



Proposed - Part 2

SJRWMD 96-hr tenth 100-yr96hr Rainfall=15.00"

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Time span=5.00-96.00 hrs, dt=0.05 hrs, 1821 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment1S: BE-4

Runoff Area=40.270 ac 0.00% Impervious Runoff Depth>11.40"
Flow Length=5,044' Tc=83.4 min CN=74 Runoff=137.89 cfs 38.248 af

Subcatchment7S: BN4C

Runoff Area=210.700 ac 0.00% Impervious Runoff Depth>11.64"
Tc=144.6 min CN=76 Runoff=487.51 cfs 204.377 af

Subcatchment10S: BN4B1B

Runoff Area=311.400 ac 0.00% Impervious Runoff Depth>11.00"
Tc=174.4 min CN=72 Runoff=603.22 cfs 285.509 af

Subcatchment15S: BN4B1

Runoff Area=61.200 ac 0.00% Impervious Runoff Depth>12.53"
Tc=127.6 min CN=82 Runoff=162.86 cfs 63.895 af

Reach 9R: RN4C

Avg. Flow Depth=2.84' Max Vel=1.89 fps Inflow=74.77 cfs 149.835 af
n=0.060 L=1,000.0' S=0.0060 '/' Capacity=41.26 cfs Outflow=74.63 cfs 149.153 af

Reach 13R: RN4B3

Avg. Flow Depth=6.96' Max Vel=1.35 fps Inflow=182.60 cfs 274.886 af
n=0.040 L=4,459.0' S=0.0004 '/' Capacity=206.00 cfs Outflow=163.15 cfs 269.181 af

Pond 8P: Wetland Storage - BN4C

Peak Elev=55.67' Storage=123.833 af Inflow=487.51 cfs 204.377 af
Outflow=74.77 cfs 149.835 af

Pond 12P: NN4B3

Peak Elev=39.82' Storage=111.618 af Inflow=647.40 cfs 434.662 af
Primary=157.48 cfs 216.552 af Secondary=117.44 cfs 198.769 af Outflow=274.92 cfs 415.321 af

Pond 16P: Wetland Storage BN4B1

Peak Elev=35.82' Storage=21.597 af Inflow=162.86 cfs 63.895 af
Outflow=55.89 cfs 62.661 af

Pond 20P: Pond BE-4

Peak Elev=35.54' Storage=9.955 af Inflow=201.90 cfs 299.678 af
Outflow=182.60 cfs 274.886 af

Link 17L: NN4B1

Inflow=163.15 cfs 269.181 af
Primary=163.15 cfs 269.181 af

Link 18L: To Pond BE4-3

Inflow=157.48 cfs 216.552 af
Primary=157.48 cfs 216.552 af

Total Runoff Area = 623.570 ac Runoff Volume = 592.030 af Average Runoff Depth = 11.39"
100.00% Pervious = 623.570 ac 0.00% Impervious = 0.000 ac

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SJRWMD 96-hr tenth 100-yr96hr Rainfall=15.00"

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Summary for Subcatchment 1S: BE-4

Runoff = 137.89 cfs @ 60.89 hrs, Volume= 38.248 af, Depth>11.40"

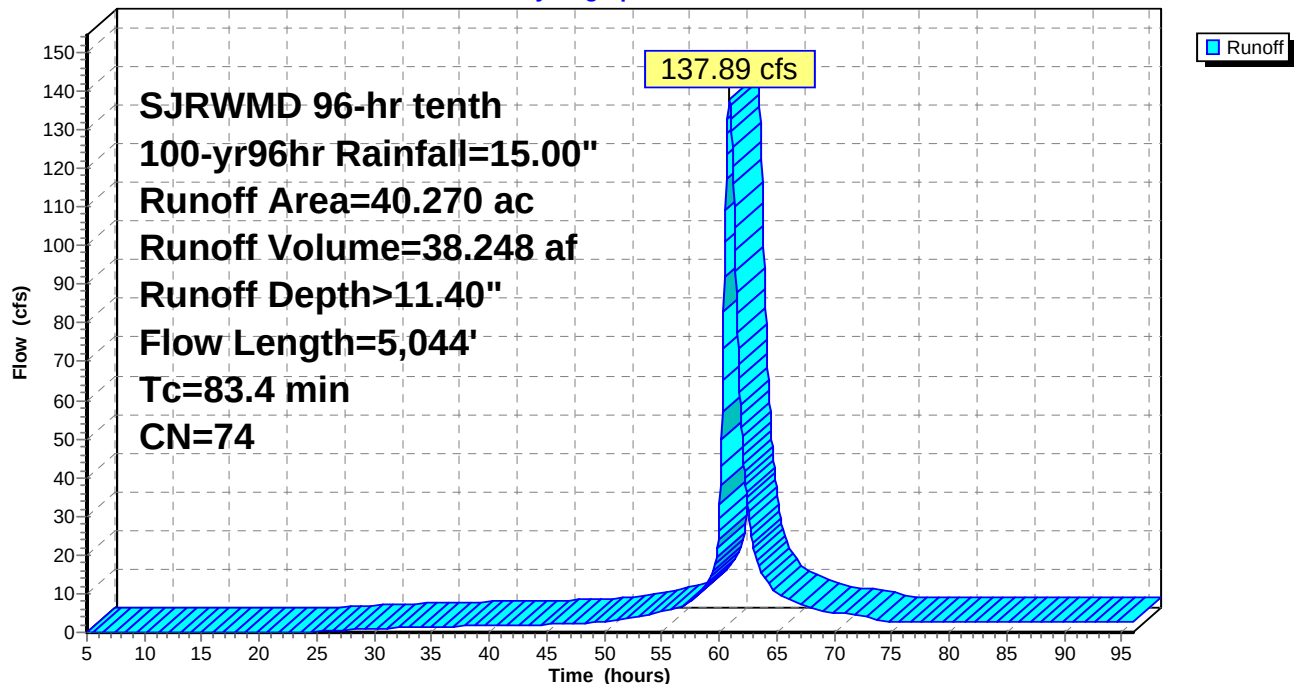
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-96.00 hrs, dt= 0.05 hrs
SJRWMD 96-hr tenth 100-yr96hr Rainfall=15.00"

Area (ac)	CN	Description
* 40.270	74	
40.270		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.9	200	0.0050	0.28		Sheet Flow, Cultivated: Residue<=20% n= 0.060 P2= 4.58"
47.9	1,422	0.0050	0.49		Shallow Concentrated Flow, Short Grass Pasture Kv= 7.0 fps
23.6	3,422	0.0008	2.41	237.12	Channel Flow, Area= 98.2 sf Perim= 43.4' r= 2.26' n= 0.030
83.4	5,044	Total			

Subcatchment 1S: BE-4

Hydrograph



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SJRWMD 96-hr tenth 100-yr96hr Rainfall=15.00"

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Summary for Subcatchment 7S: BN4C

Runoff = 487.51 cfs @ 61.68 hrs, Volume= 204.377 af, Depth>11.64"

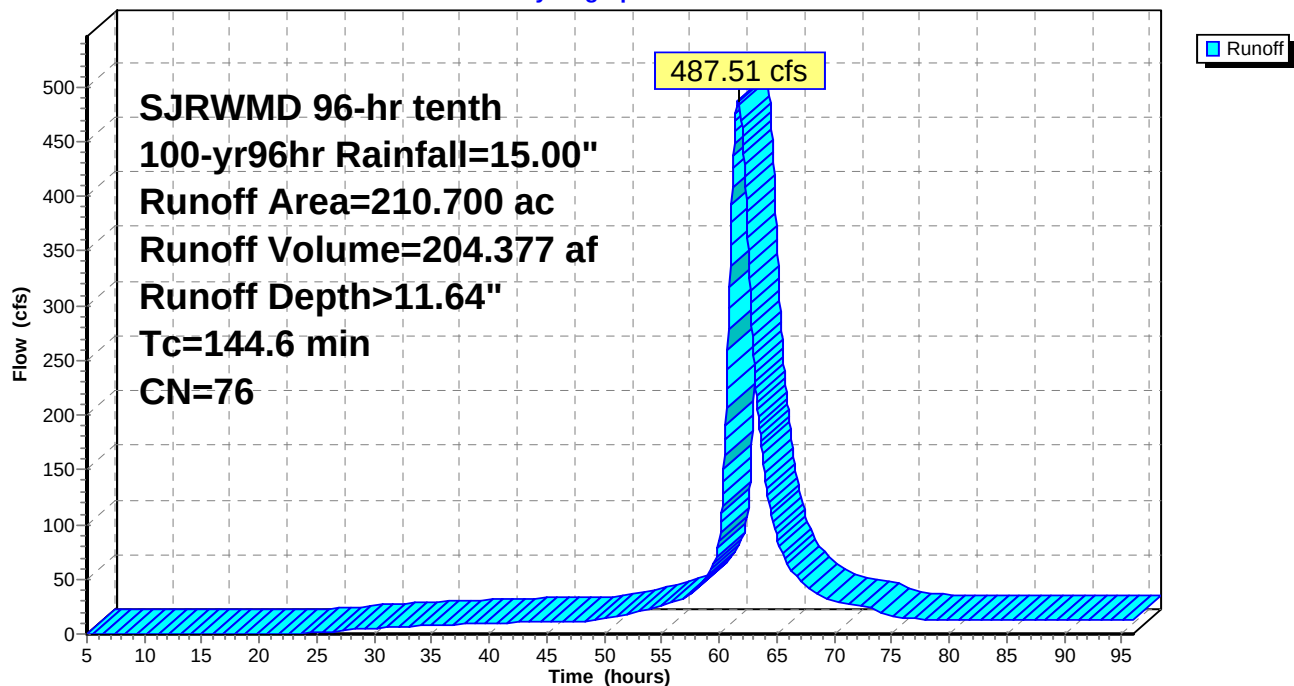
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-96.00 hrs, dt= 0.05 hrs
SJRWMD 96-hr tenth 100-yr96hr Rainfall=15.00"

Area (ac)	CN	Description
* 210.700	76	
210.700		100.00% Pervious Area

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

Subcatchment 7S: BN4C

Hydrograph



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SJRWMD 96-hr tenth 100-yr96hr Rainfall=15.00"

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Summary for Subcatchment 10S: BN4B1B

Runoff = 603.22 cfs @ 62.04 hrs, Volume= 285.509 af, Depth>11.00"

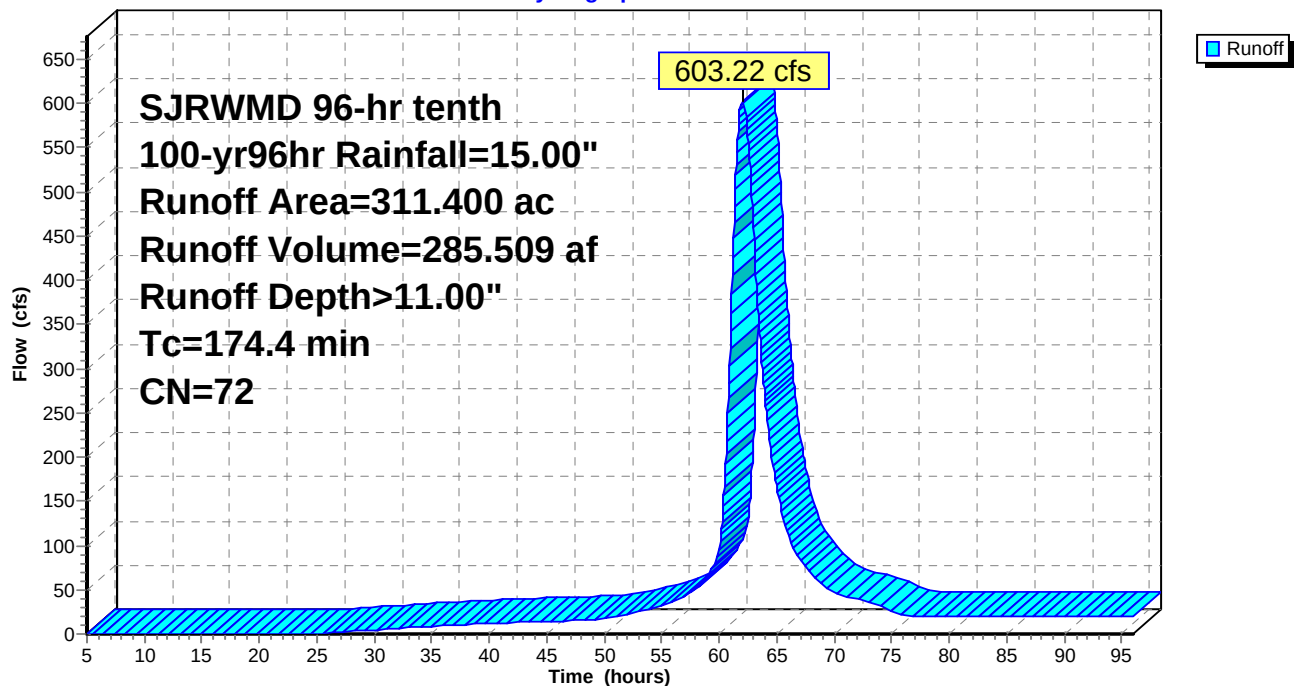
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-96.00 hrs, dt= 0.05 hrs
SJRWMD 96-hr tenth 100-yr96hr Rainfall=15.00"

Area (ac)	CN	Description
* 311.400	72	
311.400		100.00% Pervious Area

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

Subcatchment 10S: BN4B1B

Hydrograph



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SJRWMD 96-hr tenth 100-yr96hr Rainfall=15.00"

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Summary for Subcatchment 15S: BN4B1

Runoff = 162.86 cfs @ 61.41 hrs, Volume= 63.895 af, Depth>12.53"

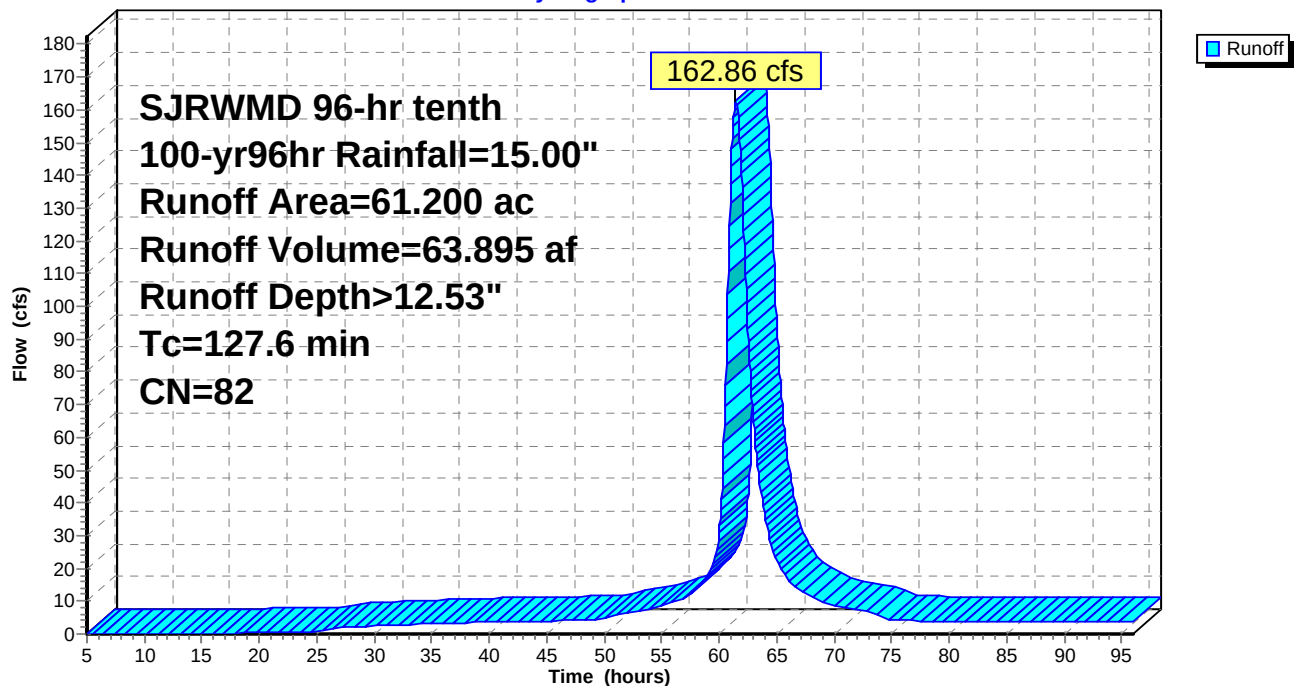
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-96.00 hrs, dt= 0.05 hrs
SJRWMD 96-hr tenth 100-yr96hr Rainfall=15.00"

Area (ac)	CN	Description
* 61.200	82	
61.200		100.00% Pervious Area

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

Subcatchment 15S: BN4B1

Hydrograph



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SJRWMD 96-hr tenth 100-yr96hr Rainfall=15.00"

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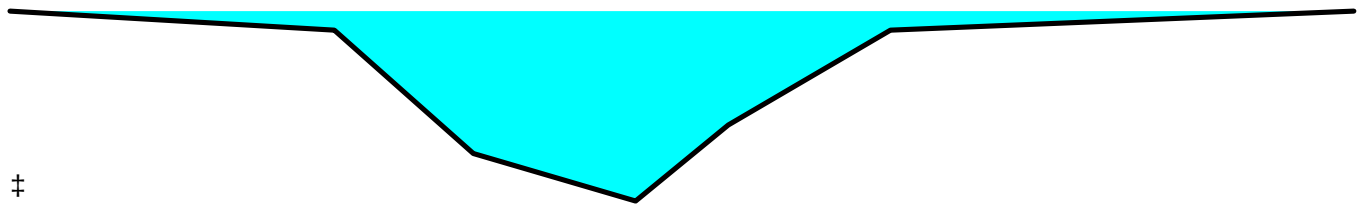
Summary for Reach 9R: RN4C

Inflow Area = 210.700 ac, 0.00% Impervious, Inflow Depth > 8.53" for 100-yr96hr event
Inflow = 74.77 cfs @ 65.46 hrs, Volume= 149.835 af
Outflow = 74.63 cfs @ 66.07 hrs, Volume= 149.153 af, Atten= 0%, Lag= 36.6 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-96.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.89 fps, Min. Travel Time= 8.8 min
Avg. Velocity= 0.92 fps, Avg. Travel Time= 18.1 min

Peak Storage= 79,086 cf @ 65.92 hrs
Average Depth at Peak Storage= 2.84'
Bank-Full Depth= 2.00' Flow Area= 32.0 sf, Capacity= 41.26 cfs

Custom cross-section, Length= 1,000.0' Slope= 0.0060 '/
Constant n= 0.060
Inlet Invert= 54.00', Outlet Invert= 48.00'



Offset (feet)	Elevation (feet)	Chan.Depth (feet)
0.00	50.40	0.00
14.00	50.20	0.20
20.00	48.90	1.50
27.00	48.40	2.00
31.00	49.20	1.20
38.00	50.20	0.20
58.00	50.40	0.00

Depth (feet)	End Area (sq-ft)	Perim. (feet)	Storage (cubic-feet)	Discharge (cfs)
0.00	0.0	0.0	0	0.00
0.50	2.4	9.6	2,375	1.80
0.80	5.7	12.5	5,658	6.39
1.80	23.9	24.3	23,850	45.18
2.00	32.0	58.3	32,050	41.26

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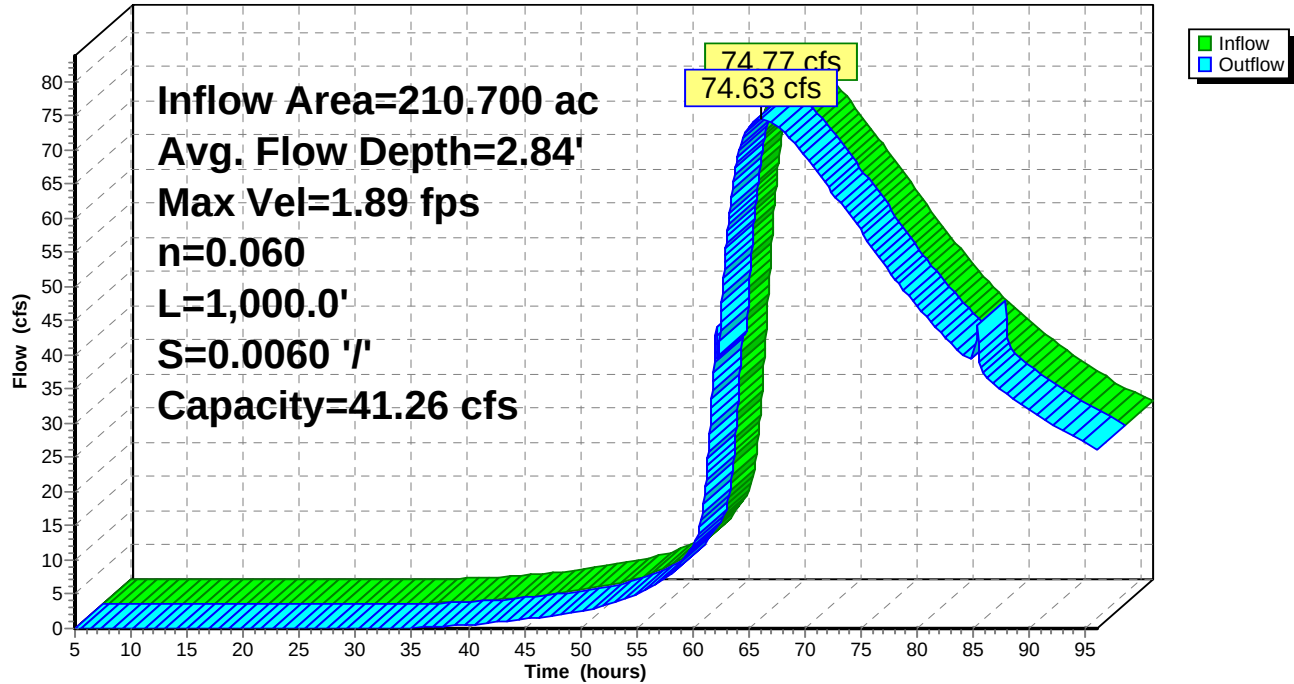
SJRWMD 96-hr tenth 100-yr96hr Rainfall=15.00"

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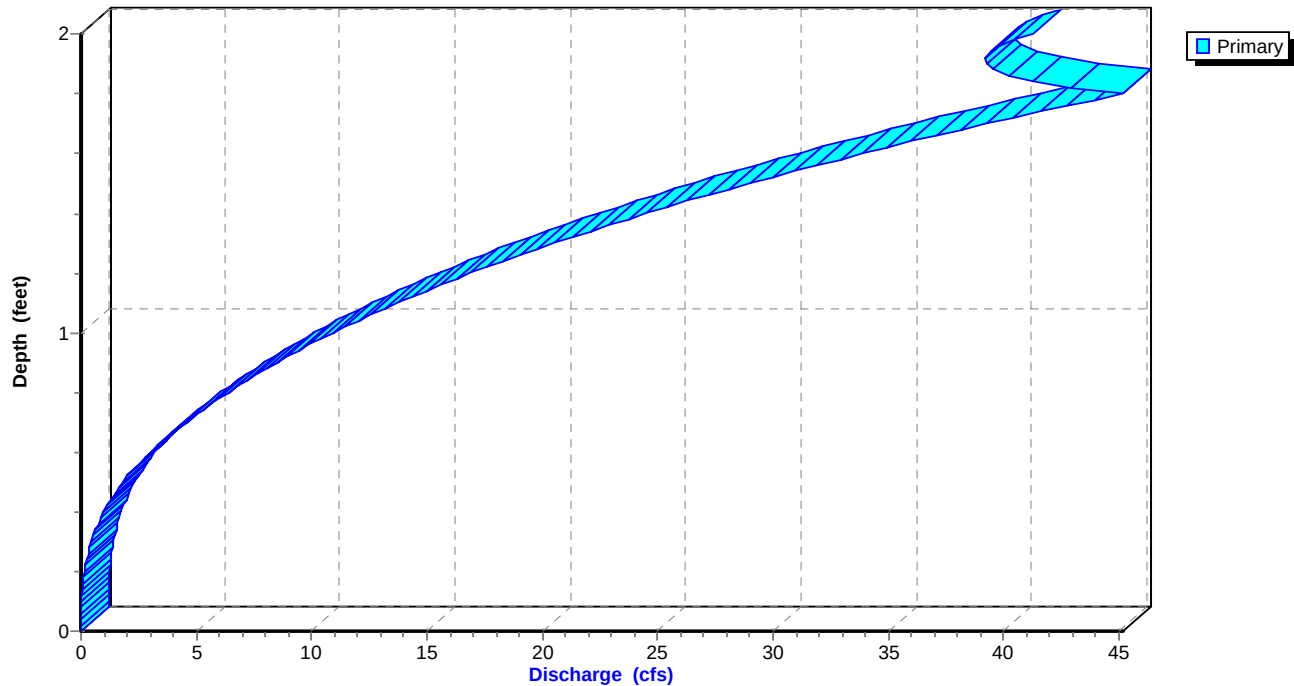
Reach 9R: RN4C

Hydrograph



Reach 9R: RN4C

Stage-Discharge



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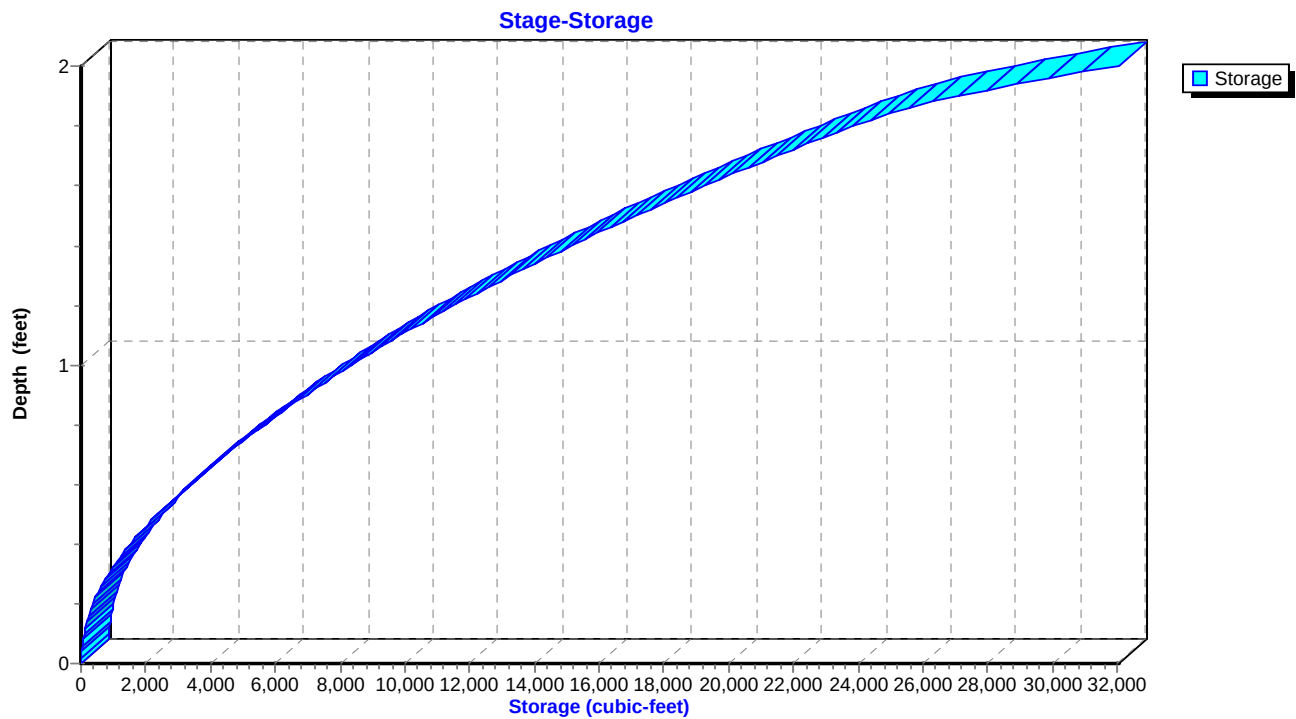
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SJRWMD 96-hr tenth 100-yr96hr Rainfall=15.00"

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Reach 9R: RN4C



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SJRWMD 96-hr tenth 100-yr96hr Rainfall=15.00"

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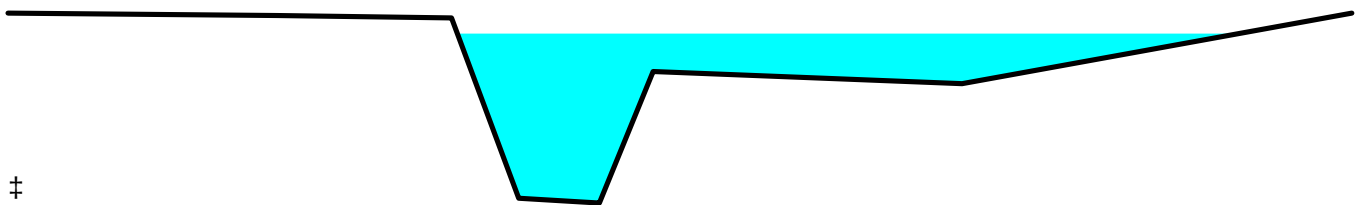
Summary for Reach 13R: RN4B3

Inflow Area = 101.470 ac, 0.00% Impervious, Inflow Depth > 32.51" for 100-yr96hr event
Inflow = 182.60 cfs @ 61.03 hrs, Volume= 274.886 af
Outflow = 163.15 cfs @ 65.37 hrs, Volume= 269.181 af, Atten= 11%, Lag= 260.1 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-96.00 hrs, dt= 0.05 hrs / 4
Max. Velocity= 1.35 fps, Min. Travel Time= 55.0 min
Avg. Velocity= 0.80 fps, Avg. Travel Time= 92.7 min

Peak Storage= 608,887 cf @ 64.45 hrs
Average Depth at Peak Storage= 6.96'
Bank-Full Depth= 7.80' Flow Area= 192.0 sf, Capacity= 206.00 cfs

Custom cross-section, Length= 4,459.0' Slope= 0.0004 '/' (105 Elevation Intervals)
Constant n= 0.040
Inlet Invert= 31.00', Outlet Invert= 29.30'



Offset (feet)	Elevation (feet)	Chan.Depth (feet)
0.00	40.90	0.00
20.00	40.80	0.10
33.00	40.70	0.20
38.00	33.30	7.60
44.00	33.10	7.80
48.00	38.50	2.40
71.00	38.00	2.90
100.00	40.90	0.00

Depth (feet)	End Area (sq-ft)	Perim. (feet)	Storage (cubic-feet)	Discharge (cfs)
0.00	0.0	0.0	0	0.00
0.20	0.6	6.3	2,741	0.10
4.90	45.2	17.8	201,348	60.99
5.40	58.7	47.0	261,900	49.41
7.60	175.9	71.8	784,338	231.89
7.70	183.1	85.8	816,443	220.15
7.80	192.0	106.8	856,351	206.00

Proposed - Part 2

Prepared by Black & Veatch

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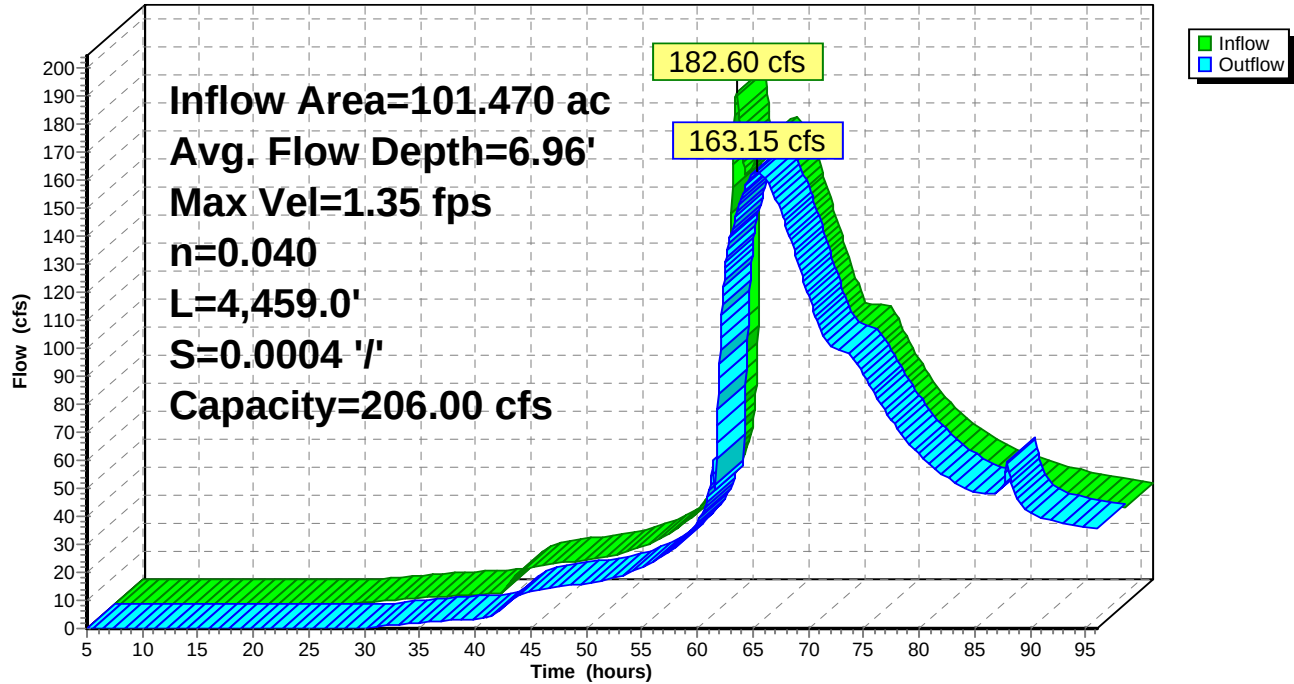
SJRWMD 96-hr tenth 100-yr96hr Rainfall=15.00"

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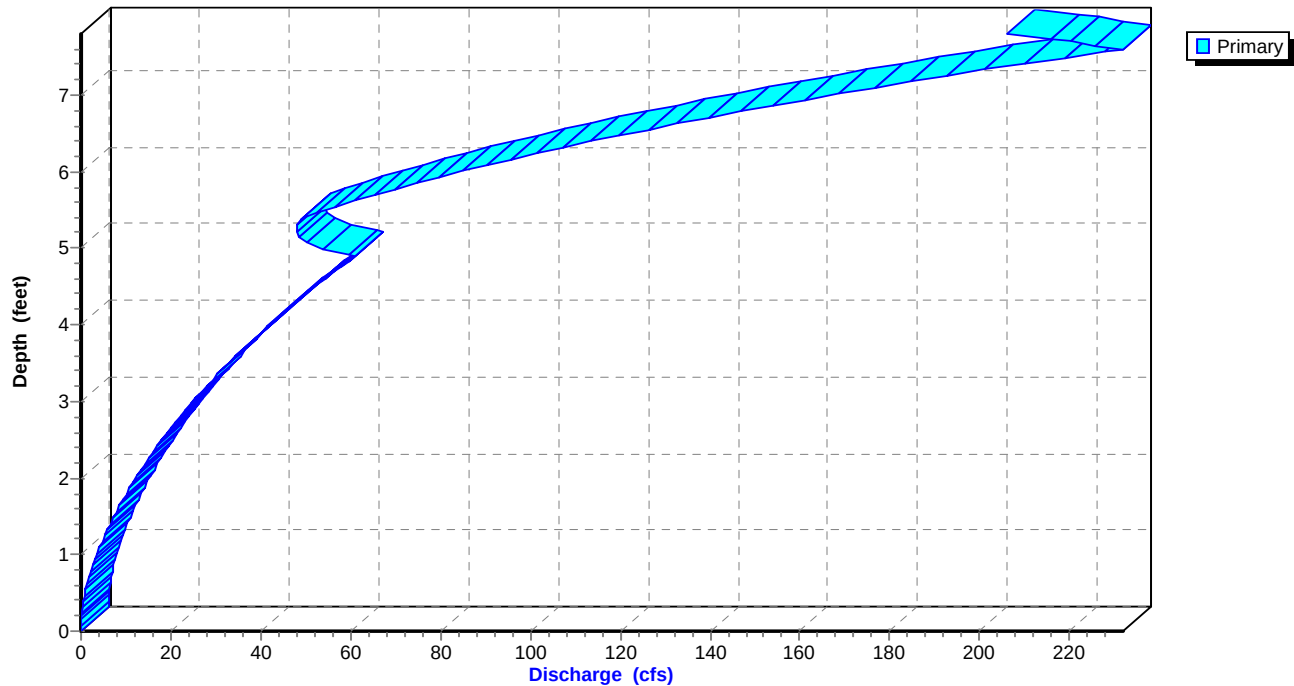
Reach 13R: RN4B3

Hydrograph



Reach 13R: RN4B3

Stage-Discharge



Proposed - Part 2

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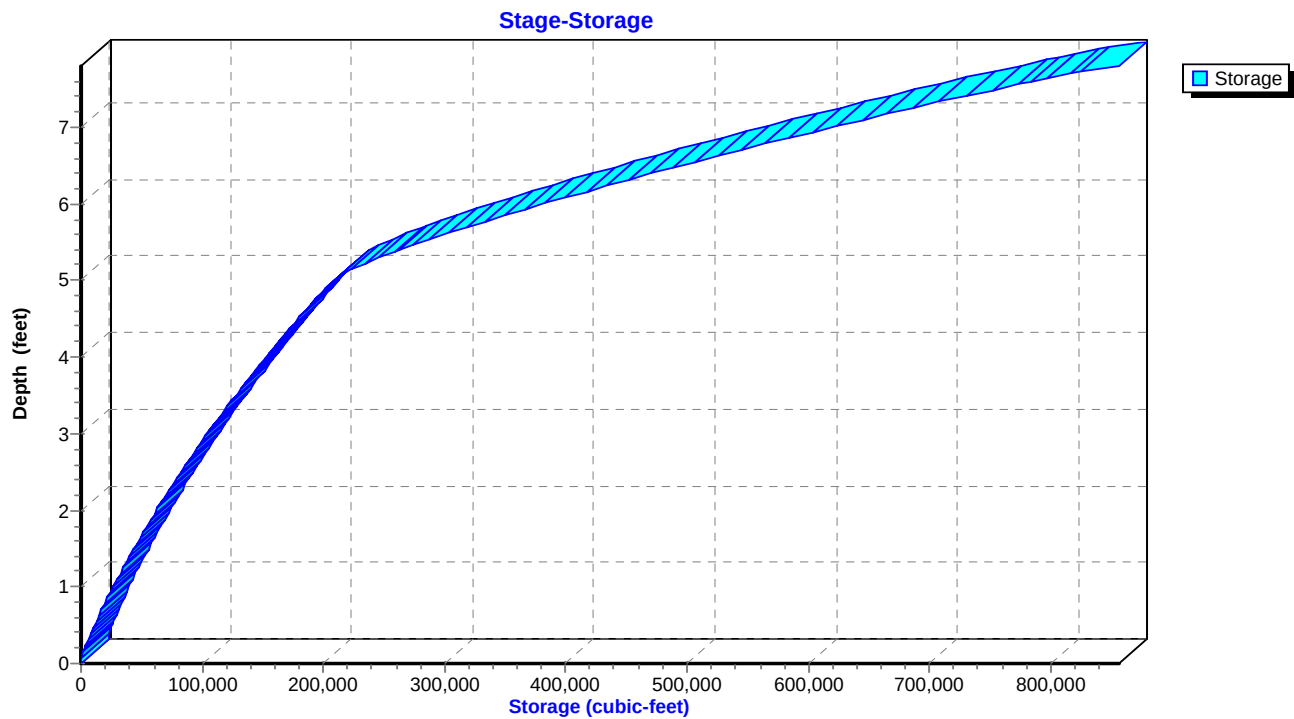
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SJRWMD 96-hr tenth 100-yr96hr Rainfall=15.00"

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Reach 13R: RN4B3



Proposed - Part 2

SJRWMD 96-hr tenth 100-yr96hr Rainfall=15.00"

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Summary for Pond 8P: Wetland Storage - BN4C

Inflow Area = 210.700 ac, 0.00% Impervious, Inflow Depth > 11.64" for 100-yr96hr event
 Inflow = 487.51 cfs @ 61.68 hrs, Volume= 204.377 af
 Outflow = 74.77 cfs @ 65.46 hrs, Volume= 149.835 af, Atten= 85%, Lag= 226.7 min
 Primary = 74.77 cfs @ 65.46 hrs, Volume= 149.835 af

Routing by Stor-Ind method, Time Span= 5.00-96.00 hrs, dt= 0.05 hrs
 Peak Elev= 55.67' @ 65.46 hrs Surf.Area= 147.668 ac Storage= 123.833 af

Plug-Flow detention time= 957.7 min calculated for 149.835 af (73% of inflow)
 Center-of-Mass det. time= 681.5 min (4,474.2 - 3,792.7)

Volume	Invert	Avail.Storage	Storage Description
#1	54.00'	377.100 af	Custom Stage Data (Prismatic) Listed below (Recalc)
Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
54.00	29.500	0.000	0.000
55.00	71.600	50.550	50.550
56.00	185.400	128.500	179.050
57.00	210.700	198.050	377.100

Device	Routing	Invert	Outlet Devices
#1	Primary	54.00'	Custom Weir/Orifice, Cv= 2.62 (C= 3.28) Head (feet) 0.00 0.60 1.80 2.00 Width (feet) 0.00 11.00 24.00 58.00

Primary OutFlow Max=74.76 cfs @ 65.46 hrs HW=55.67' (Free Discharge)
 ↑1=Custom Weir/Orifice (Weir Controls 74.76 cfs @ 3.52 fps)

Proposed - Part 2

Prepared by Black & Veatch

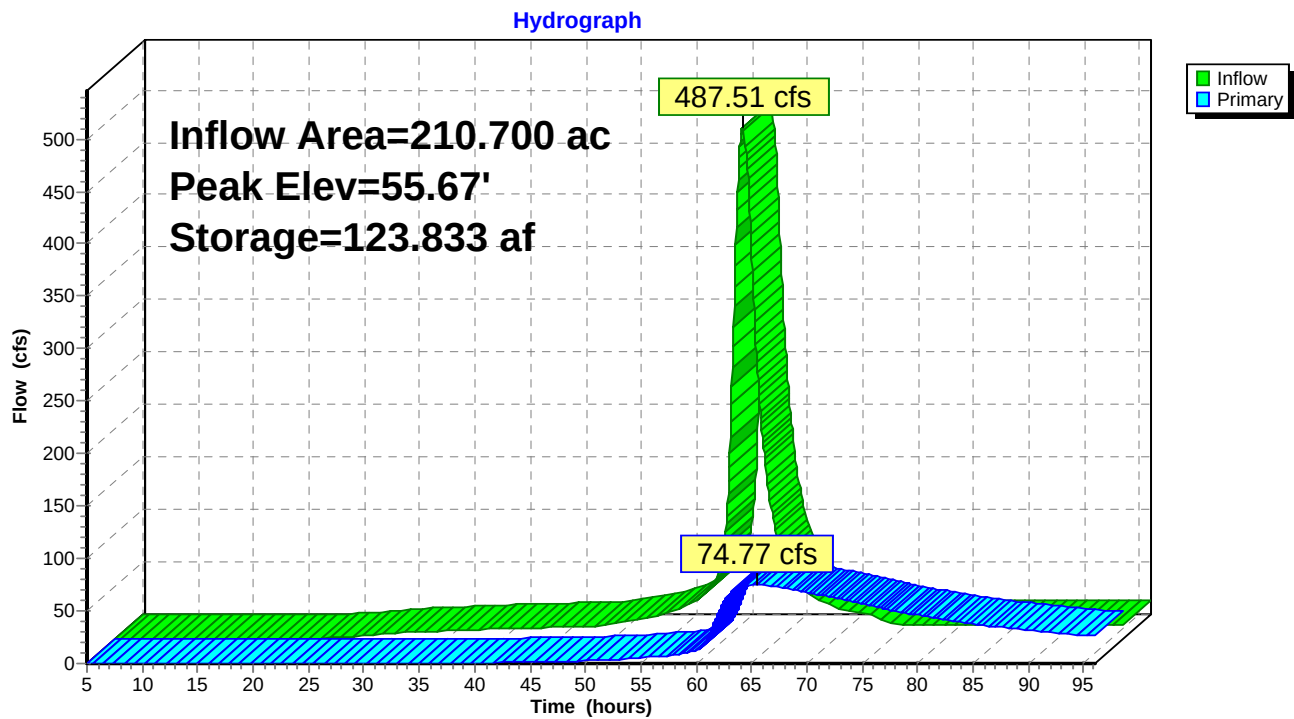
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SJRWMD 96-hr tenth 100-yr96hr Rainfall=15.00"

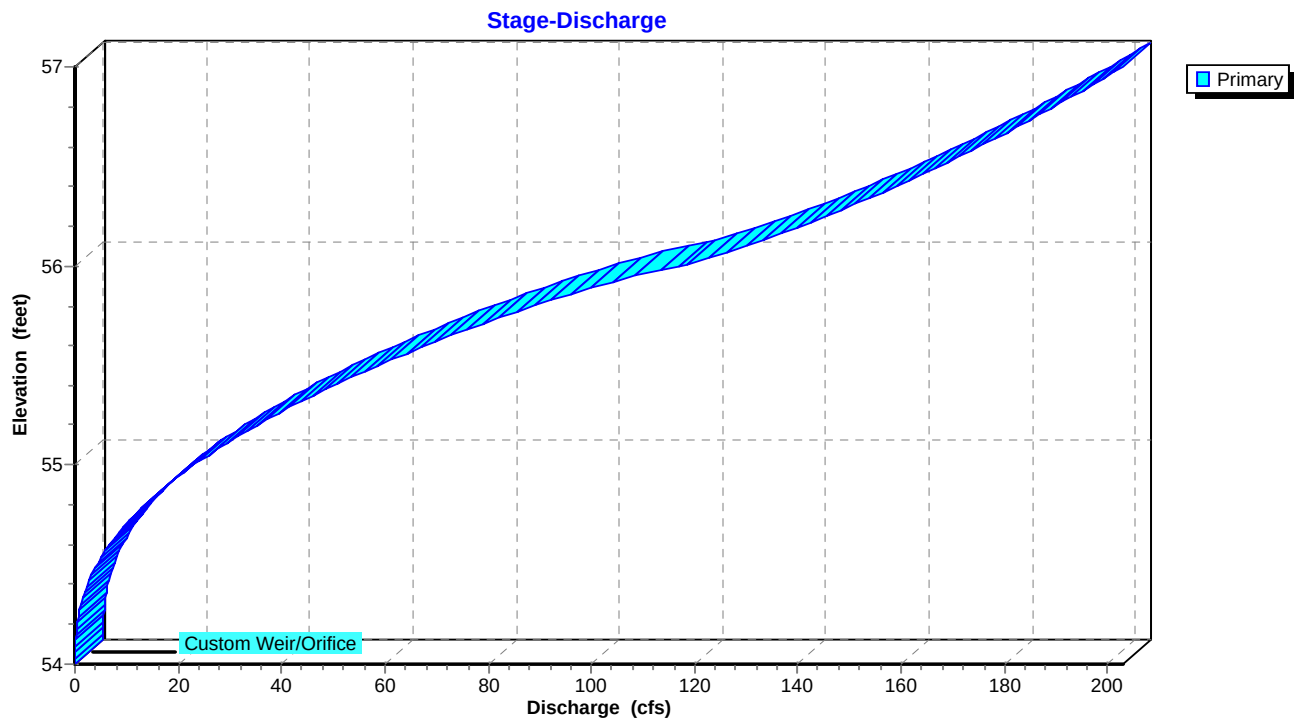
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Pond 8P: Wetland Storage - BN4C



Pond 8P: Wetland Storage - BN4C



Proposed - Part 2

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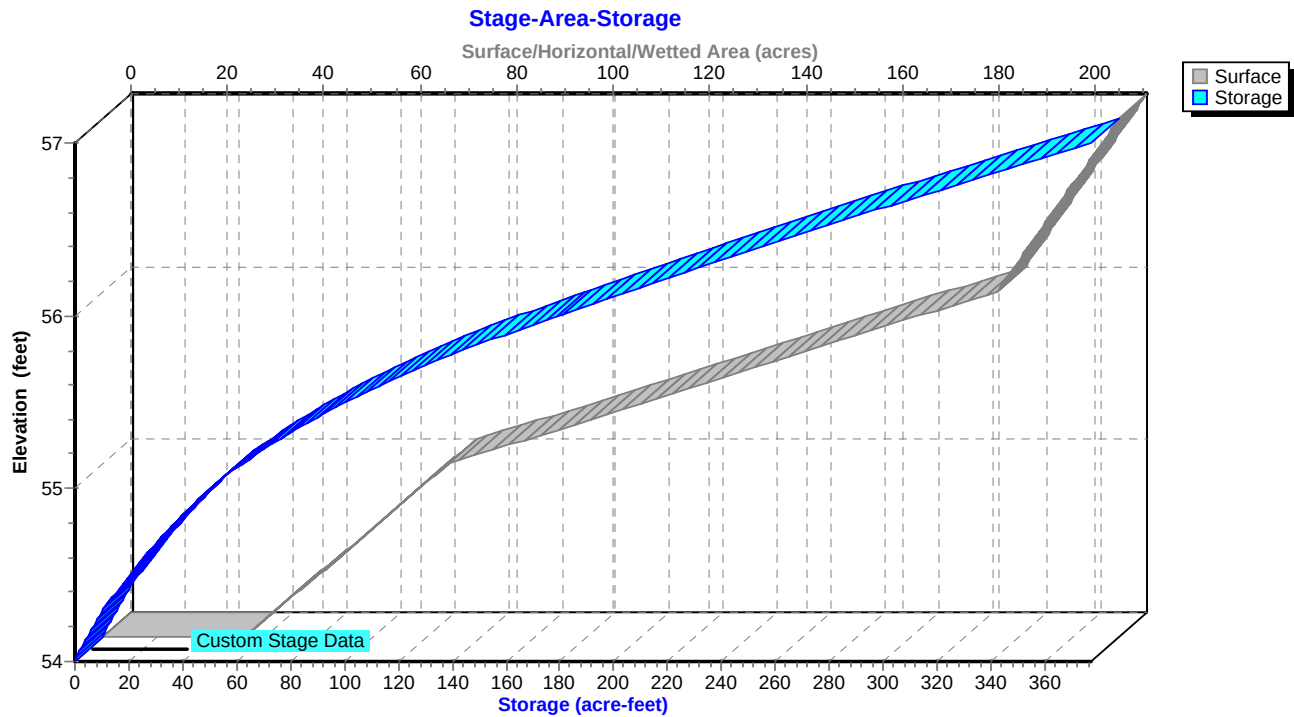
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SJRWMD 96-hr tenth 100-yr96hr Rainfall=15.00"

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Pond 8P: Wetland Storage - BN4C



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SJRWMD 96-hr tenth 100-yr96hr Rainfall=15.00"

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Summary for Pond 12P: NN4B3

Inflow Area = 522.100 ac, 0.00% Impervious, Inflow Depth > 9.99" for 100-yr96hr event
 Inflow = 647.40 cfs @ 62.13 hrs, Volume= 434.662 af
 Outflow = 274.92 cfs @ 64.54 hrs, Volume= 415.321 af, Atten= 58%, Lag= 145.1 min
 Primary = 157.48 cfs @ 64.54 hrs, Volume= 216.552 af
 Secondary = 117.44 cfs @ 64.54 hrs, Volume= 198.769 af

Routing by Stor-Ind method, Time Span= 5.00-96.00 hrs, dt= 0.05 hrs
 Peak Elev= 39.82' @ 64.54 hrs Surf.Area= 73.935 ac Storage= 111.618 af

Plug-Flow detention time= 275.7 min calculated for 415.093 af (95% of inflow)
 Center-of-Mass det. time= 203.8 min (4,272.5 - 4,068.7)

Volume	Invert	Avail.Storage	Storage Description
#1	37.00'	1,299.525 af	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
37.00	0.000	0.000	0.000
37.50	9.300	2.325	2.325
38.00	34.300	10.900	13.225
39.00	56.100	45.200	58.425
40.00	77.900	67.000	125.425
42.00	109.000	186.900	312.325
44.00	149.500	258.500	570.825
46.00	180.600	330.100	900.925
48.00	218.000	398.600	1,299.525

Device	Routing	Invert	Outlet Devices
#1	Primary	37.30'	To REQUAL, Cv= 2.62 (C= 3.28) Head (feet) 0.00 3.00 7.00 Width (feet) 8.00 20.00 180.00
#2	Secondary	37.00'	To RN4B3, Cv= 2.62 (C= 3.28) Head (feet) 0.00 5.00 Width (feet) 6.00 13.00

Primary OutFlow Max=157.42 cfs @ 64.54 hrs HW=39.82' (Free Discharge)

↑**1=To REQUAL** (Weir Controls 157.42 cfs @ 4.80 fps)

Secondary OutFlow Max=117.41 cfs @ 64.54 hrs HW=39.82' (Free Discharge)

↑**2=To RN4B3** (Weir Controls 117.41 cfs @ 5.23 fps)

Proposed - Part 2

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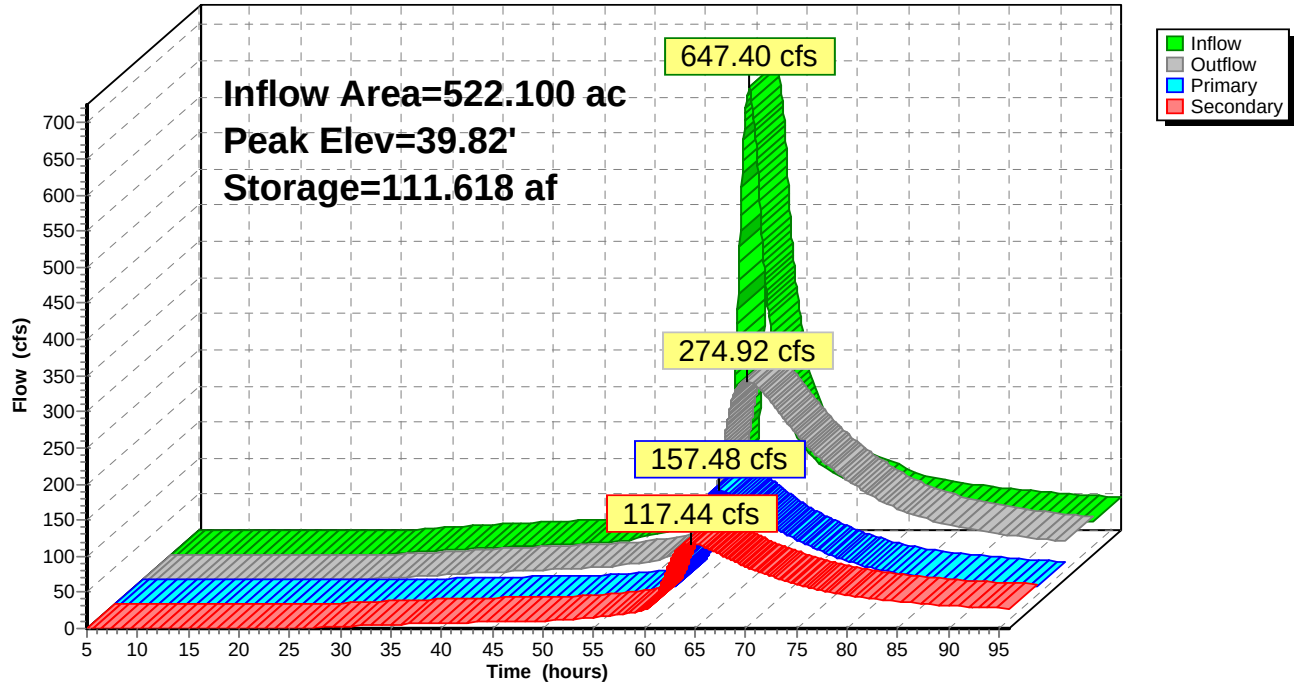
SJRWMD 96-hr tenth 100-yr96hr Rainfall=15.00"

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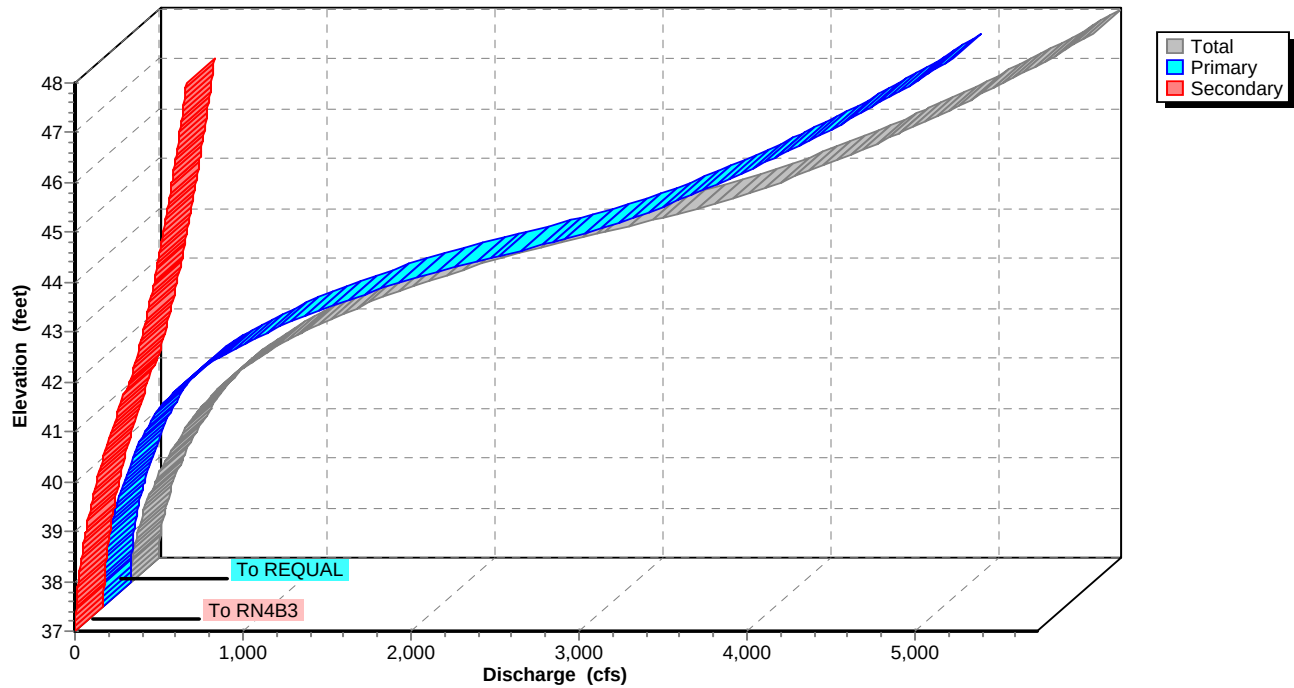
Pond 12P: NN4B3

Hydrograph



Pond 12P: NN4B3

Stage-Discharge



Proposed - Part 2

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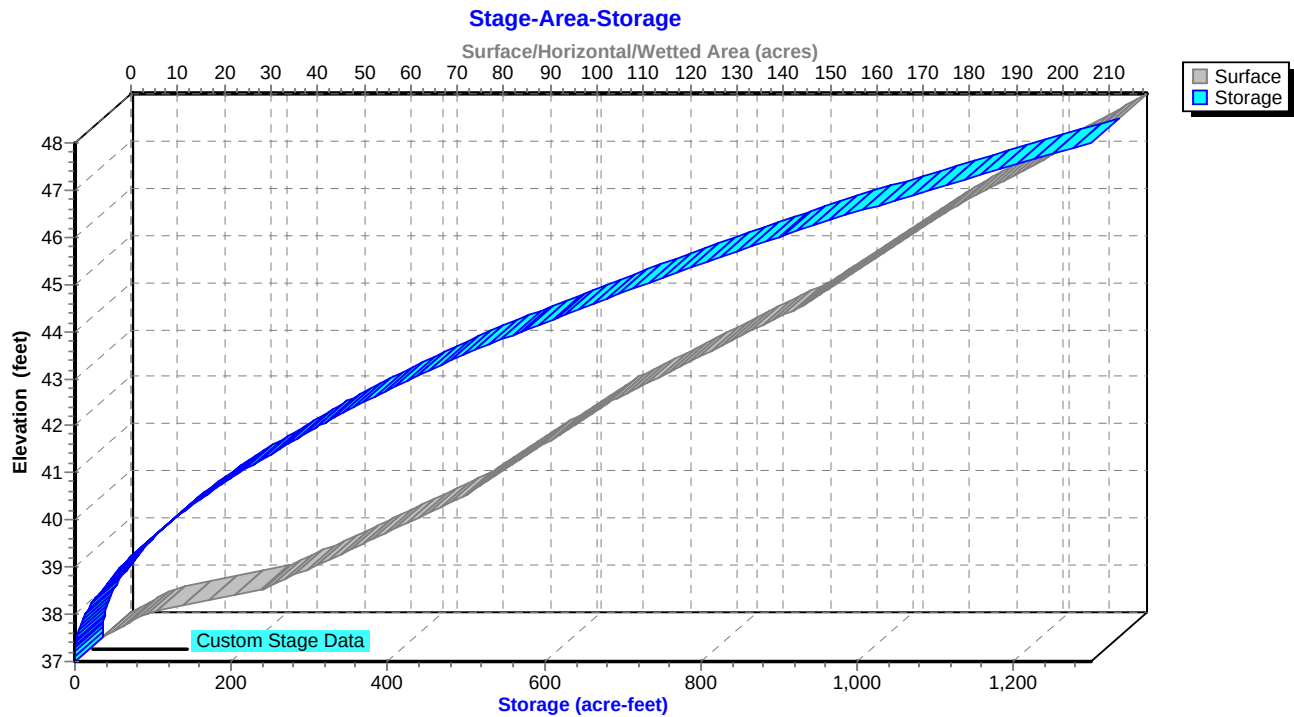
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SJRWMD 96-hr tenth 100-yr96hr Rainfall=15.00"

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Pond 12P: NN4B3



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Summary for Pond 16P: Wetland Storage BN4B1

Inflow Area = 61.200 ac, 0.00% Impervious, Inflow Depth > 12.53" for 100-yr96hr event
Inflow = 162.86 cfs @ 61.41 hrs, Volume= 63.895 af
Outflow = 55.89 cfs @ 63.22 hrs, Volume= 62.661 af, Atten= 66%, Lag= 108.7 min
Primary = 55.89 cfs @ 63.22 hrs, Volume= 62.661 af

Routing by Stor-Ind method, Time Span= 5.00-96.00 hrs, dt= 0.05 hrs
Peak Elev= 35.82' @ 63.22 hrs Surf.Area= 27.891 ac Storage= 21.597 af

Plug-Flow detention time= 236.7 min calculated for 62.626 af (98% of inflow)
Center-of-Mass det. time= 198.8 min (3,925.3 - 3,726.5)

Volume	Invert	Avail.Storage	Storage Description
#1	34.00'	175.900 af	Custom Stage Data (Prismatic) Listed below (Recalc)
Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
34.00	2.400	0.000	0.000
35.00	9.800	6.100	6.100
36.00	31.800	20.800	26.900
37.00	46.500	39.150	66.050
38.00	56.300	51.400	117.450
39.00	60.600	58.450	175.900

Device	Routing	Invert	Outlet Devices
#1	Primary	34.00'	Custom Weir/Orifice, Cv= 2.62 (C= 3.28) Head (feet) 0.00 7.00 Width (feet) 6.00 15.00

Primary OutFlow Max=55.89 cfs @ 63.22 hrs HW=35.82' (Free Discharge)
↑1=Custom Weir/Orifice (Weir Controls 55.89 cfs @ 4.28 fps)

Proposed - Part 2

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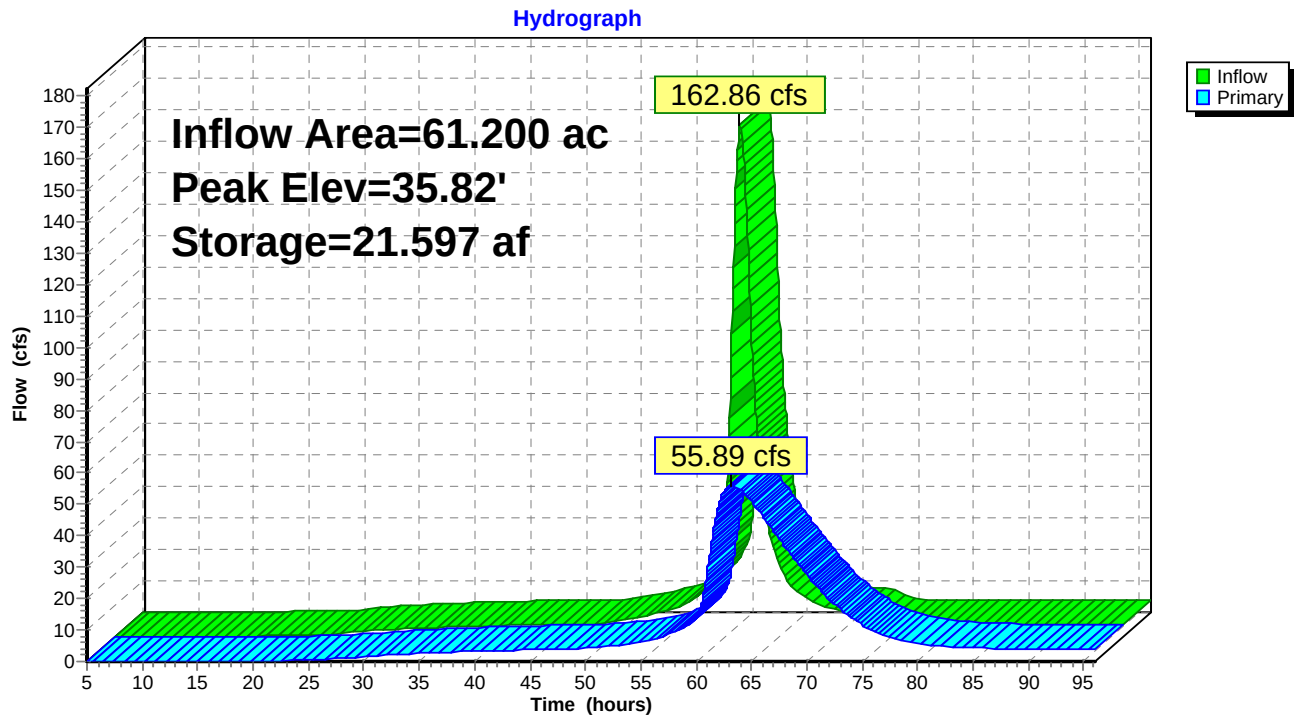
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SJRWMD 96-hr tenth 100-yr96hr Rainfall=15.00"

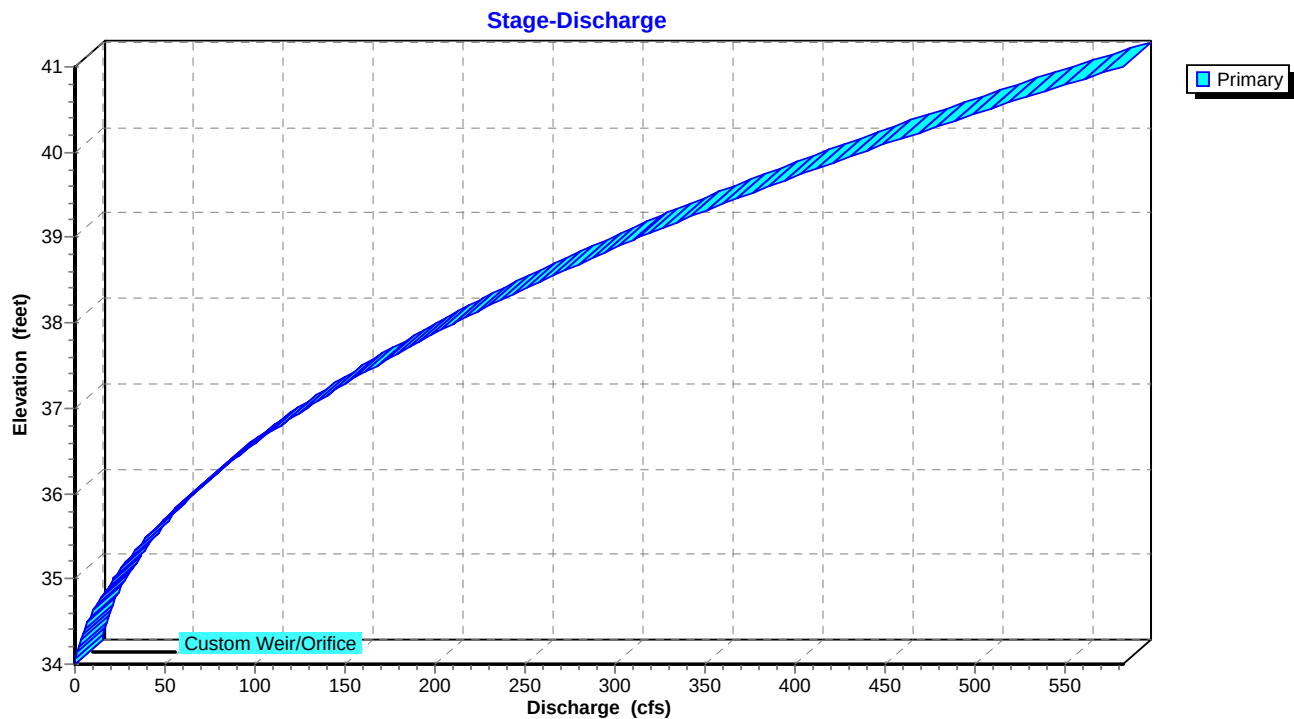
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Pond 16P: Wetland Storage BN4B1



Pond 16P: Wetland Storage BN4B1



Proposed - Part 2

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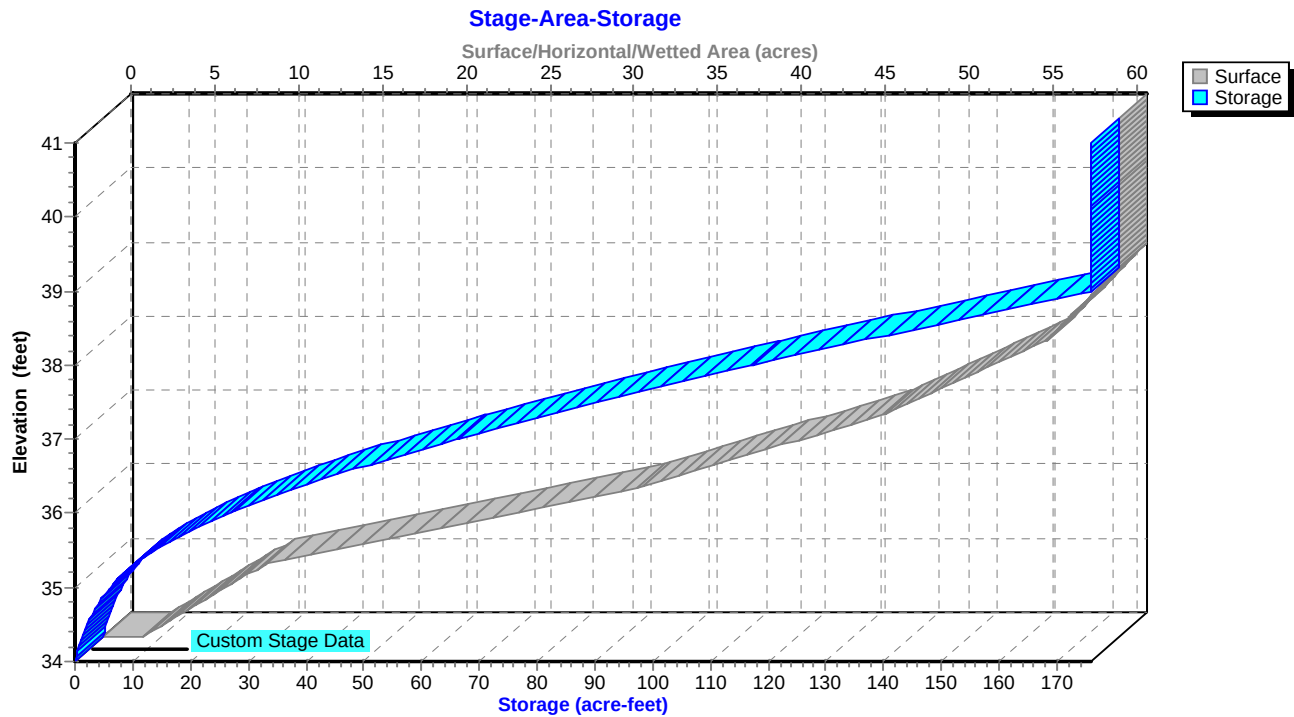
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SJRWMD 96-hr tenth 100-yr96hr Rainfall=15.00"

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Pond 16P: Wetland Storage BN4B1



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SJRWMD 96-hr tenth 100-yr96hr Rainfall=15.00"

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Summary for Pond 20P: Pond BE-4

Inflow Area = 101.470 ac, 0.00% Impervious, Inflow Depth > 35.44" for 100-yr96hr event
Inflow = 201.90 cfs @ 61.03 hrs, Volume= 299.678 af
Outflow = 182.60 cfs @ 61.03 hrs, Volume= 274.886 af, Atten= 10%, Lag= 0.0 min
Primary = 182.60 cfs @ 61.03 hrs, Volume= 274.886 af

Routing by Stor-Ind method, Time Span= 5.00-96.00 hrs, dt= 0.05 hrs / 4
Peak Elev= 35.54' @ 61.03 hrs Surf.Area= 4.140 ac Storage= 9.955 af

Plug-Flow detention time= 199.2 min calculated for 274.886 af (92% of inflow)
Center-of-Mass det. time= 73.5 min (4,188.7 - 4,115.2)

Volume	Invert	Avail.Storage	Storage Description
#1	31.00'	9.955 af	Custom Stage Data (Prismatic) Listed below (Recalc)
Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
31.00	0.830	0.000	0.000
32.00	1.660	1.245	1.245
33.00	2.490	2.075	3.320
34.00	3.320	2.905	6.225
35.00	4.140	3.730	9.955

Device	Routing	Invert	Outlet Devices
#1	Primary	31.00'	12.0" Round Culvert L= 50.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 31.00' / 30.50' S= 0.0100 '/' Cc= 0.900 n= 0.024, Flow Area= 0.79 sf
#2	Primary	34.00'	35.0' long x 10.0' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64

Primary OutFlow Max=182.47 cfs @ 61.03 hrs HW=35.54' (Free Discharge)

1=Culvert (Barrel Controls 4.71 cfs @ 5.99 fps)

2=Broad-Crested Rectangular Weir (Weir Controls 177.77 cfs @ 3.29 fps)

Proposed - Part 2

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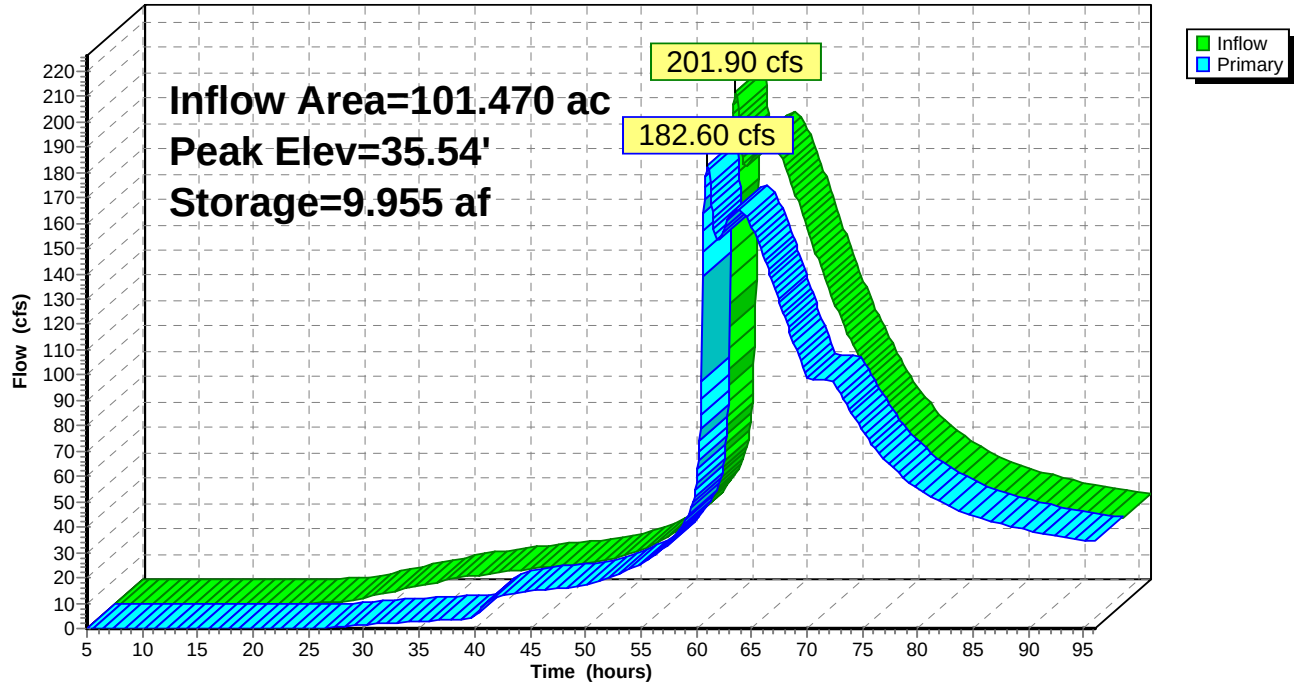
SJRWMD 96-hr tenth 100-yr96hr Rainfall=15.00"

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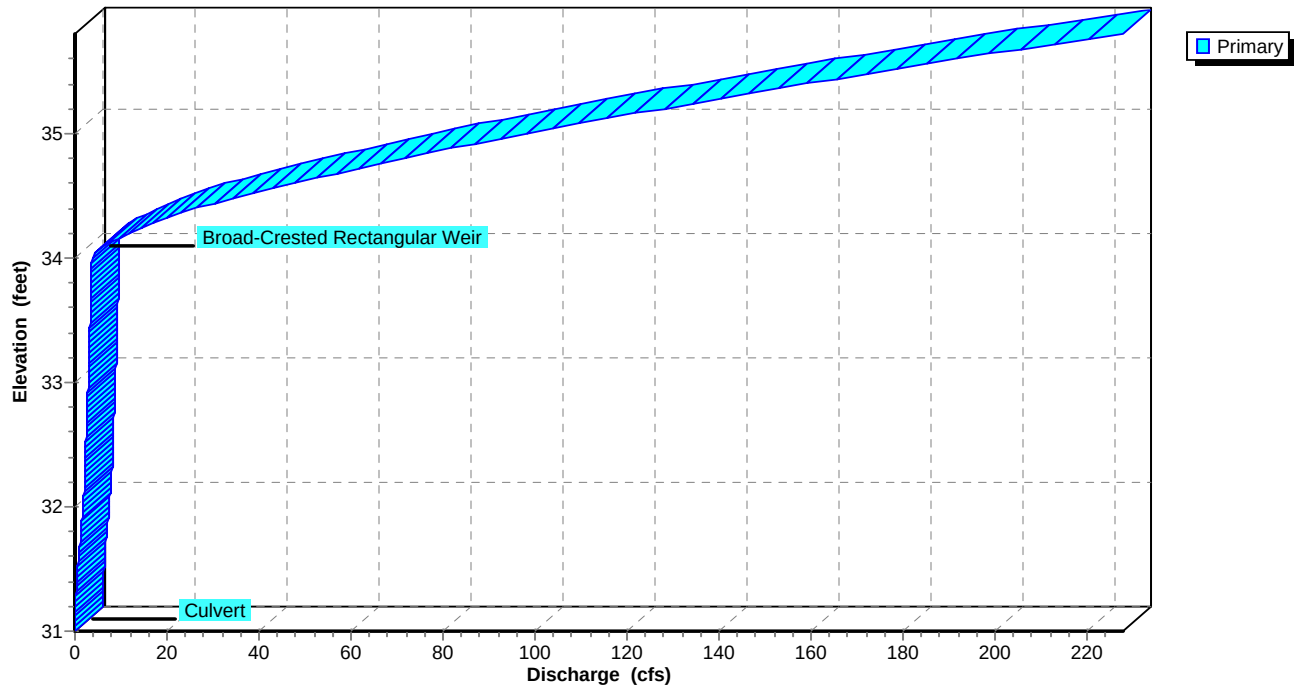
Pond 20P: Pond BE-4

Hydrograph



Pond 20P: Pond BE-4

Stage-Discharge



Proposed - Part 2

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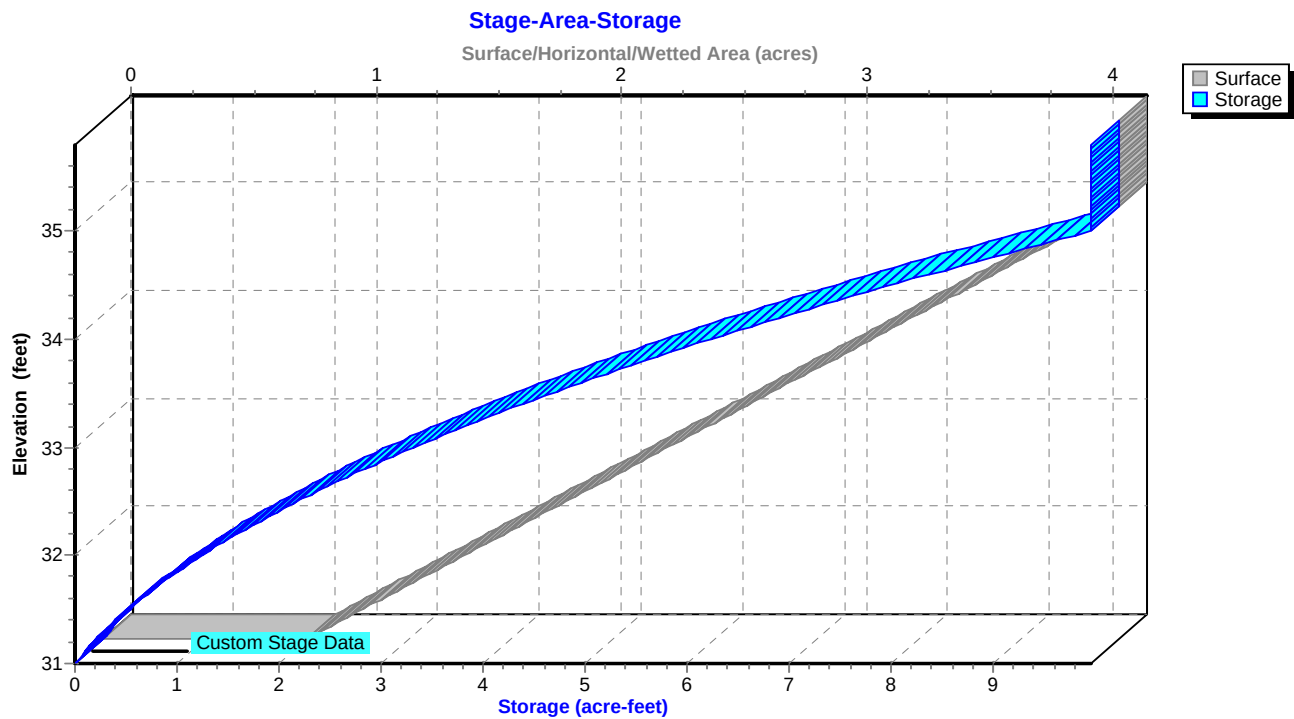
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SJRWMD 96-hr tenth 100-yr96hr Rainfall=15.00"

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Pond 20P: Pond BE-4



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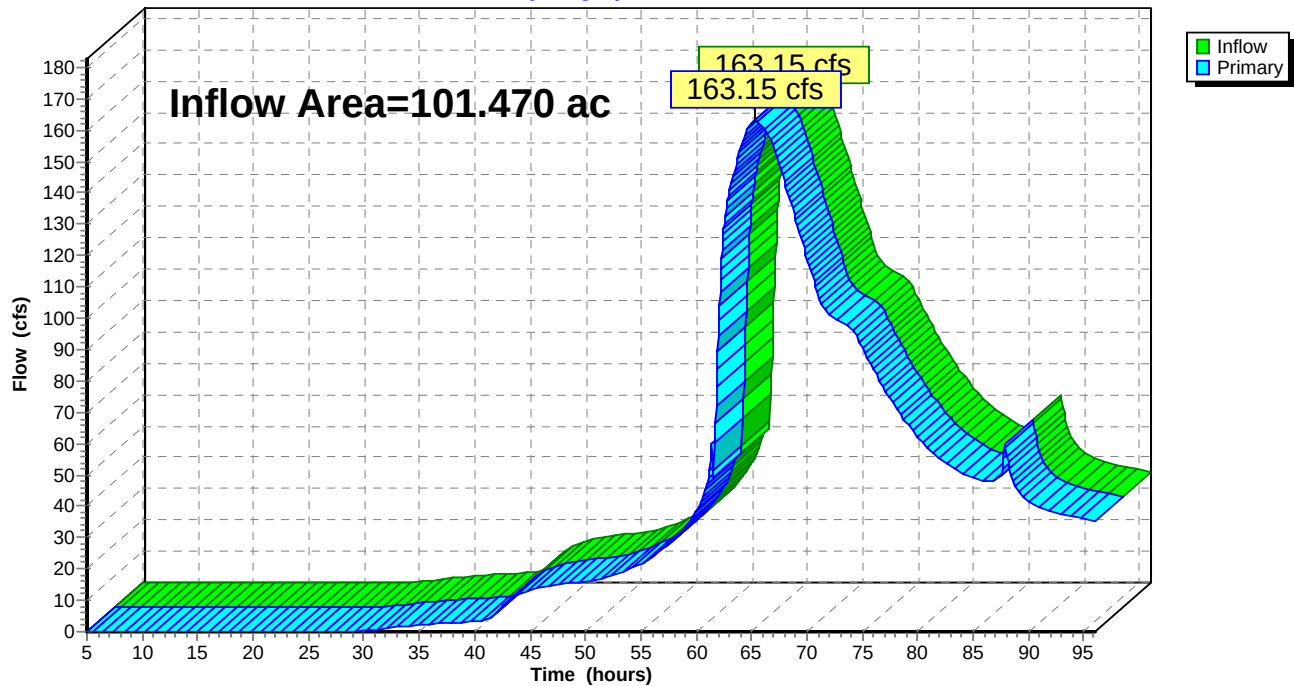
Summary for Link 17L: NN4B1

Inflow Area = 101.470 ac, 0.00% Impervious, Inflow Depth > 31.83" for 100-yr96hr event
Inflow = 163.15 cfs @ 65.37 hrs, Volume= 269.181 af
Primary = 163.15 cfs @ 65.37 hrs, Volume= 269.181 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-96.00 hrs, dt= 0.05 hrs

Link 17L: NN4B1

Hydrograph



Proposed - Part 2

Prepared by Black & Veatch

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SJRWMD 96-hr tenth 100-yr96hr Rainfall=15.00"

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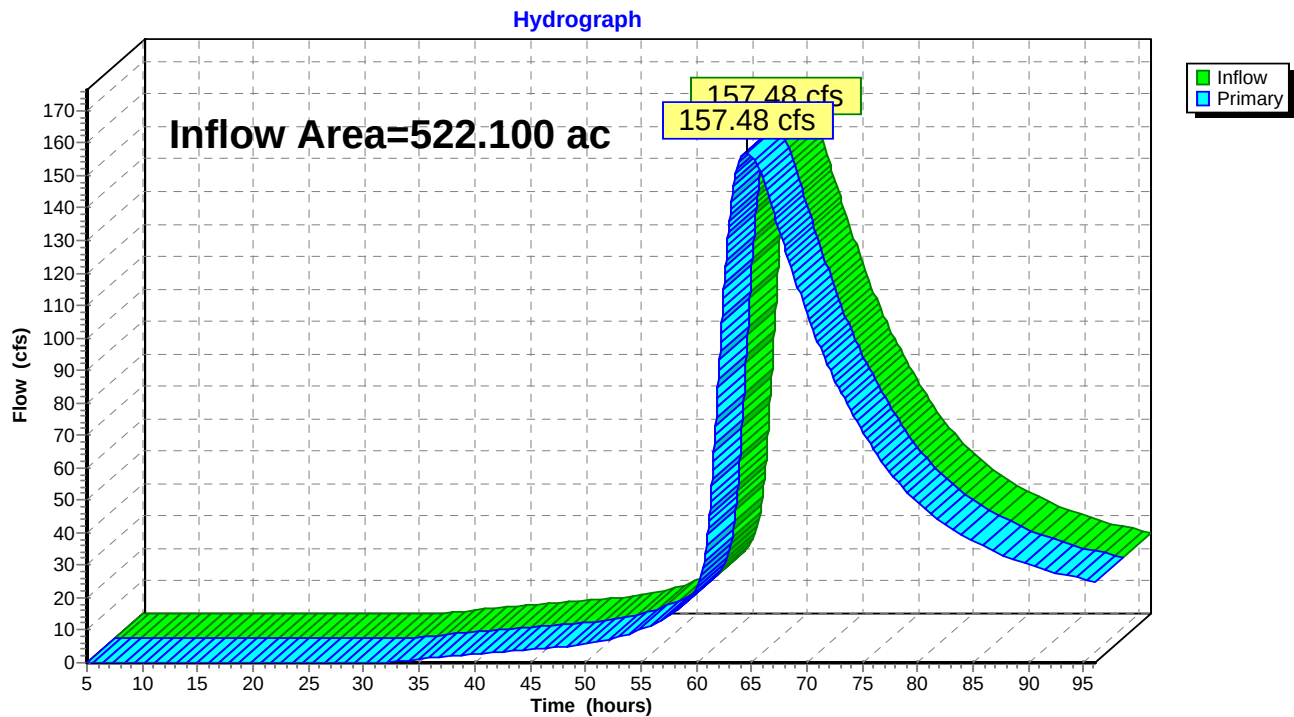
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Summary for Link 18L: To Pond BE4-3

Inflow Area = 522.100 ac, 0.00% Impervious, Inflow Depth > 4.98" for 100-yr96hr event
Inflow = 157.48 cfs @ 64.54 hrs, Volume= 216.552 af
Primary = 157.48 cfs @ 64.54 hrs, Volume= 216.552 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-96.00 hrs, dt= 0.05 hrs

Link 18L: To Pond BE4-3





BLACK & VEATCH

Owner: FPL
Plant: Okeechobee Clean Energy Center
Project No. 185922
File No. 58.5406.1102
Title: Post-Development Stormwater
Analysis

Prepared by: O Jankauskaite
Date: 09/01/15
Verified by: J C Barranco
Date: 09/01/15
Page No. 24 of 21
Template Rev: 0

Attachment 4
Supporting Files

Worksheet 3: Time of Concentration (T_c) or travel time (T_t)

Project Okeechobee Energy Center	By SJW	Date
Location	Checked	Date

Check one: ☐ Present ☒ Developed

Check one: ☒ T_c ☐ T_t through subarea

Notes: Space for as many as two segments per flow type can be used for each worksheet.
Include a map, schematic, or description of flow segments.

Sheet flow (Applicable to T_c only)

Segment ID 1. Surface description (table 3-1) Sho. 2. Manning's roughness coefficient, n (table 3-1) 3. Flow length, L (total $L \leq 300$ ft) ft 4. Two-year 24-hour rainfall, P_2 in 5. Land slope, s ft/ft 6. $T_t = \frac{0.007 (nL)^{0.8}}{P_2^{0.5} s^{0.4}}$ Compute T_t hr	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr><td style="width: 50%;">BE 4-1</td><td style="width: 50%;"></td></tr> <tr><td>Short Grass</td><td></td></tr> <tr><td>0.15</td><td></td></tr> <tr><td>300</td><td></td></tr> <tr><td>4.58</td><td>See NOAA Report</td></tr> <tr><td>0.005</td><td>this Appendix</td></tr> <tr> <td>0.57</td> <td>+ = </td> </tr> </table>	BE 4-1		Short Grass		0.15		300		4.58	See NOAA Report	0.005	this Appendix	0.57	+ =
BE 4-1															
Short Grass															
0.15															
300															
4.58	See NOAA Report														
0.005	this Appendix														
0.57	+ = 														

Shallow concentrated flow

Segment ID 7. Surface description (paved or unpaved) 8. Flow length, L ft 9. Watercourse slope, s ft/ft 10. Average velocity, V (figure 3-1) ft/s 11. $T_t = \frac{L}{3600 V}$ Compute T_t hr	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr><td style="width: 50%;"></td><td style="width: 50%;"></td></tr> <tr><td></td><td></td></tr> <tr><td></td><td></td></tr> <tr><td></td><td></td></tr> <tr><td></td><td></td></tr> <tr> <td></td> <td>+ = </td> </tr> </table>												+ =
	+ = 												

Channel flow

Segment ID 12. Cross sectional flow area, a ft ² 13. Wetted perimeter, p_w ft 14. Hydraulic radius, $r = \frac{a}{p_w}$ Compute r ft 15. Channel slope, s ft/ft 16. Manning's roughness coefficient, n Smooth Natural Stream 17. $V = \frac{1.49 r^{2/3} s^{1/2}}{n}$ Compute V ft/s 18. Flow length, L ft 19. $T_t = \frac{L}{3600 V}$ Compute T_t hr 20. Watershed or subarea T_c or T_t (add T_t in steps 6, 11, and 19) Hr	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr><td style="width: 50%;"></td><td style="width: 50%;"></td></tr> <tr><td>60</td><td></td></tr> <tr><td>12</td><td></td></tr> <tr><td>0.2</td><td></td></tr> <tr><td>0.0003</td><td></td></tr> <tr><td>0.025</td><td></td></tr> <tr><td>1.13</td><td></td></tr> <tr><td>2509</td><td></td></tr> <tr> <td>0.117</td> <td>+ = </td> </tr> </table>			60		12		0.2		0.0003		0.025		1.13		2509		0.117	+ =
60																			
12																			
0.2																			
0.0003																			
0.025																			
1.13																			
2509																			
0.117	+ = 																		

Worksheet 3: Time of Concentration (T_c) or travel time (T_t)

Project Oketchoe Energy Center	By STW	Date
Location	Checked	Date

Check one: ☐ Present ☐ Developed

Check one: ☐ T_c ☐ T_t through subarea

Notes: Space for as many as two segments per flow type can be used for each worksheet.
Include a map, schematic, or description of flow segments.

Sheet flow (Applicable to T_c only)

Segment ID 1. Surface description (table 3-1) 2. Manning's roughness coefficient, n (table 3-1) 3. Flow length, L (total $L \leq 300$ ft) ft 4. Two-year 24-hour rainfall, P_2 in 5. Land slope, s ft/ft 6. $T_t = \frac{0.007 (nL)^{0.8}}{P_2^{0.5} s^{0.4}}$ Compute T_t hr	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr><td style="padding: 2px 10px;">BE 4-2</td><td></td></tr> <tr><td style="padding: 2px 10px;">short grass</td><td></td></tr> <tr><td style="padding: 2px 10px;">0.15</td><td></td></tr> <tr><td style="padding: 2px 10px;">300</td><td></td></tr> <tr><td style="padding: 2px 10px;">4.58</td><td></td></tr> <tr><td style="padding: 2px 10px;">0.005</td><td></td></tr> <tr> <td style="padding: 2px 10px;">0.57</td> <td style="padding: 2px 10px;">+ = </td> </tr> </table>	BE 4-2		short grass		0.15		300		4.58		0.005		0.57	+ =
BE 4-2															
short grass															
0.15															
300															
4.58															
0.005															
0.57	+ = 														

Shallow concentrated flow

Segment ID 7. Surface description (paved or unpaved) 8. Flow length, L ft 9. Watercourse slope, s ft/ft 10. Average velocity, V (figure 3-1) ft/s 11. $T_t = \frac{L}{3600 V}$ Compute T_t hr	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr><td style="height: 20px;"></td><td></td></tr> <tr><td style="height: 20px;"></td><td></td></tr> <tr><td style="height: 20px;"></td><td></td></tr> <tr><td style="height: 20px;"></td><td></td></tr> <tr><td style="height: 20px;"></td><td></td></tr> <tr> <td style="padding: 2px 10px;"></td> <td style="padding: 2px 10px;">+ = </td> </tr> </table>												+ =
	+ = 												

Channel flow

Segment ID 12. Cross sectional flow area, a ft ² 13. Wetted perimeter, p_w ft 14. Hydraulic radius, $r = \frac{a}{p_w}$ Compute r ft 15. Channel slope, s ft/ft 16. Manning's roughness coefficient, n 17. $V = \frac{1.49 r^{2/3} s^{1/2}}{n}$ Compute V ft/s 18. Flow length, L ft 19. $T_t = \frac{L}{3600 V}$ Compute T_t hr 20. Watershed or subarea T_c or T_t (add T_t in steps 6, 11, and 19) Hr	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr><td style="height: 20px;"></td><td></td></tr> <tr><td style="padding: 2px 10px;">60</td><td></td></tr> <tr><td style="padding: 2px 10px;">12</td><td></td></tr> <tr><td style="padding: 2px 10px;">.2</td><td></td></tr> <tr><td style="padding: 2px 10px;">0.003</td><td></td></tr> <tr><td style="padding: 2px 10px;">0.025</td><td></td></tr> <tr><td style="padding: 2px 10px;">1.13</td><td></td></tr> <tr><td style="padding: 2px 10px;">2544</td><td></td></tr> <tr> <td style="padding: 2px 10px;">0.625</td> <td style="padding: 2px 10px;">+ = </td> </tr> <tr> <td style="padding: 2px 10px;"></td> <td style="padding: 2px 10px;"></td> </tr> </table>			60		12		.2		0.003		0.025		1.13		2544		0.625	+ = 		
60																					
12																					
.2																					
0.003																					
0.025																					
1.13																					
2544																					
0.625	+ = 																				

= 71.8 min

Worksheet 3: Time of Concentration (T_c) or travel time (T_t)

Project Okeechobee CEC	By SJW	Date 4/18/15
Location BE4-3	Checked	Date

Check one: ☐ Present ☒ Developed

Check one: ☒ T_c ☐ T_t through subarea

Notes: Space for as many as two segments per flow type can be used for each worksheet.
Include a map, schematic, or description of flow segments.

Sheet flow (Applicable to T_c only)

	Segment ID	BE 4-3		
1. Surface description (table 3-1)		Cult Res <=20%		
2. Manning's roughness coefficient, n (table 3-1)		0.060		
3. Flow length, L (total L $\geq$ 300 ft) ft		200		
4. Two-year 24-hour rainfall, P_2 in		4.58		
5. Land slope, s ft/ft		0.005		
6. $T_t = \frac{0.007 (nL)^{0.8}}{P_2^{0.5} s^{0.4}}$ Compute T_t hr			+	= 11.9 min

Shallow concentrated flow

	Segment ID			
7. Surface description (paved or unpaved)		Short Grass		
8. Flow length, Lft		86		
9. Watercourse slope, s ft/ft		0.0008		
10. Average velocity, V (figure 3-1) ft/s		7.0		
11. $T_t = \frac{L}{3600 V}$ Compute T_t hr			+	= 7.2 min

Channel flow

	Segment ID			
12. Cross sectional flow area, a ft ²		98.2		
13. Wetted perimeter, p_w ft		43.4		
14. Hydraulic radius, $r = \frac{a}{p_w}$ Compute r ft				
15 Channel slope, s ft/ft		0.0008		
16. Manning's roughness coefficient, n		0.030		
17. $V = \frac{1.49 r^{2/3} s^{1/2}}{n}$ Compute Vft/s		2.41		
18. Flow length, L ft		3511		
19. $T_t = \frac{L}{3600 V}$ Compute T_t hr			+	= 24.2 min
20. Watershed or subarea T_c or T_t (add T_t in steps 6, 11, and 19) Hr				43.3 min

Worksheet 3: Time of Concentration (T_c) or travel time (T_t)

Project Okeechobee Clean Energy Center	By SJW	Date 4/28/15
Location BE4	Checked	Date

Check one: ☐ Present ☒ Developed

Check one: ☒ T_c ☐ T_t through subarea

Notes: Space for as many as two segments per flow type can be used for each worksheet.
Include a map, schematic, or description of flow segments.

Sheet flow (Applicable to T_c only)

	Segment ID			
1. Surface description (table 3-1)	BE4			
2. Manning's roughness coefficient, n (table 3-1)	BE 4-3			
3. Flow length, L (total L $\geq$ 300 ft) ft	Cult Res $\leq 20\%$			
4. Two-year 24-hour rainfall, P_2 in	0.060			
5. Land slope, s ft/ft	200			
	4.58			
6. $T_t = \frac{0.007 (nL)^{0.8}}{P_2^{0.5} s^{0.4}}$ Compute T_t hr	0.005	+		= 11.9 min

Shallow concentrated flow

	Segment ID			
7. Surface description (paved or unpaved)	Short Grass Pasture			
8. Flow length, L ft	1422			
9. Watercourse slope, s ft/ft	0.005			
10. Average velocity, V (figure 3-1) ft/s	7.0			
11. $T_t = \frac{L}{3600 V}$ Compute T_t hr		+		= 47.9 min

Channel flow

	Segment ID			
12. Cross sectional flow area, a ft ²	98.2			
13. Wetted perimeter, p_w ft	43.4			
14. Hydraulic radius, $r = \frac{a}{p_w}$ Compute r ft				
15. Channel slope, s ft/ft	0.0008			
16. Manning's roughness coefficient, n	0.030			
17. $V = \frac{1.49 r^{2/3} s^{1/2}}{n}$ Compute V ft/s	2.41			
18. Flow length, L ft	3422			
19. $T_t = \frac{L}{3600 V}$ Compute T_t hr		+		= 23.6 min
20. Watershed or subarea T_c or T_t (add T_t in steps 6, 11, and 19) Hr				83.4

Client Name FPL Page 1 of 21Project Name Okeechobee Clean Energy Center Project No. 185922Calculation Title Compensating Storage AnalysisCalculation No./File No. 58.5406.1103Verification Method: ☒ Check and Review ☐ Alternate Calculations

Objective: The objective of this calculation is to determine compensatory storage requirement for the Florida Power & Light (FPL) Company's Okeechobee Clean Energy Center Project.

Unverified Assumptions Requiring Subsequent Verification

No.	Assumption	Verified By	Date
N/A	N/A	N/A	N/A

Refer to Page ____ of this calculation for additional assumptions.

This Section Used for Software-Generated CalculationsProgram Name/Number Trimble Terramodel Version 10.43Standard B&V Application Used? ☒ Yes ☐ No

If no, list approved deviation permit number below and attach approved deviation permit.

Review and Approval

Rev	Prepared By	Date	Verified By	Date	Approved By	Date
0	O Jankauskaite	9/01/15	J C Barranco, Jr.	9/02/15	J C Barranco, Jr.	
	<i>[Signature]</i>	<i>9/01/15</i>	<i>[Signature]</i>	<i>9/2/2015</i>		

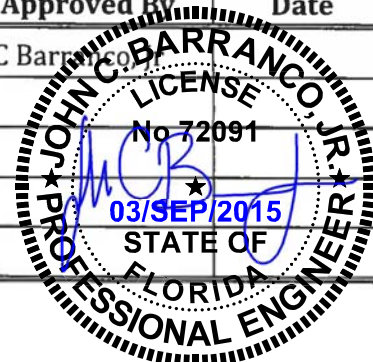


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5.0 Definitions of Units and Constants.....	4
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1.0 Purpose

The objective of this calculation is to determine compensatory storage requirement for the Florida Power & Light (FPL) Company's Okeechobee Clean Energy Center Project.

2.0 References

1. St. Johns River Water Management District (SJRWMD), Environmental Resource Permit (ERP) Applicant's Handbook Volume II, 1 Oct. 2013
2. Trimble Terramodel, Ver. 10.43
3. Black & Veatch drawing, 185922-DS-1104, "Proposed Stormwater Management Plan"
4. Aerial Topographic Survey of Okeechobee Energy Center Property, Performed 24 February 2015, by Carter Associates, Inc.
5. Sufsurface Exploration Florida Power & Light Okeechobee Clean Energy Center Okeechobee County, FL , Performed 27 March 2015, by Ardman & Associates, Inc.

3.0 Conclusion

Compensating storage was analyzed for the delta between the amount of fill placed within the flood plain and the storage provided within the plant area below the 100 year flood plain elevation (34 feet NAVD88). The proposed site requires a fill of 117,200 CY yards within the 100 year flood plain (1% probability). The proposed site includes Ponds and diversion canals that are contiguous to the 100 year flood plain, providing flood storage within these areas. The flood storage available within the Ponds and the diversion canals below the 100 year flood plain elevation and above the seasonal high ground water is 155,300 CY; therefore no additional compensating storage is required outside of the flood storage provided within these areas.

Table 1. Summary of Results

		Cubic Yards (CY)
Fill placed onsite within the FEMA 100 Year Flood Plain		117,165.00
Compensatory Storage Provided Onsite	Stormater Detention Ponds	131,789.00
	Stormwater Diversion Canals	23,400.00
Net Difference		(38,024.00)

4.0 Design Methodology

4.1 Trimble Terramodel, Ver 10.43 was used to compute site fill quantities within the 100 year flood plain, between the existing site elevation and the Base Flood Elevation (BFE).

4.2 Trimble Terramodel was used to quantify the volume available in the proposed stormwater ponds 4-1 and 4-2 between the normal water elevation and Base Flood Elevation (BFE).

4.3 The available storage within the diversion canals was estimated using the surface area and an average depth of 1 ft across all of the canals.

4.4 The Fill quantity placed within the 100 year flood plain has to be equal to or less than the compensating storage provided within the stormwater ponds and perimeter canals, to not require for additional compensating storage.

5.0 Definitions of Units and Constants

CY = Cubic Yards
NAVD 88 = North American Vertical Datum of 1988
BFE = Base Flood Elevation
FIRM = Flood insurance Rate Map

6.0 Analysis

Applicable Regulations:

The Project is located in Okeechobee County, FL and therefore the water management system (SWMS) is governed by Florida Department of Environmental Protection (FDEP) regulations for Stormwater Discharge (Chapter 62-25, F.A.C.) and Environmental Resource Permitting (ERP) (Chapter 62-330, F.A.C.). According to these regulations, the rules of the local water management district are adopted by reference for FDEP ERP requirements. St. Johns River Water Management District (SJRWMD) oversees projects in Okeechobee County. Therefore, the SWMS for this project has been designed to meet or exceed the criteria set forth in the SJRWMD ERP Applicant's Handbook Volume II.

6.1 Determining Base Flood Elevation (BFE).

To determine the Base Flood Elevation, the 100 year Flood Plain boundary as determined by FEMA Flood Insurance Rate Map (FIRM) panel 12093C0100C was overlayed on to the recent topographic survey of the site (Att 1). The site fell partially within the 100 year Flood Plain boundary. The highest existing elevation that the FEMA map intersected the site at was EL 34.0 ft NAVD 88. Therefore, based on the the highest elevation that the FEMA 100 year flood plain intercepted our site at, the BFE was determined to be 34.0 ft NAVD 88.

6.2 Site Fill Placed Within the 100 year flood boundary

The fill placed onsite between the existing ground elevation and the BFE 34.0 ft NAVD 88 within the FEMA 100 year flood boundary was quantified to be 117,165 CY (Att 2).

6.3 Compensatory Storage Provided Onsite

There are two proposed stormwater wet detention ponds onsite and diversion canals around the perimeter of the site that are providing compensatory storage.

The volume that can be used as compensatory storage in the stormwater ponds is between the normal water elevation of the pond and the determined BFE elevation of 34 ft NAVD 88. Based on the geotechnical exploration report (Ref 5), the normal water elevation in Pond 4-1 is approximately 31 ft NAVD 88, and the normal water elevation in Pond 4-2 is approximately 30 ft NAVD 88. The volume provided in Pond 4-1 is 68,007 CY and the volume provided in Pond 4-2 is 63,782 CY (Att 2). The total compensatory storage provided within both ponds is 131,789 CY.

The stormwater diversion canals are on average 1 foot deep with the bottom set on or around the seasonal high ground water table. The storage provided within the canals was estimated using the surface area of the canals and multiplying by the average depth of 1 foot. The diversion canals provide approximately 23,400 CY of compensatory storage.

The total compensatory storage provided onsite within the stormwater ponds and the stormwater diversion canals is 155,189 CY.

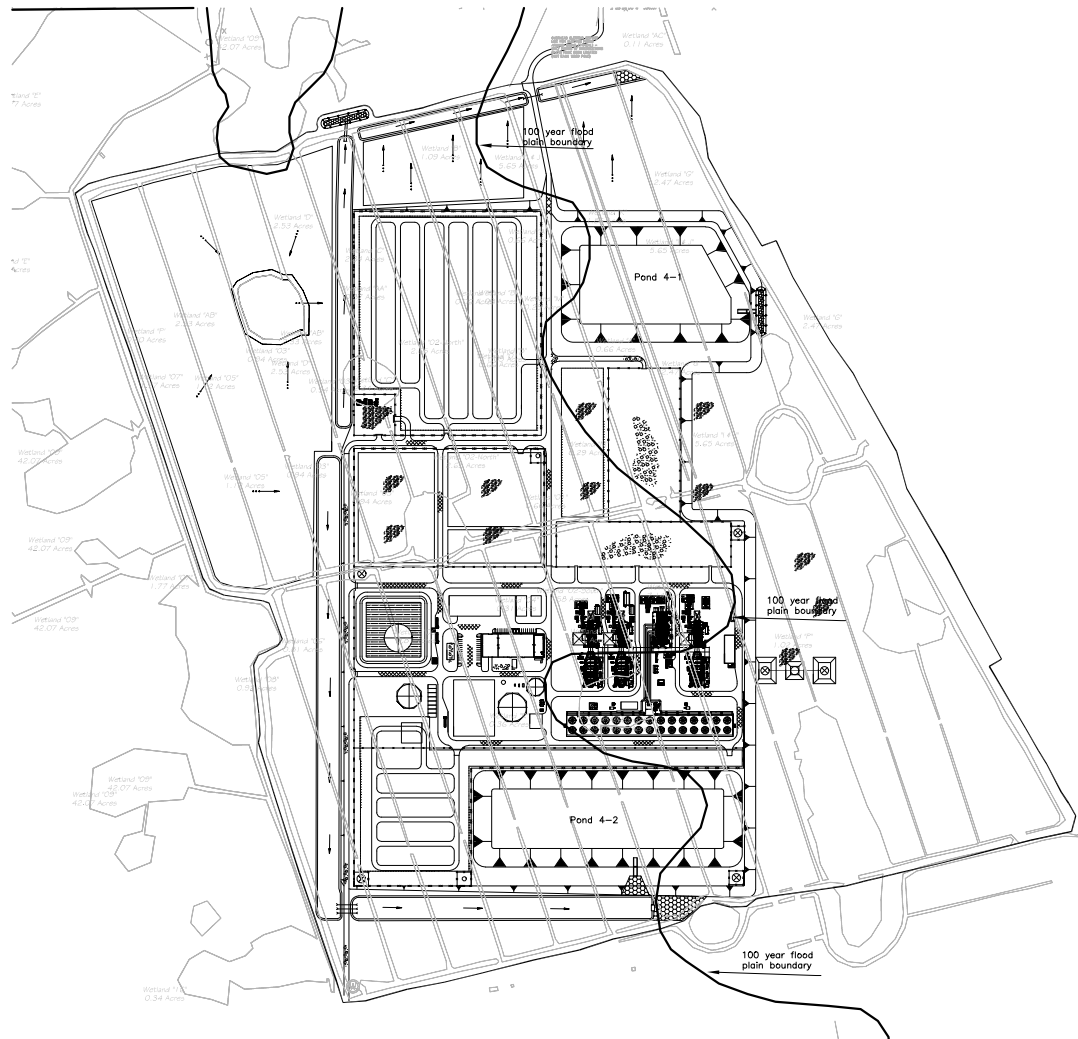
6.4 Summary of Results

		Cubic Yards (CY)
Fill placed onsite within the FEMA 100 Year Flood Plain		117,165.00
Compensatory Storage Provided Onsite	Stormwater Detention Ponds	131,789.00
	Stormwater Diversion Canals	23,400.00
Net Difference		(38,024.00)

We are currently providing approximately 38,024 CY more compensatory storage onsite than what we filled within the FEMA 100 year flood map, therefore no additional compensating storage is required outside the flood storage provided.

ATTACHMENTS

ATTACHMENT 1
Flood Plain Overlay Sketch



ATTACHMENT 2
Earthwork Reports

Site Fill Within the 100 Year Flood Boundary

SURFACE TO SURFACE VOLUME REPORT

Trimble
5475 Kellenburger Road
Dayton, Ohio 45424-1099, USA
1-937-233-8921

Project: C:\Users\jan78716\Desktop\okeechobee_35ftbackup
ponds_.pro
Report Generated: Wednesday, September 02, 2015 7:34:43 AM

Where the second surface is above the first the volume is reported as fill.
Where the second surface is below the first the volume is reported as
excavation.

Shrinkage/swell factors:	Excavation	1.0000	Fill	1.0000
First Surface Layer Name	Number of Points	Second Surface Layer Name	Number of Points	

OB-SRF-CONT-MN 33,774	5,029,568	DTM_NEWPAD		

Volume limited to that within the constraining boundary - Object 1241533
Area within boundary: 7,720,390.60 Sq. Ft. (177.2358 Acres)
Total triangulated area: 1,738,324.67 Sq. Ft. (39.9064 Acres)

Elev Range (ft)	Cut Volume (Cu. Yd.)	Fill Volume (Cu. Yd.)

28.00 > 29.00	0.0	33.8
29.00 > 30.00	0.0	233.4
30.00 > 31.00	0.0	7,458.1
31.00 > 32.00	243.4	22,210.6
32.00 > 33.00	1,372.9	40,246.9
33.00 > 34.00	840.6	43,109.8
34.00 > 35.00	355.8	38,620.2
35.00 > 36.00	30.4	36,268.1
36.00 > 37.00	0.0	35,049.7

Base Flood Elevation

Total: 113,293 CY

Excavation Volume (Cu. Yd.)	Fill Volume (Cu. Yd.)
-----	-----
2,843.0	223,230.5

Net Difference: 220,387.5 Cu. Yd. Borrow

Pond 4-1

SURFACE TO SURFACE VOLUME REPORT

Trimble
5475 Kellenburger Road
Dayton, Ohio 45424-1099, USA
1-937-233-8921

Project: C:\Users\jan78716\Desktop\Okeechobee\okeechobee_35ftbackup
ponds_.pro

Report Generated: Thursday, July 30, 2015 10:54:25 AM

Where the second surface is above the first the volume is reported as fill.
Where the second surface is below the first the volume is reported as
excavation.

Shrinkage/swell factors:	Excavation	1.0000	Fill	1.0000
First Surface	Number	Second Surface		Number
Layer Name	of Points	Layer Name		of Points
-----	-----	-----		

PAD_N_POND	4	NORTH POND		82

Volume limited to that within the constraining boundary - Object 1241710
Area within boundary: 7,720,390.60 Sq. Ft. (177.2358 Acres)
Total triangulated area: 445,028.75 Sq. Ft. (10.2165 Acres)

Elev Range (ft)	Cut Volume (Cu. Yd.)	Fill Volume (Cu. Yd.)
-----	-----	-----
-0.50 > 0.00	4,464.4	0.0
0.00 > 0.50	4,498.9	0.0
0.50 > 1.00	4,533.4	0.0
1.00 > 1.50	4,568.1	0.0
1.50 > 2.00	4,602.8	0.0
2.00 > 2.50	4,637.5	0.0
2.50 > 3.00	4,672.3	0.0
3.00 > 3.50	4,707.2	0.0
3.50 > 4.00	4,742.2	0.0
4.00 > 4.50	4,777.2	0.0
4.50 > 5.00	4,812.3	0.0
5.00 > 5.50	4,847.5	0.0
5.50 > 6.00	4,882.7	0.0
6.00 > 6.50	4,918.0	0.0
6.50 > 7.00	4,953.4	0.0
7.00 > 7.50	4,988.9	0.0
7.50 > 8.00	5,024.4	0.0
8.00 > 8.50	5,060.0	0.0
8.50 > 9.00	5,095.6	0.0
9.00 > 9.50	5,131.4	0.0
9.50 > 10.00	5,167.2	0.0
10.00 > 10.50	5,203.0	0.0
10.50 > 11.00	5,239.0	0.0
11.00 > 11.50	5,275.0	0.0

11.50 > 12.00	5,311.1	0.0
12.00 > 12.50	5,347.2	0.0
12.50 > 13.00	5,383.4	0.0
13.00 > 13.50	5,419.7	0.0
13.50 > 14.00	5,456.1	0.0
14.00 > 14.50	5,492.5	0.0
14.50 > 15.00	5,529.0	0.0
15.00 > 15.50	5,565.6	0.0
15.50 > 16.00	5,602.2	0.0
16.00 > 16.50	5,638.9	0.0
16.50 > 17.00	5,675.7	0.0
17.00 > 17.50	5,712.6	0.0
17.50 > 18.00	5,749.5	0.0
18.00 > 18.50	5,786.5	0.0
18.50 > 19.00	5,823.5	0.0
19.00 > 19.50	5,860.7	0.0
19.50 > 20.00	5,916.5	0.0
20.00 > 20.50	5,991.2	0.0
20.50 > 21.00	6,066.1	0.0
21.00 > 21.50	6,141.4	0.0
21.50 > 22.00	6,217.0	0.0
22.00 > 22.50	6,292.8	0.0
22.50 > 23.00	6,368.9	0.0
23.00 > 23.50	6,445.4	0.0
23.50 > 24.00	6,522.1	0.0
24.00 > 24.50	6,599.1	0.0
24.50 > 25.00	6,676.4	0.0
25.00 > 25.50	6,753.9	0.0
25.50 > 26.00	6,831.8	0.0
26.00 > 26.50	6,910.0	0.0
26.50 > 27.00	6,988.4	0.0
27.00 > 27.50	7,067.1	0.0
27.50 > 28.00	7,146.2	0.0
28.00 > 28.50	7,225.5	0.0
28.50 > 29.00	7,305.1	0.0
29.00 > 29.50	7,385.0	0.0
29.50 > 30.00	7,465.1	0.0
30.00 > 30.50	8,154.7	0.0
30.50 > 31.00	8,252.7	0.0
31.00 > 31.50	8,351.2	0.0
31.50 > 32.00	8,450.1	0.0
32.00 > 32.50	8,549.5	0.0
32.50 > 33.00	8,649.3	0.0
33.00 > 33.50	8,749.6	0.0
33.50 > 34.00	8,850.4	0.0
34.00 > 34.50	8,999.8	0.0

Seasonal High
Ground Water Table



Base Flood Elevation



Total: 68,007.5 CY

Excavation Volume (Cu. Yd.)

422,778.8

Fill Volume (Cu. Yd.)

0.0

Net Difference: 422,778.8 Cu. Yd. Waste

Pond 4-2

SURFACE TO SURFACE VOLUME REPORT

Trimble
5475 Kellenburger Road
Dayton, Ohio 45424-1099, USA
1-937-233-8921

Project: C:\Users\jan78716\Desktop\Okeechobee\okeechobee_35ftbackup
ponds_.pro

Report Generated: Thursday, July 30, 2015 11:11:14 AM

Where the second surface is above the first the volume is reported as fill.
Where the second surface is below the first the volume is reported as
excavation.

Shrinkage/swell factors: Excavation 1.0000 Fill 1.0000

First Surface Layer Name	Number of Points	Second Surface Layer Name	Number of Points
-----------------------------	---------------------	------------------------------	---------------------

PAD_S_POND	4	SOUTH POND	99
------------	---	------------	----

Volume limited to that within the constraining boundary - Object 10755

Area within boundary: 846,560.76 Sq. Ft. (19.4344 Acres)

Total triangulated area: 613,213.96 Sq. Ft. (14.0775 Acres)

Elev Range (ft)	Cut Volume (Cu. Yd.)	Fill Volume (Cu. Yd.)
0.00 > 0.50	0.0	0.0
0.50 > 1.00	5,582.4	0.0
1.00 > 1.50	5,634.1	0.0
1.50 > 2.00	5,686.0	0.0
2.00 > 2.50	5,738.3	0.0
2.50 > 3.00	5,790.9	0.0
3.00 > 3.50	5,843.8	0.0
3.50 > 4.00	5,897.0	0.0
4.00 > 4.50	5,950.5	0.0
4.50 > 5.00	6,004.4	0.0
5.00 > 5.50	6,058.5	0.0
5.50 > 6.00	6,113.0	0.0
6.00 > 6.50	6,167.8	0.0
6.50 > 7.00	6,222.9	0.0
7.00 > 7.50	6,278.3	0.0
7.50 > 8.00	6,334.0	0.0
8.00 > 8.50	6,390.1	0.0
8.50 > 9.00	6,446.4	0.0
9.00 > 9.50	6,503.1	0.0
9.50 > 10.00	6,560.1	0.0
10.00 > 10.50	6,617.4	0.0
10.50 > 11.00	6,675.0	0.0
11.00 > 11.50	6,733.0	0.0
11.50 > 12.00	6,791.2	0.0

12.00 > 12.50	6,849.8	0.0
12.50 > 13.00	6,908.6	0.0
13.00 > 13.50	6,967.8	0.0
13.50 > 14.00	7,027.3	0.0
14.00 > 14.50	7,087.1	0.0
14.50 > 15.00	7,147.3	0.0
15.00 > 15.50	7,207.7	0.0
15.50 > 16.00	7,268.5	0.0
16.00 > 16.50	7,329.6	0.0
16.50 > 17.00	7,391.0	0.0
17.00 > 17.50	7,452.7	0.0
17.50 > 18.00	7,514.7	0.0
18.00 > 18.50	7,577.0	0.0
18.50 > 19.00	7,639.7	0.0
19.00 > 19.50	7,702.6	0.0
19.50 > 20.00	7,765.9	0.0
20.00 > 20.50	7,829.5	0.0
20.50 > 21.00	7,916.9	0.0
21.00 > 21.50	8,028.1	0.0
21.50 > 22.00	8,139.7	0.0
22.00 > 22.50	8,251.6	0.0
22.50 > 23.00	8,364.0	0.0
23.00 > 23.50	8,476.7	0.0
23.50 > 24.00	8,589.8	0.0
24.00 > 24.50	8,703.2	0.0
24.50 > 25.00	8,817.1	0.0
25.00 > 25.50	8,931.3	0.0
25.50 > 26.00	9,045.9	0.0
26.00 > 26.50	9,160.9	0.0
26.50 > 27.00	9,276.2	0.0
27.00 > 27.50	9,392.0	0.0
27.50 > 28.00	9,508.1	0.0
28.00 > 28.50	9,624.5	0.0
28.50 > 29.00	9,741.4	0.0
29.00 > 29.50	9,858.6	0.0
29.50 > 30.00	9,976.2	0.0
30.00 > 30.50	10,094.2	0.0
30.50 > 31.00	10,212.6	0.0
31.00 > 31.50	10,331.3	0.0
31.50 > 32.00	10,450.5	0.0
32.00 > 32.50	10,569.9	0.0
32.50 > 33.00	10,689.8	0.0
33.00 > 33.50	10,810.1	0.0
33.50 > 34.00	10,930.7	0.0
34.00 > 34.50	11,051.7	0.0
34.50 > 35.00	11,173.1	0.0
35.00 > 35.50	11,294.8	0.0

Seasonal High Ground
Water Table



Base Flood Elevation



Total: 63,782 CY

Excavation Volume (Cu. Yd.)

554,095.6

Fill Volume (Cu. Yd.)

0.0

Net Difference: 554,095.6 Cu. Yd. Waste



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CALCULATION RECORD

Client Name: FPL Page 1 of 10

Project Name: Okeechobee Energy Center Project No.: 185922

Calculation Title: Stormwater ponds dewatering water quantity estimate

Calculation No./File No.: 58.5406.1104

Verification Method: ☒ Check and Review ☐ Alternate Calculations

Objective To estimate the amount of water to be discharged from the soils from the stormwater ponds excavated in wet using draglines.

Unverified Assumptions Requiring Subsequent Verification

No.	Assumption	Verified By	Date

Refer to Page _____ of this calculation for additional assumptions.

This Section Used for Software-Generated Calculations

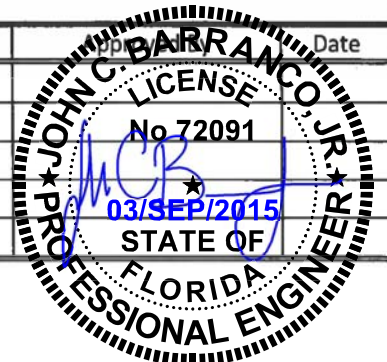
Program Name/Number: MathCAD Version: 15.0

Standard B&V Application Used? ☐ Yes ☐ No

If no, list approved deviation permit number below and attach approved deviation permit.

Review and Approval

Rev	Prepared By	Date	Verified By	Date	App. By	Date
0	Wei Tu <i>Wei Tu</i>	04/09/15	<i>J. L. Jeyaraj</i>	4/14/15		



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Unit: 1
Project No. 185922
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Prepared by: W Tu
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Verified by:
Date:
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Attachments

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1.0 Purpose

To estimate the amount of water to be discharged from the soils from the stormwater ponds excavated in wet using draglines.

2.0 Reference

1. Ardaman & Associates, Inc., Draft Report - SUBSURFACE EXPLORATION FLORIDA POWER & LIGHT OKEECHOBEE CLEAN ENERGY CENTER OKEECHOBEE COUNTY, FLORIDA, Mar-02-2015;
2. Nunnally, Construction Methods and Management, 4th Edition, 1997;
3. Day and Benjamin, Construction Equipment Guide, 1991;
4. BV drawing, 185922-DS-1104, Florida Power & Light, Okeechobee Energy Center, Proposed Stormwater Management Plan, Rev. A;
5. BV drawing, 185922-1GAU-1001, Florida Power & Light, Okeechobee Energy Center, Site Arrangement, Rev. 1;
6. BARRANCO, J., email communication, subject: 185922.52.5406 150402 FPL OCEC - Stormwater Drawings and Calculations - Issued for Client Review //34.0000, Sent on Thu 4/2/2015 6:14 PM;
7. BARRANCO, J., verbal communication and Lync Instant Messages, 4/9/2015.
8. Monahan, Construction of fills, 2nd Edition, 1994;
9. Holtz and Kovacs, An Introduction to Geotechnical Engineering, 1st Edition, 1981;
10. Coduto, Yeung, and Kitch, Geotechnical Engineering: Principles and Practices, 2nd Edition, 2010;
11. US Army Corps of Engineers, Technical Report, DS-78-11, Guidelines for Dewatering/Densifying Confined Dredged Material.

3.0 Design Basis

- Total volume of soils to be excavated based on Ref. 7;
- Natural water contents of soils to be excavated per Ref. 1;
- Swelling or bulking factor for the excavation per Ref. 2 and 3;
- Typical value of optimum moisture content per Ref. 8 and 9.

4.0 Definition of Units and Constants

US Custom

$$\text{pcf} = \frac{\text{lbf}}{\text{ft}^3} \quad \text{psf} = \frac{\text{lbf}}{\text{ft}^2} \quad \text{ksf} = 1000\text{psf} \quad \text{tsf} = 2000\text{psf} \quad \text{ksi} = 1000\text{psi} \quad \text{ton} = 2000\text{lbf} \quad \text{pci} = \frac{\text{lbf}}{\text{in}^3}$$

$$\text{dpt} = 0.5506\text{L} \quad (\text{dry pint}) \quad \text{lpt} = 1.164\text{dpt} \quad (\text{liquid pint})$$

$$\text{Unit weight of water:} \quad \gamma_w = 62.4\text{pcf}$$

SI

$$\text{kPa} = 10^3\text{Pa} \quad \text{MPa} = 10^6\text{Pa} \quad \text{GPa} = 1000\text{MPa} \quad \text{kN} = 10^3\text{newton} \quad \text{TN} = 10^3\text{kgf} \quad \text{tsm} = \frac{\text{TN}}{\text{m}^2}$$

$$\text{Atmosphere pressure:} \quad P_a = 100\text{kPa} \quad \text{Concrete unit weight:} \quad \gamma_c = 24 \frac{\text{kN}}{\text{m}^3}$$

$$\text{Set ORIGIN to 1 according to customary usage:} \quad \text{ORIGIN} = 1$$



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5.0 Symbols and Acronyms

w_N	Natural moisture content (%)
e_0	Initial void ratio
γ_t	Total unit weight of soil (pcf)
γ_d	Dry unit weight of soil (pcf)
n, n_0	Porosity of soil (%)
S_w	Swell factor (%)
G_s	Specific gravity of soil
V_{cut}	Total cut volume from excavation in situ (yd ³)
V_{cutsw}	Total cut volume from excavation after swell (yd ³)
V_s	Total volume of solid phase (soil particle) in the the excavated soils (yd ³)
V_w	Total volume of water in the the excavated soils after swell (gal)
V_{womc}	Total volume of water in the the excavated soils after dewatering (gal)
$V_{dewater}$	Total volume of water to be removed from the excavated soils (gal)



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6.0 Analysis

Per Ref. 1, three borings were drilled to support the permitting effort for the project: SB-08, PSB-01 and PSB-02. Boring SB-08 was advanced to depth of 100' while both PSB-01 and PSB-02 ended at depth of 30'. Based on the boring logs, the site is underlain by loose to medium dense clayey fine sand with a thin layer of firm sandy clay (5ft) at depth of 67' to 72' and bottom of boring ended in a firm sandy clay at the bottom 8ft. Per Ref. 4, the two stormwater ponds will be 30' deep (Figure 1). Per Ref. 7, because the client does not want to have a separate borrow pit (southwest to the site as shown in Figure 1), the size of the current ponds are both increased to 35ft deep.

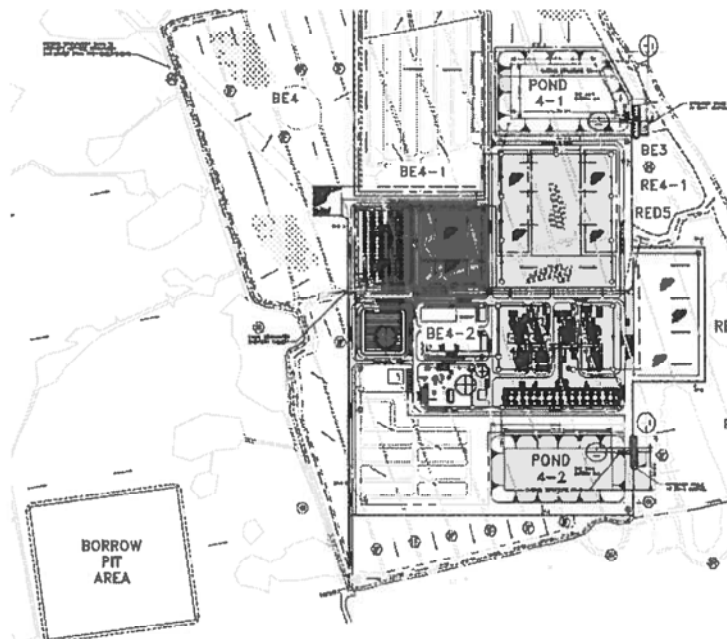


Figure. 1 Layout of the Stormwater Ponds (Ref. 4)



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Figure 2 plots the measured natural moisture contents of the selected samples collected in the three borings from Ref. 1.

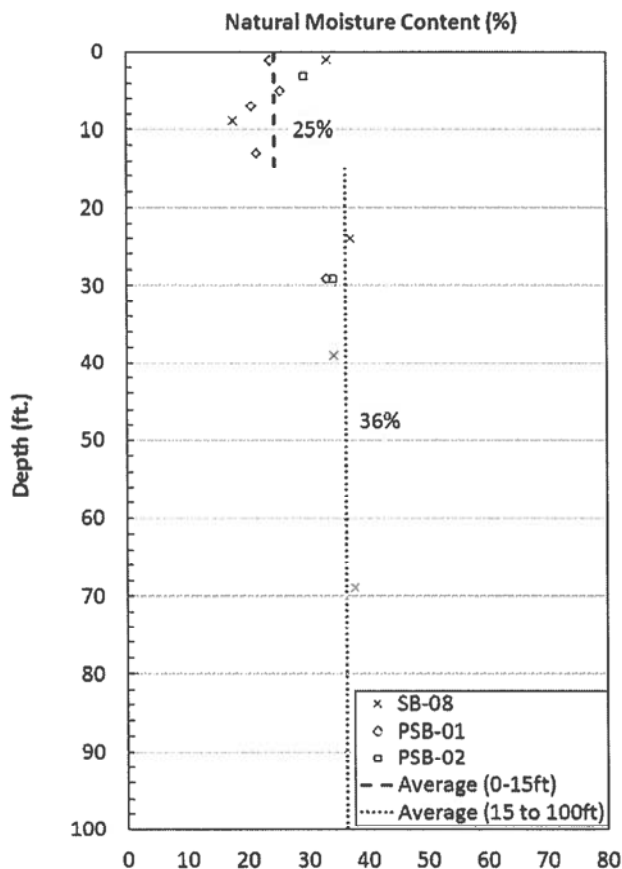


Figure 2 Measured Soil Natural Moisture Content (Ref. 1)

A total of 13 moisture content test were taken. In general, the top 15ft of soil has lower moisture content with an average value of 25% to the upper 15ft and 36% for soils below 15ft. For the excavated soil dewatering water quantity estimate, assume the weighted average value for in situ average moisture content based on excavation depth of 35ft.

In situ Soil Moisture Content:

$$w_N := \frac{15\text{ft} \cdot 25\% + 20\text{ft} \cdot 36\%}{35\text{ft}} \Rightarrow w_N = 31.29\% \quad \text{use } w_N := 30\%$$

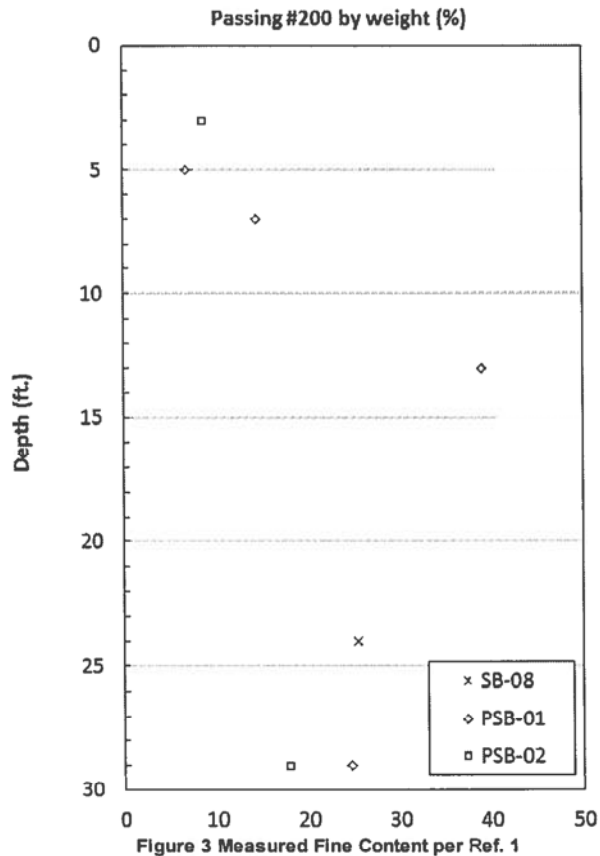


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Per Ref. 1, the groundwater table is located at 0.5 to 2ft below the existing grade. Per Ref. 7, the existing grade elevation of the site is about 36ft grading lower from west to east to about 31ft. Because the shallow groundwater, the stormwater ponds are planned to be excavated in wet using dragline buckets. The soils will be initially saturated and stockpiled to be drained with or without mechanical procedure to dewater and be dried to a moisture content close to the optimum moisture content before being used as fill materials on site. No full gradation tests were performed in Ref. 1. Figure 3 plots the seven passing #200 sieve tests from Ref. 1.



Based on the limited data, the shallower soil (0 to 15 ft) seems to be cleaner with 10 to 15% fine. Deeper soil has more fine content 20 to 40%. The excavated soil in the top 30' is described as fine sand with trace clay (borderline SP) to clayey sand (SC) with fine content up to 40%.



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Per Ref. 8 and 9, the optimum moisture content for well graded sand, the optimum moisture content is generally 10% or less while clay and silt is from 15% to 20% or higher (Figures 4 and 5).

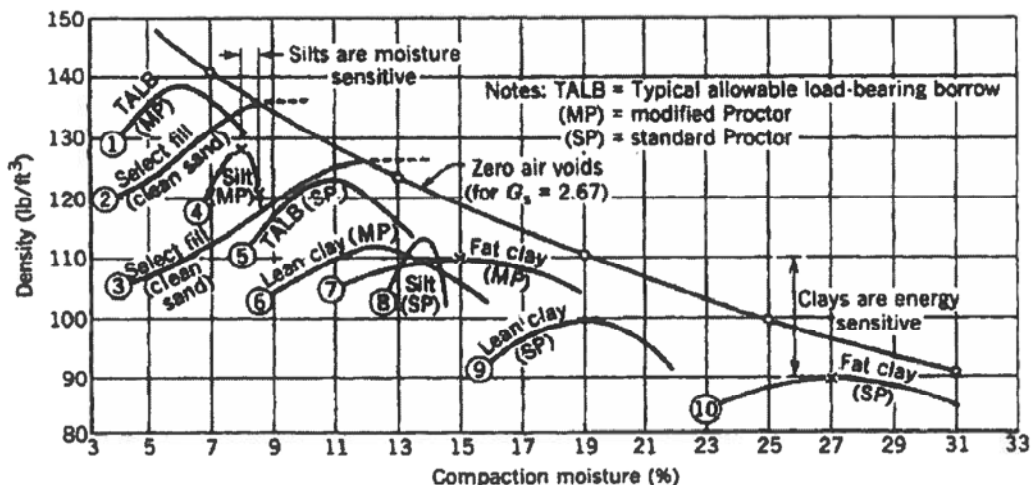


Figure 4 Compaction Curves for Typical Soil Types (Ref. 8)

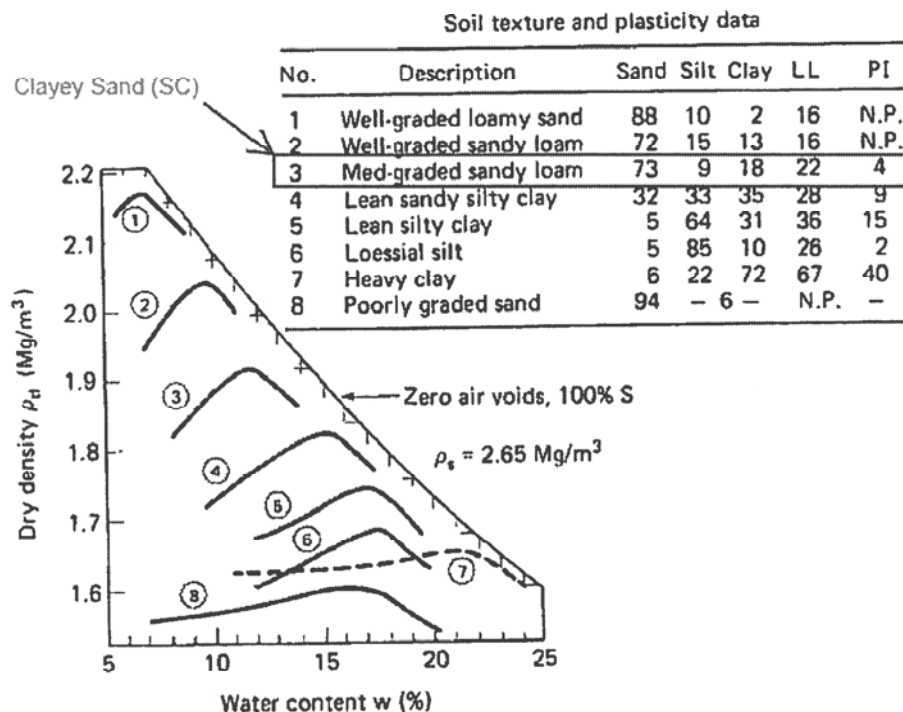


Figure 5 Compaction Curves for Typical Soil Types (Ref. 9)



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Per Ref. 8 and 9, an optimum moisture content of 12% with Standard Proctor test (ASTM D698) is assumed for average target moisture content for fill compaction.

Moisture Content for Fill Compaction: $w_{OMC} := 12\%$

Per Ref. 2, the swelling factor for gravel and sand earthwork under dry condition is typically 12%. Per Ref. 3, for dragline excavation in loose cohesionless material, the swelling is limited. For estimate purpose, a 10% swelling factor is conservatively used.

Swelling Factor for Dragline Excavation: $S_w := 10\%$

Per Ref. 7, the total In situ volume of soils to be excavated in the ponds: $V_{cut} := 894016 \text{ yd}^3$

Total excavated soil after swelling: $V_{cutsw} := V_{cut} (1 + S_w)$
 $\Rightarrow V_{cutsw} = 9.83 \times 10^5 \cdot \text{yd}^3$

Specific Gravity of soil: $G_s := 2.65$ Typical value for Sand

Since the insitu soil is saturated below groundwater, the void ratio of in situ soil can be estimated using the natural moisture content and specific gravity.

In situ void ratio of soil: $e_0 := w_N G_s$
 $\Rightarrow e_0 = 0.8$

Total (saturated) unit weight of in situ soil: $\gamma_{t0} := \frac{G_s + e_0}{1 + e_0} \cdot \gamma_w$
 $\Rightarrow \gamma_{t0} = 119.76 \cdot \text{pcf}$

Falls within the typical saturated unit weight for clayey sand (110 to 135pcf) per Table 4.1 of Ref. 10, OK.

Dry unit weight of in situ soil: $\gamma_{d0} := \frac{\gamma_{t0}}{1 + w_N}$
 $\Rightarrow \gamma_{d0} = 92.12 \cdot \text{pcf}$

The in situ porosity of soil: $n_0 := \frac{e_0}{1 + e_0}$
 $\Rightarrow n_0 = 44.29\%$

Total volume of solid phase (soil particles) in the excavated soil: $V_s := V_{cut} (1 - n_0)$
 $\Rightarrow V_s = 1.01 \times 10^8 \text{ gal}$

Total weight of solid phase (soil particles) in the excavated soil: $W_s := G_s \cdot V_s \cdot \gamma_w$
 $\Rightarrow W_s = 1.11 \times 10^6 \cdot \text{ton}$



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Total volume of water (or void assuming saturated condition) in the excavated soil after swelling:

$$V_w := V_{\text{cutsw}} - V_s$$

$$\Rightarrow V_w = 9.8 \times 10^7 \text{ gal}$$

Weight of water in the excavated soil after dewatering at target optimum moisture content for compaction:

$$W_{\text{womc}} := w_{\text{OMC}} \cdot W_s$$

$$\Rightarrow W_{\text{womc}} = 1.33 \times 10^5 \text{ ton}$$

Total volume of water in the excavated soil after dewatering at target optimum moisture content for compaction:

$$V_{\text{womc}} := \frac{W_{\text{womc}}}{\gamma_w}$$

$$\Rightarrow V_{\text{womc}} = 3.2 \times 10^7 \text{ gal}$$

Estimated total volume of water to be removed from the excavated soils:

$$V_{\text{dewater}} := V_w - V_{\text{womc}}$$

$$\Rightarrow V_{\text{dewater}} = 6.6 \times 10^7 \text{ gal}$$

7.0 Conclusions

The estimated total volume of water to be discharged from the excavated soils from the two stormwater ponds is about:

$$V_{\text{dewater}} = 6.6 \times 10^7 \text{ gal}$$

Note:

1. this estimate is very rough and performed based on limited subsurface investigation data available in Ref. 1 and conservative assumption of material swell factor after excavation and no consideration of evaporation and/or wetting from precipitation; It assumes that all water will be collected from discharge. It is expected that some water will drain back into the soil beneath the stockpile areas.
2. Per Ref. 11, the use of progressive surface trenching to remove the ponded surface water and precipitation and enhance evaporative dewatering of low permeability dredged material is the most cost-effective dewatering alternative at the time of the research performed at the time of Ref. 11. which may still be the best solution. The net dewatering and effectiveness will depend on existing climatic conditions and the engineering properties of the excavated materials;
3. This estimate is for permitting purpose only and a refined estimate should be used for construction in a later stage when more subsurface investigation information is available.



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CALCULATION RECORD

Client Name: FPL Page 1 of 19

Project Name: Okeechobee Energy Center Project No.: 185922

Calculation Title: Dewatering Design for the Power Block Bathtub Excavation

Calculation No./File No.: 58.5406.1105.01

Verification Method: ☒ Check and Review ☐ Alternate Calculations

Objective To determine site dewatering requirements for reducing groundwater levels to 2 feet below the base of excavation.

Unverified Assumptions Requiring Subsequent Verification

No.	Assumption	Verified By	Date

Refer to Page ____ of this calculation for additional assumptions.

This Section Used for Software-Generated Calculations

Program Name/Number: MathCAD Version: 15.0

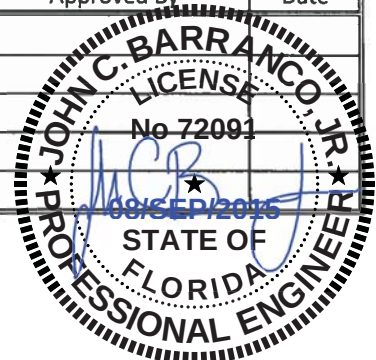
Standard B&V Application Used? ☐ Yes ☐ No

If no, list approved deviation permit number below and attach approved deviation permit.

Review and Approval

Rev	Prepared By	Date	Verified By	Date	Approved By	Date
0	Wei Tu 	04/08/15	J. L. Heggen  J. L. Heggen	4/20/15		

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File No. 58.5406.1105.01
Title: Dewatering Design for the Power
Block Bathtub Excavation

Prepared by: W Tu
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1.0 Purpose

To determine site dewatering requirements for reducing groundwater levels to 2 feet below the base of excavation.

2.0 Reference

1. Ardaman & Associates, Inc., Draft Report - SUBSURFACE EXPLORATION FLORIDA POWER & LIGHT OKEECHOBEE CLEAN ENERGY CENTER OKEECHOBEE COUNTY, FLORIDA, Mar-02-2015;
2. Department of the Army, the Navy and the Air Force, Army TM 5-818-5, Navy NAVFAC P-418, , Air Force AFM 88-5, Chap. 6, "Dewatering and Groundwater Control", November 1983;
3. Powers, J. P., "Construction Dewatering - A Guide to Theory and Practice", 2nd Ed., John Wiley & Sons, 1992;
4. BV drawing, 185922-DS-1104, Florida Power & Light, Okeechobee Energy Center, Proposed Stormwater Management Plan, Rev. A;
5. BV drawing, 185922-1GAU-1001, Florida Power & Light, Okeechobee Energy Center, Site Arrangement, Rev. 1;
6. BARRANCO, J., email communication, subject: RE: 185992 FPL Okeechobee Energy Center - Dewatering Calculations, Sent Mon 4/6/2015 3:31 PM;
7. BARRANCO, J., verbal communication and Lync Instant Messages, 4/7/2015;
8. Das, B.M., Principles of Foundation Engineering, 6th Edition, 2007.

3.0 Design Basis

- In situ hydraulic conductivity of soil based on consideration of slug test results in Ref. 1 and empirical correlations in Ref. 3 and 8;
- Dimensions of the base of excavation based on Ref. 6;
- Design of dewatering system based on References 2 and 3.

4.0 Definition of Units and Constants

US Custom

$$\text{pcf} = \frac{\text{lbf}}{\text{ft}^3} \quad \text{psf} = \frac{\text{lbf}}{\text{ft}^2} \quad \text{ksf} = 1000\text{psf} \quad \text{tsf} = 2000\text{psf} \quad \text{ksi} = 1000\text{psi} \quad \text{ton} = 2000\text{lbf} \quad \text{pci} = \frac{\text{lbf}}{\text{in}^3} \quad \text{gpd} = \frac{\text{gal}}{\text{day}}$$

$$\text{dpt} = 0.5506\text{L} \quad (\text{dry pint}) \quad \text{lpt} = 1.164\text{dpt} \quad (\text{liquid pint})$$

$$\text{Unit weight of water:} \quad \gamma_w = 62.4\text{pcf}$$

SI

$$\text{kPa} = 10^3\text{Pa} \quad \text{MPa} = 10^6\text{Pa} \quad \text{GPa} = 1000\text{MPa} \quad \text{kN} = 10^3\text{newton} \quad \text{TN} = 10^3\text{kgf} \quad \text{tsm} = \frac{\text{TN}}{\text{m}^2}$$

$$\text{Atmosphere pressure:} \quad P_a = 100\text{kPa} \quad \text{Concrete unit weight:} \quad \gamma_c = 24 \frac{\text{kN}}{\text{m}^3}$$

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5.0 Symbols and Acronyms

SPT	Standard penetration test
k_h, k	horizontal permeability and permeability (cm/s)
GWT	Groundwater
El, Elev	Elevation (ft)
w_N	Natural moisture content (%)
D_{10}	The particle size that passing 10% per weight (mm)
Gs	Specific gravity
e	Void ratio
w, L	Width and Length of base of the excavation (ft)
b, a	Width and length of the rectangular wellpoints system (ft)
L or R	Influence radius of wellpoints slot (ft)
Q	Flow (gpm or gpd)
h_0	Head at the wellpoints or wells (ft)
H	Original head before dewatering (ft)
h_D	Maximum residual head downstream of a single slot or between the two slots of wellpoints (ft)
r_w	Radius of wells (in)



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6.0 Analysis

Subsurface conditions

Per Ref. 1, three soil borings were drilled: SB-08, PSB-01, and PSB-02. Boring SB-08 was advanced to depth of 100' while both PSB-01 and PSB-02 ended at depth of 30'. Based on the boring logs, the site is underlain by loose to medium dense clayey fine sand with a thin layer of firm sandy clay (5ft) at depth of 67' to 72' and bottom of boring ended in a firm sandy clay at the bottom 8ft.

Figure 1 and Table 1 show the SPT-N values and soil profile vs. the depth below the original grade.

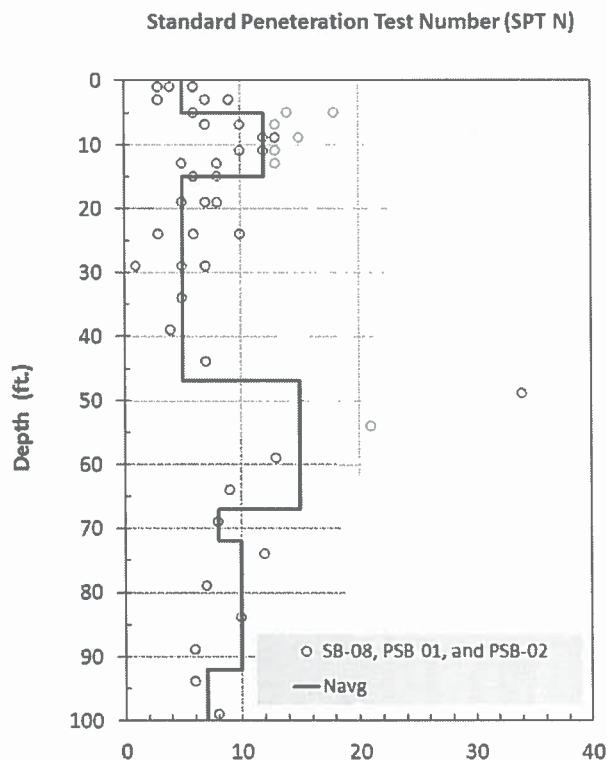


Figure 1 SPT Blow Counts and Profile per Boring Logs from Ref. 1



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Table 1 Soil Profile based on Borings SB-08, PSB-01, and PSB-02

Layer #	Description	Depth (ft)	SPT N (bpf)
1	Loose Fine Sand	0-5	5
2	Medium dense fine sand	5-15	12
3	Loose Sand	15-47	5
4	Medium dense fine sand	47-67	15
5	Firm Sandy Clay	67-72	8
6	Loose sand	72-92	10
7	Firm Sandy Clay	92-100	7

Per Ref. 1, the hydraulic conductivity from the slug tests performed in borings SB-08, PSB-01, and PSB-02 are shown in Table 2.

Table 2 Horizontal Hydraulic Conductivity based on the Slug Tests per Ref. 1

Piezometer	Horizontal Hydraulic Conductivity, k_h (feet/day)
PSB-01	0.10
PSB-02	0.24
SB-08	0.18

Use the average of the three tests for design: $k_h := \frac{\left(0.10 \frac{\text{ft}}{\text{day}} + 0.24 \frac{\text{ft}}{\text{day}} + 0.18 \frac{\text{ft}}{\text{day}}\right)}{3}$

$$\Rightarrow k_h = 0.173 \frac{\text{ft}}{\text{day}} \quad \text{or} \quad k_h = 6.115 \times 10^{-5} \frac{\text{cm}}{\text{s}}$$

The impermeable layer is assumed at the top of the firm sandy clay at depth of 67 ft per boring logs.

Per Ref. 1, the groundwater table is located at 0.5 to 2ft below the existing grade. Per Ref. 7, the existing grade elevation of the site is about 36ft grading lower from west to east to about 31ft. No full gradation tests were performed in Ref. 1. Figure 3 plots the seven passing #200 sieve tests from Ref. 1.



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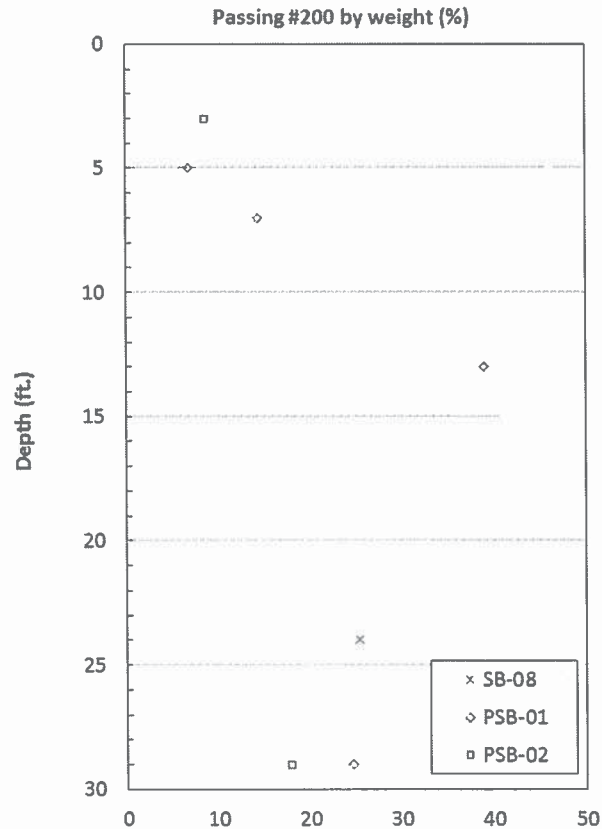


Figure 2 Measured Fine Content per Ref. 1

Based on the limited data, the shallower soil (0 to 15 ft) seems to be cleaner with 6 to 15% fine. Deeper soil has more fine content 20 to 40%. The excavated soil in the top 30' is described as fine sand with trace clay (borderline SP) to clayey sand (SC) with fine content up to 40%. All three slug tests were screened with depth of 20 to 30ft deep where the measured fine content is higher. The three passing #200 tests performed showed fine content of 6.8%, 14.4%, and 8.6% with an average value of 10% which means the #200 sieve size is approximately D_{10} on average.

D_{10} of top 15ft of soil:

$$D_{10} := 0.075\text{mm}$$

Estimated hydraulic conductivity
 of top 15ft of soil per Hazen
 equation (Ref. 3 Equ. 3.11):

$$k_1 := \left(0.1 \cdot \frac{D_{10}}{\text{mm}} \right)^2 \cdot \frac{\text{m}}{\text{s}}$$

$$\Rightarrow k_1 = 5.625 \times 10^{-3} \cdot \frac{\text{cm}}{\text{s}} \quad \text{or} \quad k_1 = 56.25 \cdot \frac{\mu\text{m}}{\text{s}}$$



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Per Ref. 1, the groundwater depth at the power plant area is only about 0.5ft to 2ft below the existing grade.
 Figure 3 plots the measured natural moisture contents of soil samples collected from the three borings. The average moisture content measured in the top 15ft shows about 11% lower than the averaged moisture content measured in the deeper soil.

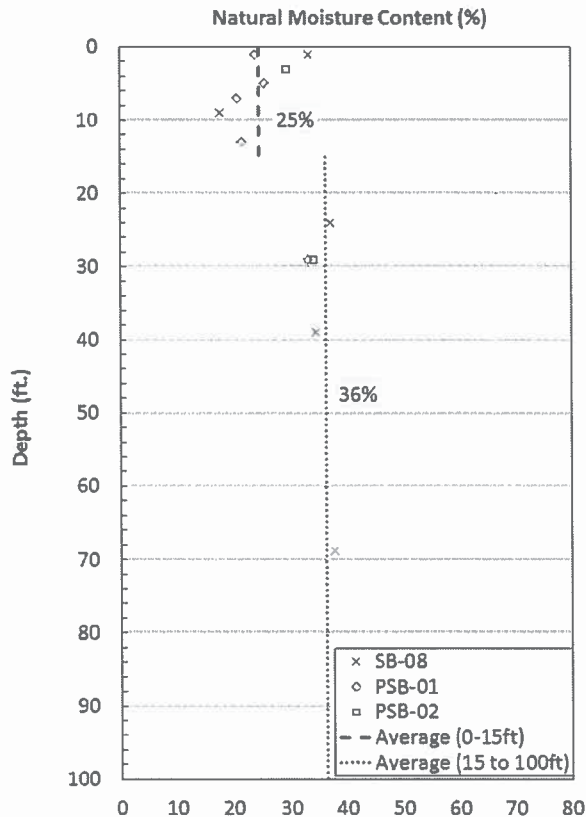


Figure 3 Measured Natural Moisture Content for Upper 15ft and below 15ft Depth

For the upper 15ft soil:

In situ Soil Moisture Content:

$$w_N := 25\%$$

Specific Gravity of soil:

$$G_s := 2.65$$

Typical value for Sand

The in situ soil is saturated below groundwater. The void ratio of in situ soil can be estimated using the natural moisture content and specific gravity.

In situ void ratio of soil:

$$e_0 := w_N G_s$$

$$\Rightarrow e_0 = 0.66$$



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Per Ref. 8 (Equ. 1.27) recommends a more recent empirical equation by Chapuis (2004) using effective particle size D_{10} and void ratio:

Hydraulic conductivity of upper 15ft soil per Chapuis (2004):

$$k_2 := 2.4622 \cdot \left[\left(\frac{D_{10}}{\text{mm}} \right)^2 \cdot \frac{e_0^3}{1 + e_0} \right]^{0.7825} \cdot \frac{\text{cm}}{\text{s}}$$

$$\Rightarrow k_2 = 0.011 \cdot \frac{\text{cm}}{\text{s}} \quad \text{or} \quad k_2 = 109.215 \cdot \frac{\mu\text{m}}{\text{s}}$$

Table 2 shows the range of permeability for typical natural soil types Per Ref. 3 Table 3.7.

Table 2 Range of Permeabilities of Natural Soils (Ref. 3)

Description	Permeability (μsec)
Openwork gravel (GP)	10,000 or higher
Uniform gravel (GP)	2,000–10,000
Well graded gravel (GW)	500–3,000
Uniform sand (SP)	50–2,000
Well graded sand (SW)	10–1,000
Silty sand (SM)	10–50
Clayey sand (SC)	1–10
Silt (ML)	0.5–1.0
Clay (CL)	0.1–0.0001

As shown in Table 2, the measured average horizontal permeability of the soil screen at 20 to 30ft below grade at the three borings:

$$k_h = 0.6 \cdot \frac{\mu\text{m}}{\text{s}} \quad \text{is slightly below the typical range of permeability for clayey sand and falls in the range of Silt (ML).}$$

The correlated permeability using effective particle using the two empirical equations:

$$\text{Hazen Equation: } k_1 = 56.25 \cdot \frac{\mu\text{m}}{\text{s}}$$

$$\text{Chapuis Equation: } k_2 = 109.215 \cdot \frac{\mu\text{m}}{\text{s}}$$

Considering the lower fine content in the upper 15ft, for preliminary dewatering design and dewatering water estimate permitting purpose, use:

$$k := 50 \frac{\mu\text{m}}{\text{s}} \quad \text{which is about the lower bound of range of permeability for uniform sand and close to the empirically correlated value using Hazen Equation with } D_{10} = 0.75 \mu\text{m} \text{ (\#200 sieve).}$$



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Dewatering Design for Powerblock Bathtub

Per Ref. 1, the groundwater depth at the power plant area is only about 0.5ft to 2ft below the existing grade. Use groundwater depth 0ft or at the existing grade for dewatering design.

Per site arrangement drawing (Ref. 5):

Elevation of grade: $El_{\text{grade}} := 37\text{ft}$
Elevation of bottom of excavation: $El_{\text{bottom}} := 32\text{ft}$
Depth of excavation: $D_{\text{exc}} := El_{\text{grade}} - El_{\text{bottom}}$
 $\Rightarrow D_{\text{exc}} = 5\text{ft}$

Per Ref. 7, the existing grade elevation at the powerblock is about 36ft sloping to the west to about 31ft. Use average of 34ft as existing grade elevation.

Elevation of original groundwater: $El_{\text{gw1}} := 34\text{ft}$
Elevation of final groundwater table after dewatering: $El_{\text{gw2}} := El_{\text{bottom}} - 2\text{ft}$
 $\Rightarrow El_{\text{gw2}} = 30\text{ft}$
Elevation of impermeable layer: $El_{\text{imp}} := El_{\text{grade}} - 67\text{ft}$
 $\Rightarrow El_{\text{imp}} = -30\text{ft}$
Height of the Initial groundwater table: $H := El_{\text{gw1}} - El_{\text{imp}}$
 $\Rightarrow H = 64\text{ft}$

Assume the center of wellpoint pumps is 2 ft above the collector original groundwater table.

Required Total Suction Lift for wellpoint: $SL_{\text{total}} := El_{\text{gw1}} + 2\text{ft} - El_{\text{gw2}}$
 $\Rightarrow SL_{\text{total}} = 6\text{ft}$

Per Ref. 2 and 3, in practice the suction lift of a single-stage wellpoint system at sea level is limited to about 15 ft (4.6 m) as measured from the suction of the pump to the lowered water table at the center of the wellpoint system (Figure 4). With special techniques, lifts of up to about 28 ft (8.5 m) can be achieved depending on site-specific conditions.

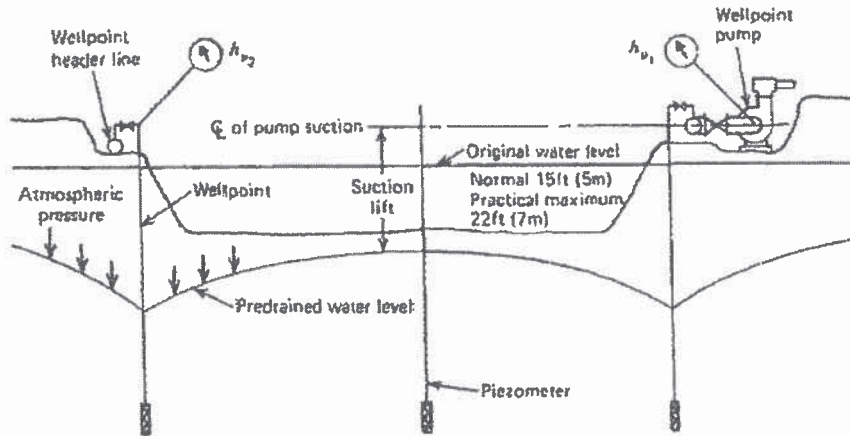


Figure 4 Suction Lift Limitation of Wellpoint System (Ref. 3)

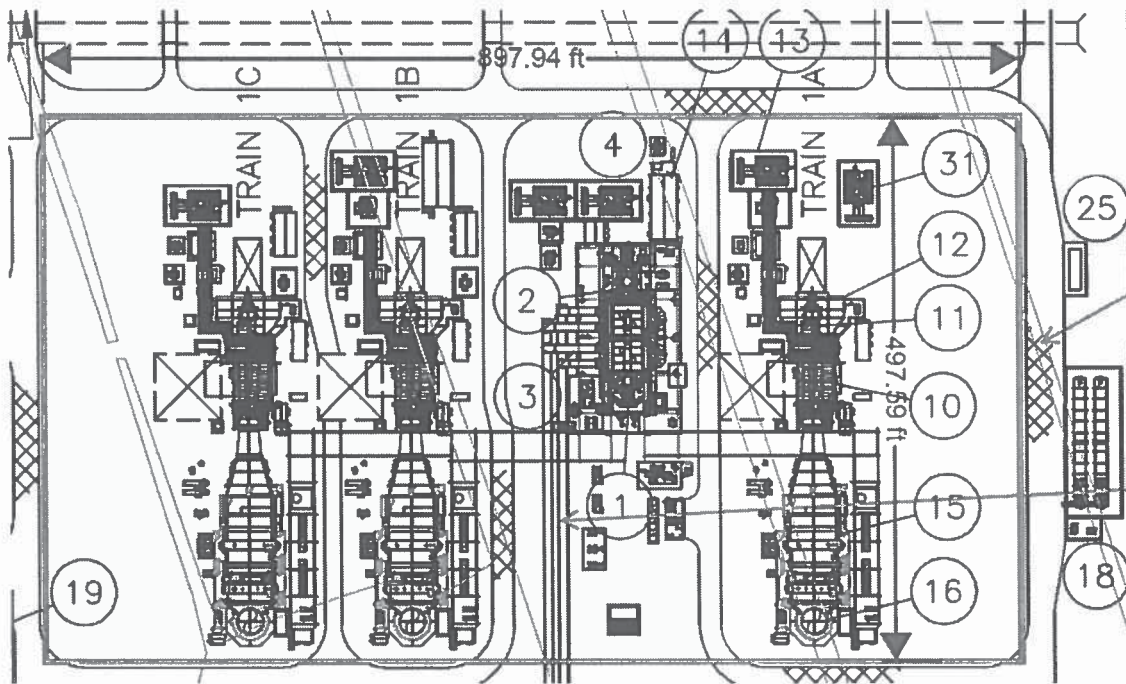


Figure 5 Plan view and dimensions of the Powerblock bathtub (Ref. 5)

Width of the powerblock excavation: $w_{base} := 500\text{ft}$
 Length of the powerblock excavation: $L_{base} := 900\text{ft}$



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Based on the boring logs, the soil to be excavated is classified as OSHA Type C60. For short term excavation purpose, a 1.5:1 slope (H:V) is recommended.

Distance from edge of excavation at the base to the top of slope = $1.5 \times 5\text{ft} = 7.5\text{ft}$

Assume the pumps and wellpoints collection piping is 5' away from the excavation for safety.

Width of the wellpoint system: $b := w_{\text{base}} + 2 \cdot 5\text{ft} + 2 \cdot 7.5\text{ft}$

$$\Rightarrow b = 525\text{ft}$$

Length of the wellpoint system: $a := L_{\text{base}} + 2 \cdot 5\text{ft} + 2 \cdot 7.5\text{ft}$

$$\Rightarrow a = 925\text{ft}$$

Check Single-stage two partially penetrating wellpoints around the excavation area (Figure 6):

Use 2" self-jetting wellpoints: $r_w := 1\text{in}$

Per Ref. 2 Fig. 4-5 Equ. (1):

$$h_D := h_0 \left[\frac{C_1 \cdot C_2}{R} \cdot (H - h_0) + 1 \right]$$

where

h_D = maximum residual head midway between two slots of wellpoints;

h_0 = head at the wellpoints after required drawdown;

C_1, C_2 = constants per Ref. 2 Fig. (c)&(d) in Fig. 4-5;

R = radius of influence from slot.

Per Ref. 2 Fig. 4-23 Equ. (1), the radius of influence (L , or R) of a single line of wellpoints is

$$R := C \cdot (H - h_0) \cdot \sqrt{k}$$

where

k = hydraulic conductivity in 10^{-4} cm/s or $\mu\text{m/s}$;

$C = 1.5$ to 2 for a single line of wellpoints, use average of 1.75 .



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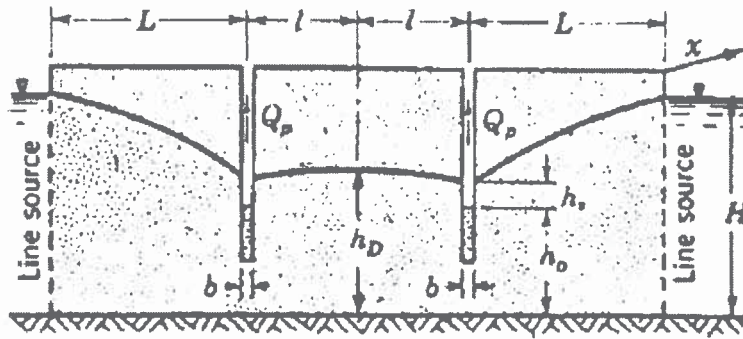


Figure 6 Flow and head (midway) for two partially penetrating slots two-line source and gravity flows (Ref. 2)

At middle of excavation, the required minimum drawdown is 2ft below bottom of excavation.

Maximum residual head midway between two slots of wellpoints:

$$h_{Dreq} := H - (El_{gw1} - El_{gw2})$$

$$\Rightarrow h_{Dreq} = 60 \text{ ft}$$

Ratio of half of b to h₀ to look up C₁ per Ref. 2 Fig. (c):

$$lth_0 := \frac{\frac{b}{2}}{49 \text{ ft}}$$

$$\Rightarrow lth_0 = 5.357$$

Assume h₀ := 49ft or 15ft drawdown at the wellpoints

Constant C₁ per Ref. 2 Fig. (c):

$$C_1 := 1.05$$

Figure 7(a)

Ratio of wellpoint diameter to H to look up C₂ per Ref. 2 Fig. (d):

$$dtH := \frac{2 \cdot r_w}{H}$$

$$\Rightarrow dtH = 2.604 \times 10^{-3}$$

Constant C₂ per Ref. 2 Fig. (d):

$$C_2 := 1.48$$

Figure 7(b)



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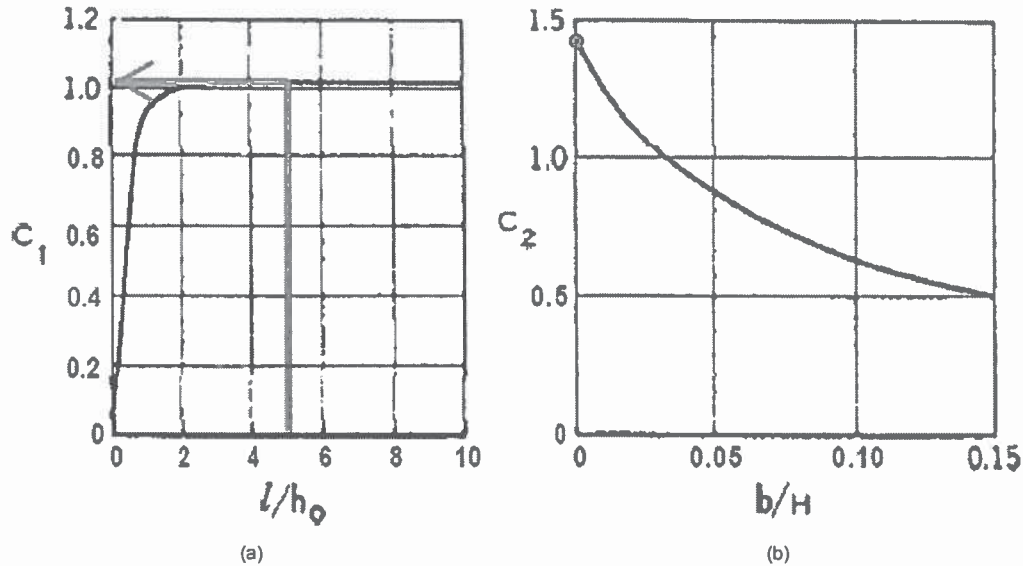


Figure 7 Empirical Charts for C_1 and C_2 for Ref. 2 Fig. 4-5 Equ. (1)

Maximum head at midway between the two slots of wellpoints:

$$h_D := h_0 \cdot \left[\frac{C_1 \cdot C_2 \cdot (H - h_0)}{1.75 \cdot (H - h_0) \cdot \sqrt{\frac{k}{10^{-4} \frac{\text{cm}}{\text{s}}}}} + 1 \right]$$

$$\Rightarrow h_D = 55.154 \text{ ft}$$

Check drawdown at midway between two slots:

$$\text{Drawdown_check} := \begin{cases} \text{"OK!"} & \text{if } h_D \leq h_{D\text{req}} \\ \text{"NO GOOD!"} & \text{otherwise} \end{cases}$$

$$\Rightarrow \boxed{\text{Drawdown_check} = \text{"OK!"}}$$

Per Ref. 2 Fig. 4-23 Equ. (1) Radius of Influence:

$$R := 1.75 \cdot (H - h_0) \cdot \sqrt{\frac{k}{10^{-4} \frac{\text{cm}}{\text{s}}}}$$

$$\Rightarrow R = 185.616 \text{ ft}$$

Check radius of influence against the excavation width:

$$\text{InfluenceRadius_Check} := \begin{cases} \text{"OK!"} & \text{if } R \geq \frac{b}{2} \\ \text{"NO GOOD!"} & \text{otherwise} \end{cases}$$

$$\Rightarrow \boxed{\text{InfluenceRadius_Check} = \text{"NO GOOD!"}}$$



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Check the maximum residual head downstream
 of one slot of wellpoints (Ref. 2 Fig. 4-3 Equ. (4)):

$$h_{D1} = h_0 \left[\frac{1.48}{R} \cdot (H - h_0) + 1 \right]$$

$$\Rightarrow h_D = 54.861 \text{ ft}$$

Check drawdown inside the excavation within the
 radius of influence:

$$\text{Drawdown_check} := \begin{cases} \text{"OK!"} & \text{if } h_D \leq h_{D\text{req}} \\ \text{"NO GOOD!"} & \text{otherwise} \end{cases}$$

$$\Rightarrow \text{Drawdown_check} = \text{"OK!"}$$

Because the influence zone of the two slots of wellpoints do not intersect over the entire excavation width, two slot of sock drain (a variation of French drain) parallel to the wellpoint slots should be installed once the groundwater is lowered minimum of 2ft below the final excavation subgrade to Elev. 30' at 1/3 width (175ft) away from the wellpoint slots which is within the influence radius of ~185ft.

Spacing between wellpoints:

$$x := 10 \text{ ft}$$

Estimate flow to each slot of wellpoints (single line
 source) per Ref. 2 Fig. 4-3 Equ. (3):

$$Q_p := \left(0.73 + 0.27 \cdot \frac{H - h_0}{H} \right) \cdot \frac{k \cdot x}{2 \cdot R} \cdot (H^2 - h_0^2)$$

$$\Rightarrow Q_p = 2.667 \text{ gpm}$$

Total flow from all wellpoints and two sock
 drains:

$$Q_{\text{total1}} := Q_p \frac{2(a+b) + 2 \cdot a}{x}$$

$$\Rightarrow Q_{\text{total1}} = 1.267 \times 10^3 \text{ gpm} \quad \text{or} \quad Q_{\text{total1}} = 1.824 \times 10^6 \text{ gpd}$$

Total number of wells at perimeter wellpoints:

$$n_w := \frac{2 \cdot (a+b)}{x}$$

$$\Rightarrow n_w = 290$$

Note: In order to estimate the total flow using the equivalent single well equation, the radius of influence of the two slots of wellpoints on the perimeter must overlap. Because the width of the dewatering area (525ft) is greater than two times of the influence radius of one slot of wellpoints, the dewatering area is divided into two equal size dewatering sub-areas in the width to make the radius of influence of each wellpoints slot overlap (i.e., $525\text{ft}/2 = 262.5\text{ft} < 185\text{ft} \cdot 2 = 370\text{ft}$) as shown in sketch in Figure 8.

Equivalent well radius for the half system Ref.
 3 Equ. 6.10

$$r_{s1} := \sqrt{\frac{b}{\pi} \cdot \frac{a - \frac{b}{2}}{2}}$$

$$\Rightarrow r_{s1} = 278.01 \text{ ft}$$

Equivalent well radius for half system Ref.
 3 Equ 6.11

$$r_{s2} := \frac{a + \frac{b}{2}}{\pi}$$

$$\Rightarrow r_{s2} = 377.993 \text{ ft}$$



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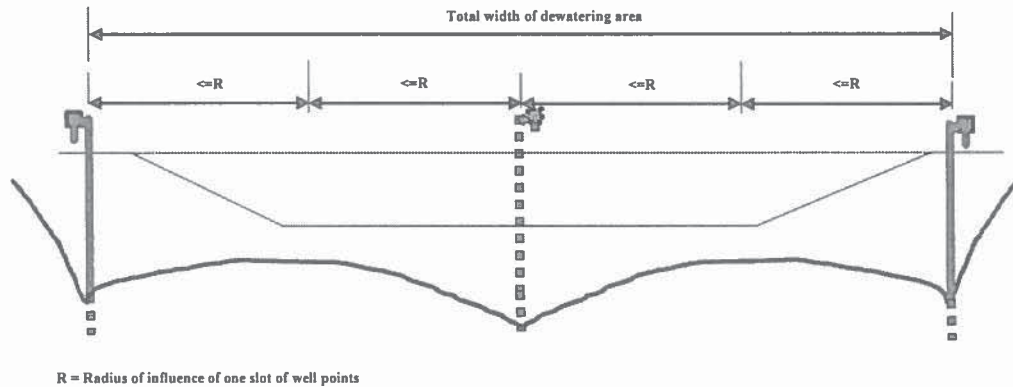


Figure 8 Dividing the Total Dewatering Area for the Estimate of Flow using Equivalent Single Well Equation

Use average:

$$r_s := \frac{r_{s1} + r_{s2}}{2}$$

$\Rightarrow r_s = 328.002 \text{ ft}$

Estimate radius of influence of equivalent single well:

$$R_{\text{single1}} := 3(H - h_0) \cdot \sqrt{\frac{k}{10^{-4} \frac{\text{cm}}{\text{s}}}}$$

Ref. 2 Fig. 4-23

$\Rightarrow R_{\text{single1}} = 318.198 \text{ ft}$

Transmissivity of aquifer:

$$T := k \cdot H$$

$\Rightarrow T = 0.63 \cdot \frac{\text{ft}^2}{\text{min}} \quad \text{or} \quad T = 6.785 \times 10^3 \cdot \frac{\text{gpd}}{\text{ft}}$

Pumping time to reach steady state in minutes:

$t := 30 \text{ day}$ Assume 1 month to reach steady state condition

Factor C_4 from pump test results:

$C_4 := 4790$ Per Ref. 3 Table 4.2

Factor C_s :

$C_s := 0.2$ for unconfined aquifers

$$R_{\text{single2}} := r_s + \sqrt{\frac{T}{C_4 \cdot C_s} \cdot \frac{t}{\text{min}} \cdot \frac{\text{ft}}{\text{gpd}}}$$

$\Rightarrow R_{\text{single2}} = 881.16 \text{ ft}$



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Use average:

$$R_{\text{single}} := \frac{R_{\text{single1}} + R_{\text{single2}}}{2}$$

$$\Rightarrow R_{\text{single}} = 599.679 \text{ ft}$$

Estimate total flow from equivalent single well:

$$Q_{\text{total2}} := 2 \frac{\pi \cdot k \cdot (H^2 - h_0^2)}{\ln \left(\frac{R_{\text{single}}}{r_s} \right)}$$

$$\Rightarrow Q_{\text{total2}} = 1.3 \times 10^3 \text{ gpm} \quad \text{or} \quad Q_{\text{total2}} = 1.871 \times 10^6 \text{ gpd}$$

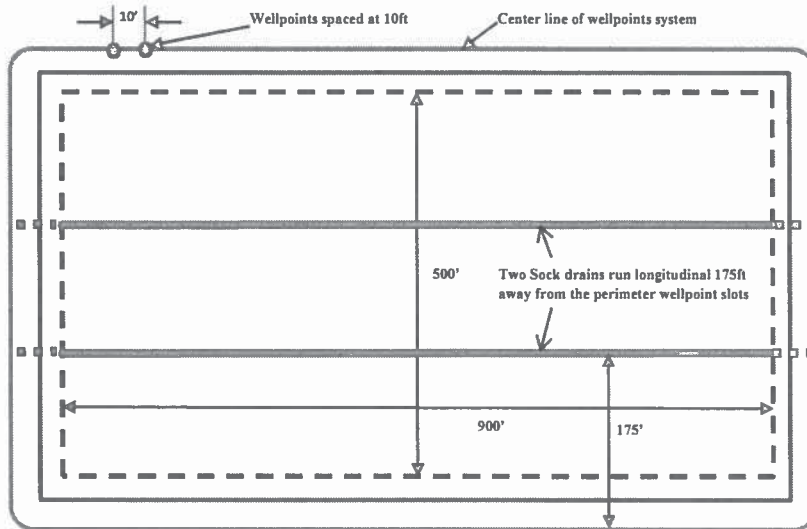
Total flow from wellpoints estimate:

$$Q_{\text{total1}} = 1.267 \times 10^3 \text{ gpm}$$

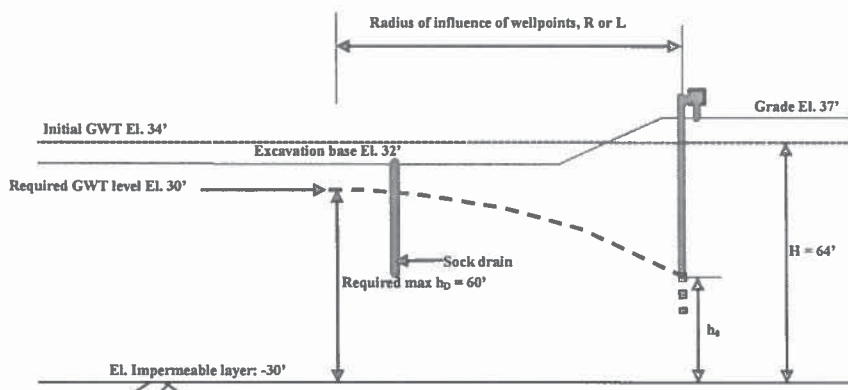
Total flow from single well estimate:

$$Q_{\text{total2}} = 1.3 \times 10^3 \text{ gpm} \quad \text{Two estimate came up very close.}$$

Figure 9 shows a sketch of dewatering system for the powerblock bathtub.



(a) Plan View



(b) Elevation View

Figure 9 Sketch of Dewatering System for the Power Block Bathtub Excavation

Note: NOT TO SCALE



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7.0 Conclusions

The preliminary dewatering design for the powerblock bathtub excavation:

- Total flow $Q_{total} = 1280$ gpm or 1.8 million gal/day;
- $Q_{well} = 2.7$ gpm per well @ 10' spacing;
- $h_0 = 49$ ft (drawdown at well = 15ft)
- Wellpoints = 2" self-jetting;
- # of wells ~ 290 total;
- Two sock drains run parallel to the wellpoints longitudinally spaced at 175' away from the wellpoints slot and from each other as shown in Figure 8(a). The sock drains should be installed to enough depth that can provide equivalent drawdown (15ft from the initial groundwater table) as the perimeter wellpoints.

Note:

1. The permeability measured in the three slug tests available in Ref. 1 were performed in the deeper soil (screened at 20' to 30' deep) where the fine contents is higher. Based on the measured permeability from the slug tests, the material is borderline applicable for wellpoints method;
2. For permitting purpose, the dewatering design and flow estimate is performed with conservatively assumed permeability based on empirical correlations and typical values of the type of material identified in the boring logs;
3. The dewatering should be reviewed and revised as necessary for construction later when more data becomes available.



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Date			
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Attachment A

Boring logs (Ref. 1)

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STANDARD PENETRATION TEST BORING LOG

BORING SB-08

PROJECT: FPL Okeechobee Clean Energy Center
Okeechobee County, Florida

FILE No.: 15-1624

BORING LOCATION: As per plan

DRILL CREW: IDI

WATER OBSERVED AT DEPTH 0.5 feet

DATE DRILLED: 02-12-15

DEPTH (FEET)	SYMBOLS FIELD TEST DATA	SOIL DESCRIPTION	SAMPLE No.	N VALUE	N VALUE
0					
	2/6	Dark reddish brown fine sand with roots	1		
	2/6	[MC: 33.4% / OC: 8.8%]	2	6	
	4/6	Light reddish brown fine sand	3		
	4/6	Light grayish brown fine sand			
	3/6			7	
	4/6				
	2/6		4		
	3/6			18	
5	7/6	Light brownish gray fine sand	5		
	11/6				
	12/6	Light brownish gray fine sand with trace of clay	6	10	
	1/6				
	2/6				
	8/6				
	7/6	Gray clayey fine sand	7	15	
	8/6	[MC: 17.7% / LL: 22.8 / PL: 15.9 / PI: 6.9]			
10	8/6	Gray slightly clayey fine sand	8	13	
	6/6				
	7/6				
	6/6	Gray fine sand with trace of clay	9	13	
	4/6				
	7/6				
	6/6		10	8	
15	5/6	Gray fine sand			
	4/6				
	4/6				
	3/6				
	3/6	Greenish gray slightly clayey fine sand with shell fragments	11	7	
20	4/6				
	3/6				
	2/6				
	4/6	Greenish gray clay	12	6	
	2/6	Greenish gray clayey fine sand with shell fragments			
25	4/6	[MC: 37.3% / -200: 25.3%]			
	3/6				
	5/6		13	5	
	2/6				
	3/6				
30	3/6				

NOTES:

FIELD TEST DATA ARE "BLOWS"/"INCHES DRIVEN"

140-LB HAMMER, 30-INCH FALL.

(ASTM D-1586)

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STANDARD PENETRATION TEST BORING LOG BORING SB-08

PROJECT: FPL Okeechobee Clean Energy Center
Okeechobee County, Florida

FILE No.: 15-1624

BORING LOCATION: As per plan

DRILL CREW: IDI

WATER OBSERVED AT DEPTH 0.5 feet

DATE DRILLED: 02-12-15

DEPTH (FEET)	SYMBOLS FIELD TEST DATA	SOIL DESCRIPTION	SAMPLE No.	N VALUE	N VALUE
30					10 15 20 25 30 35 40 45 50 55 60
35	3/6 3/6 2/6 2/6		14	5	
40	3/6 2/6 2/6 2/6	[MC: 34.6% / -200: 16.0%]	15	4	
45	4/6 4/6 3/6 5/6	Greenish gray fine sand with shell fragments	16	7	
50	7/6 18/6 16/6 17/6	Light gray slightly clayey poorly cemented sand and shell	17	34	
55	6/6 9/6 12/6 21/6		18	21	
60	4/6 5/6 8/6 8/6	Light gray slightly clayey, sandy poorly cemented sand and shell	19	13	

NOTES:

FIELD TEST DATA ARE "BLOWS"/"INCHES DRIVEN"

140-LB HAMMER, 30-INCH FALL.

(ASTM D-1586)

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STANDARD PENETRATION TEST BORING LOG

BORING SB-08

PROJECT: FPL Okeechobee Clean Energy Center
Okeechobee County, Florida

FILE No.: 15-1624

BORING LOCATION: As per plan

DRILL CREW: IDI

WATER OBSERVED AT DEPTH 0.5 feet

DATE DRILLED: 02-12-15

DEPTH (FEET)	SYMBOLS FIELD TEST DATA	SOIL DESCRIPTION	SAMPLE No.	N VALUE	N VALUE
65	5/6 4/6 5/6 5/6	Light brownish gray slightly clayey fine sand with cemented sand and shell fragments	20	9	
70	2/6 4/6 4/6 4/6	Light gray sandy clay [MC: 37.9% / LL: 42 / PL: 23.6 / PI: 18.4]	21	8	
75	1/6 6/6 6/6 5/6	Light gray clayey fine sand with cemented sand and shell fragments	22	12	
80	3/6 3/6 4/6 6/6	Light grayish brown clayey fine sand with shell fragments	23	7	
85	4/6 5/6 5/6 8/6	Greenish brown slightly clayey fine sand with shell fragments	24	10	
90	3/6 2/6 4/6 4/6	Greenish brown slightly clayey to clayey fine sand with trace of shell fragments	25	6	

NOTES:

FIELD TEST DATA ARE "BLOWS"/"INCHES DRIVEN"

140-LB HAMMER, 30-INCH FALL.

(ASTM D-1586)

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STANDARD PENETRATION TEST BORING LOG

BORING SB-08

PROJECT: FPL Okeechobee Clean Energy Center
Okeechobee County, Florida

FILE No.: 15-1624

BORING LOCATION: As per plan

DRILL CREW: IDI

WATER OBSERVED AT DEPTH 0.5 feet

DATE DRILLED: 02-12-15

DEPTH (FEET)	SYMBOLS FIELD TEST DATA	SOIL DESCRIPTION	SAMPLE No.	N VALUE	N VALUE
					5 10 15 20 25 30 35 40 45
95		Greenish brown sandy clay [MC: 41.5% / LL: 40.8 / PL: 24.3 / PI: 16.5]	26	6	
100			27	8	
100		Boring terminated at a depth of 100 feet			
105					
110					
115					
120					

NOTES:

FIELD TEST DATA ARE "BLOWS"/"INCHES DRIVEN" 140-LB HAMMER, 30-INCH FALL. (ASTM D-1586)

Ardaman & Associates

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Ardaman & Associates, Inc.

STANDARD PENETRATION TEST BORING LOG

BORING PSB-01

PROJECT: FPL Okeechobee Clean Energy Center
Okeechobee County, Florida

FILE No.: 15-1624

BORING LOCATION: As per plan

DRILL CREW: IDI

WATER OBSERVED AT DEPTH 2.0 feet

DATE DRILLED: 02-12-15

DEPTH (FEET)	SYMBOLS FIELD TEST DATA	SOIL DESCRIPTION	SAMPLE No.	N VALUE	N VALUE
0					5 10 15 20 25 30 35 40
1/6		Gray fine sand	1	3	
1/6		Dark brownish red slightly silty fine sand with small roots			
2/6		[MC: 23.9% / OC: 3.7%]			
8/6					
9/6					
5/6		Light brownish red fine sand with trace of clay	2	9	
4/6					
3/6					
3/6					
2/6					
4/6		Dark brown slightly clayey fine sand	3	6	
5/6		[MC: 25.6% / -200: 6.8%]	4		
5/6		Dark reddish brown fine sand		13	
6/6					
7/6					
9/6		Gray clayey fine sand	5	12	
6/6		[MC: 20.7% / -200: 14.4%]			
6/6					
8/6					
7/6		Gray fine sand	6	10	
6/6					
4/6					
4/6			7	5	
3/6					
3/6					
2/6					
2/6		Greenish gray clayey fine sand with shell fragments	8	6	
2/6		[MC: 21.5% / -200: 39.0%]			
2/6					
4/6					
3/6					
2/6		Greenish gray slightly clayey fine sand with shell fragments	9	8	
3/6					
3/6					
2/6					
4/6		Greenish brown slightly clayey fine sand with shell fragments	10	10	
7/6					
3/6					
3/6					
2/6		Greenish brown clayey fine sand with shell fragments	11	1	
1/6		[MC: 33.2% / -200: 24.6%]			
0/6					
1/6					

NOTES: Boring terminated at a depth of 30 feet

FIELD TEST DATA ARE "BLOWS"/"INCHES DRIVEN"

140-LB HAMMER, 30-INCH FALL.

(ASTM D-1586)

Ardaman & Associates

DRAFT



Ardaman & Associates, Inc.

STANDARD PENETRATION TEST BORING LOG

BORING PSB-02

PROJECT: FPL Okeechobee Clean Energy Center
Okeechobee County, Florida

FILE No.: 15-1624

BORING LOCATION: As per plan

DRILL CREW: IDI

WATER OBSERVED AT DEPTH 1.5 feet

DATE DRILLED: 02-12-15

DEPTH (FEET)	SYMBOLS FIELD TEST DATA	SOIL DESCRIPTION	SAMPLE No.	N VALUE	N VALUE
0					5 10 15 20 25 30 35 40 45
0	2/6 2/6 2/6 1/6 1/6 1/6	Light reddish brown fine sand with trace of clay	1	4	
2.5	2/6 2/6 3/6 3/6 6/6 8/6 10/6	Dark brownish red slightly silty fine sand [MC: 29.4% / -200: 8.6%]	2	3	
5	2/6 2/6 2/6 5/6 6/6 6/6 6/6	Light grayish brown fine sand with trace of clay Light grayish brown fine sand	3 4	14 7	
7.5	7/6 8/6 5/6 6/6 6/6 6/6	Light brown fine sand	5 6	13 12	
10	5/6 4/6 4/6 4/6 5/6 3/6 3/6 5/6	Gray fine sand	7 8	8 6	
15	5/6 3/6 2/6 1/6		9	5	
20	2/6 2/6 1/6 1/6	Greenish gray clayey fine sand with shell fragments	10	3	
25	4/6 4/6 3/6 2/6	[MC: 34.2% / -200: 17.9%]	11	7	
30					

NOTES: Boring terminated at a depth of 30 feet

FIELD TEST DATA ARE "BLOWS"/"INCHES DRIVEN"

140-LB HAMMER, 30-INCH FALL.

(ASTM D-1586)

Ardaman & Associates



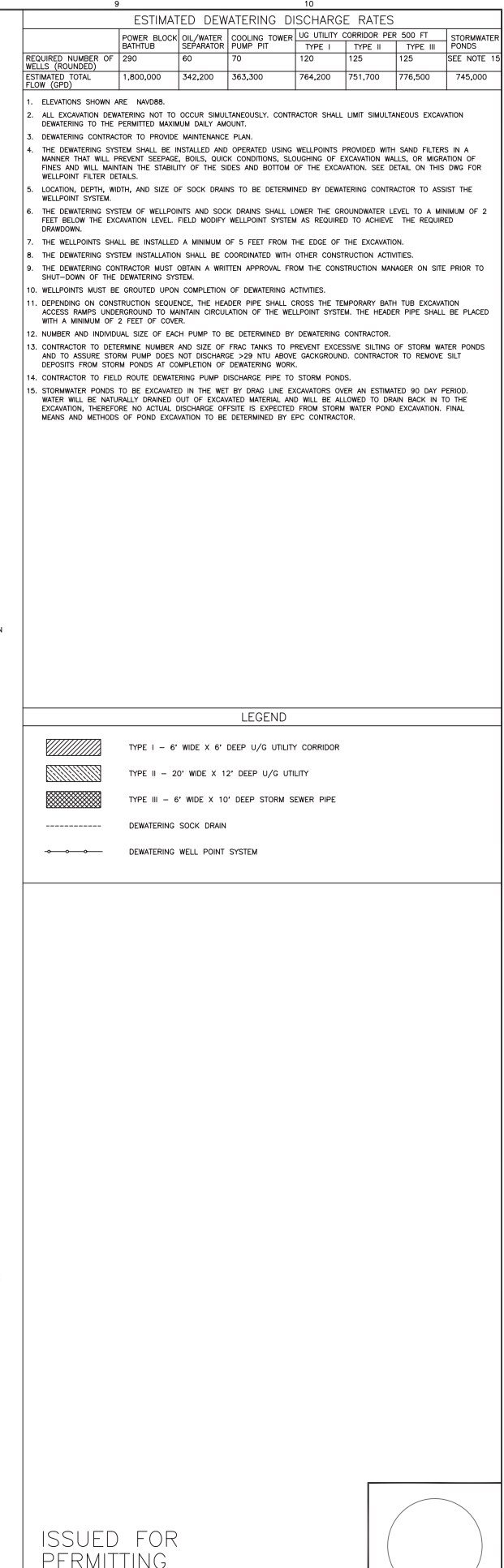
BLACK & VEATCH

Client	FPL		
Project	Okeechobee Energy Center	Unit	-
Project No.	185922	File No.	58.5406.1105.01
Title	Dewatering Design for the Power Block Bathtub Excavation		

Computed By	WT		
Date	04/08/2015		
Verified By			
Date			
	# of Pages	3	
Rev.	0		

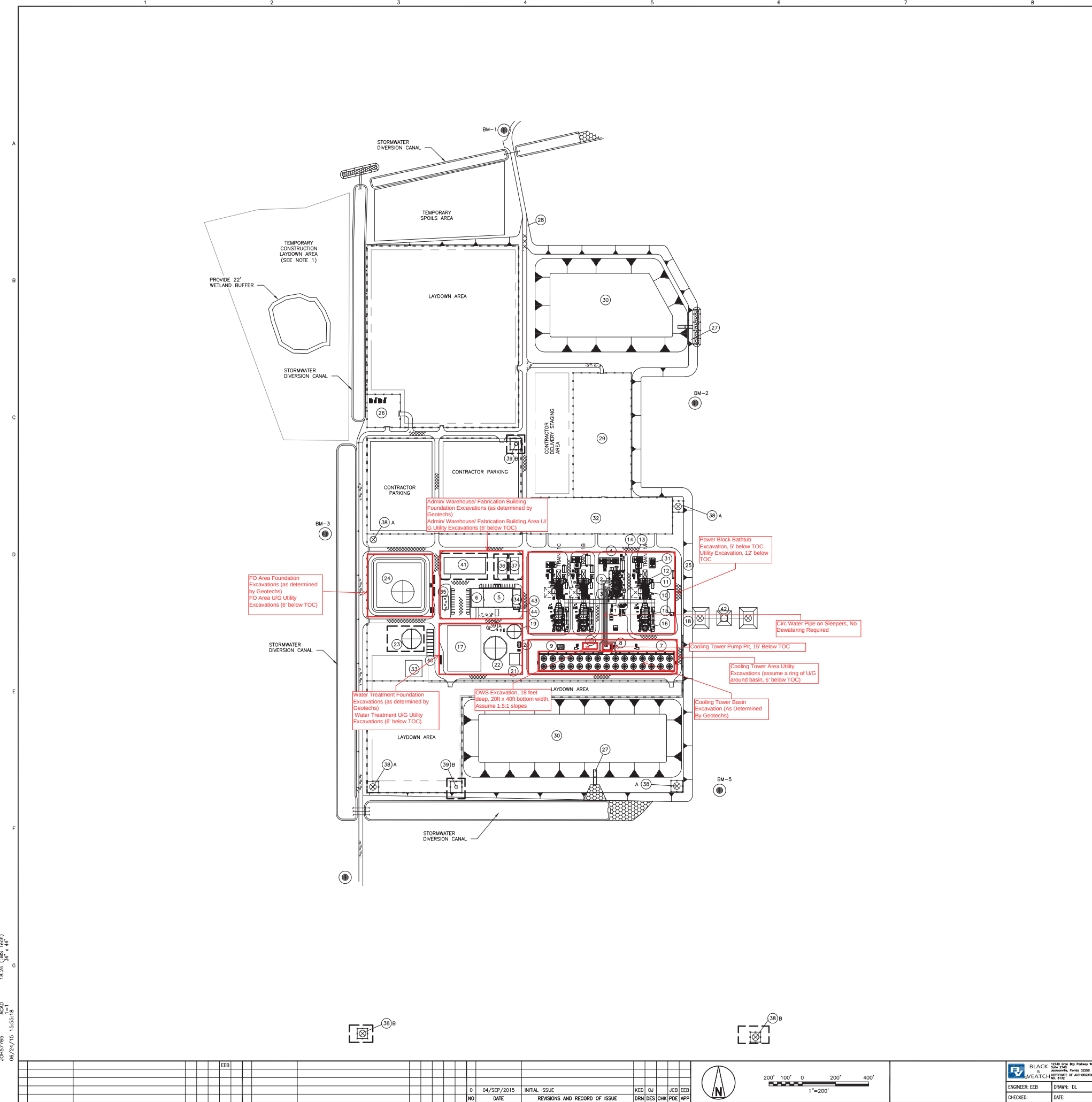
Attachment B

Drawings (Ref. 4 and 5)



LEGEND	
	TYPE I - 6' WIDE X 6' DEEP U/G UTILITY CORRIDOR
	TYPE II - 20' WIDE X 12' DEEP U/G UTILITY
	TYPE III - 6' WIDE X 10' DEEP STORM SEWER PIPE
	DEWATERING SOCK DRAIN
	DEWATERING WELL POINT SYSTEM

[illegible]



FACILITIES LEGEND				
ID	FACILITY	FOUNDATION	TIEDOWN LOCATION	
			NORTH	EAST
1	STEAM TURBINE	—	—	—
2	STEAM TURBINE GENERATOR	—	—	—
3	SURFACE CONDENSER (BELOW)	—	—	—
4	ST GENERATOR STEP-UP TRANSFORMER	—	—	—
5	ADMINISTRATION BUILDING	—	—	—
6	WAREHOUSE	—	—	—
7	COOLING TOWER	—	—	—
8	CIRCULATING WATER PUMP STRUCTURE	—	—	—
9	COOLING TOWER CHEMICAL FEED	—	—	—
10	COMBUSTION TURBINE	—	—	—
11	COMBUSTION TURBINE GENERATOR	—	—	—
12	INLET AIR FILTER (ABOVE)	—	—	—
13	CT GENERATOR STEP-UP TRANSFORMER	—	—	—
14	POWER CONTROL MODULE	—	—	—
15	HEAT RECOVERY STEAM GENERATOR	—	—	—
16	HRSG EXHAUST STACK	—	—	—
17	WATER TREATMENT AREA	—	—	—
18	AMMONIA STORAGE AREA	—	—	—
19	FIRE/SERVICE WATER STORAGE TANK	—	—	—
20	FIRE PUMP ENCLOSURE	—	—	—
21	DEMINERALIZATION AREA	—	—	—
22	DEMINERALIZED WATER STORAGE TANK	—	—	—
23	RAW WATER STORAGE TANK (FUTURE EPC OPTION)	—	—	—
24	FUEL OIL STORAGE TANK	—	—	—
25	HYDROGEN STORAGE AREA	—	—	—
26	FUEL GAS REGULATING AREA	—	—	—
27	POND OUTFALL STRUCTURE	—	—	—
28	MAIN ENTRANCE ROAD	—	—	—
29	500KV SWITCHYARD	—	—	—
30	STORMWATER DETENTION POND	—	—	—
31	SPARE STG GSU TRANSFORMER	—	—	—
32	COLLECTOR YARD	—	—	—
33	LEACH FIELD	—	—	—
34	CONTROL AREA	—	—	—
35	OIL/WATER SEPARATOR	—	—	—
36	AUXILIARY BOILER (FUTURE EPC OPTION)	—	—	—
37	EMERGENCY DIESEL GENERATORS (FUTURE EPC OPTION)	—	—	—
38A	MAKE-UP WATER WELL (FLORIDIAN) (BASE SCOPE)	—	—	—
38B	MAKE-UP WATER WELL (FLORIDIAN) (FUTURE EPC OPTION)	—	—	—
39A	POTABLE WATER WELL (SURFICIAL) (BASE SCOPE)	—	—	—
39B	POTABLE WATER WELL (SURFICIAL) (FUTURE EPC OPTION)	—	—	—
40	ROLL-OFF AREA AND MISC STORAGE FACILITY	—	—	—
41	FABRICATION/STORAGE BUILDING (FUTURE EPC OPTION)	—	—	—
42	UIC/DZMW WELLS	—	—	—
43	HURRICANE SHELTER	—	—	—
44	HURRICANE SHELTER GENERATORS	—	—	—

LEGEND	
	ASPHALT ROAD
	AGGREGATE ROAD
	PLANT FENCING
	CONTRACTOR FENCING
	FUTURE - EPC TO PROVIDE OPTION

NOTES	
1. AREAS WEST OF THE PROPOSED PLANT WITHIN INDICATED DISTURBED LIMITS TO BE USED AS TEMPORARY LAYDOWN AREAS AS NEEDED DURING CONSTRUCTION. BEST MANAGEMENT PRACTICES IN ACCORDANCE WITH THE STORM WATER POLLUTION PREVENTION PLAN WILL BE IMPLEMENTED AS REQUIRES.	

NOT TO BE USED
FOR CONSTRUCTION

THE DISTRIBUTION AND USE OF THE NATIVE FORMAT CAD FILE OF THIS DRAWING IS UNCONTROLLED. THE USER SHALL VERIFY TRACEABILITY OF THIS DRAWING TO THE LATEST CONTROLLED VERSION.

FLORIDA POWER & LIGHT
OKEECHOBEE CLEAN ENERGY CENTER
SITE ARRANGEMENT

PROJECT NUMBER:
185922-1GAU-G1001

DRAWING NUMBER:
REV:
0

CODE:
AREA:

REFERENCE DWG NUMBER:

AREAS WEST OF THE PROPOSED PLANT WITHIN INDICATED DISTURBED LIMITS TO BE USED AS TEMPORARY LAYDOWN AREAS AS NEEDED DURING CONSTRUCTION. BEST MANAGEMENT PRACTICES IN ACCORDANCE WITH



BLACK & VEATCH

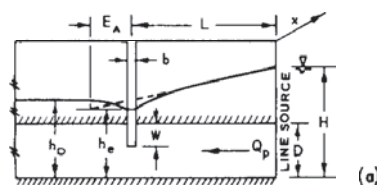
Client	FPL		
Project	Okeechobee Energy Center	Unit	-
Project No.	185922	File No.	58.5406.1105.01
Title	Dewatering Design for the Power Block Bathtub Excavation		

Computed By	WT		
Date	04/08/2015		
Verified By			
Date			
	# of Pages	10	
Rev.	0		

Attachment D

Selected excerpt from References (Ref. 2-3 and 8)

Ref. 2



(a)

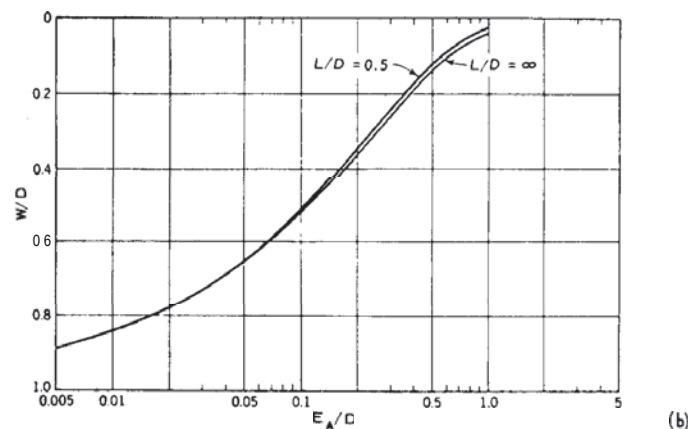
FLOW

$$Q_p = \frac{kDx(H - h_e)}{L + E_A} \quad (1)$$

MAX RESIDUAL HEAD DOWNSTREAM OF SLOT

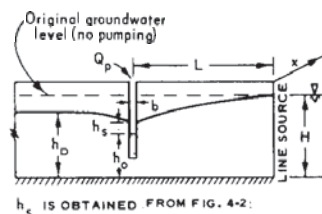
$$h_o = \frac{E_A(H - h_e)}{L + E_A} + h_e \quad (2)$$

WHERE E_A IS AN ADDITIONAL LENGTH FACTOR OBTAINED FROM THE FIGURE BELOW



(b)

ARTESIAN FLOW



(c)

FLOW

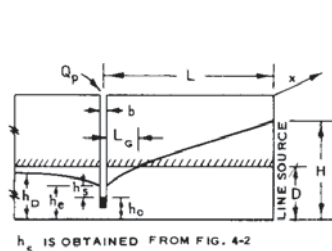
$$Q_p = \left(0.73 + 0.27 \frac{H - h_o}{H} \right) \frac{kx}{2L} (H^2 - h_o^2) \quad (3)$$

MAX RESIDUAL HEAD DOWNSTREAM OF SLOT

$$h_o = h_o \left[\frac{1.48}{L} (H - h_o) + 1 \right] \quad (4)$$

WHERE $L \geq 3H$

GRAVITY FLOW



(d)

FLOW

$$Q_p = \frac{kDx(H - D)}{L - L_g} \quad (5)$$

MAX RESIDUAL HEAD DOWNSTREAM OF SLOT+

$$h_o = h_o \left[\frac{1.48}{L_g} (D - h_o) + 1 \right] \quad (6)$$

PROVIDED $h_o \leq D$; $L_g \geq 3D$

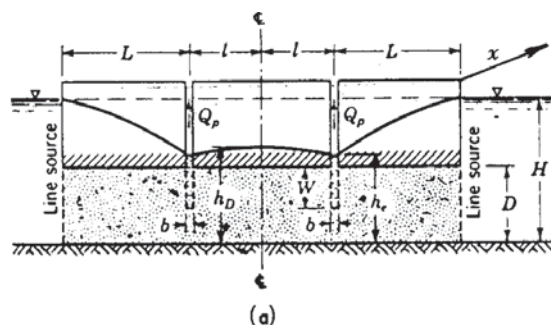
$$\text{WHERE } L_g = \frac{L(D^2 - h_o^2) \left(0.73 + 0.27 \frac{D - h_o}{D} \right)}{2D(H - D) + (D^2 - h_o^2) \left(0.73 + 0.27 \frac{D - h_o}{D} \right)} \quad (7)$$

COMBINED ARTESIAN AND GRAVITY FLOWS

(Modified from "Foundation Engineering," G. A. Leonards, ed., 1962, McGraw-Hill Book Company. Used with permission of McGraw-Hill Book Company.)

Figure 4-3. Flow and head for partially penetrating line slot; single-line source; artesian, gravity, and combined flows.

A FREQUENTLY ENCOUNTERED **DEWATERING** SYSTEM IS ONE WITH TWO LINES OF PARTIALLY PENETRATING WELLPOINTS ALONG EACH SIDE OF A LONG EXCAVATION, WHERE THE FLOW CAN BE ASSUMED TO ORIGINATE FROM TWO EQUIDISTANT LINE SOURCES.



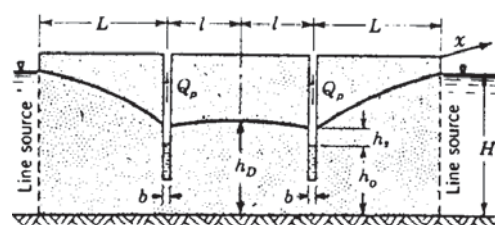
FLOW

FLOW FOR EACH SLOT CAN BE ESTIMATED AS FOR ONE SLOT WITH ONE LINE SOURCE, EQ 1 FIG. 4-3.

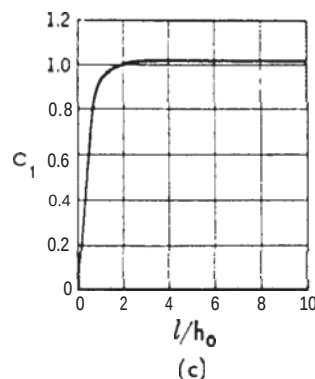
$$h_D^{\dagger}$$

VALUE OF h_D CAN BE ESTIMATED AS FOR ONE SLOT AND ONE LINE SOURCE, EQ 2, FIG. 4-3.

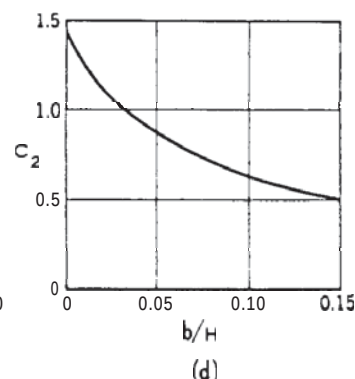
ARTESIAN FLOW



(b)



(c)



(d)

FLOW

FLOW TO EACH SLOT APPROXIMATELY THAT ONE SLOT WITH ONE LINE SOURCE, EQ 3, FIG. 4-3.

$$h_D^{\dagger} = h_0 \left[\frac{C_1 C_2}{L} (H - h_0) t_1 \right] \quad (1)$$

WHERE C_1 AND C_2 ARE OBTAINED FROM FIG.(c) AND (d) ABOVE.

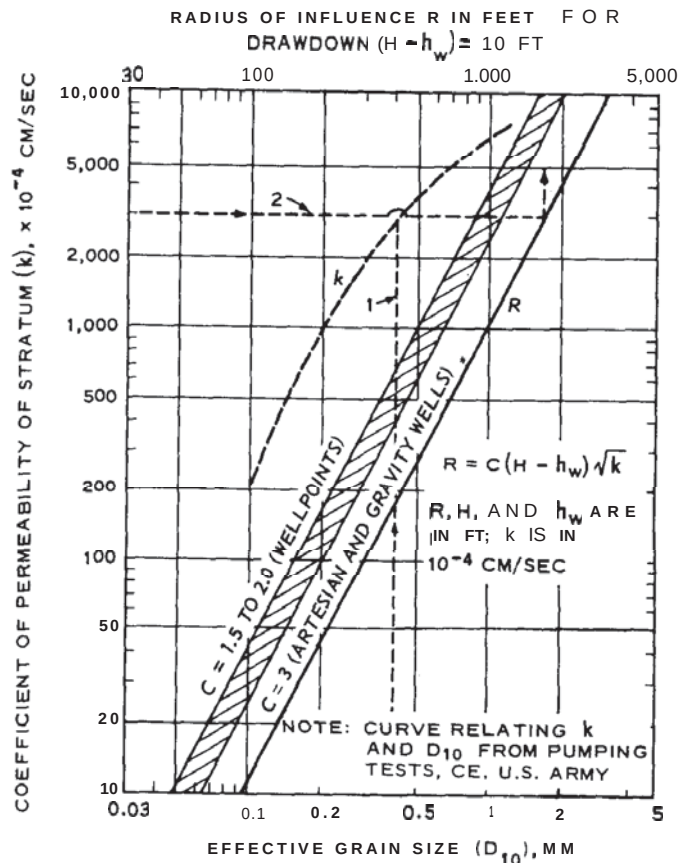
GRAVITY FLOW

t MAXIMUM RESIDUAL HEAD MIDWAY BETWEEN THE TWO SLOTS

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Figure 4-5. Flow and head (midway) for two partially penetrating slots; two-line source; artesian and gravity flows,

TM 5-818-5/AFM 88-5, Chap 6/NAVFAC P-418



1. R DETERMINED WHEN ONLY D_{10} IS KNOWN.
2. R DETERMINED WHEN k IS KNOWN.

RADIUS OF INFLUENCE, R , CAN BE ESTIMATED FOR BOTH ARTESIAN AND GRAVITY FLOWS BY

$$R = C (H - h_w) \sqrt{k} \quad (1)$$

WHERE R , H , AND h_w ARE DEFINED PREVIOUSLY AND EXPRESSED IN FEET. COEFFICIENT OF PERMEABILITY, k , IS EXPRESSED IN 10^{-4} CM/SEC.

AND $C = 3$ FOR ARTESIAN AND GRAVITY FLOWS TO A WELL.

$C = 1.5$ TO 2.0 FOR A SINGLE LINE OF WELLPOINTS.

THE VALUE OF R FOR $(H - h_w) = 10$ FT CAN BE DETERMINED FROM THE PLOT HEREIN WHEN EITHER THE D_{10} SIZE OR PERMEABILITY OF THE MATERIAL IS KNOWN. THE VALUE OF R WHEN $(H - h_w) \neq 10$ CAN BE DETERMINED BY MULTIPLYING THE R VALUE OBTAINED FROM THE PLOT BY THE RATIO OF THE ACTUAL VALUE OF $(H - h_w)$ TO 10 FT.

A DISCUSSION ON THE DETERMINATION OF R FROM EQ 1 AND PUMPING TESTS IS CONTAINED IN PARAGRAPH 4-2a(3) OF THE TEXT.

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Figure 4-23. Approximate radius of influence R .

(b) Head losses in the screened section of a well H_s are calculated from figure 4-24b. This head loss is based on equal inflow per unit of screen surface and turbulent flow inside the well and is equivalent to the entire well flow passing through one-half the screen length. Other head losses can be determined directly from figure 4-24. Hydraulic head loss within a well-point system can be estimated from figure 4-25. As stated in a(4) above, flow into a well can be impeded by the lack of "wetted screen length," in addition to hydraulic head losses in the filter or through the screens and/or chemical or mechanical clogging of the aquifer and filter.

b. Flow to a drainage slot.

(1) *Line drainage slots.* Equations presented in figures 4-1 through 4-5 can be used to compute flow and head produced by pumping either a single or a double continuous slot of infinite length. These equations assume that the source of seepage and the drainage slot are infinite in length and parallel and that seepage enters the pervious stratum from a vertical line source. In actuality, the slot will be of finite length, the flow at the ends of the slot for a distance of about $L/2$ (where L equals distance between slot and source) will be greater, and the drawdown will be less than for the central portion of the slot. Flow to the ends of a fully penetrating slot can be estimated, if necessary, from flow-net analyses subsequently presented.

Ref. 3

3.5 PERMEABILITY / 41

TABLE 3.4 Range of Permeabilities of Natural Soils

Description	Permeability (μ /sec)
Openwork gravel (GP)	10,000 or higher
Uniform gravel (GP)	2,000–10,000
Well graded gravel (GW)	500–3,000
Uniform sand (SP)	50–2,000
Well graded sand (SW)	10–1,000
Silty sand (SM)	10–50
Clayey sand (SC)	1–10
Silt (ML)	0.5–1.0
Clay (CL)	0.1–0.0001

migration of contaminant plumes. The very high permeabilities shown for open work gravels can produce enormous water quantities, but fortunately their occurrence is rare. We can say that the great majority of dewatering problems concern soils in the range of 10–10,000 μ /sec. At three orders of magnitude, the range is quite enough.

Permeability of soil samples can be measured in the laboratory by permeameters (9). Permeability of granular soils can be estimated from mechanical analysis curves by empirical methods. Hazen (34) relates permeability (k) to the D_{10} size of the soil from grain size curves, in millimeters:

$$K = 2(100 D_{10})^2 \text{ gpd/ft}^2 \quad (\text{U.S.}) \quad (3.10)$$

$$K = (100 D_{10})^2 \mu/\text{sec} \quad (\text{METRIC}) \quad (3.11)$$

The results obtained from the Hazen relationship can be reasonable approximations if the samples are representative. But not always. There are inherent flaws in Hazen, in that the uniformity and density of the soils are not considered. A well graded soil will have a lower permeability than a uniform soil of the same D_{10} . A dense soil will have lower permeability than a loose one of the same grain size distribution.

By a combination of laboratory and field investigation, Byron Prugh developed a previously unpublished method for estimating permeability based on mechanical analysis and *in situ* density. Figure 3.4 shows the results of Prugh's work.

From a mechanical analysis such as that illustrated in Fig. 3.1a, the D_{50} and C_u of the sample are determined. The *in situ* density is estimated from blow counts (Table 3.7). One of the three charts in Fig. 3.4 is selected as representative of the density, and the estimated permeability can be read off.

The estimated permeabilities shown in Fig. 3.4 have in the author's experience given good results if the samples selected for analysis are representative as discussed in Section 3.2.

When estimating permeability from grain size distribution, we must rec-

TABLE 4.2 Constants for Jacob Plot Calculations

	U.S. Units	Type 1 Metric $K = \mu\text{/sec}$	Conversion to U.S.: Multiply Metric by	Type 2 Metric $K = \text{m/day}$	Conversion to U.S.: Multiply Metric By
Transmissibility T					
From $\delta/\log t$ plot	$T = \frac{264 Q}{\Delta \delta}$	$\frac{3055 Q}{\Delta \delta}$		$\frac{0.183 Q}{\Delta \delta}$	
From $\delta/\log r$ plot	$T = \frac{528 Q}{\Delta \delta}$	$\frac{6110 Q}{\Delta \delta}$		$\frac{0.366 Q}{\Delta \delta}$	
Storage coefficient C_s					
From $\delta/\log t$ plot	$C_s = \frac{T t_0}{4790 r^2}$	$\frac{T t_0}{7401 r^2}$		$\frac{T t_0}{640 r^2}$	
From $\delta/\log r$ plot	$C_s = \frac{T t}{4790 R^2}$	$\frac{T t}{7401 R^2}$		$\frac{T t}{640 R^2}$	
where Q = well discharge	gpm	m^3/min	264	m^3/day	0.183
T = transmissibility	gpd/ft	$\text{m}\mu\text{/sec}$	6.95	m^2/day	80.52
K = permeability	gpd/ft ²	$\mu\text{/sec}$	2.13	m/day	24.53
t = time	min	min	—	min	—
t_0 = zero drawdown Intercept	min	min	—	min	—
r = distance to observation well	ft	m	3.28	m	3.28
R_0 = zero drawdown Intercept	ft	m	3.28	m	3.28
δ = drawdown	ft	m	3.28	m	3.28
$\Delta \delta$ = drawdown difference per log cycle	ft	m	3.28	m	3.28

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For the water table aquifer of Fig. 6.6b,

$$\frac{Q}{x} = \frac{K(H^2 - h^2)}{2L} \quad (6.9)$$

Section 6.5 discusses the use of the drainage trench Eqs. (6.8) and (6.9) in analyzing long narrow dewatering systems.

6.5 THE SYSTEM AS A WELL: EQUIVALENT RADIUS r_s

Many problems can be analyzed by assuming the entire system acts as a single large well of radius r_s . The assumption is of greatest validity with a circular system of closely spaced wells, as in Fig. 6.7a. Rectangular systems as in Fig. 6.7b are assumed to act as a circular system of the same enclosed area:

$$r_s = \sqrt{\frac{ab}{\pi}} \quad (6.10)$$

Some analysts prefer to consider a rectangular system to act as a circular system with the same perimeter:

$$r_s = \frac{a + b}{\pi} \quad (6.11)$$

Either Eq. (6.10) or (6.11) gives satisfactory approximations when the wells are spaced closely, when R_0 is great in relation to r_s , and when the ratio a/b is less than about 1.5. If the wells are widely spaced, the actual Q will be significantly higher than that estimated for the equivalent well.

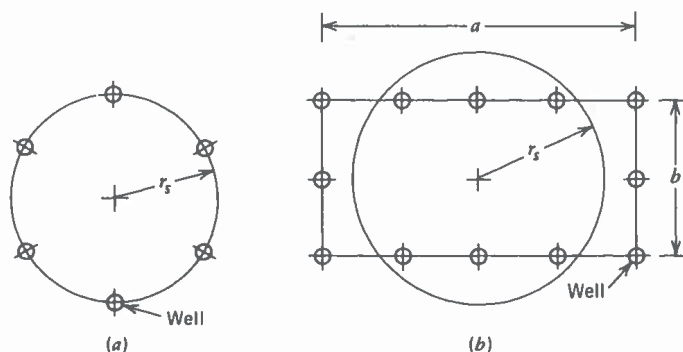


Figure 6.7 Approximation of equivalent radius r_s . (a) Circular systems. (b) Rectangular systems.

6.6 RADIUS OF INFLUENCE R_0 / 103

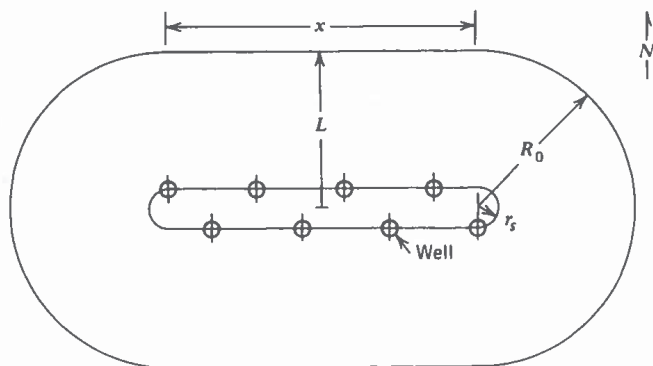


Figure 6.8 Approximate analysis of long narrow systems.

If the system contains only a few widely spaced wells, or if R_0 is small, then the system should probably be analyzed by the method of cumulative drawdowns, discussed in Section 6.12 or by a groundwater model (Chapter 7).

For long, narrow systems where the ratio a/b is large, a combined mathematical model can be constructed, using both Eqs. (6.3) and (6.9). Figure 6.8 shows such a system of closely spaced wells for dewatering a trench excavation of length x . The wells are staggered at a distance r_s from the center of the trench. The northward and southward flow from the line sources at distance L can be approximated from the trench Eq. (6.9). However, Eq. (6.9) assumes a drainage trench of infinite length. Since the length of the actual system is finite, the end effects must be considered. This can be done by assuming that at each end of the system, there is a flow equal to one half the flow to a circular well of radius r_s . The total flow to the system may be approximated by adding Eqs. (6.3) and (6.9).

$$Q = \frac{\pi K (H^2 - h^2)}{\ln R_0/r_s} + 2 \left[\frac{xK (H^2 - h^2)}{2L} \right] \quad (6.12)$$

While the total Q from this model is usually a reliable approximation, it is obvious that the wells at the ends will pump more than those in the center, if spacing is constant. In practice, such systems are leapfrogged as the trench excavation continuously progresses, so a given well will at times be anywhere in the system. It is good practice therefore to design each well and its pump for the high capacity it will yield when near the end of the system.

6.6 RADIUS OF INFLUENCE R_0

The equivalent radius of influence R_0 that appears in Eqs. (6.1)–(6.5) is a mathematical convenience. As discussed in Section 5.3, the sum of the re-

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charge to the aquifer is assumed to create an effect similar to that of a constant source on a vertical cylindrical surface at R_0 . Thus the concept is to a degree nebulous. Because R_0 appears as a log function in Eqs. (6.1)–(6.4), precision in estimating it is not necessary when analyzing a well. However, in Eqs. (6.8) and (6.9) the distance to the line source L (a similar concept to R_0) is proportional to Q . We have seen R_0 vary from 100 to 100,000 ft (30 to 30,000 m) on various projects. The literature cites instances of even greater magnitude. So the possibility of gross error exists.

The most reliable means of estimating R_0 is by Jacob analysis of a pumping test, as described in Chapter 9. Only this method will reveal recharge from other aquifers, and the degree of connection with surface water bodies. It is necessary also to extrapolate from the conditions existing during the pumping test to others that may occur within the life of the dewatering system. We have seen the Q of a dewatering system increase by 20, 40, or even 100% during high river stages, particularly when accompanied by inundation of large surface areas (Section 5.3).

Lacking a pumping test, it is necessary to make rough approximations of R_0 from topography and areal geology, or from estimated aquifer parameters. In an ideal aquifer, without recharge, R_0 is a function of the transmissibility, the storage coefficient and the duration of pumping. By adapting the Jacob formula [Eq. (4.5)], we can estimate the order of magnitude of R_0 , without recharge as follows:

$$R_0 = r_s + \sqrt{\frac{Tt}{C_4C_s}} \quad (6.13)$$

Units to be used in this equation are given in Table 4.2. The value for pumping time t is selected from schedule or cost considerations regarding the time available to accomplish the result.

The value computed for R_0 by Eq. (6.13) should be adjusted downward on the basis of judgments as to possible recharge. Equation (6.13) is valid only for confined aquifers, but results obtained for water table aquifers are reasonable. It is apparent from Eq. (6.13) that R_0 computed for a typical confined aquifer ($C_s = 0.001$) will be some 14 times greater than that in a typical water table aquifer ($C_s = 0.2$), with the same transmissibility, pumped for the same time. Experience confirms that very large values for R_0 are typical of confined aquifers.

An empirical relationship developed by Sichart and Kyrieleis (72) gives R_0 as a function of drawdown $H - h$ and K :

$$R_0 = 3(H - h) \sqrt{K} \quad (6.14)$$

where $H - h$ is in feet and K is in microns per second. Theoretically R_0 is independent of drawdown, and is related to pumping time, which does

Ref. 8

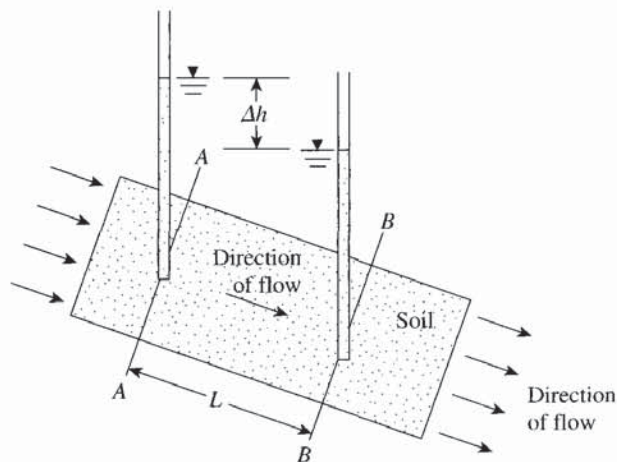


Figure 1.9 Definition of Darcy's law

1.9

Table 1.7 Range of the Hydraulic Conductivity for Various Soils

Type of soil	Hydraulic conductivity, k (cm/sec)
Medium to coarse gravel	Greater than 10^{-1}
Coarse to fine sand	10^{-1} to 10^{-3}
Fine sand, silty sand	10^{-3} to 10^{-5}
Silt, clayey silt, silty clay	10^{-4} to 10^{-6}
Clays	10^{-7} or less

Darcy's law [Eq. (1.24)] is valid for a wide range of soils. However, with materials like clean gravel and open-graded rockfills, the law breaks down because of the turbulent nature of flow through them.

The value of the hydraulic conductivity of soils varies greatly. In the laboratory, it can be determined by means of *constant-head* or *falling-head* permeability tests. The constant-head test is more suitable for granular soils. Table 1.7 provides the general range for the values of k for various soils. In granular soils, the value depends primarily on the void ratio. In the past, several equations have been proposed to relate the value of k to the void ratio in granular soil.

However the author recommends the following equation for use (also see Carrier, 2003):

$$k \propto \frac{e^3}{1 + e} \quad (1.26)$$

where

k = hydraulic conductivity

e = void ratio

More recently, Chapuis (2004) proposed an empirical relationship for k in conjunction with Eq. (1.26) as

$$k \text{ (cm/s)} = 2.4622 \left[D_{10}^2 \frac{e^3}{(1 + e)} \right]^{0.7825} \quad (1.27)$$

where D = effective size (mm).

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No.	Assumption	Verified By	Date

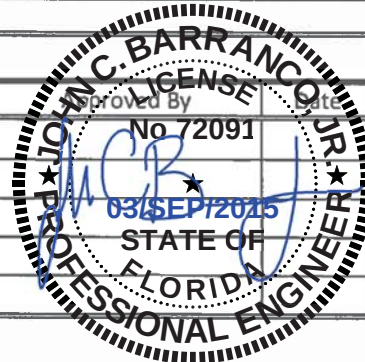
Refer to Page _____ of this calculation for additional assumptions.

This Section Used for Software-Generated CalculationsProgram Name/Number: MathCAD Version: 15.0Standard B&V Application Used? ☐ Yes ☐ No

If no, list approved deviation permit number below and attach approved deviation permit.

Review and Approval

Rev	Prepared By	Date	Verified By	Date
0	Wei Tu <i>Wei Tu</i>	04/10/15	<i>J. L. Jeyaraj</i> <i>J. L. Jeyaraj</i>	4/20/15





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1.0 Purpose

To determine site dewatering requirements for reducing groundwater levels to 2 feet below the base of excavation for Oil Water Separator (OWS).

2.0 Reference

1. Ardaman & Associates, Inc., Draft Report - SUBSURFACE EXPLORATION FLORIDA POWER & LIGHT OKEECHOBEE CLEAN ENERGY CENTER OKEECHOBEE COUNTY, FLORIDA, Mar-02-2015;
2. Department of the Army, the Navy and the Air Force, Army TM 5-818-5, Navy NAVFAC P-418, , Air Force AFM 88-5, Chap. 6, "Dewatering and Groundwater Control", November 1983;
3. Powers, J. P., "Construction Dewatering - A Guide to Theory and Practice", 2nd Ed., John Wiley & Sons, 1992;
4. BV drawing, 185922-DS-1104, Florida Power & Light, Okeechobee Energy Center, Proposed Stormwater Management Plan, Rev. A;
5. BV drawing, 185922-1GAU-1001, Florida Power & Light, Okeechobee Energy Center, Site Arrangement, Rev. 1;
6. BARRANCO, J., email communication, subject: RE: 185992 FPL Okeechobee Energy Center - Dewatering Calculations, Sent Mon 4/6/2015 3:31 PM;
7. BARRANCO, J., verbal communication and Lync Instant Messages, 4/7/2015;
8. Das, B.M., Principles of Foundation Engineering, 6th Edition, 2007.

3.0 Design Basis

- In situ hydraulic conductivity of soil based on consideration of slug test results in Ref. 1 and empirical correlations in Ref. 3 and 8;
- Dimensions of the base of excavation based on Ref. 6;
- Design of dewatering system based on References 2 and 3.

4.0 Definition of Units and Constants

US Custom

$$\text{pcf} = \frac{\text{lb}_f}{\text{ft}^3} \quad \text{psf} = \frac{\text{lb}_f}{\text{ft}^2} \quad \text{ksf} = 1000\text{psf} \quad \text{tsf} = 2000\text{psf} \quad \text{ksi} = 1000\text{psi} \quad \text{ton} = 2000\text{lb}_f \quad \text{pci} = \frac{\text{lb}_f}{\text{in}^3} \quad \text{gpd} = \frac{\text{gal}}{\text{day}}$$

$$\text{dpt} = 0.5506\text{L} \quad (\text{dry pint}) \quad \text{lpt} = 1.164\text{dpt} \quad (\text{liquid pint})$$

$$\text{Unit weight of water:} \quad \gamma_w = 62.4\text{pcf}$$

SI

$$\text{kPa} = 10^3\text{Pa} \quad \text{MPa} = 10^6\text{Pa} \quad \text{GPa} = 1000\text{MPa} \quad \text{kN} = 10^3\text{newton} \quad \text{TN} = 10^3\text{kgf} \quad \text{tsm} = \frac{\text{TN}}{\text{m}^2}$$

$$\text{Atmosphere pressure:} \quad P_a = 100\text{kPa} \quad \text{Concrete unit weight:} \quad \gamma_c = 24 \frac{\text{kN}}{\text{m}^3}$$

$$\text{Set ORIGIN to 1 according to customary usage:} \quad \text{ORIGIN} = 1$$



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5.0 Symbols and Acronyms

SPT	Standard penetration test
k_h, k	horizontal permeability and permeability (cm/s)
GWT	Groundwater
El, Elev	Elevation (ft)
w_N	Natural moisture content (%)
D_{10}	The particle size that passing 10% per weight (mm)
Gs	Specific gravity
e	Void ratio
w, L	Width and Length of base of the excavation (ft)
b, a	Width and length of the rectangular wellpoints system (ft)
L or R	Influence radius of wellpoints slot (ft)
Q	Flow (gpm or gpd)
h_{OU}	Head at the first-stage wellpoints
h_{OL}	Head at the second-stage wellpoints
H	Original head before dewatering (ft)
h_{DU}	Maximum residual head downstream of a single slot of the first-stage wellpoints (ft)
h_{DL}	Maximum residual head downstream of a single slot of the second-stage wellpoints (ft)
r_w	Radius of wells (in)



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6.0 Analysis

Subsurface conditions

Per Ref. 1, three soil borings were drilled: SB-08, PSB-01, and PSB-02. Boring SB-08 was advanced to depth of 100' while both PSB-01 and PSB-02 ended at depth of 30'. Based on the boring logs, the site is underlain by loose to medium dense clayey fine sand with a thin layer of firm sandy clay (5ft) at depth of 67' to 72' and bottom of boring ended in a firm sandy clay at the bottom 8ft.

Figure 1 and Table 1 show the SPT-N values and soil profile vs. the depth below the original grade.

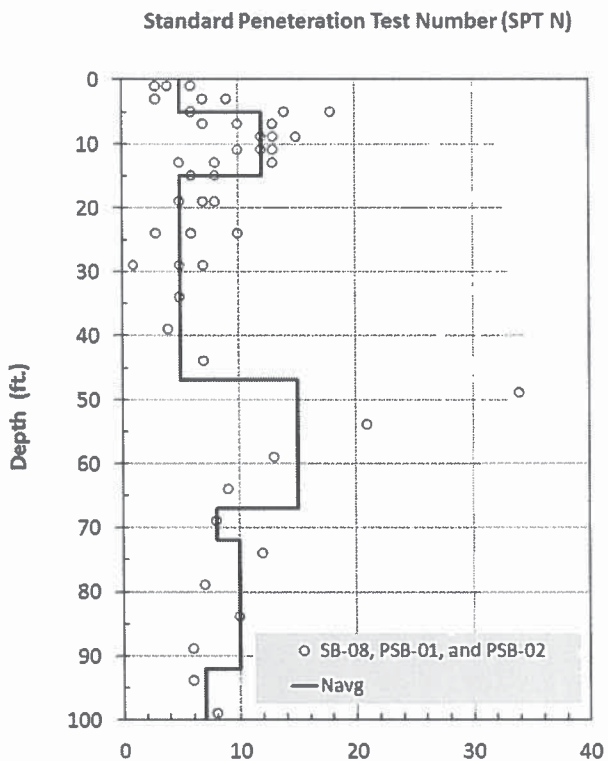


Figure 1 SPT Blow Counts and Profile per Boring Logs from Ref. 1



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Table 1 Soil Profile based on Borings SB-08, PSB-01, and PSB-02

Layer #	Description	Depth (ft)	SPT N (bpf)
1	Loose Fine Sand	0-5	5
2	Medium dense fine sand	5-15	12
3	Loose Sand	15-47	5
4	Medium dense fine sand	47-67	15
5	Firm Sandy Clay	67-72	8
6	Loose sand	72-92	10
7	Firm Sandy Clay	92-100	7

Per Ref. 1, the hydraulic conductivity from the slug tests performed in borings SB-08, PSB-01, and PSB-02 are shown in Table 2.

Table 2 Horizontal Hydraulic Conductivity based on the Slug Tests per Ref. 1

Piezometer	Horizontal Hydraulic Conductivity, k_h (feet/day)
PSB-01	0.10
PSB-02	0.24
SB-08	0.18

Use the average of the three tests for design: $k_h := \frac{\left(0.10 \frac{\text{ft}}{\text{day}} + 0.24 \frac{\text{ft}}{\text{day}} + 0.18 \frac{\text{ft}}{\text{day}}\right)}{3}$

$$\Rightarrow k_h = 0.173 \frac{\text{ft}}{\text{day}} \quad \text{or} \quad k_h = 6.115 \times 10^{-5} \frac{\text{cm}}{\text{s}}$$

The impermeable layer is assumed at the top of the firm sandy clay at depth of 67 ft per boring logs.

Per Ref. 1, the groundwater table is located at 0.5 to 2ft below the existing grade. Per Ref. 7, the existing grade elevation of the site is about 36ft grading lower from west to east to about 31ft. ~~Because the shallow groundwater, the stormwater ponds are planned to be excavated in wet using dragline buckets. The soils will be initially saturated and stockpiled with either drain with or without mechanical procedure to dewater and dried to close to the optimum moisture content before being used as fill materials on site.~~ No full gradation tests were performed in Ref. 1. Figure 3 plots the seven passing #200 sieve tests from Ref. 1.

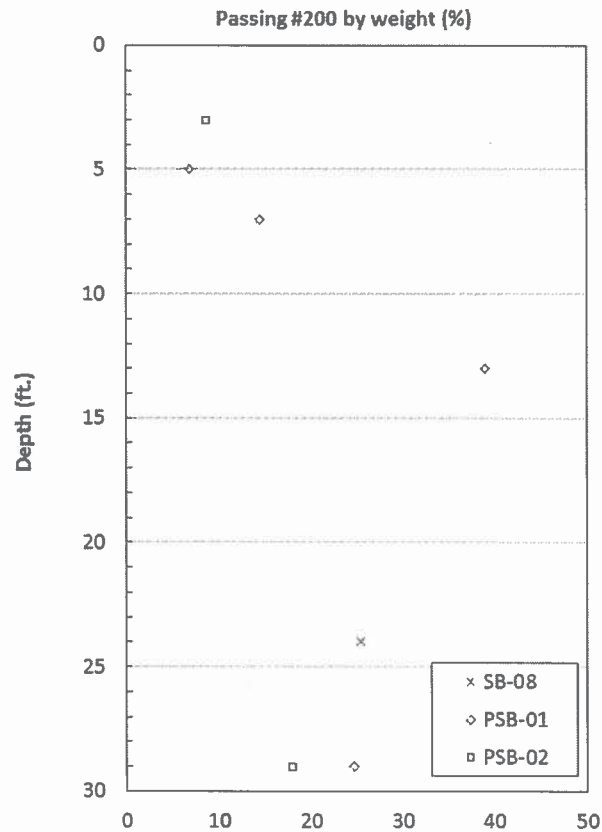


Figure 2 Measured Fine Content per Ref. 1

Based on the limited data, the shallower soil (0 to 15 ft) seems to be cleaner with 6 to 15% fine. Deeper soil has more fine content 20 to 40%. The excavated soil in the top 30' is described as fine sand with trace clay (borderline SP) to clayey sand (SC) with fine content up to 40%. All three slug tests were screened with depth of 20 to 30ft deep where the measured fine content is higher. The three passing #200 tests performed showed fine content of 6.8%, 14.4%, and 8.6% with an average value of 10% which means the #200 sieve size is approximately D_{10} on average.

D_{10} of top 15ft of soil:

$$D_{10} := 0.075 \text{ mm}$$

Estimated hydraulic conductivity
of top 15ft of soil per Hazen
equation (Ref. 3 Equ. 3.11):

$$k_1 := \left(0.1 \cdot \frac{D_{10}}{\text{mm}} \right)^2 \cdot \frac{\text{m}}{\text{s}}$$

$$\Rightarrow k_1 = 5.625 \times 10^{-3} \cdot \frac{\text{cm}}{\text{s}} \quad \text{or} \quad k_1 = 56.25 \cdot \frac{\mu\text{m}}{\text{s}}$$

Per Ref. 1, the groundwater depth at the power plant area is only about 0.5ft to 2ft below the existing grade. Figure 3 plots the measured natural moisture contents of soil samples collected from the three borings. The average moisture content measured in the top 15ft shows about 11% lower than the averaged moisture content measured in the deeper soil.

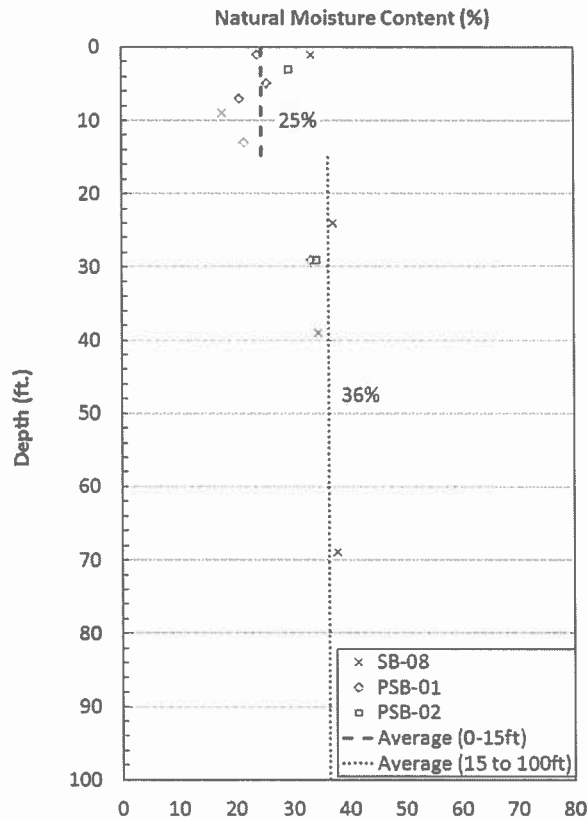


Figure 3 Measured Natural Moisture Content for Upper 15ft and below 15ft Depth

For the upper 15ft soil:

In situ Soil Moisture Content: $w_N := 25\%$

Specific Gravity of soil: $G_s := 2.65$ Typical value for Sand

The insitu soil is saturated below groundwater. The void ratio of in situ soil can be estimated using the natural moisture content and specific gravity.

In situ void ratio of soil: $e_0 := w_N \cdot G_s$
 $\Rightarrow e_0 = 0.66$



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Per Ref. 8 (Equ. 1.27) recommends a more recent empirical equation by Chapuis (2004) using effective particle size D_{10} and void ratio:

Hydraulic conductivity of upper 15ft soil per Chapuis (2004):

$$k_2 := 2.4622 \cdot \left[\left(\frac{D_{10}}{\text{mm}} \right)^2 \cdot \frac{e_0^3}{1 + e_0} \right]^{0.7825} \cdot \frac{\text{cm}}{\text{s}}$$

$$\Rightarrow k_2 = 0.011 \cdot \frac{\text{cm}}{\text{s}} \quad \text{or} \quad k_2 = 109.215 \cdot \frac{\mu\text{m}}{\text{s}}$$

Table 2 shows the range of permeability for typical natural soil types Per Ref. 3 Table 3.7.

Table 2 Range of Permeabilities of Natural Soils (Ref. 3)

Description	Permeability (μsec)
Openwork gravel (GP)	10,000 or higher
Uniform gravel (GP)	2,000–10,000
Well graded gravel (GW)	500–3,000
Uniform sand (SP)	50–2,000
Well graded sand (SW)	10–1,000
Silty sand (SM)	10–50
Clayey sand (SC)	1–10
Silt (ML)	0.5–1.0
Clay (CL)	0.1–0.0001

As shown in Table 2, the measured average horizontal permeability of the soil screen at 20 to 30ft below grade at the three borings:

$k_h = 0.6 \cdot \frac{\mu\text{m}}{\text{s}}$ is slightly below the typical range of permeability for clayey sand and falls in the range of Silt (ML).

The correlated permeability using effective particle using the two empirical equations:

Hazen Equation: $k_1 = 56.25 \cdot \frac{\mu\text{m}}{\text{s}}$

Chapuis Equation: $k_2 = 109.215 \cdot \frac{\mu\text{m}}{\text{s}}$

Considering the lower fine content in the upper 15ft, for preliminary dewatering design and dewatering water estimate permitting purpose, use:

$k := 50 \frac{\mu\text{m}}{\text{s}}$ which is about the lower bound of range of permeability for uniform sand and close to the empirically correlated value using Hazen Equation with $D_{10} = 0.75\text{mm}$ (#200 sieve).



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Dewatering Design for OWS

Per Ref. 1, the groundwater depth at the power plant area is only about 0.5ft to 2ft below the existing grade. Use groundwater depth 0ft or at the existing grade for dewatering design.

Per site arrangement drawing (Ref. 5):

Elevation of grade: $El_{grade} := 37ft$ ✓
Elevation of bottom of excavation: $El_{bottom} := 19ft$ ✓
Depth of excavation: $D_{exc} := El_{grade} - El_{bottom}$
 $\Rightarrow D_{exc} = 18ft$ ✓

Per Ref. 7, the existing grade elevation at the OWS area is about 33ft.

Elevation of original groundwater: $El_{gw1} := 33ft$ ✓
Elevation of final groundwater table after dewatering: $El_{gw2} := El_{bottom} - 2ft$ ✓
 $\Rightarrow El_{gw2} = 17ft$ ✓

Elevation of impermeable layer: $El_{imp} := El_{grade} - 67ft$
 $\Rightarrow El_{imp} = -30ft$ ✓

Height of the initial groundwater table: $H := El_{gw1} - El_{imp}$
 $\Rightarrow H = 63ft$ ✓

Assume the center of wellpoint pumps is 2 ft above the original grade.

Elevation of first stage wellpoints pump and collection piping: $El_{pump1} := El_{grade} + 2ft$
 $\Rightarrow El_{pump1} = 39ft$ ✓

Required Total Suction Lift for wellpoint: $SL_{total} := El_{grade} + 2ft - El_{gw2}$
 $\Rightarrow SL_{total} = 22ft$

Per Ref. 2 and 3, in practice the suction lift of a single-stage wellpoint system at sea level is limited to about 15 ft (4.6 m) as measured from the suction of the pump to the lowered water table at the center of the wellpoint system (Figure 4). With special techniques, lifts of up to about 28 ft (8.5 m) can be achieved depending on site-specific conditions. The single stage wellpoints has a practical maximum suction lift of about 22ft. The system is approaching practical limit and a two-stage system is used instead.

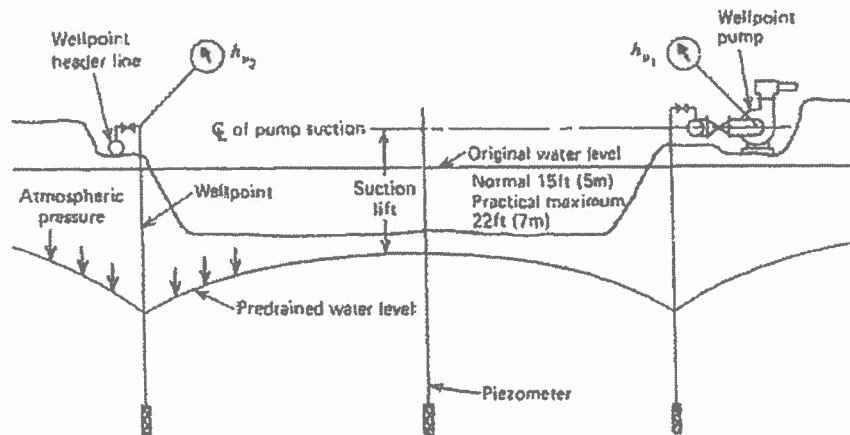


Figure 4 Suction Lift Limitation of Wellpoint System (Ref. 3)

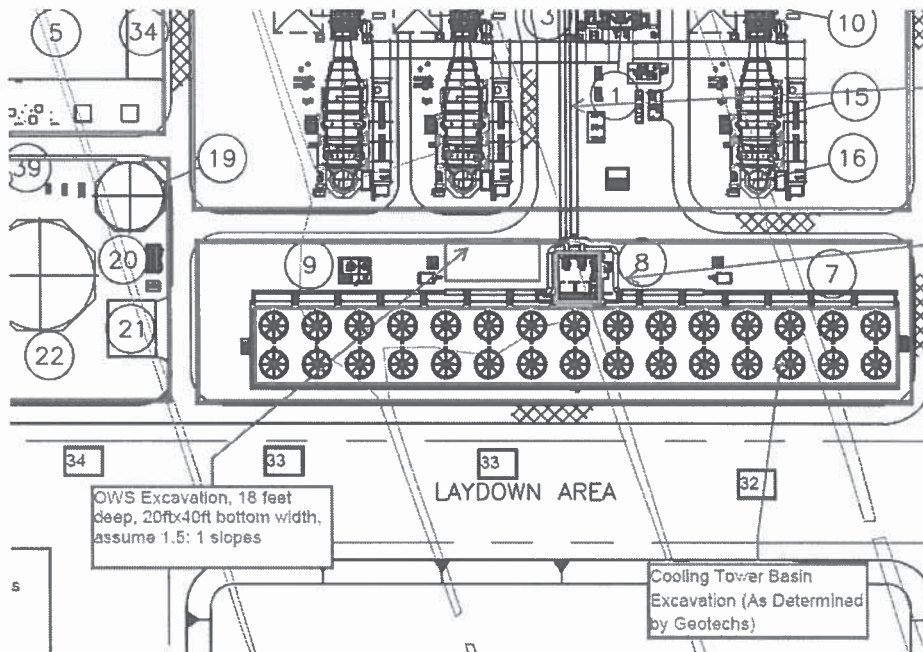


Figure 5 Plan view and dimensions of the Oil Water Separator excavation (Ref. 5)

Width of the OWS excavation: $w_{base} := 20\text{ft}$
 Length of the OWS excavation: $L_{base} := 40\text{ft}$



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Based on the boring logs, the soil to be excavated is classified as OSHA Type C60. For short term excavation purpose, a 1.5:1 slope (H:V) is recommended.

Distance from edge of excavation at the base to the top of slope = $1.5 \cdot D_{exc}$

Assume the first stage pumps and wellpoints collection piping is 5' away from the excavation for safety.

Width of the first stage wellpoint system:

$$b := w_{base} + 2 \cdot 5ft + 2 \cdot (1.5 \cdot D_{exc})$$

$$\Rightarrow b = 84ft \checkmark$$

Length of the first stage wellpoint system:

$$a := L_{base} + 2 \cdot 5ft + 2 \cdot (1.5 \cdot D_{exc})$$

$$\Rightarrow a = 104ft \checkmark$$

Check the maximum residual head downstream of one slot of wellpoints (Ref. 2 Fig. 4-3 Equ. (4):

$$h_D := h_0 \left[\frac{1.48}{R} \cdot (H - h_0) + 1 \right]^{\frac{2}{3}}$$

Per Ref. 2 Fig. 4-23 Equ. (1), the radius of influence (L, or R) of a single line of wellpoints is

$$R := C \cdot (H - h_0) \cdot \sqrt{k}$$

where

k = hydraulic conductivity in 10^{-4} cm/s or μ m/s;

C = 1.5 to 2 for a single line of wellpoints, use average of 1.75.



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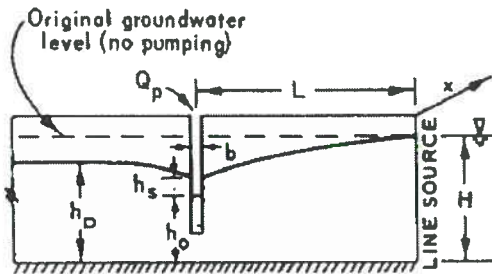


Figure 6 Flow and residual head for a partially penetrating slot with single line source and gravity flows (Ref. 2)

Assume the first stage wellpoints will lower the groundwater table from El. 33' to 25' to allow the excavation and installation of second wellpoints.

Required residual head at downstream for first stage wellpoints:

$$h_{DU} := 55 \text{ ft} \checkmark$$

Given

Required head at wellpoint: $h_{0U} := 10 \text{ ft}$

$$h_{DU} = h_{0U} \left[\frac{1.48(H - h_{0U})}{1.75(H - h_{0U}) \cdot \sqrt{\frac{k}{10^{-4} \frac{\text{cm}}{\text{s}}}}} + 1 \right]$$

Required maximum head at first stage wellpoints:

$$h_{0U} = \text{Find}(h_{0U}) \text{ - based on } h_{DU} = 55$$

$$\Rightarrow h_{0U} = 49.125 \text{ ft}$$

Minimum Drawdown at first-stage wellpoints:

$$H - h_{0U} = 13.875 \text{ ft}$$

Per Ref. 2 Fig. 4-23 Equ. (1) Radius of Influence:

$$R_{\infty} = 1.75(H - h_{0U}) \cdot \sqrt{\frac{k}{10^{-4} \frac{\text{cm}}{\text{s}}}}$$

$$\Rightarrow R = 171.699 \text{ ft}$$

Spacing between wellpoints:

$$x := 10 \text{ ft}$$

Calculate first stage wellpoints flow per Ref. 2 Fig. 4-3 Eq. (3):

$$Q_{pU} := \left[0.73 + 0.27 \left(\frac{H - h_{0U}}{H} \right) \right] \cdot \frac{k \cdot x}{2 \cdot R} \cdot (H^2 - h_{0U}^2)$$

$$\Rightarrow Q_{pU} = 2.633 \text{ gpm}$$

this is for single line source PL will likely be small compared to the drawdown to use two slots. if 2 slots C.L. = 1.3 not 1.43



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Per Ref. 2, because of slot flow equation was developed for infinite line of wellpoints, for finite line of wellpoints with 20ftx40ft excavation dimension, the flow from wellpoints will be greater.

Assume 35% higher flow per well per Ref. 2 Fig. D-1 : $Q_{pL} := 135\% \cdot Q_{pU}$
 $\Rightarrow Q_{pU} = 3.555 \text{ gpm}$ ✓

At middle of excavation, the required minimum drawdown is 2ft below bottom of excavation.

Maximum residual head at the downstream
of second stage wellpoints: $h_{DL} := H - (El_{gw1} - El_{gw2})$
 $\Rightarrow h_{DL} = 47 \text{ ft}$ ✓

Second stage wellpoints located 2ft above the lowered groundwater after first stage drawdown:

Elevation of second stage pump and
collection piping: $El_{pump2} := El_{imp} + h_{DU} + 2 \text{ ft}$
 $\Rightarrow El_{pump2} = 27 \text{ ft}$ ✓

Width of the first stage wellpoint
system: $b' := w_{base} + 2 \cdot (El_{pump2} - El_{bottom})^{1.5}$
 $\Rightarrow b' = 44 \text{ ft}$ *ok, + actually 2' above grade*

Length of the first stage wellpoint
system: $a' := L_{base} + 2 \cdot (El_{pump2} - El_{bottom})^{1.5}$
 $\Rightarrow a' = 64 \text{ ft}$ ✓

Given

Required head at wellpoint: $h_{0L} := 10 \text{ ft}$

$$h_{DL} = h_{0L} \cdot \left[\frac{1.48 \cdot (H - h_{0L})}{1.75 \cdot (H - h_{0L}) \cdot \sqrt{\frac{k}{10^{-4} \frac{\text{cm}}{\text{s}}}}} + 1 \right]$$

Required maximum head at first stage wellpoints:

$$h_{0L} := \text{Find}(h_{0L}) \quad \text{— based on } h_{DL} = 47' \quad H = 63$$

 $\Rightarrow h_{0L} = 41.979 \text{ ft}$

Drawdown at the second stage wellpoints:

$$H - h_{0L} = 21.021 \text{ ft}$$

Use same spacing between wellpoints for second stage:

$$x = 10 \text{ ft}$$

Calculate second stage wellpoints flow per Ref. 2
Fig. 4-3 Eq. (3):

$$Q_{pL} := \left[0.73 + 0.27 \cdot \left(\frac{H - h_{0L}}{H} \right) \right] \cdot \frac{k \cdot x}{2 \cdot R} \cdot (H^2 - h_{0L}^2)$$

$$\Rightarrow Q_{pL} = 3.88 \text{ gpm}$$
 ✓



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Assume 35% higher flow per well per Ref. 2 Fig. D-1 : $Q_{pL} := 135\% \cdot Q_{pL}$

$$\Rightarrow Q_{pL} = 5.238 \text{ gpm} \checkmark$$

Total flow from wellpoints system:

$$Q_{total1} := Q_{pU} \frac{2 \cdot (a + b)}{x} + Q_{pL} \frac{2 \cdot (a' + b')}{x}$$

$$\Rightarrow Q_{total1} = 246.818 \text{ gpm} \quad \text{or} \quad Q_{total1} = 3.554 \times 10^5 \cdot \text{gpd}$$

Total number of wells at perimeter wellpoints:

$$n_w := \text{ceil} \left[\frac{2(a + b)}{x} + \frac{2(a' + b')}{x} \right]$$

$$\Rightarrow n_w = 60$$

Equivalent well radius for the system Ref. 3
Equ. 6.10

$$r_{s1} := \sqrt{\frac{a \cdot b}{\pi}}$$

$$\Rightarrow r_{s1} = 52.733 \text{ ft}$$

Equivalent well radius for the system Ref. 3
Equ. 6.11

$$r_{s2} := \frac{a + b}{\pi}$$

$$\Rightarrow r_{s2} = 59.842 \text{ ft}$$

Use average:

$$r_s := \frac{r_{s1} + r_{s2}}{2}$$

$$\Rightarrow r_s = 56.288 \text{ ft}$$

Estimate radius of influence of equivalent
single well:

$$R_{single1} := 3(H - h_{0L}) \cdot \sqrt{\frac{k}{10^{-4} \frac{\text{cm}}{\text{s}}}}$$

Ref. 2 Fig. 4-23

$$\Rightarrow R_{single1} = 445.918 \text{ ft}$$

Transmissivity of aquifer:

$$T := k \cdot H$$

$$\Rightarrow T = 0.62 \cdot \frac{\text{ft}^2}{\text{min}} \quad \text{or} \quad T = 6.679 \times 10^3 \cdot \frac{\text{gpd}}{\text{ft}}$$

Pumping time to reach steady state in
minutes:

$$t := 30 \text{ day}$$

Assume 1 month to reach steady state condition

Factor C_4 from pump test results:

$$C_4 := 4790$$

Per Ref. 3 Table 4.2

Factor C_5 :

$$C_5 := 0.2$$

for unconfined aquifers



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$$R_{\text{single2}} := r_s + \sqrt{\frac{\frac{T}{\text{gpd}} \cdot \frac{t}{\text{min}}}{C_4 \cdot C_s}} \cdot \text{ft}$$

$$\Rightarrow R_{\text{single2}} = 605.107 \text{ ft}$$

Use average:

$$R_{\text{single}} := \frac{R_{\text{single1}} + R_{\text{single2}}}{2}$$

$$\Rightarrow R_{\text{single}} = 525.513 \text{ ft}$$

Estimate total flow from equivalent single well:

$$Q_{\text{total2}} := \frac{\pi \cdot k \cdot (H^2 - h_{0L}^2)}{\ln\left(\frac{R_{\text{single}}}{r_s}\right)}$$

$$\Rightarrow Q_{\text{total2}} = 228.495 \text{ gpm} \quad \text{or} \quad Q_{\text{total2}} = 3.29 \times 10^5 \cdot \text{gpd}$$

Total flow from wellpoints estimate:

$$Q_{\text{total1}} = 246.818 \text{ gpm} \quad \text{or} \quad Q_{\text{total1}} = 3.554 \times 10^5 \cdot \text{gpd}$$

Total flow from single well estimate:

$$Q_{\text{total2}} = 228.495 \text{ gpm} \quad \text{or} \quad Q_{\text{total2}} = 3.29 \times 10^5 \cdot \text{gpd}$$

The two estimates are comparable.

Take average of the two:

$$Q_{\text{total}} := \frac{Q_{\text{total1}} + Q_{\text{total2}}}{2}$$

$$\Rightarrow Q_{\text{total}} = 237.657 \text{ gpm} \quad \text{or} \quad Q_{\text{total}} = 3.422 \times 10^5 \cdot \text{gpd} \quad \checkmark$$

Figure 7 shows a sketch of dewatering system for the OWS excavation.

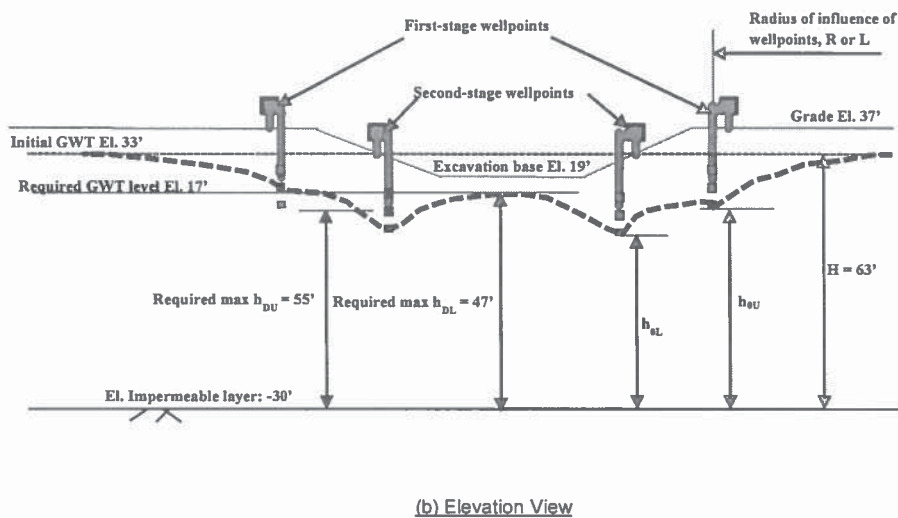
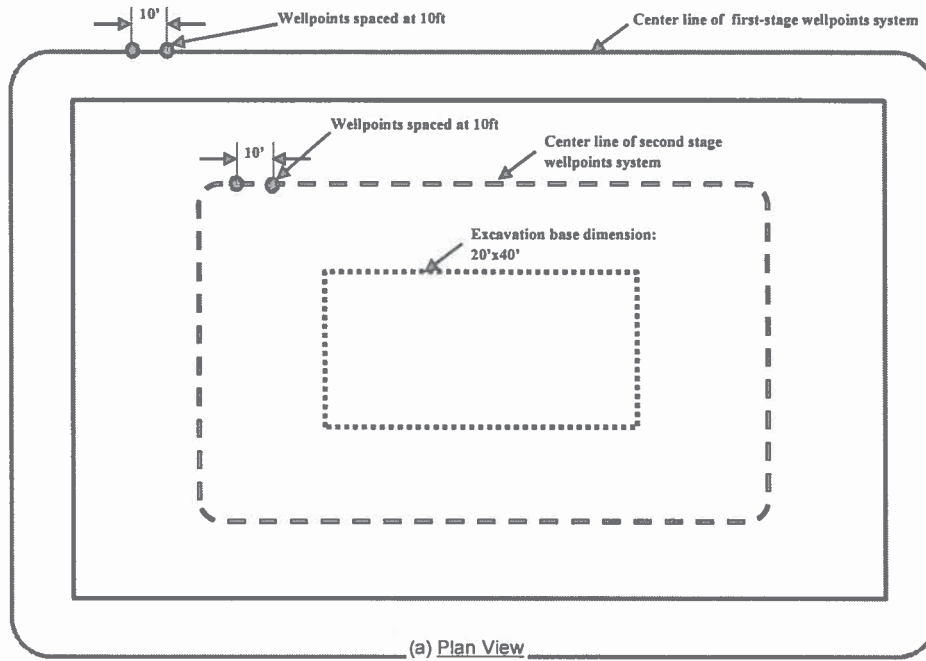


Figure 7 Sketch of Dewatering System for the OWS Excavation

Note: NOT TO SCALE



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Dewatering Design for Cooling Tower Sump Pit

Per Ref. 1, the groundwater depth at the power plant area is only about 0.5ft to 2ft below the existing grade. Use groundwater depth 0ft or at the existing grade for dewatering design.

Per site arrangement drawing (Ref. 5):

Elevation of grade:

$$El_{grade} := 37ft$$

Elevation of bottom of excavation:

$$El_{bottom} := 22ft$$

Depth of excavation:

$$D_{exc} := El_{grade} - El_{bottom}$$

$$\Rightarrow D_{exc} = 15ft$$

plow be reference

Per Ref. 7, the existing grade elevation at the Cooling tower area is about 33ft.

Elevation of original groundwater:

$$El_{gw1} := 33ft$$

Elevation of final groundwater table after dewatering:

$$El_{gw2} := El_{bottom} - 2ft$$

$$\Rightarrow El_{gw2} = 20ft$$

Elevation of impermeable layer:

$$El_{imp} := El_{grade} - 67ft$$

$$\Rightarrow El_{imp} = -30ft$$

Height of the initial groundwater table:

$$H := El_{gw1} - El_{imp}$$

$$\Rightarrow H = 63ft$$

Assume the center of wellpoint pumps is 2 ft above the original grade.

Elevation of first stage wellpoints pump and collection piping:

$$El_{pump1} := El_{grade} + 2ft$$

$$\Rightarrow El_{pump1} = 39ft$$

Required Total Suction Lift for wellpoint:

$$SL_{total} := El_{grade} + 2ft - El_{gw2}$$

$$\Rightarrow SL_{total} = 19ft$$

Per Ref. 2 and 3, in practice the suction lift of a single-stage wellpoint system at sea level is limited to about 15 ft (4.6 m) as measured from the suction of the pump to the lowered water table at the center of the wellpoint system (Figure 8). With special techniques, lifts of up to about 28 ft (8.5 m) can be achieved depending on site-specific conditions. The single stage wellpoints has a practical maximum suction lift of about 22ft. The system is approaching practical limit and a two-stage system is used instead.

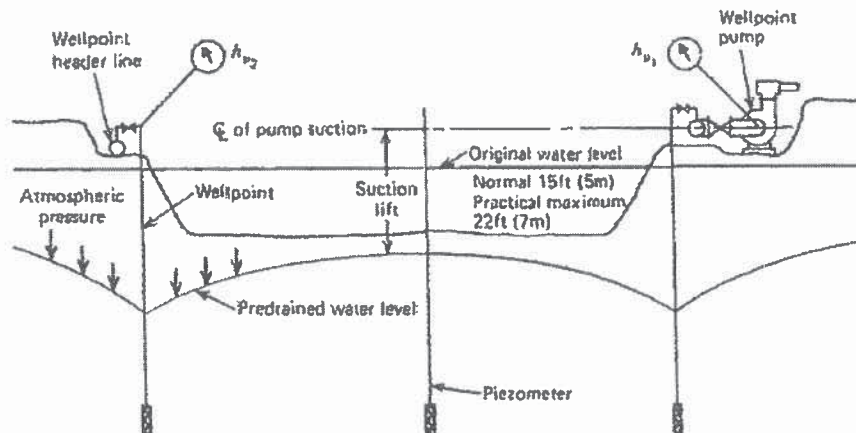


Figure 8 Suction Lift Limitation of Wellpoint System (Ref. 3)

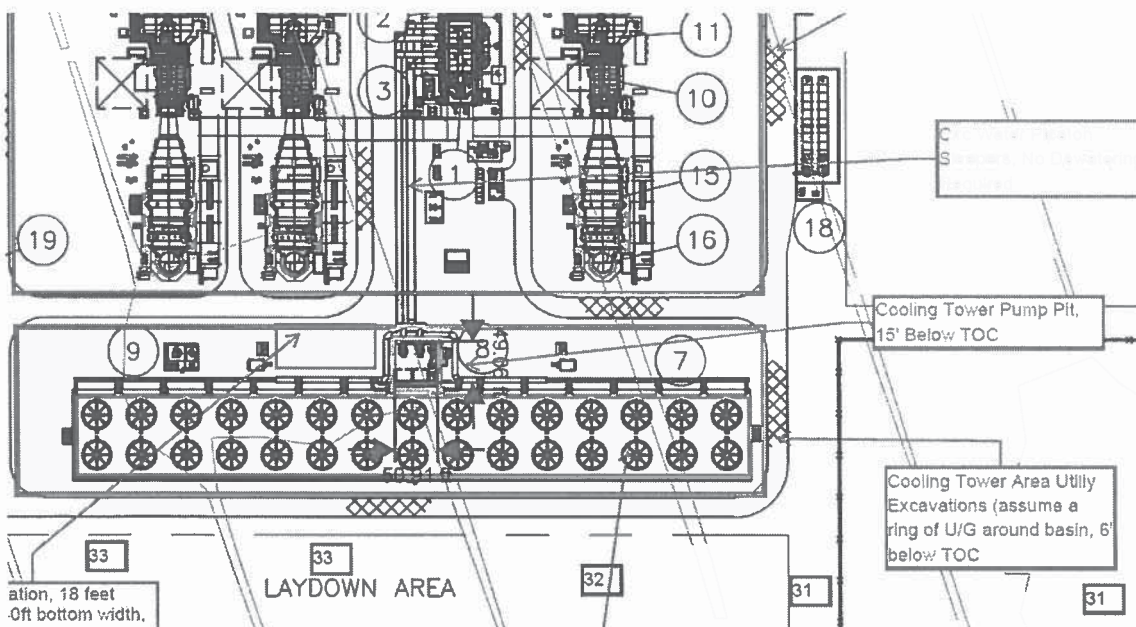


Figure 9 Plan view and dimensions of the Cooling Water Sump Pump excavation (Ref. 5)

Width of the Cooling Tower Sump
 excavation:

$$w_{base} := 50\text{ft}$$

Length of the Cooling Tower Sump
 excavation:

$$L_{base} := 50\text{ft}$$



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Based on the boring logs, the soil to be excavated is classified as OSHA Type C60. For short term excavation purpose, a 1.5:1 slope (H:V) is recommended.

Distance from edge of excavation at the base to the top of slope = $1.5 \cdot D_{exc}$

Assume the first stage pumps and wellpoints collection piping is 5' away from the excavation for safety.

Width of the first stage wellpoint system: $b := w_{base} + 2 \cdot 5\text{ft} + 2 \cdot 1.5 \cdot D_{exc}$

$$\Rightarrow b = 105\text{ft} \quad \checkmark$$

Length of the first stage wellpoint system: $a := L_{base} + 2 \cdot 5\text{ft} + 2 \cdot 1.5 \cdot D_{exc}$

$$\Rightarrow a = 105\text{ft} \quad \checkmark$$

Check the maximum residual head downstream of one slot of wellpoints (Ref. 2 Fig. 4-3 Equ. (4): $h_D := h_0 \left[\frac{1.48}{R} \cdot (H - h_0) + 1 \right]^2$

Per Ref. 2 Fig. 4-23 Equ. (1), the radius of influence (L, or R) of a single line of wellpoints is

$$R := C \cdot (H - h_0) \cdot \sqrt{k}$$

where

k = hydraulic conductivity in 10^{-4} cm/s or $\mu\text{m/s}$;

C = 1.5 to 2 for a single line of wellpoints, use average of 1.75.

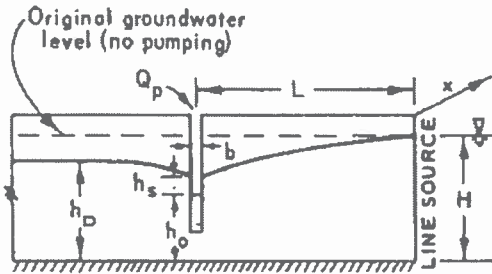


Figure 10 Flow and residual head for a partially penetrating slot with single line source and gravity flows (Ref. 2)

Assume the first stage wellpoints will lower the groundwater table from El. 33' to 25' to allow the excavation and installation of second wellpoints.

Required residual head at downstream for first stage wellpoints:

$$h_{DU} := 56 \text{ ft}$$

Given

Required head at wellpoint:

$$h_{0U} := 10 \text{ ft}$$

$$h_{DU} = h_{0U} \left[\frac{1.48 \cdot (H - h_{0U})}{1.75 \cdot (H - h_{0U}) \cdot \sqrt{\frac{k}{10^{-4} \frac{\text{cm}}{\text{s}}}}} + 1 \right]$$

Required maximum head at first stage wellpoints:

$$h_{0U} := \text{Find}(h_{0U})$$

$$\Rightarrow h_{0U} = 50.018 \text{ ft}$$

Minimum Drawdown at first-stage wellpoints:

$$H - h_{0U} = 12.982 \text{ ft}$$

Per Ref. 2 Fig. 4-23 Equ. (1) Radius of Influence:

$$R := 1.75 \cdot (H - h_{0U}) \cdot \sqrt{\frac{k}{10^{-4} \frac{\text{cm}}{\text{s}}}}$$

$$\Rightarrow R = 160.647 \text{ ft}$$

Spacing between wellpoints:

$$x := 10 \text{ ft}$$

Calculate first stage wellpoints flow per Ref. 2 Fig. 4-3 Eq. (3):

$$Q_{pU} := \left[0.73 + 0.27 \cdot \left(\frac{H - h_{0U}}{H} \right) \right] \cdot \frac{k \cdot x}{2 \cdot R} \cdot (H^2 - h_{0U}^2)$$

$$\Rightarrow Q_{pU} = 2.642 \text{ gpm}$$



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Per Ref. 2, because of slot flow equation was developed for infinite line of wellpoints, for finite line of wellpoints with 20ftx40ft excavation dimension, the flow from wellpoints will be greater.

Assume 35% higher flow per well per Ref. 2 Fig. D-1 : $Q_{pL} := 135\% \cdot Q_{pU}$
 $\Rightarrow Q_{pU} = 3.566 \text{ gpm}$

At middle of excavation, the required minimum drawdown is 2ft below bottom of excavation.

Maximum residual head at the downstream
 of second stage wellpoints: $h_{DL} := H - (El_{gw1} - El_{gw2})$
 $\Rightarrow h_{DL} = 50 \text{ ft}$

Second stage wellpoints located 2ft above the lowered groundwater after first stage drawdown:

Elevation of second stage pump and
 collection piping: $El_{pump2} := El_{imp} + h_{DU} + 2 \text{ ft}$
 $\Rightarrow El_{pump2} = 28 \text{ ft}$

Width of the first stage wellpoint
 system: $b' := w_{base} + 2 \cdot (El_{pump2} - El_{bottom}) \cdot 1.5$
 $\Rightarrow b' = 68 \text{ ft}$

Length of the first stage wellpoint
 system: $a' := L_{base} + 2 \cdot (El_{pump2} - El_{bottom}) \cdot 1.5$
 $\Rightarrow a' = 68 \text{ ft}$

Given

Required head at wellpoint: $h_{0L} := 10 \text{ ft}$

$$h_{DL} = h_{0L} \cdot \left[\frac{1.48 \cdot (H - h_{0L})}{1.75 \cdot (H - h_{0L}) \cdot \sqrt{\frac{k}{10^{-4} \frac{\text{cm}}{\text{s}}}}} + 1 \right]$$

Required maximum head at first stage wellpoints: $h_{0L} := \text{Find}(h_{0L})$
 $\Rightarrow h_{0L} = 44.659 \text{ ft}$

Drawdown at the second stage at wellpoints: $H - h_{0L} = 18.341 \text{ ft}$

Use same spacing between wellpoints for second stage: $x = 10 \text{ ft}$

Calculate second stage wellpoints flow per Ref. 2
 Fig. 4-3 Eq. (3): $Q_{pL} := \left[0.73 + 0.27 \cdot \left(\frac{H - h_{0L}}{H} \right) \right] \cdot \frac{k \cdot x}{2 \cdot R} \cdot (H^2 - h_{0L}^2)$
 $\Rightarrow Q_{pL} = 3.659 \text{ gpm}$



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Assume 35% higher flow per well per Ref. 2 Fig. D-1 : $Q_{pLw} := 135\% \cdot Q_{pL}$

$$\Rightarrow Q_{pL} = 4.94 \text{ gpm}$$

Total flow from wellpoints system:

$$Q_{total1} := Q_{pU} \frac{2 \cdot (a + b)}{x} + Q_{pL} \frac{2 \cdot (a' + b')}{x}$$

$$\Rightarrow Q_{total1} = 284.129 \text{ gpm} \quad \text{or} \quad Q_{total1} = 4.091 \times 10^5 \text{ gpd}$$

Total number of wells at perimeter wellpoints:

$$n_w := \text{ceil} \left[\frac{2(a + b)}{x} + \frac{2(a' + b')}{x} \right]$$

$$\Rightarrow n_w = 70$$

Equivalent well radius for the system Ref. 3
 Equ. 6.10

$$r_{s1} := \sqrt{\frac{a \cdot b}{\pi}}$$

$$\Rightarrow r_{s1} = 59.24 \text{ ft}$$

Equivalent well radius for the system Ref. 3
 Equ. 6.11

$$r_{s2} := \frac{a + b}{\pi}$$

$$\Rightarrow r_{s2} = 66.845 \text{ ft}$$

Use average:

$$r_s := \frac{r_{s1} + r_{s2}}{2}$$

$$\Rightarrow r_s = 63.042 \text{ ft}$$

Estimate radius of influence of equivalent
 single well:

$$R_{single1} := 3(H - h_{0L}) \cdot \sqrt{\frac{k}{10^{-4} \frac{\text{cm}}{\text{s}}}}$$

Ref. 2 Fig. 4-23

$$\Rightarrow R_{single1} = 389.077 \text{ ft}$$

Transmissivity of aquifer:

$$T_w := k \cdot H$$

$$\Rightarrow T = 0.62 \frac{\text{ft}^2}{\text{min}} \quad \text{or} \quad T = 6.679 \times 10^3 \frac{\text{gpd}}{\text{ft}}$$

Pumping time to reach steady state in
 minutes:

$$t := 30 \text{ day} \quad \text{Assume 1 month to reach steady state condition}$$

Factor C_4 from pump test results:

$$C_4 := 4790 \quad \text{Per Ref. 3 Table 4.2}$$

Factor C_5 :

$$C_5 := 0.2 \quad \text{for unconfined aquifers}$$



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$$R_{\text{single}2} := r_s + \sqrt{\frac{\frac{T}{\text{gpd}} \cdot \frac{t}{\text{min}}}{C_4 \cdot C_s}} \cdot \text{ft}$$

$$\Rightarrow R_{\text{single}2} = 611.862 \text{ ft}$$

Use average:

$$R_{\text{single}} := \frac{R_{\text{single}1} + R_{\text{single}2}}{2}$$

$$\Rightarrow R_{\text{single}} = 500.47 \text{ ft}$$

Estimate total flow from equivalent single well:

$$Q_{\text{total}2} := \frac{\pi \cdot k \cdot (H^2 - h_{0L}^2)}{\ln\left(\frac{R_{\text{single}}}{r_s}\right)}$$

$$\Rightarrow Q_{\text{total}2} = 220.461 \text{ gpm} \quad \text{or} \quad Q_{\text{total}2} = 3.175 \times 10^5 \cdot \text{gpd}$$

Total flow from wellpoints estimate: $Q_{\text{total}1} = 284.129 \text{ gpm}$

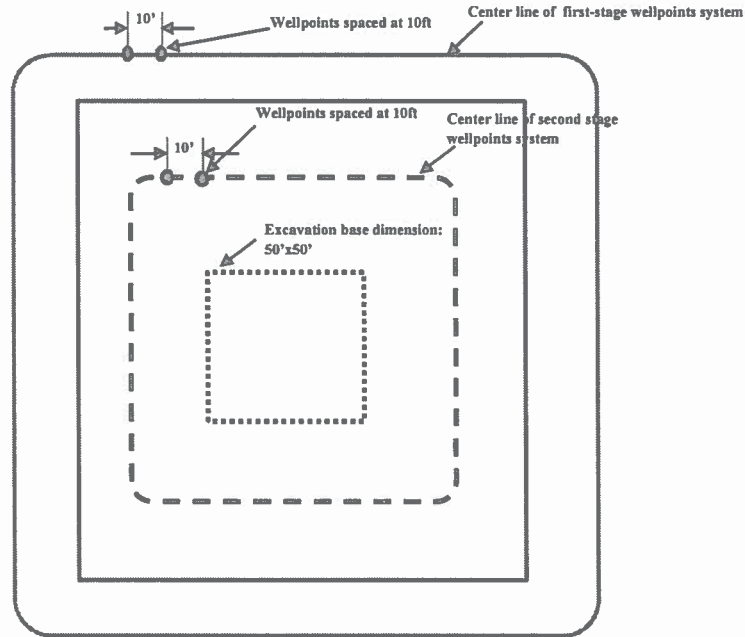
Total flow from single well estimate: $Q_{\text{total}2} = 220.461 \text{ gpm}$ The two estimates are comparable.

Take average of the two:

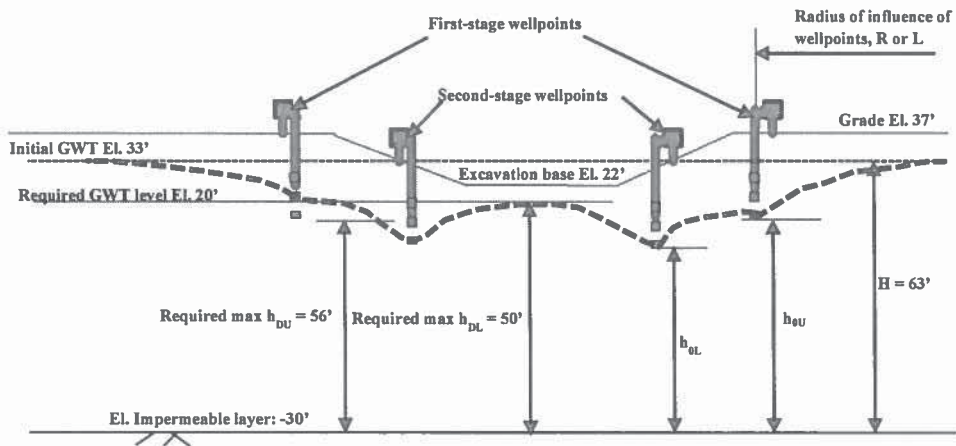
$$Q_{\text{total}} := \frac{Q_{\text{total}1} + Q_{\text{total}2}}{2}$$

$$\Rightarrow Q_{\text{total}} = 252.295 \text{ gpm} \quad \text{or} \quad Q_{\text{total}} = 3.633 \times 10^5 \cdot \text{gpd} \checkmark$$

Figure 11 shows a sketch of dewatering system for the Cooling Tower Sump Pit excavation.



(a) Plan View



(b) Elevation View

Figure 11 Sketch of Dewatering System for the Cooling Tower Sump Pit Excavation
 Note: NOT TO SCALE



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7.0 Conclusions

OWS Excavation (20ft x 40ft, 18ft below TOC, Figure 7)

Because the suction lift required for a single stage system is about 22ft which approaches the practical limit, use a two-stage wellpoints system for dewatering OWS excavation:

- Total flow Q_{total} = 238 gpm or 342,200 gal/day;
- First Stage Q_{well} = 3.6 gpm per well @ 10' spacing;
- First Stage h_0 = 49ft (drawdown at well = 14ft);
- Second Stage Q_{well} = 5.2 gpm per well @ 10' spacing;
- Second Stage h_0 = 42ft (drawdown at well = 21ft);
- Wellpoints = 2" self-jetting;
- # of wells ~ 60 total.

Cooling Tower Sump Pit Excavation (50ft x 50ft, 15ft below TOC, Figure 11)

Because the suction lift required for a single stage system is about 19ft which beyond the typical practical limit of 15ft, use a two-stage wellpoints system for dewatering the Cooling Tower Sump Pit excavation.

- Total flow Q_{total} = 253 gpm or 363,300 gal/day;
- First Stage Q_{well} = 3.6 gpm per well @ 10' spacing;
- First Stage h_0 = 50ft (drawdown at well = 13ft);
- Second Stage Q_{well} = 4.9 gpm per well @ 10' spacing;
- Second Stage h_0 = 44.7ft (drawdown at well = 18.3ft);
- Wellpoints = 2" self-jetting;
- # of wells ~ 70 total.

Note:

1. The permeability measured in the three slug tests available in Ref. 1 were performed in the deeper soil (screened at 20' to 30' deep) where the fine contents is higher. Based on the measured permeability from the slug tests, the material is borderline applicable for wellpoints method;
2. For permitting purpose, the dewatering design and flow estimate is performed with conservatively assumed permeability based on empirical correlations and typical values of the type of material identified in the boring logs;
3. The dewatering should be reviewed and revised as necessary for construction later when more data becomes available.



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Project	Okeechobee Energy Center	Unit	-
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Attachment A

Boring logs (Ref. 1)

DRAFT



Ardaman & Associates, Inc.

STANDARD PENETRATION TEST BORING LOG

BORING SB-08

PROJECT: FPL Okeechobee Clean Energy Center
Okeechobee County, Florida

FILE No.: 15-1624

BORING LOCATION: As per plan

DRILL CREW: IDI

WATER OBSERVED AT DEPTH 0.5 feet

DATE DRILLED: 02-12-15

DEPTH (FEET)	SYMBOLS FIELD TEST DATA	SOIL DESCRIPTION	SAMPLE No.	N VALUE	N VALUE
0					
	2/6	Dark reddish brown fine sand with roots	1		
	2/6	[MC: 33.4% / OC: 8.8%]	2	6	
	4/6	Light reddish brown fine sand	3		
	4/6	Light grayish brown fine sand			
	3/6			7	
	4/6				
	2/6		4		
	3/6			18	
5	7/6				
	11/6	Light brownish gray fine sand	5		
	12/6		6		
	1/6	Light brownish gray fine sand with trace of clay		10	
	2/6				
	8/6				
	7/6		7	15	
	8/6	Gray clayey fine sand			
	7/6	[MC: 17.7% / LL: 22.8 / PL: 15.9 / PI: 6.9]			
10	8/6		8	13	
	6/6	Gray slightly clayey fine sand			
	7/6				
	6/6		9	13	
	6/6	Gray fine sand with trace of clay			
	4/6		10	8	
	7/6				
	6/6				
15	5/6	Gray fine sand			
	4/6				
	4/6				
	3/6				
			11	7	
	3/6	Greenish gray slightly clayey fine sand with shell fragments			
	4/6				
	3/6				
20	2/6				
	4/6	Greenish gray clay	12	6	
	2/6	Greenish gray clayey fine sand with shell fragments			
	4/6	[MC: 37.3% / -200: 25.3%]			
	3/6				
25					
	5/6		13	5	
	2/6				
	3/6				
30	3/6				

NOTES:

FIELD TEST DATA ARE "BLOWS"/"INCHES DRIVEN"

140-LB HAMMER, 30-INCH FALL.

(ASTM D-1586)

Ardaman & Associates

DRAFT



Ardaman & Associates, Inc.

STANDARD PENETRATION TEST BORING LOG

BORING SB-08

PROJECT: FPL Okeechobee Clean Energy Center
Okeechobee County, Florida

FILE No.: 15-1624

BORING LOCATION: As per plan

DRILL CREW: IDI

WATER OBSERVED AT DEPTH 0.5 feet

DATE DRILLED: 02-12-15

DEPTH (FEET)	SYMBOLS FIELD TEST DATA	SOIL DESCRIPTION	SAMPLE No.	N VALUE	N VALUE
30					10 15 20 25 30 35 40 45 50 55 60
35	3/6 3/6 2/6 2/6		14	5	
40	3/6 2/6 2/6 2/6	[MC: 34.6% / -200: 16.0%]	15	4	
45	4/6 4/6 3/6 5/6	Greenish gray fine sand with shell fragments	16	7	
50	7/6 18/6 16/6 17/6	Light gray slightly clayey poorly cemented sand and shell	17	34	
55	6/6 9/6 12/6 21/6		18	21	
60	4/6 5/6 8/6 8/6	Light gray slightly clayey, sandy poorly cemented sand and shell	19	13	

NOTES:

FIELD TEST DATA ARE "BLOWS"/"INCHES DRIVEN"

140-LB HAMMER, 30-INCH FALL.

(ASTM D-1586)

Ardaman & Associates

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Ardaman & Associates, Inc.

STANDARD PENETRATION TEST BORING LOG

BORING SB-08

PROJECT: FPL Okeechobee Clean Energy Center
Okeechobee County, Florida

FILE No.: 15-1624

BORING LOCATION: As per plan

DRILL CREW: IDI

WATER OBSERVED AT DEPTH 0.5 feet

DATE DRILLED: 02-12-15

DEPTH (FEET)	SYMBOLS FIELD TEST DATA	SOIL DESCRIPTION	SAMPLE No.	N VALUE	N VALUE
65	5/6 4/6 5/6 5/6	Light brownish gray slightly clayey fine sand with cemented sand and shell fragments	20	9	
70	2/6 4/6 4/6 4/6	Light gray sandy clay [MC: 37.9% / LL: 42 / PL: 23.6 / PI: 18.4]	21	8	
75	1/6 6/6 6/6 5/6	Light gray clayey fine sand with cemented sand and shell fragments	22	12	
80	3/6 3/6 4/6 6/6	Light grayish brown clayey fine sand with shell fragments	23	7	
85	4/6 5/6 5/6 8/6	Greenish brown slightly clayey fine sand with shell fragments	24	10	
90	3/6 2/6 4/6 4/6	Greenish brown slightly clayey to clayey fine sand with trace of shell fragments	25	6	

NOTES:

FIELD TEST DATA ARE "BLOWS"/"INCHES DRIVEN"

140-LB HAMMER, 30-INCH FALL.

(ASTM D-1586)

Ardaman & Associates

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Ardaman & Associates, Inc.

STANDARD PENETRATION TEST BORING LOG

BORING SB-08

PROJECT: FPL Okeechobee Clean Energy Center
Okeechobee County, Florida

FILE No.: 15-1624

BORING LOCATION: As per plan

DRILL CREW: IDI

WATER OBSERVED AT DEPTH 0.5 feet

DATE DRILLED: 02-12-15

DEPTH (FEET)	SYMBOLS FIELD TEST DATA	SOIL DESCRIPTION	SAMPLE No.	N VALUE	N VALUE
					5 10 15 20 25 30 35 40 45
95		Greenish brown sandy clay [MC: 41.5% / LL: 40.8 / PL: 24.3 / PI: 16.5]	26	6	
100			27	8	
100		Boring terminated at a depth of 100 feet			
105					
110					
115					
120					

NOTES:

FIELD TEST DATA ARE "BLOWS"/"INCHES DRIVEN" 140-LB HAMMER, 30-INCH FALL. (ASTM D-1586)

Ardaman & Associates

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Ardaman & Associates, Inc.

STANDARD PENETRATION TEST BORING LOG BORING PSB-01

PROJECT: FPL Okeechobee Clean Energy Center
Okeechobee County, Florida

FILE No.: 15-1624

BORING LOCATION: As per plan

DRILL CREW: IDI

WATER OBSERVED AT DEPTH 2.0 feet

DATE DRILLED: 02-12-15

DEPTH (FEET)	SYMBOLS FIELD TEST DATA	SOIL DESCRIPTION	SAMPLE No.	N VALUE	N VALUE
					510152025303540
0	1/6	Gray fine sand	1	3	
	1/6	Dark brownish red slightly silty fine sand with small roots			
	2/6	[MC: 23.9% / OC: 3.7%]			
	8/6				
	9/6				
	5/6				
	4/6	Light brownish red fine sand with trace of clay	2	9	
	3/6				
	3/6				
	2/6				
5	4/6	Dark brown slightly clayey fine sand	3	6	
	5/6	[MC: 25.6% / -200: 6.8%]			
	5/6	Dark reddish brown fine sand	4	13	
	6/6				
	7/6				
	9/6				
	6/6	Gray clayey fine sand	5	12	
	6/6	[MC: 20.7% / -200: 14.4%]			
	6/6				
10	8/6				
	7/6	Gray fine sand	6	10	
	6/6				
	4/6				
	4/6				
	3/6		7	5	
	3/6				
	2/6				
	2/6				
15	2/6	Greenish gray clayey fine sand with shell fragments	8	6	
	2/6	[MC: 21.5% / -200: 39.0%]			
	4/6				
	3/6				
	2/6	Greenish gray slightly clayey fine sand with shell fragments	9	8	
	3/6				
	5/6				
20	3/6				
	4/6	Greenish brown slightly clayey fine sand with shell fragments	10	10	
	7/6				
	3/6				
25	3/6				
	2/6	Greenish brown clayey fine sand with shell fragments	11	1	
	1/6	[MC: 33.2% / -200: 24.6%]			
	0/6				
30	1/6				

NOTES: Boring terminated at a depth of 30 feet

FIELD TEST DATA ARE "BLOWS"/"INCHES DRIVEN"

140-LB HAMMER, 30-INCH FALL.

(ASTM D-1586)

Ardaman & Associates

DRAFT



Ardaman & Associates, Inc.

STANDARD PENETRATION TEST BORING LOG

BORING PSB-02

PROJECT: FPL Okeechobee Clean Energy Center
Okeechobee County, Florida

FILE No.: 15-1624

BORING LOCATION: As per plan

DRILL CREW: IDI

WATER OBSERVED AT DEPTH 1.5 feet

DATE DRILLED: 02-12-15

DEPTH (FEET)	SYMBOLS FIELD TEST DATA	SOIL DESCRIPTION	SAMPLE No.	N VALUE	N VALUE
0					5 10 15 20 25 30 35 40 45
0	2/6 2/6 2/6 1/6 1/6 1/6 2/6 3/6 3/6 6/6 8/6 10/6	Light reddish brown fine sand with trace of clay	1	4	
5	2/6 3/6 3/6 6/6 8/6 10/6 2/6 2/6 5/6 6/6 6/6 7/6 8/6 5/6 6/6 6/6 5/6 4/6 4/6 4/6 5/6 3/6 3/6 5/6	Dark brownish red slightly silty fine sand [MC: 29.4% / -200: 8.6%]	2	3	
		Light grayish brown fine sand with trace of clay	3	14	
		Light grayish brown fine sand	4	7	
10		Light brown fine sand	5	13	
			6	12	
		Gray fine sand	7	8	
			8	6	
15			9	5	
20			10	3	
25	2/6 2/6 1/6 1/6 4/6 4/6 3/6 2/6	Greenish gray clayey fine sand with shell fragments [MC: 34.2% / -200: 17.9%]	11	7	
30					

NOTES: Boring terminated at a depth of 30 feet

FIELD TEST DATA ARE "BLOWS"/"INCHES DRIVEN"

140-LB HAMMER, 30-INCH FALL.

(ASTM D-1586)

Ardaman & Associates



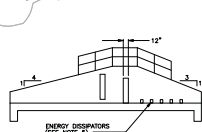
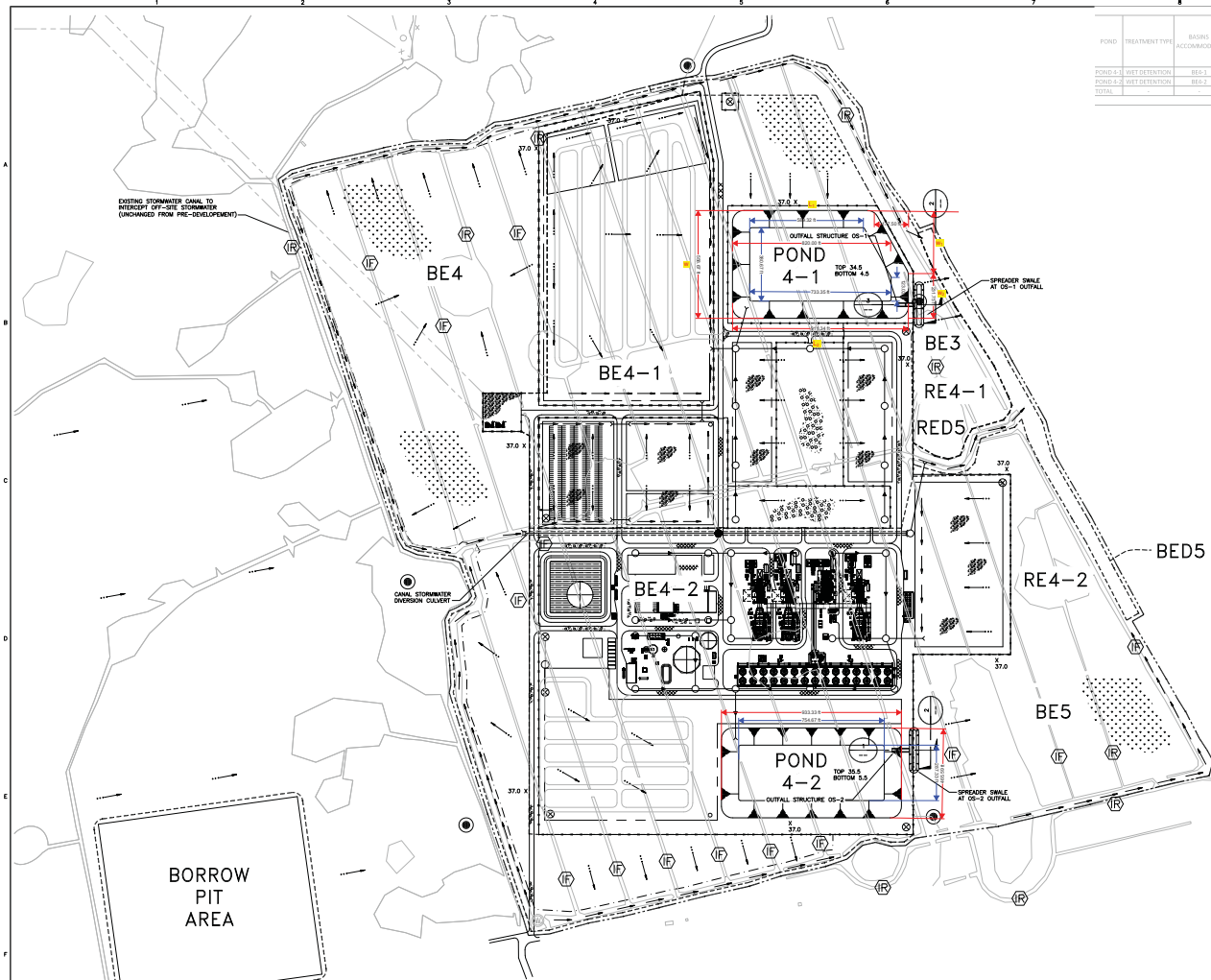
BLACK & VEATCH

Client	FPL		
Project	Okeechobee Energy Center	Unit	-
Project No.	185922	File No.	58.5406.1105.02
Title	Dewatering Design for the Oil Water Separator and Cooling Tower Sump Pit Excavation		

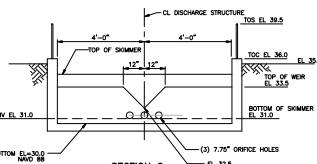
Computed By	WT		
Date	04/10/2015		
Verified By			
Date			
	# of Pages	3	
Rev.	0		

Attachment B

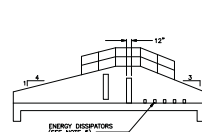
Drawings (Ref. 4 and 5)



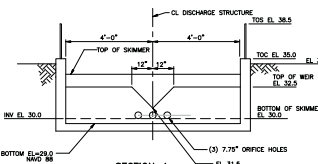
SECTION 1
NO SCALE
SEE THIS DWG



SECTION 2
NO SCALE
SEE THIS DWG



SECTION 3
NO SCALE
SEE THIS DWG



SECTION 4
NO SCALE
SEE THIS DWG

POST DEVELOPMENT STORM WATER PONDS											
POND	TREATMENT TYPE	BASINS ACCOUNTED	AREA TREATED		BASIN AREA & PERCENT SURFACING BREAKDOWN		TREATED VOLUME REQUIRE (CFS)	TREATMENT VOLUME PROVIDED		TOP EL.	BOTTOM EL.
			ACRE	PERCENT	ACRE	PERCENT		AC-FT	AC-FT		
POND 4-1	VEGETATION	BE4-1	10.0	100%	10.0	100%	7.88	10.0	10.0	34.5	30.0
POND 4-2	VEGETATION	BE4-2	10.0	100%	10.0	100%	7.88	10.0	10.0	34.5	30.0
TOTAL			20.0	200%	20.0	200%	15.76	20.0	20.0	34.5	30.0

POST DEVELOPMENT PROJECT UNITS SURFACING SUMMARY											
SUB AREA	TOTAL AREA	PERCENT OF TOTAL		PERCENT OF TOTAL		PERCENT OF TOTAL		PERCENT OF TOTAL		PERCENT OF TOTAL	
		ACRE	PERCENT	ACRE	PERCENT	ACRE	PERCENT	ACRE	PERCENT	ACRE	PERCENT
BE4-1	10.0	10.0	100%	10.0	100%	10.0	100%	10.0	100%	10.0	100%
BE4-2	10.0	10.0	100%	10.0	100%	10.0	100%	10.0	100%	10.0	100%
BE4-3	10.0	10.0	100%	10.0	100%	10.0	100%	10.0	100%	10.0	100%
BE4-4	10.0	10.0	100%	10.0	100%	10.0	100%	10.0	100%	10.0	100%
BE4-5	10.0	10.0	100%	10.0	100%	10.0	100%	10.0	100%	10.0	100%
BE4-6	10.0	10.0	100%	10.0	100%	10.0	100%	10.0	100%	10.0	100%
BE4-7	10.0	10.0	100%	10.0	100%	10.0	100%	10.0	100%	10.0	100%
BE4-8	10.0	10.0	100%	10.0	100%	10.0	100%	10.0	100%	10.0	100%
BE4-9	10.0	10.0	100%	10.0	100%	10.0	100%	10.0	100%	10.0	100%
BE4-10	10.0	10.0	100%	10.0	100%	10.0	100%	10.0	100%	10.0	100%

NOTE: SURFACING SURFACES TO BE MAINTAINED WITHIN THE DEVELOPMENT CONTOUR. NO ADJUSTMENT TO EXISTING STORMWATER SYSTEM IS REQUIRED.

- NOTES**
- ELEVATIONS ARE REPORTED AS MSL.
 - EXISTING STORMWATER CANAL DOES NOT CONTRIBUTE STORM WATER RUNOFF TO STORM WATER MANAGEMENT SYSTEM.
 - WETLANDS SHOWN ON THESE DRAWINGS ARE FOR REFERENCE ONLY.
 - ALL AREAS WITHIN LOOP ROAD OF EQUIPMENT AND BUILDING AREAS TO BE AGGREGATE SURFACED. ALL OTHER AREAS NOT INDICATED WITH SURFACING SHALL BE RESEED/GRASSED WITH BIVALVA.
 - ENERGY DISSIPATORS TO BE DESIGNED BY EPIC CONTRACTOR TO NON-EROSIVE DISCHARGE VELOCITIES.

- LEGEND**
- DISTURBED AREA LIMITS
 - - - BASIN CHANCE
 - - - TEMPORARY CONSTRUCTION FENCE
 - - - SECURITY FENCE
 - CATCH BASIN
 - MANHOLE
 - STORM SEWER SYSTEM
 - SURFACE FLOW INDICATOR
 - DITCH FLOW INDICATOR
 - CULVERT
 - IF IRRIGATION CANAL TO BE FILLED
 - IF IRRIGATION CANAL TO REMAIN
 - CONTAINMENT AREA W/GEOMEMBRANE LINER (SEE NOTE 2)
 - WETLANDS
 - ASPHALT
 - AGGREGATE
 - CRUSHED GRANITE
 - GRASS

NOT TO BE USED FOR CONSTRUCTION

THE DISTRIBUTION AND USE OF THE NATURE FORMAT CAD FILE OF THIS DRAWING IS UNCONTROLLED. THE USER SHALL VERIFY THE ACCURACY OF THIS DRAWING TO THE LATEST CONTROLLED VERSION.

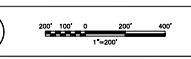
FLORIDA POWER & LIGHT
OKEECHOBEE ENERGY CENTER
PROPOSED STORMWATER
MANAGEMENT PLAN

PROJECT NUMBER: 185922-DS-1104
DRAWING NUMBER: 185922-DS-1104
CODE: AREA
REFERENCE: SEE NUMBER

DATE: 02/04/2015
DESIGNED BY: [Signature]
CHECKED: [Signature]

18.5x 11.5 (11.5x 17.5)
02/04/2015 09:34:47
JMS/785

NO.	DATE	DESCRIPTION	BY	CHKD.	APP'D.
1	02/04/2015	DESIGNED FOR CLIENT REVIEW	JMS	JMS	JMS
2	02/04/2015	REVISION AND RECORD OF ISSUE	JMS	JMS	JMS





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Client	FPL		
Project	Okeechobee Energy Center	Unit	-
Project No.	185922	File No.	58.5406.1105.02
Title	Dewatering Design for the Oil Water Separator and Cooling Tower Sump Pit Excavation		

Computed By	WT		
Date	04/10/2015		
Verified By			
Date			
	# of Pages	4	
Rev.	0		

Attachment C
Email (Ref. 6)

Tu, Wei

From: Barranco Jr., John
Sent: Monday, April 06, 2015 3:31 PM
To: Tu, Wei
Cc: Liljegren, James; Christensen, Brian; Jankauskaite, Orinta; Williams, Steven J. (Civil/Structural)
Subject: RE: 185992 FPL Okeechobee Energy Center - Dewatering Calculations
Attachments: 185922-1GAU-G1001-Dewatering Markup.pdf

Wei,

As requested, attached is a markup of the arrangement with the limits of each of the excavation areas. I also annotated in blue the existing elevations across the site. It is generally a single elevation between each irrigation canal finger as annotated.

TOC = 38.0'
Road Elevation Crown = 37.5'
Nominal Site Grade = 37'

Thanks,

JOHN C BARRANCO, JR., P.E.* | Civil/Structural Section Lead - Jacksonville, Energy
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From: Barranco Jr., John
Sent: Thursday, April 02, 2015 4:05 PM
To: Tu, Wei
Cc: Liljegren, James; Christensen, Brian; Jankauskaite, Orinta; Williams, Steven J. (Civil/Structural)
Subject: RE: 185992 FPL Okeechobee Energy Center - Dewatering Calculations

Wei,

The Excavations depths are listed in my initial email below. We will markup the limitations of the excavations on the site drawing. For the Site Certification Application (SCA) that is our current scope, we are not required to produce Grading drawings with contours, but we did determine final nominal site elevations and have indicated this on the "Post Development Stormwater Plan"; which we are finishing up for review today. We will pass along this drawing to you as well. This drawing is overlaid in the site model on the existing contours, but not included on the drawing; therefore we will also send you the AutoCAD model file.

In addition to equipment/foundation excavations, we are also digging approximately 30' deep ponds and a 15' deep borrow pit. The ponds are being dug to those depths to obtain the borrow material needed for the site in addition to the borrow pit. I assume we would need to dewater the ponds/pit to obtain the borrow material, unless you can recommend a process that we can effectively excavate the ponds/pits in the wet and allow the material to drain before placing.

Thanks,

JOHN C BARRANCO, JR., P.E.* | Civil/Structural Section Lead - Jacksonville, Energy

Black & Veatch | 12740 Gran Bay Parkway West - Suite 2140, Jacksonville, FL 32258
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From: Tu, Wei
Sent: Thursday, April 02, 2015 3:18 PM
To: Barranco Jr., John
Cc: Liljegren, James; Christensen, Brian
Subject: 185992 FPL Okeechobee Energy Center - Dewatering Calculations

John,
I am tasked to complete these dewatering calculations. Can you please provide the following information as dewatering design input?

- dimensions for each excavation at the base (length and width)
- depth of each excavation below the final grade
- existing and final grade elevation for each excavation (site grading drawing)

Thanks,
-Wei

From: Barranco Jr., John
Sent: Tuesday, March 24, 2015 12:18 PM
To: Liljegren, James
Cc: Christensen, Brian
Subject: RE: 185992 FPL Okeechobee Energy Center - Dewatering Calculations

Okay, I will buy us some time.

From: Liljegren, James
Sent: Tuesday, March 24, 2015 12:16 PM
To: Barranco Jr., John
Cc: Christensen, Brian
Subject: RE: 185992 FPL Okeechobee Energy Center - Dewatering Calculations

John,

Can we get the due date moved back another week? Due to staffing, meeting the April 2nd date will be challenging.

Jim

From: Barranco Jr., John
Sent: Thursday, March 19, 2015 3:02 PM
To: Liljegren, James
Cc: Jankauskaite, Orinta; Bergt, Gene E.; Christensen, Brian
Subject: 185992 FPL Okeechobee Energy Center - Dewatering Calculations

Jim,

We need to have dewatering calculations, conceptual design sketches, and associated short write-up developed for the FPL Okeechobee Energy Center project to support the SCA. Similar to what was produced for the FPL Fort Myers Simple Cycle ERP. FPL is requesting this to be completed by April 2, 2015. We are working on finalizing the site elevation, and should have this by beginning of next week to support the dewatering calcs.

In addition to the site elevation and excavation depths, please let me know what else you need to support the dewatering development.

Excavations:

Circ Water: Above Grade on Sleepers (Not Dewatering Required)

Bathtub Excavation: 5' below TOC

Power Block U/G Excavations: up to 12 ' below TOC

OWS: 18' below TOC

Cooling Tower Pump Pit: 15' below TOC

Pipeline Routes from UIC Well/Makeup Wells: 5' below grade

Water Treatment Area U/G Foundation Excavations: Geotech Determined**

Water Treatment Area U/G Utility Excavations: 6' below TOC

Admin/Warehouse/Fabrication Bldg Area Foundation Excavations: Geotech Determined**

Admin/Warehouse/Fabrication Bldg Area U/G Utility Excavations: Geotech Determined: 6' below TOC

Fuel Oil Storage Tank Foundation Excavation: Geotech Determined **

**I assume the Building Areas , Water Treatment, and FO Tank Areas will be built up enough that the dewatering will not be required for these building foundations, but please verify base off the final site elevation we will provide you.

Thanks,

JOHN C BARRANCO, JR., P.E.* | Civil/Structural Section Lead - Jacksonville, Energy

Black & Veatch | 12740 Gran Bay Parkway West - Suite 2140, Jacksonville, FL 32258

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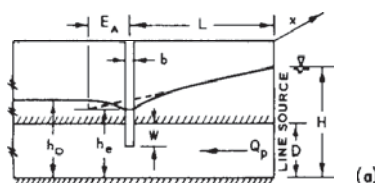
Client	FPL		
Project	Okeechobee Energy Center	Unit	-
Project No.	185922	File No.	58.5406.1105.02
Title	Dewatering Design for the Oil Water Separator and Cooling Tower Sump Pit Excavation		

Computed By	WT		
Date	04/10/2015		
Verified By			
Date			
	# of Pages	10	
Rev.	0		

Attachment D

Selected excerpt from References (Ref. 2-3 and 8)

Ref. 2



(a)

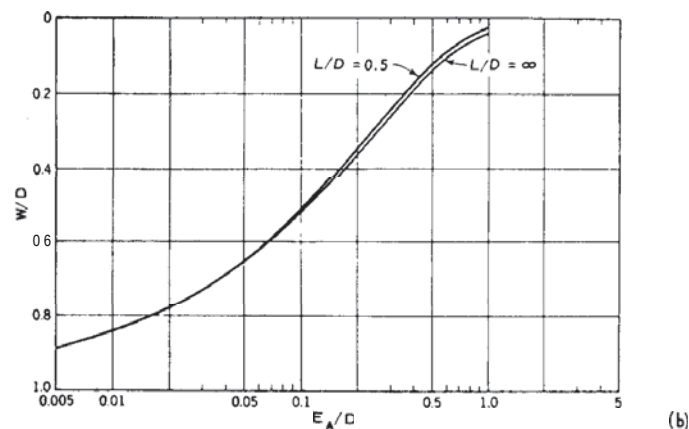
FLOW

$$Q_p = \frac{kDx(H - h_e)}{L + E_A} \quad (1)$$

MAX RESIDUAL HEAD DOWNSTREAM OF SLOT

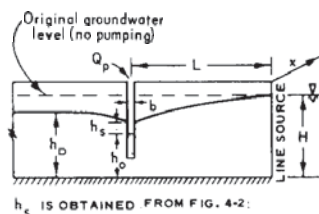
$$h_o = \frac{E_A(H - h_e)}{L + E_A} + h_e \quad (2)$$

WHERE E_A IS AN ADDITIONAL LENGTH FACTOR OBTAINED FROM THE FIGURE BELOW



(b)

ARTESIAN FLOW



(c)

h_s IS OBTAINED FROM FIG. 4-2:

FLOW

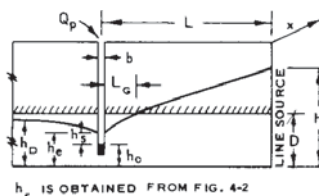
$$Q_p = \left(0.73 + 0.27 \frac{H - h_o}{H} \right) \frac{kx}{2L} (H^2 - h_o^2) \quad (3)$$

MAX RESIDUAL HEAD DOWNSTREAM OF SLOT

$$h_o = h_s \left[\frac{1.48}{L} (H - h_o) + 1 \right] \quad (4)$$

WHERE $L \geq 3H$

GRAVITY FLOW



(d)

h_s IS OBTAINED FROM FIG. 4-2:

FLOW

$$Q_p = \frac{kDx(H - D)}{L - L_g} \quad (5)$$

MAX RESIDUAL HEAD DOWNSTREAM OF SLOT+

$$h_o = h_s \left[\frac{1.48}{L_g} (D - h_o) + 1 \right] \quad (6)$$

PROVIDED $h_o \leq D$; $L_g \geq 3D$

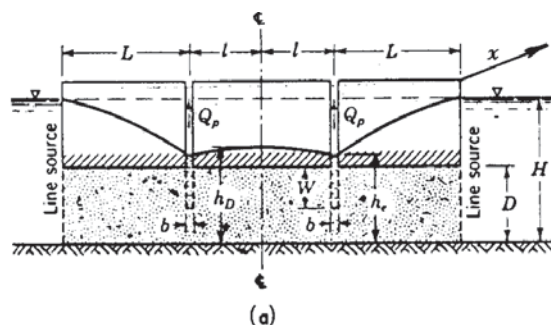
$$\text{WHERE } L_g = \frac{L(D^2 - h_o^2) \left(0.73 + 0.27 \frac{D - h_o}{D} \right)}{2D(H - D) + (D^2 - h_o^2) \left(0.73 + 0.27 \frac{D - h_o}{D} \right)} \quad (7)$$

COMBINED ARTESIAN AND GRAVITY FLOWS

(Modified from "Foundation Engineering," G. A. Leonards, ed., 1962, McGraw-Hill Book Company. Used with permission of McGraw-Hill Book Company.)

Figure 4-3. Flow and head for partially penetrating line slot; single-line source; artesian, gravity, and combined flows.

A FREQUENTLY ENCOUNTERED **DEWATERING** SYSTEM IS ONE WITH TWO LINES OF PARTIALLY PENETRATING WELLPOINTS ALONG EACH SIDE OF A LONG EXCAVATION, WHERE THE FLOW CAN BE ASSUMED TO ORIGINATE FROM TWO EQUIDISTANT LINE SOURCES.



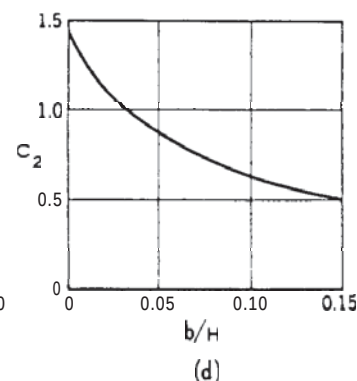
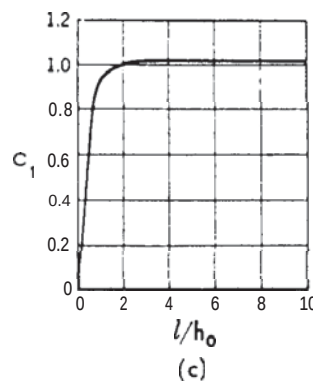
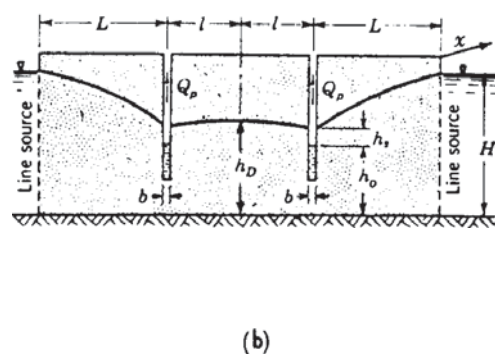
FLOW

FLOW FOR EACH SLOT CAN BE ESTIMATED AS FOR ONE SLOT WITH ONE LINE SOURCE, EQ 1 FIG. 4-3.

$$h_D^\dagger$$

VALUE OF h_D CAN BE ESTIMATED AS FOR ONE SLOT AND ONE LINE SOURCE, EQ 2, FIG. 4-3.

ARTESIAN FLOW



FLOW

FLOW TO EACH SLOT APPROXIMATELY THAT ONE SLOT WITH ONE LINE SOURCE, EQ 3, FIG. 4-3.

$$h_D^\dagger$$

$$h_D = h_o \left[\frac{C_1 C_2}{L} (H - h_o) t_1 \right] \quad (1)$$

WHERE C_1 AND C_2 ARE OBTAINED FROM FIG.(c) AND (d) ABOVE.

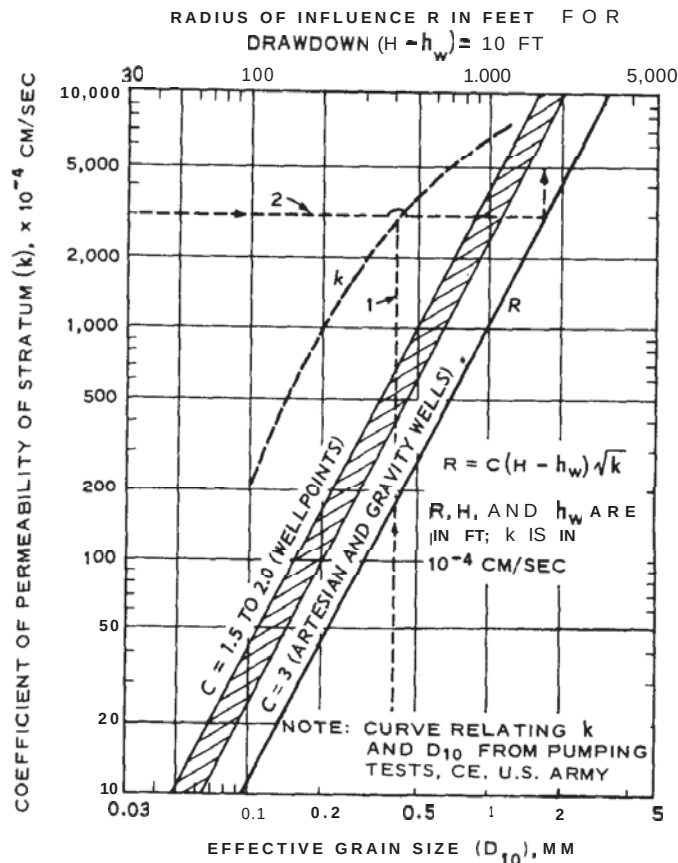
GRAVITY FLOW

t MAXIMUM RESIDUAL HEAD MIDWAY BETWEEN THE TWO SLOTS

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Figure 4-5. Flow and head (midway) for two partially penetrating slots; two-line source; artesian and gravity flows,

TM 5-818-5/AFM 88-5, Chap 6/NAVFAC P-418



1. R DETERMINED WHEN ONLY D_{10} IS KNOWN.
2. R DETERMINED WHEN k IS KNOWN.

RADIUS OF INFLUENCE, R , CAN BE ESTIMATED FOR BOTH ARTESIAN AND GRAVITY FLOWS BY

$$R \approx C (H - h_w) \sqrt{k} \quad (1)$$

WHERE R , H , AND h_w ARE DEFINED PREVIOUSLY AND EXPRESSED IN FEET. COEFFICIENT OF PERMEABILITY, k , IS EXPRESSED IN 10^{-4} CM/SEC.

AND $C \approx 3$ FOR ARTESIAN AND GRAVITY FLOWS TO A WELL.

$C \approx 1.5$ TO 2.0 FOR A SINGLE LINE OF WELLPOINTS.

THE VALUE OF R FOR $(H - h_w) \approx 10$ FT CAN BE DETERMINED FROM THE PLOT HEREIN WHEN EITHER THE D_{10} SIZE OR PERMEABILITY OF THE MATERIAL IS KNOWN. THE VALUE OF R WHEN $(H - h_w) \neq 10$ CAN BE DETERMINED BY MULTIPLYING THE R VALUE OBTAINED FROM THE PLOT BY THE RATIO OF THE ACTUAL VALUE OF $(H - h_w)$ TO 10 FT.

A DISCUSSION ON THE DETERMINATION OF R FROM EQ 1 AND PUMPING TESTS IS CONTAINED IN PARAGRAPH 4-2a(3) OF THE TEXT.

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Figure 4-23. Approximate radius of influence R .

(b) Head losses in the screened section of a well H_s are calculated from figure 4-24b. This head loss is based on equal inflow per unit of screen surface and turbulent flow inside the well and is equivalent to the entire well flow passing through one-half the screen length. Other head losses can be determined directly from figure 4-24. Hydraulic head loss within a well-point system can be estimated from figure 4-25. As stated in a(4) above, flow into a well can be impeded by the lack of "wetted screen length," in addition to hydraulic head losses in the filter or through the screens and/or chemical or mechanical clogging of the aquifer and filter.

b. Flow to a drainage slot.

(1) *Line drainage slots.* Equations presented in figures 4-1 through 4-5 can be used to compute flow and head produced by pumping either a single or a double continuous slot of infinite length. These equations assume that the source of seepage and the drainage slot are infinite in length and parallel and that seepage enters the pervious stratum from a vertical line source. In actuality, the slot will be of finite length, the flow at the ends of the slot for a distance of about $L/2$ (where L equals distance between slot and source) will be greater, and the drawdown will be less than for the central portion of the slot. Flow to the ends of a fully penetrating slot can be estimated, if necessary, from flow-net analyses subsequently presented.

Ref. 3

3.5 PERMEABILITY / 41

TABLE 3.4 Range of Permeabilities of Natural Soils

Description	Permeability (μ /sec)
Openwork gravel (GP)	10,000 or higher
Uniform gravel (GP)	2,000–10,000
Well graded gravel (GW)	500–3,000
Uniform sand (SP)	50–2,000
Well graded sand (SW)	10–1,000
Silty sand (SM)	10–50
Clayey sand (SC)	1–10
Silt (ML)	0.5–1.0
Clay (CL)	0.1–0.0001

migration of contaminant plumes. The very high permeabilities shown for open work gravels can produce enormous water quantities, but fortunately their occurrence is rare. We can say that the great majority of dewatering problems concern soils in the range of 10–10,000 μ /sec. At three orders of magnitude, the range is quite enough.

Permeability of soil samples can be measured in the laboratory by permeameters (9). Permeability of granular soils can be estimated from mechanical analysis curves by empirical methods. Hazen (34) relates permeability (k) to the D_{10} size of the soil from grain size curves, in millimeters:

$$K = 2(100 D_{10})^2 \text{ gpd/ft}^2 \quad (\text{U.S.}) \quad (3.10)$$

$$K = (100 D_{10})^2 \mu/\text{sec} \quad (\text{METRIC}) \quad (3.11)$$

The results obtained from the Hazen relationship can be reasonable approximations if the samples are representative. But not always. There are inherent flaws in Hazen, in that the uniformity and density of the soils are not considered. A well graded soil will have a lower permeability than a uniform soil of the same D_{10} . A dense soil will have lower permeability than a loose one of the same grain size distribution.

By a combination of laboratory and field investigation, Byron Prugh developed a previously unpublished method for estimating permeability based on mechanical analysis and *in situ* density. Figure 3.4 shows the results of Prugh's work.

From a mechanical analysis such as that illustrated in Fig. 3.1a, the D_{50} and C_u of the sample are determined. The *in situ* density is estimated from blow counts (Table 3.7). One of the three charts in Fig. 3.4 is selected as representative of the density, and the estimated permeability can be read off.

The estimated permeabilities shown in Fig. 3.4 have in the author's experience given good results if the samples selected for analysis are representative as discussed in Section 3.2.

When estimating permeability from grain size distribution, we must rec-

TABLE 4.2 Constants for Jacob Plot Calculations

	U.S. Units	Type 1 Metric $K = \mu/\text{sec}$	Conversion to U.S.: Multiply Metric by	Type 2 Metric $K = \text{m/day}$	Conversion to U.S.: Multiply Metric By
Transmissibility T From $\delta/\log t$ plot	$T = \frac{264 Q}{\Delta \delta}$	$\frac{3055 Q}{\Delta \delta}$		$\frac{0.183 Q}{\Delta \delta}$	
From $\delta/\log r$ plot	$T = \frac{528 Q}{\Delta \delta}$	$\frac{6110 Q}{\Delta \delta}$		$\frac{0.366 Q}{\Delta \delta}$	
Storage coefficient C_s From $\delta/\log t$ plot	$C_s = \frac{T t_0}{4790 r^2}$	$\frac{T t_0}{7401 r^2}$		$\frac{T t_0}{640 r^2}$	
From $\delta/\log r$ plot	$C_s = \frac{T t}{4790 R_0^2}$	$\frac{T t}{7401 R_0^2}$		$\frac{T t}{640 R_0^2}$	
where Q = well discharge	gpm	m^3/min	264	m^3/day	0.183
T = transmissibility	gpd/ft	$\text{m}\mu/\text{sec}$	6.95	m^2/day	80.52
K = permeability	gpd/ft ²	μ/sec	2.13	m/day	24.53
t = time	min	min	—	min	—
t_0 = zero drawdown Intercept	min	min	—	min	—
r = distance to observation well	ft	m	3.28	m	3.28
R_0 = zero drawdown intercept	ft	m	3.28	m	3.28
δ = drawdown	ft	m	3.28	m	3.28
$\Delta \delta$ = drawdown difference per log cycle	ft	m	3.28	m	3.28

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For the water table aquifer of Fig. 6.6b,

$$\frac{Q}{x} = \frac{K(H^2 - h^2)}{2L} \quad (6.9)$$

Section 6.5 discusses the use of the drainage trench Eqs. (6.8) and (6.9) in analyzing long narrow dewatering systems.

6.5 THE SYSTEM AS A WELL: EQUIVALENT RADIUS r_s

Many problems can be analyzed by assuming the entire system acts as a single large well of radius r_s . The assumption is of greatest validity with a circular system of closely spaced wells, as in Fig. 6.7a. Rectangular systems as in Fig. 6.7b are assumed to act as a circular system of the same enclosed area:

$$r_s = \sqrt{\frac{ab}{\pi}} \quad (6.10)$$

Some analysts prefer to consider a rectangular system to act as a circular system with the same perimeter:

$$r_s = \frac{a + b}{\pi} \quad (6.11)$$

Either Eq. (6.10) or (6.11) gives satisfactory approximations when the wells are spaced closely, when R_0 is great in relation to r_s , and when the ratio a/b is less than about 1.5. If the wells are widely spaced, the actual Q will be significantly higher than that estimated for the equivalent well.

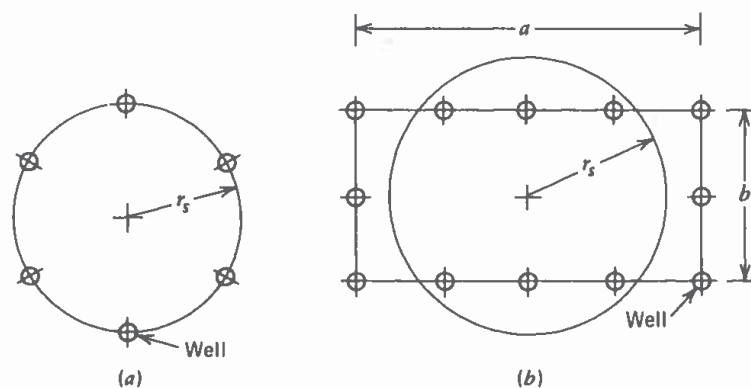


Figure 6.7 Approximation of equivalent radius r_s . (a) Circular systems. (b) Rectangular systems.

6.6 RADIUS OF INFLUENCE R_0 / 103

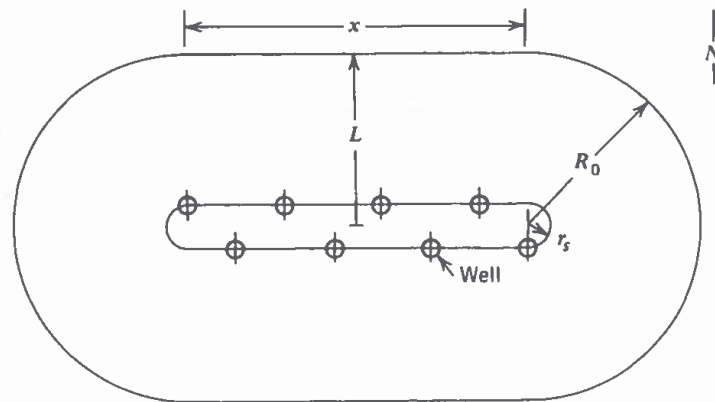


Figure 6.8 Approximate analysis of long narrow systems.

If the system contains only a few widely spaced wells, or if R_0 is small, then the system should probably be analyzed by the method of cumulative drawdowns, discussed in Section 6.12 or by a groundwater model (Chapter 7).

For long, narrow systems where the ratio a/b is large, a combined mathematical model can be constructed, using both Eqs. (6.3) and (6.9). Figure 6.8 shows such a system of closely spaced wells for dewatering a trench excavation of length x . The wells are staggered at a distance r_s from the center of the trench. The northward and southward flow from the line sources at distance L can be approximated from the trench Eq. (6.9). However, Eq. (6.9) assumes a drainage trench of infinite length. Since the length of the actual system is finite, the end effects must be considered. This can be done by assuming that at each end of the system, there is a flow equal to one half the flow to a circular well of radius r_s . The total flow to the system may be approximated by adding Eqs. (6.3) and (6.9).

$$Q = \frac{\pi K (H^2 - h^2)}{\ln R_0/r_s} + 2 \left[\frac{xK (H^2 - h^2)}{2L} \right] \quad (6.12)$$

While the total Q from this model is usually a reliable approximation, it is obvious that the wells at the ends will pump more than those in the center, if spacing is constant. In practice, such systems are leapfrogged as the trench excavation continuously progresses, so a given well will at times be anywhere in the system. It is good practice therefore to design each well and its pump for the high capacity it will yield when near the end of the system.

6.6 RADIUS OF INFLUENCE R_0

The equivalent radius of influence R_0 that appears in Eqs. (6.1)–(6.5) is a mathematical convenience. As discussed in Section 5.3, the sum of the re-

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charge to the aquifer is assumed to create an effect similar to that of a constant source on a vertical cylindrical surface at R_0 . Thus the concept is to a degree nebulous. Because R_0 appears as a log function in Eqs. (6.1)–(6.4), precision in estimating it is not necessary when analyzing a well. However, in Eqs. (6.8) and (6.9) the distance to the line source L (a similar concept to R_0) is proportional to Q . We have seen R_0 vary from 100 to 100,000 ft (30 to 30,000 m) on various projects. The literature cites instances of even greater magnitude. So the possibility of gross error exists.

The most reliable means of estimating R_0 is by Jacob analysis of a pumping test, as described in Chapter 9. Only this method will reveal recharge from other aquifers, and the degree of connection with surface water bodies. It is necessary also to extrapolate from the conditions existing during the pumping test to others that may occur within the life of the dewatering system. We have seen the Q of a dewatering system increase by 20, 40, or even 100% during high river stages, particularly when accompanied by inundation of large surface areas (Section 5.3).

Lacking a pumping test, it is necessary to make rough approximations of R_0 from topography and areal geology, or from estimated aquifer parameters. In an ideal aquifer, without recharge, R_0 is a function of the transmissibility, the storage coefficient and the duration of pumping. By adapting the Jacob formula [Eq. (4.5)], we can estimate the order of magnitude of R_0 , without recharge as follows:

$$R_0 = r_s + \sqrt{\frac{Tt}{C_4C_s}} \quad (6.13)$$

Units to be used in this equation are given in Table 4.2. The value for pumping time t is selected from schedule or cost considerations regarding the time available to accomplish the result.

The value computed for R_0 by Eq. (6.13) should be adjusted downward on the basis of judgments as to possible recharge. Equation (6.13) is valid only for confined aquifers, but results obtained for water table aquifers are reasonable. It is apparent from Eq. (6.13) that R_0 computed for a typical confined aquifer ($C_s = 0.001$) will be some 14 times greater than that in a typical water table aquifer ($C_s = 0.2$), with the same transmissibility, pumped for the same time. Experience confirms that very large values for R_0 are typical of confined aquifers.

An empirical relationship developed by Sichart and Kyrieleis (72) gives R_0 as a function of drawdown $H - h$ and K :

$$R_0 = 3(H - h) \sqrt{K} \quad (6.14)$$

where $H - h$ is in feet and K is in microns per second. Theoretically R_0 is independent of drawdown, and is related to pumping time, which does

Ref. 8

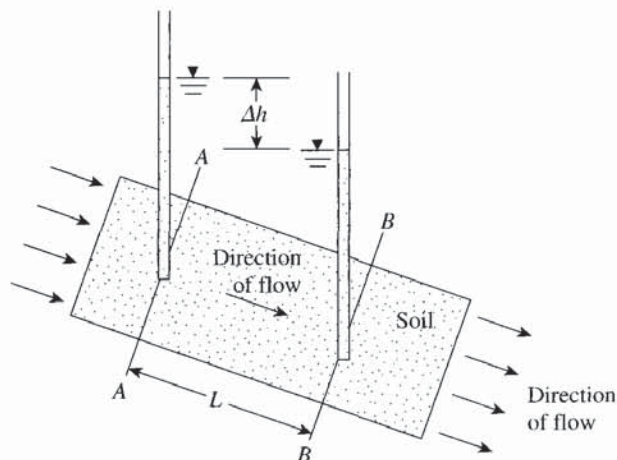


Figure 1.9 Definition of Darcy's law

1.9

Table 1.7 Range of the Hydraulic Conductivity for Various Soils

Type of soil	Hydraulic conductivity, k (cm/sec)
Medium to coarse gravel	Greater than 10^{-1}
Coarse to fine sand	10^{-1} to 10^{-3}
Fine sand, silty sand	10^{-3} to 10^{-5}
Silt, clayey silt, silty clay	10^{-4} to 10^{-6}
Clays	10^{-7} or less

Darcy's law [Eq. (1.24)] is valid for a wide range of soils. However, with materials like clean gravel and open-graded rockfills, the law breaks down because of the turbulent nature of flow through them.

The value of the hydraulic conductivity of soils varies greatly. In the laboratory, it can be determined by means of *constant-head* or *falling-head* permeability tests. The constant-head test is more suitable for granular soils. Table 1.7 provides the general range for the values of k for various soils. In granular soils, the value depends primarily on the void ratio. In the past, several equations have been proposed to relate the value of k to the void ratio in granular soil.

However the author recommends the following equation for use (also see Carrier, 2003):

$$k \propto \frac{e^3}{1 + e} \quad (1.26)$$

where

k = hydraulic conductivity

e = void ratio

More recently, Chapuis (2004) proposed an empirical relationship for k in conjunction with Eq. (1.26) as

$$k \text{ (cm/s)} = 2.4622 \left[D_{10}^2 \frac{e^3}{(1 + e)} \right]^{0.7825} \quad (1.27)$$

where D = effective size (mm).



Client Name: FPL Page 1 of 20

Project Name: Okeechobee Energy Center Project No.: 185922

Calculation Title: Dewatering Design for the Underground Utility Corridors Trench Excavation

Calculation No./File No.: 58.5406.1105.03

Verification Method: ☒ Check and Review ☐ Alternate Calculations

Objective To determine site dewatering requirements for reducing groundwater levels to 2 feet below the base of excavation of the Underground Utility Corridors.

Unverified Assumptions Requiring Subsequent Verification

No.	Assumption	Verified By	Date

Refer to Page _____ of this calculation for additional assumptions.

This Section Used for Software-Generated Calculations

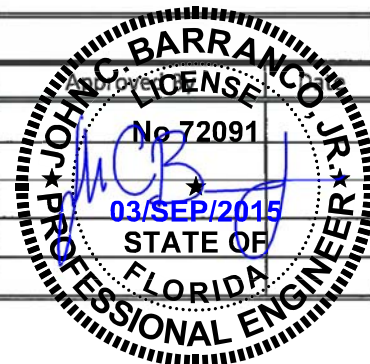
Program Name/Number: MathCAD Version: 15.0

Standard B&V Application Used? ☐ Yes ☐ No

If no, list approved deviation permit number below and attach approved deviation permit.

Review and Approval

Rev	Prepared By	Date	Verified By	Date
0	Wei Tu <i>Wei Tu</i>	04/23/15	<i>J. Liljegren</i> <i>J. Liljegren</i>	4/23/15





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Title: Dewatering Design for the
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Excavation

Prepared by: W Tu
Date: 04/23/2015
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Page No. 2 of 20
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1.0 Purpose

To determine site dewatering requirements for reducing groundwater levels to 2 feet below the base of excavation for Underground Utility Corridors.

2.0 Reference

1. Ardaman & Associates, Inc., Draft Report - SUBSURFACE EXPLORATION FLORIDA POWER & LIGHT OKEECHOBEE CLEAN ENERGY CENTER OKEECHOBEE COUNTY, FLORIDA, Mar-02-2015;
2. Department of the Army, the Navy and the Air Force, Army TM 5-818-5, Navy NAVFAC P-418, , Air Force AFM 88-5, Chap. 6, "Dewatering and Groundwater Control", November 1983;
3. Powers, J. P., "Construction Dewatering - A Guide to Theory and Practice", 2nd Ed., John Wiley & Sons, 1992;
4. B&V calculation record, 185922.585406.1105.01, Rev0;
5. BV drawing, 185922-1GAU-1001, Florida Power & Light, Okeechobee Energy Center, Site Arrangement, Rev. 1;
6. BARRANCO, J., email communication, subject: RE: 185992 FPL Okeechobee Energy Center - Dewatering Calculations, Sent Fri 4/10/2015 2:50 PM.
7. Hart, T., verbal communication, Apr-23-2015.

3.0 Design Basis

- In situ hydraulic conductivity of soil based on consideration of slug test results in Ref. 1 and empirical correlations in Ref. 3 and 8;
- Dimensions of the excavation based on Ref. 5 and 6;
- Design of dewatering system based on References 2 and 3.
- Use 500ft of trench dewatering segment per Ref. 7.

4.0 Definition of Units and Constants

US Custom

$$\text{pcf} = \frac{\text{lb}_f}{\text{ft}^3} \quad \text{psf} = \frac{\text{lb}_f}{\text{ft}^2} \quad \text{ksf} = 1000\text{psf} \quad \text{tsf} = 2000\text{psf} \quad \text{ksi} = 1000\text{psi} \quad \text{ton} = 2000\text{lb}_f \quad \text{pci} = \frac{\text{lb}_f}{\text{in}^3} \quad \text{gpd} = \frac{\text{gal}}{\text{day}}$$

$$\text{dpt} = 0.5506\text{L} \quad (\text{dry pint}) \quad \text{lpt} = 1.164\text{dpt} \quad (\text{liquid pint})$$

$$\text{Unit weight of water: } \gamma_w = 62.4\text{pcf}$$

SI

$$\text{kPa} = 10^3\text{Pa} \quad \text{MPa} = 10^6\text{Pa} \quad \text{GPa} = 1000\text{MPa} \quad \text{kN} = 10^3\text{newton} \quad \text{TN} = 10^3\text{kgf} \quad \text{tsm} = \frac{\text{TN}}{\text{m}^2}$$

$$\text{Atmosphere pressure: } P_a = 100\text{kPa} \quad \text{Concrete unit weight: } \gamma_c = 24 \frac{\text{kN}}{\text{m}^3}$$

$$\text{Set ORIGIN to 1 according to customary usage: } \text{ORIGIN} = 1$$



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5.0 Symbols and Acronyms

SPT	Standard penetration test
k_h, k	horizontal permeability and permeability (cm/s)
GWT	Groundwater
El, Elev	Elevation (ft)
w_N	Natural moisture content (%)
D_{10}	The particle size that passing 10% per weight (mm)
Gs	Specific gravity
e	Void ratio
w, L	Width and Length of base of the excavation (ft)
b, a	Width and length of the rectangular wellpoints system (ft)
L or R	Influence radius of wellpoints slot (ft)
Q	Flow (gpm or gpd)
h_{OU}	Head at the first-stage wellpoints
h_{OL}	Head at the second-stage wellpoints
H	Original head before dewatering (ft)
h_{DU}	Maximum residual head downstream of a single slot of the first-stage wellpoints (ft)
h_{DL}	Maximum residual head downstream of a single slot of the second-stage wellpoints (ft)
r_w	Radius of wells (in)
nw	Number of wellpoints



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6.0 Analysis

Subsurface condition and soil permeability

Per Ref. 1, three soil borings were drilled: SB-08, PSB-01, and PSB-02. Boring SB-08 was advanced to depth of 100' while both PSB-01 and PSB-02 ended at depth of 30'. Based on the boring logs, the site is underlain by loose to medium dense clayey fine sand with a thin layer of firm sandy clay (5ft) at depth of 67' to 72' and bottom of boring ended in a firm sandy clay at the bottom 8ft. Three slug tests were performed in these three borings. However, all three tests were screened at 20-30ft where fine content is higher.

Based on the limited data, the shallower soil (0 to 15 ft) seems to be cleaner with 6 to 15% fine. Deeper soil has more fine content 20 to 40%. The excavated soil in the top 30' is described as fine sand with trace clay (borderline SP) to clayey sand (SC) with fine content up to 40%. Because almost all excavation will be in the upper 15ft from the original grade, Ref. 4 estimates the permeability of soil based on empirical correlations based on the limited soil index test results and typical values for the type of soils encountered at the site for preliminary dewatering design and dewatering water estimate permitting purpose.

$k := 50 \frac{\mu\text{m}}{\text{s}}$ which is about the lower bound of range of permeability for uniform sand and close to the empirically correlated value using Hazen Equation with $D_{10}=0.75\mu\text{m}$ (#200 sieve).

Dewatering Design for Underground Utility Corridor Trenching

Per Ref. 1, the groundwater depth at the power plant area is only about 0.5ft to 2ft below the existing grade. Use groundwater depth 0ft or at the existing grade for dewatering design. Ref. 6 includes an attached site arrangement drawing (Ref. 5) with three types of U/G utility corridor trenching for the project (Figure 1):

- Type I: 10' wide x 6' deep, Total of ~8700' long (shown as light orange shade in Figure 1);
- Type II: 20' wide x 12' deep, Total of ~6200' long (shown as green shade in Figure 1);
- Type III: 6' wide x 10' deep, Total of ~5000' long (shown as purple shade in Figure 1).

Note: Per Ref. 6, the depth for U/G trenching above is referenced to the original final grade and needs to be adjusted for construction grade per construction sequence.



Legend

- 10' wide x 6' deep U/G Utility Corridor
- 20' wide x 12' deep U/G Utility Corridor
- 6' wide x 10' deep Storm Sewer Pipe Corridor

Figure 1 Layout of the U/G Utility Corridors (Ref. 5 and 6)

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Dewatering Design for U/G Corridor Trenching - Type I

Per Ref. 5 and Ref. 6:

Elevation of grade: $El_{grade} := 37\text{ft}$
 Elevation of bottom of excavation: $El_{bottom} := 31\text{ft}$ Assume trenching from final site general grade
 Depth of excavation: $D_{exc} := El_{grade} - El_{bottom}$
 $\Rightarrow D_{exc} = 6\text{ft}$

Per Ref. 5 and 6, the existing grade elevation of the site is about 36ft from the southwest to 31ft towards the northeast, based on Figure 1, the majority of the Type I U/G corridor is located in the higher side of the site. Assume existing grade elevation of 35ft.

Elevation of original groundwater: $El_{gw1} := 35\text{ft}$
 Elevation of final groundwater table after dewatering: $El_{gw2} := El_{bottom} - 2\text{ft}$
 $\Rightarrow El_{gw2} = 29\text{ft}$
 Elevation of impermeable layer: $El_{imp} := El_{grade} - 67\text{ft}$ Assumed per Ref. 1 as consistent in Ref. 4.
 $\Rightarrow El_{imp} = -30\text{ft}$
 Height of the initial groundwater table: $H := El_{gw1} - El_{imp}$
 $\Rightarrow H = 65\text{ft}$

Assume the center of wellpoint pumps is 2 ft above the original grade.

Elevation of first stage wellpoints pump and collection piping: $El_{pump1} := El_{grade} + 2\text{ft}$
 $\Rightarrow El_{pump1} = 39\text{ft}$
 Required Total Suction Lift for wellpoint: $SL_{total} := El_{grade} + 2\text{ft} - El_{gw2}$
 $\Rightarrow SL_{total} = 10\text{ft}$

Per Ref. 2 and 3, in practice the suction lift of a single-stage wellpoint system at sea level is limited to about 15 ft (4.6 m) as measured from the suction of the pump to the lowered water table at the center of the wellpoint system (Figure 2). With special techniques, lifts of up to about 28 ft (8.5 m) can be achieved depending on site-specific conditions. The single stage wellpoints has a practical maximum suction lift of about 22ft. A narrow single stage wellpoint system is used to dewater the trench excavation.



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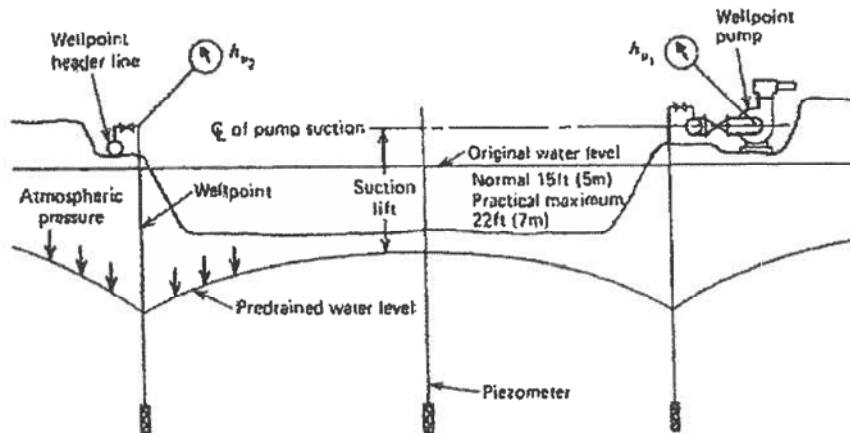


Figure 2 Suction Lift Limitation of Wellpoint System (Ref. 3)

For trench dewatering, a system of wellpoints with evenly spaced wellpoints staggered at a distance of r_s from the center of the trench. Once the segment of utility installation completed, the system is leapfrogged as the trench excavation continuously progresses along the U/G utility corridor (Figure 3).

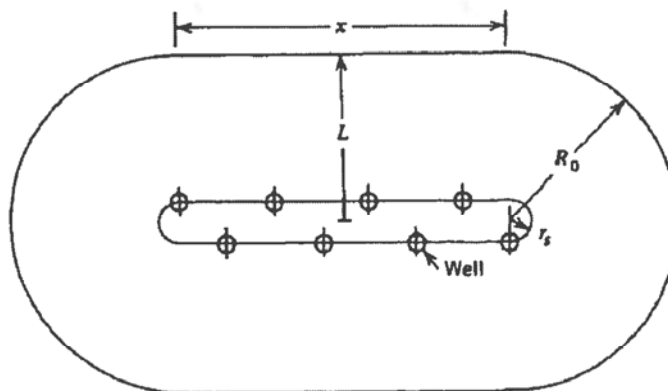


Figure 3 Plan view of a typical narrow wellpoint system for trench dewatering (Ref. 3)

Per Ref. 5 and 6:

Width of the Trench base excavation:

$$w_{\text{base}} := 10\text{ft}$$

Length of the trenching excavation segment:

$$L_{\text{base}} := 500\text{ft}$$

Per Ref. 7, a single pump can typically handle about 500' trench excavation.



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Based on the boring logs, the soil to be excavated is classified as OSHA Type C60. For short term excavation purpose, a 1.5:1 slope (H:V) is recommended.

Distance from edge of excavation at the base to the top of slope = $1.5 \cdot D_{exc}$

Assume the first stage pumps and wellpoints collection piping is 5' away from the excavation for safety.

Width of the wellpoint system: $b := w_{base} + 2.5ft + 2 \cdot (1.5 \cdot D_{exc})$

$$\Rightarrow b = 38ft$$

Length of the wellpoint system: $a := L_{base} + 2.5ft + 2 \cdot (1.5 \cdot D_{exc})$

$$\Rightarrow a = 528ft$$

Check the maximum residual head downstream of one slot of wellpoints (Ref. 2 Fig. 4-3 Equ. (4):

$$h_D := h_0 \left[\frac{1.48}{R} \cdot (H - h_0) + 1 \right]^2$$

Per Ref. 2 Fig. 4-23 Equ. (1), the radius of influence (L, or R) of a single line of wellpoints is

$$R := C \cdot (H - h_0) \cdot \sqrt{k}$$

where

k = hydraulic conductivity in 10^{-4} cm/s or μ m/s;

C = 1.5 to 2 for a single line of wellpoints, use average of 1.75.

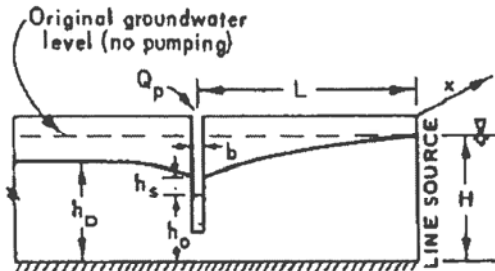


Figure 4 Flow and residual head for a partially penetrating slot with single line source and gravity flows (Ref. 2)



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Required residual head at downstream 2ft below the trench depth:

$$h_D := El_{gw12} - El_{imp} \Rightarrow h_D = 59 \text{ ft}$$

Given

Required head at wellpoint: $h_0 := 10 \text{ ft}$

$$h_D = h_0 \cdot \left[\frac{1.48 \cdot (H - h_0)}{1.75 \cdot (H - h_0) \cdot \sqrt{\frac{k}{10^{-4} \frac{\text{cm}}{\text{s}}}}} + 1 \right]$$

Required maximum head at first stage wellpoints:

$$h_{0max} := \text{Find}(h_0) \\ \Rightarrow h_0 = 52.697 \text{ ft}$$

Minimum Drawdown at wellpoints:

$$H - h_0 = 12.303 \text{ ft}$$

Per Ref. 2 Fig. 4-23 Equ. (1) Radius of Influence:

$$R_{\infty} := 1.75 \cdot (H - h_0) \cdot \sqrt{\frac{k}{10^{-4} \frac{\text{cm}}{\text{s}}}} \\ \Rightarrow R = 152.238 \text{ ft}$$

Spacing between wellpoints:

$$x := 10 \text{ ft}$$

Calculate single wellpoints flow per Ref. 2 Fig. 4-3 Eq. (3):

$$Q_p := \left[0.73 + 0.27 \cdot \left(\frac{H - h_0}{H} \right) \right] \cdot \frac{k \cdot x}{2 \cdot R} \cdot (H^2 - h_0^2)$$

$$\Rightarrow Q_p = 2.735 \text{ gpm}$$

Width of the narrow wellpoint system:

$$r_s := \frac{b}{2}$$

$$\Rightarrow r_s = 19 \text{ ft}$$

Per Ref. 3, calculate the total flow from the narrow wellpoint system Equ. 6.12:

$$Q_{\text{total}} := \frac{\pi \cdot k \cdot (H^2 - h_0^2)}{\ln\left(\frac{R}{r_s}\right)} + 2 \cdot \left[\frac{a \cdot k \cdot (H^2 - h_0^2)}{2 \cdot R} \right]$$

$$\Rightarrow Q_{\text{total}} = 530.703 \text{ gpm} \quad \text{or} \quad Q_{\text{total}} = 7.642 \times 10^5 \text{ gpd}$$

Total number of wellpoints:

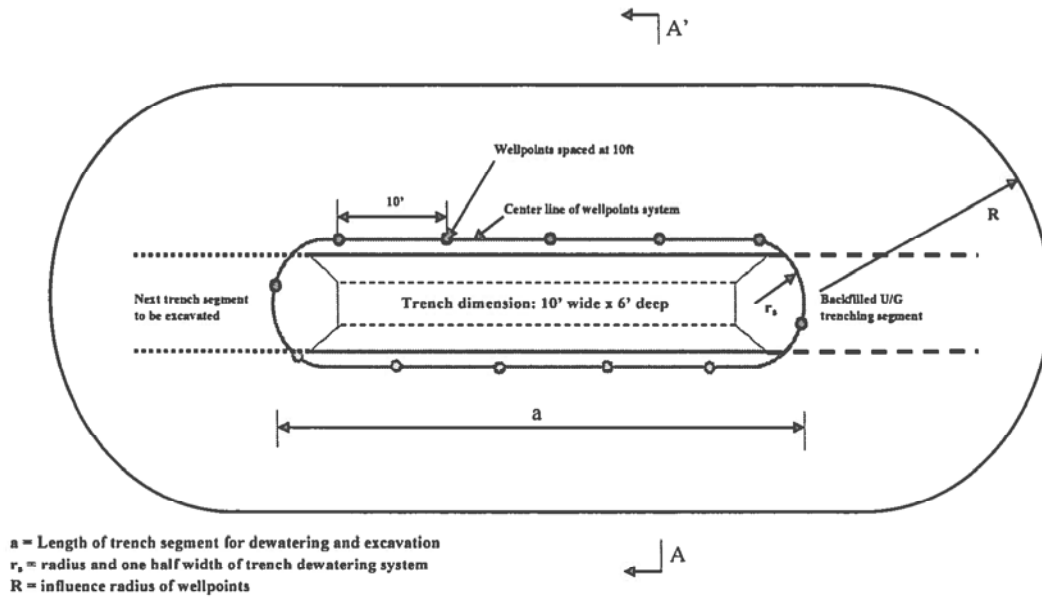
$$n_w := \text{ceil} \left[2 \cdot \frac{(\pi \cdot r_s + a)}{x} \right]$$

$$\Rightarrow n_w = 118$$

Per discussion in Ref. 3 Section 6.5, the wellpoints at the two ends will pump more than in the center. Use a total of 120 wellpoints per 500ft of trench segment.

$$\text{use } n_{\text{WW}} := 120 \quad Q_{p2} := \frac{Q_{\text{total}}}{n_w} \Rightarrow Q_{p2} = 4.423 \text{ gpm}$$

Figure 5 shows a sketch of dewatering system for the Type I trench excavation.



(a) Plan View

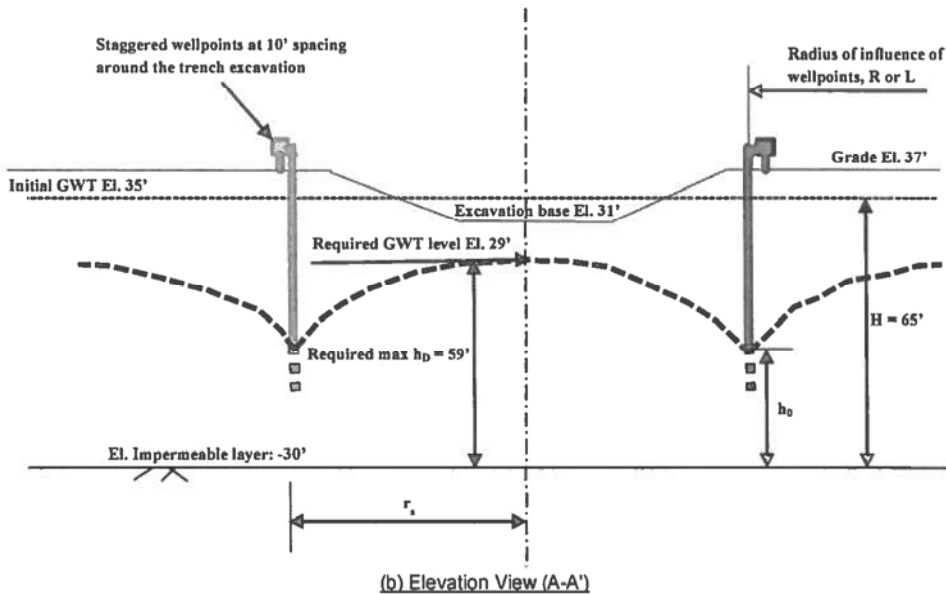


Figure 5 Sketch of Dewatering System for the Type I trench Excavation
 Note: NOT TO SCALE



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Dewatering Design for U/G Corridor Trenching - Type II (powerblock)

Per Ref. 5 and Ref. 6, the excavation of powerblock bathtub will take place first before the utility corridor to El. 33' and the groundwater lowered to @ El. 31'. The U/G utility corridor excavation will be 7ft below the bathtub base.

Elevation of bathtub grade: $El_{grade} := 33\text{ft}$

Elevation of bottom of excavation: $El_{bottom} := 26\text{ft}$ Assume trenching from bathtub base

Depth of excavation: $D_{exc} := El_{grade} - El_{bottom}$

$$\Rightarrow D_{exc} = 7\text{ft}$$

Assume the groundwater is lowered to El. 31' at the time of U/G utility trench excavation dewatering:

Elevation of original groundwater: $El_{gw1} := 31\text{ft}$

Elevation of final groundwater table after dewatering: $El_{gw2} := El_{bottom} - 2\text{ft}$

$$\Rightarrow El_{gw2} = 24\text{ft}$$

Elevation of impermeable layer: $El_{imp} := El_{grade} - 63\text{ft}$ Assumed per Ref. 1 as consistent in Ref. 4.

$$\Rightarrow El_{imp} = -30\text{ft}$$

Height of the initial groundwater table: $H := El_{gw1} - El_{imp}$

$$\Rightarrow H = 61\text{ft}$$

Assume the center of wellpoint pumps is 2 ft above the original grade.

Elevation of first stage wellpoints pump and collection piping: $El_{pump1} := El_{grade} + 2\text{ft}$

$$\Rightarrow El_{pump1} = 35\text{ft}$$

Required Total Suction Lift for wellpoint: $SL_{total} := El_{grade} + 2\text{ft} - El_{gw2}$

$$\Rightarrow SL_{total} = 11\text{ft}$$

A single stage wellpoint system is sufficient.

Per Ref. 5 and 6:

For trench dewatering, a system of wellpoints with evenly spaced wellpoints staggered at a distance of r_s from the center of the trench. Once the segment of utility installation completed, the system is leapfrogged as the trench excavation continuously progresses along the U/G utility corridor (Figure 3 on page 8).



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Width of the Trench base excavation: $w_{base} := 20 \text{ ft}$

Length of the trenching excavation segment: $L_{base} := 500 \text{ ft}$

Per Ref. 7, a single pump can typically handle about 500' trench excavation.

Based on the boring logs, the soil to be excavated is classified as OSHA Type C60. For short term excavation purpose, a 1.5:1 slope (H:V) is recommended.

Distance from edge of excavation at the base to the top of slope = $1.5 \cdot D_{exc}$.

Assume the first stage pumps and wellpoints collection piping is 5' away from the excavation for safety.

Width of the wellpoint system: $b := w_{base} + 2 \cdot 5 \text{ ft} + 2 \cdot (1.5 \cdot D_{exc})$

$$\Rightarrow b = 51 \text{ ft}$$

Length of the wellpoint system: $a := L_{base} + 2 \cdot 5 \text{ ft} + 2 \cdot (1.5 \cdot D_{exc})$

$$\Rightarrow a = 531 \text{ ft}$$

Check the maximum residual head downstream of one slot of wellpoints (Ref. 2 Fig. 4-3 Equ. (4)):

$$h_D := h_0 \left[\frac{1.48}{R} \cdot (H - h_0) + 1 \right]^{\frac{2}{3}}$$

Per Ref. 2 Fig. 4-23 Equ. (1), the radius of influence (L, or R) of a single line of wellpoints is

$$R := C \cdot (H - h_0) \cdot \sqrt{k}$$

where

k = hydraulic conductivity in 10^{-4} cm/s or $\mu\text{m/s}$;

C = 1.5 to 2 for a single line of wellpoints, use average of 1.75.

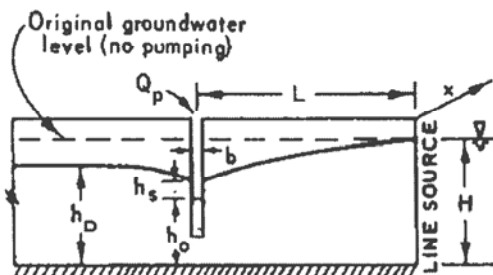


Figure 6 Flow and residual head for a partially penetrating slot with single line source and gravity flows (Ref. 2)



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Required residual head at downstream 2ft below the trench depth:

$$h_D := El_{gw2} - El_{imp} \Rightarrow h_D = 54 \text{ ft}$$

Given

Required head at wellpoint: $h_0 := 10 \text{ ft}$

$$h_D = h_0 \cdot \left[\frac{1.48 \cdot (H - h_0)}{1.75 \cdot (H - h_0) \cdot \sqrt{\frac{k}{10^{-4} \frac{\text{cm}}{\text{s}}}}} + 1 \right]$$

Required maximum head at first stage wellpoints:

$$h_{0max} := \text{Find}(h_0) \\ \Rightarrow h_0 = 48.231 \text{ ft}$$

Minimum Drawdown at wellpoints:

$$H - h_0 = 12.769 \text{ ft}$$

Per Ref. 2 Fig. 4-23 Equ. (1) Radius of Influence:

$$R := 1.75 \cdot (H - h_0) \cdot \sqrt{\frac{k}{10^{-4} \frac{\text{cm}}{\text{s}}}} \\ \Rightarrow R = 158.003 \text{ ft}$$

Spacing between wellpoints:

$$x := 10 \text{ ft}$$

Calculate single wellpoints flow per Ref. 2 Fig. 4-3 Eq. (3):

$$Q_p := \left[0.73 + 0.27 \cdot \left(\frac{H - h_0}{H} \right) \right] \cdot \frac{k \cdot x}{2 \cdot R} \cdot (H^2 - h_0^2)$$

$$\Rightarrow Q_p = 2.556 \text{ gpm}$$

Width of the narrow wellpoint system:

$$r_s := \frac{b}{2}$$

$$\Rightarrow r_s = 25.5 \text{ ft}$$

Per Ref. 3, calculate the total flow from the narrow wellpoint system Equ. 6.12:

$$Q_{total} := \frac{\pi \cdot k \cdot (H^2 - h_0^2)}{\ln\left(\frac{R}{r_s}\right)} + 2 \cdot \left[\frac{a \cdot k \cdot (H^2 - h_0^2)}{2 \cdot R} \right]$$

$$\Rightarrow Q_{total} = 521.985 \text{ gpm} \quad \text{or} \quad Q_{total} = 7.517 \times 10^5 \text{ gpd}$$

Total number of wellpoints:

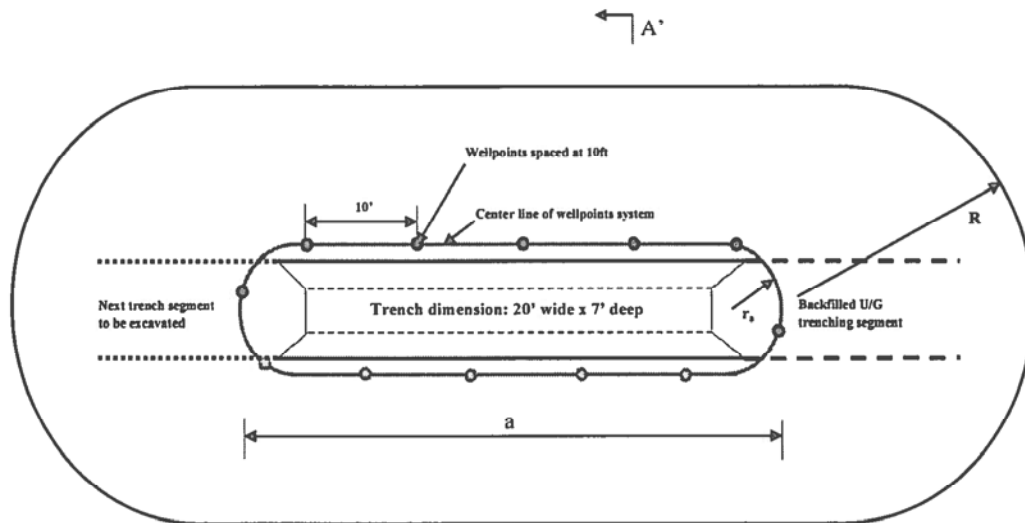
$$n_w := \text{ceil}\left[2 \cdot \frac{(\pi \cdot r_s + a)}{x} \right]$$

$$\Rightarrow n_w = 123$$

Per discussion in Ref. 3 Section 6.5, the wellpoints at the two ends will pump more than in the center. Use a total of 125 wellpoints per 500ft of trench segment.

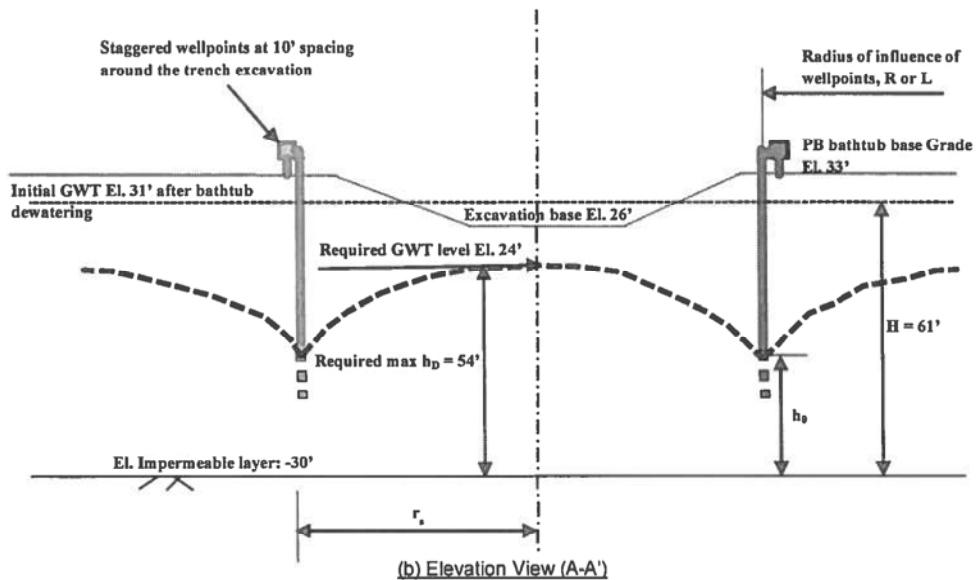
$$\text{use } n_{ww} = 125 \quad Q_{p2} := \frac{Q_{total}}{n_w} \Rightarrow Q_{p2} = 4.176 \text{ gpm}$$

Figure 7 shows a sketch of dewatering system for the Type II trench excavation.



a = Length of trench segment for dewatering and excavation
 r_s = radius and one half width of trench dewatering system
 R = influence radius of wellpoints

(a) Plan View



(b) Elevation View (A-A')

Figure 7 Sketch of Dewatering System for the Type II trench Excavation (Powerblock U/G corridors)

Note: NOT TO SCALE



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Dewatering Design for U/G Corridor Trenching - Type III (Storm Sewer Pipe)

Per Ref. 5 and Ref. 6:

Elevation of final grade: $El_{grade} := 37\text{ft}$

Elevation of bottom of excavation: $El_{bottom} := 27\text{ft}$

Assume trenching from final grade

Depth of excavation: $D_{exc} := El_{grade} - El_{bottom}$

$$\Rightarrow D_{exc} = 10\text{ft}$$

Per Ref. 5 and 6, the existing grade elevation of the site is about 36ft from the southwest to 31ft towards the northeast, based on Figure 1, the majority of the Type III U/G corridor is located in the lower side of the site. Assume existing grade elevation of 33ft.

Elevation of original groundwater: $El_{gw1} := 33\text{ft}$

Elevation of final groundwater table after dewatering: $El_{gw2} := El_{bottom} - 2\text{ft}$

$$\Rightarrow El_{gw2} = 25\text{ft}$$

Elevation of impermeable layer: $El_{imp} := El_{grade} - 67\text{ft}$

Assumed per Ref. 1 as consistent in Ref. 4.

$$\Rightarrow El_{imp} = -30\text{ft}$$

Height of the initial groundwater table: $H_{w1} := El_{gw1} - El_{imp}$

$$\Rightarrow H = 63\text{ft}$$

Assume the center of wellpoint pumps is 2 ft above the original grade.

Elevation of first stage wellpoints pump and collection piping: $El_{pump1} := El_{grade} + 2\text{ft}$

$$\Rightarrow El_{pump1} = 39\text{ft}$$

Required Total Suction Lift for wellpoint: $SL_{total} := El_{grade} + 2\text{ft} - El_{gw2}$

$$\Rightarrow SL_{total} = 14\text{ft}$$

A single stage wellpoint system is sufficient.

Per Ref. 5 and 6:

For trench dewatering, a system of wellpoints with evenly spaced wellpoints staggered at a distance of r_s from the center of the trench. Once the segment of utility installation is completed, the system is leapfrogged as the trench excavation continuously progresses along the U/G utility corridor (Figure 3 on page 8).



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Width of the Trench base excavation: $w_{base} := 6\text{ft}$

Length of the trenching excavation segment: $L_{base} := 500\text{ft}$

Per Ref. 7, a single pump can typically handle about 500' trench excavation.

Based on the boring logs, the soil to be excavated is classified as OSHA Type C60. For short term excavation purpose, a 1.5:1 slope (H:V) is recommended.

Distance from edge of excavation at the base to the top of slope = $1.5 \cdot D_{exc}$.

Assume the first stage pumps and wellpoints collection piping is 5' away from the excavation for safety.

Width of the wellpoint system: $b := w_{base} + 2 \cdot 5\text{ft} + 2 \cdot (1.5 \cdot D_{exc})$

$$\Rightarrow b = 46\text{ft}$$

Length of the wellpoint system: $a := L_{base} + 2 \cdot 5\text{ft} + 2 \cdot (1.5 \cdot D_{exc})$

$$\Rightarrow a = 540\text{ft}$$

Check the maximum residual head downstream of one slot of wellpoints (Ref. 2 Fig. 4-3 Equ. (4):
$$h_D := h_0 \left[\frac{1.48}{R} \cdot (H - h_0) + 1 \right]^2$$

Per Ref. 2 Fig. 4-23 Equ. (1), the radius of influence (L, or R) of a single line of wellpoints is

$$R := C \cdot (H - h_0) \cdot \sqrt{k}$$

where

k = hydraulic conductivity in 10^{-4} cm/s or $\mu\text{m/s}$;

C = 1.5 to 2 for a single line of wellpoints, use average of 1.75.

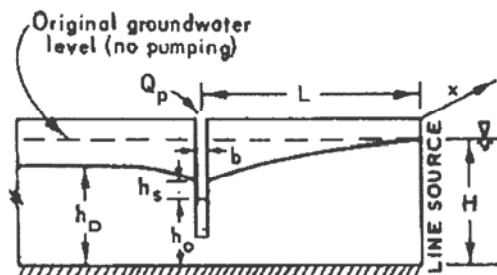


Figure 8 Flow and residual head for a partially penetrating slot with single line source and gravity flows (Ref. 2)



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Required residual head at downstream 2ft below the trench depth:

$$h_D := El_{gw2} - El_{imp} \Rightarrow h_D = 55 \text{ ft}$$

Given

Required head at wellpoint: $h_0 := 10 \text{ ft}$

$$h_D = h_0 \cdot \left[\frac{1.48 \cdot (H - h_0)}{1.75 \cdot (H - h_0) \cdot \sqrt{\frac{k}{10^{-4} \frac{\text{cm}}{\text{s}}}}} + 1 \right]$$

Required maximum head at first stage wellpoints:

$$h_{0max} := \text{Find}(h_0) \\ \Rightarrow h_0 = 49.125 \text{ ft}$$

Minimum Drawdown at wellpoints:

$$H - h_0 = 13.875 \text{ ft}$$

Per Ref. 2 Fig. 4-23 Equ. (1) Radius of Influence:

$$R_w := 1.75 \cdot (H - h_0) \cdot \sqrt{\frac{k}{10^{-4} \frac{\text{cm}}{\text{s}}}} \\ \Rightarrow R = 171.699 \text{ ft}$$

Spacing between wellpoints:

$$x := 10 \text{ ft}$$

Calculate single wellpoints flow per Ref. 2 Fig. 4-3 Eq. (3):

$$Q_p := \left[0.73 + 0.27 \cdot \left(\frac{H - h_0}{H} \right) \right] \cdot \frac{k \cdot x}{2 \cdot R} \cdot (H^2 - h_0^2)$$

$$\Rightarrow Q_p = 2.633 \text{ gpm}$$

Width of the narrow wellpoint system:

$$r_s := \frac{b}{2}$$

$$\Rightarrow r_s = 23 \text{ ft}$$

Per Ref. 3, calculate the total flow from the narrow wellpoint system Equ. 6.12:

$$Q_{total} := \frac{\pi \cdot k \cdot (H^2 - h_0^2)}{\ln\left(\frac{R}{r_s}\right)} + 2 \cdot \left[\frac{a \cdot k \cdot (H^2 - h_0^2)}{2 \cdot R} \right]$$

$$\Rightarrow Q_{total} = 539.268 \text{ gpm} \quad \text{or} \quad Q_{total} = 7.765 \times 10^5 \text{ gpd}$$

Total number of wellpoints:

$$n_w := \text{ceil}\left[\frac{2 \cdot (\pi \cdot r_s + a)}{x} \right]$$

$$\Rightarrow n_w = 123$$

Per discussion in Ref. 3 Section 6.5, the wellpoints at the two ends will pump more than in the center. Use a total of 125 wellpoints per 500ft of trench segment.

$$\text{use } n_{ww} := 125 \quad Q_{p2} := \frac{Q_{total}}{n_w} \Rightarrow Q_{p2} = 4.314 \text{ gpm}$$

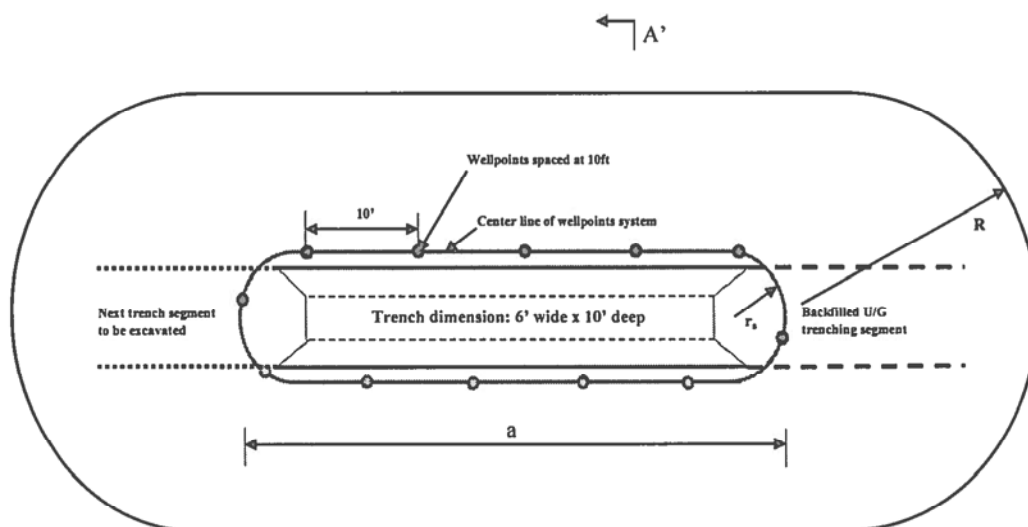


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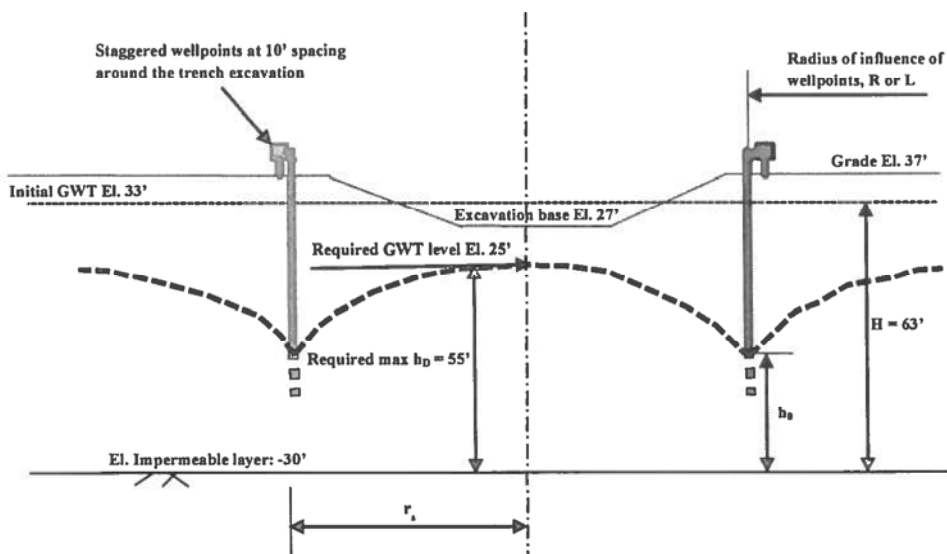
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Figure 9 shows a sketch of dewatering system for the Type III trench excavation.



a = Length of trench segment for dewatering and excavation
 r_s = radius and one half width of trench dewatering system
 R = influence radius of wellpoints

(a) Plan View



(b) Elevation View (A-A')

Figure 9 Sketch of Dewatering System for the Type III trench Excavation (Storm sewer pipes)

Note: NOT TO SCALE



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7.0 Conclusions

UG Corridor Type I Trench Excavation (10ft wide x 500'ft long, 6ft below final grade, Figure 5)

Dewatering requirement for 500ft long trench construction segment (10ft wide and 500ft long at the trench base):

- Total flow $Q_{total} = 531$ gpm or 764,200 gal/day;
- Wellpoint flow $Q_{well} = 4.4$ gpm per well @ 10' spacing;
- Maximum head at wellpoints $h_0 = 52.5$ ft (minimum drawdown at well = 12.5ft);
- Wellpoints = 2" self-jetting;
- # of wells ~ 120 total.

UG Corridor Type II Trench Excavation (20ft wide x 500'ft long, 7ft below bathtub excavation base, Figure 7)

Dewatering requirement for 500ft long trench segment (20ft wide and 500ft long at the trench base):

- Total flow $Q_{total} = 522$ gpm or 751,700 gal/day;
- Wellpoint flow $Q_{well} = 4.2$ gpm per well @ 10' spacing;
- Maximum head at wellpoints $h_0 = 48$ ft (minimum drawdown at well = 13ft);
- Wellpoints = 2" self-jetting;
- # of wells ~ 125 total.

UG Corridor Type III (storm sewer pipe) Trench Excavation (6ft wide x 500'ft long, 10ft below final grade, Figure 9)

Dewatering requirement for 500ft long trench segment (6ft wide and 500ft long at the trench base):

- Total flow $Q_{total} = 539$ gpm or 776,500 gal/day;
- Wellpoint flow $Q_{well} = 4.3$ gpm per well @ 10' spacing;
- Maximum head at wellpoints $h_0 = 49$ ft (minimum drawdown at well = 14ft);
- Wellpoints = 2" self-jetting;
- # of wells ~ 125 total.

Note:

1. The permeability measured in the three slug tests available in Ref. 1 were performed in the deeper soil (screened at 20' to 30' deep) where the fine contents is higher. Based on the measured permeability from the slug tests, the material is borderline applicable for wellpoints method;
2. For permitting purpose, the dewatering design and flow estimate is performed with conservatively assumed permeability based on empirical correlations and typical values of the type of material identified in the boring logs;
3. The dewatering should be reviewed and revised as necessary for construction later when more data becomes available;
4. Per Ref. 5 and 6, the estimated total length of U/G utility corridor for the site (rounded to the next 100' for each type) are: (a) Type I: 10' wide x 6' deep, Total of ~8700' long, (b) Type II: 20' wide x 12' deep, Total of ~6200' long, and (c) Type III: 6' wide x 10' deep, Total of ~5000' long;
5. In construction, the narrow wellpoint systems are leapfrogged along the utility corridor as the trench excavation continuously progresses. Per Ref. 7, a single 8" pump can typically handle 500' of trench dewatering. The estimated total flow quantity of dewatering U/G utility corridor was made assuming per 500ft long trenching segment. The estimated total flow from a 500' long trench segment is about 531 to 539 gpm which is within the pump rate of a 8" pump (400 to 700 gpm) per Ref. 3 Table 12.2. The total flow per system will vary depending on the as-constructed trench segment and needs to be revised as necessary when construction and dewatering schedule are available.