FRA-70-22.61
PID No. 95639

IR-70 at IR-270 Interchange
Reconstruction Project 1

Final Drainage Report

May 14, 2021

Revised 8/6/2021

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Narrative

This final drainage report is being submitted concurrent with the Final Tracings. This report has been modified since the Stage 3 submission to address the City of Columbus requirements regarding the existing flooding conditions and the proposed storm sewer design for Outfall 4, a 72 -inch storm sewer along Scarborough Blvd. The proposed final design resolves those concerns via diverting more than 12 acres of ODOT right of way from this storm conveyance system to Outfall 2B, proposing an extended detention basin in the infield area of Ramps C2 & D2. Additionally, the proposed detention basin results in single BMP treatment for the project. All the BMP's presented in the Stage 3 plan have been removed.

Existing Drainage

The FRA-70-22.61 project is within the Blacklick Creek and Big Walnut Creek watersheds, which are tributaries of the Scioto River. Storm water runoff exits the project area through eight different outlets and is conveyed via roadside ditches, culverts, and storm sewers. The outlets are shown in Appendix A and are described below.

Outlet 1: The north portion of the IR 70 and IR 270 interchange is collected in storm sewers and roadside ditches that conveys the flow westward along the north side of IR 70 and discharges into Big Walnut Creek via a ditch.

Outlet 2: The south portion of the interchange area outlets to Big Walnut Creek on the south side of IR 70. The runoff leaves the project area at two separate points: Area 2A (southwest quadrant) via existing culverts under existing Ramps D2 and D3, and Area 2B (southeast quadrant) via an existing 36" storm beneath IR 270 just north of the Norfolk Southern Railroad before combining outside of the project limits and heading west to the outlet.

Outlet 3: The east side of IR 270 south of the Norfolk Southern Railroad is conveyed in a 24" storm sewer beneath Noe Bixby Road and outlets into Big Walnut Creek.

Outlet 4: A 72" conduit 1800' east of IR 270 carries water from the north side of IR 70 to the south where it joins an existing 66" conduit beneath private property, owned by JC Penney. The flow outlets to an open channel making its way south to the north side of the Norfolk Southern Railroad where it enters a 60" sewer and travels east before passing beneath the Railroad via a 54" sewer and travels through the neighborhoods via storm sewer before ultimately entering Big Walnut Creek.

Outlet 5: An existing 84" conduit, located between the 72" conduit and the dual box culverts, conveys the flow from the north to the south under IR 70. South of Scarborough Blvd the runoff is conveyed via an enclosed system with a 60" storm sewer which discharges to an open channel east of Park Crescent Drive which conveys the flow southward to a pipe under the Railroad southeast of the previously mentioned 54" sewer and travels through the neighborhoods via storm sewer before ultimately entering Big Walnut Creek.

Outlet 6: This portion of the project's tributary area consists of two parts. Part 1 north of IR 70 and Brice Road is conveyed under IR 70 through an existing double 22'x8' box structure, FRA-70-2374, 900' west of Brice Road and flows southward. Part 2 the southwest and southeast quadrant are conveyed via an existing 30" conduit under Ramp C1 downstream of the double box structure.

Outlet 7: A portion of the southeast quadrant along Ramp G2 of the IR 70 at Brice Road interchange flows to the south through an existing ditch into the FRA-70, PID 98232 (Phase 2 & 3) project areas.

Outlet 8: This outlet is 1900' east of Brice Road, there is an existing 9'x5' concrete box culvert that carries the watershed from the north of IR 70 to the south through private property via open channel.

City of Columbus

The existing flooding conditions upstream of IR 70 due to the existing restricted outfall conditions has presented some design challenges. The City of Columbus (CoC) requires compliance with their Stormwater Drainage Manual (SWDM) for peak flow reduction and quantity storage.

- Per the CoC SWDM, a decrease in CN or expected runoff does not meet compliance. The SWDM requires the post 100yr storm be controlled to the pre 10yr storm.
- The areas tributary to the CoC MS4 must meet the DOSD SWDM. There is also documented flooding upstream and downstream of this project. Project must meet DOSD SWDM quantity requirement.

Diverting area

In order to address these City requirements, the design of previous submittals has been revised. A storm sewer alignment is proposed to remove a portion of ODOT's ROW from the CoC drainage system. The storm sewer alignment diverts area from Outfall 4 to Outfall 2B. A total of 12.71 acres is diverted. It removes almost all the project area contributing to the CoC's storm sewers within outfall 4.

Proposed Drainage

The proposed project drainage maintains the same drainage patterns as the existing except for outfall 2B and 4. Drainage design meets the requirements of the ODOT L&D Manual, Volume 2. For Scarborough Boulevard the functional classification is Urban Local per the Design Designation.

Culverts: Two new culverts will be constructed with the proposed project beneath Ramp C1. A 42" conduit at Sta. 6007+00 and a 48" conduit at Sta. 6073+41. A 25 year design and 100 year design check were used. Both culverts met requirements of L&D Volume 2, Section 1002.3.1 which requires the size shall be increases one pipe size when under 16' of fill. Calculations and drainage area maps can be found in Appendix B.

Ditches: This project uses safety grading and ditches with a 20' radius wherever possible. Clear zone grading was required to stay within existing right of way along IR 70 east of the Brice Road interchange, along with incorporating the bioretention cell BMP and to allow future underdrain outlets. Noise barrier A1 has ditches that outlet into the proposed ditches and catch basins along A1. A 5-year design and 10-year design check were used in the ditch designs. Ditch calculations, runoff coefficient calculations, and drainage area maps can be found in Appendix C.

Inlet Spacing/Storm Sewers: Portions of IR 270, IR 70, Ramps A2 and C1 are lined by retaining walls and concrete barrier, which requires the use of inlets and storm sewers. Placement of inlets were avoided within areas of MSE wall fill where possible. Inlets were placed within the MSE wall along Wall B at station 3006+50 along A2 and along Wall G-H at station 3035+00 along A2. These were placed to avoid the cast in place transition walls. Where it was unable to be avoided, conduits were designed so that outlet pipes run perpendicular to the wall to avoid conflict with the straps. Allowable spread on pavement ranged from 4 to 12 feet depending the location on the project.

Scarborough Blvd also required the use of inlets and storm sewers to drain the curb and gutter design. A 5-year design and 10-year design check were used in the storm sewer design and a 5 year design storm frequency for the inlet spacing to meet current City of Columbus Drainage Manual. Allowable spread on pavement was 7.50 feet from face of curb, which includes the 1.5 feet wide gutter. East on Scarborough, outside of work limits, the pavement spread exceeds the allowable 7.50 feet. This existing area is shown in our calculations as the high point along the road is around station 72+00. Multiple catch basins were added at the start of our project to decrease the spread. Inlet spacing, storm sewer calculations and drainage area maps can be found in Appendix D and Appendix E respectively.

The proposed flyover Ramp A2 requires scuppers near read and forward abutments along the left side where the water is flowing away from the highpoint of the bridge towards the scuppers with the super elevated pavement. The locations are located within Bridge No. FRA-70-4262. The bypass flow is almost eliminated at both locations. The scuppers are not ODOT standard and shall be a Neenah Foundry Model Number 3951 or approved equal and bolts for scupper grate shall be stainless steel. The scuppers outlet to a concrete apron.

Underdrains are utilized along the entire project. Scarborough has 4 inch underdrains whereas everywhere else along the project utilizes 6 inch. Unclassified underdrains are used where there are deep undercuts or there are restrictions on outlets. The underdrains outlet to the proposed ditches, side slopes, and catch basins.

The proposed drainage for the project is described in more detail according to each outlet below.

Outlet 1: The project work on the northwest corner of the IR 70 and IR 270 interchange adds a new fly over ramp for IR 270 to IR 70 traffic and therefore pushes the pavement limits to the west. The existing ditch is being regraded and two conduits of the storm sewer are relocated to stay outside of the proposed pavement. Two upstream conduits of the

storm sewer are also being replaced to remedy an existing negative slope in the run. Noise barrier A1 has outlets from the proposed ditch that run to the new proposed regraded ditch and to the proposed storm run.

Outlet 2: The IR 70 south outlet to Big Walnut Creek is divided into two drainage areas within the project area.

- Due to the widening of IR 70 west of IR 270 and South of IR 70 and the removal of the existing loop ramp, D3, the drainage patterns are disturbed in the gore area of where the existing Ramp D2 is and the proposed widening. The existing ditch will be shifted southward and regraded to outlet to the existing ditch conveying the runoff to Big Walnut Creek.
- The ditches between IR 70, C1 and east of D2 flow through ditches and beneath existing Ramp D2 where they flow through the post construction detention basin and pass beneath Ramp D2 again, just east of IR 270, through an existing 36" culvert flowing south along IR 270 in an existing ditch. This flow then combines with runoff from the Ramp C1 and IR 270 gore area before passing through a proposed culvert beneath Ramp C1 to the right and joining with the ditch that is carrying water from the right side of Ramp C1. The right ditch was extended northward between Ramp C1 and Scarborough to maintain the existing ODOT and City right of way drainage separation pattern. The right ditch continues to the south where it is collected in the existing 36" storm sewer, under IR 270, which is being extended eastward/upstream for the project. Once on the west side of IR 270, the flow continues through the existing conveyance system to Big Walnut Creek.

Peak Flow Outlet 2B

A peak flow rate analysis was completed to evaluate the impact of diverting area from outlet 4 to outlet 2B. A post construction detention basin is proposed for the infield area of ramp C1. The basin is designed to contain and release the WQv over a 48 hour period. Although the basin is not specifically designed to control larger storms, detaining the WQv the basin does reduce the peak flows of larger storms. A peak flow rate comparison was conducted at Ramp C1 storm sewers at Sta. 6001+80. The existing drainage area at the Ramp C1 storm sewer is 28.0 acres with a CN of 88 and a 40-minute time of concentration. The proposed drainage area is 43.0 acres with a CN of 88 and a 36-minute time of concentration. See Appendix G for calculations.

Table 1. Existing and proposed flow rates at Outfall 2B

Storm	Existing flow rate cfs	Proposed flow rate cfs
25-yr	44.5	26.9
50-yr	57.0	37.0
100-yr	78.6	49.9

Outlet 3: With Ramp C1 starting just south of the Norfolk Southern Railroad to the right side of IR 270, a MSE Wall, Wall K, was required and having a length over 1400' long. A proposed ditch at the bottom of the retaining wall and a proposed access road collects runoff within the existing right of way. New proposed storm sewer systems are needed along Ramp C1 that outlet to the right side ditch and the outlets are being routed below the MSE Wall. The IR 270 median drainage is being collected just north of Noe Bixby Road, where it joins the ditch and exits to Big Walnut Creek through a new 36" storm sewer under Noe Bixby Road.

Outlet 4: The proposed interchange improvements include the addition of two ramps to the south side of IR 70 east of Ramp D2, and north of Scarborough Blvd. Runoff from the new pavement is being collected in proposed storm sewers that divert this area to Outfall 2B. The 1966 record plans indicate that the existing 72" concrete pipe was designed and constructed as a culvert. According to the City's record drawings the JC Penney site development plans circa 1973 connected to the outlet end of the 72-inch culvert with a 66-inch pipe downstream southward through the JC Penney parking lot it outlets to an open ditch near the southern terminus of Scarborough Blvd. During a meeting with the City of Columbus on July 28th, 2016, the City stated that there is a known history of flooding upstream of the 72". Based upon the record plan information the size and slope of the 66-inch has significantly less capacity than the 72-inch record plan capacity.

Peak Flow rate

City of Columbus requires the stormwater design of the project to provide the post 100-year storm be released at flow rates less than the existing 10-year storm. The flow rates from ODOT's ROW was evaluated for the existing and proposed conditions. The existing flow rate is based on the area and surface conditions within the existing right of way. The existing ODOT area is 17.86 acres with a CN of 88. The proposed ODOT drainage area is 6.23 acres with a CN of 91. The proposed flow rates are based on the proposed ROW and surface conditions. The future paving of the median and the proposed WB IR 70 improvements, FRA-70-22.85 (Phases 2 & 3), were included in the post flow rate calculations. See Attachment H for drainage areas and surface conditions for the existing and proposed 72" system.

The storm sewer layout removes over 12.71 acres from contributing to the CoC storm sewers. Removing this large area makes it possible for the 100-year post flow rate to be less than the existing 10-year flow rate without needing additional storage. The flow rates were developed using the City's rainfall data and NRCS Curve Number method. HydroCAD (version 10.10-4a) software was used to calculate the existing and proposed flow rates. See Appendix H calculations.

Table 2. Existing and proposed flow rates from ODOT property to 72" system

Storm	Existing flow rate Cfs	Proposed flow rate cfs
10-yr	39.1	20.8
100-yr	66.0	33.6

The full drainage area for the 72" was also evaluated. The existing drainage area is 183.36 acres with a CN of 87 and a 46-minute time of concentration. The proposed drainage area is 169.40 acres with a CN of 87 and a 46-minute time of concentration. The removal of the ODOT's area impacts the flow rates system. See Appendix H calculations.

Table 3. Existing and proposed flow rates from entire 72" system

Storm	Existing flow rate cfs	Proposed flow rate cfs
2-yr	163.2	151.1
5-yr	224.7	208.1
10-yr	276.1	255.9
25-yr	348.9	323.8
50-yr	409.5	380.3
100-yr	473.4	439.7

Further hydraulic analysis was performed using ODOT's CDSS Storm Sewer Design software to develop the Stage 3 proposed 72 inch trunk line along Scarborough Blvd to divert the existing 72-inch pipe discharge from the existing downstream 66-inch private storm sewer system. The CDSS analysis indicates that the HGL satisfies the 10 year design and 25 year hydraulic grade line check storms design criteria without increasing the headwater elevation at the upstream / inlet end of the existing 72-inch located on the north side of IR 70. See Appendix E.

Outlet 5: The existing 84" picks up runoff from the north side of IR 70 along with a small drainage area on the south side of IR 70 (a drainage area of 78 acres, according to record plans for the FRA-70-21.29 project from 1966) and some of the Scarborough Blvd (outside of the project limits) runoff before heading south via 60" storm sewer beneath private property. The drainage pattern is generally maintained with a small proposed storm sewer being added to pick up what is now runoff from Ramp C1 and IR 70.

Outlet 6: The 22'x8' double box structure, FRA-70-2374, that carries flow from the north side of IR 70 to the south was analyzed and discussed in Appendix I. There are two proposed storm sewers on the east and west sides of the structure, one will outlet directly into the box to avoid extensive storm sewer runs to get around to the outlet and the other

will outlet through the proposed wing wall. All of the runoff from the Ramp C1 infield with Brice Road and Ramp G1 loop area collects and flows through a proposed 48” reinforced concrete culvert under Ramp C1 and then through an existing 28” corrugated plastic pipe to get through to the bank of the stream.

Outlet 7: The proposed realigned Ramp G2 drainage runoff flows into an existing undisturbed ditch both left and right of alignment. The infield of IR 70, Ramp G1 and Ramp G2 flow through an existing 24” concrete pipe under Ramp G2 just northeast of the Ramp G1/G2 gore that then flows through the existing ditch into the FRA-70, PID 98232 (Phase 2 & 3) project areas.

Outlet 8: Approximately 1925 feet east of Brice Road there is an existing 9’ x 5’ concrete box culvert that will be extended with this project due to the widening for Ramp G2. The existing ditch along IR 70 for the next 1350 feet east of the box culvert is undisturbed but the next 2100 feet will be regarded to allow for a bioretention cell to treat the runoff from IR 70. This area flows west to the box culvert outlet on the south side of IR 70 and flows south outside of ODOT right of way through an existing unnamed stream.

BMPs

BMP designs meet the criteria set forth in the ODOT L&D Manual, Volume 2. The project earth disturbed area (EDA) is 76.2 acres. The project produces 1.9 acres of new impervious area in new right of way and is classified as new construction and requires quality and quantity treatment at a treatment percent of 22.18%. Per the ODOT L&D Manual Volume 2, Section 1115.3, bullet point number 3, portions of the project that discharge from ODOT right of way directly to a large river (4th order stream or greater) will be excluded from the requirement to provide quantity treatment but quality treatment is still required in these areas. The total project EDA that discharges to the 4th order stream river and requires quality treatment is 44.2 acres, and the EDA that requires both quality and quantity is 32.0 acres. The treatment requirement for quality is 16.9 acres, and 7.1 quality.

A detention basin is proposed within the infield of ramp C1 and D1. The detention basin provides treatment to 31.3 acres of ODOT ROW. The basin provides both quantity and quality treatment. The basin provides a surplus treatment of 14.4 which could be used for Future projects. The previous BMP shown on the Stage 3 submittal have all been removed and are replaced with the detention basin. Calculations and drainage area maps can be found in Appendix F.

Summary

The FRA-70-22.61 project culverts, ditches, inlet spacing, storm sewers and BMP’s are designed to meet criteria in the ODOT L&D Manual, Volume 2 and the City of Columbus Drainage Manual.

- Existing catch basins on Scarborough Boulevard outside of the project limits do not meet the five year City of Columbus inlet spacing spread criteria. The bypass from the existing basins entering the proposed project area is too high to be picked up with one basin and

closely spaced basins are proposed. The proposed inlet spacing meets the City's current design spread criteria for the 5 year storm.

- BMP treatment is provided for 31.3 acres, exceeding the required treatment of 16.9 acres
- Peak flow rate reduction is provided for the CoC storm sewer at outfall 4.
- The proposed project and extension of FRA-70-2374 results in a no rise to the water surface elevation. Appendix I provides a copy of the HEC-RAS study on Structure FRA-70-2347 that was submitted in 2016 as part of the original Stage 1 Review Submission. The Stage 3 design and associated impacts are consistent with the analysis and findings of the report therefore no modification to the report has been made.

The following limitations are noted as the project advances into Final Tracings design:

- The scope of services for this project did not include video inspection of existing conduits. These existing conduits and systems have not been inspected via video or other means nor has any such information been provided to HDR. There are a number of locations where the design proposes to connect to existing culverts or storm sewers. As such, these conduits are treated in the plans as if they are in fair condition with useful service life remaining and do not warrant replacement.

Appendix A – Outlet Maps

DRAINAGE AREA MAP
OUTLETS

FRA-70-22.61

1
1

HORIZONTAL SCALE IN FEET
0 200 400 800

CALCULATED REM
CHECKED PHF

℄ IR 70
℄ RAMP G1
OUTFALL 8
UNNAMED STREAM
EX. 9'X5' BOX
CULVERT DRAINAGE
AREA UNDISTURBED
(102 AC)

℄ RAMP A1
OUTLET 1
DITCH TO BIG WALNUT CREEK
OUTLET 2
DITCH TO BIG WALNUT CREEK
BIG WALNUT CREEK
℄ IR 70
℄ RAMP A2
SEE APPENDIX G
℄ RAMP D3
OUTLET 2B
36" STORM TO BIG WALNUT CREEK
ANALYSIS POINT FOR DIVERTED AREA
℄ RAMP D2
SCARBOROUGH BLVD
℄ IR 270
℄ RAMP C1
NORFOLK SOUTHERN RR
OUTLET 4
EX. 72" STORM
ANALYSIS POINT FOR DIVERTED AREA
OUTLET 5
EX. 84" STORM
℄ RAMP C1
OUTLET 6
UNNAMED STREAM
℄ BRICE ROAD
OUTLET 7
STORM TO
UNNAMED STREAM
BIG WALNUT CREEK
OUTLET 3
EX. 24" STORM TO
BIG WALNUT CREEK

LEGEND

- OUTLET AREA 1
- OUTLET AREA 2A
- OUTLET AREA 2B
- OUTLET AREA 3
- OUTLET AREA 4
- OUTLET AREA 5
- OUTLET AREA 6
- OUTLET AREA 7
- OUTLET AREA 8
- OUTLET 2B: DETENTION BASIN DRAINAGE AREA

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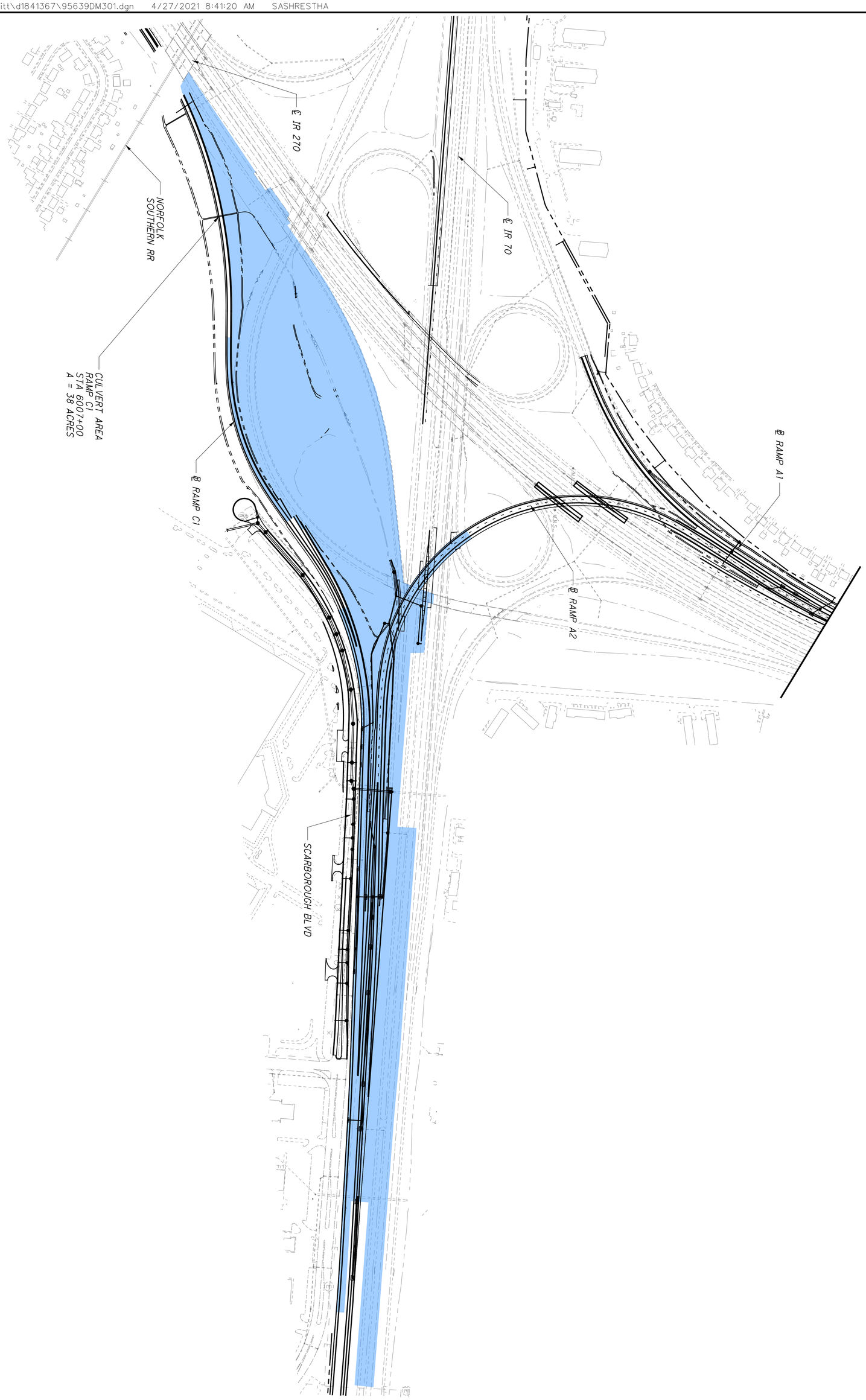
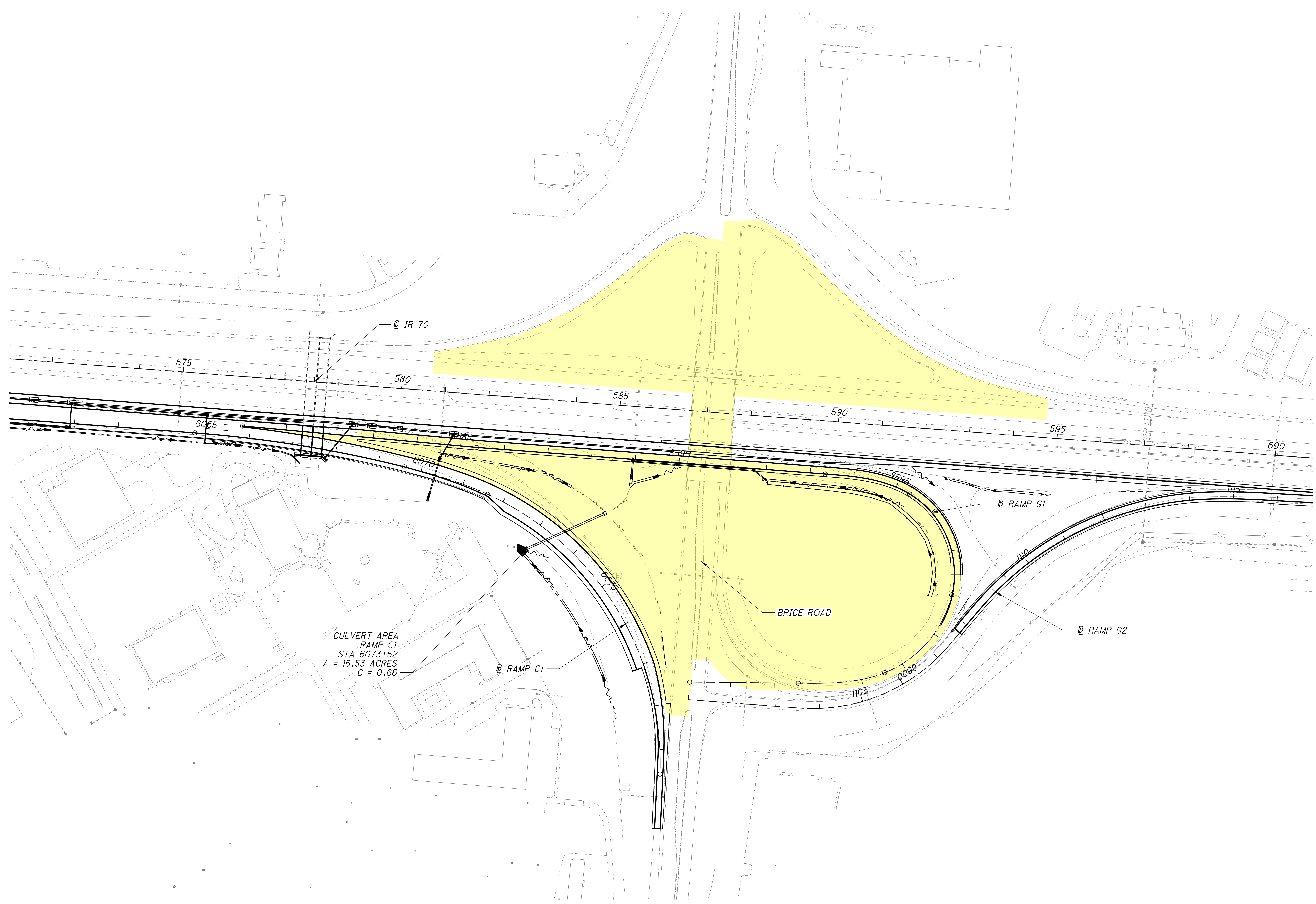
Appendix B – Culvert Calculations and Maps



1 / 2	FRA-70-22.61	DRAINAGE AREA MAP CULVERTS - 1 OF 2	CALCULATED REM CHECKED PHF	0 200 100 400 HORIZONTAL SCALE IN FEET



HORIZONTAL SCALE IN FEET
0 50 100 200

CALCULATED REM
CHECKED PHF

DRAINAGE AREA MAP
CULVERTS - 2 OF 2

FRA-70-22.61

2/2

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95639 CULVERTS SUMMARY														
Culvert Reference		Type	Existing Area	Proposed Area	Existing C Value	Proposed C Value	Existing Q Peak	Existing Q Peak	Proposed Q Peak	Proposed Q Peak	Existing HW	Existing HW	Proposed HW	Proposed HW
							(25 YRS)	(100 YRS)	(25 YRS)	(100 YRS)	(25 YRS)	(100 YRS)	(25 YRS)	(100 YRS)
			AC	AC			CFS	CFS	CFS	CFS	FT	FT	FT	FT
IR 70	606+44	Extension	102.00	102.00	0.65	0.65	125.00	146.00	125.00	146.00	803.87	804.24	803.91	804.21
Ramp C1	6007+00	New	N/A	38.00	N/A	0.60	N/A	N/A	24.23	37.76	N/A	N/A	771.46	772.15
Ramp C1	6073+41	Replacement	17.50	16.50	0.65	0.66	57.91	67.68	46.30	54.20	790.48	792.92	785.60	785.90
Noe Bixby IR-270	978+25	Replacement (Size Increase)	20.40	19.60	0.66	0.67	48.70	57.30	47.60	56.00	751.42	755.29	745.84	746.35
U-Turn 270 IR 270	987+50	New	N/A	0.98	N/A	0.68	N/A	N/A	4.00	4.70	N/A	N/A	783.00	783.10

StreamStats Report_IR 70 STA. 606+44 BOX CULVERT EXTENSION

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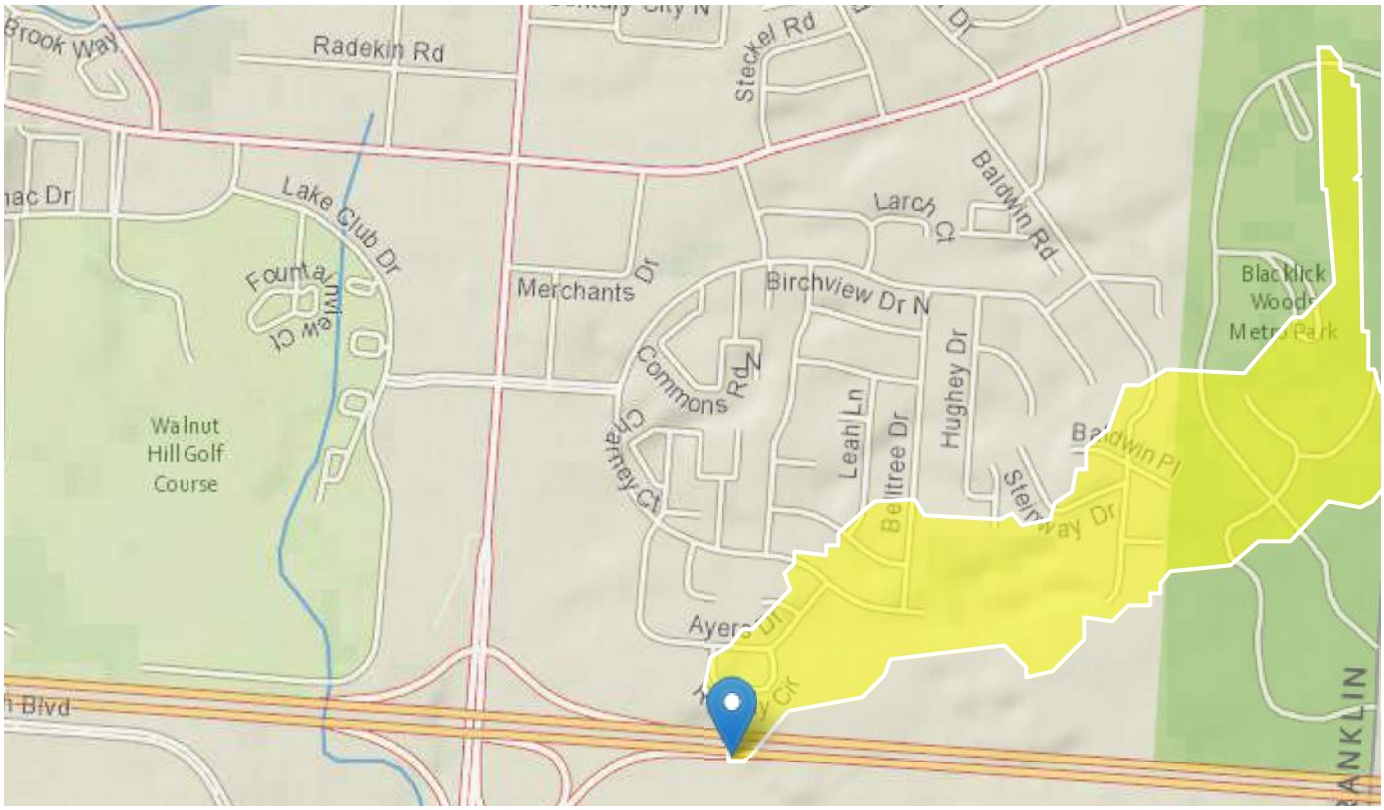

Basin Characteristics

Parameter Code	Parameter Description	Value	Unit
DRNAREA	Area that drains to a point on a stream	0.16	square miles
OHREGC	Ohio Region C Indicator	0	dimensionless
OHREGA	Ohio Region A Indicator	1	dimensionless
CSL1085LFP	Change in elevation divided by length between points 10 and 85 percent of distance along the longest flow path to the basin divide, LFP from 2D grid	74	feet per mi

Parameter Code	Parameter Description	Value	Unit
LC92STOR	Percentage of water bodies and wetlands determined from the NLCD	0	percent
STREAM_VARG	Streamflow variability index as defined in WRIR 02-4068, computed from regional grid	0.55	dimensionless
LAT_CENT	Latitude of Basin Centroid	39.9364	decimal degrees

Peak-Flow Statistics Parameters [Peak Flow Full Model]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	0.16	square miles	0.01	7422
OHREGC	Ohio Region C Indicator 1 if in C else 0	0	dimensionless	0	1
OHREGA	Ohio Region A Indicator 1 if in A else 0	1	dimensionless	0	1
CSL1085LFP	Stream Slope 10 and 85 Longest Flow Path	74	feet per mi	1.53	674
LC92STOR	Percent Storage from NLCD1992	0	percent	0	25.8

Peak-Flow Statistics Flow Report [Peak Flow Full Model]

PII: Prediction Interval-Lower, PIu: Prediction Interval-Upper, SEp: Standard Error of Prediction, SE: Standard Error (other -- see report)

Statistic	Value	Unit	PII	PIu	SE	SEp	Equiv. Yrs.
2 Year Peak Flood	30.1	ft^3/s	14.4	63	37	37	2.1
5 Year Peak Flood	56.9	ft^3/s	28.2	115	34.6	34.6	3.3
10 Year Peak Flood	77.2	ft^3/s	38.1	156	34.4	34.4	4.4
25 Year Peak Flood	104	ft^3/s	50.1	217	35.4	35.4	5.9
50 Year Peak Flood	125	ft^3/s	58.2	267	36.5	36.5	6.8
100 Year Peak Flood	146	ft^3/s	65.8	322	37.9	37.9	7.5
500 Year Peak Flood	196	ft^3/s	81.3	473	42.1	42.1	8.6

Peak-Flow Statistics Citations

Koltun, G.F., Kula, S.P., and Puskas, B.M.,2006, A Streamflow Statistics (StreamStats) Web Application for Ohio: U.S. Geological Survey Scientific Investigations Report 2006-5312, 62 p. (http://pubs.usgs.gov/sir/2006/5312/)

General Flow Statistics Parameters [Low Flow LatLE 41.2 wri02 4068]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	0.16	square miles	0.12	7422
LC92STOR	Percent Storage from NLCD1992	0	percent	0	19
STREAM_VARG	Streamflow Variability Index from Grid	0.55	dimensionless	0.25	1.13
LAT_CENT	Latitude of Basin Centroid	39.9364	decimal degrees	38.68	41.2

General Flow Statistics Flow Report [Low Flow LatLE 41.2 wri02 4068]

PII: Prediction Interval-Lower, PIu: Prediction Interval-Upper, SEp: Standard Error of Prediction, SE: Standard Error (other -- see report)

Statistic	Value	Unit	SE	SEp
Harmonic Mean Streamflow	0.0157	ft^3/s	65.9	65.9

General Flow Statistics Citations

Koltun, G. F., and Whitehead, M. T.,2002, Techniques for Estimating Selected Streamflow Characteristics of Rural, Unregulated Streams in Ohio: U. S. Geological Survey Water-Resources Investigations Report 02-4068, 50 p (http://oh.water.usgs.gov/reports/wrir/wrir02-4068.pdf)

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Application Version: 4.2.1

CULVERT ANALYSIS

PID : 95639 **Date :** 08/15/2018 **Project :** FRA-70-22.61 **Location :** COLUMBUS, OHIO

Description : IR-70 STA. 606+44 CONCRETE BOX CULVERT EXT. **Designer :** ARG

HEADWATER CONTROL CODES:

INLET - Inlet Control.
OUTLET - Outlet Control.
OUTLET* - Outlet Control with backwater curve used to compute headwater. See Figure III - 7E in HDS 5 for type flow.
OUTLET** - Outlet Control - See Figure III - 7D in HDS 5 for type flow.
N/A - Flow is supercritical with low headwater and low tailwater. Control Section is at the inlet.

Pipe Number : 1 **Use HW :** 0 **Inlet Invert Elevation (ft.) :** 801.13 **Outlet Invert Elevation (ft.) :** 800.53

Pipe Quantity : 1

Culvert Type : Box **Pipe Length (ft.) :** 201.00 **Culvert Slope (ft./ft.) :** 0.0030

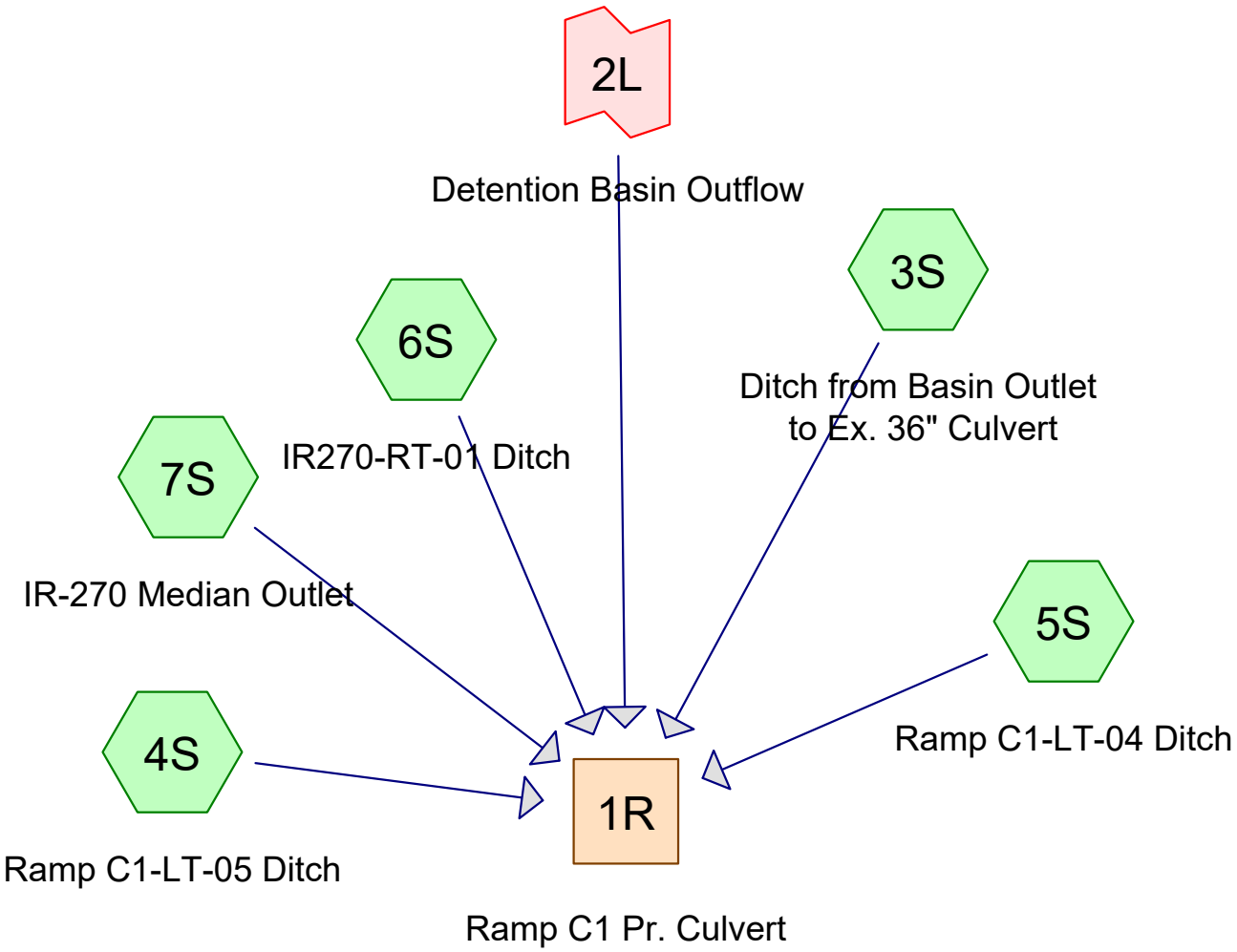
Corrugation Type :

Pipe Size : 9.0 x 5.0 ft.

Design Manning 'n' : (default)

Entrance Type : 30 - 75 degrees Wingwalls **Loss Coef. Ke :** 0.2000

FLOW (cfs.)	HEAD LOSS (ft.)	HWI (ft.)	HWO (ft.)	FLOW TYPE	VELOCITY (fps.)	DN (ft.)	DC (ft.)	MANNING N	HEADWATER CONTROL	BURIED DEPTH (ft.)	TAILWATER ELEVATION (ft.)
125.00	0.20	803.91	N/A	1 - C	7.65	1.76	1.82	0.0120	INLET	0.00	801.22
146.00	0.27	804.21	N/A	1 - C	8.05	1.95	2.01	0.0120	INLET	0.00	801.22



Subcat Reach Pond Link

Routing Diagram for FRA-70_Ramp C1 Culvert Flow Rates
Prepared by HDR, Inc, Printed 4/23/2021

Rainfall Events Listing (selected events)

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	25-yr	Type II 24-hr		Default	24.00	1	4.44	2
2	50-yr	Type II 24-hr		Default	24.00	1	5.02	2
3	100-yr	Type II 24-hr		Default	24.00	1	5.63	2

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
2.310	89	<50% Grass cover, Poor, HSG D (3S, 4S, 5S, 6S)
1.840	80	>75% Grass cover, Good, HSG D (3S, 4S, 5S, 6S)
0.830	98	Paved parking, HSG D (4S, 6S, 7S)
0.920	98	Paved roads w/curbs & sewers, HSG D (3S, 5S)
5.900	**89**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
0.000	HSG C	
5.900	HSG D	3S, 4S, 5S, 6S, 7S
0.000	Other	
5.900		**TOTAL AREA**

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	2.310	0.000	2.310	<50% Grass cover, Poor	3S, 4S, 5S, 6S
0.000	0.000	0.000	1.840	0.000	1.840	>75% Grass cover, Good	3S, 4S, 5S, 6S
0.000	0.000	0.000	0.830	0.000	0.830	Paved parking	4S, 6S, 7S
0.000	0.000	0.000	0.920	0.000	0.920	Paved roads w/curbs & sewers	3S, 5S
0.000	**0.000**	**0.000**	**5.900**	**0.000**	**5.900**	**TOTAL AREA**	

Time span=0.00-48.00 hrs, dt=0.05 hrs, 961 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment3S: Ditch from Basin Outlet Runoff Area=0.680 ac 32.35% Impervious Runoff Depth=3.14"
Tc=15.0 min CN=88 Runoff=2.69 cfs 0.178 af

Subcatchment4S: Ramp C1-LT-05 Ditch Runoff Area=1.030 ac 44.66% Impervious Runoff Depth=3.54"
Tc=14.4 min CN=92 Runoff=4.55 cfs 0.304 af

Subcatchment5S: Ramp C1-LT-04 Ditch Runoff Area=2.970 ac 23.57% Impervious Runoff Depth=3.14"
Tc=22.0 min CN=88 Runoff=9.65 cfs 0.777 af

Subcatchment6S: IR270-RT-01 Ditch Runoff Area=1.000 ac 15.00% Impervious Runoff Depth=3.04"
Tc=15.0 min CN=87 Runoff=3.85 cfs 0.254 af

Subcatchment7S: IR-270 Median Outlet Runoff Area=0.220 ac 100.00% Impervious Runoff Depth=4.20"
Tc=10.0 min CN=98 Runoff=1.21 cfs 0.077 af

Reach 1R: Ramp C1 Pr. Culvert Inflow=24.23 cfs 8.910 af
Outflow=24.23 cfs 8.910 af

Link FRA-70 MOD\HydroCAD\Current\Detention Basin Outflows\FRA-70_Detention Basin~Pond 1P.hce Inflow=14.81 cfs 7.320 af
Area= 31.550 ac 48.59% Imperv. Primary=14.81 cfs 7.320 af

Total Runoff Area = 5.900 ac Runoff Volume = 1.590 af Average Runoff Depth = 3.23"
70.34% Pervious = 4.150 ac 29.66% Impervious = 1.750 ac

Summary for Subcatchment 3S: Ditch from Basin Outlet to Ex. 36" Culvert

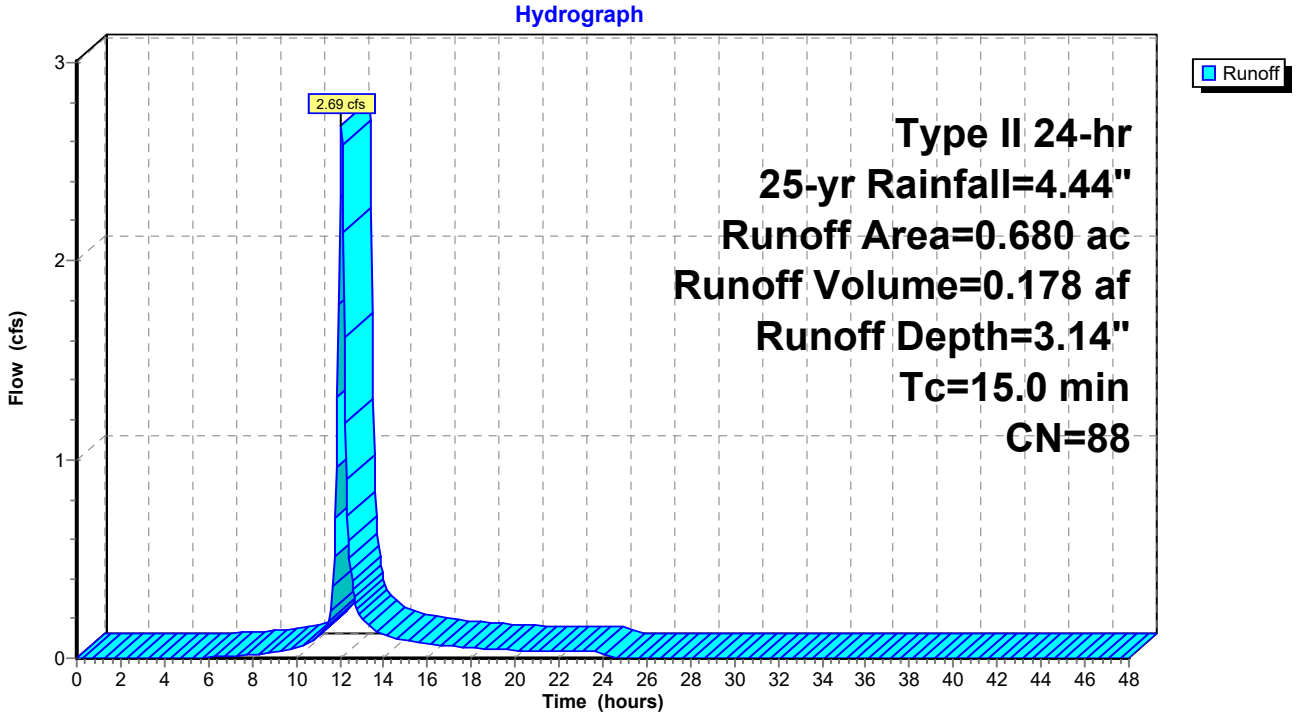
Runoff = 2.69 cfs @ 12.07 hrs, Volume= 0.178 af, Depth= 3.14"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr Rainfall=4.44"

Area (ac)	CN	Description
0.220	98	Paved roads w/curbs & sewers, HSG D
0.270	80	>75% Grass cover, Good, HSG D
0.190	89	<50% Grass cover, Poor, HSG D
0.680	88	Weighted Average
0.460		67.65% Pervious Area
0.220		32.35% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.0					**Direct Entry, Direct Flow to Ditch**

Subcatchment 3S: Ditch from Basin Outlet to Ex. 36" Culvert



Summary for Subcatchment 4S: Ramp C1-LT-05 Ditch

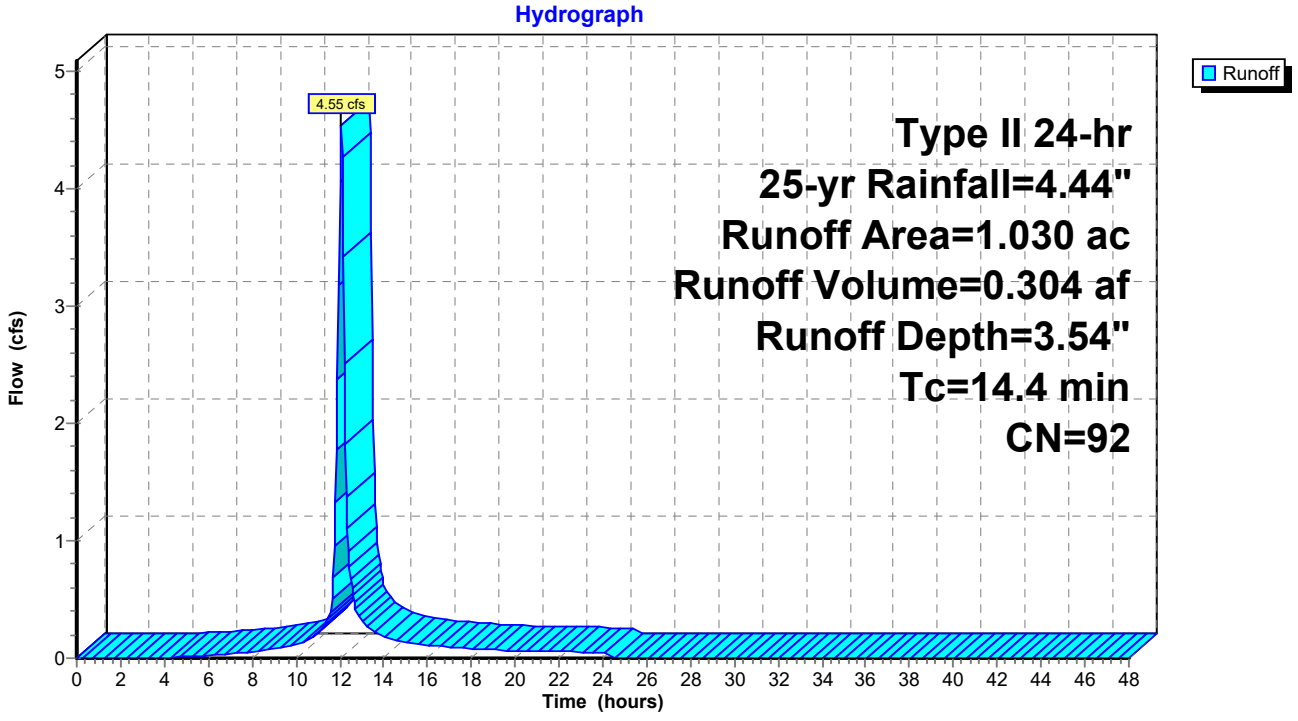
Runoff = 4.55 cfs @ 12.06 hrs, Volume= 0.304 af, Depth= 3.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr Rainfall=4.44"

Area (ac)	CN	Description
0.460	98	Paved parking, HSG D
0.470	89	<50% Grass cover, Poor, HSG D
0.100	80	>75% Grass cover, Good, HSG D
1.030	92	Weighted Average
0.570		55.34% Pervious Area
0.460		44.66% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.4					**Direct Entry, Per ditch calc**

Subcatchment 4S: Ramp C1-LT-05 Ditch



Summary for Subcatchment 5S: Ramp C1-LT-04 Ditch

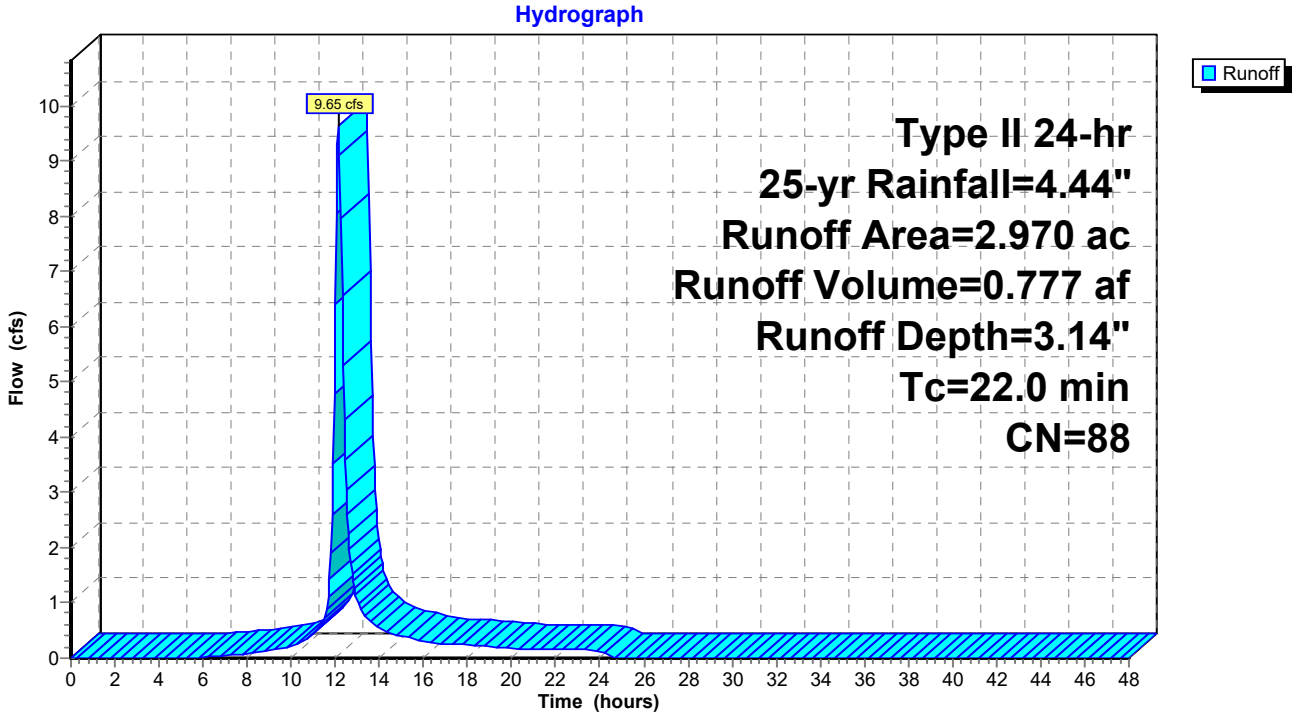
Runoff = 9.65 cfs @ 12.14 hrs, Volume= 0.777 af, Depth= 3.14"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr Rainfall=4.44"

Area (ac)	CN	Description
0.700	98	Paved roads w/curbs & sewers, HSG D
1.200	89	<50% Grass cover, Poor, HSG D
1.070	80	>75% Grass cover, Good, HSG D
2.970	88	Weighted Average
2.270		76.43% Pervious Area
0.700		23.57% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
22.0					**Direct Entry, Per ditch calc**

Subcatchment 5S: Ramp C1-LT-04 Ditch



Summary for Subcatchment 6S: IR270-RT-01 Ditch

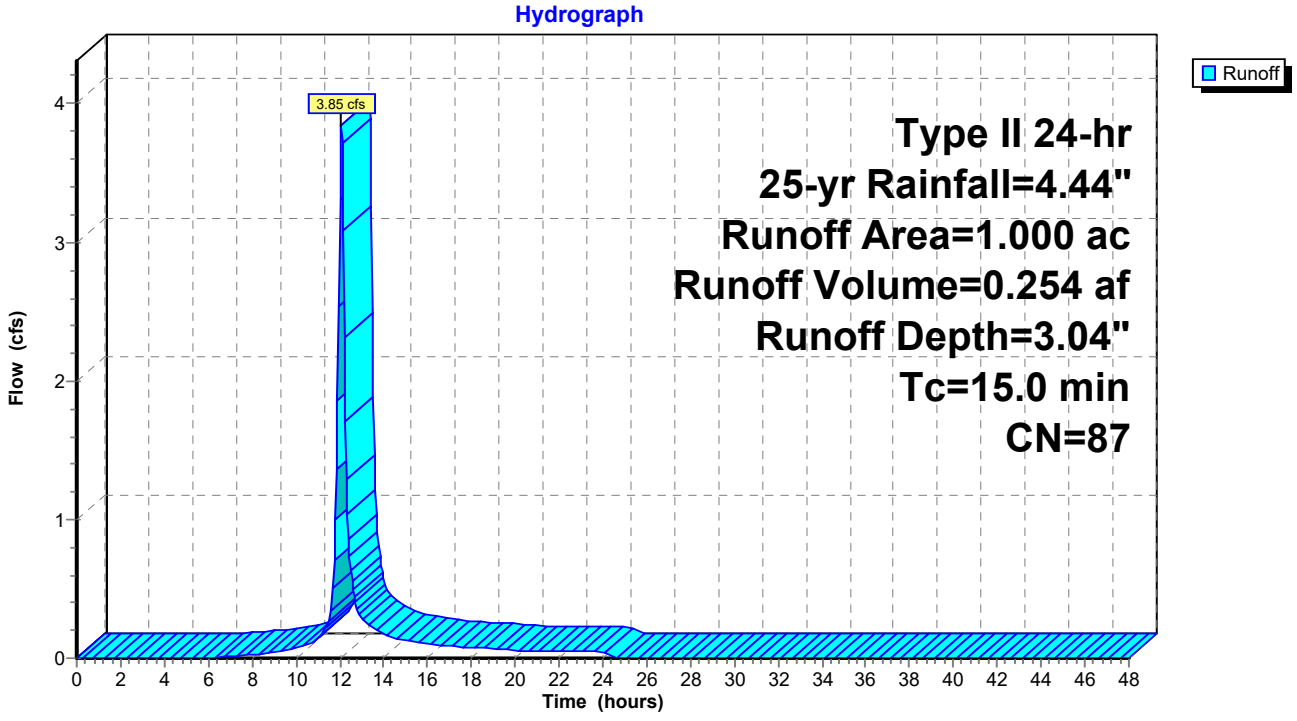
Runoff = 3.85 cfs @ 12.07 hrs, Volume= 0.254 af, Depth= 3.04"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr Rainfall=4.44"

Area (ac)	CN	Description
0.150	98	Paved parking, HSG D
0.450	89	<50% Grass cover, Poor, HSG D
0.400	80	>75% Grass cover, Good, HSG D
1.000	87	Weighted Average
0.850		85.00% Pervious Area
0.150		15.00% Impervious Area

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

Subcatchment 6S: IR270-RT-01 Ditch



Summary for Subcatchment 7S: IR-270 Median Outlet

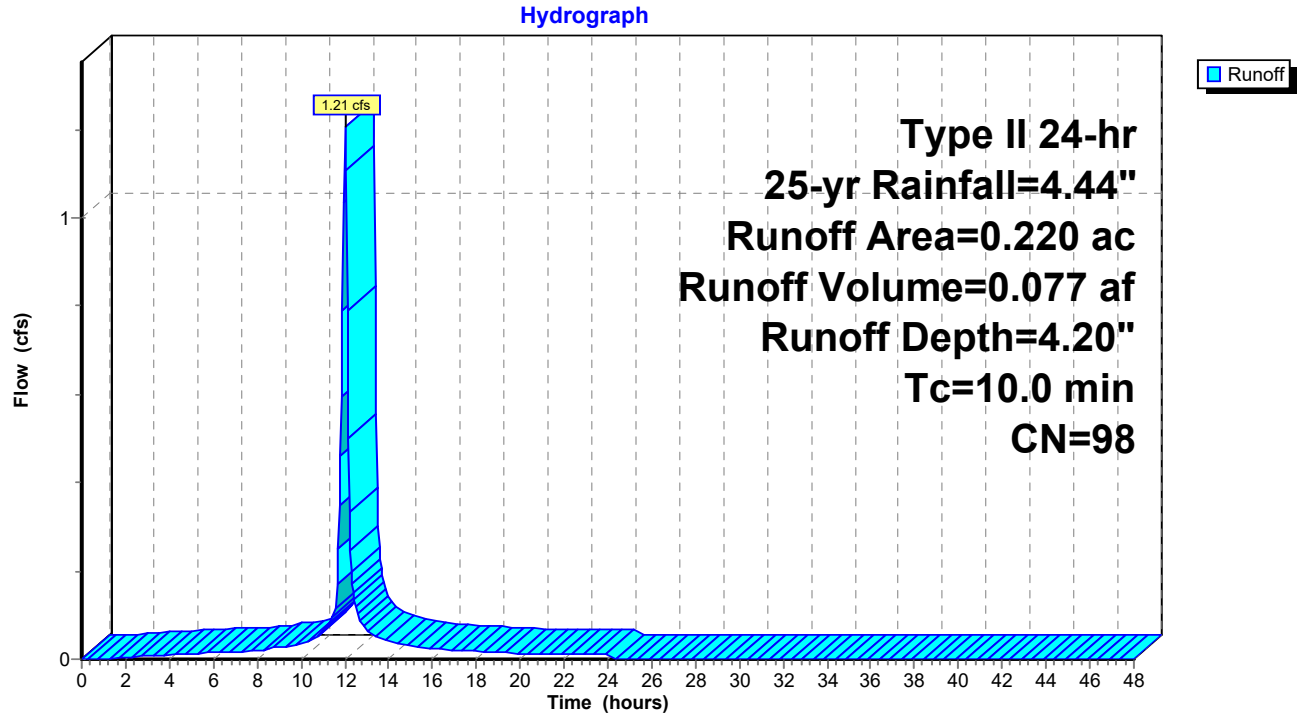
Runoff = 1.21 cfs @ 12.01 hrs, Volume= 0.077 af, Depth= 4.20"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr Rainfall=4.44"

Area (ac)	CN	Description
0.220	98	Paved parking, HSG D
0.220		100.00% Impervious Area

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

Subcatchment 7S: IR-270 Median Outlet



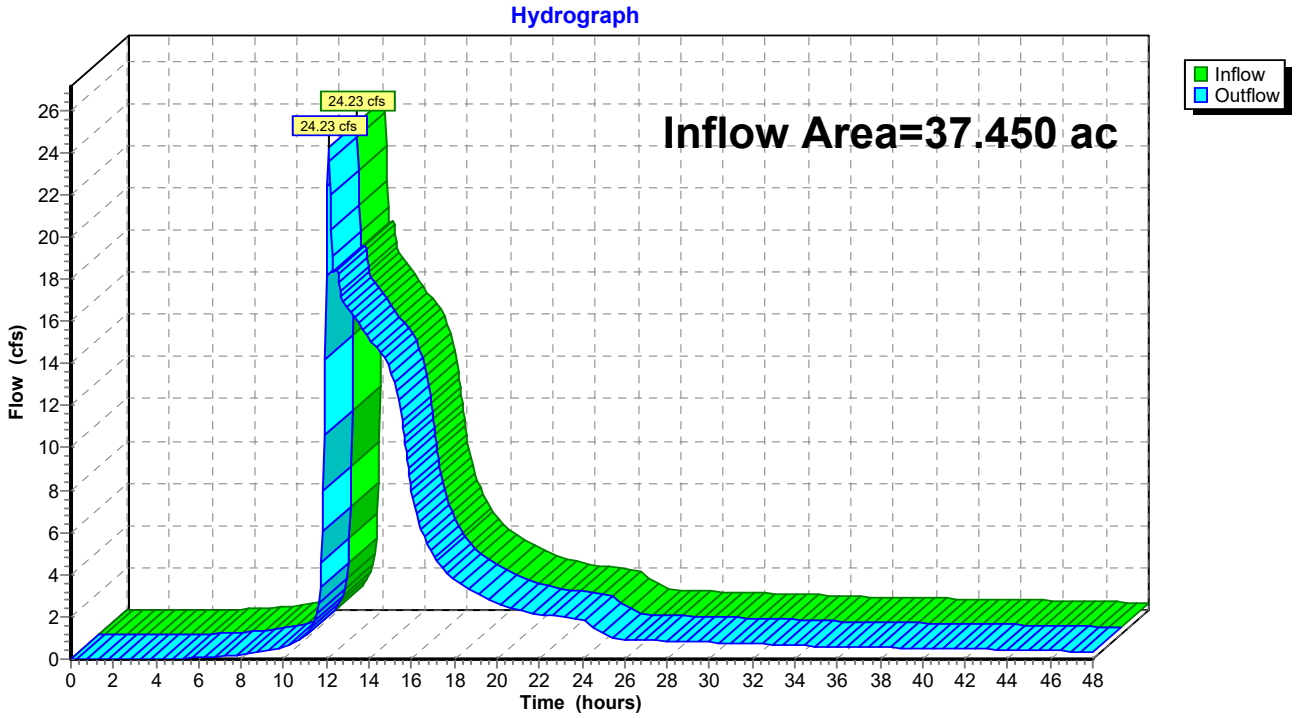
Summary for Reach 1R: Ramp C1 Pr. Culvert

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 37.450 ac, 45.61% Impervious, Inflow Depth > 2.86" for 25-yr event
Inflow = 24.23 cfs @ 12.11 hrs, Volume= 8.910 af
Outflow = 24.23 cfs @ 12.11 hrs, Volume= 8.910 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Reach 1R: Ramp C1 Pr. Culvert



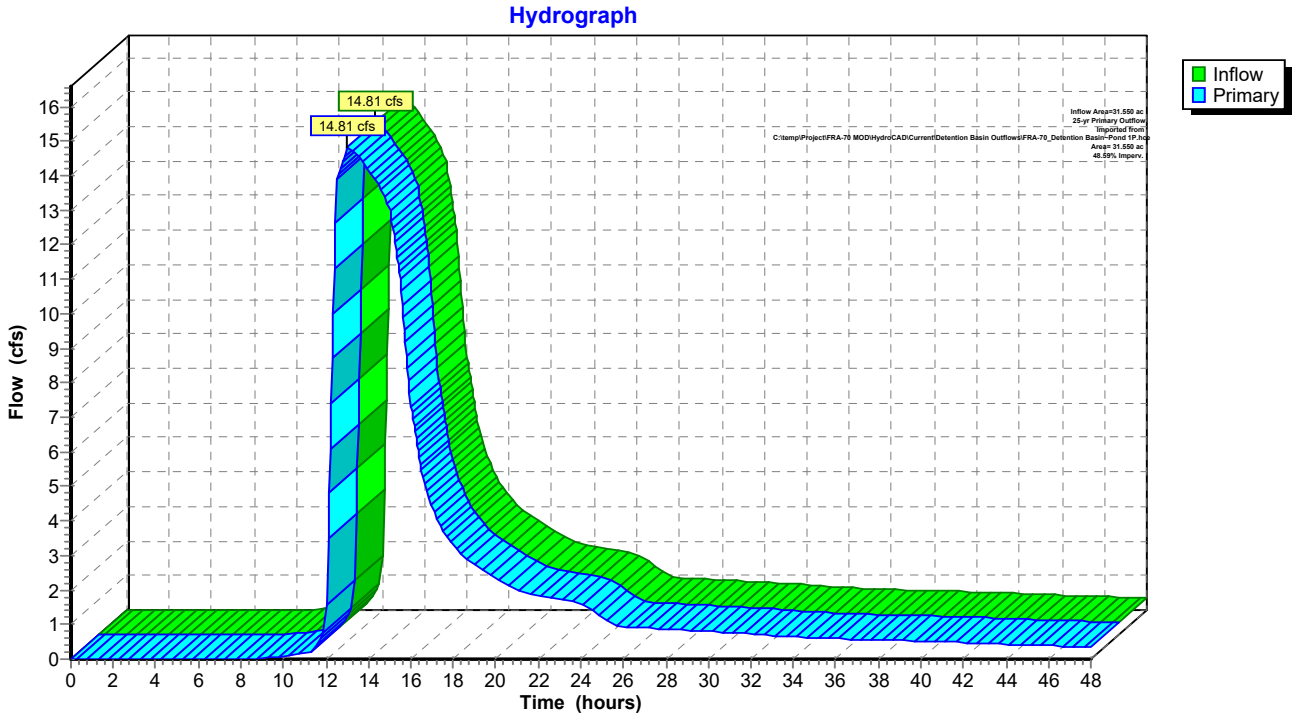
Summary for Link 2L: Detention Basin Outflow

Inflow Area = 31.550 ac, 48.59% Impervious, Inflow Depth > 2.78" for 25-yr event
Inflow = 14.81 cfs @ 13.02 hrs, Volume= 7.320 af
Primary = 14.81 cfs @ 13.02 hrs, Volume= 7.320 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

25-yr Primary Outflow Imported from C:\temp\Project\FRA-70 MOD\HydroCAD\Current\Detention Basin Outflows\FRA

Link 2L: Detention Basin Outflow



Time span=0.00-48.00 hrs, dt=0.05 hrs, 961 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment3S: Ditch from Basin Outlet Runoff Area=0.680 ac 32.35% Impervious Runoff Depth=3.69"
Tc=15.0 min CN=88 Runoff=3.13 cfs 0.209 af

Subcatchment4S: Ramp C1-LT-05 Ditch Runoff Area=1.030 ac 44.66% Impervious Runoff Depth=4.11"
Tc=14.4 min CN=92 Runoff=5.23 cfs 0.353 af

Subcatchment5S: Ramp C1-LT-04 Ditch Runoff Area=2.970 ac 23.57% Impervious Runoff Depth=3.69"
Tc=22.0 min CN=88 Runoff=11.27 cfs 0.913 af

Subcatchment6S: IR270-RT-01 Ditch Runoff Area=1.000 ac 15.00% Impervious Runoff Depth=3.59"
Tc=15.0 min CN=87 Runoff=4.50 cfs 0.299 af

Subcatchment7S: IR-270 Median Outlet Runoff Area=0.220 ac 100.00% Impervious Runoff Depth=4.78"
Tc=10.0 min CN=98 Runoff=1.37 cfs 0.088 af

Reach 1R: Ramp C1 Pr. Culvert Inflow=29.76 cfs 10.619 af
Outflow=29.76 cfs 10.619 af

Link FRA-70 MOD\HydroCAD\Current\Detention Basin Outflows\FRA-70_Detention Basin~Pond 1P.hce Inflow=15.76 cfs 8.758 af
Area= 31.550 ac 48.59% Imperv. Primary=15.76 cfs 8.758 af

Total Runoff Area = 5.900 ac Runoff Volume = 1.861 af Average Runoff Depth = 3.78"
70.34% Pervious = 4.150 ac 29.66% Impervious = 1.750 ac

Summary for Subcatchment 3S: Ditch from Basin Outlet to Ex. 36" Culvert

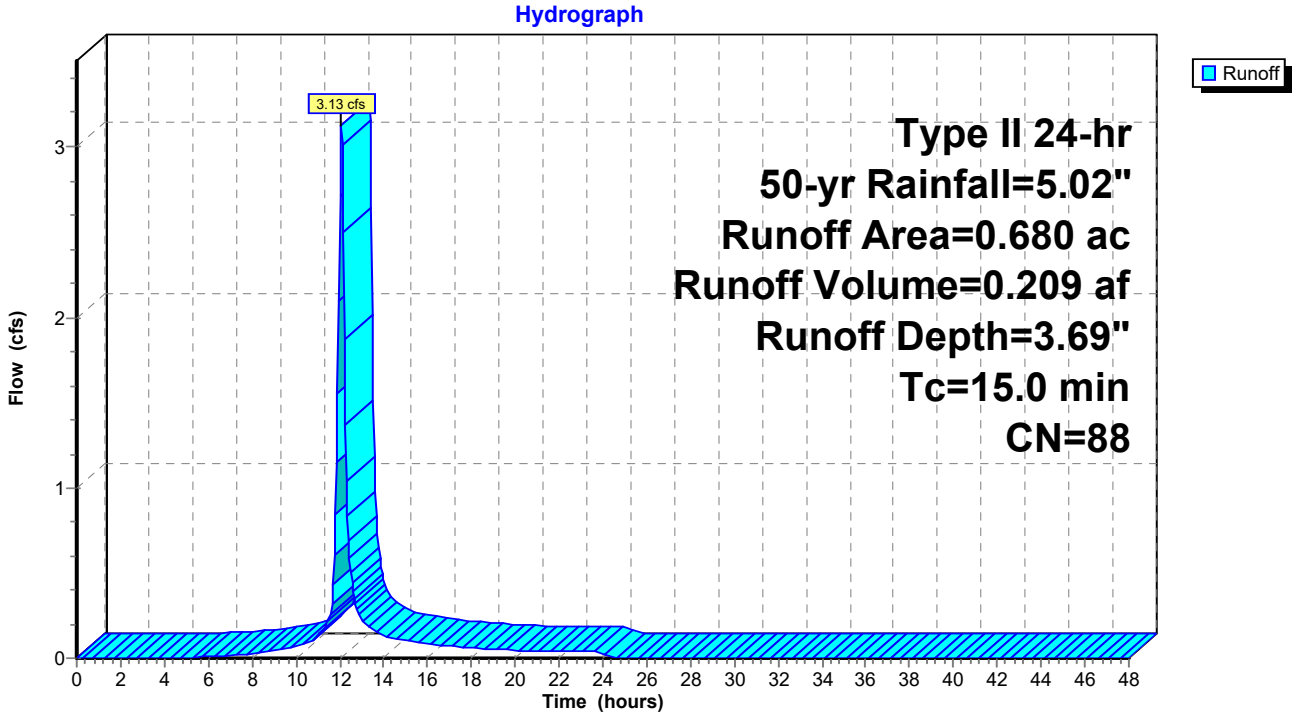
Runoff = 3.13 cfs @ 12.07 hrs, Volume= 0.209 af, Depth= 3.69"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 50-yr Rainfall=5.02"

Area (ac)	CN	Description
0.220	98	Paved roads w/curbs & sewers, HSG D
0.270	80	>75% Grass cover, Good, HSG D
0.190	89	<50% Grass cover, Poor, HSG D
0.680	88	Weighted Average
0.460		67.65% Pervious Area
0.220		32.35% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.0					**Direct Entry, Direct Flow to Ditch**

Subcatchment 3S: Ditch from Basin Outlet to Ex. 36" Culvert



Summary for Subcatchment 4S: Ramp C1-LT-05 Ditch

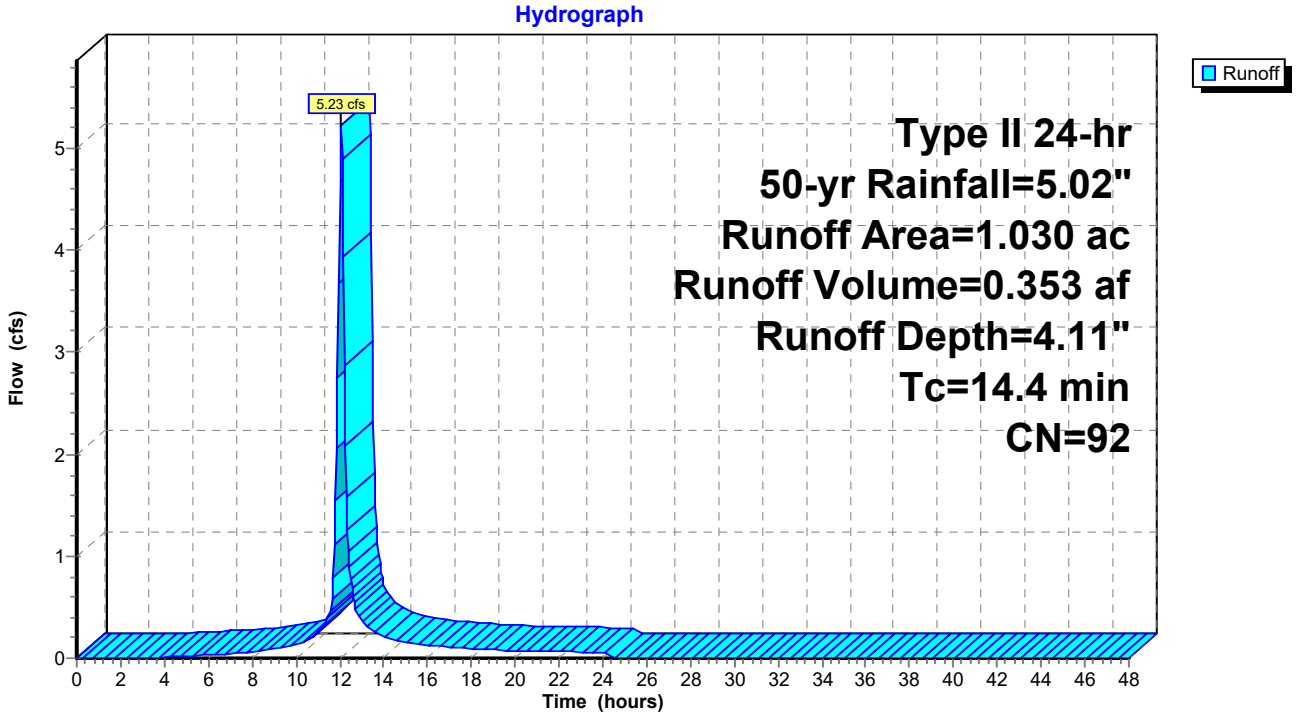
Runoff = 5.23 cfs @ 12.06 hrs, Volume= 0.353 af, Depth= 4.11"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 50-yr Rainfall=5.02"

Area (ac)	CN	Description
0.460	98	Paved parking, HSG D
0.470	89	<50% Grass cover, Poor, HSG D
0.100	80	>75% Grass cover, Good, HSG D
1.030	92	Weighted Average
0.570		55.34% Pervious Area
0.460		44.66% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.4					**Direct Entry, Per ditch calc**

Subcatchment 4S: Ramp C1-LT-05 Ditch



Summary for Subcatchment 5S: Ramp C1-LT-04 Ditch

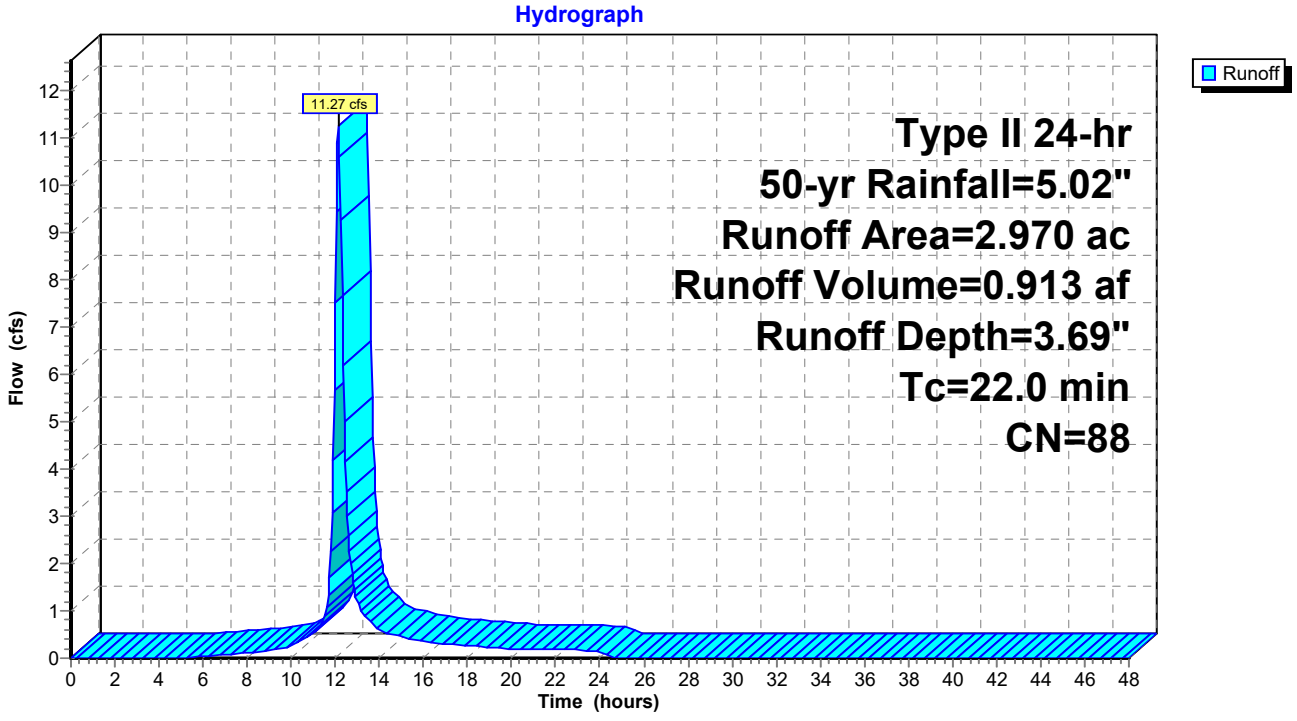
Runoff = 11.27 cfs @ 12.14 hrs, Volume= 0.913 af, Depth= 3.69"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 50-yr Rainfall=5.02"

Area (ac)	CN	Description
0.700	98	Paved roads w/curbs & sewers, HSG D
1.200	89	<50% Grass cover, Poor, HSG D
1.070	80	>75% Grass cover, Good, HSG D
2.970	88	Weighted Average
2.270		76.43% Pervious Area
0.700		23.57% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
22.0					**Direct Entry, Per ditch calc**

Subcatchment 5S: Ramp C1-LT-04 Ditch



Summary for Subcatchment 6S: IR270-RT-01 Ditch

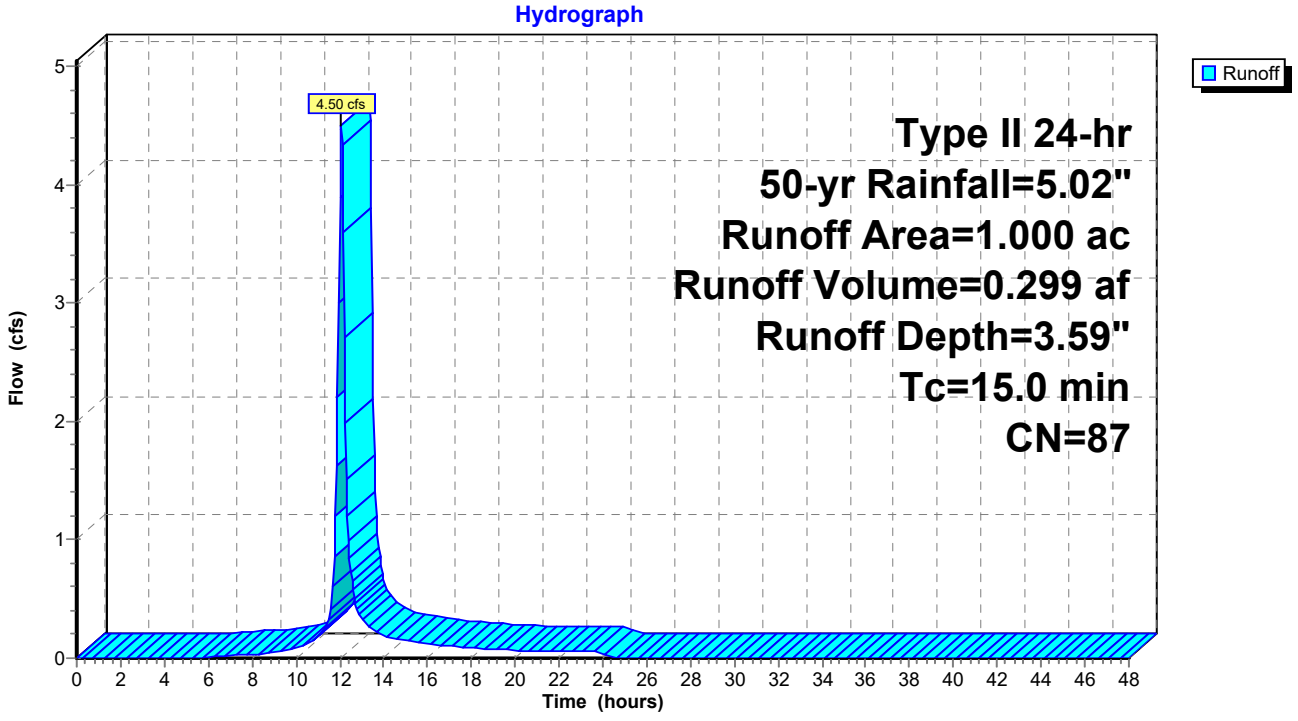
Runoff = 4.50 cfs @ 12.07 hrs, Volume= 0.299 af, Depth= 3.59"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 50-yr Rainfall=5.02"

Area (ac)	CN	Description
0.150	98	Paved parking, HSG D
0.450	89	<50% Grass cover, Poor, HSG D
0.400	80	>75% Grass cover, Good, HSG D
1.000	87	Weighted Average
0.850		85.00% Pervious Area
0.150		15.00% Impervious Area

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

Subcatchment 6S: IR270-RT-01 Ditch



Summary for Subcatchment 7S: IR-270 Median Outlet

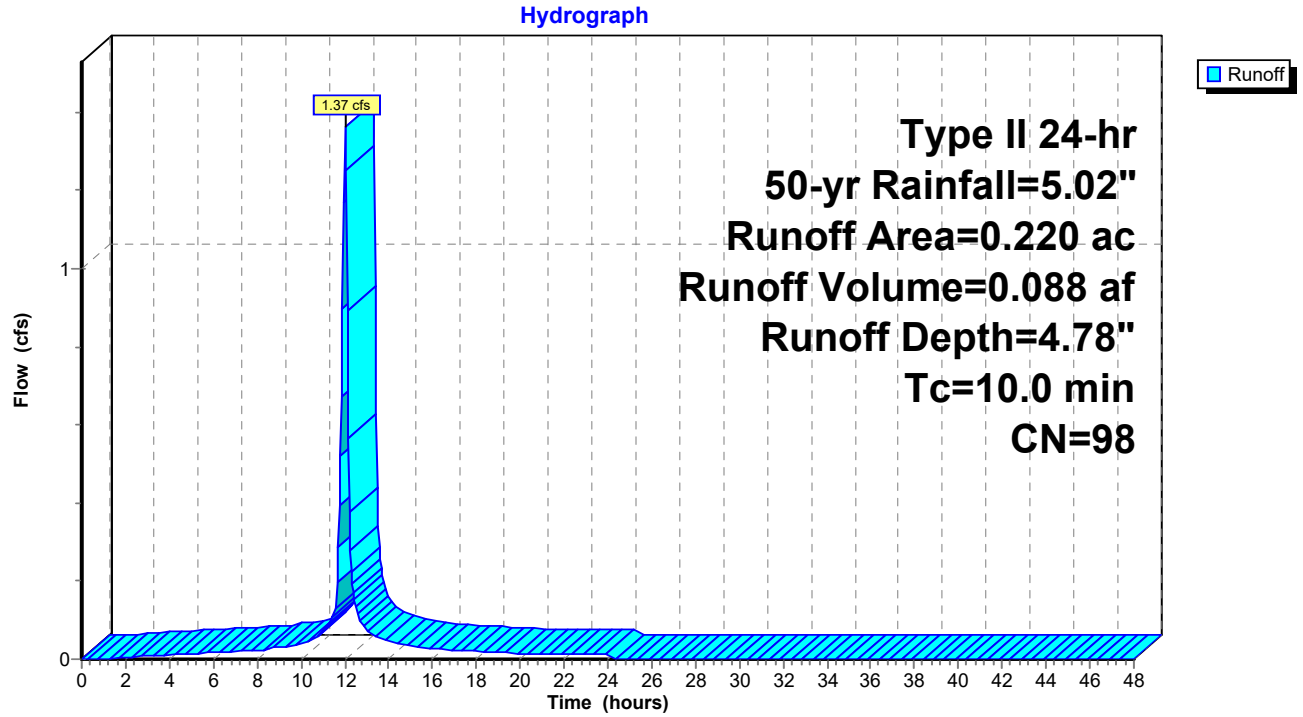
Runoff = 1.37 cfs @ 12.01 hrs, Volume= 0.088 af, Depth= 4.78"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 50-yr Rainfall=5.02"

Area (ac)	CN	Description
0.220	98	Paved parking, HSG D
0.220		100.00% Impervious Area

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

Subcatchment 7S: IR-270 Median Outlet



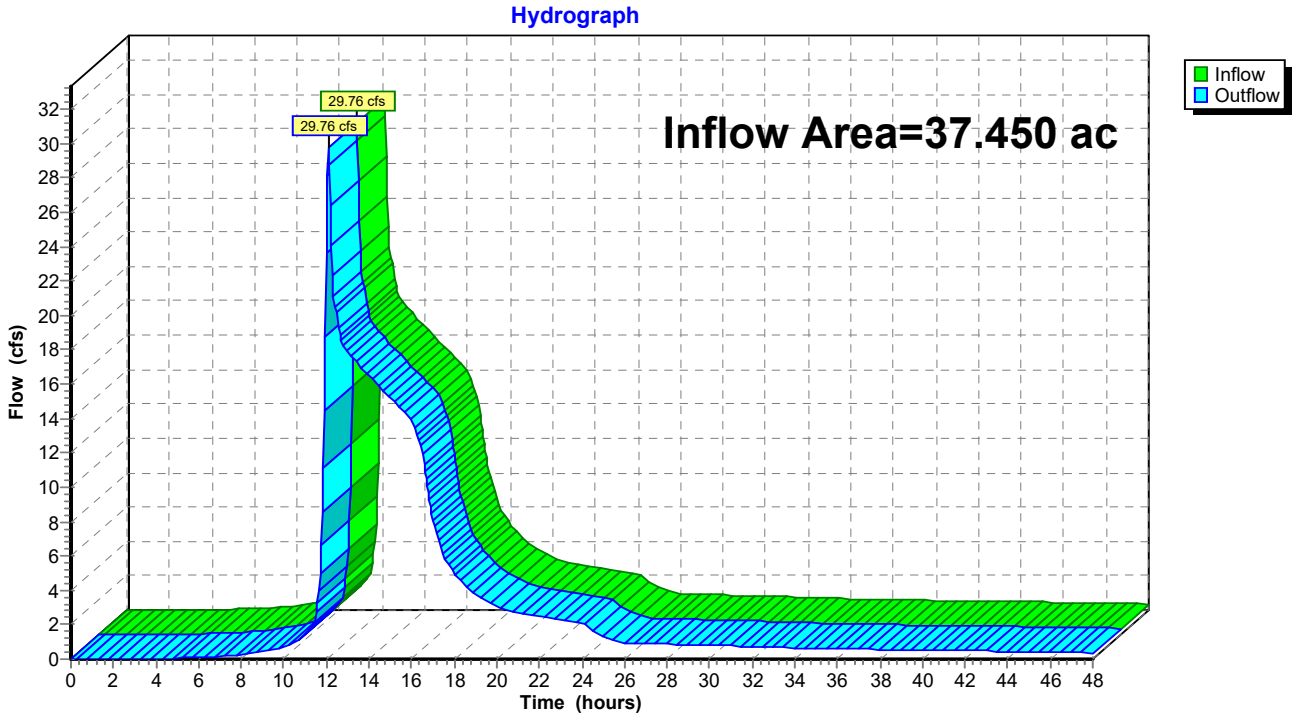
Summary for Reach 1R: Ramp C1 Pr. Culvert

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 37.450 ac, 45.61% Impervious, Inflow Depth > 3.40" for 50-yr event
Inflow = 29.76 cfs @ 12.11 hrs, Volume= 10.619 af
Outflow = 29.76 cfs @ 12.11 hrs, Volume= 10.619 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Reach 1R: Ramp C1 Pr. Culvert



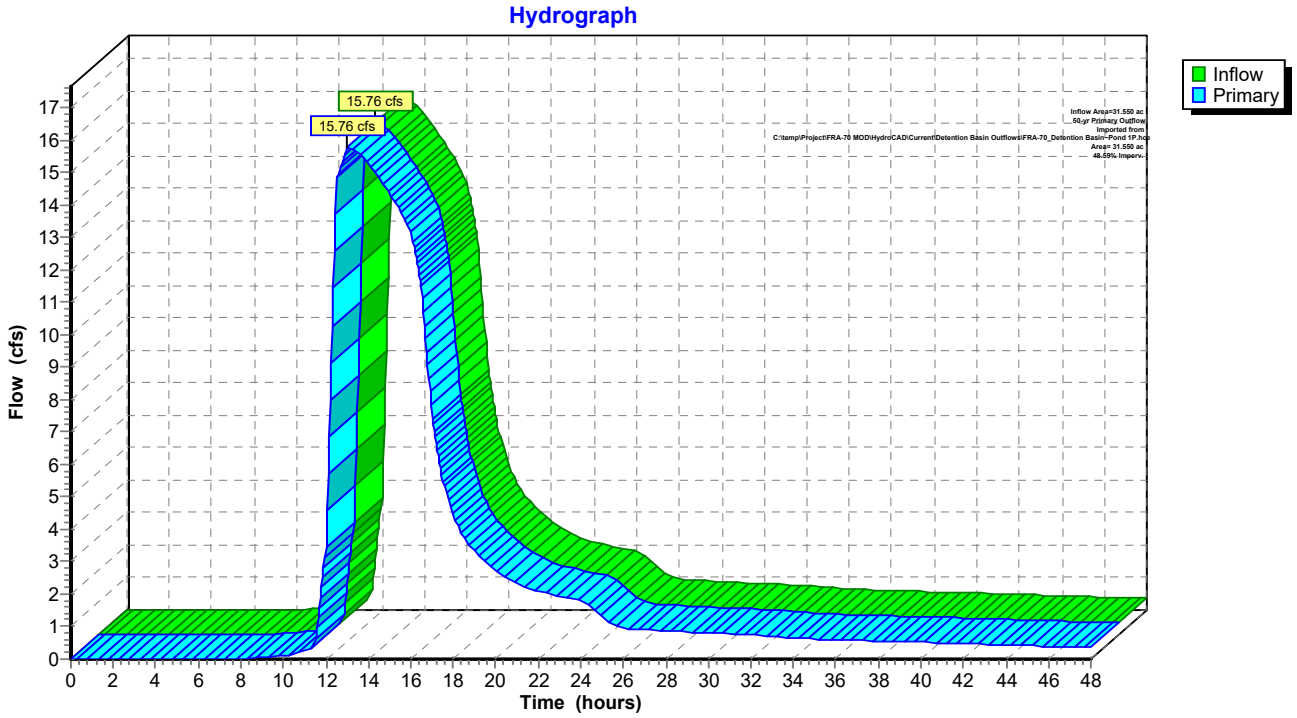
Summary for Link 2L: Detention Basin Outflow

Inflow Area = 31.550 ac, 48.59% Impervious, Inflow Depth > 3.33" for 50-yr event
Inflow = 15.76 cfs @ 13.02 hrs, Volume= 8.758 af
Primary = 15.76 cfs @ 13.02 hrs, Volume= 8.758 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

50-yr Primary Outflow Imported from C:\temp\Project\FRA-70 MOD\HydroCAD\Current\Detention Basin Outflows\FRA

Link 2L: Detention Basin Outflow



Time span=0.00-48.00 hrs, dt=0.05 hrs, 961 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment3S: Ditch from Basin Outlet Runoff Area=0.680 ac 32.35% Impervious Runoff Depth=4.27"
Tc=15.0 min CN=88 Runoff=3.60 cfs 0.242 af

Subcatchment4S: Ramp C1-LT-05 Ditch Runoff Area=1.030 ac 44.66% Impervious Runoff Depth=4.71"
Tc=14.4 min CN=92 Runoff=5.94 cfs 0.404 af

Subcatchment5S: Ramp C1-LT-04 Ditch Runoff Area=2.970 ac 23.57% Impervious Runoff Depth=4.27"
Tc=22.0 min CN=88 Runoff=12.97 cfs 1.057 af

Subcatchment6S: IR270-RT-01 Ditch Runoff Area=1.000 ac 15.00% Impervious Runoff Depth=4.16"
Tc=15.0 min CN=87 Runoff=5.19 cfs 0.347 af

Subcatchment7S: IR-270 Median Outlet Runoff Area=0.220 ac 100.00% Impervious Runoff Depth=5.39"
Tc=10.0 min CN=98 Runoff=1.54 cfs 0.099 af

Reach 1R: Ramp C1 Pr. Culvert Inflow=37.76 cfs 12.436 af
Outflow=37.76 cfs 12.436 af

Link RA-70 MOD\HydroCAD\Current\Detention Basin Outflows\FRA-70_Detention Basin~Pond 1P.hce Inflow=16.47 cfs 10.287 af
Area= 31.550 ac 48.59% Imperv. Primary=16.47 cfs 10.287 af

Total Runoff Area = 5.900 ac Runoff Volume = 2.149 af Average Runoff Depth = 4.37"
70.34% Pervious = 4.150 ac 29.66% Impervious = 1.750 ac

Summary for Subcatchment 3S: Ditch from Basin Outlet to Ex. 36" Culvert

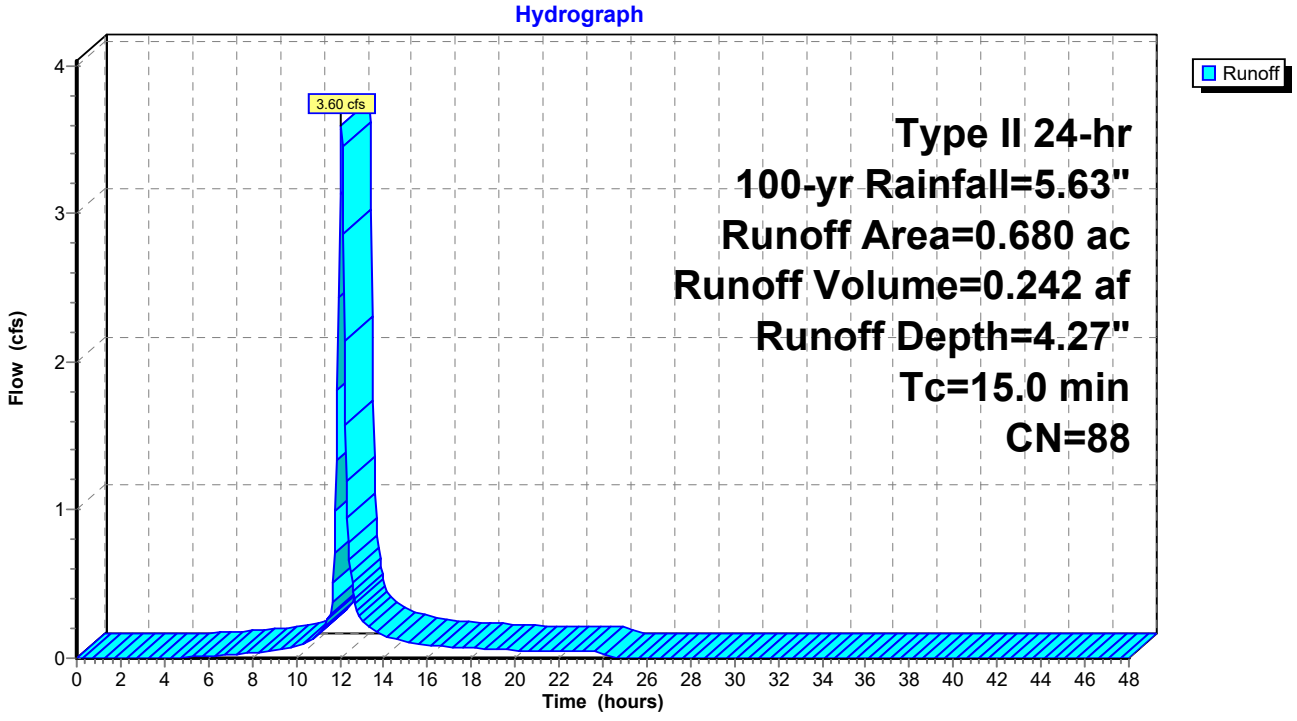
Runoff = 3.60 cfs @ 12.06 hrs, Volume= 0.242 af, Depth= 4.27"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-yr Rainfall=5.63"

Area (ac)	CN	Description
0.220	98	Paved roads w/curbs & sewers, HSG D
0.270	80	>75% Grass cover, Good, HSG D
0.190	89	<50% Grass cover, Poor, HSG D
0.680	88	Weighted Average
0.460		67.65% Pervious Area
0.220		32.35% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.0					**Direct Entry, Direct Flow to Ditch**

Subcatchment 3S: Ditch from Basin Outlet to Ex. 36" Culvert



Summary for Subcatchment 4S: Ramp C1-LT-05 Ditch

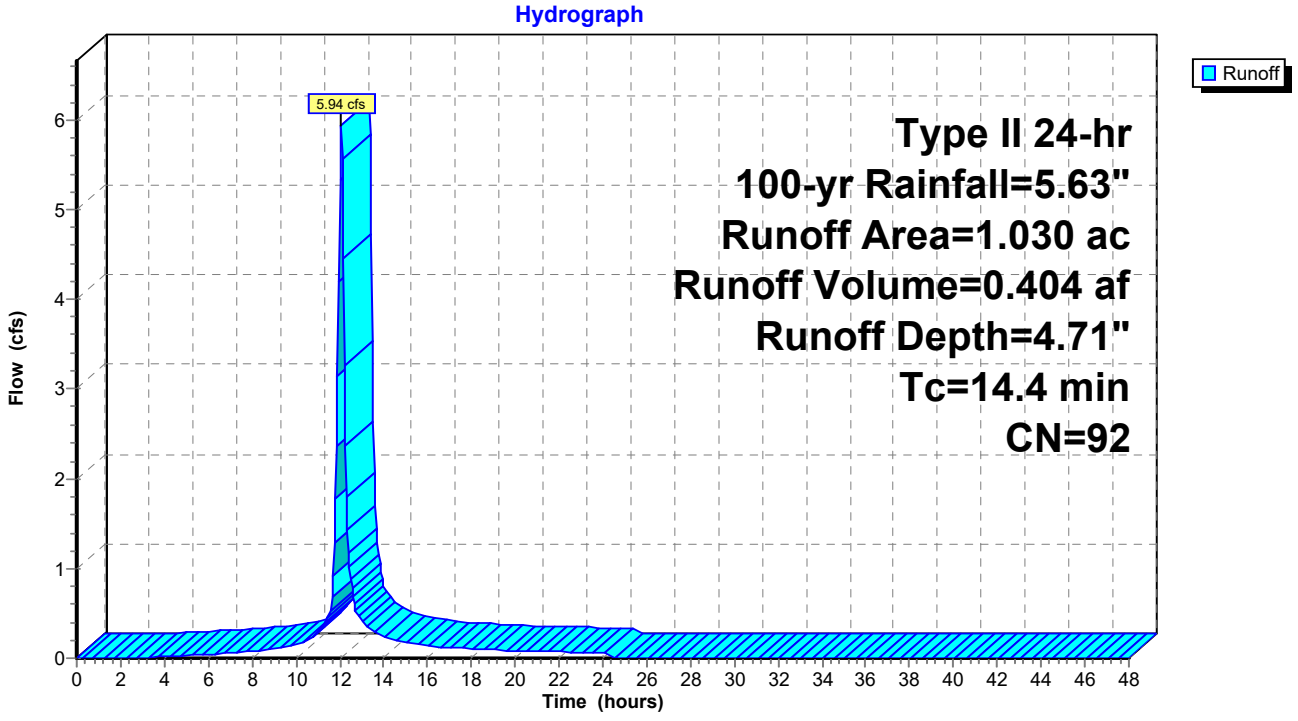
Runoff = 5.94 cfs @ 12.06 hrs, Volume= 0.404 af, Depth= 4.71"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-yr Rainfall=5.63"

Area (ac)	CN	Description
0.460	98	Paved parking, HSG D
0.470	89	<50% Grass cover, Poor, HSG D
0.100	80	>75% Grass cover, Good, HSG D
1.030	92	Weighted Average
0.570		55.34% Pervious Area
0.460		44.66% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.4					**Direct Entry, Per ditch calc**

Subcatchment 4S: Ramp C1-LT-05 Ditch



Summary for Subcatchment 5S: Ramp C1-LT-04 Ditch

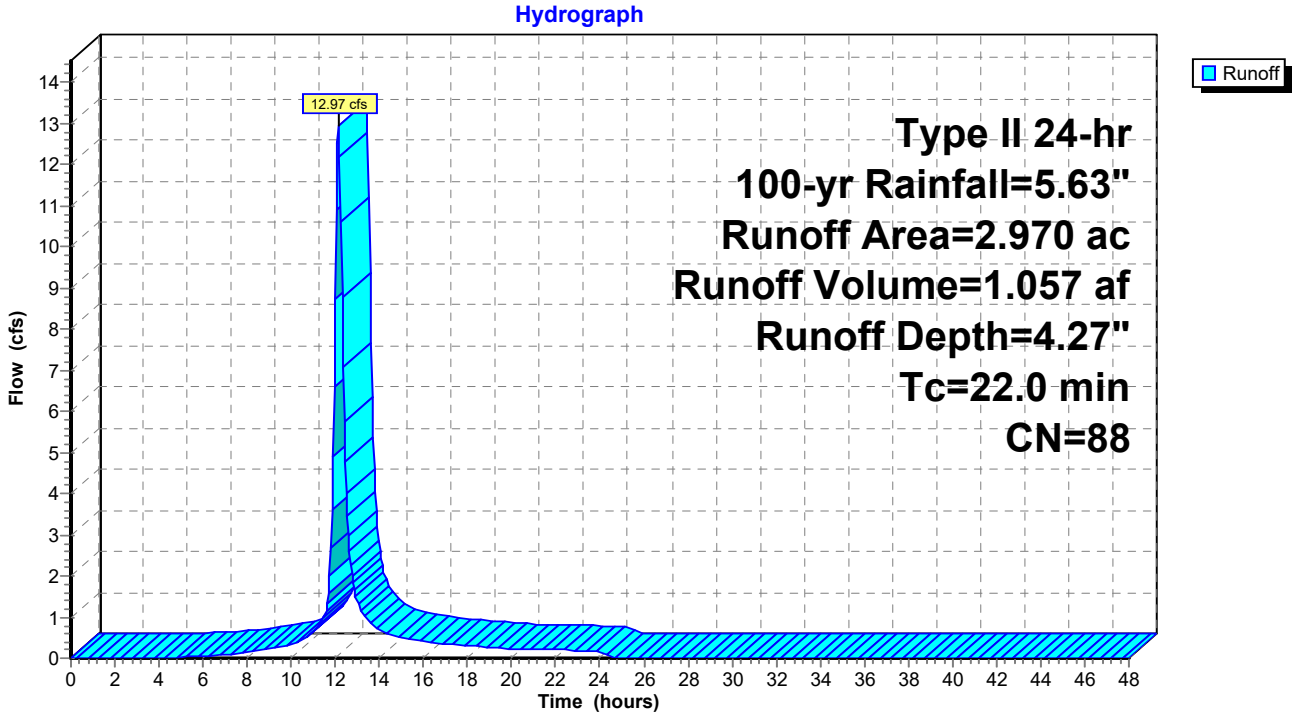
Runoff = 12.97 cfs @ 12.14 hrs, Volume= 1.057 af, Depth= 4.27"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-yr Rainfall=5.63"

Area (ac)	CN	Description
0.700	98	Paved roads w/curbs & sewers, HSG D
1.200	89	<50% Grass cover, Poor, HSG D
1.070	80	>75% Grass cover, Good, HSG D
2.970	88	Weighted Average
2.270		76.43% Pervious Area
0.700		23.57% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
22.0					**Direct Entry, Per ditch calc**

Subcatchment 5S: Ramp C1-LT-04 Ditch



Summary for Subcatchment 6S: IR270-RT-01 Ditch

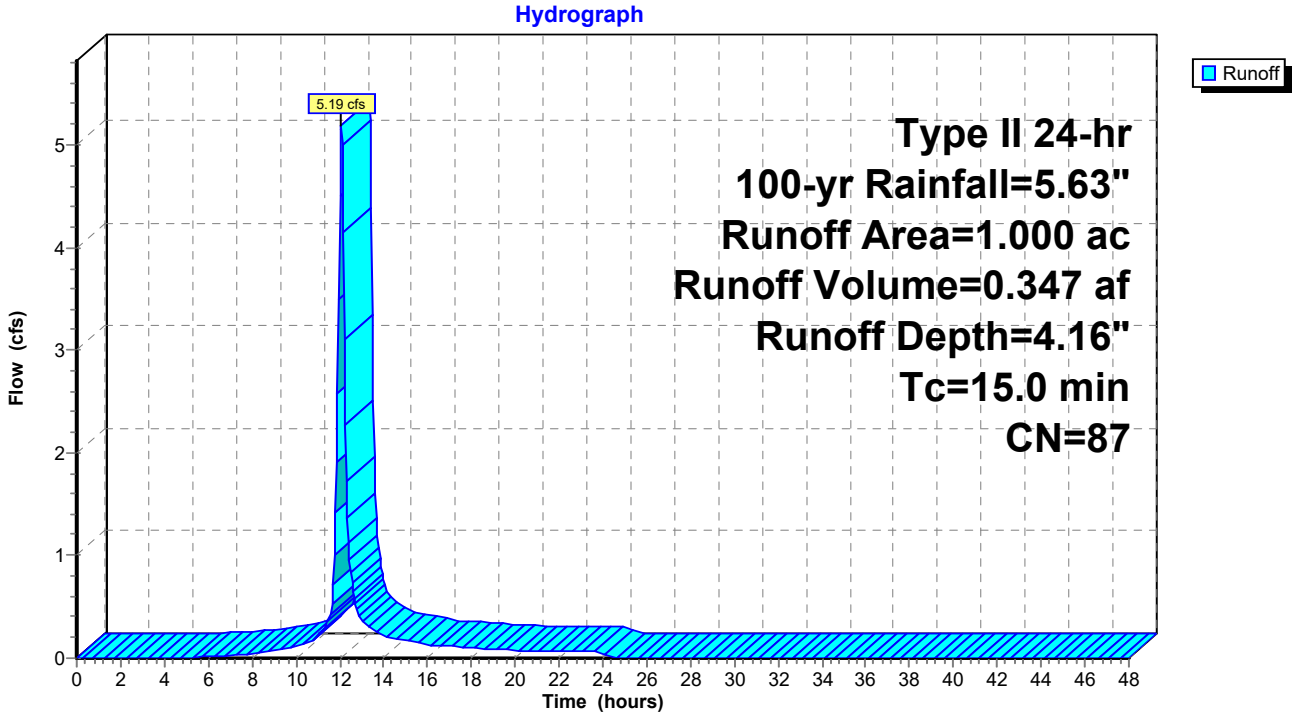
Runoff = 5.19 cfs @ 12.06 hrs, Volume= 0.347 af, Depth= 4.16"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-yr Rainfall=5.63"

Area (ac)	CN	Description
0.150	98	Paved parking, HSG D
0.450	89	<50% Grass cover, Poor, HSG D
0.400	80	>75% Grass cover, Good, HSG D
1.000	87	Weighted Average
0.850		85.00% Pervious Area
0.150		15.00% Impervious Area

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

Subcatchment 6S: IR270-RT-01 Ditch



Summary for Subcatchment 7S: IR-270 Median Outlet

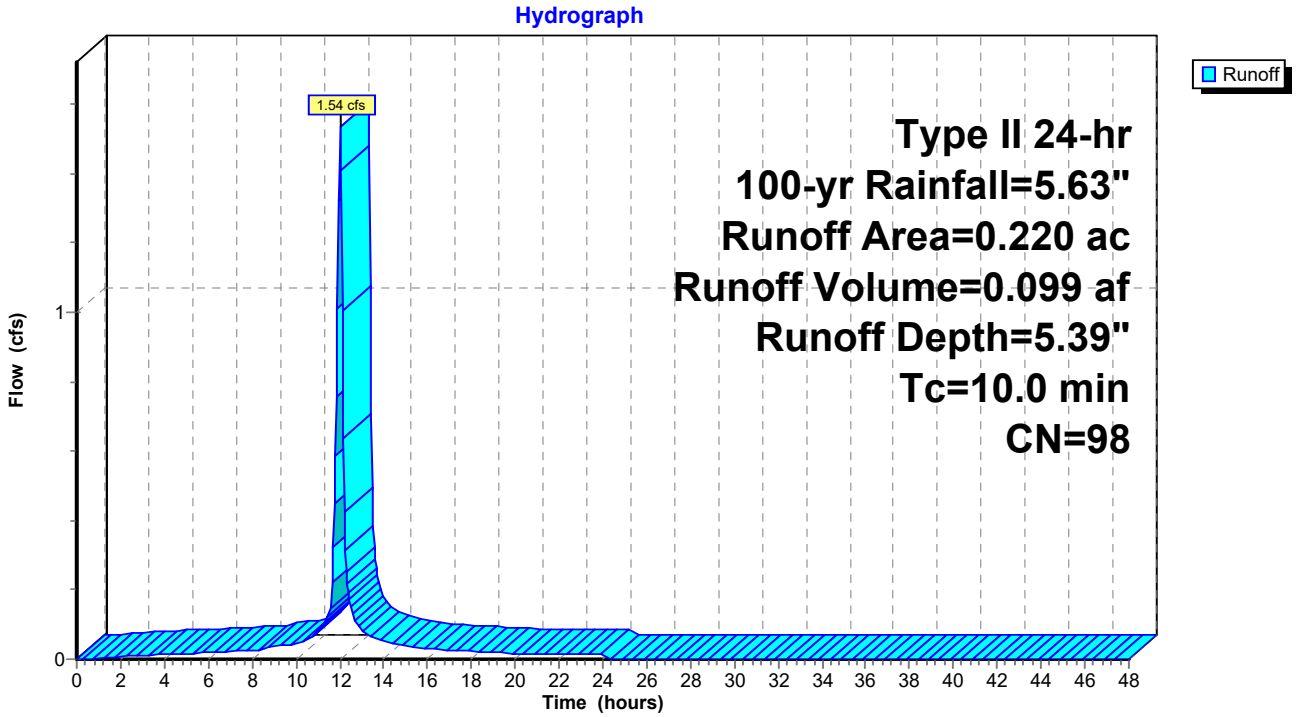
Runoff = 1.54 cfs @ 12.01 hrs, Volume= 0.099 af, Depth= 5.39"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-yr Rainfall=5.63"

Area (ac)	CN	Description
0.220	98	Paved parking, HSG D
0.220		100.00% Impervious Area

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

Subcatchment 7S: IR-270 Median Outlet



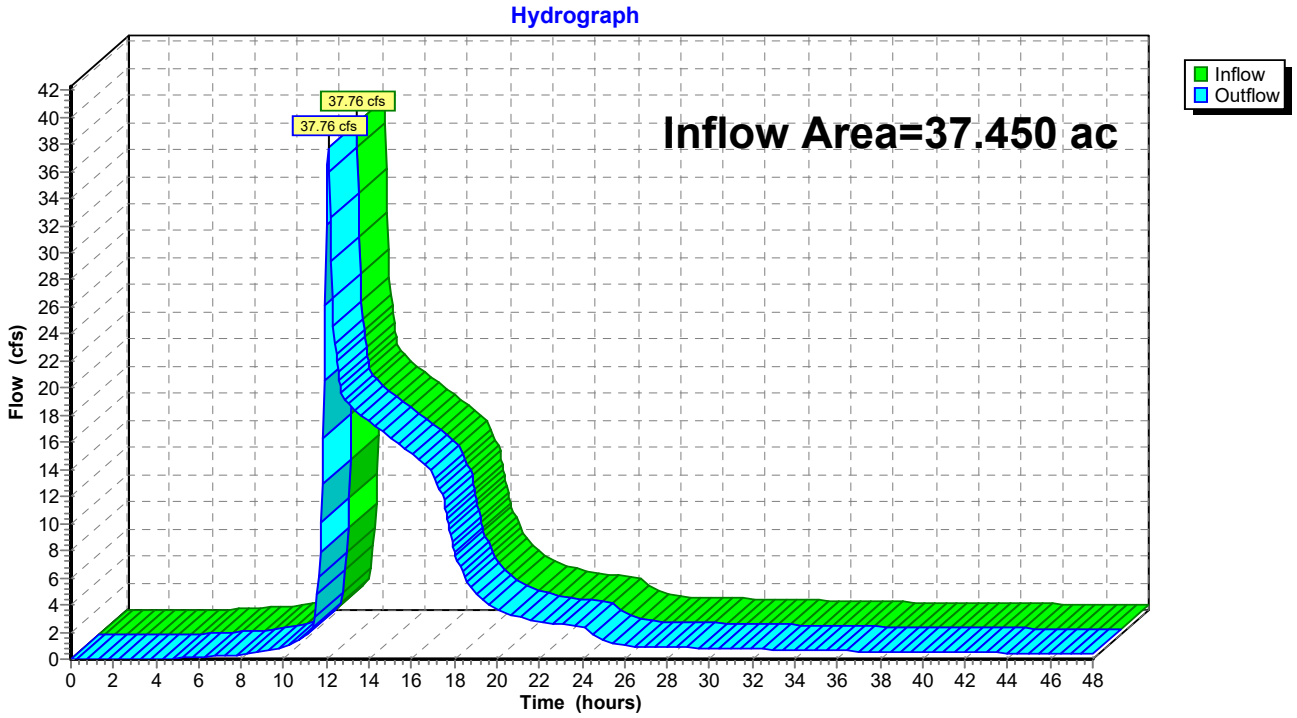
Summary for Reach 1R: Ramp C1 Pr. Culvert

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 37.450 ac, 45.61% Impervious, Inflow Depth > 3.98" for 100-yr event
Inflow = 37.76 cfs @ 12.10 hrs, Volume= 12.436 af
Outflow = 37.76 cfs @ 12.10 hrs, Volume= 12.436 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Reach 1R: Ramp C1 Pr. Culvert



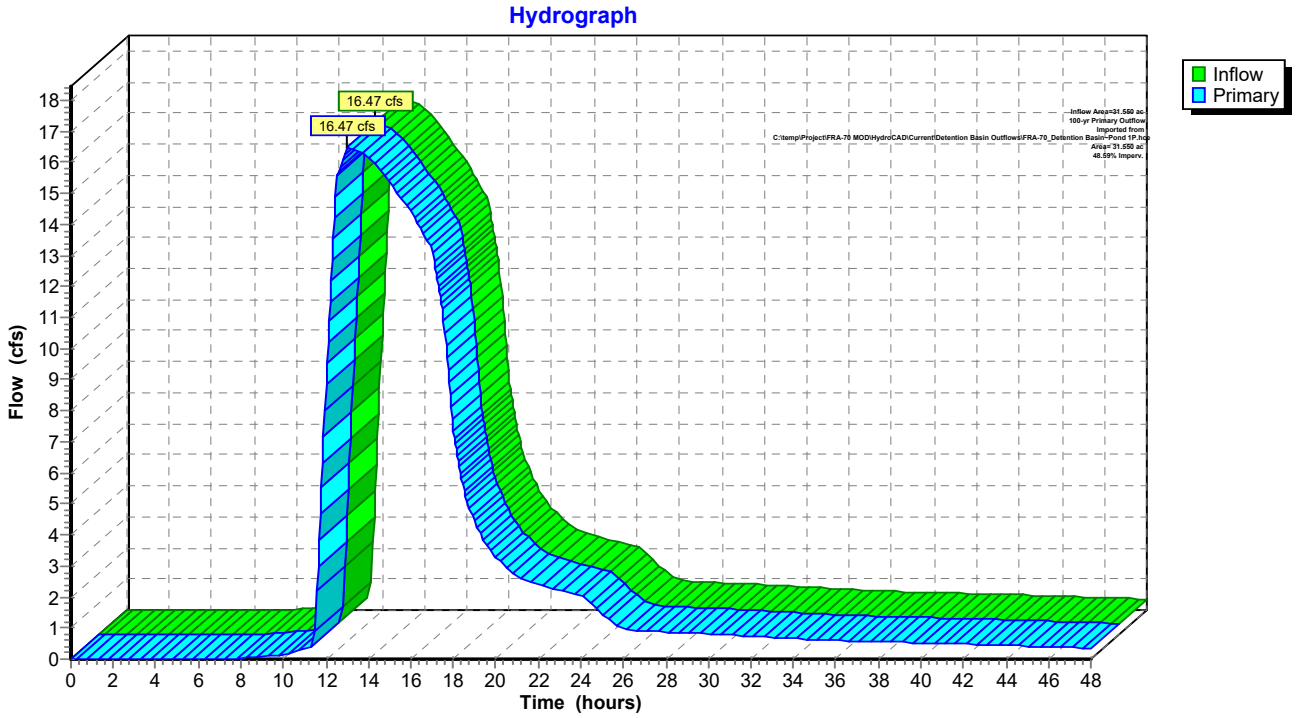
Summary for Link 2L: Detention Basin Outflow

Inflow Area = 31.550 ac, 48.59% Impervious, Inflow Depth > 3.91" for 100-yr event
Inflow = 16.47 cfs @ 13.02 hrs, Volume= 10.287 af
Primary = 16.47 cfs @ 13.02 hrs, Volume= 10.287 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

100-yr Primary Outflow Imported from C:\temp\Project\FRA-70 MOD\HydroCAD\Current\Detention Basin Outflows\FR

Link 2L: Detention Basin Outflow



CULVERT ANALYSIS

PID : 95639 **Date :** 04/23/2021 **Project :** FRA-70-22.61 **Location :** Columbus, Ohio

Description : Ramp C1 - Sta. 6007+00 **Designer :** ARG

HEADWATER CONTROL CODES:

INLET - Inlet Control.
OUTLET - Outlet Control.
OUTLET* - Outlet Control with backwater curve used to compute headwater. See Figure III - 7E in HDS 5 for type flow.
OUTLET** - Outlet Control - See Figure III - 7D in HDS 5 for type flow.
N/A - Flow is supercritical with low headwater and low tailwater. Control Section is at the inlet.

Pipe Number : 1 **Use HW :** 0 **Inlet Invert Elevation (ft.) :** 769.18 **Outlet Invert Elevation (ft.) :** 767.70

Pipe Quantity : 1

Culvert Type : Circular Smooth **Pipe Length (ft.) :** 148.00 **Culvert Slope (ft./ft.) :** 0.0100

Corrugation Type :

Pipe Size : 36 in.

Design Manning 'n' : (default)

Entrance Type : Half Headwall **Loss Coef. Ke :** 0.2000

FLOW (cfs.)	HEAD LOSS (ft.)	HWI (ft.)	HWO (ft.)	FLOW TYPE	VELOCITY (fps.)	DN (ft.)	DC (ft.)	MANNING N	HEADWATER CONTROL	BURIED DEPTH (ft.)	TAILWATER ELEVATION (ft.)
24.23	1.47	771.46	N/A	1 - C	9.22	1.20	1.59	0.0120	INLET	0.00	767.70
37.76	1.95	772.15	N/A	1 - C	10.33	1.54	2.00	0.0120	INLET	0.00	767.70

CULVERT ANALYSIS

PID : 95639 **Date :** 10/14/2021 **Project :** FRA-70-22.61 **Location :** Columbus, Ohio

Description : Ramp C1 - Sta. 6007+00 - 707.01 CMP **Designer :** ARG

HEADWATER CONTROL CODES:
INLET - Inlet Control.
OUTLET - Outlet Control.
OUTLET* - Outlet Control with backwater curve used to compute headwater. See Figure III - 7E in HDS 5 for type flow.
OUTLET** - Outlet Control - See Figure III - 7D in HDS 5 for type flow.
N/A - Flow is supercritical with low headwater and low tailwater. Control Section is at the inlet.

Pipe Number : 1 **Use HW :** 0 **Inlet Invert Elevation (ft.) :** 769.18 **Outlet Invert Elevation (ft.) :** 767.70

Pipe Quantity : 1

Culvert Type : Circular Corrugated
Corrugation Type : Corrugated Metal Pipe (2 2/3 x 1/2 in. corrugations)
Pipe Size : 36 in.
Design Manning 'n' : (default)

Pipe Length (ft.) : 148.00 **Culvert Slope (ft./ft.) :** 0.0100

Entrance Type : Half Headwall **Loss Coef. Ke :** 0.9000

FLOW (cfs.)	HEAD LOSS (ft.)	HWI (ft.)	HWO (ft.)	FLOW TYPE	VELOCITY (fps.)	DN (ft.)	DC (ft.)	MANNING N	HEADWATER CONTROL	BURIED DEPTH (ft.)	TAILWATER ELEVATION (ft.)
24.23	2.57	771.54	771.86	1 - A	6.38	1.80	1.59	0.0241	OUTLET*	0.00	767.70
37.76	3.05	772.44	772.75	1 - A	7.55	2.62	2.00	0.0241	OUTLET*	0.00	767.70

CULVERT ANALYSIS

PID : 95639 **Date :** 10/14/2021 **Project :** FRA-70-22.61 **Location :** Columbus, Ohio

Description : Ramp C1 - Sta. 6007+00 - 707.02 CMP **Designer :** ARG

HEADWATER CONTROL CODES:
INLET - Inlet Control.
OUTLET - Outlet Control.
OUTLET* - Outlet Control with backwater curve used to compute headwater. See Figure III - 7E in HDS 5 for type flow.
OUTLET** - Outlet Control - See Figure III - 7D in HDS 5 for type flow.
N/A - Flow is supercritical with low headwater and low tailwater. Control Section is at the inlet.

Pipe Number : 1 **Use HW :** 0 **Inlet Invert Elevation (ft.) :** 769.18 **Outlet Invert Elevation (ft.) :** 767.70
Pipe Quantity : 1

Culvert Type : Circular Corrugated
Corrugation Type : Corrugated Metal Pipe (3 x 1 in. corrugations) **Pipe Length (ft.) :** 148.00 **Culvert Slope (ft./ft.) :** 0.0100
Pipe Size : 36 in.
Design Manning 'n' : (default)

Entrance Type : Half Headwall **Loss Coef. Ke :** 0.9000

FLOW (cfs.)	HEAD LOSS (ft.)	HWI (ft.)	HWO (ft.)	FLOW TYPE	VELOCITY (fps.)	DN (ft.)	DC (ft.)	MANNING N	HEADWATER CONTROL	BURIED DEPTH (ft.)	TAILWATER ELEVATION (ft.)
24.23	2.56	771.54	771.85	1 - A	6.38	2.00	1.59	0.0281	OUTLET*	0.00	767.70
37.76	3.05	772.44	773.25	2 - F	7.55	3.00	2.00	0.0281	OUTLET**	0.00	767.70

ODOT Conduit Durability Design January 2020

County	Franklin	Route	Ramp C1	Section	22.61	PID	95639	Shape	Circular
Station	6007+00	Station	6007+00					Span x Rise	42

User Input	
pH_w	Abrasion Level
7.5	2.0

Constants and Calculated Values			
pHs	Sediment/Rise	End of Service Life GA	Service Life Required
7.6	0	4	75

Metal Conduit Durability Results

Material		707.01 , 707.02, or 707.03 Metallic coated (galvanized)	707.01 or 707.02 or 707.03 Metallic coated (galvanized) with Concrete Field Paving	707.01 or 707.02 Metallic coated (Aluminized)	***707.01 or 707.02 Metallic coated (aluminized) with Concrete Field Paving	707.04 Polymeric Coated over galvanized steel	***707.04 Polymeric Coated with Concrete Field Paving	707.05 or 707.07 (707.01 or 707.02 galvanized) 1/2 Bituminous coated with Bituminous paved invert	***707.05 or 707.07 (707.01 or 707.02 aluminized) 1/2 Bituminous coated with Bituminous paved invert	**707.11 Polymer Precoated spiral rib steel	**707.12 or 707.17 Aluminum coated spiral rib steel	707.13 or 707.14 (707.01 or 707.02 galvanized) Bituminous lined galvanized steel	707.13 or 707.14 (707.01 or 707.02 aluminized) Bituminous lined aluminized steel	707.15 Galvanized steel box	**707.18 Polymer Precoated, Galvanized Steel Conduits with precoated galvanized smooth steel interior liner	**707.19 Aluminum coated Steel Conduits with precoated galvanized smooth steel interior liner	**707.20 Galvanized Coated Steel Conduits with precoated galvanized smooth steel interior liner	**748.06 Steel Casing Pipe non-galvanized	707.21 or 707.22 Aluminum	707.23 Aluminum Structural Plate	707.24 Aluminum Spiral Rib	707.25 Aluminum Box	707.21, 707.22, or 707.23 Aluminum Alloy or Aluminum Alloy Structural Plate with Concrete Invert Paving
Conduit Use and Shape		Culvert or Liner Pipe - Round or Pipe Arch	Culvert-Round, Pipe Arch, and Arch	Culvert or Liner Pipe -Round or Pipe Arch	Culvert -Round or Pipe Arch	Culvert or Liner Pipe - Round or Pipe Arch	Culvert-Round or Pipe Arch	Culvert -Round or Pipe Arch	Culvert -Round or Pipe Arch	Storm Sewer or Liner Pipe- Round	Liner Pipe- Round or Pipe Arch	Storm Sewer - Round or Pipe Arch	Storm Sewer -Round or Pipe Arch	Culvert -Box	Liner Pipe -Round	Liner Pipe -Round	Liner Pipe - Round	Culvert or Liner Pipe-Round, Pipe Arch, or Box	Culvert or Liner Pipe-Round or Pipe Arch	Culvert or Liner Pipe - Round, Pipe Arch, and Arch	Storm Sewer or Liner Pipe -Round	Culvert -Box	Culvert - Round or Pipe Arch
	Corr. Depth (inches)																					
min gauge or thickness	1/4 or 1/2	16	16	16	16	16	16	16	16	N/A	N/A	16	16	N/A	16	16	16	0.5	12	N/A	N/A	N/A	12
	1	16	16	16	16	16	16	16	16	N/A	N/A	16	16	N/A	N/A	N/A	N/A		16	N/A	N/A	N/A	16
	2	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A	N/A
	3/4	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	16	16	N/A	N/A	N/A	N/A	N/A	N/A		N/A	N/A	12	N/A	N/A
max gauge or thickness	1/4 or 1/2	8	8	10	10	10	10	8	10	N/A	N/A	8	10	N/A	12	12	12	0.5	8	N/A	12	N/A	8
	1	8	8	10	10	10	10	8	10	N/A	N/A	8	10	N/A	N/A	N/A	N/A		10	N/A	N/A	N/A	10
	2	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A	N/A
	3/4	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	12	12	N/A	N/A	N/A	N/A	N/A	N/A		N/A	N/A	12	N/A	N/A
Gauge	*Thickness (inches)*																						
16	0.064																						
14	0.079																						
12	0.109																						
10	0.138																						
8	0.168																						
7	0.188																						
5	0.218																						
3	0.249																						
1	0.28																						
Casing	0.5																						

Concrete Conduit Durability Results

Material	**706.01 Non-reinforced Concrete Pipe	**706.02 Reinforced Concrete Circular Pipe	**706.03 Reinforced Concrete Pipe, Epoxy Coated	**706.04 Reinforced Concrete Elliptical Culvert, Storm Drain, and Sewer Pipe	**706.05 Precast Reinforced Concrete Box Sections	706.08 Clay Drain Tile
Conduit Use and Shape	Culvert or Storm Sewer - Round	Culvet or Storm Sewer -Round	Culvert or Storm Sewer - Round or Elliptical	Culvert or Storm Sewer -Elliptical	Culvert or Storm Sewer - Box	Culvert or Storm Sewer - Round

Plastic Conduit Durability Results

Material	707.33 Corrugated Polyethylene Smooth Lined Pipe	707.34 Polyethylene Plastic Pipe Based on Outside Diameter (OD)	707.35 Polyethylene Profile Wall Pipe	707.42 Polyvinyl Chloride Corrugated Smooth Interior Pipe	707.43 Polyvinyl Chloride Profile Wall Pipe	707.45 Polyvinyl Chloride Solid Wall Pipe	707.46 Polyvinyl Chloride Drain Waste and Vent Pipe	707.47 ABS and Polyvinyl Chloride Composite Pipe	707.48 Polyvinyl Chloride Large-Diameter Solid Wall Pipe	707.65 Polypropylene corrugated Double Wall Pipe	707.69 Polypropylene Triple Wall Pipe	707.75 Glass-Fiber-Reinforced Polymer Mortar Pipe	748.02 Polyvinyl Chloride (PVC) Pipe, Joints, and Fittings	SS938 Steel Reinforced Thermoplastic Ribbed Pipe
Conduit Use and Shape	Culvert, Storm Sewer, or Liner Pipe - Round	Culvert, Storm Sewer, or Liner Pipe - Round	Culvert, Storm Sewer, or Liner Pipe - Round	Storm Sewer or Liner Pipe - Round	Storm Sewer or Liner Pipe - Round	Storm Sewer - Round	Storm Sewer - Round	Storm Sewer - Round	Storm Sewer - Round	Culvert or Storm Sewer - Round	Culvert or Storm Sewer - Round	Culvert, Storm Sewer, or Liner Pipe - Round	Storm Sewer - Round	Culvert or Liner Pipe - Round

Notes:

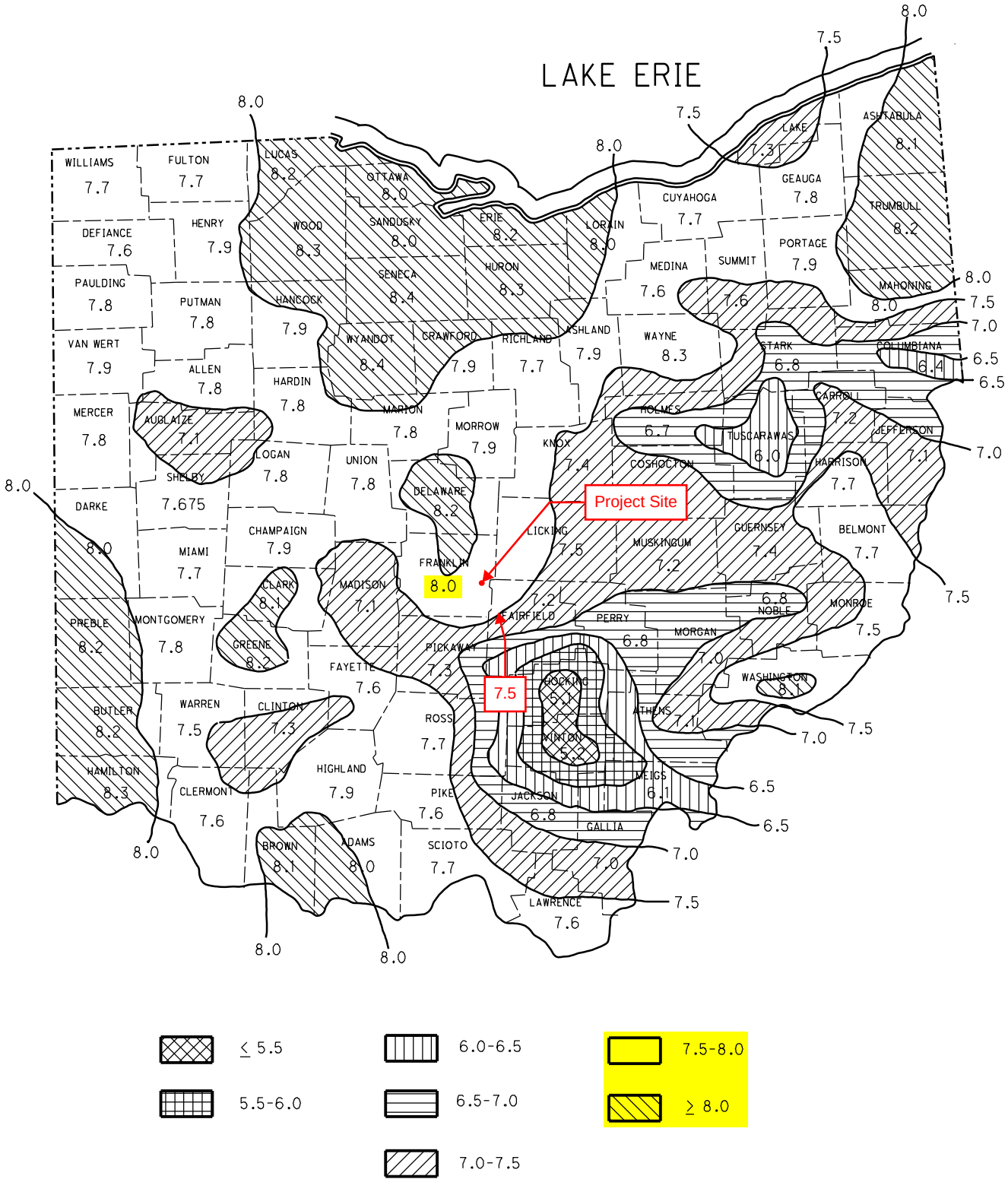
- Many metal options are eliminated when abrasion level equals 4 or greater
- Aluminum is only available between pH levels ranging from 5.0 to less than 9.0
- Alumized protective coating is 0 years when pH levels are outside of allowable for Aluminum
- Polymeric coated is only available for pH ranges greater than 5.0 and less than 9.0
- Options were emiminated when the NCSPA online Service Life Calculator did not recommend option; typically due to abrasive conditions or pH limitations
- Epoxy is required on all concrete surfaces when pH<5
- ** Smooth lined conduit
- ***Minimum gauges set per industry comments; see Reference Data
- Provide concrete field paving on corrugated metal conduits 60" or larger where the invert is always submerged due to tail water conditions from a body of water

Constants	
Protective Coating Constants-Initial Service Life (years)	
Concrete Invert Paving=	20
Aluminized=	35
Aluminized Spiral Rib=	35
Polymeric=	50
Bituminous coated w/ bitum. paved invert=	10
Bituminous lined =	25
Galvanized=	0

WATER pH CONTOURS BASED ON AVE. pH FOR COUNTIES

1002-2

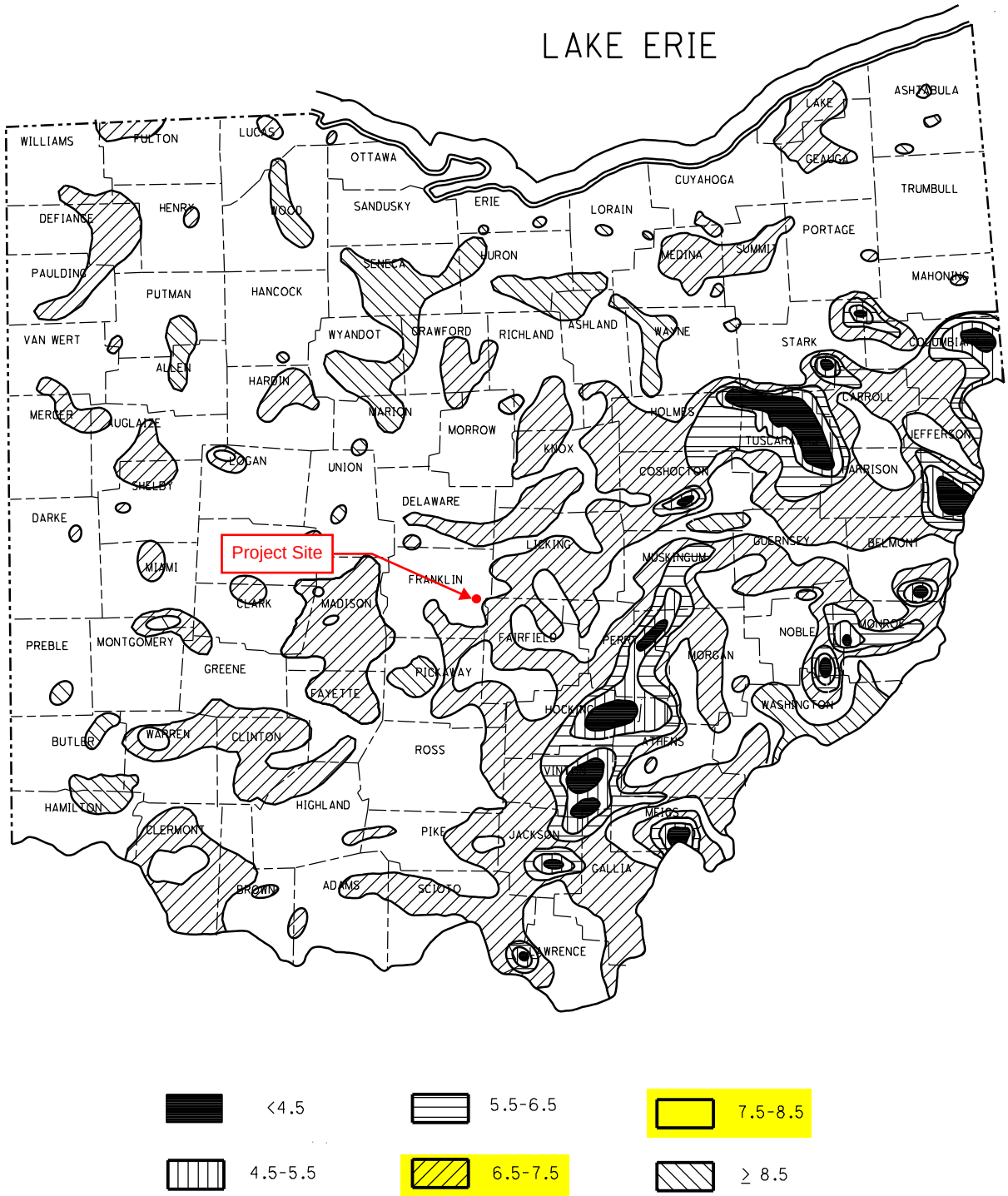
REFERENCE SECTION
1002.3.1



WATER pH CONTOURS BASED ON pH VALUES OF INDIVIDUAL CULVERTS

1002-3

REFERENCE SECTION
1002.3.1



CULVERT FLOW CALCULATIONS

Rainfall Intensity per L&D Volume 2, Figure 1101-3

Rainfall Intensity Zone C

For Time of Concentration calculations and Ditch flow times, see Appendix D.

Ramp C1 Sta. 6007+00

SURFACE	C	AREA	C*A
IR-270: 01	0.61	20.23	12.38
C1-LT-05	0.67	2.97	2
C1-LT-06	0.75	1.95	1.46
IR-270 MEDIAN OUTLET	0.9	0.223	0.2007
TOTALS/WEIGHTED	0.63	25.37	16.04

See HydroCAD for flow rates

	Tc=	38
25 Year (CFS)	Q = CiA	48.75
	`i=	3.05
	C=	0.63
	A=	25.37
100 Year (CFS)	Q = CiA	57.71
	`i=	3.61
	C=	0.63
	A=	25.37

Ramp C1 Sta. 6073+52

SURFACE	C	AREA	C*A
C1-LT-EX	0.77	1.62	1.24
G1-RT-01	0.62	1.39	0.86
G1-RT-02	0.65	13.52	8.83
TOTALS/WEIGHTED	0.66	16.53	10.93

	Tc=	22.00
25 Year (CFS)	Q = CiA	46.26
	`i=	4.24
	C=	0.66
	A=	16.53
100 Year (CFS)	Q = CiA	54.22
	`i=	4.97
	C=	0.66
	A=	16.53

HY-8 Culvert Analysis Report

Culvert Data Summary - Ramp C1 6073+50

Barrel Shape: Circular

Barrel Diameter: 4.00 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0120

Culvert Type: Straight

Inlet Configuration: Square Edge with Headwall

Inlet Depression: None

L&D V.2 Section 1002.3.1: high fills over 16 feet, the size shall be increased one pipe size over the required size.

Site Data - Ramp C1 6073+50

Site Data Option: Culvert Invert Data

Inlet Station: 400.14 ft

Inlet Elevation: 782.59 ft

Outlet Station: 205.50 ft

Outlet Elevation: 781.71 ft

Number of Barrels: 1

Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 46.26 cfs

Design Flow: 46.26 cfs

Maximum Flow: 54.22 cfs

Table 1 - Culvert Summary Table: Ramp C1 6073+50

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
46.26	46.26	785.60	3.006	1.643	1-S2n	1.812	2.036	1.862	1.297	7.804	5.028
47.06	47.06	785.63	3.038	1.677	1-S2n	1.830	2.054	1.881	1.309	7.835	5.052
47.85	47.85	785.66	3.069	1.712	1-S2n	1.848	2.071	1.900	1.320	7.865	5.077
48.65	48.65	785.69	3.100	1.747	1-S2n	1.865	2.089	1.919	1.332	7.894	5.100
49.44	49.44	785.72	3.131	1.782	1-S2n	1.883	2.106	1.938	1.343	7.923	5.124
50.24	50.24	785.75	3.162	1.817	1-S2n	1.901	2.123	1.957	1.354	7.953	5.146
51.04	51.04	785.78	3.193	1.852	1-S2n	1.918	2.140	1.976	1.365	7.982	5.169
51.83	51.83	785.81	3.223	1.888	1-S2n	1.936	2.157	1.994	1.377	8.012	5.192
52.63	52.63	785.84	3.254	1.923	1-S2n	1.953	2.173	1.953	1.388	8.352	5.213
53.42	53.42	785.87	3.284	1.963	1-S2n	1.971	2.194	2.030	1.398	8.072	5.235
54.22	54.22	785.90	3.315	1.999	1-S2n	1.988	2.210	1.988	1.409	8.414	5.257

****

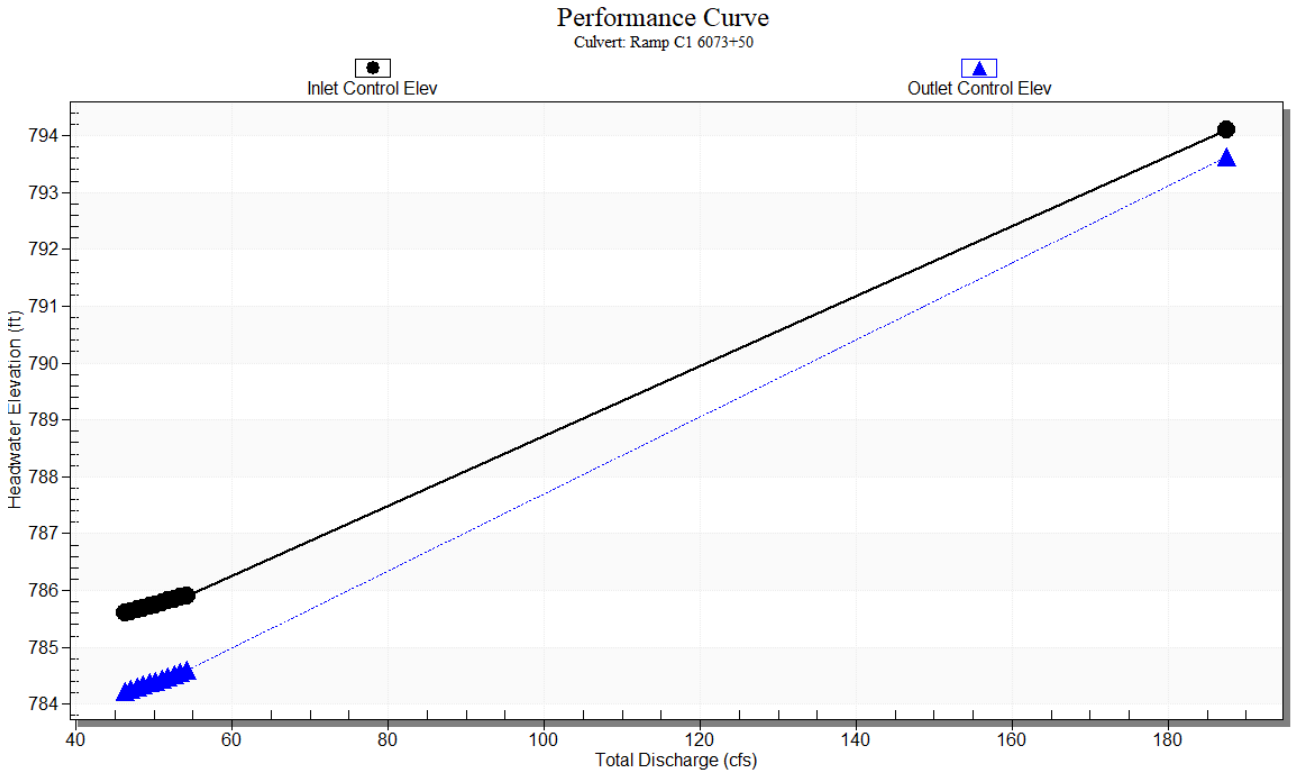
Straight Culvert

Inlet Elevation (invert): 782.59 ft, Outlet Elevation (invert): 781.71 ft

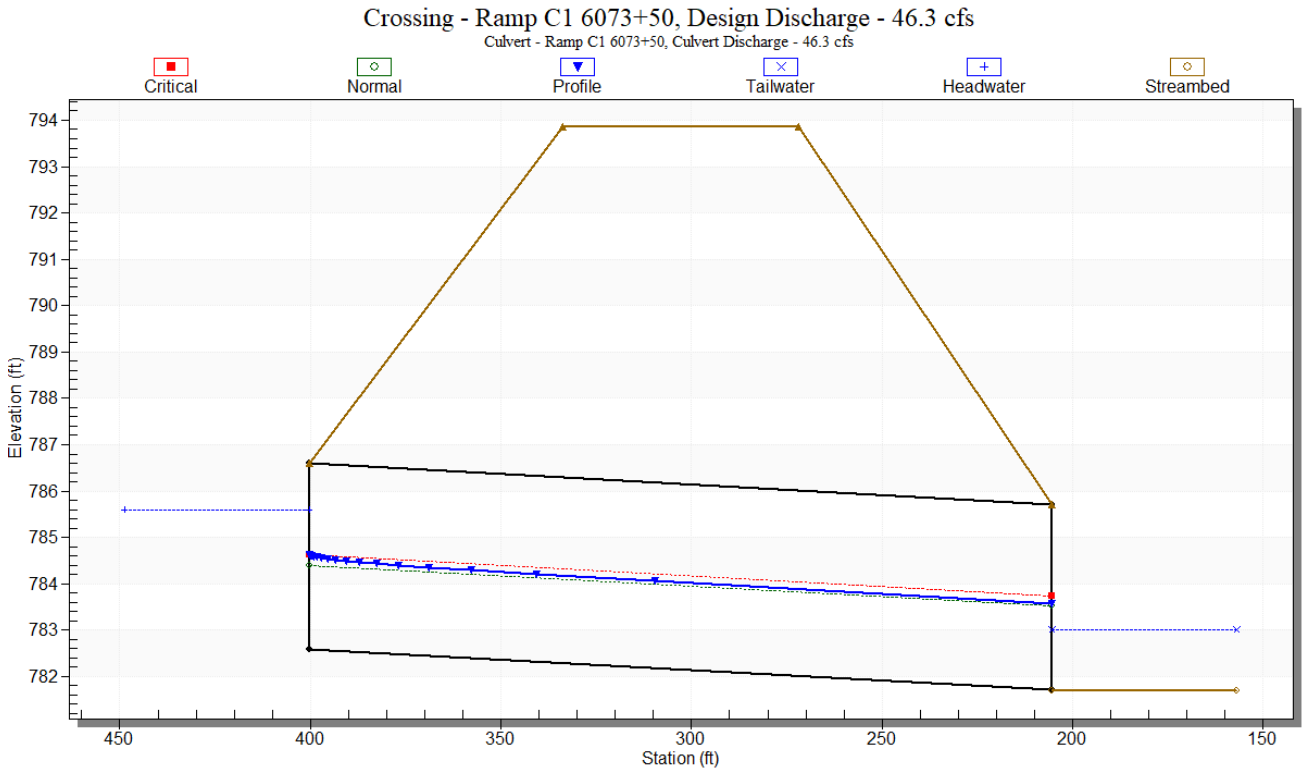
Culvert Length: 194.64 ft, Culvert Slope: 0.0045

****

Culvert Performance Curve Plot: Ramp C1 6073+50



Water Surface Profile Plot for Culvert: Ramp C1 6073+50



Roadway Data for Crossing: Ramp C1 6073+50

Roadway Profile Shape: Irregular Roadway Shape (coordinates)

Irregular Roadway Cross-Section:

Coord No.	Station (ft)	Elevation (ft)
0	606954.66	793.85
1	607000.00	794.11
2	607050.00	794.76
3	607100.00	795.79
4	607150.00	797.20
5	607200.00	798.88
6	607350.00	805.69
7	607450.00	810.44

Roadway Surface: Paved

Roadway Top Width: 62.00 ft

Table 2 - Downstream Channel Rating Curve (Crossing: Ramp C1 6073+50)

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
46.26	783.00	1.30	5.03	1.72	0.91
47.06	783.01	1.31	5.05	1.74	0.91
47.85	783.02	1.32	5.08	1.75	0.91
48.65	783.03	1.33	5.10	1.77	0.91
49.44	783.04	1.34	5.12	1.78	0.91
50.24	783.05	1.35	5.15	1.80	0.91
51.04	783.07	1.37	5.17	1.81	0.91
51.83	783.08	1.38	5.19	1.83	0.92
52.63	783.09	1.39	5.21	1.84	0.92
53.42	783.10	1.40	5.24	1.86	0.92
54.22	783.11	1.41	5.26	1.87	0.92

Tailwater Channel Data - Ramp C1 6073+50

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 4.50 ft

Side Slope (H:V): 2.00 (_:1)

Channel Slope: 0.0213

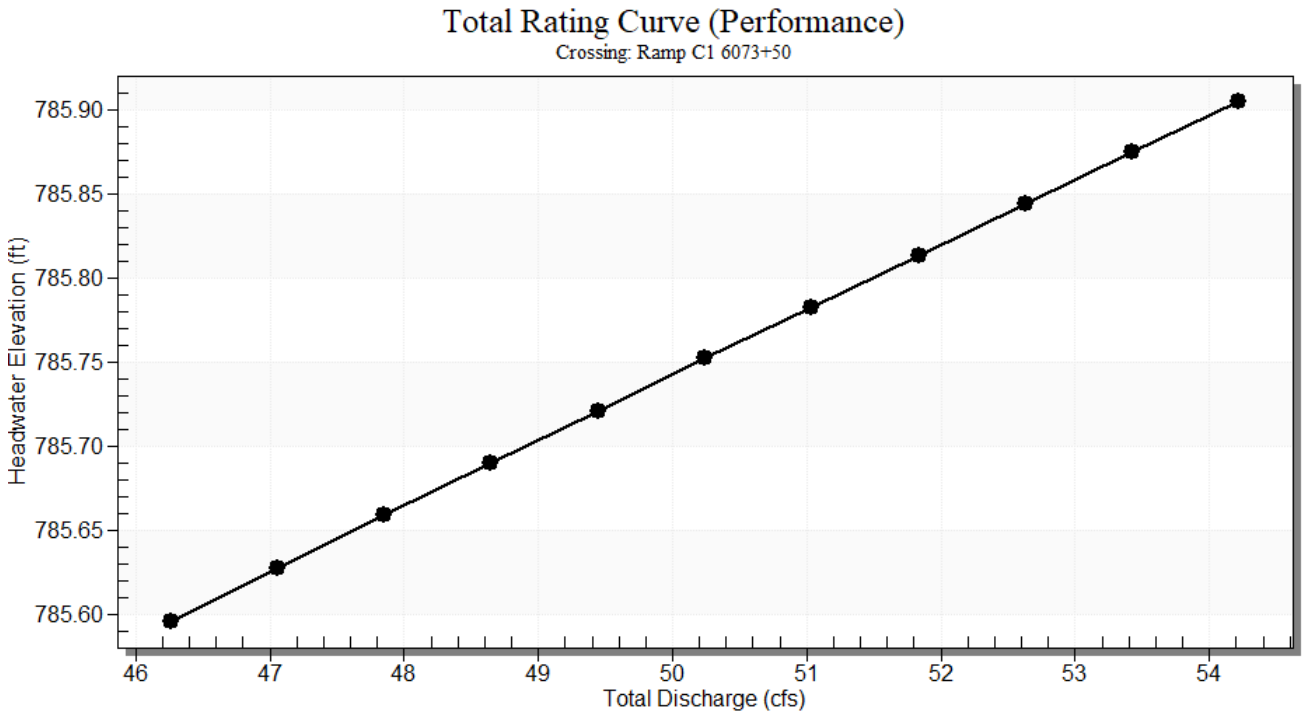
Channel Manning's n: 0.0400

Channel Invert Elevation: 781.70 ft

Table 3 - Summary of Culvert Flows at Crossing: Ramp C1 6073+50

Headwater Elevation (ft)	Total Discharge (cfs)	Ramp C1 6073+50 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
785.60	46.26	46.26	0.00	1
785.63	47.06	47.06	0.00	1
785.66	47.85	47.85	0.00	1
785.69	48.65	48.65	0.00	1
785.72	49.44	49.44	0.00	1
785.75	50.24	50.24	0.00	1
785.78	51.04	51.04	0.00	1
785.81	51.83	51.83	0.00	1
785.84	52.63	52.63	0.00	1
785.87	53.42	53.42	0.00	1
785.90	54.22	54.22	0.00	1
794.11	187.55	187.55	0.00	Overtopping

Rating Curve Plot for Crossing: Ramp C1 6073+50



CULVERT ANALYSIS

PID : 95639 **Date :** 10/14/2021 **Project :** FRA-70-22.61 **Location :** Columbus, Ohio

Description : Ramp C1 - Sta. 6073+50 - 707.01 CMP **Designer :** ARG

HEADWATER CONTROL CODES:
INLET - Inlet Control.
OUTLET - Outlet Control.
OUTLET* - Outlet Control with backwater curve used to compute headwater. See Figure III - 7E in HDS 5 for type flow.
OUTLET** - Outlet Control - See Figure III - 7D in HDS 5 for type flow.
N/A - Flow is supercritical with low headwater and low tailwater. Control Section is at the inlet.

Pipe Number : 1 **Use HW :** 0 **Inlet Invert Elevation (ft.) :** 782.59 **Outlet Invert Elevation (ft.) :** 781.71
Pipe Quantity : 1

Culvert Type : Circular Corrugated
Corrugation Type : Corrugated Metal Pipe (2 2/3 x 1/2 in. corrugations) **Pipe Length (ft.) :** 195.00 **Culvert Slope (ft./ft.) :** 0.0045
Pipe Size : 48 in.
Design Manning 'n' : (default)

Entrance Type : Half Headwall **Loss Coef. Ke :** 0.9000

FLOW (cfs.)	HEAD LOSS (ft.)	HWI (ft.)	HWO (ft.)	FLOW TYPE	VELOCITY (fps.)	DN (ft.)	DC (ft.)	MANNING N	HEADWATER CONTROL	BURIED DEPTH (ft.)	TAILWATER ELEVATION (ft.)
46.26	2.33	785.61	786.07	1 - A	7.20	2.88	2.04	0.0235	OUTLET*	0.00	781.71
54.22	2.54	785.92	786.46	1 - A	7.60	3.34	2.21	0.0235	OUTLET*	0.00	781.71

CULVERT ANALYSIS

PID : 95639 **Date :** 10/14/2021 **Project :** FRA-70-22.61 **Location :** Columbus, Ohio

Description : Ramp C1 - Sta. 6073+50 - 707.02 CMP **Designer :** ARG

HEADWATER CONTROL CODES:
INLET - Inlet Control.
OUTLET - Outlet Control.
OUTLET* - Outlet Control with backwater curve used to compute headwater. See Figure III - 7E in HDS 5 for type flow.
OUTLET** - Outlet Control - See Figure III - 7D in HDS 5 for type flow.
N/A - Flow is supercritical with low headwater and low tailwater. Control Section is at the inlet.

Pipe Number : 1 **Use HW :** 0 **Inlet Invert Elevation (ft.) :** 782.59 **Outlet Invert Elevation (ft.) :** 781.71
Pipe Quantity : 1

Culvert Type : Circular Corrugated
Corrugation Type : Corrugated Metal Pipe (3 x 1 in. corrugations) **Pipe Length (ft.) :** 195.00 **Culvert Slope (ft./ft.) :** 0.0045
Pipe Size : 48 in.
Design Manning 'n' : (default)

Entrance Type : Half Headwall **Loss Coef. Ke :** 0.9000

FLOW (cfs.)	HEAD LOSS (ft.)	HWI (ft.)	HWO (ft.)	FLOW TYPE	VELOCITY (fps.)	DN (ft.)	DC (ft.)	MANNING N	HEADWATER CONTROL	BURIED DEPTH (ft.)	TAILWATER ELEVATION (ft.)
46.26	2.44	785.61	786.19	1 - A	7.20	3.33	2.04	0.0275	OUTLET*	0.00	781.71
54.22	2.70	785.92	786.63	1 - A	7.60	3.65	2.21	0.0275	OUTLET*	0.00	781.71

ODOT Conduit Durability Design January 2020

County	Franklin	Route	70 - Ramp C1	Section	22.61	PID	95639	Shape	Circular
Station	6073+00	Station	6073+00					Span x Rise	48

User Input	
pH_w	Abrasion Level
7.5	2.0

Constants and Calculated Values			
pHs	Sediment/Rise	End of Service Life GA	Service Life Required
7.6	0	4	75

Metal Conduit Durability Results

Material		707.01 , 707.02, or 707.03 Metallic coated (galvanized)	707.01 or 707.02 or 707.03 Metallic coated (galvanized) with Concrete Field Paving	707.01 or 707.02 Metallic coated (Aluminized)	***707.01 or 707.02 Metallic coated (aluminized) with Concrete Field Paving	707.04 Polymeric Coated over galvanized steel	***707.04 Polymeric Coated with Concrete Field Paving	707.05 or 707.07 (707.01 or 707.02 galvanized) 1/2 Bituminous coated with Bituminous paved invert	***707.05 or 707.07 (707.01 or 707.02 aluminized) 1/2 Bituminous coated with Bituminous paved invert	**707.11 Polymer Precoated spiral rib steel	**707.12 or 707.17 Aluminum coated spiral rib steel	707.13 or 707.14 (707.01 or 707.02 galvanized) Bituminous lined galvanized steel	707.13 or 707.14 (707.01 or 707.02 aluminized) Bituminous lined aluminized steel	707.15 Galvanized steel box	**707.18 Polymer Precoated, Galvanized Steel Conduits with precoated galvanized smooth steel interior liner	**707.19 Aluminum coated Steel Conduits with precoated galvanized smooth steel interior liner	**707.20 Galvanized Coated Steel Conduits with precoated galvanized smooth steel interior liner	**748.06 Steel Casing Pipe non-galvanized	707.21 or 707.22 Aluminum	707.23 Aluminum Structural Plate	707.24 Aluminum Spiral Rib	707.25 Aluminum Box	707.21, 707.22, or 707.23 Aluminum Alloy or Aluminum Alloy Structural Plate with Concrete Invert Paving
Conduit Use and Shape		Culvert or Liner Pipe - Round or Pipe Arch	Culvert-Round, Pipe Arch, and Arch	Culvert or Liner Pipe -Round or Pipe Arch	Culvert -Round or Pipe Arch	Culvert or Liner Pipe - Round or Pipe Arch	Culvert-Round or Pipe Arch	Culvert -Round or Pipe Arch	Culvert -Round or Pipe Arch	Storm Sewer or Liner Pipe- Round	Liner Pipe- Round or Pipe Arch	Storm Sewer - Round or Pipe Arch	Storm Sewer -Round or Pipe Arch	Culvert -Box	Liner Pipe -Round	Liner Pipe -Round	Liner Pipe - Round	Culvert or Liner Pipe-Round, Pipe Arch, or Box	Culvert or Liner Pipe-Round or Pipe Arch	Culvert or Liner Pipe - Round, Pipe Arch, and Arch	Storm Sewer or Liner Pipe -Round	Culvert -Box	Culvert - Round or Pipe Arch
	Corr. Depth (inches)																					
min gauge or thickness	1/4 or 1/2	16	16	16	16	16	16	16	16	N/A	N/A	16	16	N/A	16	16	16	0.5	12	N/A	N/A	N/A	12
	1	16	16	16	16	16	16	16	16	N/A	N/A	16	16	N/A	N/A	N/A	N/A		16	N/A	N/A	N/A	16
	2	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A	N/A
	3/4	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	16	16	N/A	N/A	N/A	N/A	N/A	N/A		N/A	N/A	12	N/A	N/A
max gauge or thickness	1/4 or 1/2	8	8	10	10	10	10	8	10	N/A	N/A	8	10	N/A	12	12	12	0.5	8	N/A	10	N/A	8
	1	8	8	10	10	10	10	8	10	N/A	N/A	8	10	N/A	N/A	N/A	N/A		10	N/A	N/A	N/A	10
	2	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A	N/A
	3/4	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	12	12	N/A	N/A	N/A	N/A	N/A	N/A		N/A	N/A	10	N/A	N/A
Gauge	*Thickness (inches)*																						
16	0.064																						
14	0.079																						
12	0.109																						
10	0.138																						
8	0.168																						
7	0.188																						
5	0.218																						
3	0.249																						
1	0.28																						
Casing	0.5																						

Concrete Conduit Durability Results

Material	**706.01 Non-reinforced Concrete Pipe	**706.02 Reinforced Concrete Circular Pipe	**706.03 Reinforced Concrete Pipe, Epoxy Coated	**706.04 Reinforced Concrete Elliptical Culvert, Storm Drain, and Sewer Pipe	**706.05 Precast Reinforced Concrete Box Sections	706.08 Clay Drain Tile
Conduit Use and Shape	Culvert or Storm Sewer - Round	Culvet or Storm Sewer -Round	Culvert or Storm Sewer - Round or Elliptical	Culvert or Storm Sewer -Elliptical	Culvert or Storm Sewer - Box	Culvert or Storm Sewer - Round

Plastic Conduit Durability Results

Material	707.33 Corrugated Polyethylene Smooth Lined Pipe	707.34 Polyethylene Plastic Pipe Based on Outside Diameter (OD)	707.35 Polyethylene Profile Wall Pipe	707.42 Polyvinyl Chloride Corrugated Smooth Interior Pipe	707.43 Polyvinyl Chloride Profile Wall Pipe	707.45 Polyvinyl Chloride Solid Wall Pipe	707.46 Polyvinyl Chloride Drain Waste and Vent Pipe	707.47 ABS and Polyvinyl Chloride Composite Pipe	707.48 Polyvinyl Chloride Large-Diameter Solid Wall Pipe	707.65 Polypropylene corrugated Double Wall Pipe	707.69 Polypropylene Triple Wall Pipe	707.75 Glass-Fiber-Reinforced Polymer Mortar Pipe	748.02 Polyvinyl Chloride (PVC) Pipe, Joints, and Fittings	SS938 Steel Reinforced Thermoplastic Ribbed Pipe
Conduit Use and Shape	Culvert, Storm Sewer, or Liner Pipe - Round	Culvert, Storm Sewer, or Liner Pipe - Round	Culvert, Storm Sewer, or Liner Pipe - Round	Storm Sewer or Liner Pipe - Round	Storm Sewer or Liner Pipe - Round	Storm Sewer - Round	Storm Sewer - Round	Storm Sewer - Round	Storm Sewer - Round	Culvert or Storm Sewer - Round	Culvert or Storm Sewer - Round	Culvert, Storm Sewer, or Liner Pipe - Round	Storm Sewer - Round	Culvert or Liner Pipe - Round

Notes:

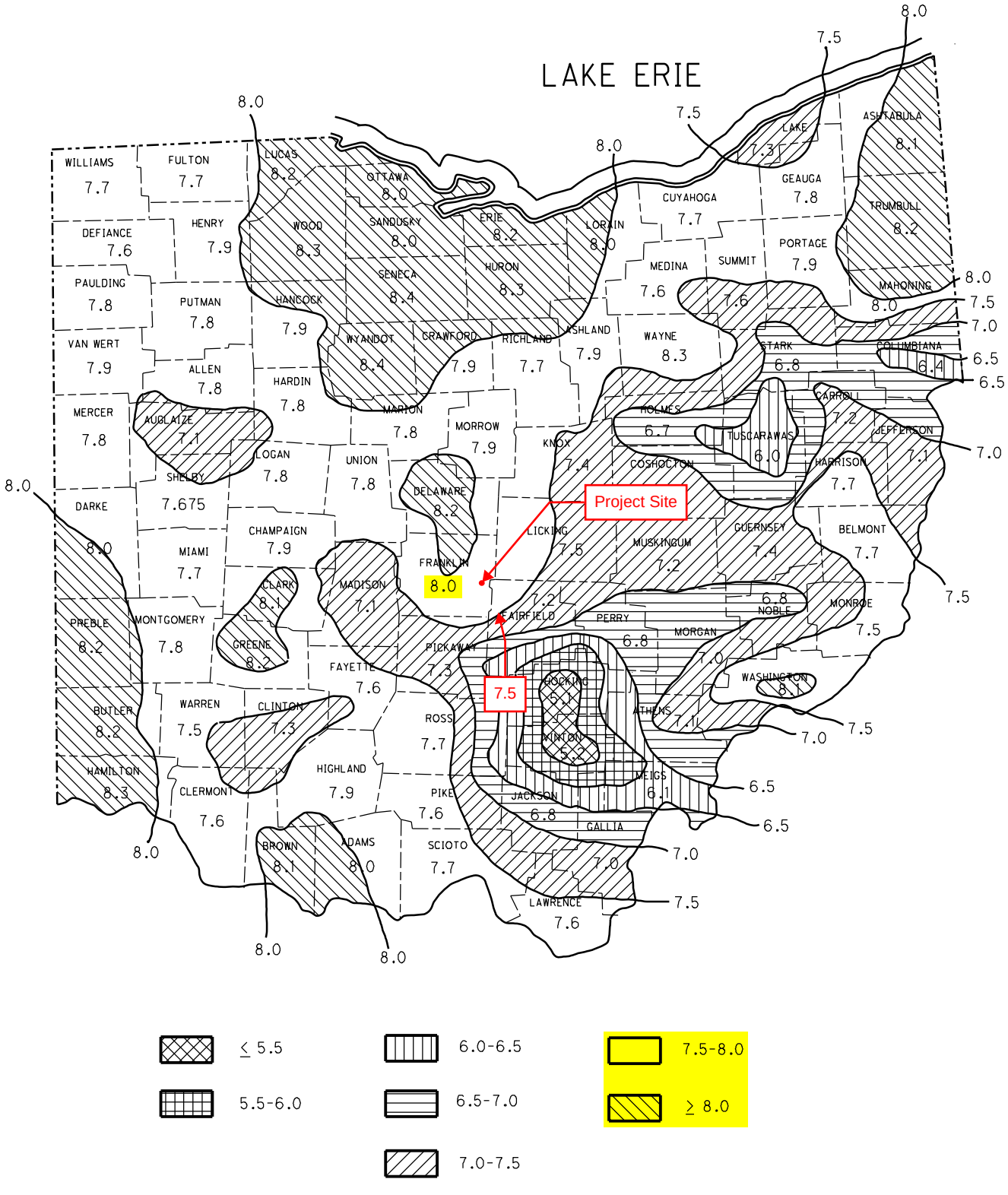
- Many metal options are eliminated when abrasion level equals 4 or greater
- Aluminum is only available between pH levels ranging from 5.0 to less than 9.0
- Alumized protective coating is 0 years when pH levels are outside of allowable for Aluminum
- Polymeric coated is only available for pH ranges greater than 5.0 and less than 9.0
- Options were emiminated when the NCSPA online Service Life Calculator did not recommend option; typically due to abrasive conditions or pH limitations
- Epoxy is required on all concrete surfaces when pH<5
- ** Smooth lined conduit
- ***Minimum gauges set per industry comments; see Reference Data
- Provide concrete field paving on corrugated metal conduits 60" or larger where the invert is always submerged due to tail water conditions from a body of water

Constants	
Protective Coating Constants-Initial Service Life (years)	
Concrete Invert Paving=	20
Aluminized=	35
Aluminized Spiral Rib=	35
Polymeric=	50
Bituminous coated w/ bitum. paved invert=	10
Bituminous lined =	25
Galvanized=	0

WATER pH CONTOURS BASED ON AVE. pH FOR COUNTIES

1002-2

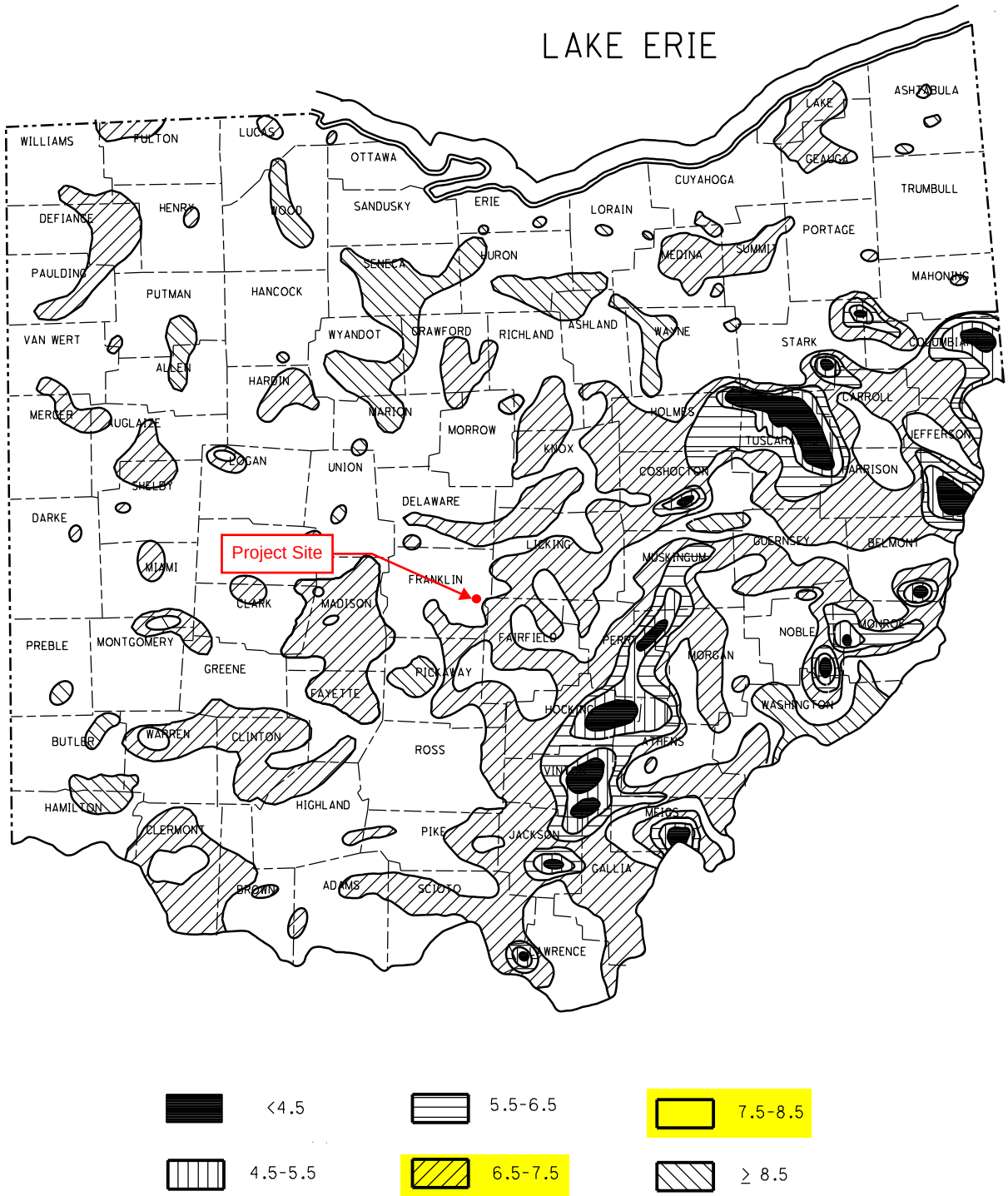
REFERENCE SECTION
1002.3.1



WATER pH CONTOURS BASED ON pH VALUES OF INDIVIDUAL CULVERTS

1002-3

REFERENCE SECTION
1002.3.1



UNIVERSAL CULVERT DESIGN

PID : 20200 **Date :** 08/13/2020 **Project :** FRA-70-22.61 **Location :** COLUMBUS, OHIO

Description : IR-270 U-TURN CULVERT **Designer :** ARG

HEADWATER CONTROL CODES:

INLET - Inlet Control.
OUTLET - Outlet Control.
OUTLET* - Outlet Control with backwater curve used to compute headwater. See Figure III - 7E in HDS 5 for type flow.
OUTLET** - Outlet Control - See Figure III - 7D in HDS 5 for type flow.
N/A - Flow is supercritical with low headwater and low tailwater. Control Section is at the inlet.

Nearside shoulder elevation

Inlet Invert Elevation (ft.) : 781.52 **Outlet Invert Elevation (ft.) :** 781.22 **Tailwater Elevation (ft.) :** 781.40 **Overflow Elevation (ft.) :** 783.55

Allowable Headwater Elevation (ft.) : 784.47 **or** Diameter + 0 ft. *(whichever is less)* U-Turn Lowpoint

Pipe Length (ft.) : 43.00 **Culvert Slope (ft./ft.) :** 0.0070 **Design Manning 'n' :** 0.0120

Design Discharge (cfs) : 4.01 **@** 25 yrs. **Flood Discharge (cfs) :** 4.69 **@** 100 yrs.

FLOW (cfs.)	PIPE #	CULVERT SIZE	HWI (ft.)	HWO (ft.)	FLOW TYPE	VELOCITY (fps.)	DN (ft.)	DC (ft.)	MANNING N	HEADWATER CONTROL	OVER FLOW (cfs.)	DESIGN CODE	BURIAL DEPTH (ft.)
CULVERT TYPE : CIRCULAR SMOOTH			**Entrance Type :** No Headwall								**Entrance Loss (Ke) :** 0.20		
4.01	1	15 in.	782.72	N/A	1 - C	5.14	0.76	0.81	0.0120	INLET	0.00	D	0.00
4.01	1	12 in.	783.03	783.09	2 - F	5.64	1.00	0.85	0.0120	OUTLET**	0.00	D - 1	0.00
4.01	1	18 in.	782.62	N/A	1 - C	5.15	0.68	0.77	0.0120	INLET	0.00	D + 1	0.00
4.69	1	15 in.	782.85	N/A	1 - C	5.29	0.85	0.88	0.0120	INLET	0.00	F	0.00
4.69	1	12 in.	783.34	783.47	2 - F	6.30	1.00	0.90	0.0120	OUTLET**	0.00	F - 1	0.00
4.69	1	18 in.	782.72	N/A	1 - C	5.35	0.74	0.83	0.0120	INLET	0.00	F + 1	0.00
CULVERT TYPE : CIRCULAR CORRUGATED			**Entrance Type :** No Headwall								**Entrance Loss (Ke) :** 0.90		
Corrugated Metal Pipe (2 2/3 x 1/2 in. corrugations)													
4.01	1	18 in.	782.73	782.83	1 - A	4.41	1.09	0.77	0.0249	OUTLET*	0.00	D	0.00
4.01	1	15 in.	782.92	783.17	2 - F	4.77	1.25	0.81	0.0250	OUTLET**	0.00	D - 1	0.00
2.81	1	12 in.	783.55	784.93	2 - F	4.66	1.00	0.72	0.0251	OUTLET**	1.20	D - 2	0.00

UNIVERSAL CULVERT DESIGN

	FLOW (cfs.)	PIPE #	CULVERT SIZE	HWI (ft.)	HWO (ft.)	FLOW TYPE	VELOCITY (fps.)	DN (ft.)	DC (ft.)	MANNING N	HEADWATER CONTROL	OVER FLOW (cfs.)	DESIGN CODE	BURIAL DEPTH (ft.)
	4.01	1	21 in.	782.63	782.71	1 - A	4.22	0.95	0.73	0.0248	OUTLET*	0.00	D + 1	0.00
	4.69	1	18 in.	782.86	782.97	1 - A	4.67	1.26	0.83	0.0249	OUTLET*	0.00	F	0.00
	4.69	1	15 in.	783.12	783.55	2 - F	5.09	1.25	0.88	0.0250	OUTLET**	0.00	F - 1	0.00
	2.89	1	12 in.	784.08	785.98	2 - F	4.71	1.00	0.73	0.0251	OUTLET**	1.80	F - 2	0.00
	4.69	1	21 in.	782.74	782.83	1 - A	4.42	1.05	0.79	0.0248	OUTLET*	0.00	F + 1	0.00
Corrugated Metal Pipe (3 x 1 in. corrugations)														
	4.01	1	36 in.	782.49	782.51	1 - A	3.76	0.80	0.62	0.0281	OUTLET*	0.00	D	0.00
	4.01	1	42 in.	782.51	782.46	1 - C	2.63	0.75	0.60	0.0278	INLET	0.00	D + 1	0.00
	4.69	1	36 in.	782.56	782.59	1 - A	3.92	0.87	0.68	0.0281	OUTLET*	0.00	F	0.00
	4.69	1	42 in.	782.56	782.54	1 - C	2.75	0.82	0.65	0.0278	INLET	0.00	F + 1	0.00
Corrugated Metal Pipe (6 x 2 in. corrugations)														
Diameter exceeds 1.25 HWA	4.01	1	60 in.	782.66	782.38	1 - C	2.22	0.74	0.55	0.0332	INLET	0.00	D	0.00
	4.01	1	66 in.	782.72	782.36	1 - C	2.20	0.72	0.53	0.0330	INLET	0.00	D + 1	0.00
	4.69	1	60 in.	782.69	782.46	1 - C	2.33	0.80	0.59	0.0332	INLET	0.00	F	0.00
	4.69	1	66 in.	782.75	782.42	1 - C	2.31	0.77	0.58	0.0330	INLET	0.00	F + 1	0.00
Diameter exceeds 1.25 HWA	2.01	2	60 in.	782.56	782.12	1 - C	1.81	0.53	0.38	0.0332	INLET	0.00	D	0.00
	2.01	2	66 in.	782.64	782.10	1 - C	1.79	0.51	0.37	0.0330	INLET	0.00	D + 1	0.00
	2.35	2	60 in.	782.57	782.18	1 - C	1.89	0.57	0.42	0.0332	INLET	0.00	F	0.00
	2.35	2	66 in.	782.65	782.15	1 - C	1.88	0.55	0.40	0.0330	INLET	0.00	F + 1	0.00
Corrugated Metal Pipe (6 x 2 in. corrugations, Field Paved Invert)														
Diameter exceeds 1.25 HWA	4.01	1	60 in.	782.66	782.36	1 - C	2.64	0.66	0.55	0.0260	INLET	0.00	D	0.00
	4.01	1	66 in.	782.72	782.34	1 - C	2.61	0.64	0.53	0.0260	INLET	0.00	D + 1	0.00
	4.69	1	60 in.	782.69	782.43	1 - C	2.76	0.71	0.59	0.0260	INLET	0.00	F	0.00
	4.69	1	66 in.	782.75	782.41	1 - C	2.72	0.69	0.58	0.0260	INLET	0.00	F + 1	0.00

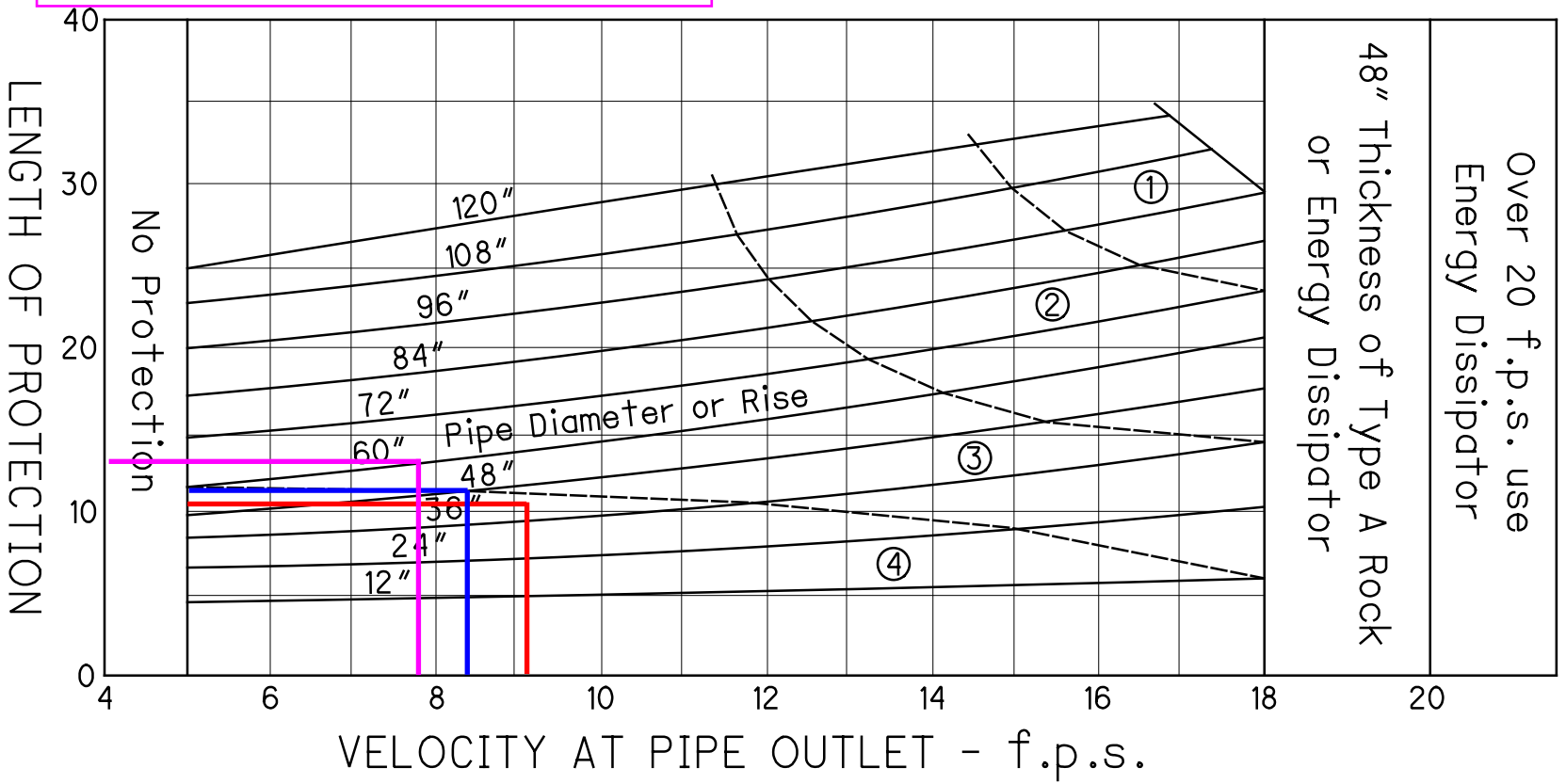
UNIVERSAL CULVERT DESIGN

	FLOW (cfs.)	PIPE #	CULVERT SIZE	HWI (ft.)	HWO (ft.)	FLOW TYPE	VELOCITY (fps.)	DN (ft.)	DC (ft.)	MANNING N	HEADWATER CONTROL	OVER FLOW (cfs.)	DESIGN CODE	BURIAL DEPTH (ft.)
Diameter exceeds 1.25 HWA	2.01	2	60 in.	782.56	782.11	1 - C	2.14	0.47	0.38	0.0260	INLET	0.00	D	0.00
	2.01	2	66 in.	782.64	782.09	1 - C	2.11	0.46	0.37	0.0260	INLET	0.00	D + 1	0.00
	2.35	2	60 in.	782.57	782.16	1 - C	2.25	0.51	0.42	0.0260	INLET	0.00	F	0.00
	2.35	2	66 in.	782.65	782.14	1 - C	2.22	0.49	0.40	0.0260	INLET	0.00	F + 1	0.00

Ramp C1: Sta. 6007+00.00, 42", 9.2 fps, 11.0 ft of 18" Type C

Ramp C1: Sta. 6073+50, 48", 8.4 fps, 11 ft of 30" Type B

IR-70 Sta. 606+42.82; 9' x 5', 7.7 fps = 13 ft



NOTES

Rock size (6", 12", 18") indicates the square opening on which 85% of the material, by weight, will be retained.

The width of protection shall be the width of the headwall, with 4' being the minimum.

(Where a stream bed will withstand the calculated velocity without erosion, no rock channel protection will be required.)

LEGEND	ROCK TYPE
① 48" of 18" rock	A
② 36" of 18" rock	A
③ 30" of 12" rock	B
④ 18" of 6" rock	C

ROCK CHANNEL PROTECTION AT CULVERT AND STORM SEWER OUTLETS

1107-1

REFERENCE SECTION 1107.2

Appendix C – Ditch Calculations and Maps

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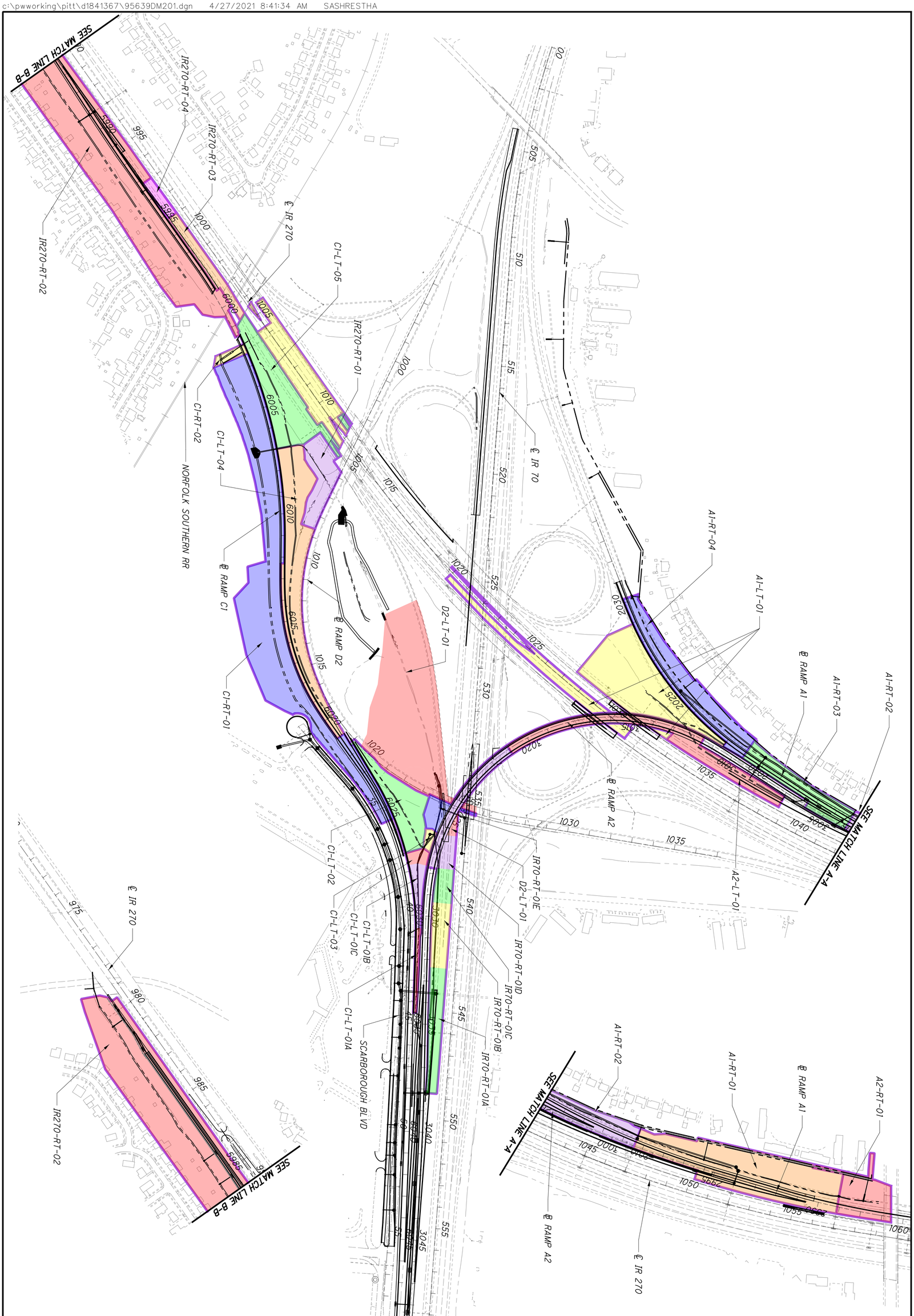

2 / 1	FRA-70-22.61	DRAINAGE AREA MAP DITCHES - 1 OF 2	CALCULATED REM CHECKED PHF	0 200 100 400 HORIZONTAL SCALE IN FEET

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2 / 2	FRA-70-22.61	DRAINAGE AREA MAP DITCHES - 2 OF 2	CALCULATED REM CHECKED PHF	0 200 100 400 HORIZONTAL SCALE IN FEET

WEIGHTED RUNOFF COEFFICIENTS

RAMP A1 01: 2022+00 TO 2028+95 LEFT DITCH

STA	STA	SIDE
2022+00	2023+50	LT

SURFACE	C	AREA	C*A
Pavement & Paved Shoulders	0.90	0.014	0.013
Berms and slopes 4:1 or flatter	0.50	0.127	0.064
Berms and slopes steeper than 4:1	0.70		0.000
TOTALS/WEIGHTED	0.54	0.141	0.076

STA	STA	SIDE
2023+50	2024+00	LT

SURFACE	C	AREA	C*A
Pavement & Paved Shoulders	0.90	0.005	0.005
Berms and slopes 4:1 or flatter	0.50	0.078	0.039
Berms and slopes steeper than 4:1	0.70		0.000
TOTALS/WEIGHTED THIS SECTION	0.53	0.083	0.044

STA	STA	SIDE
2024+00		LT
CONCENTRATED FLOW		
RAMP A2 LT DITCH		
SEE CALCS		

SURFACE	C	AREA	C*A
Pavement & Paved Shoulders	0.90		0.000
Berms and slopes 4:1 or flatter	0.50		0.000
Berms and slopes steeper than 4:1	0.70		0.000
TOTALS/WEIGHTED	#DIV/0!	0.000	0.000

STA	STA	SIDE
2024+00	2024+50	LT

SURFACE	C	AREA	C*A
Pavement & Paved Shoulders	0.90	0.043	0.039
Berms and slopes 4:1 or flatter	0.50	0.110	0.055
Berms and slopes steeper than 4:1	0.70		0.000
TOTALS/WEIGHTED	0.61	0.153	0.094

STA	STA	SIDE
2024+50	2025+00	LT

SURFACE	C	AREA	C*A
Pavement & Paved Shoulders	0.90	0.015	0.014
Berms and slopes 4:1 or flatter	0.50	0.150	0.075
Berms and slopes steeper than 4:1	0.70		0.000
TOTALS/WEIGHTED	0.54	0.165	0.089

STA	STA	SIDE
2025+00	2025+50	LT

SURFACE	C	AREA	C*A
Pavement & Paved Shoulders	0.90	0.009	0.008
Berms and slopes 4:1 or flatter	0.50	0.201	0.101
Berms and slopes steeper than 4:1	0.70		0.000
TOTALS/WEIGHTED	0.52	0.210	0.109

WEIGHTED RUNOFF COEFFICIENTS

STA	STA	SIDE
2025+50		LT
CONCENTRATED FLOW		
IR 270 MEDIAN INLETS		

SURFACE	C	AREA	C*A
Pavement & Paved Shoulders	0.90	1.159	1.043
Berms and slopes 4:1 or flatter	0.50		0.000
Berms and slopes steeper than 4:1	0.70		0.000
TOTALS/WEIGHTED	0.90	1.159	1.043

STA	STA	SIDE
2025+50	2028+95	LT

SURFACE	C	AREA	C*A
Pavement & Paved Shoulders	0.90	0.293	0.264
Berms and slopes 4:1 or flatter	0.50	1.960	0.980
Berms and slopes steeper than 4:1	0.70		0.000
TOTALS/WEIGHTED	0.55	2.253	1.244

WEIGHTED RUNOFF COEFFICIENTS

RAMP A2 01: 2987+25 TO 2989+15 (A1 = 1999+00 TO 2000+62) RIGHT DITCH

STA	STA	SIDE
2988+64	2989+15	RT

SURFACE	C	AREA	C*A
Pavement & Paved Shoulders	0.9	0.322	0.290
Berms and slopes 4:1 or flatter	0.5	0.703	0.352
Berms and slopes steeper than 4:1	0.7	0.125	0.088
TOTALS/WEIGHTED	0.63	1.150	0.729

RAMP A1 01: Ramp A2 2989+15 TO RAMP A1 2010+40 RIGHT DITCH

STA	STA	SIDE
2989+15	2010+40	RT
Ramp A2	Ramp A1	

SURFACE	C	AREA	C*A
Pavement & Paved Shoulders	0.9	1.341	1.207
Berms and slopes 4:1 or flatter	0.5	2.487	1.244
Berms and slopes steeper than 4:1	0.7		0.000
TOTALS/WEIGHTED	0.64	3.828	2.450

RAMP A1 02: 2010+40 TO 2015+25 RIGHT DITCH

STA	STA	SIDE
2010+40	2015+25	RT

SURFACE	C	AREA	C*A
Pavement & Paved Shoulders	0.9	0.604	0.544
Berms and slopes 4:1 or flatter	0.5	0.519	0.260
Berms and slopes steeper than 4:1	0.7		0.000
TOTALS/WEIGHTED	0.72	1.123	0.803

RAMP A1 03: 2015+25 TO 2021+00 RIGHT DITCH

STA	STA	SIDE
2015+25	2016+50	RT

SURFACE	C	AREA	C*A
Pavement & Paved Shoulders	0.9	0.263	0.237
Berms and slopes 4:1 or flatter	0.5	0.093	0.047
Berms and slopes steeper than 4:1	0.7		0.000
TOTALS/WEIGHTED	0.79	0.356	0.283

STA	STA	SIDE
2016+50	2021+00	RT

SURFACE	C	AREA	C*A
Pavement & Paved Shoulders	0.9	0.381	0.343
Berms and slopes 4:1 or flatter	0.5	0.406	0.203
Berms and slopes steeper than 4:1	0.7		0.000
TOTALS/WEIGHTED	0.69	0.787	0.546

WEIGHTED RUNOFF COEFFICIENTS

RAMP A1 04: 2021+00 TO 2030+15 RIGHT DITCH

STA	STA	SIDE
2021+00	2030+00	RT

SURFACE	C	AREA	C*A
Pavement & Paved Shoulders	0.9	0.506	0.455
Berms and slopes 4:1 or flatter	0.5	1.646	0.823
Berms and slopes steeper than 4:1	0.7		0.000
TOTALS/WEIGHTED	0.59	2.152	1.278

STA	STA	SIDE
2030+00	2030+15	RT

SURFACE	C	AREA	C*A
Pavement & Paved Shoulders	0.9	0.009	0.008
Berms and slopes 4:1 or flatter	0.5	0.017	0.009
Berms and slopes steeper than 4:1	0.7		0.000
TOTALS/WEIGHTED	0.65	0.026	0.017

WEIGHTED RUNOFF COEFFICIENTS

RAMP A2 01: 3007+00 TO 2024+00 RAMP A1 LEFT

STA	STA	SIDE
3007+00	3011+60	LT

SURFACE	C	AREA	C*A
Pavement & Paved Shoulders	0.90	0.369	0.332
Berms and slopes 4:1 or flatter	0.50	0.244	0.122
Berms and slopes steeper than 4:1	0.70	0.062	0.043
TOTALS/WEIGHTED	0.74	0.675	0.498

STA	STA	SIDE
3011+60		LT
CONCENTRATED FLOW		
BRIDGE 3 SCUPPER		

SURFACE	C	AREA	C*A
Pavement & Paved Shoulders	0.90	1.063	0.957
Berms and slopes 4:1 or flatter	0.50		0.000
Berms and slopes steeper than 4:1	0.70		0.000
TOTALS/WEIGHTED	0.90	1.063	0.957

STA	STA	SIDE
3011+60	2024+00	LT
	RAMP A1	

SURFACE	C	AREA	C*A
Pavement & Paved Shoulders	0.90	0.104	0.094
Berms and slopes 4:1 or flatter	0.50	0.056	0.028
Berms and slopes steeper than 4:1	0.70		0.000
TOTALS/WEIGHTED	0.76	0.160	0.122

WEIGHTED RUNOFF COEFFICIENTS

RAMP A1 NOISEWALL - NORTH SIDE DITCH

DA400

STA	STA	SIDE
14+00	11+00	RT

SURFACE	C	AREA	C*A
Pavement & Paved Shoulders	0.90		0.000
Berms and slopes 4:1 or flatter	0.50	0.117	0.059
Berms and slopes steeper than 4:1	0.70		0.000
TOTALS/WEIGHTED	0.50	0.117	0.059

DA402

STA	STA	SIDE
14+00	19+00	RT

SURFACE	C	AREA	C*A
Pavement & Paved Shoulders	0.90		0.000
Berms and slopes 4:1 or flatter	0.50	0.104	0.052
Berms and slopes steeper than 4:1	0.70		0.000
TOTALS/WEIGHTED THIS SECTION	0.50	0.104	0.052

DA404

STA	STA	SIDE
19+50	19+00	RT

SURFACE	C	AREA	C*A
Pavement & Paved Shoulders	0.90		0.000
Berms and slopes 4:1 or flatter	0.50	0.010	0.005
Berms and slopes steeper than 4:1	0.70		0.000
TOTALS/WEIGHTED	0.50	0.010	0.005

DA406

STA	STA	SIDE
19+50	22+16	RT

SURFACE	C	AREA	C*A
Pavement & Paved Shoulders	0.90		0.000
Berms and slopes 4:1 or flatter	0.50	0.054	0.027
Berms and slopes steeper than 4:1	0.70		0.000
TOTALS/WEIGHTED	0.50	0.054	0.027

DA408

STA	STA	SIDE
26+50	22+16	RT

SURFACE	C	AREA	C*A
Pavement & Paved Shoulders	0.90		0.000
Berms and slopes 4:1 or flatter	0.50	0.120	0.060
Berms and slopes steeper than 4:1	0.70		0.000
TOTALS/WEIGHTED	0.50	0.120	0.060

WEIGHTED RUNOFF COEFFICIENTS

DA409A

STA	STA	SIDE
26+92	32+50	RT

SURFACE	C	AREA	C*A
Pavement & Paved Shoulders	0.90		0.000
Berms and slopes 4:1 or flatter	0.50	0.011	0.006
Berms and slopes steeper than 4:1	0.70		0.000
TOTALS/WEIGHTED	0.55	0.011	0.006

DA409B

STA	STA	SIDE
26+50	26+92	RT

SURFACE	C	AREA	C*A
Pavement & Paved Shoulders	0.90		0.000
Berms and slopes 4:1 or flatter	0.50	0.138	0.069
Berms and slopes steeper than 4:1	0.70		0.000
TOTALS/WEIGHTED	0.50	0.138	0.069

DA410a

STA	STA	SIDE
32+50	36+54	RT

SURFACE	C	AREA	C*A
Pavement & Paved Shoulders	0.90		0.000
Berms and slopes 4:1 or flatter	0.50	0.104	0.052
Berms and slopes steeper than 4:1	0.70		0.000
TOTALS/WEIGHTED	0.50	0.104	0.052

DA410b

STA	STA	SIDE
36+54	41+24	RT

SURFACE	C	AREA	C*A
Pavement & Paved Shoulders	0.90		0.000
Berms and slopes 4:1 or flatter	0.50	0.123	0.062
Berms and slopes steeper than 4:1	0.70		0.000
TOTALS/WEIGHTED	0.50	0.123	0.062

DA410c

STA	STA	SIDE
41+24	47+50	RT

SURFACE	C	AREA	C*A
Pavement & Paved Shoulders	0.90		0.000
Berms and slopes 4:1 or flatter	0.50	0.143	0.072
Berms and slopes steeper than 4:1	0.70		0.000
TOTALS/WEIGHTED	0.50	0.143	0.072

DA413

STA	STA	SIDE
51+00	47+50	RT

SURFACE	C	AREA	C*A
Pavement & Paved Shoulders	0.90		0.000
Berms and slopes 4:1 or flatter	0.50	0.077	0.039
Berms and slopes steeper than 4:1	0.70		0.000
TOTALS/WEIGHTED	0.51	0.077	0.039

WEIGHTED RUNOFF COEFFICIENTS

DA414

STA	STA	SIDE
52+00	51+00	RT

SURFACE	C	AREA	C*A
Pavement & Paved Shoulders	0.90		0.000
Berms and slopes 4:1 or flatter	0.50	0.022	0.011
Berms and slopes steeper than 4:1	0.70		0.000
TOTALS/WEIGHTED	0.51	0.022	0.011

DA415A

STA	STA	SIDE
52+00	54+00	RT

SURFACE	C	AREA	C*A
Pavement & Paved Shoulders	0.90		0.000
Berms and slopes 4:1 or flatter	0.50	0.043	0.022
Berms and slopes steeper than 4:1	0.70		0.000
TOTALS/WEIGHTED	0.51	0.043	0.022

DA415B

STA	STA	SIDE
54+75	54+00	RT

SURFACE	C	AREA	C*A
Pavement & Paved Shoulders	0.90		0.000
Berms and slopes 4:1 or flatter	0.50	0.018	0.009
Berms and slopes steeper than 4:1	0.70		0.000
TOTALS/WEIGHTED	0.50	0.018	0.009

DA416A

STA	STA	SIDE
54+75	58+50	RT

SURFACE	C	AREA	C*A
Pavement & Paved Shoulders	0.90		0.000
Berms and slopes 4:1 or flatter	0.50	0.096	0.048
Berms and slopes steeper than 4:1	0.70		0.000
TOTALS/WEIGHTED	0.50	0.096	0.048

DA416b

STA	STA	SIDE
59+60	58+50	RT

SURFACE	C	AREA	C*A
Pavement & Paved Shoulders	0.90		0.000
Berms and slopes 4:1 or flatter	0.50	0.028	0.014
Berms and slopes steeper than 4:1	0.70		0.000
TOTALS/WEIGHTED	0.50	0.028	0.014

WEIGHTED RUNOFF COEFFICIENTS

RAMP A1 NOISEWALL - SOUTH SIDE DITCH

DA401

STA	STA	SIDE
14+00	11+00	LT

SURFACE	C	AREA	C*A
Pavement & Paved Shoulders	0.90		0.000
Berms and slopes 4:1 or flatter	0.50	0.054	0.027
Berms and slopes steeper than 4:1	0.70		0.000
TOTALS/WEIGHTED	0.50	0.054	0.027

DA403

STA	STA	SIDE
14+00	19+00	LT

SURFACE	C	AREA	C*A
Pavement & Paved Shoulders	0.90		0.000
Berms and slopes 4:1 or flatter	0.50	0.121	0.061
Berms and slopes steeper than 4:1	0.70		0.000
TOTALS/WEIGHTED THIS SECTION	0.50	0.121	0.061

DA405

STA	STA	SIDE
19+50	19+00	LT

SURFACE	C	AREA	C*A
Pavement & Paved Shoulders	0.90		0.000
Berms and slopes 4:1 or flatter	0.50	0.010	0.005
Berms and slopes steeper than 4:1	0.70		0.000
TOTALS/WEIGHTED	0.50	0.010	0.005

DA407

STA	STA	SIDE
19+50	22+75	LT

SURFACE	C	AREA	C*A
Pavement & Paved Shoulders	0.90		0.000
Berms and slopes 4:1 or flatter	0.50	0.083	0.042
Berms and slopes steeper than 4:1	0.70		0.000
TOTALS/WEIGHTED	0.50	0.083	0.042

DA412

STA	STA	SIDE
41+50	47+75	LT

SURFACE	C	AREA	C*A
Pavement & Paved Shoulders	0.90		0.000
Berms and slopes 4:1 or flatter	0.50	0.193	0.097
Berms and slopes steeper than 4:1	0.70		0.000
TOTALS/WEIGHTED	0.50	0.193	0.097

WEIGHTED RUNOFF COEFFICIENTS

DA417

STA	STA	SIDE
57+50	58+50	LT

SURFACE	C	AREA	C*A
Pavement & Paved Shoulders	0.90		0.000
Berms and slopes 4:1 or flatter	0.50	0.045	0.023
Berms and slopes steeper than 4:1	0.70		0.000
TOTALS/WEIGHTED	0.51	0.045	0.023

DA418

STA	STA	SIDE
59+60	58+50	LT

SURFACE	C	AREA	C*A
Pavement & Paved Shoulders	0.90		0.000
Berms and slopes 4:1 or flatter	0.50	0.028	0.014
Berms and slopes steeper than 4:1	0.70		0.000
TOTALS/WEIGHTED	0.50	0.028	0.014

WEIGHTED RUNOFF COEFFICIENTS

RAMP C1 01A: 6034+40 TO 6030+60 LEFT

STA	STA	SIDE	SURFACE	C	AREA	C*A
6034+40	6033+25	LT	Pavement & Paved Shoulders	0.9	0.012	0.01
			Berms and slopes 4:1 or flatter	0.5	0.022	0.01
			Berms and slopes steeper than 4:1	0.7	0.015	0.01
			TOTALS/WEIGHTED	0.65	0.049	0.03

STA	STA	SIDE	SURFACE	C	AREA	C*A
6033+25	6032+00	LT	Pavement & Paved Shoulders	0.9	0.012	0.01
			Berms and slopes 4:1 or flatter	0.5	0.021	0.01
			Berms and slopes steeper than 4:1	0.7	0.024	0.02
			TOTALS/WEIGHTED	0.67	0.057	0.04

STA	STA	SIDE	SURFACE	C	AREA	C*A
6032+00	6030+60	LT	Pavement & Paved Shoulders	0.9	0.010	0.01
			Berms and slopes 4:1 or flatter	0.5	0.020	0.01
			Berms and slopes steeper than 4:1	0.7	0.030	0.02
			TOTALS/WEIGHTED	0.67	0.060	0.04

RAMP C1 01B: 6030+60 TO 6027+15 LEFT

STA	STA	SIDE	SURFACE	C	AREA	C*A
6030+60	6028+50	LT	Pavement & Paved Shoulders	0.9	0.020	0.02
			Berms and slopes 4:1 or flatter	0.5	0.030	0.02
			Berms and slopes steeper than 4:1	0.7	0.130	0.09
			TOTALS/WEIGHTED	0.69	0.180	0.12

STA	STA	SIDE	SURFACE	C	AREA	C*A
6028+50	6027+73	LT	Pavement & Paved Shoulders	0.9	0.007	0.01
			Berms and slopes 4:1 or flatter	0.5	0.020	0.01
			Berms and slopes steeper than 4:1	0.7	0.100	0.07
			TOTALS/WEIGHTED	0.68	0.127	0.09

RAMP C1 01: 6030+60 TO 6027+15 LEFT

STA	STA	SIDE	SURFACE	C	AREA	C*A
6027+73	6027+15	LT	Pavement & Paved Shoulders	0.9	0.005	0.00
			Berms and slopes 4:1 or flatter	0.5	0.080	0.04
			Berms and slopes steeper than 4:1	0.7	0.060	0.04
			TOTALS/WEIGHTED	0.6	0.145	0.09

WEIGHTED RUNOFF COEFFICIENTS

RAMP C1 02: 6021+60 TO 6027+15 LEFT

STA	STA	SIDE	SURFACE	C	AREA	C*A
6021+60	6022+00	LT	Pavement & Paved Shoulders	0.9	0.009	0.01
			Berms and slopes 4:1 or flatter	0.5	0.018	0.01
			Berms and slopes steeper than 4:1	0.7	0.002	0.00
			TOTALS/WEIGHTED	0.66	0.029	0.02

STA	STA	SIDE	SURFACE	C	AREA	C*A
6022+00	6023+50	LT	Pavement & Paved Shoulders	0.9	0.014	0.01
			Berms and slopes 4:1 or flatter	0.5	0.122	0.06
			Berms and slopes steeper than 4:1	0.7	0.023	0.02
			TOTALS/WEIGHTED	0.57	0.159	0.09

STA	STA	SIDE	SURFACE	C	AREA	C*A
6023+50	6023+95	LT	Pavement & Paved Shoulders	0.9	0.004	0.00
			Berms and slopes 4:1 or flatter	0.5	0.068	0.03
			Berms and slopes steeper than 4:1	0.7	0.011	0.01
			TOTALS/WEIGHTED	0.54	0.083	0.05

STA	STA	SIDE	SURFACE	C	AREA	C*A
6023+95	6026+50	LT	Pavement & Paved Shoulders	0.9	0.024	0.02
			Berms and slopes 4:1 or flatter	0.5	0.848	0.42
			Berms and slopes steeper than 4:1	0.7		0.00
			TOTALS/WEIGHTED	0.51	0.872	0.45

STA	STA	SIDE	SURFACE	C	AREA	C*A
6026+50	6027+15	LT	Pavement & Paved Shoulders	0.9	0.006	0.01
			Berms and slopes 4:1 or flatter	0.5	0.171	0.09
			Berms and slopes steeper than 4:1	0.7		0.00
			TOTALS/WEIGHTED	0.51	0.177	0.09

RAMP C1 03: RAMP C1 6027+15 LEFT TO IR-70 536+75 RIGHT

STA	STA	SIDE	SURFACE	C	AREA	C*A
6027+15	536+75	RT	Pavement & Paved Shoulders	0.9		0.00
RAMP C1	IR-70		Berms and slopes 4:1 or flatter	0.5	0.009	0.00
			Berms and slopes steeper than 4:1	0.7	0.090	0.06
			TOTALS/WEIGHTED	0.69	0.099	0.07

WEIGHTED RUNOFF COEFFICIENTS

RAMP C1 04: 6019+50 TO 6007+00 LEFT

STA	STA	SIDE
6019+50	6017+57	LT

SURFACE	C	AREA	C*A
Pavement & Paved Shoulders	0.9	0.265	0.24
Berms and slopes 4:1 or flatter	0.5	0.163	0.08
TOTALS/WEIGHTED	0.75	0.428	0.32

STA	STA	SIDE
6017+57	6011+00	LT

SURFACE	C	AREA	C*A
Pavement & Paved Shoulders	0.9	0.386	0.35
Berms and slopes 4:1 or flatter	0.5	0.587	0.29
Berms and slopes steeper than 4:1	0.7	0.383	0.27
TOTALS/WEIGHTED	0.67	1.356	0.91

STA	STA	SIDE
6011+00	6007+00	LT

SURFACE	C	AREA	C*A
Pavement & Paved Shoulders	0.9	0.049	0.04
Berms and slopes 4:1 or flatter	0.5	0.323	0.16
Berms and slopes steeper than 4:1	0.7	0.812	0.57
TOTALS/WEIGHTED	0.65	1.184	0.77

RAMP C1 05: 6001+22 TO 6007+00 LEFT

STA	STA	SIDE
6001+22	6002+00	LT

SURFACE	C	AREA	C*A
Pavement & Paved Shoulders	0.9	0.114	0.10
Berms and slopes 4:1 or flatter	0.5	0.029	0.01
Berms and slopes steeper than 4:1	0.7	0.048	0.03
TOTALS/WEIGHTED	0.79	0.191	0.15

STA	STA	SIDE
6002+00	6003+00	LT

SURFACE	C	AREA	C*A
Pavement & Paved Shoulders	0.9	0.112	0.10
Berms and slopes 4:1 or flatter	0.5	0.023	0.01
Berms and slopes steeper than 4:1	0.7	0.087	0.06
TOTALS/WEIGHTED	0.78	0.222	0.17

STA	STA	SIDE
6003+00	6005+00	LT

SURFACE	C	AREA	C*A
Pavement & Paved Shoulders	0.9	0.233	0.21
Berms and slopes 4:1 or flatter	0.5	0.045	0.02
Berms and slopes steeper than 4:1	0.7	0.335	0.23
TOTALS/WEIGHTED	0.76	0.613	0.47

WEIGHTED RUNOFF COEFFICIENTS

STA	STA	SIDE	SURFACE	C	AREA	C*A
6005+00	6007+00	LT	Pavement & Paved Shoulders	0.9	0.208	0.19
			Berms and slopes 4:1 or flatter	0.5	0.089	0.04
			Berms and slopes steeper than 4:1	0.7	0.631	0.44
			TOTALS/WEIGHTED	0.73	0.928	0.67

RAMP C1 01: 6019+50 to 6002+40 RIGHT

STA	STA	SIDE	SURFACE	C	AREA	C*A
6025+50	6025+00	RT	Pavement & Paved Shoulders	0.9	0.045	0.04
			Berms and slopes 4:1 or flatter	0.5	0.006	0.00
			Berms and slopes steeper than 4:1	0.7	0.024	0.02
			TOTALS/WEIGHTED	0.8	0.075	0.06

STA	STA	SIDE	SURFACE	C	AREA	C*A
6025+00	6024+50	RT	Pavement & Paved Shoulders	0.9	0.046	0.04
			Berms and slopes 4:1 or flatter	0.5	0.006	0.00
			Berms and slopes steeper than 4:1	0.7	0.028	0.02
			TOTALS/WEIGHTED	0.8	0.080	0.06

STA	STA	SIDE	SURFACE	C	AREA	C*A
6024+50	6024+00	RT	Pavement & Paved Shoulders	0.9	0.048	0.04
			Berms and slopes 4:1 or flatter	0.5	0.006	0.00
			Berms and slopes steeper than 4:1	0.7	0.031	0.02
			TOTALS/WEIGHTED	0.8	0.085	0.07

STA	STA	SIDE	SURFACE	C	AREA	C*A
6024+00	6019+00	RT	Pavement & Paved Shoulders	0.9	0.353	0.32
			Berms and slopes 4:1 or flatter	0.5	0.102	0.05
			Berms and slopes steeper than 4:1	0.7	0.540	0.38
			TOTALS/WEIGHTED	0.75	0.995	0.75

STA	STA	SIDE	SURFACE	C	AREA	C*A
6019+00	6007+00	RT	Pavement & Paved Shoulders	0.9	0.361	0.32
			Berms and slopes 4:1 or flatter	0.5	0.594	0.30
			Berms and slopes steeper than 4:1	0.7	3.405	2.38
			TOTALS/WEIGHTED	0.69	4.360	3.01

WEIGHTED RUNOFF COEFFICIENTS

STA	STA	SIDE
6007+00		RT
CONCENTRATED FLOW		
CULVERT OUTLET		
SEE CALCULATIONS		

SURFACE	C	AREA	C*A
Pavement & Paved Shoulders	0.9		0.00
Berms and slopes 4:1 or flatter	0.5		0.00
Berms and slopes steeper than 4:1	0.7		0.00
TOTALS/WEIGHTED	#DIV/0!	0.000	0.00

STA	STA	SIDE
6007+00	6002+40	RT

SURFACE	C	AREA	C*A
Pavement & Paved Shoulders	0.9	0.233	0.21
Berms and slopes 4:1 or flatter	0.5	0.218	0.11
Berms and slopes steeper than 4:1	0.7	1.159	0.81
TOTALS/WEIGHTED	0.7	1.610	1.13

RAMP C1 02: 6001+93 TO 6002+40 RIGHT

STA	STA	SIDE
6001+93	6002+40	RT

SURFACE	C	AREA	C*A
Pavement & Paved Shoulders	0.9	0.024	0.02
Berms and slopes 4:1 or flatter	0.5	0.023	0.01
Berms and slopes steeper than 4:1	0.7	0.116	0.08
TOTALS/WEIGHTED	0.7	0.163	0.11

STA	STA	SIDE
6001+93		RT
CONCENTRATED FLOW		
MEDIAN OUTLET		

SURFACE	C	AREA	C*A
Pavement & Paved Shoulders	0.9	1.645	1.48
Berms and slopes 4:1 or flatter	0.5		0.00
Berms and slopes steeper than 4:1	0.7		0.00
TOTALS/WEIGHTED	0.9	1.645	1.48

RAMP C1 03A-C: 6057+38 to 6067+00 RIGHT

STA	STA	SIDE
6057+38	6065+00	RT

SURFACE	C	AREA	C*A
Pavement & Paved Shoulders	0.9		0.00
Berms and slopes 4:1 or flatter	0.5	0.640	0.32
Berms and slopes steeper than 4:1	0.7	0.160	0.11
TOTALS/WEIGHTED	0.54	0.800	0.43

STA	STA	SIDE
6065+00	6065+50	RT

SURFACE	C	AREA	C*A
Pavement & Paved Shoulders	0.9		0.00
Berms and slopes 4:1 or flatter	0.5	0.033	0.02
Berms and slopes steeper than 4:1	0.7	0.010	0.01
TOTALS/WEIGHTED	0.56	0.043	0.02

WEIGHTED RUNOFF COEFFICIENTS

STA	STA	SIDE	SURFACE	C	AREA	C*A
6065+50	6067+00	RT	Pavement & Paved Shoulders	0.9		0.00
			Berms and slopes 4:1 or flatter	0.5	0.033	0.02
			Berms and slopes steeper than 4:1	0.7	0.046	0.03
			TOTALS/WEIGHTED	0.62	0.079	0.05

RAMP C1 04: 6073+00 TO 6076+50 RIGHT

STA	STA	SIDE	SURFACE	C	AREA	C*A
6077+25	6073+50	RT	Pavement & Paved Shoulders	0.9	1.590	1.43
			Berms and slopes 4:1 or flatter	0.5	0.610	0.31
			Berms and slopes steeper than 4:1	0.7	1.090	0.76
			TOTALS/WEIGHTED	0.76	3.290	2.50

STA	STA	SIDE	SURFACE	C	AREA	C*A
6073+50	6073+00	RT	Pavement & Paved Shoulders	0.9	0.060	0.05
			Berms and slopes 4:1 or flatter	0.5	0.020	0.01
			Berms and slopes steeper than 4:1	0.7	0.060	0.04
			TOTALS/WEIGHTED	0.76	0.140	0.11

WEIGHTED RUNOFF COEFFICIENTS

RAMP C1 Existing Ditch 6077+25 to Culvert Inlet 6073+87

STA	STA	SIDE	SURFACE	C	AREA	C*A
6077+25	6077+00	LT	Pavement & Paved Shoulders	0.9	0.176	0.16
			Berms and slopes steeper than 4:1	0.7	0.041	0.03
			TOTALS/WEIGHTED	0.86	0.217	0.19

STA	STA	SIDE	SURFACE	C	AREA	C*A
6077+00	6075+59	LT	Pavement & Paved Shoulders	0.9	0.201	0.18
			Berms and slopes steeper than 4:1	0.7	0.280	0.20
			TOTALS/WEIGHTED	0.78	0.481	0.38

STA	STA	SIDE	SURFACE	C	AREA	C*A
6075+59	6073+87	LT	Pavement & Paved Shoulders	0.9	0.182	0.16
			Berms and slopes steeper than 4:1	0.7	0.736	0.52
			TOTALS/WEIGHTED	0.74	0.918	0.68

WEIGHTED RUNOFF COEFFICIENTS

RAMP G1 01: RAMP G1 8584+50 RIGHT TO RAMP C1 6073+87 LEFT

STA	STA	SIDE	SURFACE	C	AREA	C*A
8584+50	8585+00	RT	Pavement & Paved Shoulders	0.9	0.173	0.16
			Berms and slopes 4:1 or flatter	0.5	0.112	0.06
			Berms and slopes steeper than 4:1	0.7		0.00
			TOTALS/WEIGHTED	0.74	0.285	0.21

STA	STA	SIDE	SURFACE	C	AREA	C*A
8585+00	8587+00	RT	Pavement & Paved Shoulders	0.9	0.145	0.13
			Berms and slopes 4:1 or flatter	0.5	0.335	0.17
			Berms and slopes steeper than 4:1	0.7		0.00
			TOTALS/WEIGHTED	0.62	0.480	0.30

STA	STA	SIDE	SURFACE	C	AREA	C*A
8587+00	8587+50	RT	Pavement & Paved Shoulders	0.9	0.033	0.03
			Berms and slopes 4:1 or flatter	0.5	0.134	0.07
			Berms and slopes steeper than 4:1	0.7		0.00
			TOTALS/WEIGHTED	0.58	0.167	0.10

STA	STA	SIDE	SURFACE	C	AREA	C*A
8587+50	6073+87	RT	Pavement & Paved Shoulders	0.9	0.071	0.06
Ramp G1	Ramp C1		Berms and slopes 4:1 or flatter	0.5	0.391	0.20
			Berms and slopes steeper than 4:1	0.7		0.00
			TOTALS/WEIGHTED	0.56	0.462	0.26

WEIGHTED RUNOFF COEFFICIENTS

RAMP G1 02: 8589+50 RIGHT TO RAMP C1 6073+87 LEFT

STA	STA	SIDE
8589+50	8589+00	RT

SURFACE	C	AREA	C*A
Pavement & Paved Shoulders	0.9	0.072	0.06
Berms and slopes 4:1 or flatter	0.5	0.078	0.04
Berms and slopes steeper than 4:1	0.7	0.055	0.04
TOTALS/WEIGHTED	0.69	0.205	0.14

STA	STA	SIDE
CONCENTRATED FLOW		RT

SURFACE	C	AREA	C*A
STORM SEWER OUTLET		12.730	8.22
TOTALS/WEIGHTED	0.65	12.730	8.22

STA	STA	SIDE
8589+00	6073+87	RT
Ramp G1	Ramp C1	

SURFACE	C	AREA	C*A
Pavement & Paved Shoulders	0.9	0.229	0.21
Berms and slopes 4:1 or flatter	0.5	0.197	0.10
Berms and slopes steeper than 4:1	0.7	0.154	0.11
TOTALS/WEIGHTED	0.71	0.580	0.41

RAMP G1 03: 8598+75 TO 8592+00 RIGHT

STA	STA	SIDE
8598+75	8594+50	RT
Existing Ditch		

SURFACE	C	AREA	C*A
Pavement & Paved Shoulders	0.9	1.280	1.15
Berms and slopes 4:1 or flatter	0.5	3.570	1.79
Berms and slopes steeper than 4:1	0.7	0.050	0.04
TOTALS/WEIGHTED	0.61	4.900	2.97

STA	STA	SIDE
8594+50	8592+00	RT

SURFACE	C	AREA	C*A
Pavement & Paved Shoulders	0.9	0.490	0.44
Berms and slopes 4:1 or flatter	0.5	0.900	0.45
Berms and slopes steeper than 4:1	0.7	0.110	0.08
TOTALS/WEIGHTED	0.65	1.500	0.97

WEIGHTED RUNOFF COEFFICIENTS

IR270 01: RAMP D2 1008+60 TO IR-270 1011+15 RIGHT

STA	STA	SIDE
1008+60	1013+06	RT
RAMP D2	IR-270	

SURFACE	C	AREA	C*A
Pavement & Paved Shoulders	0.9	0.046	0.04
Berms and slopes 4:1 or flatter	0.5	0.236	0.12
Berms and slopes steeper than 4:1	0.7	0.127	0.09
TOTALS/WEIGHTED	0.61	0.409	0.25

STA	STA	SIDE
1013+06		RT
CONCENTRATED FLOW		
RAMP D2 INFIELD		
SEE CALCULATIONS		

SURFACE	C	AREA	C*A
Pavement & Paved Shoulders	0.9		0.00
Berms and slopes 4:1 or flatter	0.5		0.00
Berms and slopes steeper than 4:1	0.7		0.00
TOTALS/WEIGHTED	0.69	32.110	22.16

STA	STA	SIDE
1013+06	1011+15	RT

SURFACE	C	AREA	C*A
Pavement & Paved Shoulders	0.9	0.100	0.09
Berms and slopes 4:1 or flatter	0.5	0.164	0.08
Berms and slopes steeper than 4:1	0.7	0.323	0.23
TOTALS/WEIGHTED	0.68	0.587	0.40

IR270 02: 1003+00 to 979+00 RIGHT

STA	STA	SIDE
1003+00	993+00	LT

SURFACE	C	AREA	C*A
Pavement & Paved Shoulders	0.9		0.00
Berms and slopes 4:1 or flatter	0.5	3.021	1.51
Berms and slopes steeper than 4:1	0.7	0.989	0.69
TOTALS/WEIGHTED	0.55	4.010	2.20

STA	STA	SIDE
993+00		LT
CONCENTRATED FLOW		
IR270 MEDIAN INLETS		
SEE CALCULATIONS		

SURFACE	C	AREA	C*A
Pavement & Paved Shoulders	0.9		0.00
Berms and slopes 4:1 or flatter	0.5		0.00
Berms and slopes steeper than 4:1	0.7		0.00
TOTALS/WEIGHTED	0.81	4.850	3.93

STA	STA	SIDE
993+00	989+50	LT

SURFACE	C	AREA	C*A
Pavement & Paved Shoulders	0.9		0.00
Berms and slopes 4:1 or flatter	0.5	0.941	0.47
Berms and slopes steeper than 4:1	0.7	0.460	0.32
TOTALS/WEIGHTED	0.57	1.401	0.79

WEIGHTED RUNOFF COEFFICIENTS

STA	STA	SIDE
989+50	988+00	RT

SURFACE	C	AREA	C*A
Pavement & Paved Shoulders	0.9		0.00
Berms and slopes 4:1 or flatter	0.5	0.431	0.22
Berms and slopes steeper than 4:1	0.7	0.203	0.14
TOTALS/WEIGHTED	0.56	0.634	0.36

STA	STA	SIDE
988+00		LT
CONCENTRATED FLOW		
IR270 MEDIAN INLETS		

SURFACE	C	AREA	C*A
Pavement & Paved Shoulders	0.9	1.110	1.00
Berms and slopes 4:1 or flatter	0.5		0.00
Berms and slopes steeper than 4:1	0.7		0.00
TOTALS/WEIGHTED	0.9	1.110	1.00

STA	STA	SIDE
988+00	980+50	LT

SURFACE	C	AREA	C*A
Pavement & Paved Shoulders	0.9		0.00
Berms and slopes 4:1 or flatter	0.5	2.274	1.14
Berms and slopes steeper than 4:1	0.7	0.939	0.66
TOTALS/WEIGHTED	0.56	3.213	1.79

STA	STA	SIDE
980+50		LT
CONCENTRATED FLOW		
IR270 MEDIAN INLETS		

SURFACE	C	AREA	C*A
Pavement & Paved Shoulders	0.9		0.00
Berms and slopes 4:1 or flatter	0.5		0.00
Berms and slopes steeper than 4:1	0.7		0.00
TOTALS/WEIGHTED	0.73	3.300	2.40

STA	112+45	SIDE
980+50	980+00	LT

SURFACE	C	AREA	C*A
Pavement & Paved Shoulders	0.9		0.00
Berms and slopes 4:1 or flatter	0.5	0.122	0.06
Berms and slopes steeper than 4:1	0.7	0.055	0.04
TOTALS/WEIGHTED	0.56	0.177	0.10

STA	112+45	SIDE
980+00	979+00	LT

SURFACE	C	AREA	C*A
Pavement & Paved Shoulders	0.9		0.00
Berms and slopes 4:1 or flatter	0.5	0.238	0.12
Berms and slopes steeper than 4:1	0.7	0.112	0.08
TOTALS/WEIGHTED	0.56	0.350	0.20

WEIGHTED RUNOFF COEFFICIENTS

IR270 03: 1003+00 to 999+00 RIGHT

STA	STA	SIDE
1003+00	999+00	LT
		0.87%

SURFACE	C	AREA	C*A
Pavement & Paved Shoulders	0.9	0.460	0.41
Berms and slopes steeper than 4:1	0.7	0.151	0.11
TOTALS/WEIGHTED	0.85	0.611	0.52

IR270 04: 1003+00 to 999+00 RIGHT

STA	STA	SIDE
996+50	999+00	LT
		0.25%

SURFACE	C	AREA	C*A
Pavement & Paved Shoulders	0.9	0.154	0.14
Berms and slopes steeper than 4:1	0.7	0.072	0.05
TOTALS/WEIGHTED	0.84	0.226	0.19

IR270 NOE BIXBY: 977+00 to 979+00 RIGHT

STA	112+45	SIDE
977+00	979+00	RT

SURFACE	C	AREA	C*A
Pavement & Paved Shoulders	0.9	0.082	0.07
Berms and slopes 4:1 or flatter	0.5	0.130	0.07
Berms and slopes steeper than 4:1	0.7	0.260	0.18
TOTALS/WEIGHTED	0.68	0.472	0.32

IR270 NOE BIXBY: 977+00 to 979+00 RIGHT

STA	112+45	SIDE
977+00	979+00	RT

SURFACE	C	AREA	C*A
Pavement & Paved Shoulders	0.9	0.013	0.01
Berms and slopes 4:1 or flatter	0.5	0.073	0.04
Berms and slopes steeper than 4:1	0.7	0.007	0.00
TOTALS/WEIGHTED	0.57	0.093	0.05

WEIGHTED RUNOFF COEFFICIENTS

IR-70 01: 516+00 TO 518+00 RIGHT

STA	STA	SIDE
516+00	518+00	RT

SURFACE	C	AREA	C*A
Pavement & Paved Shoulders	0.9	0.155	0.14
Berms and slopes 4:1 or flatter	0.5	0.234	0.12
Berms and slopes steeper than 4:1	0.7		0.00
TOTALS/WEIGHTED	0.66	0.389	0.26

IR-70 01A: 546+50 TO 543+00 RIGHT

STA	STA	SIDE
545+37	543+00	RT

SURFACE	C	AREA	C*A
Pavement & Paved Shoulders	0.9	0.700	0.63
Berms and slopes 4:1 or flatter	0.5	0.140	0.07
Berms and slopes steeper than 4:1	0.7		0.00
TOTALS/WEIGHTED	0.83	0.840	0.70

IR-70 01B: 543+00 TO 540+00 RIGHT

STA	STA	SIDE
543+00	541+00	RT

SURFACE	C	AREA	C*A
Pavement & Paved Shoulders	0.9	0.220	0.20
Berms and slopes 4:1 or flatter	0.5	0.150	0.08
Berms and slopes steeper than 4:1	0.7		0.00
TOTALS/WEIGHTED	0.74	0.370	0.27

STA	STA	SIDE
541+00	540+00	RT

SURFACE	C	AREA	C*A
Pavement & Paved Shoulders	0.9	0.120	0.11
Berms and slopes 4:1 or flatter	0.5	0.080	0.04
Berms and slopes steeper than 4:1	0.7		0.00
TOTALS/WEIGHTED	0.74	0.200	0.15

IR-70 01C: 540+00 TO 538+37 RIGHT

STA	STA	SIDE
540+00	538+37	RT

SURFACE	C	AREA	C*A
Pavement & Paved Shoulders	0.9	0.210	0.19
Berms and slopes 4:1 or flatter	0.5	0.100	0.05
Berms and slopes steeper than 4:1	0.7		0.00
TOTALS/WEIGHTED	0.77	0.310	0.24

WEIGHTED RUNOFF COEFFICIENTS

IR-70 01D: 538+37 TO 536+82 RIGHT

STA	STA	SIDE
538+37		RT
CONCENTRATED FLOW RAMP A2 BRIDGE 3 SCUPPERS		

SURFACE	C	AREA	C*A
Pavement & Paved Shoulders	0.9	0.776	0.70
Berms and slopes 4:1 or flatter	0.5		0.00
Berms and slopes steeper than 4:1	0.7		0.00
TOTALS/WEIGHTED	0.9	0.776	0.70

STA	STA	SIDE
538+37	536+82	RT

SURFACE	C	AREA	C*A
Pavement & Paved Shoulders	0.9	0.200	0.18
Berms and slopes 4:1 or flatter	0.5	0.030	0.02
Berms and slopes steeper than 4:1	0.7		0.00
TOTALS/WEIGHTED	0.85	0.230	0.20

IR-70 01E: 536+82 TO 535+61 RIGHT

STA	STA	SIDE
536+82	535+61	RT

SURFACE	C	AREA	C*A
Pavement & Paved Shoulders	0.9	0.060	0.05
Berms and slopes 4:1 or flatter	0.5	0.050	0.03
Berms and slopes steeper than 4:1	0.7	0.190	0.13
TOTALS/WEIGHTED	0.71	0.300	0.21

IR 70 02: 641+05 to 606+41 RIGHT

STA	STA	SIDE
641+05	621+20	RT

SURFACE	C	AREA	C*A
Pavement & Paved Shoulders	0.9	2.220	2.00
Berms and slopes 4:1 or flatter	0.5	2.540	1.27
Berms and slopes steeper than 4:1	0.7		0.00
TOTALS/WEIGHTED	0.69	4.760	3.27

STA	STA	SIDE
621+20	620+18	RT

SURFACE	C	AREA	C*A
Pavement & Paved Shoulders	0.9	0.112	0.10
Berms and slopes 4:1 or flatter	0.5	0.156	0.08
Berms and slopes steeper than 4:1	0.7		0.00
TOTALS/WEIGHTED	0.67	0.268	0.18

STA	STA	SIDE
620+00		RT
CONCENTRATED CALC MEDIAN DRAINAGE OUTLET		

SURFACE	C	AREA	C*A
Pavement & Paved Shoulders	0.9	0.163	0.15
Berms and slopes 4:1 or flatter	0.5	0.231	0.12
Berms and slopes steeper than 4:1	0.7		0.00
TOTALS/WEIGHTED	0.66	0.394	0.26

WEIGHTED RUNOFF COEFFICIENTS

STA	STA	SIDE
620+18	618+70	RT

SURFACE	C	AREA	C*A
Pavement & Paved Shoulders	0.9	0.171	0.15
Berms and slopes 4:1 or flatter	0.5	0.242	0.12
Berms and slopes steeper than 4:1	0.7		0.00
TOTALS/WEIGHTED	0.67	0.413	0.28

STA	STA	SIDE
618+70	610+00	RT

SURFACE	C	AREA	C*A
Pavement & Paved Shoulders	0.9	0.967	0.87
Berms and slopes 4:1 or flatter	0.5	1.147	0.57
Berms and slopes steeper than 4:1	0.7		0.00
TOTALS/WEIGHTED	0.68	2.114	1.44

STA	STA	SIDE
610+00		RT
CONCENTRATED CALC		
DRAINAGE OUTLET		

SURFACE	C	AREA	C*A
Pavement & Paved Shoulders	0.9	1.220	1.10
Berms and slopes 4:1 or flatter	0.5	0.705	0.35
Berms and slopes steeper than 4:1	0.7		0.00
TOTALS/WEIGHTED	0.75	1.925	1.45

STA	STA	SIDE
610+00	607+25	RT

SURFACE	C	AREA	C*A
Pavement & Paved Shoulders	0.9	0.330	0.30
Berms and slopes 4:1 or flatter	0.5	0.508	0.25
Berms and slopes steeper than 4:1	0.7		0.00
TOTALS/WEIGHTED	0.66	0.838	0.55

STA	STA	SIDE
610+00	606+41	RT

SURFACE	C	AREA	C*A
Pavement & Paved Shoulders	0.9	0.106	0.10
Berms and slopes 4:1 or flatter	0.5	0.141	0.07
Berms and slopes steeper than 4:1	0.7		0.00
TOTALS/WEIGHTED	0.67	0.247	0.17

WEIGHTED RUNOFF COEFFICIENTS

IR-70 03 - 593+50 TO 595+00 RIGHT

STA	STA	SIDE
593+50	595+00	RT

SURFACE	C	AREA	C*A
Pavement & Paved Shoulders	0.9	0.428	0.39
Berms and slopes 4:1 or flatter	0.5	0.400	0.20
Berms and slopes steeper than 4:1	0.7		0.00
TOTALS/WEIGHTED	0.71	0.828	0.59

IR-70 04 - 592+50 TO 593+50 RIGHT

STA	STA	SIDE
592+50	593+50	RT

SURFACE	C	AREA	C*A
Pavement & Paved Shoulders	0.9	0.134	0.12
Berms and slopes 4:1 or flatter	0.5	0.106	0.05
Berms and slopes steeper than 4:1	0.7		0.00
TOTALS/WEIGHTED	0.72	0.240	0.17

20

WEIGHTED RUNOFF COEFFICIENTS

IR-70 01: 537+32 TO 545+67 LEFT

STA	STA	SIDE
545+67	537+32	LT

SURFACE	C	AREA	C*A
Pavement & Paved Shoulders	0.9	1.010	0.91
Berms and slopes 4:1 or flatter	0.5	0.592	0.30
Berms and slopes steeper than 4:1	0.7		0.00
TOTALS/WEIGHTED	0.75	1.602	1.21

WEIGHTED RUNOFF COEFFICIENTS

CALC NAME/AREA

STA	STA	SIDE	SURFACE AREA (ACRES)			C*A	TOTAL AREA	WEIGHTED C
			PAVEMENT	SLOPES STEEPER THAN 4:1	SLOPES 4:1 OR FLATTER			
			0.9	0.7	0.5			
68+35	72+00	LT	0.290	0.000	0.197	0.360	0.49	0.74
64+85	68+35	LT	0.278	0.000	0.181	0.340	0.46	0.74
60+85	64+85	LT	0.320	0.000	0.282	0.430	0.60	0.71
56+55	60+85	LT	0.366	0.000	0.216	0.440	0.58	0.76
55+50	56+55	LT	0.091	0.012	0.022	0.100	0.13	0.80
55+30	55+50	LT	0.017	0.002	0.004	0.020	0.02	0.87
55+10	55+30	LT	0.017	0.002	0.004	0.020	0.02	0.87
54+00	55+10	LT	0.092	0.013	0.022	0.100	0.13	0.79
52+50	54+00	LT	0.116	0.019	0.039	0.140	0.17	0.80
51+65	52+50	LT	0.060	0.017	0.022	0.080	0.10	0.81
50+88	51+65	LT	0.051	0.019	0.020	0.070	0.09	0.78
50+05	50+88	LT	0.054	0.023	0.020	0.070	0.10	0.72
49+57	50+05	LT	0.031	0.013	0.011	0.040	0.06	0.73
48+00	49+57	LT	0.101	0.039	0.034	0.140	0.17	0.80
46+50	48+00	LT	0.100	0.022	0.038	0.120	0.16	0.75
45+40	46+50	LT	0.073	0.013	0.028	0.090	0.11	0.79
44+30	45+40	LT	0.068	0.013	0.028	0.080	0.11	0.73
43+50	44+30	LT	0.048	0.009	0.020	0.060	0.08	0.78
41+52	42+70	LT	0.064	0.014	0.030	0.080	0.11	0.74
42+70	43+50	LT	0.048	0.009	0.020	0.060	0.08	0.78
39+50	41+52	LT	0.084	0.025	0.059	0.120	0.17	0.71
37+75	39+50	LT	0.057	0.053	0.047	0.110	0.16	0.70
36+99	37+75	LT	0.025	0.027	0.024	0.050	0.08	0.66
34+15	36+20	LT	0.066	0.007	0.052	0.090	0.13	0.72
36+20	36+99	LT	0.025	0.038	0.022	0.060	0.09	0.71
31+52	34+15	LT	0.085	0.000	0.106	0.130	0.19	0.68
29+66	30+70	LT	0.086	0.070	0.000	0.130	0.16	0.83
30+70	31+52	LT	0.029	0.011	0.052	0.060	0.09	0.65
31+52	34+15	RT	0.114	0.000	0.039	0.122	0.15	0.80
30+64	31+52	RT	0.055	0.003	0.008	0.056	0.07	0.85
29+66	30+64	RT	0.089	0.090	0.000	0.143	0.18	0.80

WEIGHTED RUNOFF COEFFICIENTS

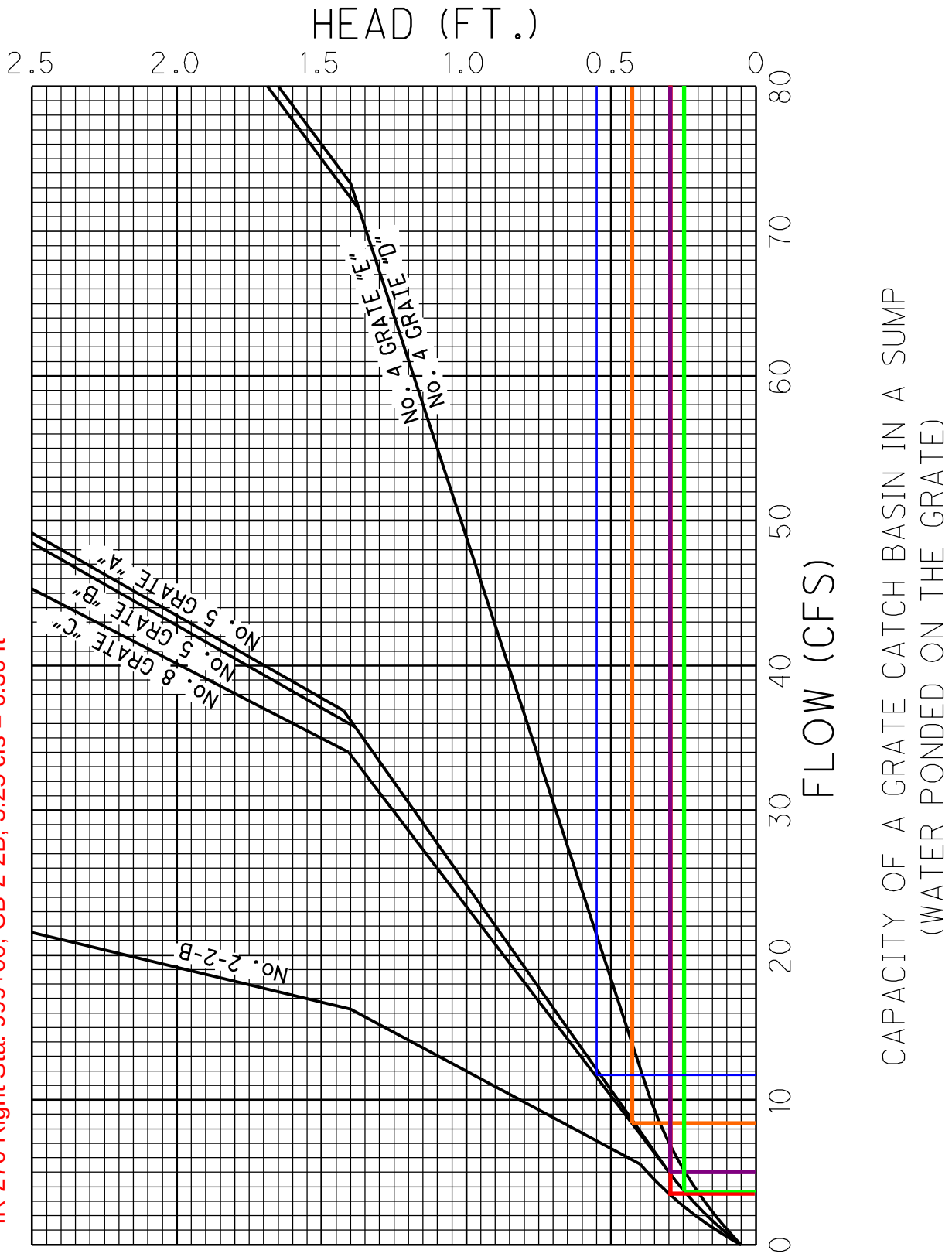
CALC NAME/AREA

STA	STA	SIDE	SURFACE AREA (ACRES)			C*A	TOTAL AREA	WEIGHTED C
			PAVEMENT	SLOPES STEEPER THAN 4:1	SLOPES 4:1 OR FLATTER			
			0.9	0.7	0.5			
34+15	36+20	RT	0.089	0.000	0.030	0.095	0.12	0.80
36+20	36+99	RT	0.034	0.000	0.011	0.036	0.05	0.80
39+50	41+52	RT	0.105	0.000	0.029	0.109	0.13	0.81
37+75	39+50	RT	0.076	0.000	0.026	0.081	0.10	0.79
36+99	37+75	RT	0.033	0.000	0.011	0.035	0.04	0.80
41+52	42+70	RT	0.068	0.000	0.009	0.066	0.08	0.86
42+70	43+50	RT	0.035	0.000	0.012	0.038	0.05	0.81
47+78	49+57	RT	0.090	0.000	0.027	0.090	0.12	0.77
46+00	47+78	RT	0.092	0.000	0.019	0.090	0.11	0.81
44+30	46+00	RT	0.078	0.000	0.025	0.080	0.10	0.78
43+50	44+30	RT	0.035	0.000	0.012	0.040	0.05	0.85
49+57	50+05	RT	0.024	0.000	0.007	0.030	0.03	0.97
50+05	50+88	RT	0.042	0.000	0.012	0.040	0.05	0.74
54+00	56+55	RT	0.147	0.000	0.023	0.140	0.17	0.82
52+36	54+00	RT	0.096	0.000	0.024	0.100	0.12	0.83
51+47	52+36	RT	0.057	0.000	0.006	0.050	0.06	0.79
50+88	51+47	RT	0.030	0.000	0.009	0.030	0.04	0.77

CAPACITY OF A GRATE CATCH BASIN IN A SUMP

1102-1

REFERENCE SECTION
1102.3.5



Ramp A1 Right Sta. 2030+15, CB-8, 5.09 cfs = 0.30 ft

RAMP A1 Right Sta. 2015+25, CB-8, 3.70 cfs = 0.25 ft

Ramp A1 Right Sta. 2010+50, CB-8, 11.70 cfs = 0.55 ft

Ramp A2 Right Sta. 2989+13, CB-8, 8.31 cfs = 0.43 ft

IR-270 Right Sta. 999+00, CB-2-2B, 3.25 cfs = 0.30 ft

DITCH ANALYSIS

PID : 95639 **Date :** 04/05/2021 **Project :** FRA-70-22.61 **Location :** COLUMBUS, OHIO

Description : IR-70 01A: 545+37 to 543+00 RIGHT **Designer :** ARG

Rainfall Area : C

Allowable Shears

		Seed:	0.40	**Jute Mat:**	0.45	**Temporary Mat:**	1.00
	Permanent Mat	**Type 1:**	2.00	**Type 2:**	3.00	**Type 3:**	5.00
	RCP	**Type B:**	6.00				

(*) Warning: Grade is steeper than allowable. If value is parantheses, design parameters have been exceeded. - See user manual.

STATION BEGIN	STATION END	SIDE	LENGTH (ft.)	RADIUS WIDTH (ft.)	IN SLOPE (ft./ft.)	BACK SLOPE (ft./ft.)	GRADE (ft./ft.)	AREA (acres)	AREA SUM (acres)	RUNOFF COEFF.	CA (Sum)	PROTECT TYPE	RAIN INT. (in./hr.)	STORM FREQ. (yrs.)	MANN. COEFF.	TIME FLOW (min.)	VEL. FLOW (fps.)	SHEAR (lbs./ sq.ft.)	DESIGN FLOW (cfs.)	DEPTH FLOW (ft.)	WIDTH FLOW (ft.)
545+37	543+00	R	237.00	3.00	4.00	4.00	0.0060	0.84	0.84	0.83	0.70	Seed	4.41	5	0.030	12.28	1.68	0.15	3.07	0.40	6.18
												Seed	4.82	10	0.040	12.73	1.41	0.18	3.36	0.48	6.87

DITCH ANALYSIS

PID : 95639 **Date :** 04/05/2021 **Project :** FRA-70-22.61 **Location :** COLUMBUS, OHIO

Description : IR-70 01B: 543+00 TO 540+00 RIGHT **Designer :** ARG

Rainfall Area : C

Allowable Shears

	Seed:	0.40	**Jute Mat:**	0.45	**Temporary Mat:**	1.00
Permanent Mat	**Type 1:**	2.00	**Type 2:**	3.00	**Type 3:**	5.00
RCP	**Type B:**	6.00				

(*) Warning: Grade is steeper than allowable. If value is parantheses, design parameters have been exceeded. - See user manual.

STATION BEGIN	STATION END	SIDE	LENGTH (ft.)	RADIUS WIDTH (ft.)	IN SLOPE (ft./ft.)	BACK SLOPE (ft./ft.)	GRADE (ft./ft.)	AREA (acres)	AREA SUM (acres)	RUNOFF COEFF.	CA (Sum)	PROTECT TYPE	RAIN INT. (in./hr.)	STORM FREQ. (yrs.)	MANN. COEFF.	TIME FLOW (min.)	VEL. FLOW (fps.)	SHEAR (lbs./ sq.ft.)	DESIGN FLOW (cfs.)	DEPTH FLOW (ft.)	WIDTH FLOW (ft.)
543+00	541+00	R	200.00	3.00	4.00	4.00	0.0060	0.37	0.37	0.74	0.27	Seed	4.36	5	0.030	12.56	1.26	0.09	1.19	0.24	4.91
												Seed	4.77	10	0.040	13.03	1.07	0.11	1.31	0.29	5.34
541+00	540+00	R	100.00	3.00	4.00	4.00	0.0140	0.20	0.57	0.74	0.42	Seed	4.23	5	0.030	13.41	1.93	0.21	1.78	0.23	4.88
												Seed	4.61	10	0.040	14.05	1.61	0.25	1.95	0.29	5.32

DITCH ANALYSIS

PID : 95639 **Date :** 04/05/2021 **Project :** FRA-70-22.61 **Location :** COLUMBUS, OHIO

Description : IR-70 01C: 540+00 to 538+37 RIGHT **Designer :** ARG

Rainfall Area : C

Allowable Shears

		Seed:	0.40	**Jute Mat:**	0.45	**Temporary Mat:**	1.00
	Permanent Mat	**Type 1:**	2.00	**Type 2:**	3.00	**Type 3:**	5.00
	RCP	**Type B:**	6.00				

(*) Warning: Grade is steeper than allowable. If value is parantheses, design parameters have been exceeded. - See user manual.

STATION BEGIN	STATION END	SIDE	LENGTH (ft.)	RADIUS WIDTH (ft.)	IN SLOPE (ft./ft.)	BACK SLOPE (ft./ft.)	GRADE (ft./ft.)	AREA (acres)	AREA SUM (acres)	RUNOFF COEFF.	CA (Sum)	PROTECT TYPE	RAIN INT. (in./hr.)	STORM FREQ. (yrs.)	MANN. COEFF.	TIME FLOW (min.)	VEL. FLOW (fps.)	SHEAR (lbs./ sq.ft.)	DESIGN FLOW (cfs.)	DEPTH FLOW (ft.)	WIDTH FLOW (ft.)
540+00	538+37	R	163.00	3.00	4.00	4.00	0.0140	0.31	0.31	0.77	0.24	Seed	4.52	5	0.030	11.62	1.64	0.15	1.08	0.18	4.42
												Seed	4.96	10	0.040	11.91	1.39	0.19	1.18	0.22	4.76

DITCH ANALYSIS

PID : 95639 **Date :** 04/05/2021 **Project :** FRA-70-22.61 **Location :** COLUMBUS, OHIO

Description : IR-70 01D: 538+37 to 536+82 RIGHT **Designer :** ARG

Rainfall Area : C

Allowable Shears

		Seed:	0.40	**Jute Mat:**	0.45	**Temporary Mat:**	1.00
	Permanent Mat	**Type 1:**	2.00	**Type 2:**	3.00	**Type 3:**	5.00
	RCP	**Type B:**	6.00				

(*) Warning: Grade is steeper than allowable. If value is parantheses, design parameters have been exceeded. - See user manual.

STATION BEGIN	STATION END	SIDE	LENGTH (ft.)	RADIUS WIDTH (ft.)	IN SLOPE (ft./ft.)	BACK SLOPE (ft./ft.)	GRADE (ft./ft.)	AREA (acres)	AREA SUM (acres)	RUNOFF COEFF.	CA (Sum)	PROTECT TYPE	RAIN INT. (in./hr.)	STORM FREQ. (yrs.)	MANN. COEFF.	TIME FLOW (min.)	VEL. FLOW (fps.)	SHEAR (lbs./ sq.ft.)	DESIGN FLOW (cfs.)	DEPTH FLOW (ft.)	WIDTH FLOW (ft.)
538+37	Concent							0.78		0.90	0.70					10.00					
538+37	536+82	R	155.00	4.00	4.00	3.00	0.0070	0.23	1.01	0.85	0.89	Seed	4.57	5	0.030	11.33	1.91	0.17	4.08	0.40	6.78
												Seed	5.02	10	0.040	11.58	1.60	0.21	4.49	0.49	7.43

DITCH ANALYSIS

PID : 95639 **Date :** 04/05/2021 **Project :** FRA-70-22.61 **Location :** COLUMBUS, OHIO

Description : IR-70 01E - 536+82 to 535+61 RIGHT **Designer :** ARG

Rainfall Area : C

Allowable Shears

		Seed:	0.40	**Jute Mat:**	0.45	**Temporary Mat:**	1.00
	Permanent Mat	**Type 1:**	2.00	**Type 2:**	3.00	**Type 3:**	5.00
	RCP	**Type B:**	6.00				

(*) Warning: Grade is steeper than allowable. If value is parantheses, design parameters have been exceeded. - See user manual.

STATION BEGIN	STATION END	SIDE	LENGTH (ft.)	RADIUS WIDTH (ft.)	IN SLOPE (ft./ft.)	BACK SLOPE (ft./ft.)	GRADE (ft./ft.)	AREA (acres)	AREA SUM (acres)	RUNOFF COEFF.	CA (Sum)	PROTECT TYPE	RAIN INT. (in./hr.)	STORM FREQ. (yrs.)	MANN. COEFF.	TIME FLOW (min.)	VEL. FLOW (fps.)	SHEAR (lbs./ sq.ft.)	DESIGN FLOW (cfs.)	DEPTH FLOW (ft.)	WIDTH FLOW (ft.)
536+82	535+61	R	121.00	4.00	4.00	3.00	0.0054	0.30	0.30	0.71	0.21	Seed	4.49	5	0.030	11.80	1.09	0.06	0.96	0.19	5.32
												Seed	4.93	10	0.040	12.11	0.93	0.08	1.05	0.23	5.64

DITCH ANALYSIS

PID : 95639 **Date :** 04/09/2021 **Project :** FRA-70-22.61 **Location :** COLUMBUS, OHIO

Description : IR-70 02: 641+05 TO 606+41 RIGHT **Designer :** ARG

Rainfall Area : C

Allowable Shears

	Seed:	0.40	**Jute Mat:** 0.45	**Temporary Mat:**	1.00
Permanent Mat	**Type 1:**	2.00	**Type 2:** 3.00	**Type 3:**	5.00
RCP	**Type B:**	6.00			

(*) Warning: Grade is steeper than allowable. If value is parantheses, design parameters have been exceeded. - See user manual.

STATION BEGIN	STATION END	SIDE	LENGTH (ft.)	RADIUS WIDTH (ft.)	IN SLOPE (ft./ft.)	BACK SLOPE (ft./ft.)	GRADE (ft./ft.)	AREA (acres)	AREA SUM (acres)	RUNOFF COEFF.	CA (Sum)	PROTECT TYPE	RAIN INT. (in./hr.)	STORM FREQ. (yrs.)	MANN. COEFF.	TIME FLOW (min.)	VEL. FLOW (fps.)	SHEAR (lbs./ sq.ft.)	DESIGN FLOW (cfs.)	DEPTH FLOW (ft.)	WIDTH FLOW (ft.)
641+05	621+20	R	1985.0	5.00	4.00	3.00	0.0090	4.76	4.76	0.69	3.28	Seed	3.35	5	0.030	20.92	2.72	0.32	11.00	0.58	9.04
												Seed	3.58	10	0.040	23.03	2.26	0.39	11.76	0.70	9.89
621+20	620+18	R	102.00	5.00	4.00	3.00	0.0050	0.27	5.03	0.67	3.46	Seed	3.28	5	0.030	21.68	2.23	0.21	11.37	0.69	9.81
												Seed	3.50	10	0.040	23.94	1.85	0.26	12.14	0.83	10.80
620+04	Concent							4.77		0.76	7.09					15.00					
620+18	618+70	R	148.00	3.00	6.00	4.00	0.0116	0.41	10.21	0.67	7.37	Seed	3.22	5	0.030	22.37	3.58	0.65	23.75	0.89	11.90
												Jute Mat	3.21	5	0.040	22.53	2.89	0.74	23.65	1.01	13.14
												Temp. Mat	3.21	5	0.040	22.53	2.89	0.74	23.65	1.01	13.14
												Temp. Mat	3.44	10	0.040	24.78	2.94	0.76	25.31	1.05	13.46
618+70	610+00	R	870.00	3.00	2.00	2.00	0.0104	2.11	12.33	0.68	8.80	Seed	2.95	5	0.030	25.91	4.19	0.76	26.00	1.16	7.66
												Jute Mat	2.90	5	0.040	26.70	3.38	0.86	25.52	1.33	8.33
												Temp. Mat	2.90	5	0.040	26.70	3.38	0.86	25.52	1.33	8.33
												Temp. Mat	3.14	10	0.040	28.88	3.45	0.90	27.62	1.39	8.54

Ditch Erosion Protection Mat, Type A up to Sta. 620+00, existing ditch to Sta. 618+70

Existing Ditch

DITCH ANALYSIS

STATION BEGIN	STATION END	SIDE	LENGTH (ft.)	RADIUS WIDTH (ft.)	IN SLOPE (ft./ft.)	BACK SLOPE (ft./ft.)	GRADE (ft./ft.)	AREA (acres)	AREA SUM (acres)	RUNOFF COEFF.	CA (Sum)	PROTECT TYPE	RAIN INT. (in./hr.)	STORM FREQ. (yrs.)	MANN. COEFF.	TIME FLOW (min.)	VEL. FLOW (fps.)	SHEAR (lbs./ sq.ft.)	DESIGN FLOW (cfs.)	DEPTH FLOW (ft.)	WIDTH FLOW (ft.)
610+00	Concent							1.93		0.75	10.25					15.00					
610+00	607+25	R	275.00	3.00	2.00	2.00	0.0104	0.84	15.09	0.66	10.80	Seed	2.83	5	0.030	27.74	4.38	0.82	30.58	1.26	8.05
	Existing Ditch											Jute Mat	2.82	5	0.040	27.99	3.54	0.94	30.41	1.45	8.81
												Temp. Mat	2.82	5	0.040	27.99	3.54	0.94	30.41	1.45	8.81
												Temp. Mat	3.06	10	0.040	30.14	3.62	0.98	33.01	1.51	9.05
607+25	606+41	R	84.00	3.00	2.00	2.00	0.0248	0.25	15.34	0.67	10.97	Seed	2.80	5	0.030	28.22	6.01	1.57	30.72	1.02	7.06
	Existing Ditch											Jute Mat	2.80	5	0.040	28.27	4.88	1.82	30.68	1.18	7.70
												Temp. Mat	2.80	5	0.040	28.27	4.88	1.82	30.68	1.18	7.70
												Perm, Type 1	2.80	5	0.040	28.27	4.88	1.82	30.68	1.18	7.70
												Perm, Type 1	3.04	10	0.040	30.42	4.99	1.89	33.33	1.23	7.90

DITCH ANALYSIS

PID : 95639 **Date :** 04/12/2021 **Project :** FRA-70-22.61 **Location :** COLUMBUS, OHIO

Description : IR-70 03: 592+50 - 595+00 RIGHT **Designer :** ARG

Rainfall Area : C

Allowable Shears

		Seed:	0.40	**Jute Mat:**	0.45	**Temporary Mat:**	1.00
	Permanent Mat	**Type 1:**	2.00	**Type 2:**	3.00	**Type 3:**	5.00
	RCP	**Type B:**	6.00				

(*) Warning: Grade is steeper than allowable. If value is parantheses, design parameters have been exceeded. - See user manual.

STATION BEGIN	STATION END	SIDE	LENGTH (ft.)	RADIUS WIDTH (ft.)	IN SLOPE (ft./ft.)	BACK SLOPE (ft./ft.)	GRADE (ft./ft.)	AREA (acres)	AREA SUM (acres)	RUNOFF COEFF.	CA (Sum)	PROTECT TYPE	RAIN INT. (in./hr.)	STORM FREQ. (yrs.)	MANN. COEFF.	TIME FLOW (min.)	VEL. FLOW (fps.)	SHEAR (lbs./ sq.ft.)	DESIGN FLOW (cfs.)	DEPTH FLOW (ft.)	WIDTH FLOW (ft.)
595+00	593+50	R	150.00	4.00	6.00	4.00	0.0080	0.83	0.83	0.71	0.59	Seed	3.81	5	0.030	16.56	1.57	0.13	2.24	0.27	6.67
												Seed	4.23	10	0.040	16.85	1.34	0.16	2.49	0.33	7.30

DITCH ANALYSIS

PID : 95639 **Date :** 04/12/2021 **Project :** FRA-70-22.61 **Location :** COLUMBUS, OHIO

Description : IR-70 04 - 592+50 - 593+50 RIGHT **Designer :** ARG

Rainfall Area : C

Allowable Shears

		Seed:	0.40	**Jute Mat:**	0.45	**Temporary Mat:**	1.00
	Permanent Mat	**Type 1:**	2.00	**Type 2:**	3.00	**Type 3:**	5.00
	RCP	**Type B:**	6.00				

(*) Warning: Grade is steeper than allowable. If value is parantheses, design parameters have been exceeded. - See user manual.

STATION BEGIN	STATION END	SIDE	LENGTH (ft.)	RADIUS WIDTH (ft.)	IN SLOPE (ft./ft.)	BACK SLOPE (ft./ft.)	GRADE (ft./ft.)	AREA (acres)	AREA SUM (acres)	RUNOFF COEFF.	CA (Sum)	PROTECT TYPE	RAIN INT. (in./hr.)	STORM FREQ. (yrs.)	MANN. COEFF.	TIME FLOW (min.)	VEL. FLOW (fps.)	SHEAR (lbs./ sq.ft.)	DESIGN FLOW (cfs.)	DEPTH FLOW (ft.)	WIDTH FLOW (ft.)
592+50	593+50	R	100.00	4.00	6.00	4.00	0.0264	0.24	0.24	0.72	0.17	Seed	3.87	5	0.030	16.04	1.57	0.16	0.67	0.10	4.95
												Seed	4.31	10	0.040	16.23	1.34	0.20	0.74	0.12	5.21

DITCH ANALYSIS

PID : 95639 **Date :** 10/18/2019 **Project :** FRA-70-22.61 **Location :** COLUMBUS, OHIO

Description : IR-70 03: 516+00 TO 518+00 RIGHT **Designer :** SJB

Rainfall Area : C

Allowable Shears

		Seed:	0.40	**Jute Mat:**	0.45	**Temporary Mat:**	1.00
	Permanent Mat	**Type 1:**	2.00	**Type 2:**	3.00	**Type 3:**	5.00
	RCP	**Type B:**	6.00				

(*) Warning: Grade is steeper than allowable. If value is parantheses, design parameters have been exceeded. - See user manual.

STATION BEGIN	STATION END	SIDE	LENGTH (ft.)	RADIUS WIDTH (ft.)	IN SLOPE (ft./ft.)	BACK SLOPE (ft./ft.)	GRADE (ft./ft.)	AREA (acres)	AREA SUM (acres)	RUNOFF COEFF.	CA (Sum)	PROTECT TYPE	RAIN INT. (in./hr.)	STORM FREQ. (yrs.)	MANN. COEFF.	TIME FLOW (min.)	VEL. FLOW (fps.)	SHEAR (lbs./ sq.ft.)	DESIGN FLOW (cfs.)	DEPTH FLOW (ft.)	WIDTH FLOW (ft.)
518+00	516+00	R	200.00	20.00			0.0160	0.39	0.39	0.66	0.26	Seed	3.74	5	0.030	17.15	1.51	0.18	0.96	0.18	5.34
												Seed	4.14	10	0.040	17.54	1.28	0.21	1.07	0.21	5.84

DITCH ANALYSIS

PID : 95639 **Date :** 04/13/2021 **Project :** FRA-70-22.61 **Location :** COLUMBUS, OHIO

Description : IR-270 01:EX: RAMP D2 1008+60 TO IR-270 1011+15 RIGHT **Designer :** ARG

Rainfall Area : C

Allowable Shears

		Seed:	0.40	**Jute Mat:**	0.45	**Temporary Mat:**	1.00
	Permanent Mat	**Type 1:**	2.00	**Type 2:**	3.00	**Type 3:**	5.00
	RCP	**Type B:**	6.00				

(*) Warning: Grade is steeper than allowable. If value is parantheses, design parameters have been exceeded. - See user manual.

STATION BEGIN	STATION END	SIDE	LENGTH (ft.)	RADIUS WIDTH (ft.)	IN SLOPE (ft./ft.)	BACK SLOPE (ft./ft.)	GRADE (ft./ft.)	AREA (acres)	AREA SUM (acres)	RUNOFF COEFF.	CA (Sum)	PROTECT TYPE	RAIN INT. (in./hr.)	STORM FREQ. (yrs.)	MANN. COEFF.	TIME FLOW (min.)	VEL. FLOW (fps.)	SHEAR (lbs./ sq.ft.)	DESIGN FLOW (cfs.)	DEPTH FLOW (ft.)	WIDTH FLOW (ft.)
1008+60	1013+06	R	150.00	4.00	3.50	3.50	0.0154	0.41	0.41	0.61	0.25	Seed	4.54	5	0.030	11.50	1.63	0.15	1.13	0.15	5.07
												Seed	4.99	10	0.040	11.76	1.40	0.18	1.24	0.19	5.33
1013+06	Concent							32.11		0.69	22.41					33.61					
1013+06	1011+15	R	246.00	8.00	3.00	3.00	0.0050	0.59	33.11	0.68	22.80	Seed	2.45	5	0.030	34.79	3.45	0.42	55.83	1.34	16.06
												Jute Mat	2.44	5	0.040	35.06	2.81	0.49	55.55	1.56	17.35
												Temp. Mat	2.44	5	0.040	35.06	2.81	0.49	55.55	1.56	17.35
												Temp. Mat	2.78	10	0.040	35.00	2.92	0.52	63.42	1.67	18.02

DITCH ANALYSIS

PID : 95639 **Date :** 04/05/2021 **Project :** FRA-70-22.61 **Location :** COLUMBUS, OHIO

Description : RAMP C1 01: 6027+73 TO 6027+15 LEFT **Designer :** ARG

Rainfall Area : C

Allowable Shears

	Seed:	0.40	**Jute Mat:** 0.45	**Temporary Mat:**	1.00
Permanent Mat	**Type 1:**	2.00	**Type 2:** 3.00	**Type 3:**	5.00
RCP	**Type B:**	6.00			

(*) Warning: Grade is steeper than allowable. If value is parantheses, design parameters have been exceeded. - See user manual.

STATION BEGIN	STATION END	SIDE	LENGTH (ft.)	RADIUS WIDTH (ft.)	IN SLOPE (ft./ft.)	BACK SLOPE (ft./ft.)	GRADE (ft./ft.)	AREA (acres)	AREA SUM (acres)	RUNOFF COEFF.	CA (Sum)	PROTECT TYPE	RAIN INT. (in./hr.)	STORM FREQ. (yrs.)	MANN. COEFF.	TIME FLOW (min.)	VEL. FLOW (fps.)	SHEAR (lbs./ sq.ft.)	DESIGN FLOW (cfs.)	DEPTH FLOW (ft.)	WIDTH FLOW (ft.)
6027+73	6027+15	L	58.00	2.00	6.00	2.00	0.0025	0.15	0.15	0.60	0.09	Seed	4.57	5	0.030	11.33	0.72	0.03	0.40	0.20	3.59
												Seed	5.02	10	0.040	11.59	0.59	0.04	0.44	0.25	3.98

DITCH ANALYSIS

PID : 95639 **Date :** 04/05/2021 **Project :** FRA-70-22.61 **Location :** COLUMBUS, OHIO

Description : RAMP C1 01B: 6030+60 to 6027+73 LEFT **Designer :** ARG

Rainfall Area : C

Allowable Shears

	Seed:	0.40	**Jute Mat:** 0.45	**Temporary Mat:**	1.00
Permanent Mat	**Type 1:**	2.00	**Type 2:** 3.00	**Type 3:**	5.00
RCP	**Type B:**	6.00			

(*) Warning: Grade is steeper than allowable. If value is parantheses, design parameters have been exceeded. - See user manual.

STATION BEGIN	STATION END	SIDE	LENGTH (ft.)	RADIUS WIDTH (ft.)	IN SLOPE (ft./ft.)	BACK SLOPE (ft./ft.)	GRADE (ft./ft.)	AREA (acres)	AREA SUM (acres)	RUNOFF COEFF.	CA (Sum)	PROTECT TYPE	RAIN INT. (in./hr.)	STORM FREQ. (yrs.)	MANN. COEFF.	TIME FLOW (min.)	VEL. FLOW (fps.)	SHEAR (lbs./ sq.ft.)	DESIGN FLOW (cfs.)	DEPTH FLOW (ft.)	WIDTH FLOW (ft.)
6030+60	6028+50	L	210.00	2.00	4.00	2.00	0.0030	0.18	0.18	0.69	0.12	Seed	4.15	5	0.030	13.96	0.85	0.04	0.52	0.23	3.35
												Seed	4.53	10	0.040	14.62	0.71	0.05	0.56	0.28	3.68
6028+50	6027+73	L	77.00	2.00	6.00	2.00	0.0025	0.13	0.31	0.68	0.21	Seed	3.95	5	0.030	15.41	0.88	0.05	0.83	0.30	4.36
												Seed	4.29	10	0.040	16.36	0.73	0.06	0.90	0.36	4.88

DITCH ANALYSIS

PID : 95639 **Date :** 04/05/2021 **Project :** FRA-70-22.61 **Location :** COLUMBUS, OHIO

Description : RAMP C1 01A: 6034+40 TO 6027+15 LEFT **Designer :** ARG

Rainfall Area : C

Allowable Shears

		Seed:	0.40	**Jute Mat:**	0.45	**Temporary Mat:**	1.00
	Permanent Mat	**Type 1:**	2.00	**Type 2:**	3.00	**Type 3:**	5.00
	RCP	**Type B:**	6.00				

(*) Warning: Grade is steeper than allowable. If value is parantheses, design parameters have been exceeded. - See user manual.

STATION BEGIN	STATION END	SIDE	LENGTH (ft.)	RADIUS WIDTH (ft.)	IN SLOPE (ft./ft.)	BACK SLOPE (ft./ft.)	GRADE (ft./ft.)	AREA (acres)	AREA SUM (acres)	RUNOFF COEFF.	CA (Sum)	PROTECT TYPE	RAIN INT. (in./hr.)	STORM FREQ. (yrs.)	MANN. COEFF.	TIME FLOW (min.)	VEL. FLOW (fps.)	SHEAR (lbs./ sq.ft.)	DESIGN FLOW (cfs.)	DEPTH FLOW (ft.)	WIDTH FLOW (ft.)
6034+40	6033+25	L	115.00	2.00	4.00	2.00	0.0121	0.05	0.05	0.65	0.03	Seed	4.44	5	0.030	12.09	0.84	0.06	0.14	0.08	2.45
												Seed	4.86	10	0.040	12.50	0.75	0.07	0.15	0.09	2.55
6033+25	6032+00	L	125.00	2.00	4.00	2.00	0.0075	0.06	0.11	0.67	0.07	Seed	4.12	5	0.030	14.15	0.99	0.06	0.29	0.12	2.74
												Seed	4.48	10	0.040	14.95	0.82	0.07	0.31	0.16	2.93
6032+00	6030+60	L	140.00	2.00	4.00	2.00	0.0030	0.06	0.17	0.67	0.11	Seed	3.76	5	0.030	16.98	0.80	0.04	0.41	0.20	3.19
												Seed	4.05	10	0.040	18.33	0.66	0.05	0.45	0.25	3.48

DITCH ANALYSIS

PID : 95639 **Date :** 01/29/2019 **Project :** FRA-70-22.61 **Location :** COLUMBUS, OHIO

Description : RAMP C1 02: 6021+60 TO 6027+15 LEFT **Designer :** ARG

Rainfall Area : C

Allowable Shears

	Seed:	0.40	**Jute Mat:** 0.45	**Temporary Mat:**	1.00
Permanent Mat	**Type 1:**	2.00	**Type 2:** 3.00	**Type 3:**	5.00
RCP	**Type B:**	6.00			

(*) Warning: Grade is steeper than allowable. If value is parantheses, design parameters have been exceeded. - See user manual.

STATION BEGIN	STATION END	SIDE	LENGTH (ft.)	RADIUS WIDTH (ft.)	IN SLOPE (ft./ft.)	BACK SLOPE (ft./ft.)	GRADE (ft./ft.)	AREA (acres)	AREA SUM (acres)	RUNOFF COEFF.	CA (Sum)	PROTECT TYPE	RAIN INT. (in./hr.)	STORM FREQ. (yrs.)	MANN. COEFF.	TIME FLOW (min.)	VEL. FLOW (fps.)	SHEAR (lbs./ sq.ft.)	DESIGN FLOW (cfs.)	DEPTH FLOW (ft.)	WIDTH FLOW (ft.)
6021+60	6022+00	L	40.00	2.00	2.00	8.00	0.0048	0.03	0.03	0.66	0.02	Seed	4.58	5	0.030	11.29	0.53	0.02	0.09	0.07	2.70
												Seed	5.06	10	0.040	11.37	0.46	0.03	0.10	0.09	2.86
6022+00	6023+50	L	154.00	2.00	5.00	2.00	0.0147	0.16	0.19	0.57	0.11	Seed	4.28	5	0.030	13.07	1.42	0.12	0.47	0.13	2.94
												Seed	4.70	10	0.040	13.47	1.20	0.15	0.52	0.17	3.17
6023+50	6023+95	L	47.00	2.00	5.00	6.00	0.0370	0.08	0.27	0.54	0.15	Seed	4.22	5	0.030	13.46	2.03	0.28	0.65	0.12	3.33
												Seed	4.63	10	0.040	13.93	1.68	0.35	0.72	0.15	3.65
6023+95	6026+50	L	273.00	4.00	5.50	5.50	0.0370	0.87	1.14	0.51	0.60	Seed	3.99	5	0.030	15.13	2.67	0.41	2.39	0.18	5.97
												Jute Mat	3.94	5	0.040	15.49	2.19	0.48	2.36	0.21	6.30
												Temp. Mat	3.94	5	0.040	15.49	2.19	0.48	2.36	0.21	6.30
												Temp. Mat	4.35	10	0.040	15.90	2.26	0.51	2.61	0.22	6.43
6026+50	6027+15	L	75.00	4.00	7.00	6.00	0.0100	0.18	1.32	0.51	0.69	Seed	3.85	5	0.030	16.21	1.72	0.17	2.65	0.27	7.49
												Seed	4.24	10	0.040	16.76	1.45	0.21	2.92	0.33	8.28

DITCH ANALYSIS

PID : 95639 **Date :** 04/05/2021 **Project :** FRA-70-22.61 **Location :** COLUMBUS, OHIO

Description : RAMP C1 03: RAMP C1 6027+15 LEFT TO IR-70 536+75 RIGHT **Designer :** ARG

Rainfall Area : C

Allowable Shears

	Seed:	0.40	**Jute Mat:**	0.45	**Temporary Mat:**	1.00
Permanent Mat	**Type 1:**	2.00	**Type 2:**	3.00	**Type 3:**	5.00
RCP	**Type B:**	6.00				

(*) Warning: Grade is steeper than allowable. If value is parantheses, design parameters have been exceeded. - See user manual.

STATION BEGIN	STATION END	SIDE	LENGTH (ft.)	RADIUS WIDTH (ft.)	IN SLOPE (ft./ft.)	BACK SLOPE (ft./ft.)	GRADE (ft./ft.)	AREA (acres)	AREA SUM (acres)	RUNOFF COEFF.	CA (Sum)	PROTECT TYPE	RAIN INT. (in./hr.)	STORM FREQ. (yrs.)	MANN. COEFF.	TIME FLOW (min.)	VEL. FLOW (fps.)	SHEAR (lbs./ sq.ft.)	DESIGN FLOW (cfs.)	DEPTH FLOW (ft.)	WIDTH FLOW (ft.)
6027+15	Concent							0.15		0.60	0.09					11.59					
6027+15	Concent							1.33		0.53	0.79					16.61					
6027+15	536+75	L	80.00	4.00	3.00	3.00	0.0124	0.10	1.57	0.69	0.86	Seed	3.73	5	0.030	17.22	2.19	0.23	3.21	0.30	5.80
												Seed	4.17	10	0.040	17.32	1.86	0.29	3.59	0.38	6.26

DITCH ANALYSIS

PID : 95639 **Date :** 04/23/2021 **Project :** FRA-70-22.61 **Location :** COLUMBUS, OHIO

Description : RAMP C1 04: 6019+50 TO 6007+00 LEFT **Designer :** ARG

Rainfall Area : C

Allowable Shears

	Seed:	0.40	**Jute Mat:** 0.45	**Temporary Mat:**	1.00
Permanent Mat	**Type 1:**	2.00	**Type 2:** 3.00	**Type 3:**	5.00
RCP	**Type B:**	6.00			

(*) Warning: Grade is steeper than allowable. If value is parantheses, design parameters have been exceeded. - See user manual.

STATION BEGIN	STATION END	SIDE	LENGTH (ft.)	RADIUS WIDTH (ft.)	IN SLOPE (ft./ft.)	BACK SLOPE (ft./ft.)	GRADE (ft./ft.)	AREA (acres)	AREA SUM (acres)	RUNOFF COEFF.	CA (Sum)	PROTECT TYPE	RAIN INT. (in./hr.)	STORM FREQ. (yrs.)	MANN. COEFF.	TIME FLOW (min.)	VEL. FLOW (fps.)	SHEAR (lbs./ sq.ft.)	DESIGN FLOW (cfs.)	DEPTH FLOW (ft.)	WIDTH FLOW (ft.)
6019+50	6017+57	L	188.00	4.00	3.00	8.00	0.0205	0.43	0.43	0.75	0.32	Seed	4.52	5	0.030	11.64	1.86	0.20	1.45	0.16	5.76
												Seed	4.96	10	0.040	11.93	1.58	0.25	1.59	0.20	6.17
6017+57	6011+00	L	645.00	4.00	3.00	6.00	0.0240	1.36	1.78	0.67	1.23	Seed	3.99	5	0.030	15.12	2.98	0.46	4.90	0.31	6.76
												Jute Mat	3.89	5	0.040	15.89	2.42	0.53	4.78	0.35	7.18
												Temp. Mat	3.89	5	0.040	15.89	2.42	0.53	4.78	0.35	7.18
												Temp. Mat	4.33	10	0.040	16.07	2.50	0.56	5.32	0.37	7.37
6011+00	6007+25	L	375.00	4.00	3.00	10.00	0.0025	1.18	2.97	0.65	2.00	Seed	3.41	5	0.030	20.32	1.36	0.10	6.81	0.62	12.09
												Seed	3.73	10	0.040	21.40	1.13	0.12	7.46	0.75	13.71
6007+25	6007+25	L	0.00	4.00	2.00	2.00	0.1000 *	0.01	2.98	0.01	2.00	Seed	3.41	5	0.030	20.32	5.82	1.62	6.81	0.26	5.04
												Jute Mat	3.41	5	0.040	20.32	4.82	1.91	6.81	0.31	5.22
												Temp. Mat	3.41	5	0.040	20.32	4.82	1.91	6.81	0.31	5.22
												Perm, Type 1	3.41	5	0.040	20.32	4.82	1.91	6.81	0.31	5.22
												Perm, Type 1	3.73	10	0.040	21.40	4.97	2.02	7.46	0.32	5.29

DITCH ANALYSIS

PID : 95639 **Date :** 04/23/2021 **Project :** FRA-70-22.61 **Location :** COLUMBUS, OHIO

Description : RAMP C1 05: 6001+22 TO 6007+00 LEFT **Designer :** ARG

Rainfall Area : C

Allowable Shears

	Seed:	0.40	**Jute Mat:** 0.45	**Temporary Mat:**	1.00
Permanent Mat	**Type 1:**	2.00	**Type 2:** 3.00	**Type 3:**	5.00
RCP	**Type B:**	6.00			

(*) Warning: Grade is steeper than allowable. If value is parantheses, design parameters have been exceeded. - See user manual.

STATION BEGIN	STATION END	SIDE	LENGTH (ft.)	RADIUS WIDTH (ft.)	IN SLOPE (ft./ft.)	BACK SLOPE (ft./ft.)	GRADE (ft./ft.)	AREA (acres)	AREA SUM (acres)	RUNOFF COEFF.	CA (Sum)	PROTECT TYPE	RAIN INT. (in./hr.)	STORM FREQ. (yrs.)	MANN. COEFF.	TIME FLOW (min.)	VEL. FLOW (fps.)	SHEAR (lbs./ sq.ft.)	DESIGN FLOW (cfs.)	DEPTH FLOW (ft.)	WIDTH FLOW (ft.)
6001+22	6002+00	L	80.00	2.00	3.00	3.00	0.0100	0.19	0.19	0.79	0.15	Seed	4.64	5	0.030	10.93	1.43	0.12	0.70	0.19	3.14
												Seed	5.11	10	0.040	11.09	1.20	0.15	0.77	0.24	3.42
6002+00	6003+00	L	103.00	2.00	3.00	3.00	0.0100	0.22	0.41	0.78	0.32	Seed	4.47	5	0.030	11.89	1.77	0.18	1.45	0.29	3.72
												Seed	4.90	10	0.040	12.23	1.49	0.22	1.59	0.35	4.09
6003+00	6005+00	L	200.00	4.00	2.00	3.00	0.0780	0.61	1.03	0.76	0.79	Seed	4.34	5	0.030	12.68	4.16	0.90	3.43	0.18	4.92
												Jute Mat	4.32	5	0.040	12.84	3.45	1.06	3.41	0.22	5.09
												Temp. Mat	4.32	5	0.040	12.84	3.45	1.06	3.41	0.22	5.09
												Perm, Type 1	4.32	5	0.040	12.84	3.45	1.06	3.41	0.22	5.09
												Perm, Type 1	4.75	10	0.040	13.16	3.56	1.12	3.75	0.23	5.15
6005+00	6006+75	L	175.00	4.00	2.00	10.00	0.0282	0.93	1.95	0.73	1.47	Seed	4.18	5	0.030	13.74	3.21	0.57	6.13	0.32	7.86
												Jute Mat	4.15	5	0.040	13.94	2.61	0.66	6.09	0.37	8.48
												Temp. Mat	4.15	5	0.040	13.94	2.61	0.66	6.09	0.37	8.48
												Temp. Mat	4.59	10	0.040	14.23	2.69	0.69	6.73	0.39	8.72

DITCH ANALYSIS

STATION BEGIN	STATION END	SIDE	LENGTH (ft.)	RADIUS WIDTH (ft.)	IN SLOPE (ft./ft.)	BACK SLOPE (ft./ft.)	GRADE (ft./ft.)	AREA (acres)	AREA SUM (acres)	RUNOFF COEFF.	CA (Sum)	PROTECT TYPE	RAIN INT. (in./hr.)	STORM FREQ. (yrs.)	MANN. COEFF.	TIME FLOW (min.)	VEL. FLOW (fps.)	SHEAR (lbs./ sq.ft.)	DESIGN FLOW (cfs.)	DEPTH FLOW (ft.)	WIDTH FLOW (ft.)
6006+75	6007+00	L	25.00	4.00	2.00	2.00	0.1000 *	0.01	1.96	0.01	1.47	Seed	4.14	5	0.030	14.02	5.60	1.51	6.08	0.24	4.97
												Jute Mat	4.14	5	0.040	14.03	4.64	1.79	6.07	0.29	5.15
												Temp. Mat	4.14	5	0.040	14.03	4.64	1.79	6.07	0.29	5.15
												Perm, Type 1	4.14	5	0.040	14.03	4.64	1.79	6.07	0.29	5.15
												Perm, Type 1	4.57	10	0.040	14.32	4.80	1.89	6.71	0.30	5.21

DITCH ANALYSIS

PID : 95639 **Date :** 01/29/2019 **Project :** FRA-70-22.61 **Location :** COLUMBUS, OHIO

Description : RAMP C1: EXISTING DITCH LEFT 6077+25 TO 6073+87 **Designer :** ARG

Rainfall Area : C

Allowable Shears

	Seed:	0.40	**Jute Mat:**	0.45	**Temporary Mat:**	1.00
Permanent Mat	**Type 1:**	2.00	**Type 2:**	3.00	**Type 3:**	5.00
RCP	**Type B:**	6.00				

(*) Warning: Grade is steeper than allowable. If value is parantheses, design parameters have been exceeded. - See user manual.

STATION BEGIN	STATION END	SIDE	LENGTH (ft.)	RADIUS WIDTH (ft.)	IN SLOPE (ft./ft.)	BACK SLOPE (ft./ft.)	GRADE (ft./ft.)	AREA (acres)	AREA SUM (acres)	RUNOFF COEFF.	CA (Sum)	PROTECT TYPE	RAIN INT. (in./hr.)	STORM FREQ. (yrs.)	MANN. COEFF.	TIME FLOW (min.)	VEL. FLOW (fps.)	SHEAR (lbs./ sq.ft.)	DESIGN FLOW (cfs.)	DEPTH FLOW (ft.)	WIDTH FLOW (ft.)
6077+25	6077+00	L	27.00	0.50	2.00	2.00	0.0956	0.22	0.22	0.86	0.19	Seed	4.80	5	0.030	10.11	4.17	1.35	0.90	0.23	1.40
												Jute Mat	4.79	5	0.040	10.13	3.36	1.55	0.89	0.26	1.54
												Temp. Mat	4.79	5	0.040	10.13	3.36	1.55	0.89	0.26	1.54
												Perm, Type 1	4.79	5	0.040	10.13	3.36	1.55	0.89	0.26	1.54
												Perm, Type 1	5.30	10	0.040	10.13	3.44	1.63	0.99	0.27	1.60
6077+00	6075+59	L	164.00	4.00	2.00	2.00	0.1087*	0.48	0.70	0.78	0.56	Seed	4.67	5	0.030	10.77	4.26	0.97	2.62	0.14	4.57
												Jute Mat	4.65	5	0.040	10.90	3.53	1.16	2.61	0.17	4.68
												Temp. Mat	4.65	5	0.040	10.90	3.53	1.16	2.61	0.17	4.68
												Perm, Type 1	4.65	5	0.040	10.90	3.53	1.16	2.61	0.17	4.68
												Perm, Type 1	5.15	10	0.040	10.87	3.67	1.22	2.89	0.18	4.72
6075+59	6073+87	L	201.00	4.00	2.00	2.00	0.0215	0.92	1.62	0.74	1.24	Seed	4.47	5	0.030	11.91	3.27	0.48	5.55	0.36	5.44
												Jute Mat	4.43	5	0.040	12.12	2.69	0.57	5.50	0.42	5.69
												Temp. Mat	4.43	5	0.040	12.12	2.69	0.57	5.50	0.42	5.69

DITCH ANALYSIS

STATION BEGIN	STATION END	SIDE	LENGTH (ft.)	RADIUS WIDTH (ft.)	IN SLOPE (ft./ft.)	BACK SLOPE (ft./ft.)	GRADE (ft./ft.)	AREA (acres)	AREA SUM (acres)	RUNOFF COEFF.	CA (Sum)	PROTECT TYPE	RAIN INT. (in./hr.)	STORM FREQ. (yrs.)	MANN. COEFF.	TIME FLOW (min.)	VEL. FLOW (fps.)	SHEAR (lbs./ sq.ft.)	DESIGN FLOW (cfs.)	DEPTH FLOW (ft.)	WIDTH FLOW (ft.)
												Temp. Mat	4.94	10	0.040	12.05	2.79	0.60	6.13	0.45	5.79

DITCH ANALYSIS

PID : 95639 **Date :** 04/13/2021 **Project :** FRA-70-22.61 **Location :** COLUMBUS, OHIO

Description : RAMP C1 01: 6025+50 TO 6002+40 RIGHT **Designer :** ARG

Rainfall Area : C

Allowable Shears

		Seed:	0.40	**Jute Mat:**	0.45	**Temporary Mat:**	1.00
	Permanent Mat	**Type 1:**	2.00	**Type 2:**	3.00	**Type 3:**	5.00
	RCP	**Type B:**	6.00				

(*) Warning: Grade is steeper than allowable. If value is parantheses, design parameters have been exceeded. - See user manual.

STATION BEGIN	STATION END	SIDE	LENGTH (ft.)	RADIUS WIDTH (ft.)	IN SLOPE (ft./ft.)	BACK SLOPE (ft./ft.)	GRADE (ft./ft.)	AREA (acres)	AREA SUM (acres)	RUNOFF COEFF.	CA (Sum)	PROTECT TYPE	RAIN INT. (in./hr.)	STORM FREQ. (yrs.)	MANN. COEFF.	TIME FLOW (min.)	VEL. FLOW (fps.)	SHEAR (lbs./ sq.ft.)	DESIGN FLOW (cfs.)	DEPTH FLOW (ft.)	WIDTH FLOW (ft.)
6025+50	6025+00	R	50.00	0.50	2.00	2.00	0.0020	0.08	0.08	0.80	0.06	Seed	4.61	5	0.030	11.12	0.75	0.04	0.28	0.32	1.79
												Seed	5.06	10	0.040	11.34	0.62	0.05	0.30	0.39	2.05
6025+00	6024+50	R	50.00	1.00	2.00	2.00	0.0034	0.08	0.16	0.80	0.12	Seed	4.47	5	0.030	11.91	1.05	0.07	0.55	0.32	2.29
												Seed	4.89	10	0.040	12.29	0.87	0.08	0.61	0.39	2.57
6024+50	6024+00	R	50.00	2.00	2.00	2.00	0.0026	0.09	0.24	0.80	0.19	Seed	4.33	5	0.030	12.74	1.00	0.05	0.83	0.32	3.27
												Seed	4.73	10	0.040	13.28	0.83	0.06	0.91	0.39	3.57
6024+00	6019+00	R	500.00	4.00	2.00	2.00	0.0043	1.00	1.24	0.75	0.94	Seed	3.69	5	0.030	17.59	1.63	0.12	3.46	0.44	5.74
												Seed	3.97	10	0.040	19.02	1.37	0.14	3.73	0.54	6.14
6019+00	6007+00	R	1200.0	6.00	2.00	2.00	0.0065	4.36	5.60	0.69	3.95	Seed	3.03	5	0.030	24.85	2.59	0.26	11.95	0.64	8.54
												Seed	3.22	10	0.040	27.65	2.17	0.31	12.71	0.78	9.10
6007+00	Concent							33.11		0.69	26.79					35.00					
6007+00	Concent							2.97		0.67	28.78					19.51					
6007+00	Concent							1.95		0.75	30.24					14.17					

DITCH ANALYSIS

STATION BEGIN	STATION END	SIDE	LENGTH (ft.)	RADIUS WIDTH (ft.)	IN SLOPE (ft./ft.)	BACK SLOPE (ft./ft.)	GRADE (ft./ft.)	AREA (acres)	AREA SUM (acres)	RUNOFF COEFF.	CA (Sum)	PROTECT TYPE	RAIN INT. (in./hr.)	STORM FREQ. (yrs.)	MANN. COEFF.	TIME FLOW (min.)	VEL. FLOW (fps.)	SHEAR (lbs./ sq.ft.)	DESIGN FLOW (cfs.)	DEPTH FLOW (ft.)	WIDTH FLOW (ft.)
6007+00	Concent							0.22		0.90	30.45					10.00					
6007+00	6002+40	R	460.00	6.00	2.00	2.00	0.0157	1.61	45.46	0.70	31.57	Seed	2.38	5	0.030	36.23	6.18	1.35	75.25	1.39	11.55
												Jute Mat	2.37	5	0.040	36.51	5.03	1.58	74.86	1.61	12.45
												Temp. Mat	2.37	5	0.040	36.51	5.03	1.58	74.86	1.61	12.45
												Perm, Type 1	2.37	5	0.040	36.51	5.03	1.58	74.86	1.61	12.45
												Perm, Type 1	2.71	10	0.040	36.46	5.22	1.69	85.53	1.73	12.92

DITCH ANALYSIS

PID : 95639 **Date :** 01/29/2019 **Project :** FRA-70-22.61 **Location :** COLUMBUS, OHIO

Description : RAMP C1 02: 6001+93 TO 6002+40 RIGHT **Designer :** ARG

Rainfall Area : C

Allowable Shears

	Seed:	0.40	**Jute Mat:** 0.45	**Temporary Mat:**	1.00
Permanent Mat	**Type 1:**	2.00	**Type 2:** 3.00	**Type 3:**	5.00
RCP	**Type B:**	6.00			

(*) Warning: Grade is steeper than allowable. If value is parantheses, design parameters have been exceeded. - See user manual.

STATION BEGIN	STATION END	SIDE	LENGTH (ft.)	RADIUS WIDTH (ft.)	IN SLOPE (ft./ft.)	BACK SLOPE (ft./ft.)	GRADE (ft./ft.)	AREA (acres)	AREA SUM (acres)	RUNOFF COEFF.	CA (Sum)	PROTECT TYPE	RAIN INT. (in./hr.)	STORM FREQ. (yrs.)	MANN. COEFF.	TIME FLOW (min.)	VEL. FLOW (fps.)	SHEAR (lbs./ sq.ft.)	DESIGN FLOW (cfs.)	DEPTH FLOW (ft.)	WIDTH FLOW (ft.)
	Concent							1.65		0.90	1.48					15.00					
6001+93	6002+40	R	48.00	6.00	2.00	2.00	0.0227	0.16	1.81	0.70	1.59	Seed	3.97	5	0.030	15.25	3.14	0.43	6.33	0.30	7.22
												Jute Mat	3.96	5	0.040	15.31	2.61	0.51	6.32	0.36	7.44
												Temp. Mat	3.96	5	0.040	15.31	2.61	0.51	6.32	0.36	7.44
												Temp. Mat	4.43	10	0.040	15.29	2.71	0.55	7.07	0.38	7.54

DITCH ANALYSIS

PID : 95639 **Date :** 10/21/2019 **Project :** FRA-70-22.61 **Location :** COLUMBUS, OHIO

Description : RAMP C1 3A: 6057+38 to 6065+00 RIGHT **Designer :** SJB

Rainfall Area : C

Allowable Shears

	Seed:	0.40	**Jute Mat:** 0.45	**Temporary Mat:**	1.00
Permanent Mat	**Type 1:**	2.00	**Type 2:** 3.00	**Type 3:**	5.00
RCP	**Type B:**	6.00			

(*) Warning: Grade is steeper than allowable. If value is parantheses, design parameters have been exceeded. - See user manual.

STATION BEGIN	STATION END	SIDE	LENGTH (ft.)	RADIUS WIDTH (ft.)	IN SLOPE (ft./ft.)	BACK SLOPE (ft./ft.)	GRADE (ft./ft.)	AREA (acres)	AREA SUM (acres)	RUNOFF COEFF.	CA (Sum)	PROTECT TYPE	RAIN INT. (in./hr.)	STORM FREQ. (yrs.)	MANN. COEFF.	TIME FLOW (min.)	VEL. FLOW (fps.)	SHEAR (lbs./ sq.ft.)	DESIGN FLOW (cfs.)	DEPTH FLOW (ft.)	WIDTH FLOW (ft.)
6057+38	6065+00	R	763.00	2.00	2.00	2.00	0.0023	0.80	0.80	0.54	0.43	Seed	3.42	5	0.030	20.22	1.13	0.06	1.48	0.45	3.80
												Seed	3.65	10	0.040	22.27	0.94	0.08	1.58	0.55	4.18

DITCH ANALYSIS

PID : 95639 **Date :** 10/25/2019 **Project :** FRA-70-22.61 **Location :** COLUMBUS, OHIO

Description : RAMP C1 3B: 6065+00 to 6065+00 RIGHT **Designer :** SJB

Rainfall Area : C

Allowable Shears

	Seed:	0.40	**Jute Mat:** 0.45	**Temporary Mat:**	1.00
Permanent Mat	**Type 1:**	2.00	**Type 2:** 3.00	**Type 3:**	5.00
RCP	**Type B:**	6.00			

(*) Warning: Grade is steeper than allowable. If value is parantheses, design parameters have been exceeded. - See user manual.

STATION BEGIN	STATION END	SIDE	LENGTH (ft.)	RADIUS WIDTH (ft.)	IN SLOPE (ft./ft.)	BACK SLOPE (ft./ft.)	GRADE (ft./ft.)	AREA (acres)	AREA SUM (acres)	RUNOFF COEFF.	CA (Sum)	PROTECT TYPE	RAIN INT. (in./hr.)	STORM FREQ. (yrs.)	MANN. COEFF.	TIME FLOW (min.)	VEL. FLOW (fps.)	SHEAR (lbs./ sq.ft.)	DESIGN FLOW (cfs.)	DEPTH FLOW (ft.)	WIDTH FLOW (ft.)
6065+00	6065+50	R	50.00	2.00	2.00	2.00	0.0340	0.04	0.04	0.55	0.02	Seed	4.68	5	0.030	10.70	1.15	0.09	0.10	0.04	2.17
												Seed	5.15	10	0.040	10.89	1.00	0.11	0.11	0.05	2.21

DITCH ANALYSIS

PID : 95639 **Date :** 10/21/2019 **Project :** FRA-70-22.61 **Location :** COLUMBUS, OHIO

Description : RAMP C1 3C: 6065+50 to 6067+00 RIGHT **Designer :** SJB

Rainfall Area : C

Allowable Shears

	Seed:	0.40	**Jute Mat:** 0.45	**Temporary Mat:**	1.00
Permanent Mat	**Type 1:**	2.00	**Type 2:** 3.00	**Type 3:**	5.00
RCP	**Type B:**	6.00			

(*) Warning: Grade is steeper than allowable. If value is parantheses, design parameters have been exceeded. - See user manual.

STATION BEGIN	STATION END	SIDE	LENGTH (ft.)	RADIUS WIDTH (ft.)	IN SLOPE (ft./ft.)	BACK SLOPE (ft./ft.)	GRADE (ft./ft.)	AREA (acres)	AREA SUM (acres)	RUNOFF COEFF.	CA (Sum)	PROTECT TYPE	RAIN INT. (in./hr.)	STORM FREQ. (yrs.)	MANN. COEFF.	TIME FLOW (min.)	VEL. FLOW (fps.)	SHEAR (lbs./ sq.ft.)	DESIGN FLOW (cfs.)	DEPTH FLOW (ft.)	WIDTH FLOW (ft.)
6066+50	6067+00	R	175.00	2.00	2.00	2.00	0.0100	0.08	0.08	0.62	0.05	Seed	4.33	5	0.030	12.78	1.00	0.06	0.21	0.10	2.39
												Seed	4.74	10	0.040	13.26	0.84	0.08	0.23	0.12	2.49

DITCH ANALYSIS

PID : 95639 **Date :** 10/23/2019 **Project :** FRA-70-22.61 **Location :** COLUMBUS, OHIO

Description : RAMP C1 04: 6073+00 TO 6077+25 RIGHT **Designer :** SJB

Rainfall Area : C

Allowable Shears

	Seed:	0.40	**Jute Mat:** 0.45	**Temporary Mat:**	1.00
Permanent Mat	**Type 1:**	2.00	**Type 2:** 3.00	**Type 3:**	5.00
RCP	**Type B:**	6.00			

(*) Warning: Grade is steeper than allowable. If value is parantheses, design parameters have been exceeded. - See user manual.

STATION BEGIN	STATION END	SIDE	LENGTH (ft.)	RADIUS WIDTH (ft.)	IN SLOPE (ft./ft.)	BACK SLOPE (ft./ft.)	GRADE (ft./ft.)	AREA (acres)	AREA SUM (acres)	RUNOFF COEFF.	CA (Sum)	PROTECT TYPE	RAIN INT. (in./hr.)	STORM FREQ. (yrs.)	MANN. COEFF.	TIME FLOW (min.)	VEL. FLOW (fps.)	SHEAR (lbs./ sq.ft.)	DESIGN FLOW (cfs.)	DEPTH FLOW (ft.)	WIDTH FLOW (ft.)
6077+25	6073+50	R	311.00	4.00	2.00	2.00	0.0048	3.44	3.44	0.75	2.58	Seed	4.44	5	0.030	12.06	2.46	0.25	11.46	0.83	7.30
												Seed	4.87	10	0.040	12.45	2.06	0.30	12.55	1.01	8.05
6073+50	6073+00	R	50.00	4.00	2.00	2.00	0.0460	0.14	3.58	0.76	2.69	Seed	4.42	5	0.030	12.21	5.42	1.28	11.87	0.45	5.79
												Jute Mat	4.41	5	0.040	12.25	4.46	1.51	11.85	0.53	6.11
												Temp. Mat	4.41	5	0.040	12.25	4.46	1.51	11.85	0.53	6.11
												Perm, Type 1	4.41	5	0.040	12.25	4.46	1.51	11.85	0.53	6.11
												Perm, Type 1	4.84	10	0.040	12.64	4.59	1.59	12.99	0.55	6.22

DITCH ANALYSIS

PID : 95639 **Date :** 01/29/2019 **Project :** FRA-70-22.61 **Location :** COLUMBUS, OHIO

Description : RAMP G1 01: 8584+50 RIGHT TO RAMP C1 6073+87 LEFT **Designer :** ARG

Rainfall Area : C

Allowable Shears

	Seed:	0.40	**Jute Mat:**	0.45	**Temporary Mat:**	1.00
Permanent Mat	**Type 1:**	2.00	**Type 2:**	3.00	**Type 3:**	5.00
RCP	**Type B:**	6.00				

(*) Warning: Grade is steeper than allowable. If value is parantheses, design parameters have been exceeded. - See user manual.

STATION BEGIN	STATION END	SIDE	LENGTH (ft.)	RADIUS WIDTH (ft.)	IN SLOPE (ft./ft.)	BACK SLOPE (ft./ft.)	GRADE (ft./ft.)	AREA (acres)	AREA SUM (acres)	RUNOFF COEFF.	CA (Sum)	PROTECT TYPE	RAIN INT. (in./hr.)	STORM FREQ. (yrs.)	MANN. COEFF.	TIME FLOW (min.)	VEL. FLOW (fps.)	SHEAR (lbs./ sq.ft.)	DESIGN FLOW (cfs.)	DEPTH FLOW (ft.)	WIDTH FLOW (ft.)
8584+50	8585+00	R	50.00	2.00	6.00	4.00	0.0120	0.29	0.29	0.74	0.21	Seed	4.72	5	0.030	10.53	1.56	0.16	0.99	0.21	4.09
												Seed	5.20	10	0.040	10.63	1.31	0.19	1.10	0.26	4.55
8585+00	8587+00	R	201.50	4.00	6.00	4.00	0.0122	0.48	0.77	0.62	0.51	Seed	4.40	5	0.030	12.34	1.81	0.18	2.24	0.24	6.38
												Seed	4.81	10	0.040	12.77	1.53	0.22	2.45	0.29	6.93
8587+00	8587+50	R	52.00	4.00	6.00	5.00	0.0123	0.17	0.93	0.58	0.61	Seed	4.32	5	0.030	12.80	1.89	0.20	2.62	0.26	6.82
												Seed	4.73	10	0.040	13.31	1.59	0.24	2.86	0.31	7.46
8587+50	6073+87	R	106.00	4.00	4.00	3.50	0.0461	0.46	1.39	0.56	0.86	Seed	4.24	5	0.030	13.31	3.46	0.63	3.67	0.22	5.65
												Jute Mat	4.23	5	0.040	13.41	2.85	0.74	3.65	0.26	5.93
												Temp. Mat	4.23	5	0.040	13.41	2.85	0.74	3.65	0.26	5.93
												Temp. Mat	4.63	10	0.040	13.91	2.93	0.78	4.00	0.27	6.04

DITCH ANALYSIS

PID : 95639 **Date :** 01/29/2019 **Project :** FRA-70-22.61 **Location :** COLUMBUS, OHIO

Description : RAMP G1 02: 8589+50 RIGHT TO RAMP C1 6073+87 LEFT **Designer :** ARG

Rainfall Area : C

Allowable Shears

	Seed:	0.40	**Jute Mat:**	0.45	**Temporary Mat:**	1.00
Permanent Mat	**Type 1:**	2.00	**Type 2:**	3.00	**Type 3:**	5.00
RCP	**Type B:**	6.00				

(*) Warning: Grade is steeper than allowable. If value is parantheses, design parameters have been exceeded. - See user manual.

STATION BEGIN	STATION END	SIDE	LENGTH (ft.)	RADIUS WIDTH (ft.)	IN SLOPE (ft./ft.)	BACK SLOPE (ft./ft.)	GRADE (ft./ft.)	AREA (acres)	AREA SUM (acres)	RUNOFF COEFF.	CA (Sum)	PROTECT TYPE	RAIN INT. (in./hr.)	STORM FREQ. (yrs.)	MANN. COEFF.	TIME FLOW (min.)	VEL. FLOW (fps.)	SHEAR (lbs./ sq.ft.)	DESIGN FLOW (cfs.)	DEPTH FLOW (ft.)	WIDTH FLOW (ft.)
8589+50	8589+00	R	50.00	4.00	6.00	4.00	0.0640	0.21	0.21	0.69	0.14	Seed	4.74	5	0.030	10.39	2.08	0.29	0.67	0.07	4.74
												Seed	5.23	10	0.040	10.47	1.79	0.37	0.74	0.09	4.93
8589+00	Concent							12.73		0.65	8.42					21.53					
8589+00	6073+87	R	103.00	4.00	2.00	2.00	0.0350	0.58	13.52	0.71	8.83	Seed	3.27	5	0.030	21.79	6.50	1.73	28.89	0.79	7.18
												Jute Mat	3.27	5	0.040	21.85	5.30	2.03	28.84	0.93	7.71
												Temp. Mat	3.27	5	0.040	21.85	5.30	2.03	28.84	0.93	7.71
												Perm, Type 1	3.27	5	0.040	21.85	5.30	2.03	28.84	0.93	7.71
												Perm, Type 2	3.27	5	0.040	21.85	5.30	2.03	28.84	0.93	7.71
												Perm, Type 2	3.69	10	0.040	21.84	5.49	2.16	32.57	0.99	7.97

DITCH ANALYSIS

PID : 95639 **Date :** 04/12/2021 **Project :** FRA-70-22.61 **Location :** COLUMBUS, OHIO

Description : RAMP G1 03: 8598+75 to 8592+00 RIGHT **Designer :** ARG

Rainfall Area : C

Allowable Shears

		Seed:	0.40	**Jute Mat:**	0.45	**Temporary Mat:**	1.00
	Permanent Mat	**Type 1:**	2.00	**Type 2:**	3.00	**Type 3:**	5.00
	RCP	**Type B:**	6.00				

(*) Warning: Grade is steeper than allowable. If value is parantheses, design parameters have been exceeded. - See user manual.

STATION BEGIN	STATION END	SIDE	LENGTH (ft.)	RADIUS WIDTH (ft.)	IN SLOPE (ft./ft.)	BACK SLOPE (ft./ft.)	GRADE (ft./ft.)	AREA (acres)	AREA SUM (acres)	RUNOFF COEFF.	CA (Sum)	PROTECT TYPE	RAIN INT. (in./hr.)	STORM FREQ. (yrs.)	MANN. COEFF.	TIME FLOW (min.)	VEL. FLOW (fps.)	SHEAR (lbs./ sq.ft.)	DESIGN FLOW (cfs.)	DEPTH FLOW (ft.)	WIDTH FLOW (ft.)
8598+75	8594+50	R	425.00	20.00	6.00	6.00	0.0013	4.90	4.90	0.61	2.99	Seed	3.83	5	0.030	16.38	1.03	0.04	11.44	0.49	25.84
												Seed	4.15	10	0.040	17.47	0.87	0.05	12.41	0.60	27.23
8594+50	8592+00	R	250.00	4.00	4.00	2.00	0.0053	1.50	6.40	0.65	3.96	Seed	3.64	5	0.030	17.99	2.55	0.28	14.44	0.86	9.16
												Seed	3.93	10	0.040	19.41	2.12	0.34	15.59	1.04	10.21

DITCH ANALYSIS

PID : 95639 **Date :** 04/15/2021 **Project :** FRA-70-22.61 **Location :** COLUMBUS, OHIO

Description : RAMP D2 01: INFIELD TO EX. CULVERT INLET 1006+65 LEFT **Designer :** ARG

Rainfall Area : C

Allowable Shears

	Seed:	0.40	**Jute Mat:** 0.45	**Temporary Mat:**	1.00
Permanent Mat	**Type 1:**	2.00	**Type 2:** 3.00	**Type 3:**	5.00
RCP	**Type B:**	6.00			

(*) Warning: Grade is steeper than allowable. If value is parantheses, design parameters have been exceeded. - See user manual.

STATION BEGIN	STATION END	SIDE	LENGTH (ft.)	RADIUS WIDTH (ft.)	IN SLOPE (ft./ft.)	BACK SLOPE (ft./ft.)	GRADE (ft./ft.)	AREA (acres)	AREA SUM (acres)	RUNOFF COEFF.	CA (Sum)	PROTECT TYPE	RAIN INT. (in./hr.)	STORM FREQ. (yrs.)	MANN. COEFF.	TIME FLOW (min.)	VEL. FLOW (fps.)	SHEAR (lbs./ sq.ft.)	DESIGN FLOW (cfs.)	DEPTH FLOW (ft.)	WIDTH FLOW (ft.)
1023+50	Concent							18.00		0.79	14.22					24.10					
1023+50	1006+65	L	760.00	4.00	4.00	4.00	0.0025	5.46	23.46	0.58	17.39	Seed	2.76	5	0.030	28.96	2.53	0.27	47.92	1.73	17.85
												Seed	3.07	10	0.040	29.93	2.10	0.32	53.37	2.07	20.54

DITCH ANALYSIS

PID : 95639 **Date :** 01/29/2019 **Project :** FRA-70-22.61 **Location :** COLUMBUS, OHIO

Description : IR-270 02: 1001+80 TO 979+00 RIGHT **Designer :** ARG

Rainfall Area : C

Allowable Shears

	Seed:	0.40	**Jute Mat:**	0.45	**Temporary Mat:**	1.00
Permanent Mat	**Type 1:**	2.00	**Type 2:**	3.00	**Type 3:**	5.00
RCP	**Type B:**	6.00				

(*) Warning: Grade is steeper than allowable. If value is parantheses, design parameters have been exceeded. - See user manual.

STATION BEGIN	STATION END	SIDE	LENGTH (ft.)	RADIUS WIDTH (ft.)	IN SLOPE (ft./ft.)	BACK SLOPE (ft./ft.)	GRADE (ft./ft.)	AREA (acres)	AREA SUM (acres)	RUNOFF COEFF.	CA (Sum)	PROTECT TYPE	RAIN INT. (in./hr.)	STORM FREQ. (yrs.)	MANN. COEFF.	TIME FLOW (min.)	VEL. FLOW (fps.)	SHEAR (lbs./ sq.ft.)	DESIGN FLOW (cfs.)	DEPTH FLOW (ft.)	WIDTH FLOW (ft.)
1001+80	993+00	R	880.00	5.00	2.00	2.00	0.0025	4.01	4.01	0.55	2.21	Seed	3.65	5	0.030	17.90	1.71	0.11	8.06	0.73	7.92
												Seed	3.94	10	0.040	19.38	1.43	0.14	8.68	0.89	8.58
993+00	Concent							4.85		0.81	6.13					17.62					
993+00	989+50	R	350.00	5.00	2.00	2.00	0.0025	1.40	10.26	0.57	6.93	Seed	3.40	5	0.030	20.34	2.34	0.20	23.60	1.32	10.27
												Seed	3.65	10	0.040	22.32	1.94	0.25	25.27	1.59	11.36
989+50	988+00	R	150.00	5.00	2.00	2.00	0.0037	0.63	10.90	0.56	7.29	Seed	3.32	5	0.030	21.25	2.71	0.28	24.20	1.20	9.82
												Seed	3.55	10	0.040	23.42	2.25	0.33	25.86	1.45	10.82
988+00	Concent							1.11		0.90	8.29					10.61					
988+00	980+50	R	750.00	5.00	2.00	2.00	0.0036	3.21	15.22	0.56	10.09	Seed	2.98	5	0.030	25.48	2.87	0.31	30.08	1.36	10.44
												Seed	3.16	10	0.040	28.53	2.37	0.37	31.87	1.63	11.52
980+50	Concent							3.30		0.73	12.49					11.29					
980+50	980+00	R	50.00	5.00	2.00	2.00	0.0036	0.18	18.70	0.56	12.59	Seed	2.96	5	0.030	25.76	3.05	0.34	37.32	1.52	11.09
												Seed	3.14	10	0.040	28.86	2.51	0.41	39.52	1.82	12.28

DITCH ANALYSIS

STATION BEGIN	STATION END	SIDE	LENGTH (ft.)	RADIUS WIDTH (ft.)	IN SLOPE (ft./ft.)	BACK SLOPE (ft./ft.)	GRADE (ft./ft.)	AREA (acres)	AREA SUM (acres)	RUNOFF COEFF.	CA (Sum)	PROTECT TYPE	RAIN INT. (in./hr.)	STORM FREQ. (yrs.)	MANN. COEFF.	TIME FLOW (min.)	VEL. FLOW (fps.)	SHEAR (lbs./ sq.ft.)	DESIGN FLOW (cfs.)	DEPTH FLOW (ft.)	WIDTH FLOW (ft.)
980+00	979+40	R	60.00	5.00	2.00	2.00	0.0290	0.35	19.05	0.56	12.79	Seed	2.95	5	0.030	25.91	6.41	1.58	37.77	0.87	8.50
												Jute Mat	2.95	5	0.040	25.95	5.24	1.85	37.73	1.02	9.09
												Temp. Mat	2.95	5	0.040	25.95	5.24	1.85	37.73	1.02	9.09
												Perm, Type 1	2.95	5	0.040	25.95	5.24	1.85	37.73	1.02	9.09
												Perm, Type 1	3.13	10	0.040	29.05	5.32	1.91	39.98	1.06	9.22

DITCH ANALYSIS

PID : 95639 **Date :** 01/29/2019 **Project :** FRA-70-22.61 **Location :** COLUMBUS, OHIO

Description : IR-270 03: 1003+00 TO 999+00 RIGHT **Designer :** ARG

Rainfall Area : C

Allowable Shears

		Seed:	0.40	**Jute Mat:**	0.45	**Temporary Mat:**	1.00
	Permanent Mat	**Type 1:**	2.00	**Type 2:**	3.00	**Type 3:**	5.00
	RCP	**Type B:**	6.00				

(*) Warning: Grade is steeper than allowable. If value is parantheses, design parameters have been exceeded. - See user manual.

STATION BEGIN	STATION END	SIDE	LENGTH (ft.)	RADIUS WIDTH (ft.)	IN SLOPE (ft./ft.)	BACK SLOPE (ft./ft.)	GRADE (ft./ft.)	AREA (acres)	AREA SUM (acres)	RUNOFF COEFF.	CA (Sum)	PROTECT TYPE	RAIN INT. (in./hr.)	STORM FREQ. (yrs.)	MANN. COEFF.	TIME FLOW (min.)	VEL. FLOW (fps.)	SHEAR (lbs./ sq.ft.)	DESIGN FLOW (cfs.)	DEPTH FLOW (ft.)	WIDTH FLOW (ft.)
1003+00	999+00	R	400.00	1.00	2.00	2.00	0.0053	0.61	0.61	0.85	0.52	Seed	4.20	5	0.030	13.63	1.77	0.19	2.18	0.57	3.29
												Seed	4.56	10	0.040	14.39	1.46	0.23	2.37	0.68	3.74

DITCH ANALYSIS

PID : 95639 **Date :** 01/29/2019 **Project :** FRA-70-22.61 **Location :** COLUMBUS, OHIO

Description : IR-270 04: 996+50 TO 999+00 **Designer :** ARG

Rainfall Area : C

Allowable Shears

		Seed:	0.40	**Jute Mat:**	0.45	**Temporary Mat:**	1.00
	Permanent Mat	**Type 1:**	2.00	**Type 2:**	3.00	**Type 3:**	5.00
	RCP	**Type B:**	6.00				

(*) Warning: Grade is steeper than allowable. If value is parantheses, design parameters have been exceeded. - See user manual.

STATION BEGIN	STATION END	SIDE	LENGTH (ft.)	RADIUS WIDTH (ft.)	IN SLOPE (ft./ft.)	BACK SLOPE (ft./ft.)	GRADE (ft./ft.)	AREA (acres)	AREA SUM (acres)	RUNOFF COEFF.	CA (Sum)	PROTECT TYPE	RAIN INT. (in./hr.)	STORM FREQ. (yrs.)	MANN. COEFF.	TIME FLOW (min.)	VEL. FLOW (fps.)	SHEAR (lbs./ sq.ft.)	DESIGN FLOW (cfs.)	DEPTH FLOW (ft.)	WIDTH FLOW (ft.)
997+00	999+00	R	200.00	1.00	2.00	2.00	0.0025	0.23	0.23	0.84	0.19	Seed	4.27	5	0.030	13.13	1.03	0.07	0.81	0.42	2.70
												Seed	4.66	10	0.040	13.73	0.86	0.08	0.88	0.51	3.04

DITCH ANALYSIS

PID : 95639 **Date :** 01/29/2019 **Project :** FRA-70-22.61 **Location :** COLUMBUS, OHIO

Description : RAMP A2 01- 3007+00 TO RAMP A1 LEFT 2024+00 **Designer :** ARG

Rainfall Area : C

Allowable Shears

	Seed:	0.40	**Jute Mat:**	0.45	**Temporary Mat:**	1.00
Permanent Mat	**Type 1:**	2.00	**Type 2:**	3.00	**Type 3:**	5.00
RCP	**Type B:**	6.00				

(*) Warning: Grade is steeper than allowable. If value is parantheses, design parameters have been exceeded. - See user manual.

STATION BEGIN	STATION END	SIDE	LENGTH (ft.)	RADIUS WIDTH (ft.)	IN SLOPE (ft./ft.)	BACK SLOPE (ft./ft.)	GRADE (ft./ft.)	AREA (acres)	AREA SUM (acres)	RUNOFF COEFF.	CA (Sum)	PROTECT TYPE	RAIN INT. (in./hr.)	STORM FREQ. (yrs.)	MANN. COEFF.	TIME FLOW (min.)	VEL. FLOW (fps.)	SHEAR (lbs./ sq.ft.)	DESIGN FLOW (cfs.)	DEPTH FLOW (ft.)	WIDTH FLOW (ft.)
3007+00	3011+60	L	460.00	4.00	3.00	4.00	0.0025	0.68	0.68	0.74	0.50	Seed	3.78	5	0.030	16.77	1.05	0.05	1.89	0.35	6.42
												Seed	4.08	10	0.040	18.05	0.88	0.07	2.04	0.42	6.95
3011+60	Concent							1.06		0.90	1.46					10.00					
3011+60	2024+00	L	136.00	4.00	4.00	4.00	0.0221	0.16	1.90	0.76	1.58	Seed	3.70	5	0.030	17.49	3.10	0.48	5.83	0.35	6.79
												Jute Mat	3.68	5	0.040	17.65	2.54	0.56	5.81	0.41	7.25
												Temp. Mat	3.68	5	0.040	17.65	2.54	0.56	5.81	0.41	7.25
												Temp. Mat	3.99	10	0.040	18.92	2.60	0.59	6.29	0.42	7.40

DITCH ANALYSIS

PID : 95639 **Date :** 01/29/2019 **Project :** FRA-70-22.61 **Location :** COLUMBUS, OHIO

Description : RAMP A2 01: 2987+25 TO 2989+15 RIGHT **Designer :** REM

Rainfall Area : C

Allowable Shears

	Seed:	0.40	**Jute Mat:** 0.45	**Temporary Mat:**	1.00
Permanent Mat	**Type 1:**	2.00	**Type 2:** 3.00	**Type 3:**	5.00
RCP	**Type B:**	6.00			

(*) Warning: Grade is steeper than allowable. If value is parantheses, design parameters have been exceeded. - See user manual.

STATION BEGIN	STATION END	SIDE	LENGTH (ft.)	RADIUS WIDTH (ft.)	IN SLOPE (ft./ft.)	BACK SLOPE (ft./ft.)	GRADE (ft./ft.)	AREA (acres)	AREA SUM (acres)	RUNOFF COEFF.	CA (Sum)	PROTECT TYPE	RAIN INT. (in./hr.)	STORM FREQ. (yrs.)	MANN. COEFF.	TIME FLOW (min.)	VEL. FLOW (fps.)	SHEAR (lbs./ sq.ft.)	DESIGN FLOW (cfs.)	DEPTH FLOW (ft.)	WIDTH FLOW (ft.)
2988+64	2989+15	R	51.00	3.00	10.00	6.00	0.0050	1.15	1.15	0.63	0.72	Seed	3.92	5	0.030	15.63	1.35	0.11	2.84	0.36	8.74
												Seed	4.37	10	0.040	15.75	1.13	0.14	3.17	0.43	9.94

DITCH ANALYSIS

PID : 95639 **Date :** 01/29/2019 **Project :** FRA-70-22.61 **Location :** COLUMBUS, OHIO

Description : RAMP A1 01 - 2021+50 TO 2028+95 LEFT **Designer :** ARG

Rainfall Area : C

Allowable Shears

	Seed:	0.40	**Jute Mat:**	0.45	**Temporary Mat:**	1.00
Permanent Mat	**Type 1:**	2.00	**Type 2:**	3.00	**Type 3:**	5.00
RCP	**Type B:**	6.00				

(*) Warning: Grade is steeper than allowable. If value is parantheses, design parameters have been exceeded. - See user manual.

STATION BEGIN	STATION END	SIDE	LENGTH (ft.)	RADIUS WIDTH (ft.)	IN SLOPE (ft./ft.)	BACK SLOPE (ft./ft.)	GRADE (ft./ft.)	AREA (acres)	AREA SUM (acres)	RUNOFF COEFF.	CA (Sum)	PROTECT TYPE	RAIN INT. (in./hr.)	STORM FREQ. (yrs.)	MANN. COEFF.	TIME FLOW (min.)	VEL. FLOW (fps.)	SHEAR (lbs./ sq.ft.)	DESIGN FLOW (cfs.)	DEPTH FLOW (ft.)	WIDTH FLOW (ft.)
2022+00	2023+50	L	150.00	4.00	9.00	4.00	0.0165	0.14	0.14	0.54	0.08	Seed	4.40	5	0.030	12.34	1.03	0.07	0.33	0.07	4.94
												Seed	4.82	10	0.040	12.76	0.87	0.09	0.37	0.09	5.19
2023+50	2024+00	L	50.00	4.00	15.00	14.00	0.0180	0.08	0.22	0.53	0.12	Seed	4.28	5	0.030	13.08	1.14	0.10	0.51	0.09	6.49
												Seed	4.68	10	0.040	13.62	0.94	0.12	0.56	0.11	7.12
2024+00	Concent							1.90		0.83	1.70					18.83					
2024+00	2024+50	L	50.00	4.00	15.00	10.00	0.0160	0.15	2.28	0.61	1.79	Seed	3.52	5	0.030	19.19	2.29	0.33	6.30	0.34	12.38
												Seed	3.95	10	0.040	19.26	1.91	0.41	7.07	0.41	14.16
2024+50	2025+00	L	50.00	4.00	14.00	12.00	0.0180	0.17	2.44	0.54	1.88	Seed	3.48	5	0.030	19.54	2.40	0.37	6.54	0.33	12.57
												Seed	3.90	10	0.040	19.68	2.00	0.45	7.34	0.40	14.37
2025+00	2025+50	L	50.00	4.00	14.00	13.00	0.0160	0.21	2.65	0.52	1.99	Seed	3.45	5	0.030	19.90	2.31	0.34	6.85	0.34	13.28
												Seed	3.86	10	0.040	20.11	1.92	0.41	7.68	0.42	15.22
2025+50	Concent							1.16		0.90	3.03					10.00					
2025+50	2028+95	L	380.00	4.00	12.00	10.00	0.0303	2.25	6.06	0.55	4.27	Seed	3.29	5	0.030	21.59	3.69	0.82	14.05	0.43	13.54

DITCH ANALYSIS

STATION BEGIN	STATION END	SIDE	LENGTH (ft.)	RADIUS WIDTH (ft.)	IN SLOPE (ft./ft.)	BACK SLOPE (ft./ft.)	GRADE (ft./ft.)	AREA (acres)	AREA SUM (acres)	RUNOFF COEFF.	CA (Sum)	PROTECT TYPE	RAIN INT. (in./hr.)	STORM FREQ. (yrs.)	MANN. COEFF.	TIME FLOW (min.)	VEL. FLOW (fps.)	SHEAR (lbs./ sq.ft.)	DESIGN FLOW (cfs.)	DEPTH FLOW (ft.)	WIDTH FLOW (ft.)
												Jute Mat	3.26	5	0.040	21.99	2.98	0.93	13.90	0.49	14.88
												Temp. Mat	3.26	5	0.040	21.99	2.98	0.93	13.90	0.49	14.88
												Temp. Mat	3.66	10	0.040	22.14	3.07	0.99	15.64	0.52	15.49

DITCH ANALYSIS

PID : 95639 **Date :** 01/29/2019 **Project :** FRA-70-22.61 **Location :** COLUMBUS, OHIO

Description : RAMP A1 01: RAMP A1 2010+40 TO RAMP A2 STA. 2989+15 RIGHT **Designer :** REM

Rainfall Area : C

Allowable Shears

		Seed:	0.40	**Jute Mat:**	0.45	**Temporary Mat:**	1.00
	Permanent Mat	**Type 1:**	2.00	**Type 2:**	3.00	**Type 3:**	5.00
	RCP	**Type B:**	6.00				

(*) Warning: Grade is steeper than allowable. If value is parantheses, design parameters have been exceeded. - See user manual.

STATION BEGIN	STATION END	SIDE	LENGTH (ft.)	RADIUS WIDTH (ft.)	IN SLOPE (ft./ft.)	BACK SLOPE (ft./ft.)	GRADE (ft./ft.)	AREA (acres)	AREA SUM (acres)	RUNOFF COEFF.	CA (Sum)	PROTECT TYPE	RAIN INT. (in./hr.)	STORM FREQ. (yrs.)	MANN. COEFF.	TIME FLOW (min.)	VEL. FLOW (fps.)	SHEAR (lbs./ sq.ft.)	DESIGN FLOW (cfs.)	DEPTH FLOW (ft.)	WIDTH FLOW (ft.)
2010+40	2989+15	R	979.00	3.00	10.00	5.00	0.0030	3.83	3.83	0.64	2.45	Seed	2.99	5	0.030	25.39	1.46	0.12	7.33	0.64	12.65
												Seed	3.23	10	0.040	27.51	1.20	0.14	7.92	0.76	14.39

DITCH ANALYSIS

PID : 95639 **Date :** 01/29/2019 **Project :** FRA-70-22.61 **Location :** COLUMBUS, OHIO

Description : RAMP A1 02- 2010+40 TO 2015+25 RIGHT **Designer :** ARG

Rainfall Area : C

Allowable Shears

		Seed:	0.40	**Jute Mat:**	0.45	**Temporary Mat:**	1.00
	Permanent Mat	**Type 1:**	2.00	**Type 2:**	3.00	**Type 3:**	5.00
	RCP	**Type B:**	6.00				

(*) Warning: Grade is steeper than allowable. If value is parantheses, design parameters have been exceeded. - See user manual.

STATION BEGIN	STATION END	SIDE	LENGTH (ft.)	RADIUS WIDTH (ft.)	IN SLOPE (ft./ft.)	BACK SLOPE (ft./ft.)	GRADE (ft./ft.)	AREA (acres)	AREA SUM (acres)	RUNOFF COEFF.	CA (Sum)	PROTECT TYPE	RAIN INT. (in./hr.)	STORM FREQ. (yrs.)	MANN. COEFF.	TIME FLOW (min.)	VEL. FLOW (fps.)	SHEAR (lbs./ sq.ft.)	DESIGN FLOW (cfs.)	DEPTH FLOW (ft.)	WIDTH FLOW (ft.)
2015+25	2010+40	R	475.00	3.00	8.00	6.00	0.0030	1.12	1.12	0.72	0.81	Seed	3.29	5	0.030	21.64	1.13	0.08	2.66	0.40	8.64
												Seed	3.59	10	0.040	22.95	0.94	0.09	2.90	0.48	9.77

DITCH ANALYSIS

PID : 95639 **Date :** 01/29/2019 **Project :** FRA-70-22.61 **Location :** COLUMBUS, OHIO

Description : RAMP A1 03- 2015+25 TO 2021+00 RIGHT **Designer :** ARG

Rainfall Area : C

Allowable Shears

		Seed:	0.40	**Jute Mat:**	0.45	**Temporary Mat:**	1.00
	Permanent Mat	**Type 1:**	2.00	**Type 2:**	3.00	**Type 3:**	5.00
	RCP	**Type B:**	6.00				

(*) Warning: Grade is steeper than allowable. If value is parantheses, design parameters have been exceeded. - See user manual.

STATION BEGIN	STATION END	SIDE	LENGTH (ft.)	RADIUS WIDTH (ft.)	IN SLOPE (ft./ft.)	BACK SLOPE (ft./ft.)	GRADE (ft./ft.)	AREA (acres)	AREA SUM (acres)	RUNOFF COEFF.	CA (Sum)	PROTECT TYPE	RAIN INT. (in./hr.)	STORM FREQ. (yrs.)	MANN. COEFF.	TIME FLOW (min.)	VEL. FLOW (fps.)	SHEAR (lbs./ sq.ft.)	DESIGN FLOW (cfs.)	DEPTH FLOW (ft.)	WIDTH FLOW (ft.)
2021+00	2016+50	R	450.00	7.00	8.00	6.00	0.0046	0.79	0.79	0.69	0.54	Seed	3.84	5	0.030	16.30	1.10	0.06	2.08	0.22	10.10
												Seed	4.16	10	0.040	17.44	0.93	0.08	2.26	0.27	10.82
2016+50	2015+25	R	123.00	7.00	8.00	6.00	0.0048	0.36	1.14	0.79	0.82	Seed	3.65	5	0.030	17.91	1.25	0.08	3.01	0.27	10.78
												Seed	3.94	10	0.040	19.35	1.06	0.10	3.25	0.33	11.62

DITCH ANALYSIS

PID : 95639 **Date :** 01/29/2019 **Project :** FRA-70-22.61 **Location :** COLUMBUS, OHIO

Description : RAMP A1 04- 2021+00 TO 2030+15 RIGHT **Designer :** REM

Rainfall Area : C

Allowable Shears

		Seed:	0.40	**Jute Mat:**	0.45	**Temporary Mat:**	1.00
	Permanent Mat	**Type 1:**	2.00	**Type 2:**	3.00	**Type 3:**	5.00
	RCP	**Type B:**	6.00				

(*) Warning: Grade is steeper than allowable. If value is parantheses, design parameters have been exceeded. - See user manual.

STATION BEGIN	STATION END	SIDE	LENGTH (ft.)	RADIUS WIDTH (ft.)	IN SLOPE (ft./ft.)	BACK SLOPE (ft./ft.)	GRADE (ft./ft.)	AREA (acres)	AREA SUM (acres)	RUNOFF COEFF.	CA (Sum)	PROTECT TYPE	RAIN INT. (in./hr.)	STORM FREQ. (yrs.)	MANN. COEFF.	TIME FLOW (min.)	VEL. FLOW (fps.)	SHEAR (lbs./ sq.ft.)	DESIGN FLOW (cfs.)	DEPTH FLOW (ft.)	WIDTH FLOW (ft.)
2021+00	2030+00	R	900.00	4.50			0.0100	2.15	2.15	0.59	1.27	Seed	3.98	5	0.030	15.16	2.73	0.38	5.06	0.61	4.58
												Seed	4.33	10	0.040	16.09	2.30	0.45	5.49	0.72	4.97
2030+00	2030+15	R	12.00	4.50	8.00	6.00	0.0175	0.03	2.18	0.65	1.29	Seed	3.97	5	0.030	15.24	2.48	0.34	5.11	0.31	8.83
												Seed	4.31	10	0.040	16.19	2.07	0.41	5.55	0.38	9.76

DITCH ANALYSIS

PID : 95639 **Date :** 11/13/2019 **Project :** FRA-70-22.61 **Location :** COLUMBUS, OHIO

Description : RAMP A1 NOISEWALL - LT SIDE DITCH STA. 11+40 TO STA. 14+00 **Designer :** CDR

Rainfall Area : C

Allowable Shears

		Seed:	0.40	**Jute Mat:**	0.45	**Temporary Mat:**	1.00
	Permanent Mat	**Type 1:**	2.00	**Type 2:**	3.00	**Type 3:**	5.00
	RCP	**Type B:**	6.00				

(*) Warning: Grade is steeper than allowable. If value is parantheses, design parameters have been exceeded. - See user manual.

STATION BEGIN	STATION END	SIDE	LENGTH (ft.)	RADIUS WIDTH (ft.)	IN SLOPE (ft./ft.)	BACK SLOPE (ft./ft.)	GRADE (ft./ft.)	AREA (acres)	AREA SUM (acres)	RUNOFF COEFF.	CA (Sum)	PROTECT TYPE	RAIN INT. (in./hr.)	STORM FREQ. (yrs.)	MANN. COEFF.	TIME FLOW (min.)	VEL. FLOW (fps.)	SHEAR (lbs./ sq.ft.)	DESIGN FLOW (cfs.)	DEPTH FLOW (ft.)	WIDTH FLOW (ft.)
14+00	11+40	L	260.00	2.00	2.00	2.00	0.0050	0.05	0.05	0.50	0.03	Seed	3.26	5	0.030	21.98	0.54	0.02	0.09	0.08	2.30
												Seed	3.58	10	0.040	23.07	0.52	0.03	0.10	0.09	2.34

DITCH ANALYSIS

PID : 95639 **Date :** 11/13/2019 **Project :** FRA-70-22.61 **Location :** COLUMBUS, OHIO

Description : RAMP A1 NOISEWALL - LT SIDE DITCH STA. 14+00 TO STA. 19+50 **Designer :** CDR

Rainfall Area : C

Allowable Shears

	Seed:	0.40	**Jute Mat:**	0.45	**Temporary Mat:**	1.00
Permanent Mat	**Type 1:**	2.00	**Type 2:**	3.00	**Type 3:**	5.00
RCP	**Type B:**	6.00				

(*) Warning: Grade is steeper than allowable. If value is parantheses, design parameters have been exceeded. - See user manual.

STATION BEGIN	STATION END	SIDE	LENGTH (ft.)	RADIUS WIDTH (ft.)	IN SLOPE (ft./ft.)	BACK SLOPE (ft./ft.)	GRADE (ft./ft.)	AREA (acres)	AREA SUM (acres)	RUNOFF COEFF.	CA (Sum)	PROTECT TYPE	RAIN INT. (in./hr.)	STORM FREQ. (yrs.)	MANN. COEFF.	TIME FLOW (min.)	VEL. FLOW (fps.)	SHEAR (lbs./ sq.ft.)	DESIGN FLOW (cfs.)	DEPTH FLOW (ft.)	WIDTH FLOW (ft.)
14+00	19+00	L	500.00	2.00	2.00	2.00	0.0088	0.12	0.12	0.50	0.06	Seed	3.12	5	0.030	23.64	0.89	0.05	0.19	0.10	2.39
												Seed	3.43	10	0.040	24.80	0.79	0.06	0.21	0.12	2.47

DITCH ANALYSIS

PID : 95639 **Date :** 11/13/2019 **Project :** FRA-70-22.61 **Location :** COLUMBUS, OHIO

Description : RAMP A1 NOISEWALL - LT SIDE DITCH STA. 14+00 TO STA. 19+50 **Designer :** CDR

Rainfall Area : C

Allowable Shears

		Seed:	0.40	**Jute Mat:**	0.45	**Temporary Mat:**	1.00
	Permanent Mat	**Type 1:**	2.00	**Type 2:**	3.00	**Type 3:**	5.00
	RCP	**Type B:**	6.00				

(*) Warning: Grade is steeper than allowable. If value is parantheses, design parameters have been exceeded. - See user manual.

STATION BEGIN	STATION END	SIDE	LENGTH (ft.)	RADIUS WIDTH (ft.)	IN SLOPE (ft./ft.)	BACK SLOPE (ft./ft.)	GRADE (ft./ft.)	AREA (acres)	AREA SUM (acres)	RUNOFF COEFF.	CA (Sum)	PROTECT TYPE	RAIN INT. (in./hr.)	STORM FREQ. (yrs.)	MANN. COEFF.	TIME FLOW (min.)	VEL. FLOW (fps.)	SHEAR (lbs./ sq.ft.)	DESIGN FLOW (cfs.)	DEPTH FLOW (ft.)	WIDTH FLOW (ft.)
19+50	19+00	R	50.00	2.00	2.00	2.00	0.0053	0.01	0.01	0.50	0.01	Seed	3.77	5	0.030	16.83	0.43	0.01	0.02	0.02	2.09
												Seed	4.05	10	0.040	18.34	0.23	0.01	0.02	0.04	2.17

DITCH ANALYSIS

PID : 95639 **Date :** 11/13/2019 **Project :** FRA-70-22.61 **Location :** COLUMBUS, OHIO

Description : RAMP A1 NOISEWALL - LT SIDE DITCH STA. 19+50 TO STA. 22+16 **Designer :** CDR

Rainfall Area : C

Allowable Shears

		Seed:	0.40	**Jute Mat:**	0.45	**Temporary Mat:**	1.00
	Permanent Mat	**Type 1:**	2.00	**Type 2:**	3.00	**Type 3:**	5.00
	RCP	**Type B:**	6.00				

(*) Warning: Grade is steeper than allowable. If value is parantheses, design parameters have been exceeded. - See user manual.

STATION BEGIN	STATION END	SIDE	LENGTH (ft.)	RADIUS WIDTH (ft.)	IN SLOPE (ft./ft.)	BACK SLOPE (ft./ft.)	GRADE (ft./ft.)	AREA (acres)	AREA SUM (acres)	RUNOFF COEFF.	CA (Sum)	PROTECT TYPE	RAIN INT. (in./hr.)	STORM FREQ. (yrs.)	MANN. COEFF.	TIME FLOW (min.)	VEL. FLOW (fps.)	SHEAR (lbs./ sq.ft.)	DESIGN FLOW (cfs.)	DEPTH FLOW (ft.)	WIDTH FLOW (ft.)
19+50	22+16	L	266.00	2.00	2.00	2.00	0.0050	0.08	0.08	0.50	0.04	Seed	3.31	5	0.030	21.35	0.65	0.03	0.14	0.10	2.39
												Seed	3.68	10	0.040	21.95	0.58	0.04	0.15	0.12	2.47

DITCH ANALYSIS

PID : 95639 **Date :** 11/13/2019 **Project :** FRA-70-22.61 **Location :** COLUMBUS, OHIO

Description : RAMP A1 NOISEWALL - LT SIDE DITCH STA. 41+50 TO STA. 47+50 **Designer :** CDR

Rainfall Area : C

Allowable Shears

		Seed:	0.40	**Jute Mat:**	0.45	**Temporary Mat:**	1.00
	Permanent Mat	**Type 1:**	2.00	**Type 2:**	3.00	**Type 3:**	5.00
	RCP	**Type B:**	6.00				

(*) Warning: Grade is steeper than allowable. If value is parantheses, design parameters have been exceeded. - See user manual.

STATION BEGIN	STATION END	SIDE	LENGTH (ft.)	RADIUS WIDTH (ft.)	IN SLOPE (ft./ft.)	BACK SLOPE (ft./ft.)	GRADE (ft./ft.)	AREA (acres)	AREA SUM (acres)	RUNOFF COEFF.	CA (Sum)	PROTECT TYPE	RAIN INT. (in./hr.)	STORM FREQ. (yrs.)	MANN. COEFF.	TIME FLOW (min.)	VEL. FLOW (fps.)	SHEAR (lbs./ sq.ft.)	DESIGN FLOW (cfs.)	DEPTH FLOW (ft.)	WIDTH FLOW (ft.)
41+50	47+50	L	600.00	2.00	2.00	2.00	0.0050	0.19	0.19	0.50	0.10	Seed	2.99	5	0.030	25.43	0.87	0.05	0.29	0.15	2.58
												Seed	3.26	10	0.040	27.09	0.75	0.06	0.31	0.18	2.71

DITCH ANALYSIS

PID : 95639 **Date :** 11/13/2019 **Project :** FRA-70-22.61 **Location :** COLUMBUS, OHIO

Description : RAMP A1 NOISEWALL - LT SIDE DITCH STA. 57+50 TO STA. 58+50 **Designer :** CDR

Rainfall Area : C

Allowable Shears

		Seed:	0.40	**Jute Mat:**	0.45	**Temporary Mat:**	1.00
	Permanent Mat	**Type 1:**	2.00	**Type 2:**	3.00	**Type 3:**	5.00
	RCP	**Type B:**	6.00				

(*) Warning: Grade is steeper than allowable. If value is parantheses, design parameters have been exceeded. - See user manual.

STATION BEGIN	STATION END	SIDE	LENGTH (ft.)	RADIUS WIDTH (ft.)	IN SLOPE (ft./ft.)	BACK SLOPE (ft./ft.)	GRADE (ft./ft.)	AREA (acres)	AREA SUM (acres)	RUNOFF COEFF.	CA (Sum)	PROTECT TYPE	RAIN INT. (in./hr.)	STORM FREQ. (yrs.)	MANN. COEFF.	TIME FLOW (min.)	VEL. FLOW (fps.)	SHEAR (lbs./ sq.ft.)	DESIGN FLOW (cfs.)	DEPTH FLOW (ft.)	WIDTH FLOW (ft.)
57+50	58+50	L	100.00	2.00	2.00	2.00	0.0050	0.05	0.05	0.50	0.02	Seed	3.64	5	0.030	17.99	0.60	0.02	0.08	0.06	2.26
												Seed	4.03	10	0.040	18.51	0.49	0.03	0.09	0.09	2.34

DITCH ANALYSIS

PID : 95639 **Date :** 11/13/2019 **Project :** FRA-70-22.61 **Location :** COLUMBUS, OHIO

Description : RAMP A1 NOISEWALL - LT SIDE DITCH STA. 58+50 TO STA. 59+60 **Designer :** CDR

Rainfall Area : C

Allowable Shears

		Seed:	0.40	**Jute Mat:**	0.45	**Temporary Mat:**	1.00
	Permanent Mat	**Type 1:**	2.00	**Type 2:**	3.00	**Type 3:**	5.00
	RCP	**Type B:**	6.00				

(*) Warning: Grade is steeper than allowable. If value is parantheses, design parameters have been exceeded. - See user manual.

STATION BEGIN	STATION END	SIDE	LENGTH (ft.)	RADIUS WIDTH (ft.)	IN SLOPE (ft./ft.)	BACK SLOPE (ft./ft.)	GRADE (ft./ft.)	AREA (acres)	AREA SUM (acres)	RUNOFF COEFF.	CA (Sum)	PROTECT TYPE	RAIN INT. (in./hr.)	STORM FREQ. (yrs.)	MANN. COEFF.	TIME FLOW (min.)	VEL. FLOW (fps.)	SHEAR (lbs./ sq.ft.)	DESIGN FLOW (cfs.)	DEPTH FLOW (ft.)	WIDTH FLOW (ft.)
59+60	58+50	L	110.00	2.00	2.00	2.00	0.0393	0.03	0.03	0.50	0.01	Seed	3.73	5	0.030	17.18	0.95	0.07	0.05	0.03	2.11
												Seed	4.18	10	0.040	17.28	0.75	0.09	0.06	0.04	2.15

DITCH ANALYSIS

PID : 95639 **Date :** 11/13/2019 **Project :** FRA-70-22.61 **Location :** COLUMBUS, OHIO

Description : RAMP A1 NOISEWALL - RIGHT SIDE DITCH STA. 11+00 TO STA. 14+00 **Designer :** CDR

Rainfall Area : C

Allowable Shears

		Seed:	0.40	**Jute Mat:**	0.45	**Temporary Mat:**	1.00
	Permanent Mat	**Type 1:**	2.00	**Type 2:**	3.00	**Type 3:**	5.00
	RCP	**Type B:**	6.00				

(*) Warning: Grade is steeper than allowable. If value is parantheses, design parameters have been exceeded. - See user manual.

STATION BEGIN	STATION END	SIDE	LENGTH (ft.)	RADIUS WIDTH (ft.)	IN SLOPE (ft./ft.)	BACK SLOPE (ft./ft.)	GRADE (ft./ft.)	AREA (acres)	AREA SUM (acres)	RUNOFF COEFF.	CA (Sum)	PROTECT TYPE	RAIN INT. (in./hr.)	STORM FREQ. (yrs.)	MANN. COEFF.	TIME FLOW (min.)	VEL. FLOW (fps.)	SHEAR (lbs./ sq.ft.)	DESIGN FLOW (cfs.)	DEPTH FLOW (ft.)	WIDTH FLOW (ft.)
14+00	11+00	R	260.00	2.00	2.00	2.00	0.0050	0.12	0.12	0.50	0.06	Seed	3.40	5	0.030	20.38	0.75	0.04	0.20	0.12	2.47
												Seed	3.75	10	0.040	21.20	0.66	0.05	0.22	0.15	2.58

DITCH ANALYSIS

PID : 95639 **Date :** 11/13/2019 **Project :** FRA-70-22.61 **Location :** COLUMBUS, OHIO

Description : RAMP A1 NOISEWALL - RIGHT SIDE DITCH STA. 14+00 TO STA. 19+50 **Designer :** CDR

Rainfall Area : C

Allowable Shears

		Seed:	0.40	**Jute Mat:**	0.45	**Temporary Mat:**	1.00
	Permanent Mat	**Type 1:**	2.00	**Type 2:**	3.00	**Type 3:**	5.00
	RCP	**Type B:**	6.00				

(*) Warning: Grade is steeper than allowable. If value is parantheses, design parameters have been exceeded. - See user manual.

STATION BEGIN	STATION END	SIDE	LENGTH (ft.)	RADIUS WIDTH (ft.)	IN SLOPE (ft./ft.)	BACK SLOPE (ft./ft.)	GRADE (ft./ft.)	AREA (acres)	AREA SUM (acres)	RUNOFF COEFF.	CA (Sum)	PROTECT TYPE	RAIN INT. (in./hr.)	STORM FREQ. (yrs.)	MANN. COEFF.	TIME FLOW (min.)	VEL. FLOW (fps.)	SHEAR (lbs./ sq.ft.)	DESIGN FLOW (cfs.)	DEPTH FLOW (ft.)	WIDTH FLOW (ft.)
14+00	19+00	R	500.00	2.00	2.00	2.00	0.0088	0.10	0.10	0.50	0.05	Seed	3.09	5	0.030	24.00	0.86	0.05	0.16	0.09	2.34
												Seed	3.38	10	0.040	25.42	0.74	0.06	0.18	0.11	2.43

DITCH ANALYSIS

PID : 95639 **Date :** 11/13/2019 **Project :** FRA-70-22.61 **Location :** COLUMBUS, OHIO

Description : RAMP A1 NOISEWALL - RIGHT SIDE DITCH STA. 19+00 TO STA. 19+50 **Designer :** CDR

Rainfall Area : C

Allowable Shears

		Seed:	0.40	**Jute Mat:**	0.45	**Temporary Mat:**	1.00
	Permanent Mat	**Type 1:**	2.00	**Type 2:**	3.00	**Type 3:**	5.00
	RCP	**Type B:**	6.00				

(*) Warning: Grade is steeper than allowable. If value is parantheses, design parameters have been exceeded. - See user manual.

STATION BEGIN	STATION END	SIDE	LENGTH (ft.)	RADIUS WIDTH (ft.)	IN SLOPE (ft./ft.)	BACK SLOPE (ft./ft.)	GRADE (ft./ft.)	AREA (acres)	AREA SUM (acres)	RUNOFF COEFF.	CA (Sum)	PROTECT TYPE	RAIN INT. (in./hr.)	STORM FREQ. (yrs.)	MANN. COEFF.	TIME FLOW (min.)	VEL. FLOW (fps.)	SHEAR (lbs./ sq.ft.)	DESIGN FLOW (cfs.)	DEPTH FLOW (ft.)	WIDTH FLOW (ft.)
19+50	19+00	R	50.00	2.00	2.00	2.00	0.0053	0.01	0.01	0.50	0.01	Seed	3.77	5	0.030	16.83	0.43	0.01	0.02	0.02	2.09
												Seed	4.05	10	0.040	18.34	0.23	0.01	0.02	0.04	2.17

DITCH ANALYSIS

PID : 95639 **Date :** 11/13/2019 **Project :** FRA-70-22.61 **Location :** COLUMBUS, OHIO

Description : RAMP A1 NOISEWALL - RIGHT SIDE DITCH STA. 19+50 TO STA. 22+16 **Designer :** CDR

Rainfall Area : C

Allowable Shears

		Seed:	0.40	**Jute Mat:**	0.45	**Temporary Mat:**	1.00
	Permanent Mat	**Type 1:**	2.00	**Type 2:**	3.00	**Type 3:**	5.00
	RCP	**Type B:**	6.00				

(*) Warning: Grade is steeper than allowable. If value is parantheses, design parameters have been exceeded. - See user manual.

STATION BEGIN	STATION END	SIDE	LENGTH (ft.)	RADIUS WIDTH (ft.)	IN SLOPE (ft./ft.)	BACK SLOPE (ft./ft.)	GRADE (ft./ft.)	AREA (acres)	AREA SUM (acres)	RUNOFF COEFF.	CA (Sum)	PROTECT TYPE	RAIN INT. (in./hr.)	STORM FREQ. (yrs.)	MANN. COEFF.	TIME FLOW (min.)	VEL. FLOW (fps.)	SHEAR (lbs./ sq.ft.)	DESIGN FLOW (cfs.)	DEPTH FLOW (ft.)	WIDTH FLOW (ft.)
19+50	22+16	R	266.00	2.00	2.00	2.00	0.0050	0.05	0.05	0.50	0.03	Seed	3.24	5	0.030	22.14	0.54	0.02	0.09	0.08	2.30
												Seed	3.56	10	0.040	23.25	0.52	0.03	0.10	0.09	2.34

DITCH ANALYSIS

PID : 95639 **Date :** 11/13/2019 **Project :** FRA-70-22.61 **Location :** COLUMBUS, OHIO

Description : RAMP A1 NOISEWALL - RIGHT SIDE DITCH STA. 22+16 TO STA. 26+50 **Designer :** CDR

Rainfall Area : C

Allowable Shears

		Seed:	0.40	**Jute Mat:**	0.45	**Temporary Mat:**	1.00
	Permanent Mat	**Type 1:**	2.00	**Type 2:**	3.00	**Type 3:**	5.00
	RCP	**Type B:**	6.00				

(*) Warning: Grade is steeper than allowable. If value is parantheses, design parameters have been exceeded. - See user manual.

STATION BEGIN	STATION END	SIDE	LENGTH (ft.)	RADIUS WIDTH (ft.)	IN SLOPE (ft./ft.)	BACK SLOPE (ft./ft.)	GRADE (ft./ft.)	AREA (acres)	AREA SUM (acres)	RUNOFF COEFF.	CA (Sum)	PROTECT TYPE	RAIN INT. (in./hr.)	STORM FREQ. (yrs.)	MANN. COEFF.	TIME FLOW (min.)	VEL. FLOW (fps.)	SHEAR (lbs./ sq.ft.)	DESIGN FLOW (cfs.)	DEPTH FLOW (ft.)	WIDTH FLOW (ft.)
26+50	22+16	R	476.00	2.00	2.00	2.00	0.0050	0.12	0.12	0.50	0.06	Seed	3.05	5	0.030	24.61	0.77	0.03	0.18	0.11	2.43
												Seed	3.34	10	0.040	26.06	0.63	0.04	0.20	0.14	2.56

DITCH ANALYSIS

PID : 95639 **Date :** 11/13/2019 **Project :** FRA-70-22.61 **Location :** COLUMBUS, OHIO

Description : RAMP A1 NOISEWALL - RIGHT SIDE DITCH STA. 26+50 TO STA. 26+92 **Designer :** CDR

Rainfall Area : C

Allowable Shears

		Seed:	0.40	**Jute Mat:**	0.45	**Temporary Mat:**	1.00
	Permanent Mat	**Type 1:**	2.00	**Type 2:**	3.00	**Type 3:**	5.00
	RCP	**Type B:**	6.00				

(*) Warning: Grade is steeper than allowable. If value is parantheses, design parameters have been exceeded. - See user manual.

STATION BEGIN	STATION END	SIDE	LENGTH (ft.)	RADIUS WIDTH (ft.)	IN SLOPE (ft./ft.)	BACK SLOPE (ft./ft.)	GRADE (ft./ft.)	AREA (acres)	AREA SUM (acres)	RUNOFF COEFF.	CA (Sum)	PROTECT TYPE	RAIN INT. (in./hr.)	STORM FREQ. (yrs.)	MANN. COEFF.	TIME FLOW (min.)	VEL. FLOW (fps.)	SHEAR (lbs./ sq.ft.)	DESIGN FLOW (cfs.)	DEPTH FLOW (ft.)	WIDTH FLOW (ft.)
26+50	26+92	R	42.00	2.00	2.00	2.00	0.0188	0.01	0.01	0.50	0.01	Seed	3.86	5	0.030	16.11	0.61	0.03	0.03	0.02	2.09
												Seed	4.27	10	0.040	16.51	0.44	0.04	0.03	0.03	2.13

DITCH ANALYSIS

PID : 95639 **Date :** 11/13/2019 **Project :** FRA-70-22.61 **Location :** COLUMBUS, OHIO

Description : RAMP A1 NOISEWALL - RIGHT SIDE DITCH STA. 26+92 TO STA. 32+50 **Designer :** CDR

Rainfall Area : C

Allowable Shears

		Seed:	0.40	**Jute Mat:**	0.45	**Temporary Mat:**	1.00
	Permanent Mat	**Type 1:**	2.00	**Type 2:**	3.00	**Type 3:**	5.00
	RCP	**Type B:**	6.00				

(*) Warning: Grade is steeper than allowable. If value is parantheses, design parameters have been exceeded. - See user manual.

STATION BEGIN	STATION END	SIDE	LENGTH (ft.)	RADIUS WIDTH (ft.)	IN SLOPE (ft./ft.)	BACK SLOPE (ft./ft.)	GRADE (ft./ft.)	AREA (acres)	AREA SUM (acres)	RUNOFF COEFF.	CA (Sum)	PROTECT TYPE	RAIN INT. (in./hr.)	STORM FREQ. (yrs.)	MANN. COEFF.	TIME FLOW (min.)	VEL. FLOW (fps.)	SHEAR (lbs./ sq.ft.)	DESIGN FLOW (cfs.)	DEPTH FLOW (ft.)	WIDTH FLOW (ft.)
32+50	26+92	R	558.00	2.00	2.00	2.00	0.0086	0.14	0.14	0.50	0.07	Seed	3.10	5	0.030	23.90	0.95	0.05	0.21	0.10	2.41
												Seed	3.38	10	0.040	25.42	0.80	0.07	0.23	0.13	2.52

DITCH ANALYSIS

PID : 95639 **Date :** 11/13/2019 **Project :** FRA-70-22.61 **Location :** COLUMBUS, OHIO

Description : RAMP A1 NOISEWALL - RIGHT SIDE DITCH STA. 32+50 TO STA. 36+54.50 **Designer :** CDR

Rainfall Area : C

Allowable Shears

		Seed:	0.40	**Jute Mat:**	0.45	**Temporary Mat:**	1.00
	Permanent Mat	**Type 1:**	2.00	**Type 2:**	3.00	**Type 3:**	5.00
	RCP	**Type B:**	6.00				

(*) Warning: Grade is steeper than allowable. If value is parantheses, design parameters have been exceeded. - See user manual.

STATION BEGIN	STATION END	SIDE	LENGTH (ft.)	RADIUS WIDTH (ft.)	IN SLOPE (ft./ft.)	BACK SLOPE (ft./ft.)	GRADE (ft./ft.)	AREA (acres)	AREA SUM (acres)	RUNOFF COEFF.	CA (Sum)	PROTECT TYPE	RAIN INT. (in./hr.)	STORM FREQ. (yrs.)	MANN. COEFF.	TIME FLOW (min.)	VEL. FLOW (fps.)	SHEAR (lbs./ sq.ft.)	DESIGN FLOW (cfs.)	DEPTH FLOW (ft.)	WIDTH FLOW (ft.)
32+50	36+55	R	405.00	2.00	2.00	2.00	0.0060	0.10	0.10	0.50	0.05	Seed	3.16	5	0.030	23.14	0.77	0.04	0.16	0.10	2.39
												Seed	3.48	10	0.040	24.23	0.65	0.05	0.18	0.12	2.49

DITCH ANALYSIS

PID : 95639 **Date :** 11/13/2019 **Project :** FRA-70-22.61 **Location :** COLUMBUS, OHIO

Description : RAMP A1 NOISEWALL - RIGHT SIDE DITCH STA. 36+54.50 TO STA. 41+24 **Designer :** CDR

Rainfall Area : C

Allowable Shears

		Seed:	0.40	**Jute Mat:**	0.45	**Temporary Mat:**	1.00
	Permanent Mat	**Type 1:**	2.00	**Type 2:**	3.00	**Type 3:**	5.00
	RCP	**Type B:**	6.00				

(*) Warning: Grade is steeper than allowable. If value is parantheses, design parameters have been exceeded. - See user manual.

STATION BEGIN	STATION END	SIDE	LENGTH (ft.)	RADIUS WIDTH (ft.)	IN SLOPE (ft./ft.)	BACK SLOPE (ft./ft.)	GRADE (ft./ft.)	AREA (acres)	AREA SUM (acres)	RUNOFF COEFF.	CA (Sum)	PROTECT TYPE	RAIN INT. (in./hr.)	STORM FREQ. (yrs.)	MANN. COEFF.	TIME FLOW (min.)	VEL. FLOW (fps.)	SHEAR (lbs./ sq.ft.)	DESIGN FLOW (cfs.)	DEPTH FLOW (ft.)	WIDTH FLOW (ft.)
36+55	41+24	R	874.00	2.00	2.00	2.00	0.0073	0.12	0.12	0.50	0.06	Seed	2.66	5	0.030	30.63	0.82	0.04	0.16	0.09	2.37
												Seed	2.87	10	0.040	33.32	0.67	0.05	0.18	0.12	2.47

DITCH ANALYSIS

PID : 95639 **Date :** 11/13/2019 **Project :** FRA-70-22.61 **Location :** COLUMBUS, OHIO

Description : RAMP A1 NOISEWALL - RIGHT SIDE DITCH STA. 41+24 TO STA. 47+50 **Designer :** CDR

Rainfall Area : C

Allowable Shears

		Seed:	0.40	**Jute Mat:**	0.45	**Temporary Mat:**	1.00
	Permanent Mat	**Type 1:**	2.00	**Type 2:**	3.00	**Type 3:**	5.00
	RCP	**Type B:**	6.00				

(*) Warning: Grade is steeper than allowable. If value is parantheses, design parameters have been exceeded. - See user manual.

STATION BEGIN	STATION END	SIDE	LENGTH (ft.)	RADIUS WIDTH (ft.)	IN SLOPE (ft./ft.)	BACK SLOPE (ft./ft.)	GRADE (ft./ft.)	AREA (acres)	AREA SUM (acres)	RUNOFF COEFF.	CA (Sum)	PROTECT TYPE	RAIN INT. (in./hr.)	STORM FREQ. (yrs.)	MANN. COEFF.	TIME FLOW (min.)	VEL. FLOW (fps.)	SHEAR (lbs./ sq.ft.)	DESIGN FLOW (cfs.)	DEPTH FLOW (ft.)	WIDTH FLOW (ft.)
41+24	47+50	R	626.00	2.00	2.00	2.00	0.0050	0.14	0.14	0.50	0.07	Seed	2.87	5	0.030	27.10	0.78	0.04	0.21	0.12	2.47
												Seed	3.12	10	0.040	29.09	0.65	0.05	0.22	0.15	2.60

DITCH ANALYSIS

PID : 95639 **Date :** 11/13/2019 **Project :** FRA-70-22.61 **Location :** COLUMBUS, OHIO

Description : RAMP A1 NOISEWALL - RIGHT SIDE DITCH STA. 47+50 TO STA 51+00 **Designer :** CDR

Rainfall Area : C

Allowable Shears

		Seed:	0.40	**Jute Mat:**	0.45	**Temporary Mat:**	1.00
	Permanent Mat	**Type 1:**	2.00	**Type 2:**	3.00	**Type 3:**	5.00
	RCP	**Type B:**	6.00				

(*) Warning: Grade is steeper than allowable. If value is parantheses, design parameters have been exceeded. - See user manual.

STATION BEGIN	STATION END	SIDE	LENGTH (ft.)	RADIUS WIDTH (ft.)	IN SLOPE (ft./ft.)	BACK SLOPE (ft./ft.)	GRADE (ft./ft.)	AREA (acres)	AREA SUM (acres)	RUNOFF COEFF.	CA (Sum)	PROTECT TYPE	RAIN INT. (in./hr.)	STORM FREQ. (yrs.)	MANN. COEFF.	TIME FLOW (min.)	VEL. FLOW (fps.)	SHEAR (lbs./ sq.ft.)	DESIGN FLOW (cfs.)	DEPTH FLOW (ft.)	WIDTH FLOW (ft.)
47+50	51+00	R	350.00	2.00	2.00	2.00	0.0112	0.08	0.08	0.50	0.04	Seed	3.29	5	0.030	21.59	0.85	0.05	0.13	0.07	2.28
												Seed	3.66	10	0.040	22.18	0.75	0.06	0.14	0.09	2.34

DITCH ANALYSIS

PID : 95639 **Date :** 11/13/2019 **Project :** FRA-70-22.61 **Location :** COLUMBUS, OHIO

Description : RAMP A1 NOISEWALL - RIGHT SIDE DITCH STA. 51+00 TO STA. 52+00 **Designer :** CDR

Rainfall Area : C

Allowable Shears

		Seed:	0.40	**Jute Mat:**	0.45	**Temporary Mat:**	1.00
	Permanent Mat	**Type 1:**	2.00	**Type 2:**	3.00	**Type 3:**	5.00
	RCP	**Type B:**	6.00				

(*) Warning: Grade is steeper than allowable. If value is parantheses, design parameters have been exceeded. - See user manual.

STATION BEGIN	STATION END	SIDE	LENGTH (ft.)	RADIUS WIDTH (ft.)	IN SLOPE (ft./ft.)	BACK SLOPE (ft./ft.)	GRADE (ft./ft.)	AREA (acres)	AREA SUM (acres)	RUNOFF COEFF.	CA (Sum)	PROTECT TYPE	RAIN INT. (in./hr.)	STORM FREQ. (yrs.)	MANN. COEFF.	TIME FLOW (min.)	VEL. FLOW (fps.)	SHEAR (lbs./ sq.ft.)	DESIGN FLOW (cfs.)	DEPTH FLOW (ft.)	WIDTH FLOW (ft.)
52+00	51+00	R	100.00	2.00	2.00	2.00	0.0050	0.02	0.02	0.50	0.01	Seed	3.60	5	0.030	18.39	0.44	0.01	0.04	0.04	2.17
												Seed	3.91	10	0.040	19.65	0.38	0.02	0.04	0.05	2.21

DITCH ANALYSIS

PID : 95639 **Date :** 11/13/2019 **Project :** FRA-70-22.61 **Location :** COLUMBUS, OHIO

Description : RAMP A1 NOISEWALL - RIGHT SIDE DITCH STA. 52+00 TO STA. 54+00 **Designer :** CDR

Rainfall Area : C

Allowable Shears

		Seed:	0.40	**Jute Mat:**	0.45	**Temporary Mat:**	1.00
	Permanent Mat	**Type 1:**	2.00	**Type 2:**	3.00	**Type 3:**	5.00
	RCP	**Type B:**	6.00				

(*) Warning: Grade is steeper than allowable. If value is parantheses, design parameters have been exceeded. - See user manual.

STATION BEGIN	STATION END	SIDE	LENGTH (ft.)	RADIUS WIDTH (ft.)	IN SLOPE (ft./ft.)	BACK SLOPE (ft./ft.)	GRADE (ft./ft.)	AREA (acres)	AREA SUM (acres)	RUNOFF COEFF.	CA (Sum)	PROTECT TYPE	RAIN INT. (in./hr.)	STORM FREQ. (yrs.)	MANN. COEFF.	TIME FLOW (min.)	VEL. FLOW (fps.)	SHEAR (lbs./ sq.ft.)	DESIGN FLOW (cfs.)	DEPTH FLOW (ft.)	WIDTH FLOW (ft.)
52+00	54+00	R	200.00	2.00	2.00	2.00	0.0132	0.04	0.04	0.50	0.02	Seed	3.50	5	0.030	19.38	0.74	0.04	0.08	0.05	2.19
												Seed	3.90	10	0.040	19.75	0.61	0.05	0.08	0.06	2.26

DITCH ANALYSIS

PID : 95639 **Date :** 11/13/2019 **Project :** FRA-70-22.61 **Location :** COLUMBUS, OHIO

Description : RAMP A1 NOISEWALL - RIGHT SIDE DITCH STA. 54+00 TO STA. 54+75 **Designer :** CDR

Rainfall Area : C

Allowable Shears

		Seed:	0.40	**Jute Mat:**	0.45	**Temporary Mat:**	1.00
	Permanent Mat	**Type 1:**	2.00	**Type 2:**	3.00	**Type 3:**	5.00
	RCP	**Type B:**	6.00				

(*) Warning: Grade is steeper than allowable. If value is parantheses, design parameters have been exceeded. - See user manual.

STATION BEGIN	STATION END	SIDE	LENGTH (ft.)	RADIUS WIDTH (ft.)	IN SLOPE (ft./ft.)	BACK SLOPE (ft./ft.)	GRADE (ft./ft.)	AREA (acres)	AREA SUM (acres)	RUNOFF COEFF.	CA (Sum)	PROTECT TYPE	RAIN INT. (in./hr.)	STORM FREQ. (yrs.)	MANN. COEFF.	TIME FLOW (min.)	VEL. FLOW (fps.)	SHEAR (lbs./ sq.ft.)	DESIGN FLOW (cfs.)	DEPTH FLOW (ft.)	WIDTH FLOW (ft.)
54+75	54+00	R	75.00	2.00	2.00	2.00	0.0051	0.02	0.02	0.50	0.01	Seed	3.63	5	0.030	18.11	0.36	0.01	0.03	0.04	2.17
												Seed	4.03	10	0.040	18.51	0.40	0.01	0.04	0.04	2.17

DITCH ANALYSIS

PID : 95639 **Date :** 11/13/2019 **Project :** FRA-70-22.61 **Location :** COLUMBUS, OHIO

Description : RAMP A1 NOISEWALL - RIGHT SIDE DITCH STA. 54+75 TO STA. 58+50 **Designer :** CDR

Rainfall Area : C

Allowable Shears

		Seed:	0.40	**Jute Mat:**	0.45	**Temporary Mat:**	1.00
	Permanent Mat	**Type 1:**	2.00	**Type 2:**	3.00	**Type 3:**	5.00
	RCP	**Type B:**	6.00				

(*) Warning: Grade is steeper than allowable. If value is parantheses, design parameters have been exceeded. - See user manual.

STATION BEGIN	STATION END	SIDE	LENGTH (ft.)	RADIUS WIDTH (ft.)	IN SLOPE (ft./ft.)	BACK SLOPE (ft./ft.)	GRADE (ft./ft.)	AREA (acres)	AREA SUM (acres)	RUNOFF COEFF.	CA (Sum)	PROTECT TYPE	RAIN INT. (in./hr.)	STORM FREQ. (yrs.)	MANN. COEFF.	TIME FLOW (min.)	VEL. FLOW (fps.)	SHEAR (lbs./ sq.ft.)	DESIGN FLOW (cfs.)	DEPTH FLOW (ft.)	WIDTH FLOW (ft.)
54+75	58+50	R	375.00	2.00	2.00	2.00	0.0109	0.10	0.10	0.50	0.05	Seed	3.30	5	0.030	21.48	0.91	0.05	0.16	0.08	2.32
												Seed	3.65	10	0.040	22.31	0.78	0.07	0.18	0.10	2.41

DITCH ANALYSIS

PID : 95639 **Date :** 11/13/2019 **Project :** FRA-70-22.61 **Location :** COLUMBUS, OHIO

Description : RAMP A1 NOISEWALL - RIGHT SIDE DITCH STA. 58+50 TO STA. 59+60 **Designer :** CDR

Rainfall Area : C

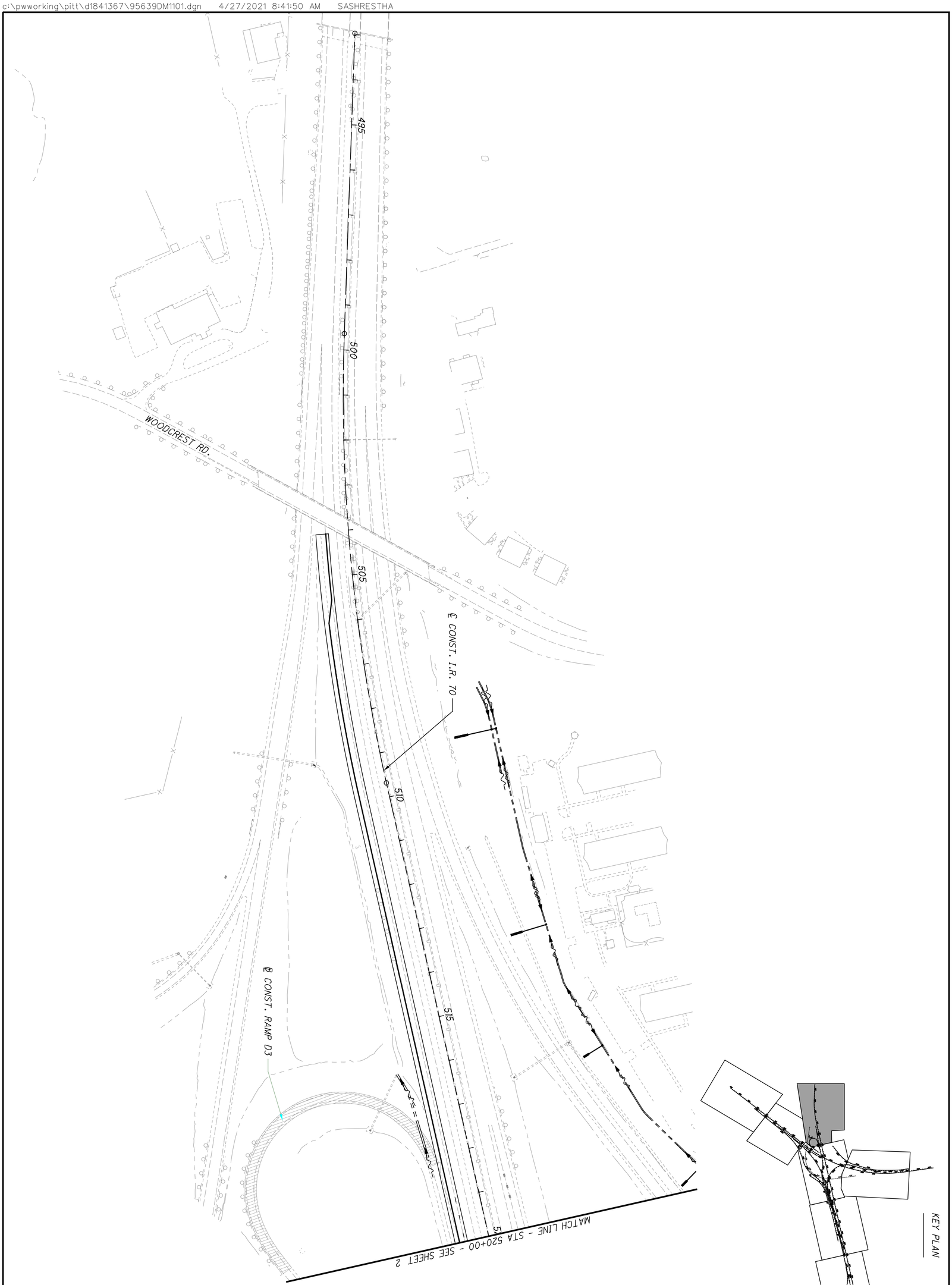
Allowable Shears

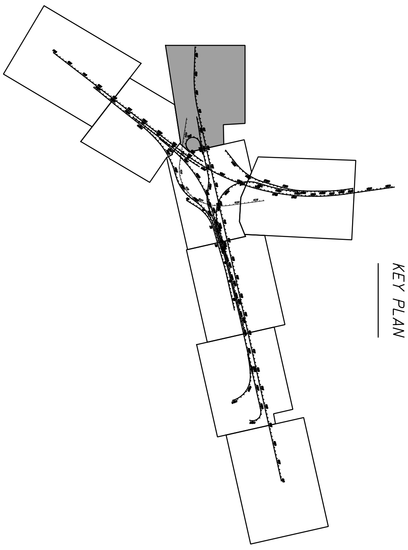
		Seed:	0.40	**Jute Mat:**	0.45	**Temporary Mat:**	1.00
	Permanent Mat	**Type 1:**	2.00	**Type 2:**	3.00	**Type 3:**	5.00
	RCP	**Type B:**	6.00				

(*) Warning: Grade is steeper than allowable. If value is parantheses, design parameters have been exceeded. - See user manual.

STATION BEGIN	STATION END	SIDE	LENGTH (ft.)	RADIUS WIDTH (ft.)	IN SLOPE (ft./ft.)	BACK SLOPE (ft./ft.)	GRADE (ft./ft.)	AREA (acres)	AREA SUM (acres)	RUNOFF COEFF.	CA (Sum)	PROTECT TYPE	RAIN INT. (in./hr.)	STORM FREQ. (yrs.)	MANN. COEFF.	TIME FLOW (min.)	VEL. FLOW (fps.)	SHEAR (lbs./ sq.ft.)	DESIGN FLOW (cfs.)	DEPTH FLOW (ft.)	WIDTH FLOW (ft.)
59+60	58+50	R	110.00	2.00	2.00	2.00	0.0393	0.03	0.03	0.50	0.01	Seed	3.73	5	0.030	17.18	0.95	0.07	0.05	0.03	2.11
												Seed	4.18	10	0.040	17.28	0.75	0.09	0.06	0.04	2.15

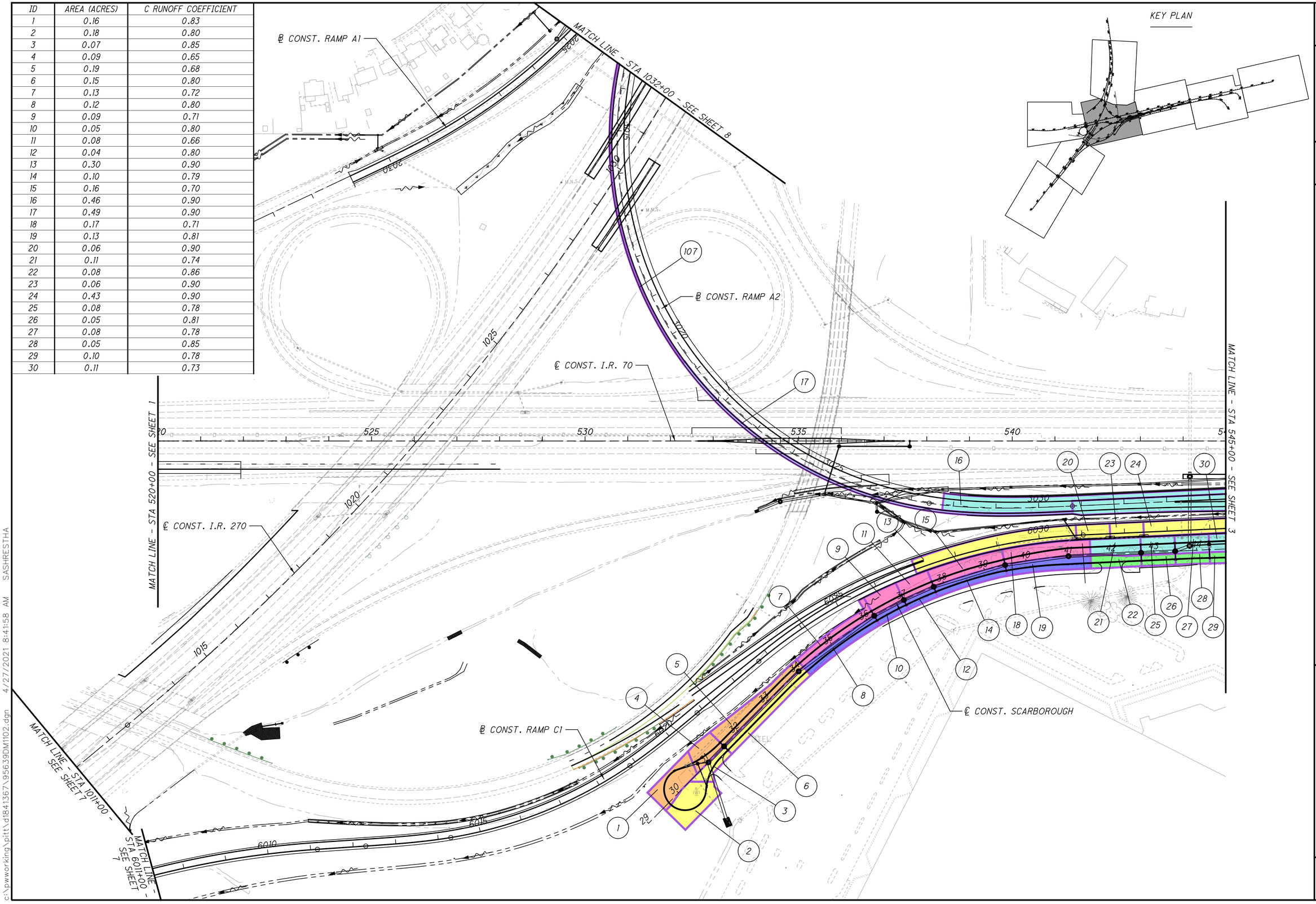
Appendix D – Inlet Spacing Calculations and Maps





8	FRA-70-22.61	DRAINAGE AREA MAP-INLET SPACING IR 70 STA. 493+00 TO STA. 520+00	CALCULATED REM CHECKED PHF	0 100 50 200 HORIZONTAL SCALE IN FEET

ID	AREA (ACRES)	C RUNOFF COEFFICIENT
1	0.16	0.83
2	0.18	0.80
3	0.07	0.85
4	0.09	0.65
5	0.19	0.68
6	0.15	0.80
7	0.13	0.72
8	0.12	0.80
9	0.09	0.71
10	0.05	0.80
11	0.08	0.66
12	0.04	0.80
13	0.30	0.90
14	0.10	0.79
15	0.16	0.70
16	0.46	0.90
17	0.49	0.90
18	0.17	0.71
19	0.13	0.81
20	0.06	0.90
21	0.11	0.74
22	0.08	0.86
23	0.06	0.90
24	0.43	0.90
25	0.08	0.78
26	0.05	0.81
27	0.08	0.78
28	0.05	0.85
29	0.10	0.78
30	0.11	0.73



c:\pwworking\pitt\d1841367\95639DM1102.dgn 4/27/2021 8:41:58 AM SASHRESTHA

HORIZONTAL SCALE IN FEET
0 50 100 200

CALCULATED REM
CHECKED PHF

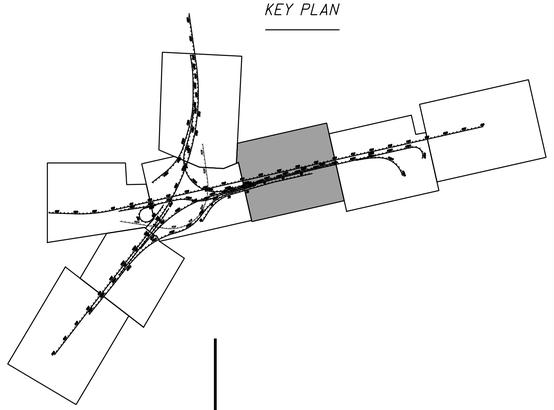
DRAINAGE AREA MAP-INLET SPACING
IR 70 STA. 520+00 TO STA. 545+00

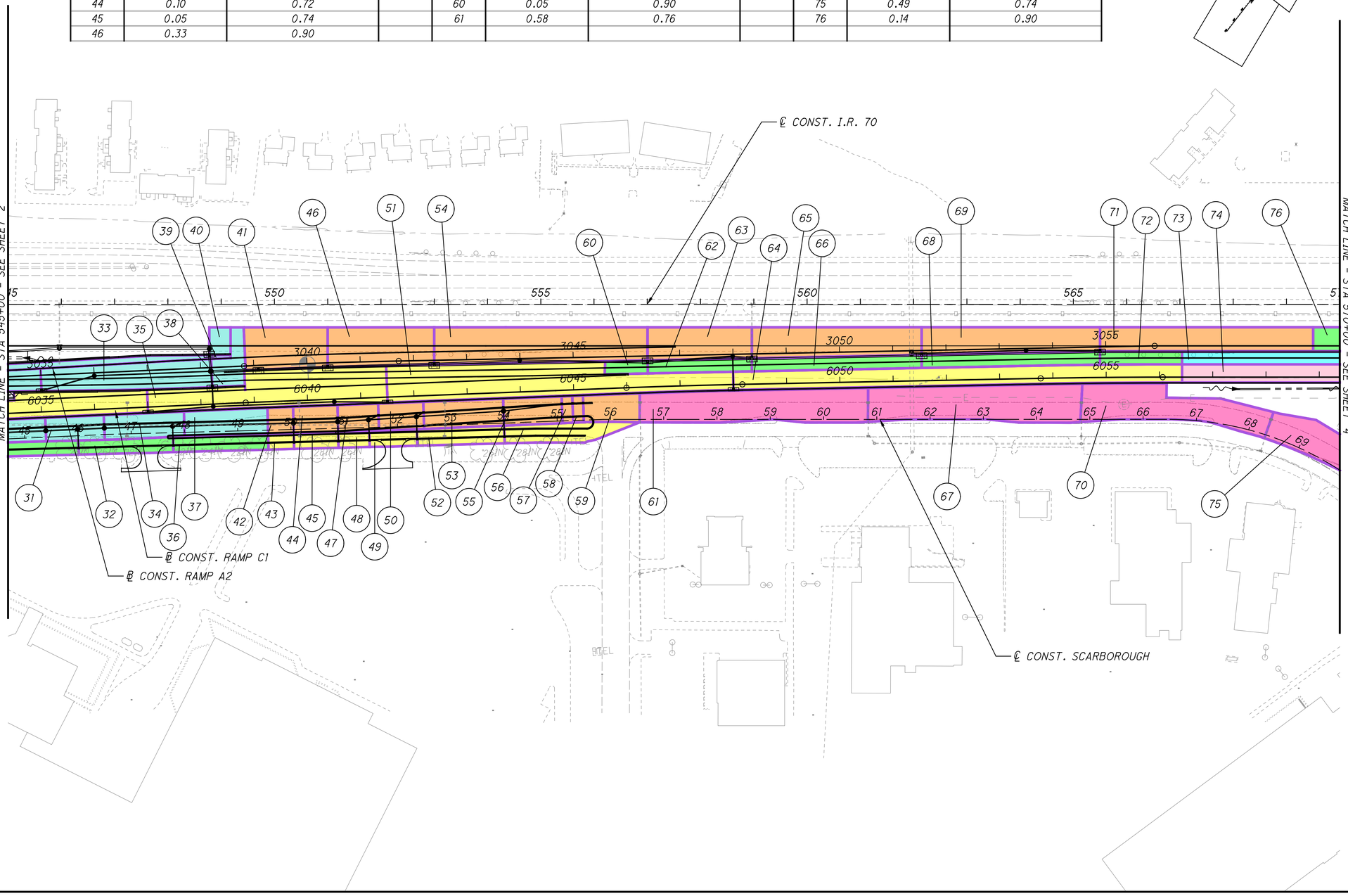
FRA-70-22.61

3
8

ID	AREA (ACRES)	C RUNOFF COEFFICIENT		ID	AREA (ACRES)	C RUNOFF COEFFICIENT		ID	AREA (ACRES)	C RUNOFF COEFFICIENT
31	0.11	0.79		47	0.09	0.78		62	0.11	0.90
32	0.11	0.81		48	0.04	0.77		63	0.27	0.90
33	0.36	0.90		49	0.06	0.79		64	0.66	0.90
34	0.16	0.75		50	0.10	0.81		65	0.40	0.90
35	0.61	0.90		51	0.81	0.90		66	0.18	0.90
36	0.12	0.77		52	0.12	0.83		67	0.60	0.71
37	0.17	0.80		53	0.17	0.80		68	0.19	0.90
38	0.14	0.90		54	0.60	0.90		69	0.37	0.90
39	0.01	0.90		55	0.13	0.79		70	0.46	0.74
40	0.05	0.90		56	0.17	0.82		71	0.41	0.90
41	0.25	0.90		57	0.02	0.87		72	0.09	0.90
42	0.06	0.73		58	0.02	0.87		73	0.21	0.90
43	0.03	0.97		59	0.12	0.80		74	0.29	0.90
44	0.10	0.72		60	0.05	0.90		75	0.49	0.74
45	0.05	0.74		61	0.58	0.76		76	0.14	0.90
46	0.33	0.90								

KEY PLAN





HORIZONTAL SCALE IN FEET
0 50 100 200

CALCULATED REM
CHECKED PHF

DRAINAGE AREA MAP-INLET SPACING
IR 70 STA. 545+00 TO STA. 570+00

FRA-70-22.61

3
8

DRAINAGE AREA MAP-INLET SPACING
IR 70 STA. 570+00 TO STA. 595+00

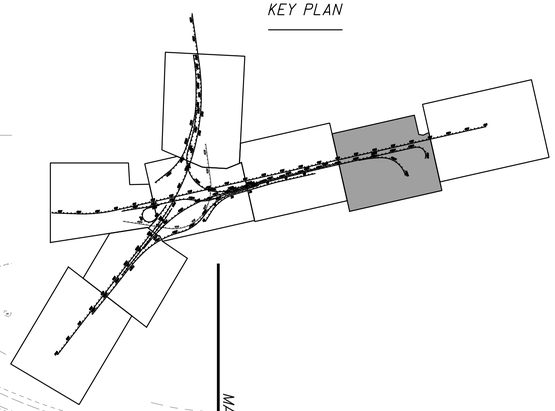
FRA-70-22.61

4
8

CALCULATED REM
CHECKED PHF

HORIZONTAL SCALE IN FEET
0 50 100 200

KEY PLAN



℄ CONST. I.R. 70

MATCH LINE – STA 570+00 – SEE SHEET 3

MATCH LINE – STA 595+00 – SEE SHEET 5

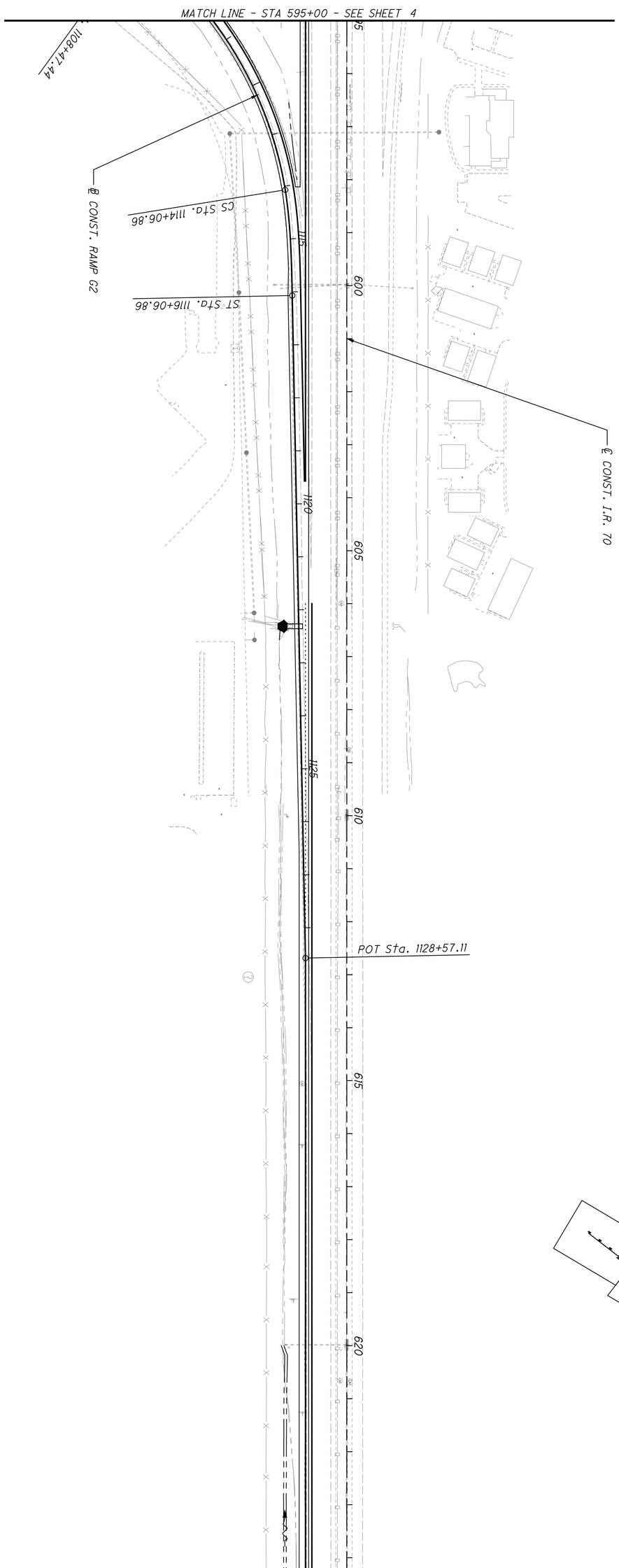
℄ CONST. RAMP C1

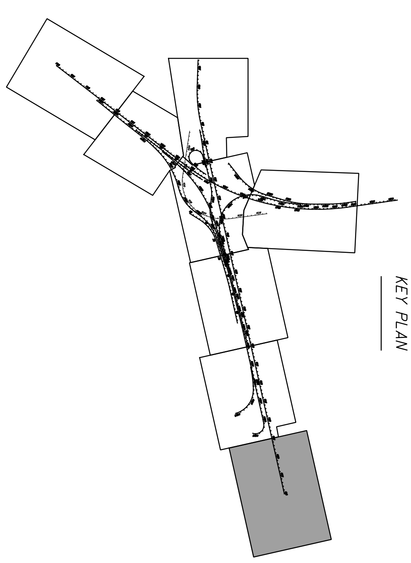
℄ CONST. RAMP G1

℄ CONST. RAMP G2

BRICE ROAD

ID	AREA (ACRES)	C RUNOFF COEFFICIENT
77	0.09	0.90
78	0.05	0.90
79	0.07	0.90
80	0.07	0.90
81	0.09	0.90
82	0.05	0.90
83	0.34	0.90
84	0.67	0.90
85	0.25	0.90
86	0.13	0.90
87	0.18	0.90
88	0.04	0.90
89	0.02	0.90
90	0.04	0.90
91	0.07	0.90
92	0.15	0.90
93	0.04	0.90
94		
95		
96	0.01	0.90
97	0.95	0.90
98	0.16	0.90

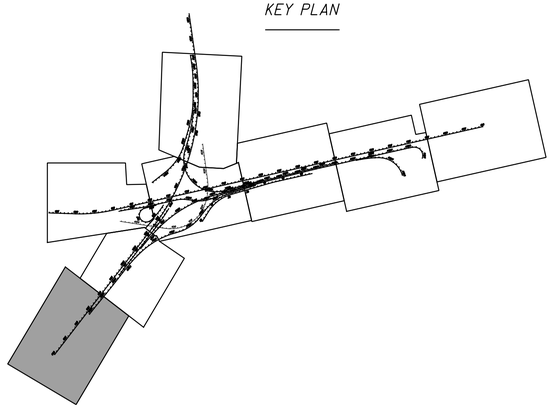


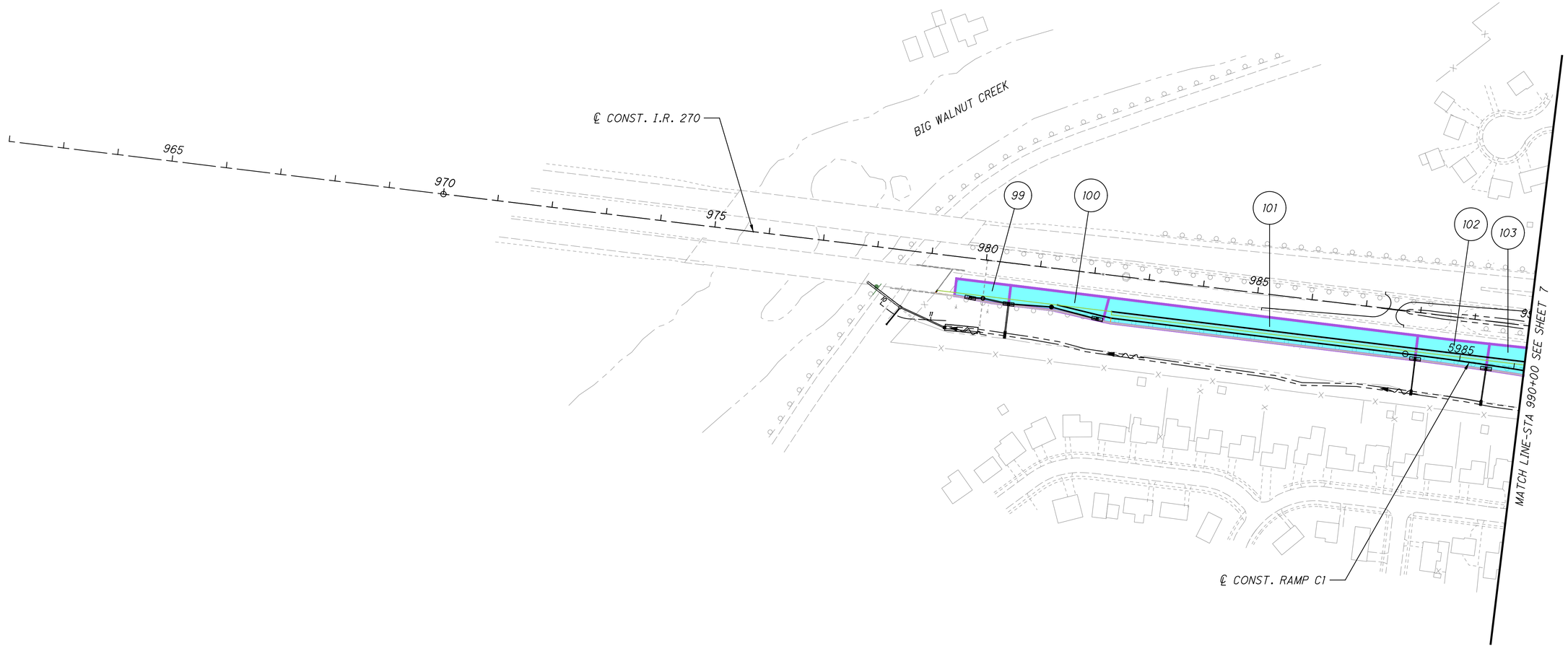


8 / 5	FRA-70-22.61	DRAINAGE AREA MAP-INLET SPACING IR 70 STA. 595+00 TO END	CALCULATED REM CHECKED PHF	0 50 100 200 HORIZONTAL SCALE IN FEET

ID	AREA (ACRES)	C RUNOFF COEFFICIENT
99	0.06	0.90
100	0.14	0.90
101	0.61	0.90
102	0.16	0.90
103	0.97	0.90

KEY PLAN





HORIZONTAL SCALE IN FEET
0 50 100 200

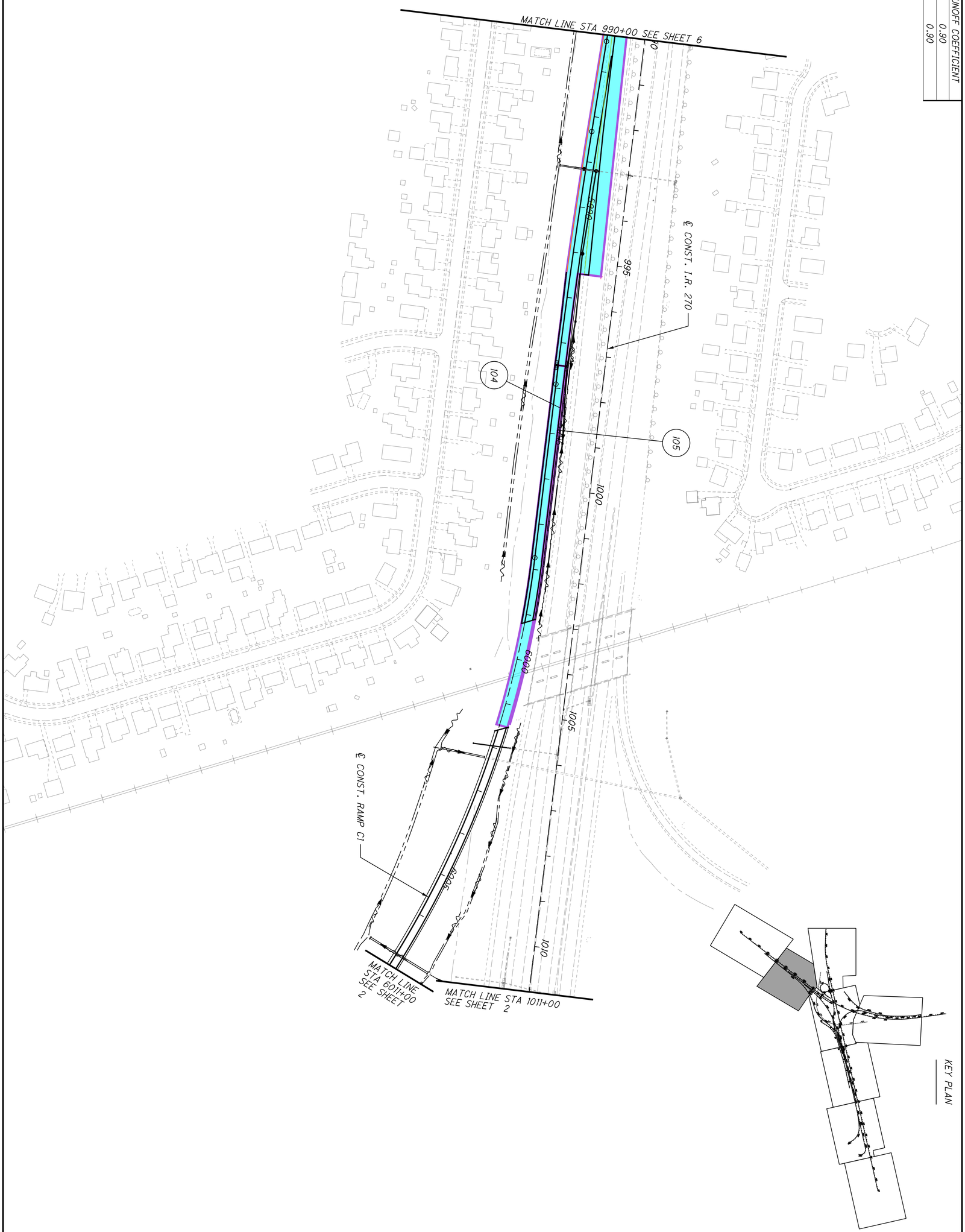
CALCULATED REM
CHECKED PHF

DRAINAGE AREA MAP-INLET SPACING
IR 270 STA. 970+00 TO 990+00

FRA-70-22.61

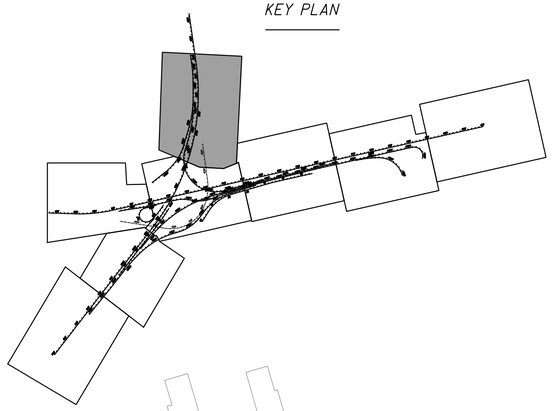
6
8

ID	AREA (ACRES)	C RUNOFF COEFFICIENT
104	0.44	0.90
105	0.07	0.90



7 / 8	FRA-70-22.61	DRAINAGE AREA MAP-INLET SPACING IR 270 STA. 990+00 TO 1011+00	CALCULATED REM CHECKED PHF	0 100 50 200 HORIZONTAL SCALE IN FEET

KEY PLAN



℄ CONST. RAMP A2

℄ CONST. RAMP A1

℄ CONST. I.R. 270

MATCH LINE STA 1032+00 SEE SHEET 2

106 107 107A 108 108A 109 110 111 112

3010 2020 3005 2015 3000 2010 2995 2990

1035 1040 1045 1050 1055 1060

ID	AREA (ACRES)	C RUNOFF COEFFICIENT
106	0.17	0.90
107	0.49	0.90
107A	0.08	0.90
108	0.28	0.90
108A	0.53	0.90
109	0.03	0.90
110	0.06	0.90
111	0.03	0.90
112	0.19	0.90

HORIZONTAL SCALE IN FEET
0 50 100 200

CALCULATED REM
CHECKED PHF

DRAINAGE AREA MAP-INLET SPACING
IR 270 STA. 1032+00 TO END

FRA-70-22.61

8
8

INLET SPACING DESIGN

PID : 95639 **Date :** 11/22/2019 **Project :** FRA-70-22.61 **Location :** COLUMBUS, OHIO

Description : RAMP A2 LT: 2995+90 TO 3011+55 **Designer :** CDR

Rainfall Area: C **Storm Frequency (yr.) :** 10 **Total Allow. Spread (ft.) :** 4.00 **Allowable Depth (ft.)** 0.50

STATION	C.B. Type	GUTTER LENGTH (ft.)	RUNOFF COEF	AREA (acres)	CONC. TIME (min.)	GUTTER TIME (min.)	TIME USED (min.)	LONG. SLOPE (ft./ft.)	GUTT. SLOPE (ft./ft.)	PAVT. SLOPE (ft./ft.)	GUTT. WIDTH (ft.)	LOCAL DEPRESS. (ft.)	RAIN FALL (in./hrs.)	INTERCPTD FLOW (cfs.)	BYPASS FLOW (cfs.)	TOTAL FLOW (cfs.)	DEPTH FLOW (ft.)	PAVT. SPREAD (ft.)
3011+55	Begin																	
3006+50	I-3D	505.00	0.90	0.17	1.00	3.08	10.00	0.0290	0.0400	0.0410	4.00	0.1667	5.32	0.82	0.00	0.82	0.139	3.47
3004+35	I-3D	215.00	0.90	0.03	1.00	2.83	10.00	0.0124	0.0400	0.0410	4.00	0.1667	5.32	0.13	0.00	0.13	0.083	2.07
2998+00	I-3C	635.00	0.90	0.06	1.00	12.31	13.31	0.0036	0.0400	0.0270	4.00	0.1667	4.73	0.24	0.00	0.24	0.129	3.24
2995+90	I-3C	210.00	0.90	0.03	1.00	4.51	10.00	0.0036	0.0400	0.0270	4.00	0.1667	5.32	0.13	0.00	0.13	0.103	2.58

INLET SPACING DESIGN

PID : 95639 **Date :** 04/19/2021 **Project :** FRA-70-22.61 **Location :** COLUMBUS, OHIO

Description : RAMP A2 RT: 3020+70 TO 3006+50 **Designer :** ARG

Rainfall Area: C **Storm Frequency (yr.) :** 10 **Total Allow. Spread (ft.) :** 10.00 **Allowable Depth (ft.)** 0.50

STATION	C.B. Type	GUTTER LENGTH (ft.)	RUNOFF COEF	RUNOFF AREA (acres)	CONC. TIME (min.)	GUTTER TIME (min.)	TIME USED (min.)	LONG. SLOPE (ft./ft.)	GUTT. SLOPE (ft./ft.)	PAVT. SLOPE (ft./ft.)	GUTT. WIDTH (ft.)	LOCAL DEPRESS. (ft.)	RAIN FALL (in./hrs.)	INTERCPTD FLOW (cfs.)	BYPASS FLOW (cfs.)	TOTAL FLOW (cfs.)	DEPTH FLOW (ft.)	PAVT. SPREAD (ft.)
3020+70	Begin																	
3006+03	I-3D	1467.00	0.90	0.49	1.00	7.68	10.00	0.0251	0.0400	0.0410	10.00	0.1667	5.32	1.73	0.60	2.33	0.211	5.27
3005+36	I-3D	67.00	0.90	0.08	1.00	0.48	10.00	0.0184	0.0400	0.0410	10.00	0.1667	5.32	0.97	0.00	0.97	0.161	4.02

INLET SPACING DESIGN

PID : 95639 **Date :** 06/07/2018 **Project :** FRA-70-22.61 **Location :** FRANKLIN COUNTY

Description : Ramp A2 3027+75-3038+58 Left of crown **Designer :** REW

Rainfall Area: C **Storm Frequency (yr.) :** 10 **Total Allow. Spread (ft.) :** 10.00 **Allowable Depth (ft.)** 0.50

STATION	C.B. Type	GUTTER LENGTH (ft.)	RUNOFF COEF	RUNOFF AREA (acres)	CONC. TIME (min.)	GUTTER TIME (min.)	TIME USED (min.)	LONG. SLOPE (ft./ft.)	GUTT. SLOPE (ft./ft.)	PAVT. SLOPE (ft./ft.)	GUTT. WIDTH (ft.)	LOCAL DEPRESS. (ft.)	RAIN FALL (in./hrs.)	INTERCPTD FLOW (cfs.)	BYPASS FLOW (cfs.)	TOTAL FLOW (cfs.)	DEPTH FLOW (ft.)	PAVT. SPREAD (ft.)	
3027+75	Begin																		
3038+18	I-3D	1043.00	0.90	0.46	1.00	15.29	16.28	0.0020	0.0400	0.0160	7.50	0.1667	4.30	******	******	1.78	0.306	7.90	Sag
3038+58	Begin																		
3038+18	I-3D	40.00	0.90	0.01	1.00	1.50	10.00	0.0020	0.0400	0.0160	7.50	0.1667	5.32	******	******	0.03	0.066	1.64	End

SUMP DATA

Total Flow (cfs) : 1.81 **Ponded Depth (ft.) :** 0.151 **Spread on Pavement (ft.) :** 2.43

INLET SPACING DESIGN

PID : 95639 **Date :** 04/20/2021 **Project :** FRA-70-22.61 **Location :** FRANKLIN COUNTY

Description : Ramp A2 3027+75-3038+85 right side of crown **Designer :** ARG

Rainfall Area: C **Storm Frequency (yr.) :** 10 **Total Allow. Spread (ft.) :** 10.00 **Allowable Depth (ft.)** 0.50

STATION	C.B. Type	GUTTER LENGTH (ft.)	RUNOFF COEF	RUNOFF AREA (acres)	CONC. TIME (min.)	GUTTER TIME (min.)	TIME USED (min.)	LONG. SLOPE (ft./ft.)	GUTT. SLOPE (ft./ft.)	PAVT. SLOPE (ft./ft.)	GUTT. WIDTH (ft.)	LOCAL DEPRESS. (ft.)	RAIN FALL (in./hrs.)	INTERCPTD FLOW (cfs.)	BYPASS FLOW (cfs.)	TOTAL FLOW (cfs.)	DEPTH FLOW (ft.)	PAVT. SPREAD (ft.)	
3027+75	Begin																		
3036+00	I-3D	825.00	0.90	0.49	1.00	11.28	12.28	0.0021	0.0400	0.0160	10.00	0.0417	4.90	2.01	0.16	2.18	0.327	8.18	
3038+20	I-3C	220.00	0.90	0.26	1.00	4.25	10.00	0.0010	0.0400	0.0160	10.00	0.0417	5.32	******	******	1.39	0.318	7.94	Sag
3038+85	Begin																		
3038+20	I-3C	65.00	0.90	0.14	1.00	1.44	10.00	0.0010	0.0400	0.0160	10.00	0.0417	5.32	******	******	0.67	0.242	6.05	End

SUMP DATA

Total Flow (cfs) : 2.06 **Ponded Depth (ft.) :** 0.164 **Spread on Pavement (ft.) :** 3.72

INLET SPACING DESIGN

PID : 95639 **Date :** 07/12/2018 **Project :** FRA-70-22.61 **Location :** FRANKLIN COUNTY

Description : Ramp C1 6001+40 - 5993+15 LT **Designer :** REW

Rainfall Area: C **Storm Frequency (yr.) :** 10 **Total Allow. Spread (ft.) :** 4.00 **Allowable Depth (ft.)** 0.50

STATION	C.B. Type	GUTTER LENGTH (ft.)	RUNOFF COEF	RUNOFF AREA (acres)	CONC. TIME (min.)	GUTTER TIME (min.)	TIME USED (min.)	LONG. SLOPE (ft./ft.)	GUTT. SLOPE (ft./ft.)	PAVT. SLOPE (ft./ft.)	GUTT. WIDTH (ft.)	LOCAL DEPRESS. (ft.)	RAIN FALL (in./hrs.)	INTERCPTD FLOW (cfs.)	BYPASS FLOW (cfs.)	TOTAL FLOW (cfs.)	DEPTH FLOW (ft.)	PAVT. SPREAD (ft.)
6001+40	Begin																	
5993+15	I-3D	825.00	0.90	0.08	1.00	10.89	11.89	0.0078	0.0400	0.0200	4.00	0.1667	4.96	0.35	0.00	0.35	0.129	3.22

INLET SPACING DESIGN

PID : 95639 **Date :** 04/20/2021 **Project :** FRA-70-22.61 **Location :** FRANKLIN COUNTY

Description : Ramp C1 6001+49 - 979+50 RT **Designer :** ARG

Rainfall Area: C **Storm Frequency (yr.) :** 10 **Total Allow. Spread (ft.) :** 8.00 **Allowable Depth (ft.)** 0.50

STATION	C.B. Type	GUTTER LENGTH (ft.)	RUNOFF COEF	AREA (acres)	CONC. TIME (min.)	GUTTER TIME (min.)	TIME USED (min.)	LONG. SLOPE (ft./ft.)	GUTT. SLOPE (ft./ft.)	PAVT. SLOPE (ft./ft.)	GUTT. WIDTH (ft.)	LOCAL DEPRESS. (ft.)	RAIN FALL (in./hrs.)	INTERCPTD FLOW (cfs.)	BYPASS FLOW (cfs.)	TOTAL FLOW (cfs.)	DEPTH FLOW (ft.)	PAVT. SPREAD (ft.)
6001+49	Begin																	
5993+50	I-3D	799.00	0.90	0.44	1.00	6.75	10.00	0.0078	0.0400	0.0200	6.00	0.0417	5.32	1.65	0.45	2.11	0.253	6.64
5985+50	I-3D	800.00	0.90	0.97	1.00	4.49	10.00	0.0128	0.0400	0.0330	8.00	0.0417	5.32	2.74	2.36	5.10	0.321	8.03
988+00	I-3D	131.00	0.90	0.14	1.00	0.83	10.00	0.0123	0.0400	0.0280	8.00	0.0417	5.32	1.96	1.06	3.02	0.266	6.65
982+14	I-3D	586.00	0.90	0.61	1.00	3.21	10.00	0.0142	0.0400	0.0200	8.00	0.0417	5.32	2.29	1.69	3.98	0.287	7.17
980+50	I-3D	164.00	0.90	0.14	1.00	1.08	10.00	0.0130	0.0400	0.0200	9.00	0.0417	5.32	1.64	0.72	2.36	0.240	5.99
979+79	I-3D	71.00	0.90	0.06	1.00	0.57	10.00	0.0130	0.0400	0.0200	5.00	0.0417	5.32	0.89	0.12	1.01	0.174	4.35

INLET SPACING DESIGN

PID : 95639 **Date :** 06/07/2018 **Project :** FRA-70-22.61 **Location :** FRANKLIN COUNTY

Description : Ramp C1 6021+79.43-6056+42.5 right side of crown 2/3 lanes & rt shldr **Designer :** REW

Rainfall Area: C **Storm Frequency (yr.) :** 10 **Total Allow. Spread (ft.) :** 10.00 **Allowable Depth (ft.)** 0.50

STATION	C.B. Type	GUTTER LENGTH (ft.)	RUNOFF COEF	RUNOFF AREA (acres)	CONC. TIME (min.)	GUTTER TIME (min.)	TIME USED (min.)	LONG. SLOPE (ft./ft.)	GUTT. SLOPE (ft./ft.)	PAVT. SLOPE (ft./ft.)	GUTT. WIDTH (ft.)	LOCAL DEPRESS. (ft.)	RAIN FALL (in./hrs.)	INTERCPTD FLOW (cfs.)	BYPASS FLOW (cfs.)	TOTAL FLOW (cfs.)	DEPTH FLOW (ft.)	PAVT. SPREAD (ft.)	
6027+00	Begin																		
6030+87	I-3D	387.00	0.90	0.30	1.00	3.94	10.00	0.0052	0.0400	0.0480	10.00	0.1667	5.32	1.45	0.00	1.45	0.237	5.94	
6031+66	I-3D	79.00	0.90	0.06	1.00	1.96	10.00	0.0013	0.0400	0.0230	10.00	0.1667	5.32	******	******	0.30	0.169	4.24	Sag
6056+42	Begin																		
6048+00	I-3D	842.00	0.90	0.66	1.00	8.54	10.00	0.0036	0.0400	0.0160	10.00	0.1667	5.32	2.78	0.37	3.15	0.340	8.50	
6041+50	I-3D	650.00	0.90	0.81	1.00	5.97	10.00	0.0036	0.0400	0.0160	10.00	0.1667	5.32	3.42	0.82	4.25	0.380	9.50	
6037+00	I-3D	450.00	0.90	0.61	1.00	2.98	10.00	0.0088	0.0400	0.0160	10.00	0.1667	5.32	2.75	1.00	3.74	0.307	7.67	
6032+45	I-3D	455.00	0.90	0.43	1.00	3.92	10.00	0.0052	0.0400	0.0160	10.00	0.1667	5.32	2.59	0.46	3.05	0.314	7.84	
6031+66	I-3D	79.00	0.90	0.06	1.00	1.62	10.00	0.0013	0.0400	0.0480	10.00	0.1667	5.32	******	******	0.76	0.241	6.02	End

SUMP DATA

Total Flow (cfs) : 1.05 **Ponded Depth (ft.) :** 0.105 **Spread on Pavement (ft.) :** 1.86

INLET SPACING DESIGN

PID : 95639 **Date :** 06/07/2018 **Project :** FRA-70-22.61 **Location :** FRANKLIN COUNTY

Description : Ramp/C1 lt of crown 6045.50+50-6056+42, makeshift lp with transitions **Designer :** REW

Rainfall Area: C **Storm Frequency (yr.) :** 10 **Total Allow. Spread (ft.) :** 10.00 **Allowable Depth (ft.)** 0.50

STATION	C.B. Type	GUTTER LENGTH (ft.)	RUNOFF COEF	RUNOFF AREA (acres)	CONC. TIME (min.)	GUTTER TIME (min.)	TIME USED (min.)	LONG. SLOPE (ft./ft.)	GUTT. SLOPE (ft./ft.)	PAVT. SLOPE (ft./ft.)	GUTT. WIDTH (ft.)	LOCAL DEPRESS. (ft.)	RAIN FALL (in./hrs.)	INTERCPTD FLOW (cfs.)	BYPASS FLOW (cfs.)	TOTAL FLOW (cfs.)	DEPTH FLOW (ft.)	PAVT. SPREAD (ft.)	
6056+42	Begin																		
6054+90	I-3C	152.00	0.90	0.09	1.00	2.38	10.00	0.0036	0.0400	0.0160	10.00	0.1667	5.32	0.42	0.00	0.42	0.160	3.99	
6051+54	I-3C	336.00	0.90	0.19	1.00	4.44	10.00	0.0036	0.0400	0.0160	10.00	0.1667	5.32	0.91	0.00	0.91	0.214	5.34	
6048+35	I-3C	319.00	0.90	0.18	1.00	4.26	10.00	0.0036	0.0400	0.0160	10.00	0.1667	5.32	0.87	0.00	0.87	0.209	5.23	
6046+40	I-3C	195.00	0.90	0.11	1.00	2.89	10.00	0.0036	0.0400	0.0160	10.00	0.1667	5.32	******	******	0.53	0.174	4.36	Sag
6045+59	Begin																		
6046+40	I-3C	81.00	0.90	0.04	1.00	1.52	10.00	0.0036	0.0400	0.0160	10.00	0.1667	5.32	******	******	0.19	0.120	2.99	End

SUMP DATA

Total Flow (cfs) : 0.73 **Ponded Depth (ft.) :** 0.082 **Spread on Pavement (ft.) :** 1.45

INLET SPACING DESIGN

PID : 95639 **Date :** 06/01/2018 **Project :** FRA-70-22.61 **Location :** FRANKLIN COUNTY

Description : Ramp C1 HP to HP 6056+42.50-6066+20.90 leftside of crown 1 lane & shldr **Designer :** REW

Rainfall Area: C **Storm Frequency (yr.) :** 10 **Total Allow. Spread (ft.) :** 10.00 **Allowable Depth (ft.)** 0.50

STATION	C.B. Type	GUTTER LENGTH (ft.)	RUNOFF COEF	RUNOFF AREA (acres)	CONC. TIME (min.)	GUTTER TIME (min.)	TIME USED (min.)	LONG. SLOPE (ft./ft.)	GUTT. SLOPE (ft./ft.)	PAVT. SLOPE (ft./ft.)	GUTT. WIDTH (ft.)	LOCAL DEPRESS. (ft.)	RAIN FALL (in./hrs.)	INTERCPTD FLOW (cfs.)	BYPASS FLOW (cfs.)	TOTAL FLOW (cfs.)	DEPTH FLOW (ft.)	PAVT. SPREAD (ft.)	
6056+42	Begin																		
6060+20	I-3C	378.00	0.90	0.21	1.00	4.51	10.00	0.0044	0.0400	0.0160	10.00	0.1667	5.32	1.03	0.00	1.03	0.215	5.37	
6061+03	I-3C	83.00	0.90	0.05	1.00	4.60	10.00	0.0002	0.0400	0.0160	10.00	0.1667	5.32	******	******	0.23	0.218	5.45	Sag
6066+21	Begin																		
6061+90	I-3C	431.00	0.90	0.25	1.00	5.17	10.00	0.0040	0.0400	0.0160	10.00	0.1667	5.32	1.19	0.00	1.19	0.231	5.78	
6061+03	I-3C	87.00	0.90	0.05	1.00	4.79	10.00	0.0002	0.0400	0.0160	10.00	0.1667	5.32	******	******	0.23	0.221	5.52	End

SUMP DATA

Total Flow (cfs) : 0.46 **Ponded Depth (ft.) :** 0.061 **Spread on Pavement (ft.) :** 1.07

INLET SPACING DESIGN

PID : 95639 **Date :** 06/01/2018 **Project :** FRA-70-22.61 **Location :** FRANKLIN COUNTY

Description : Ramp C1 HP to HP 6056+42.50-6066+20.90 right side of crown 2 lanes and rt shldr **Designer :** REW

Rainfall Area: C **Storm Frequency (yr.) :** 10 **Total Allow. Spread (ft.) :** 10.00 **Allowable Depth (ft.)** 0.50

STATION	C.B. Type	GUTTER LENGTH (ft.)	RUNOFF COEF	RUNOFF AREA (acres)	CONC. TIME (min.)	GUTTER TIME (min.)	TIME USED (min.)	LONG. SLOPE (ft./ft.)	GUTT. SLOPE (ft./ft.)	PAVT. SLOPE (ft./ft.)	GUTT. WIDTH (ft.)	LOCAL DEPRESS. (ft.)	RAIN FALL (in./hrs.)	INTERCPTD FLOW (cfs.)	BYPASS FLOW (cfs.)	TOTAL FLOW (cfs.)	DEPTH FLOW (ft.)	PAVT. SPREAD (ft.)	
6056+42	Begin																		
6060+20	I-3D	378.00	0.90	0.29	1.00	4.14	10.00	0.0044	0.0400	0.0160	10.00	0.1667	5.32	1.41	0.00	1.41	0.242	6.06	
6061+03	I-3D	83.00	0.90	0.07	1.00	4.23	10.00	0.0002	0.0400	0.0160	10.00	0.1667	5.32	******	******	0.31	0.246	6.14	Sag
6066+21	Begin																		
6061+90	I-3D	431.00	0.90	0.34	1.00	4.76	10.00	0.0040	0.0400	0.0160	10.00	0.1667	5.32	1.62	0.00	1.62	0.260	6.49	
6061+03	I-3D	87.00	0.90	0.07	1.00	4.41	10.00	0.0002	0.0400	0.0160	10.00	0.1667	5.32	******	******	0.32	0.249	6.22	End

SUMP DATA

Total Flow (cfs) : 0.64 **Ponded Depth (ft.) :** 0.075 **Spread on Pavement (ft.) :** 1.33

INLET SPACING DESIGN

PID : 95639 **Date :** 07/05/2018 **Project :** FRA-70-22.61 **Location :** FRANKLIN COUNTY

Description : Ramp C1 offramp to brice road, before wall ends sta 6066+21-6068+50 **Designer :** REW

Rainfall Area: C **Storm Frequency (yr.) :** 10 **Total Allow. Spread (ft.) :** 10.00 **Allowable Depth (ft.)** 0.50

STATION	C.B. Type	GUTTER LENGTH (ft.)	RUNOFF COEF	RUNOFF AREA (acres)	CONC. TIME (min.)	GUTTER TIME (min.)	TIME USED (min.)	LONG. SLOPE (ft./ft.)	GUTT. SLOPE (ft./ft.)	PAVT. SLOPE (ft./ft.)	GUTT. WIDTH (ft.)	LOCAL DEPRESS. (ft.)	RAIN FALL (in./hrs.)	INTERCPTD FLOW (cfs.)	BYPASS FLOW (cfs.)	TOTAL FLOW (cfs.)	DEPTH FLOW (ft.)	PAVT. SPREAD (ft.)
6066+21	Begin																	
6068+50	I-3D	229.00	0.90	0.18	1.00	2.75	10.00	0.0045	0.0400	0.0350	10.00	0.1667	5.32	0.88	0.00	0.88	0.202	5.05

INLET SPACING DESIGN

PID : 95639 **Date :** 07/05/2018 **Project :** FRA-70-22.61 **Location :** FRANKLIN COUNTY

Description : Ramp C1 & D2, before wall ends on C1 before gore sta 6021+79 - 6019+60 **Designer :** REW

Rainfall Area: C **Storm Frequency (yr.) :** 10 **Total Allow. Spread (ft.) :** 6.00 **Allowable Depth (ft.)** 0.50

STATION	C.B. Type	GUTTER LENGTH (ft.)	RUNOFF COEF	AREA (acres)	CONC. TIME (min.)	GUTTER TIME (min.)	TIME USED (min.)	LONG. SLOPE (ft./ft.)	GUTT. SLOPE (ft./ft.)	PAVT. SLOPE (ft./ft.)	GUTT. WIDTH (ft.)	LOCAL DEPRESS. (ft.)	RAIN FALL (in./hrs.)	INTERCPTD FLOW (cfs.)	BYPASS FLOW (cfs.)	TOTAL FLOW (cfs.)	DEPTH FLOW (ft.)	PAVT. SPREAD (ft.)
6021+79	Begin																	
6019+60	I-3D	219.00	0.90	0.13	1.00	1.76	10.00	0.0184	0.0337	0.0363	6.00	0.1667	5.32	0.60	0.00	0.60	0.126	3.74

INLET SPACING DESIGN

PID : 95639 **Date :** 08/21/2018 **Project :** FRA-70-22.61 **Location :** FRANKLIN COUNTY

Description : Ramp G1 8580+39 - 8582+66 LT **Designer :** REW

Rainfall Area: C **Storm Frequency (yr.) :** 10 **Total Allow. Spread (ft.) :** 10.00 **Allowable Depth (ft.)** 0.50

STATION	C.B. Type	GUTTER LENGTH (ft.)	RUNOFF COEF	RUNOFF AREA (acres)	CONC. TIME (min.)	GUTTER TIME (min.)	TIME USED (min.)	LONG. SLOPE (ft./ft.)	GUTT. SLOPE (ft./ft.)	PAVT. SLOPE (ft./ft.)	GUTT. WIDTH (ft.)	LOCAL DEPRESS. (ft.)	RAIN FALL (in./hrs.)	INTERCPTD FLOW (cfs.)	BYPASS FLOW (cfs.)	TOTAL FLOW (cfs.)	DEPTH FLOW (ft.)	PAVT. SPREAD (ft.)	
8580+39	Begin																		
8582+52	I-3C	213.00	0.90	0.13	1.00	2.80	10.00	0.0045	0.0400	0.0160	10.00	0.1667	5.32	******	******	0.62	0.177	4.44	Sag
8582+66	Begin																		
8582+52	I-3C	14.00	0.90	0.01	1.00	0.35	10.00	0.0045	0.0400	0.0160	10.00	0.1667	5.32	******	******	0.04	0.064	1.60	End

SUMP DATA

Total Flow (cfs) : 0.66 **Ponded Depth (ft.) :** 0.077 **Spread on Pavement (ft.) :** 1.36

INLET SPACING DESIGN

PID : 95639 **Date :** 08/21/2018 **Project :** FRA-70-22.61 **Location :** FRANKLIN COUNTY

Description : Ramp G1 8582+66 - 8584+53 LT **Designer :** REW

Rainfall Area: C **Storm Frequency (yr.) :** 10 **Total Allow. Spread (ft.) :** 10.00 **Allowable Depth (ft.)** 0.50

STATION	C.B. Type	GUTTER LENGTH (ft.)	RUNOFF COEF	AREA (acres)	CONC. TIME (min.)	GUTTER TIME (min.)	TIME USED (min.)	LONG. SLOPE (ft./ft.)	GUTT. SLOPE (ft./ft.)	PAVT. SLOPE (ft./ft.)	GUTT. WIDTH (ft.)	LOCAL DEPRESS. (ft.)	RAIN FALL (in./hrs.)	INTERCPTD FLOW (cfs.)	BYPASS FLOW (cfs.)	TOTAL FLOW (cfs.)	DEPTH FLOW (ft.)	PAVT. SPREAD (ft.)	
8582+66	Begin																		
8582+94	I-3C	28.00	0.90	0.02	1.00	0.58	10.00	0.0045	0.0400	0.0160	9.80	0.1667	5.32	0.09	0.00	0.09	0.084	2.11	
8583+54	I-3C	60.00	0.90	0.04	1.00	1.05	10.00	0.0045	0.0400	0.0160	9.40	0.1667	5.32	******	******	0.18	0.111	2.78	Sag
8584+53	Begin																		
8583+54	I-3C	99.00	0.90	0.04	1.00	1.71	10.00	0.0045	0.0400	0.0160	8.70	0.1667	5.32	******	******	0.20	0.115	2.88	End

SUMP DATA

Total Flow (cfs) : 0.38 **Ponded Depth (ft.) :** 0.053 **Spread on Pavement (ft.) :** 0.89

INLET SPACING DESIGN

PID : 95639 **Date :** 08/21/2018 **Project :** FRA-70-22.61 **Location :** FRANKLIN COUNTY

Description : Ramp G1 8584+53 - 8593+40 LT **Designer :** REW

Rainfall Area: C **Storm Frequency (yr.) :** 10 **Total Allow. Spread (ft.) :** 10.00 **Allowable Depth (ft.)** 0.50

STATION	C.B. Type	GUTTER LENGTH (ft.)	RUNOFF COEF	RUNOFF AREA (acres)	CONC. TIME (min.)	GUTTER TIME (min.)	TIME USED (min.)	LONG. SLOPE (ft./ft.)	GUTT. SLOPE (ft./ft.)	PAVT. SLOPE (ft./ft.)	GUTT. WIDTH (ft.)	LOCAL DEPRESS. (ft.)	RAIN FALL (in./hrs.)	INTERCPTD FLOW (cfs.)	BYPASS FLOW (cfs.)	TOTAL FLOW (cfs.)	DEPTH FLOW (ft.)	PAVT. SPREAD (ft.)	
8584+53	Begin																		
8584+82	I-3C	29.00	0.90	0.01	1.00	1.24	10.00	0.0013	0.0400	0.0160	8.50	0.1667	5.32	******	******	0.03	0.074	1.84	Sag
8593+40	Begin																		
8584+82	I-3C	858.00	0.90	0.17	1.00	19.67	20.67	0.0013	0.0400	0.0160	8.50	0.1667	3.80	******	******	0.57	0.216	5.40	End

SUMP DATA

Total Flow (cfs) : 0.60 **Ponded Depth (ft.) :** 0.072 **Spread on Pavement (ft.) :** 1.21

INLET SPACING DESIGN

PID : 95639 **Date :** 04/20/2021 **Project :** FRA-70-22.61 **Location :** FRANKLIN COUNTY

Description : IR 70 Rt of crown 549+50-569+50 A2 exit onto 70 **Designer :** ARG

Rainfall Area: C **Storm Frequency (yr.) :** 10 **Total Allow. Spread (ft.) :** 8.00 **Allowable Depth (ft.)** 0.50

STATION	C.B. Type	GUTTER LENGTH (ft.)	RUNOFF COEF	RUNOFF AREA (acres)	CONC. TIME (min.)	GUTTER TIME (min.)	TIME USED (min.)	LONG. SLOPE (ft./ft.)	GUTT. SLOPE (ft./ft.)	PAVT. SLOPE (ft./ft.)	GUTT. WIDTH (ft.)	LOCAL DEPRESS. (ft.)	RAIN FALL (in./hrs.)	INTERCPTD FLOW (cfs.)	BYPASS FLOW (cfs.)	TOTAL FLOW (cfs.)	DEPTH FLOW (ft.)	PAVT. SPREAD (ft.)
569+50	Begin																	
565+50	I-3C	400.00	0.90	0.41	1.00	5.40	10.00	0.0021	0.0400	0.0160	10.00	0.1667	5.32	1.98	0.00	1.98	0.316	7.89
562+15	I-3C	335.00	0.90	0.37	1.00	4.36	10.00	0.0024	0.0400	0.0160	8.00	0.1667	5.32	1.78	0.00	1.78	0.296	7.40
558+96	I-3C	319.00	0.90	0.40	1.00	4.20	10.00	0.0022	0.0400	0.0160	8.00	0.1667	5.32	1.92	0.00	1.92	0.310	7.74
557+00	I-3C	196.00	0.90	0.27	1.00	2.71	10.00	0.0024	0.0400	0.0200	8.00	0.1667	5.32	1.29	0.00	1.29	0.262	6.56
553+00	I-3C	400.00	0.90	0.60	1.00	4.81	10.00	0.0025	0.0400	0.0200	8.00	0.1667	5.32	2.72	0.18	2.90	0.352	9.62
551+00	I-3C	200.00	0.90	0.33	1.00	2.53	10.00	0.0025	0.0400	0.0200	8.00	0.1667	5.32	1.76	0.00	1.76	0.292	7.31
549+70	I-3C	130.00	0.90	0.25	1.00	1.78	10.00	0.0025	0.0400	0.0200	8.00	0.1667	5.32	1.20	0.00	1.20	0.253	6.33

INLET SPACING DESIGN

PID : 95639 **Date :** 06/01/2018 **Project :** FRA-70-22.61 **Location :** FRANKLIN COUNTY

Description : IR 70 569+50-591+00 Rt of 70 Crown against barrier **Designer :** REW

Rainfall Area: C **Storm Frequency (yr.) :** 10 **Total Allow. Spread (ft.) :** 10.00 **Allowable Depth (ft.)** 0.50

STATION	C.B. Type	GUTTER LENGTH (ft.)	RUNOFF COEF	RUNOFF AREA (acres)	CONC. TIME (min.)	GUTTER TIME (min.)	TIME USED (min.)	LONG. SLOPE (ft./ft.)	GUTT. SLOPE (ft./ft.)	PAVT. SLOPE (ft./ft.)	GUTT. WIDTH (ft.)	LOCAL DEPRESS. (ft.)	RAIN FALL (in./hrs.)	INTERCPTD FLOW (cfs.)	BYPASS FLOW (cfs.)	TOTAL FLOW (cfs.)	DEPTH FLOW (ft.)	PAVT. SPREAD (ft.)	
569+50	Begin																		
570+82	I-3C	132.00	0.90	0.14	1.00	2.65	10.00	0.0014	0.0400	0.0160	10.00	0.1667	5.32	0.65	0.00	0.65	0.225	5.61	
571+65	I-3C	83.00	0.90	0.09	1.00	1.64	10.00	0.0019	0.0400	0.0160	10.00	0.1667	5.32	0.41	0.00	0.41	0.179	4.47	
572+52	I-3C	87.00	0.90	0.09	1.00	1.85	10.00	0.0015	0.0400	0.0160	10.00	0.1667	5.32	0.43	0.00	0.43	0.189	4.72	
587+97	I-3C	1545.00	0.90	0.67	1.00	19.72	20.72	0.0024	0.0400	0.0160	10.00	0.1667	3.80	2.27	0.01	2.29	0.324	8.10	
579+39	I-3C	858.00	0.90	0.05	1.00	20.37	21.37	0.0027	0.0400	0.0160	10.00	0.1667	3.73	******	******	0.17	0.119	2.98	Sag
590+39	Begin																		
581+28	I-3C	911.00	0.90	0.95	1.00	6.91	10.00	0.0059	0.0400	0.0160	10.00	0.1667	5.32	3.32	1.22	4.54	0.356	8.89	
580+00	I-3C	128.00	0.90	0.15	1.00	1.38	10.00	0.0039	0.0400	0.0160	10.00	0.1667	5.32	1.91	0.01	1.92	0.278	6.94	
579+39	I-3C	61.00	0.90	0.07	1.00	1.12	10.00	0.0027	0.0400	0.0160	10.00	0.1667	5.32	******	******	0.33	0.154	3.84	End

SUMP DATA

Total Flow (cfs) : 0.49 **Ponded Depth (ft.) :** 0.063 **Spread on Pavement (ft.) :** 1.12

INLET SPACING DESIGN

PID : 95639 **Date :** 04/19/2021 **Project :** FRA-70-22.61 **Location :** COLUMBUS, OHIO

Description : IR 270 SB: 1038+75 TO 1050+10 LT **Designer :** ARG

Rainfall Area: C **Storm Frequency (yr.) :** 10 **Total Allow. Spread (ft.) :** 12.00 **Allowable Depth (ft.)** 0.50

STATION	C.B. Type	GUTTER LENGTH (ft.)	RUNOFF COEF	RUNOFF AREA (acres)	CONC. TIME (min.)	GUTTER TIME (min.)	TIME USED (min.)	LONG. SLOPE (ft./ft.)	GUTT. SLOPE (ft./ft.)	PAVT. SLOPE (ft./ft.)	GUTT. WIDTH (ft.)	LOCAL DEPRESS. (ft.)	RAIN FALL (in./hrs.)	INTERCPTD FLOW (cfs.)	BYPASS FLOW (cfs.)	TOTAL FLOW (cfs.)	DEPTH FLOW (ft.)	PAVT. SPREAD (ft.)
1038+75	Begin																	
1041+45	I-3C	270.00	0.90	0.29	1.00	3.04	10.00	0.0040	0.0400	0.0200	12.00	0.1667	5.32	1.39	0.00	1.39	0.245	6.13
1048+00	I-3C	655.00	0.90	0.52	1.00	6.64	10.00	0.0040	0.0400	0.0200	12.00	0.0417	5.32	2.07	0.42	2.49	0.305	7.63
1050+10	I-3C	210.00	0.90	0.19	1.00	2.42	10.00	0.0040	0.0400	0.0200	12.00	0.0417	5.32	1.26	0.07	1.33	0.241	6.03

INLET SPACING DESIGN

PID : 95639 **Date :** 01/16/2019 **Project :** FRA-70-22.61 **Location :** FRANKLIN COUNTY

Description : Scarborough cul de sac to high point at 34+15, Left Side **Designer :** REM

Rainfall Area: C **Storm Frequency (yr.) :** 5 **Total Allow. Spread (ft.) :** 7.50 **Allowable Depth (ft.)** 0.42

STATION	C.B. Type	GUTTER LENGTH (ft.)	RUNOFF COEF	RUNOFF AREA (acres)	CONC. TIME (min.)	GUTTER TIME (min.)	TIME USED (min.)	LONG. SLOPE (ft./ft.)	GUTT. SLOPE (ft./ft.)	PAVT. SLOPE (ft./ft.)	GUTT. WIDTH (ft.)	LOCAL DEPRESS. (ft.)	RAIN FALL (in./hrs.)	INTERCPTD FLOW (cfs.)	BYPASS FLOW (cfs.)	TOTAL FLOW (cfs.)	DEPTH FLOW (ft.)	PAVT. SPREAD (ft.)	
34+15	Begin																		
31+52	CB-3A	263.00	0.68	0.19	1.00	3.34	10.00	0.0072	0.0833	0.0156	1.50	0.0000	4.82	0.53	0.10	0.63	0.195	6.00	
30+70	CB-3	82.00	0.65	0.09	1.00	1.62	10.00	0.0030	0.0833	0.0156	1.50	0.0000	4.82	******	******	0.39	0.193	5.87	Sag
29+66	Begin																		
30+70	CB-3	143.70	0.83	0.16	1.00	2.66	10.00	0.0030	0.0833	0.0156	1.50	0.0000	4.82	******	******	0.62	0.219	7.54	End

SUMP DATA

Total Flow (cfs) : 1.01 **Ponded Depth (ft.) :** 0.089 **Spread on Pavement (ft.) :** 6.65

INLET SPACING DESIGN

PID : 95639 **Date :** 01/15/2019 **Project :** FRA-70-22.61 **Location :** FRANKLIN COUNTY

Description : Scarborough high point at 41+52 to high point at 34+15, Left Side **Designer :** REM

Rainfall Area: C **Storm Frequency (yr.) :** 5 **Total Allow. Spread (ft.) :** 7.50 **Allowable Depth (ft.)** 0.42

STATION	C.B. Type	GUTTER LENGTH (ft.)	RUNOFF COEF	RUNOFF AREA (acres)	CONC. TIME (min.)	GUTTER TIME (min.)	TIME USED (min.)	LONG. SLOPE (ft./ft.)	GUTT. SLOPE (ft./ft.)	PAVT. SLOPE (ft./ft.)	GUTT. WIDTH (ft.)	LOCAL DEPRESS. (ft.)	RAIN FALL (in./hrs.)	INTERCPTD FLOW (cfs.)	BYPASS FLOW (cfs.)	TOTAL FLOW (cfs.)	DEPTH FLOW (ft.)	PAVT. SPREAD (ft.)	
41+52	Begin																		
39+50	CB-3A	202.00	0.71	0.17	1.00	3.04	10.00	0.0050	0.0833	0.0156	1.50	0.0000	4.82	0.48	0.09	0.57	0.200	6.33	
37+75	CB-3A	175.00	0.70	0.16	1.00	2.60	10.00	0.0050	0.0833	0.0156	1.50	0.0000	4.82	0.51	0.11	0.62	0.205	6.62	
36+99	CB-3	76.00	0.66	0.08	1.00	1.51	10.00	0.0030	0.0833	0.0156	1.50	0.0000	4.82	******	******	0.36	0.189	5.59	Sag
34+15	Begin																		
36+20	CB-3A	205.00	0.72	0.13	1.00	3.18	10.00	0.0050	0.0833	0.0156	1.50	0.0000	4.82	0.39	0.04	0.43	0.186	5.39	
36+99	CB-3	79.00	0.71	0.09	1.00	1.59	10.00	0.0030	0.0833	0.0156	1.50	0.0000	4.82	******	******	0.33	0.185	5.36	End

SUMP DATA

Total Flow (cfs) : 0.69 **Ponded Depth (ft.) :** 0.059 **Spread on Pavement (ft.) :** 4.77

INLET SPACING DESIGN

PID : 95639 **Date :** 01/14/2019 **Project :** FRA-70-22.61 **Location :** FRANKLIN COUNTY

Description : Scarborough high point at 49+57 to high point at 41+52, Left Side **Designer :** REM

Rainfall Area: C **Storm Frequency (yr.) :** 5 **Total Allow. Spread (ft.) :** 7.50 **Allowable Depth (ft.)** 0.42

STATION	C.B. Type	GUTTER LENGTH (ft.)	RUNOFF COEF	RUNOFF AREA (acres)	CONC. TIME (min.)	GUTTER TIME (min.)	TIME USED (min.)	LONG. SLOPE (ft./ft.)	GUTT. SLOPE (ft./ft.)	PAVT. SLOPE (ft./ft.)	GUTT. WIDTH (ft.)	LOCAL DEPRESS. (ft.)	RAIN FALL (in./hrs.)	INTERCPTD FLOW (cfs.)	BYPASS FLOW (cfs.)	TOTAL FLOW (cfs.)	DEPTH FLOW (ft.)	PAVT. SPREAD (ft.)	
49+57	Begin																		
48+00	CB-3A	157.00	0.80	0.17	1.00	2.35	10.00	0.0048	0.0833	0.0156	1.50	0.0000	4.82	0.53	0.14	0.67	0.210	6.95	
46+50	CB-3A	150.00	0.75	0.16	1.00	2.23	10.00	0.0048	0.0833	0.0156	1.50	0.0000	4.82	0.56	0.16	0.72	0.214	7.18	
45+40	CB-3A	110.00	0.79	0.11	1.00	1.68	10.00	0.0048	0.0833	0.0156	1.50	0.0000	4.82	0.49	0.10	0.59	0.203	6.51	
44+30	CB-3A	110.00	0.73	0.11	1.00	1.72	10.00	0.0048	0.0833	0.0156	1.50	0.0000	4.82	0.43	0.06	0.49	0.193	5.84	
43+50	CB-3	80.00	0.78	0.08	1.00	1.60	10.00	0.0030	0.0833	0.0156	1.50	0.0000	4.82	******	******	0.35	0.188	5.53	Sag
41+52	Begin																		
42+70	CB-3A	118.00	0.74	0.11	1.00	1.89	10.00	0.0048	0.0833	0.0156	1.50	0.0000	4.82	0.36	0.03	0.39	0.181	5.08	
43+50	CB-3	80.00	0.78	0.08	1.00	1.61	10.00	0.0030	0.0833	0.0156	1.50	0.0000	4.82	******	******	0.32	0.183	5.21	End

SUMP DATA

Total Flow (cfs) : 0.67 **Ponded Depth (ft.) :** 0.057 **Spread on Pavement (ft.) :** 4.63

INLET SPACING DESIGN

PID : 95639 **Date :** 01/10/2019 **Project :** FRA-70-22.61 **Location :** FRANKLIN COUNTY

Description : Scarborough existing high point in curve to high point at 49+57, Left Side **Designer :** REM

Rainfall Area: C **Storm Frequency (yr.) :** 5 **Total Allow. Spread (ft.) :** 7.50 **Allowable Depth (ft.)** 0.42

STATION	C.B. Type	GUTTER LENGTH (ft.)	RUNOFF COEF	RUNOFF AREA (acres)	CONC. TIME (min.)	GUTTER TIME (min.)	TIME USED (min.)	LONG. SLOPE (ft./ft.)	GUTT. SLOPE (ft./ft.)	PAVT. SLOPE (ft./ft.)	GUTT. WIDTH (ft.)	LOCAL DEPRESS. (ft.)	RAIN FALL (in./hrs.)	INTERCPTD FLOW (cfs.)	BYPASS FLOW (cfs.)	TOTAL FLOW (cfs.)	DEPTH FLOW (ft.)	PAVT. SPREAD (ft.)	
72+00	Begin																		
68+35	CB-3	403.87	0.74	0.49	1.00	5.15	10.00	0.0047	0.0833	0.0156	1.50	0.0000	4.82	1.19	0.56	1.75	0.272	10.90	
64+85	CB-3	359.70	0.74	0.46	1.00	4.38	10.00	0.0047	0.0833	0.0156	1.50	0.0000	4.82	1.38	0.82	2.20	0.289	12.02	
60+85	CB-3	400.50	0.71	0.60	1.00	4.60	10.00	0.0047	0.0833	0.0156	1.50	0.0000	4.82	1.64	1.23	2.87	0.311	13.43	
56+55	CB-3	428.69	0.76	0.58	1.00	4.72	10.00	0.0048	0.0833	0.0156	1.50	0.0000	4.82	1.81	1.55	3.36	0.324	14.26	
55+50	CB-3A	105.00	0.80	0.13	1.00	1.48	10.00	0.0034	0.0833	0.0156	1.50	0.0000	4.82	1.05	0.98	2.03	0.296	12.44	
55+30	CB-3A	20.00	0.87	0.02	1.00	0.32	10.00	0.0034	0.0833	0.0156	1.50	0.0000	4.82	0.71	0.36	1.07	0.249	9.44	
55+10	CB-3A	20.00	0.87	0.02	1.00	0.37	10.00	0.0034	0.0833	0.0156	1.50	0.0000	4.82	0.40	0.06	0.46	0.199	6.23	
54+00	CB-3A	110.00	0.79	0.13	1.00	1.60	10.00	0.0055	0.0833	0.0156	1.50	0.0000	4.82	0.47	0.08	0.54	0.195	5.98	
52+50	CB-3A	150.00	0.80	0.17	1.00	2.09	10.00	0.0055	0.0833	0.0156	1.50	0.0000	4.82	0.58	0.17	0.75	0.212	7.10	
51+65	CB-3A	85.00	0.81	0.10	1.00	1.31	10.00	0.0048	0.0833	0.0156	1.50	0.0000	4.82	0.47	0.09	0.55	0.200	6.28	
50+88	CB-3	77.00	0.78	0.09	1.00	1.50	10.00	0.0030	0.0833	0.0156	1.50	0.0000	4.82	******	******	0.43	0.198	6.18	Sag
49+56	Begin																		
50+05	CB-3A	49.00	0.73	0.06	1.00	1.02	10.00	0.0030	0.0833	0.0156	1.50	0.0000	4.82	0.19	0.00	0.19	0.159	3.66	
50+88	CB-3	83.00	0.72	0.10	1.00	1.66	10.00	0.0030	0.0833	0.0156	1.50	0.0000	4.82	******	******	0.34	0.186	5.40	End

INLET SPACING DESIGN

STATION	C.B. Type	GUTTER LENGTH (ft.)	RUNOFF COEF	AREA (acres)	CONC. TIME (min.)	GUTTER TIME (min.)	TIME USED (min.)	LONG. SLOPE (ft./ft.)	GUTT. SLOPE (ft./ft.)	PAVT. SLOPE (ft./ft.)	GUTT. WIDTH (ft.)	LOCAL DEPRESS. (ft.)	RAIN FALL (in./hrs.)	INTERCPTD FLOW (cfs.)	BYPASS FLOW (cfs.)	TOTAL FLOW (cfs.)	DEPTH FLOW (ft.)	PAVT. SPREAD (ft.)

SUMP DATA

Total Flow (cfs) : 0.76 **Ponded Depth (ft.) :** 0.066 **Spread on Pavement (ft.) :** 5.22

INLET SPACING DESIGN

PID : 95639 **Date :** 01/16/2019 **Project :** FRA-70-22.61 **Location :** FRANKLIN COUNTY

Description : Scarborough Cul de sac 29+66 - high point 34+15, Right side **Designer :** REM

Rainfall Area: C **Storm Frequency (yr.) :** 5 **Total Allow. Spread (ft.) :** 7.50 **Allowable Depth (ft.)** 0.42

STATION	C.B. Type	GUTTER LENGTH (ft.)	RUNOFF COEF	RUNOFF AREA (acres)	CONC. TIME (min.)	GUTTER TIME (min.)	TIME USED (min.)	LONG. SLOPE (ft./ft.)	GUTT. SLOPE (ft./ft.)	PAVT. SLOPE (ft./ft.)	GUTT. WIDTH (ft.)	LOCAL DEPRESS. (ft.)	RAIN FALL (in./hrs.)	INTERCPTD FLOW (cfs.)	BYPASS FLOW (cfs.)	TOTAL FLOW (cfs.)	DEPTH FLOW (ft.)	PAVT. SPREAD (ft.)	
34+15	Begin																		
31+52	CB-3A	263.00	0.80	0.15	1.00	3.36	10.00	0.0072	0.0833	0.0156	1.50	0.0000	4.82	0.50	0.09	0.59	0.192	5.81	
30+64	CB-3	92.70	0.85	0.07	1.00	1.84	10.00	0.0030	0.0833	0.0156	1.50	0.0000	4.82	******	******	0.37	0.191	5.73	Sag
29+66	Begin																		
30+64	CB-3	133.08	0.80	0.18	1.00	2.42	10.00	0.0030	0.0833	0.0156	1.50	0.0000	4.82	******	******	0.69	0.225	7.92	End

SUMP DATA

Total Flow (cfs) : 1.06 **Ponded Depth (ft.) :** 0.093 **Spread on Pavement (ft.) :** 6.91

INLET SPACING DESIGN

PID : 95639 **Date :** 01/16/2019 **Project :** FRA-70-22.61 **Location :** FRANKLIN COUNTY

Description : Scarborough high point 34+15 - high point 41+52, Right side **Designer :** REM

Rainfall Area: C **Storm Frequency (yr.) :** 5 **Total Allow. Spread (ft.) :** 7.50 **Allowable Depth (ft.)** 0.42

STATION	C.B. Type	GUTTER LENGTH (ft.)	RUNOFF COEF	RUNOFF AREA (acres)	CONC. TIME (min.)	GUTTER TIME (min.)	TIME USED (min.)	LONG. SLOPE (ft./ft.)	GUTT. SLOPE (ft./ft.)	PAVT. SLOPE (ft./ft.)	GUTT. WIDTH (ft.)	LOCAL DEPRESS. (ft.)	RAIN FALL (in./hrs.)	INTERCPTD FLOW (cfs.)	BYPASS FLOW (cfs.)	TOTAL FLOW (cfs.)	DEPTH FLOW (ft.)	PAVT. SPREAD (ft.)	
34+15	Begin																		
36+20	CB-3A	205.00	0.80	0.12	1.00	3.17	10.00	0.0050	0.0833	0.0156	1.50	0.0000	4.82	0.41	0.05	0.46	0.189	5.58	
36+99	CB-3	79.00	0.80	0.05	1.00	1.63	10.00	0.0030	0.0833	0.0156	1.50	0.0000	4.82	******	******	0.22	0.166	4.10	Sag
41+52	Begin																		
39+50	CB-3A	202.00	0.81	0.13	1.00	3.07	10.00	0.0050	0.0833	0.0156	1.50	0.0000	4.82	0.45	0.07	0.52	0.195	6.01	
37+75	CB-3A	175.00	0.79	0.10	1.00	2.70	10.00	0.0050	0.0833	0.0156	1.50	0.0000	4.82	0.41	0.05	0.46	0.189	5.60	
36+99	CB-3	76.00	0.80	0.04	1.00	1.57	10.00	0.0030	0.0833	0.0156	1.50	0.0000	4.82	******	******	0.22	0.165	4.06	End

SUMP DATA

Total Flow (cfs) : 0.44 **Ponded Depth (ft.) :** 0.033 **Spread on Pavement (ft.) :** 3.07

INLET SPACING DESIGN

PID : 95639 **Date :** 01/17/2019 **Project :** FRA-70-22.61 **Location :** FRANKLIN COUNTY

Description : Scarborough high point 41+52 - high point 49+57, Right side **Designer :** REM

Rainfall Area: C **Storm Frequency (yr.) :** 5 **Total Allow. Spread (ft.) :** 7.50 **Allowable Depth (ft.)** 0.42

STATION	C.B. Type	GUTTER LENGTH (ft.)	RUNOFF COEF	RUNOFF AREA (acres)	CONC. TIME (min.)	GUTTER TIME (min.)	TIME USED (min.)	LONG. SLOPE (ft./ft.)	GUTT. SLOPE (ft./ft.)	PAVT. SLOPE (ft./ft.)	GUTT. WIDTH (ft.)	LOCAL DEPRESS. (ft.)	RAIN FALL (in./hrs.)	INTERCPTD FLOW (cfs.)	BYPASS FLOW (cfs.)	TOTAL FLOW (cfs.)	DEPTH FLOW (ft.)	PAVT. SPREAD (ft.)	
41+52	Begin																		
42+70	CB-3A	118.00	0.86	0.08	1.00	1.91	10.00	0.0048	0.0833	0.0156	1.50	0.0000	4.82	0.31	0.01	0.32	0.171	4.48	
43+50	CB-3	80.00	0.81	0.05	1.00	1.66	10.00	0.0030	0.0833	0.0156	1.50	0.0000	4.82	******	******	0.20	0.159	3.69	Sag
49+57	Begin																		
47+78	CB-3A	179.00	0.77	0.12	1.00	2.83	10.00	0.0048	0.0833	0.0156	1.50	0.0000	4.82	0.39	0.04	0.43	0.187	5.46	
46+00	CB-3A	178.00	0.81	0.11	1.00	2.79	10.00	0.0048	0.0833	0.0156	1.50	0.0000	4.82	0.42	0.06	0.48	0.192	5.77	
44+30	CB-3A	170.00	0.78	0.10	1.00	2.68	10.00	0.0048	0.0833	0.0156	1.50	0.0000	4.82	0.40	0.05	0.44	0.188	5.54	
43+50	CB-3	80.00	0.85	0.05	1.00	1.65	10.00	0.0030	0.0833	0.0156	1.50	0.0000	4.82	******	******	0.24	0.169	4.31	End

SUMP DATA

Total Flow (cfs) : 0.43 **Ponded Depth (ft.) :** 0.032 **Spread on Pavement (ft.) :** 3.00

INLET SPACING DESIGN

PID : 95639 **Date :** 01/17/2019 **Project :** FRA-70-22.61 **Location :** FRANKLIN COUNTY

Description : Scarborough high point 49+57 - high point 56+55, Right side **Designer :** REM

Rainfall Area: C **Storm Frequency (yr.) :** 5 **Total Allow. Spread (ft.) :** 7.50 **Allowable Depth (ft.)** 0.42

STATION	C.B. Type	GUTTER LENGTH (ft.)	RUNOFF COEF	RUNOFF AREA (acres)	CONC. TIME (min.)	GUTTER TIME (min.)	TIME USED (min.)	LONG. SLOPE (ft./ft.)	GUTT. SLOPE (ft./ft.)	PAVT. SLOPE (ft./ft.)	GUTT. WIDTH (ft.)	LOCAL DEPRESS. (ft.)	RAIN FALL (in./hrs.)	INTERCPTD FLOW (cfs.)	BYPASS FLOW (cfs.)	TOTAL FLOW (cfs.)	DEPTH FLOW (ft.)	PAVT. SPREAD (ft.)	
49+57	Begin																		
50+05	CB-3A	48.00	0.97	0.03	1.00	1.00	10.00	0.0030	0.0833	0.0156	1.50	0.0000	4.82	0.14	0.00	0.14	0.145	2.77	
50+88	CB-3	83.00	0.74	0.05	1.00	1.72	10.00	0.0030	0.0833	0.0156	1.50	0.0000	4.82	******	******	0.19	0.158	3.64	Sag
56+55	Begin																		
54+00	CB-3A	151.40	0.82	0.17	1.00	2.14	10.00	0.0055	0.0833	0.0156	1.50	0.0000	4.82	0.54	0.13	0.67	0.206	6.71	
52+36	CB-3A	164.00	0.83	0.12	1.00	2.35	10.00	0.0055	0.0833	0.0156	1.50	0.0000	4.82	0.51	0.11	0.61	0.201	6.39	
51+47	CB-3A	89.00	0.79	0.06	1.00	1.62	10.00	0.0037	0.0833	0.0156	1.50	0.0000	4.82	0.32	0.02	0.35	0.182	5.15	
50+88	CB-3	59.00	0.77	0.04	1.00	1.23	10.00	0.0030	0.0833	0.0156	1.50	0.0000	4.82	******	******	0.17	0.152	3.21	End

SUMP DATA

Total Flow (cfs) : 0.36 **Ponded Depth (ft.) :** 0.022 **Spread on Pavement (ft.) :** 2.38

Project: FRA-70-22.61
Subject: DRAINAGE
Task: SCUPPER CALCULATIONS
Job #: 95639

Computed by: McNutt, Rachael Date:12/06/2019
Checked by: Beal, Steve Date:01/10/2020
Workbook: 95639_Spread and Scupper Bypass_ODOT.xls, Ramp A2

Spread and Scupper Bypass
RAMP A2

	Criteria	Notes
Rainfall Area	C	
Design Storm	10	

Allowable Spread: 14 — Per L&D Vol II, Table 1103-1, not into travelled lane. Lanes have curve widening so an additional 2' available +12' shoulder.

LEFT	Station* (ft)	Elevation (ft)		Longitudinal Slope S (ft/ft)	Contributing Drainage Width (ft)	Area A (acres)	intensity** i (in/hr)	Gutter Flow Q (cfs)	Cross Slope S_x (ft/ft)	Spread T (ft)	Grate Width W (ft)	Efficiency E	Bypass Flow Q_b (cfs)
Begin	3020+70	840.01											
Scupper	3011+55	812.34		0.03024	42.0	0.882	5.3	4.22	0.0600	4.9	3.98	0.99	0.05

Allowable Spread: 14 — Per L&D Vol II, Table 1103-1, not into travelled lane. Lanes have curve widening so an additional 2' available +12' shoulder.

LEFT	Station* (ft)	Elevation (ft)		Longitudinal Slope S (ft/ft)	Contributing Drainage Width (ft)	Area A (acres)	intensity** i (in/hr)	Gutter Flow Q (cfs)	Cross Slope S_x (ft/ft)	Spread T (ft)	Grate Width W (ft)	Efficiency E	Bypass Flow Q_b (cfs)
Begin	3020+70	840.06											
Scupper	3027+80	821.48		0.02617	42.0	0.685	5.3	3.28	0.0600	4.6	3.98	0.99	0.02

Notes:
= input required
* i.e.; enter 22+50 as 2250
** see L&D Vol. 2 Fig. 1101-2 & 1101-3

Equations:

$$Q = ciA$$

where c=0.9

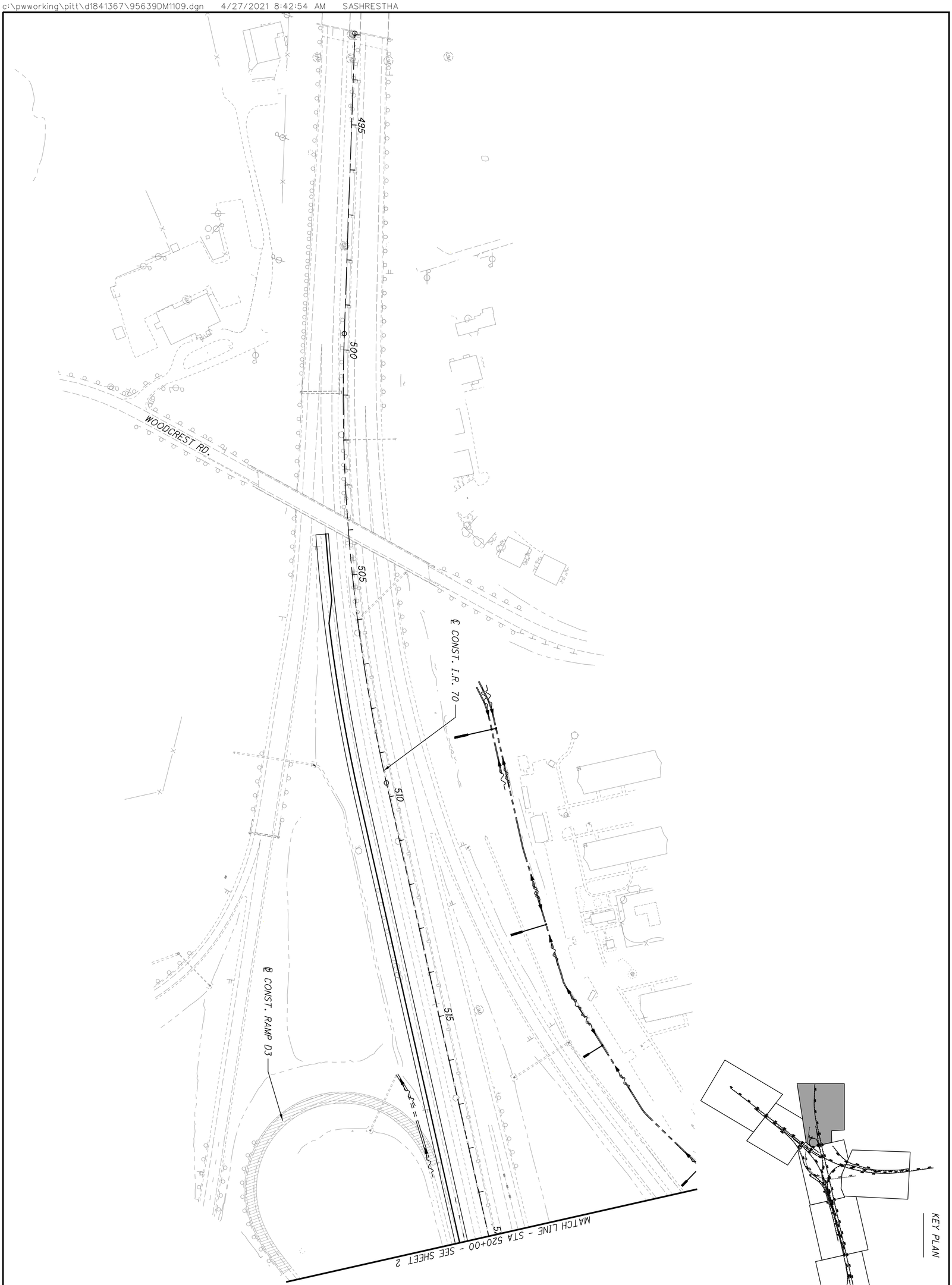
$$E = 1 - \left(1 - \frac{W}{T}\right)^{2.67}$$

$$Q_b = Q(1 - E)$$

$$T = \left(\frac{Qn}{0.56\, S_x^{1.67} S^{0.5}}\right)^{0.375}$$

where n=0.015

Appendix E – Storm Sewer Calculations and Maps



8 | 1

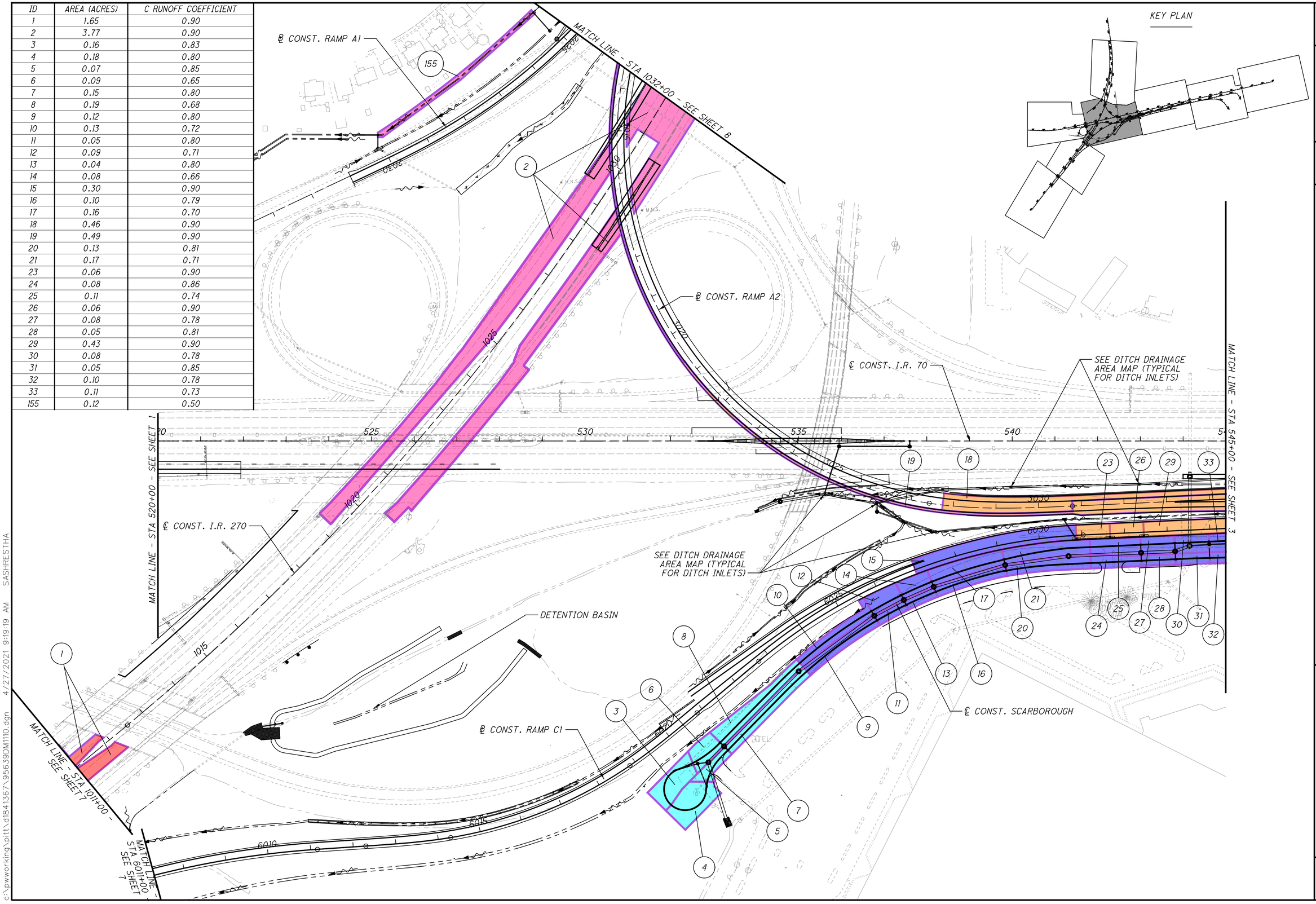
FRA-70-22.61

DRAINAGE AREA MAP STORM SEWER
IR 70 STA. 793+00 TO STA. 520+00

CALCULATED REM
CHECKED PHF

0 100 200
HORIZONTAL SCALE IN FEET

ID	AREA (ACRES)	C RUNOFF COEFFICIENT
1	1.65	0.90
2	3.77	0.90
3	0.16	0.83
4	0.18	0.80
5	0.07	0.85
6	0.09	0.65
7	0.15	0.80
8	0.19	0.68
9	0.12	0.80
10	0.13	0.72
11	0.05	0.80
12	0.09	0.71
13	0.04	0.80
14	0.08	0.66
15	0.30	0.90
16	0.10	0.79
17	0.16	0.70
18	0.46	0.90
19	0.49	0.90
20	0.13	0.81
21	0.17	0.71
23	0.06	0.90
24	0.08	0.86
25	0.11	0.74
26	0.06	0.90
27	0.08	0.78
28	0.05	0.81
29	0.43	0.90
30	0.08	0.78
31	0.05	0.85
32	0.10	0.78
33	0.11	0.73
155	0.12	0.50



HORIZONTAL SCALE IN FEET
0 50 100 200

CALCULATED REM
CHECKED PHF

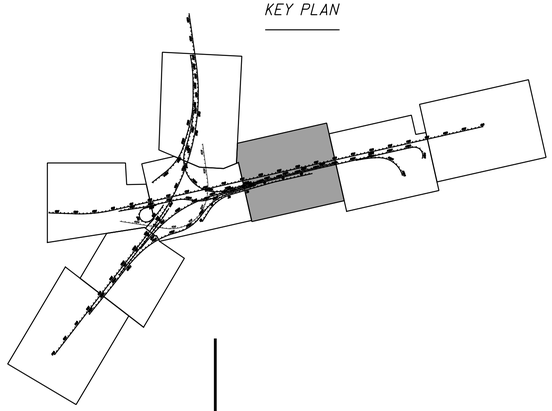
DRAINAGE AREA MAP-STORM SEWER
IR 70 STA. 520+00 TO STA. 545+00

FRA-70-22.61

2
8

c:\pwworking\pitt\d1841367\95639DM1110.dgn 4/27/2021 9:19:19 AM SASHRESTHA

KEY PLAN



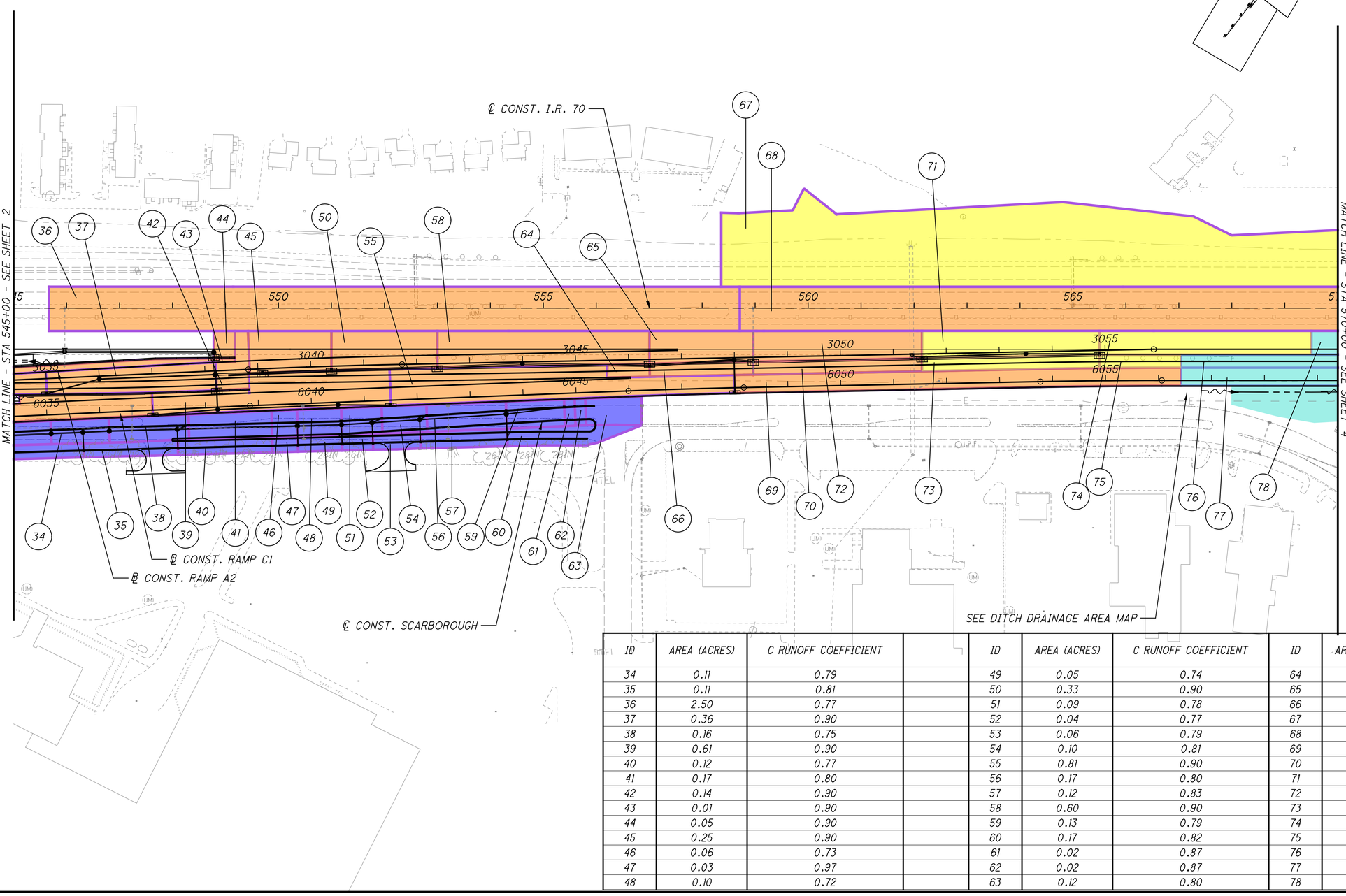
HORIZONTAL SCALE IN FEET
0 50 100 200

CALCULATED REM
CHECKED PHF

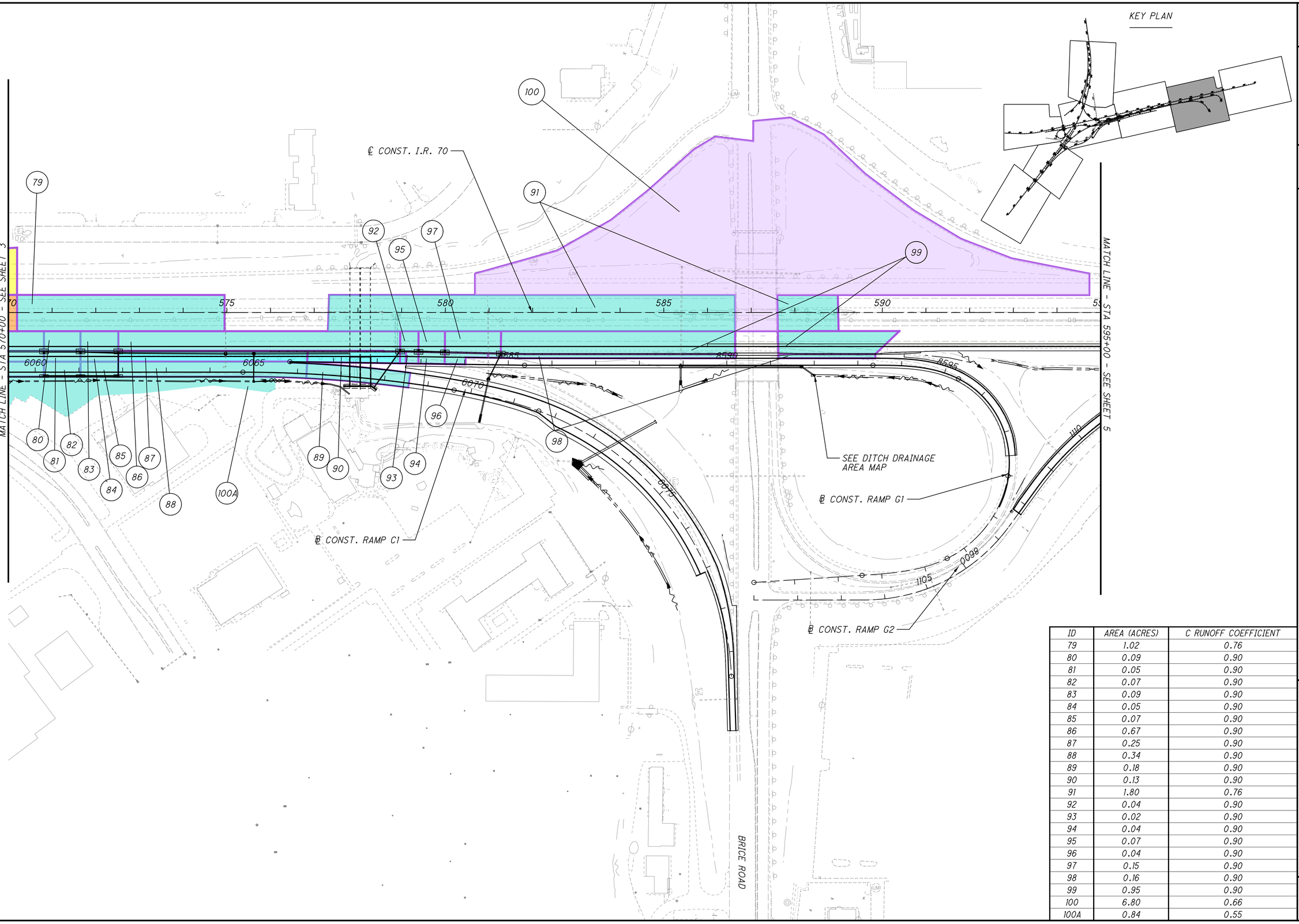
DRAINAGE AREA MAP-STORM SEWER
IR 70 STA. 545+00 TO STA. 570+00

FRA-70-22.61

3
8



ID	AREA (ACRES)	C RUNOFF COEFFICIENT	ID	AREA (ACRES)	C RUNOFF COEFFICIENT	ID	AREA (ACRES)	C RUNOFF COEFFICIENT
34	0.11	0.79	49	0.05	0.74	64	0.05	0.90
35	0.11	0.81	50	0.33	0.90	65	0.27	0.90
36	2.50	0.77	51	0.09	0.78	66	0.11	0.90
37	0.36	0.90	52	0.04	0.77	67	3.74	0.64
38	0.16	0.75	53	0.06	0.79	68	2.20	0.76
39	0.61	0.90	54	0.10	0.81	69	0.66	0.90
40	0.12	0.77	55	0.81	0.90	70	0.18	0.90
41	0.17	0.80	56	0.17	0.80	71	0.37	0.90
42	0.14	0.90	57	0.12	0.83	72	0.40	0.90
43	0.01	0.90	58	0.60	0.90	73	0.19	0.90
44	0.05	0.90	59	0.13	0.79	74	0.41	0.90
45	0.25	0.90	60	0.17	0.82	75	0.09	0.90
46	0.06	0.73	61	0.02	0.87	76	0.21	0.90
47	0.03	0.97	62	0.02	0.87	77	0.29	0.90
48	0.10	0.72	63	0.12	0.80	78	0.14	0.90



ID	AREA (ACRES)	C RUNOFF COEFFICIENT
79	1.02	0.76
80	0.09	0.90
81	0.05	0.90
82	0.07	0.90
83	0.09	0.90
84	0.05	0.90
85	0.07	0.90
86	0.67	0.90
87	0.25	0.90
88	0.34	0.90
89	0.18	0.90
90	0.13	0.90
91	1.80	0.76
92	0.04	0.90
93	0.02	0.90
94	0.04	0.90
95	0.07	0.90
96	0.04	0.90
97	0.15	0.90
98	0.16	0.90
99	0.95	0.90
100	6.80	0.66
100A	0.84	0.55

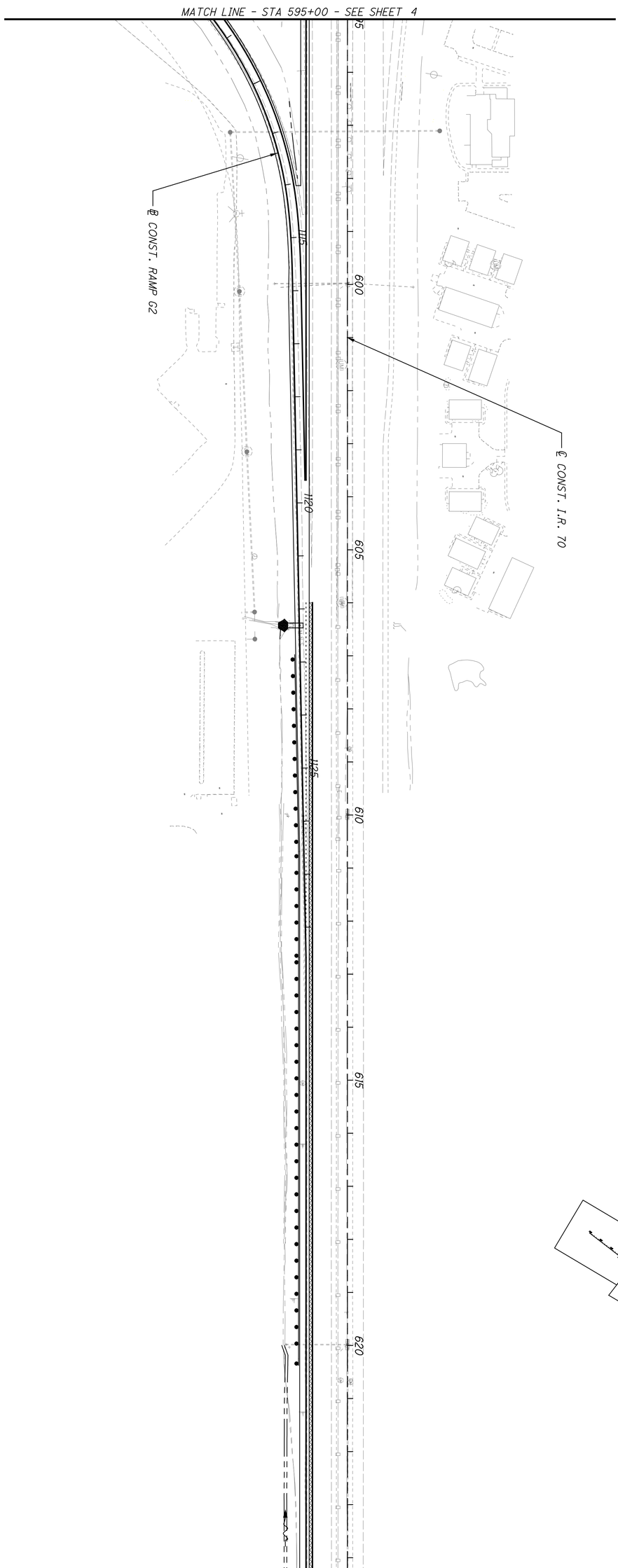
HORIZONTAL SCALE IN FEET
0 50 100 200

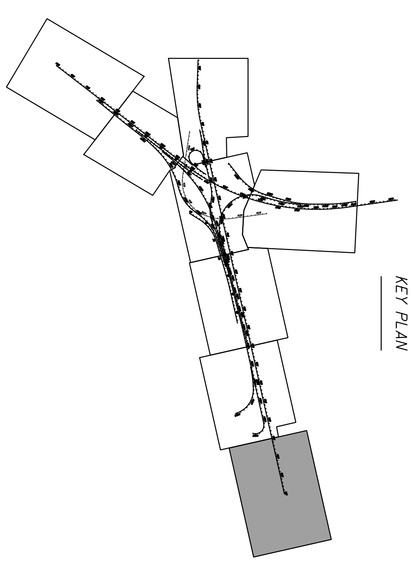
CALCULATED REM
CHECKED PHF

DRAINAGE AREA MAP-STORM SEWER
IR 70 STA. 570+00 TO STA. 595+00

FRA-70-22.61

4
8

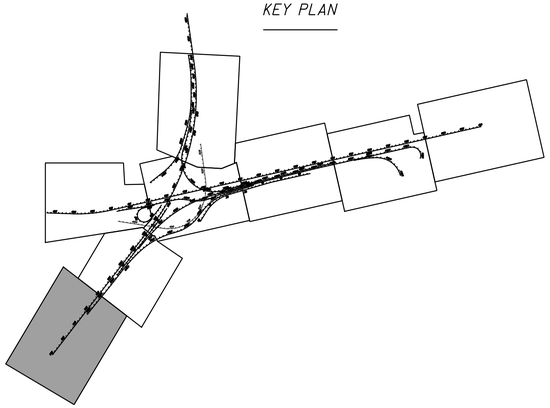


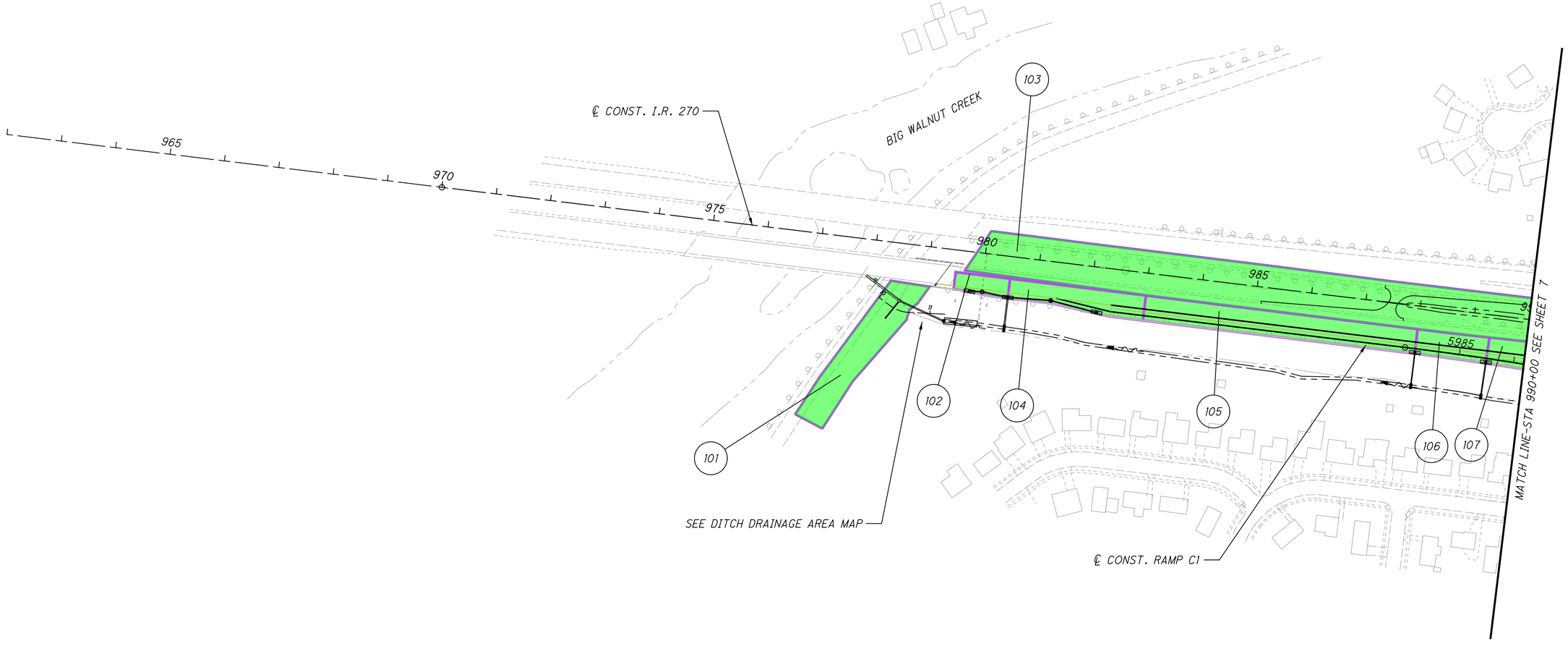


8 | 5	FRA-70-22.61	DRAINAGE AREA MAP-STORM SEWER IR 70 STA. 595+00 TO END	CALCULATED REM CHECKED PHF	0 100 50 200 HORIZONTAL SCALE IN FEET

ID	AREA (ACRES)	C RUNOFF COEFFICIENT
101	0.42	0.74
102	0.08	0.90
103	2.47	0.67
104	0.23	0.90
105	0.52	0.90
106	0.14	0.90
107	0.97	0.90

KEY PLAN





HORIZONTAL SCALE IN FEET
0 50 100 200

CALCULATED | CHECKED

DRAINAGE AREA MAP-STORM SEWER
IR 270 STA. 970+00 TO 990+00

FRA-70-22.61

6
8

ID	AREA (ACRES)	C RUNOFF COEFFICIENT
108	3.28	0.80
109	0.22	0.82
110	0.84	0.79
111	0.44	0.90
112	0.07	0.90

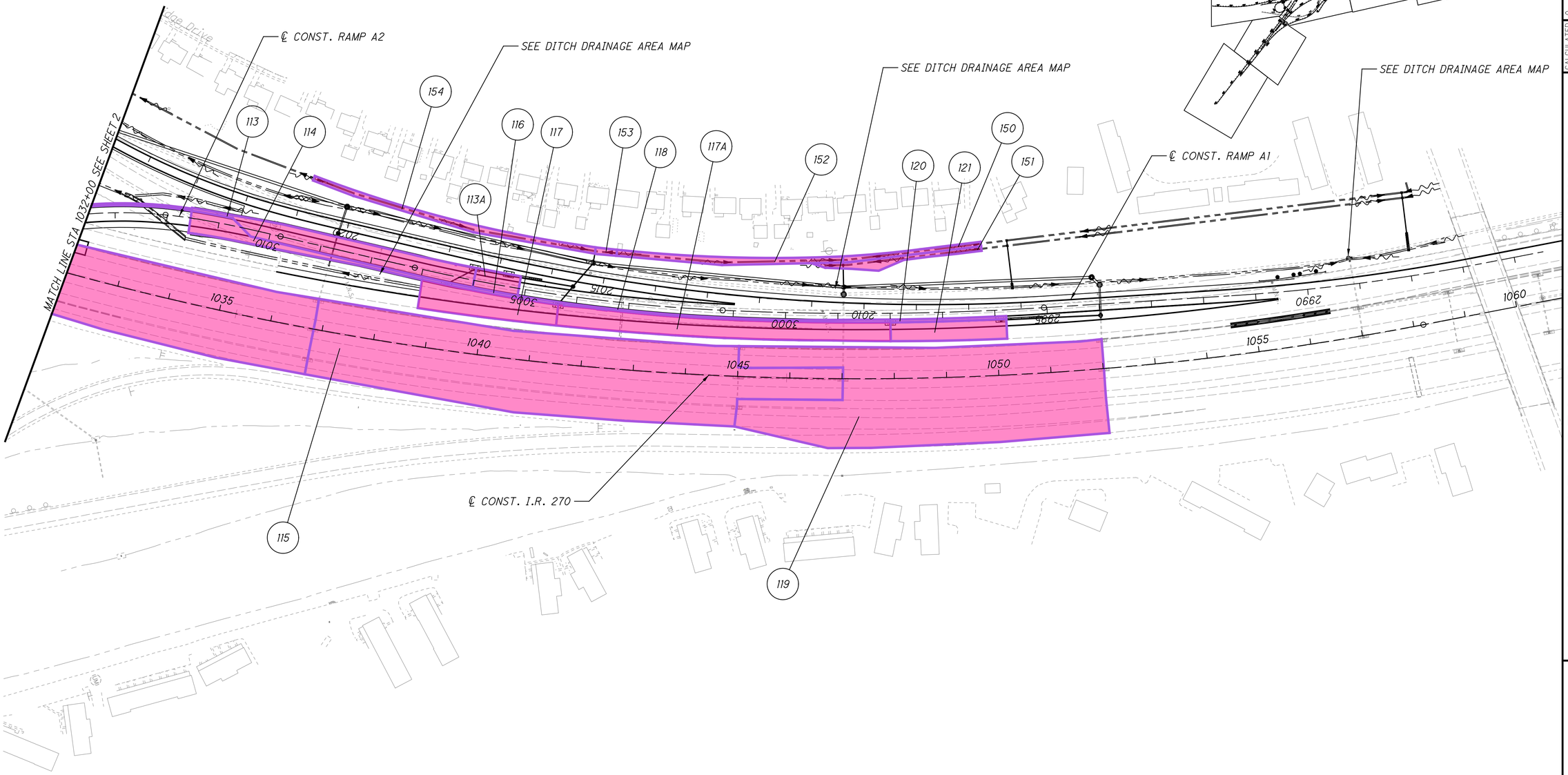
FRA-70-22.61

DRAINAGE AREA MAP-STORM SEWER
IR 270 STA. 990+00 TO 1011+00

CALCULATED REM
CHECKED PHF

0 50 100 200
HORIZONTAL SCALE IN FEET

ID	AREA (ACRES)	C RUNOFF COEFFICIENT	ID	AREA (ACRES)	C RUNOFF COEFFICIENT
113	0.49	0.90	119	2.68	0.90
113A	0.08	0.90	120	0.03	0.90
114	0.17	0.90	121	0.19	0.90
115	3.15	0.90	150	0.05	0.54
116	0.03	0.90	151	0.08	0.50
117	0.28	0.90	152	0.12	0.50
117A	0.53	0.90	153	0.01	0.55
118	0.08	0.90	154	0.14	0.50



HORIZONTAL SCALE IN FEET
0 50 100 200

CALCULATED REM
CHECKED PHF

DRAINAGE AREA MAP-STORM SEWER
IR 270 STA. 1032+00 TO END

FRA-70-22.61

8
8

STORM SEWER SYSTEM

PID : 95639 **Date :** 01/20/2020 **Project :** FRA-70-22.61 **Location :** Franklin County, Ohio

Description :270 979+40-978+49 NOE BIXBY **Designer :** REM

Rainfall Area: C **Just Full Capacity Frequency (yrs.) :** 10 **Hydraulic Gradient Frequency (yrs.) :** 25

Minimum Pipe Size : 15.00 **Tailwater Elevation (ft.):** 0.00

JUNCTION From	To	STATION From To	ΔAREA ΣAREA (acres)	ΔCA ΣCA	BEGIN TIME (min.)	RAINFALL INTENSITY (10 yrs.)	(25 yrs.)	DISCHARGE (cfs.) (10 yrs.)	(25 yrs.)	PIPE DIAM. (in.)	LENGTH (ft.)	SLOPE (ft./ft.)	F/L PIPE IN / OUT (ft.)	MEAN VEL (fps.)	JUST FULL CAPACITY (cfs.)	FRICT SLOPE (ft./ft.)	HYGR EL. IN / OUT (ft.)	COVER IN / OUT (ft.)	COVER MINUS HY GR	COVER MINUS CROWN	INLET TYPE MANNING'S 'n'
202	203	979+40	19.05	12.76	28.90	3.14	3.60	40.0	46.0	24	90.0	0.0411	747.00	14.43	42.76	0.0549	750.24	752.46	2.22	3.46	CB 5A
begin		978+53	19.05	12.76									743.30				745.30	745.78			0.015
700	203	978+33	0.47	0.32	15.00	4.47	3.60	1.4	1.2	15	40.0	0.1500	748.38	10.01	23.32	0.0004	748.58	749.63	1.05	0.00	HW Half He
begin		978+54	19.52	13.08									742.38				745.30	745.79			0.015
203	204	978+53	0.09	0.05	29.00	3.13	3.60	41.1	47.3	36	74.0	0.0051	742.30	6.68	44.56	0.0067	745.30	745.78	0.48	0.48	CB 5A
final		977+89	19.62	13.14									741.92				744.54	741.92			0.015

STORM SEWER SYSTEM

PID : 95639 **Date :** 04/20/2021 **Project :** FRA-70-22.61 **Location :** Franklin County, Ohio

Description :270 983+00-980+50 outfall to ditch, broken back **Designer :** ARG

Rainfall Area: C **Just Full Capacity Frequency (yrs.) :** 10 **Hydraulic Gradient Frequency (yrs.) :** 25

Minimum Pipe Size : 15.00 **Tailwater Elevation (ft.):** 0.00

JUNCTION From	To	STATION From To	ΔAREA ΣAREA (acres)	ΔCA ΣCA	BEGIN TIME (min.)	RAINFALL INTENSITY (10 yrs.)	(25 yrs.)	DISCHARGE (cfs.) (10 yrs.)	(25 yrs.)	PIPE DIAM. (in.)	LENGTH (ft.)	SLOPE (ft./ft.)	F/L PIPE IN / OUT (ft.)	MEAN VEL (fps.)	JUST FULL CAPACITY (cfs.)	FRICT SLOPE (ft./ft.)	HYGR EL. IN / OUT (ft.)	COVER IN / OUT (ft.)	COVER MINUS HY GR	COVER MINUS CROWN	INLET TYPE MANNING'S 'n'
178	180	982+14	0.61	0.55	10.00	5.32	5.92	2.9	3.3	15	86.5	0.0050	770.83	3.52	4.25	0.0034	771.69	776.21	4.52	4.13	I 3D
begin		981+28	0.61	0.55									770.40				771.39	775.46			0.015
180	181	981+28	0.00	0.00	10.41	5.24	5.84	2.9	3.2	15	79.0	0.0050	770.40	3.52	4.26	0.0033	771.25	775.46	4.21	3.81	MH 3
		980+50	0.61	0.55									770.01				770.99	773.99			0.015
183	184	979+79	0.06	0.05	10.00	5.32	5.95	0.3	0.3	15	23.0	0.0200	766.97	3.05	8.52	0.0000	767.53	773.14	5.61	4.92	I 3D
begin		980+02	0.67	0.60									766.51				767.53	773.67			0.015
184	181	980+02	2.47	1.65	10.13	5.30	5.95	9.0	10.1	21	48.0	0.0050	766.01	4.59	10.45	0.0054	767.53	773.67	6.14	5.91	MH 3
		980+50	3.14	2.25									765.77				767.24	773.99			0.015
181	181A	980+50	0.14	0.13	10.78	5.17	5.83	12.3	13.9	24	15.0	0.0050	765.52	4.98	14.91	0.0050	767.19	773.99	6.80	6.47	I 3D
		980+50	3.28	2.38									765.44				767.12	773.91			0.015
181A	181B	980+50	0.00	0.00	10.83	5.16	5.83	12.3	13.9	24	19.5	0.5000	765.44	27.30	149.13	0.0050	765.87	773.91	8.04	6.47	MH 3
		980+50	3.28	2.38									755.72				757.39	759.28			0.015
181B	182	980+50	0.00	0.00	10.85	5.16	5.83	12.3	13.9	24	16.8	0.0400	755.72	11.03	42.18	0.0050	756.80	759.28	2.48	1.56	MH 3
final		980+50	3.28	2.38									755.05				756.72	758.88			0.015

STORM SEWER SYSTEM

PID : 95639 **Date :** 05/12/2021 **Project :** FRA-70-22.61 **Location :** Franklin County, Ohio

Description :270 C1 999+00 - 5989+17 Outfall under Wall K, Broken Back into ditch **Designer :** REM

Rainfall Area: C **Just Full Capacity Frequency (yrs.) :** 10 **Hydraulic Gradient Frequency (yrs.) :** 25

Minimum Pipe Size : 15.00 **Tailwater Elevation (ft.):** 0.00

JUNCTION From	To	STATION From To	ΔAREA ΣAREA (acres)	ΔCA ΣCA	BEGIN TIME (min.)	RAINFALL INTENSITY (10 yrs.)	(25 yrs.)	DISCHARGE (cfs.) (10 yrs.)	(25 yrs.)	PIPE DIAM. (in.)	LENGTH (ft.)	SLOPE (ft./ft.)	F/L PIPE IN / OUT (ft.)	MEAN VEL (fps.)	JUST FULL CAPACITY (cfs.)	FRICT SLOPE (ft./ft.)	HYGR EL. IN / OUT (ft.)	COVER IN / OUT (ft.)	COVER MINUS HY GR	COVER MINUS CROWN	INLET TYPE MANNING'S 'n'
185	171	999+00	0.84	0.66	15.00	4.47	4.98	3.0	3.3	15	170.0	0.0050	789.15	3.54	4.26	0.0035	790.02	792.40	2.38	2.00	CB 2-2B
begin		5993+50	0.84	0.66									788.30				789.29	793.72			0.015
170	171	5993+50	0.44	0.40	10.00	5.32	5.98	2.1	2.4	15	23.5	0.0050	788.10	3.27	4.26	0.0018	788.96	793.35	4.39	4.00	I 3D
begin		5993+50	1.28	1.06									787.98				788.92	793.72			0.015
171	172	5993+50	0.07	0.07	15.80	4.36	4.83	4.9	5.4	18	100.0	0.0050	787.73	4.01	6.92	0.0036	788.79	793.72	4.93	4.49	I 3D
		5992+50	1.35	1.13									787.23				788.44	791.66			0.015
172	187A	5992+50	0.22	0.18	16.22	4.31	4.83	5.6	6.3	18	149.0	0.0050	787.23	4.09	6.90	0.0048	788.44	791.66	3.22	2.93	CB 2-2B
		5992+50	1.57	1.30									786.49				787.72	787.99			0.015
187A	173	5991+01	0.00	0.00	16.82	4.23	4.73	5.5	6.2	18	184.0	0.0050	786.49	4.09	6.92	0.0046	787.67	792.29	4.62	4.30	MH 3
		993+00	1.57	1.30									785.57				786.80	790.90			0.015
173	173A	993+00	3.28	2.62	17.57	4.14	4.72	16.3	18.5	27	27.0	0.0050	781.86	5.36	20.42	0.0048	783.73	790.90	7.17	6.79	MH 3
		993+00	4.85	3.93									781.73				783.60	790.27			0.015
173A	173C	993+00	0.00	0.00	17.66	4.13	4.72	16.2	18.5	27	33.0	0.2261	767.05	22.04	137.28	0.0048	767.63	790.27	22.64	20.97	MH 3
		993+00	4.85	3.93									759.59				761.47	771.20			0.015
173C	174	993+00	0.00	0.00	17.68	4.13	4.72	16.2	18.5	27	18.3	0.0400	759.59	11.83	57.75	0.0048	760.82	764.13	3.31	2.29	HW Half He
final		993+00	4.85	3.93									758.86				760.74	762.92			0.015

STORM SEWER SYSTEM

PID : 95639 **Date :** 04/19/2021 **Project :** FRA-70-22.61 **Location :** Franklin County, Ohio

Description :270/Ditch/A2/A1 1050+10 - 2035+02 new pipe **Designer :** ARG

Rainfall Area: C **Just Full Capacity Frequency (yrs.) :** 10 **Hydraulic Gradient Frequency (yrs.) :** 25

Minimum Pipe Size : 15.00 **Tailwater Elevation (ft.):** 0.00

JUNCTION From	To	STATION From / To	ΔAREA / ΣAREA (acres)	ΔCA / ΣCA	BEGIN TIME (min.)	RAINFALL INTENSITY (10 yrs.)	(25 yrs.)	DISCHARGE (cfs.) (10 yrs.)	(25 yrs.)	PIPE DIAM. (in.)	LENGTH (ft.)	SLOPE (ft./ft.)	F/L PIPE IN / OUT (ft.)	MEAN VEL (fps.)	JUST FULL CAPACITY (cfs.)	FRICT SLOPE (ft./ft.)	HYGR EL. IN / OUT (ft.)	COVER IN / OUT (ft.)	COVER MINUS HY GR	COVER MINUS CROWN	INLET TYPE MANNING'S 'n'
156	149	2998+00	0.58	0.52	10.00	5.32	5.63	2.8	2.9	15	212.0	0.0050	779.56	3.49	4.26	0.0028	780.36	785.43	5.07	4.62	I 3C
begin		2996+00	0.58	0.52									778.50				779.57	784.73			0.015
149	150	1050+10	0.22	0.19	11.01	5.12	5.63	3.7	4.0	15	191.0	0.0050	778.50	3.66	4.26	0.0052	779.57	784.73	5.16	4.98	I 3C
		1052+00	0.80	0.72									777.55				778.58	784.38			0.015
150	151	1052+00	2.68	2.41	11.88	4.97	5.59	15.5	17.5	27	58.0	0.0050	776.54	5.32	20.42	0.0042	778.35	784.38	6.03	5.59	MH 3
		299+97	3.48	3.13									776.25				778.11	781.82			0.015
152	151	2089+14	11.19	9.03	15.00	4.47	4.89	40.4	44.2	54	477.4	0.0034	773.62	5.93	106.90	0.0007	775.72	779.77	4.05	1.65	CB 8A
begin		2993+98	14.67	12.16									772.00				775.33	781.82			0.015
151	153	299+97	0.00	0.00	16.34	4.29	4.89	52.2	59.5	54	21.0	0.0030	772.00	6.03	100.42	0.0012	775.33	781.82	6.49	5.32	MH 3
		299+11	14.67	12.16									771.94				775.31	782.48			0.015
153	147	2994+11	0.00	0.00	16.40	4.29	4.72	52.1	57.3	54	475.0	0.0030	771.94	6.03	100.42	0.0011	774.49	782.48	7.99	6.04	MH 3
		2010+39	14.67	12.16									770.52				773.86	782.73			0.015
148	147	2010+40	4.07	3.66	10.00	5.32	6.00	19.5	22.0	27	14.0	0.0050	777.27	5.43	20.42	0.0067	779.52	784.27	4.75	4.75	MH 3
begin		2010+39	18.74	15.82									777.20				779.15	782.73			0.015
406	407	2010+44	0.17	0.09	15.00	4.47	5.09	0.4	0.4	12	10.0	0.0200	781.93	3.43	4.70	0.0002	782.37	784.43	2.06	1.50	CB 2-2B
begin		2010+43	18.91	15.91									781.73				782.37	784.43			0.015

STORM SEWER SYSTEM

JUNCTION From	To	STATION From	To	ΔAREA ΣAREA (acres)	ΔCA ΣCA	BEGIN TIME (min.)	RAINFALL INTENSITY (10 yrs.)	(25 yrs.)	DISCHARGE (cfs.) (10 yrs.)	(25 yrs.)	PIPE DIAM. (in.)	LENGTH (ft.)	SLOPE (ft./ft.)	F/L PIPE IN / OUT (ft.)	MEAN VEL (fps.)	JUST FULL CAPACITY (cfs.)	FRICT SLOPE (ft./ft.)	HYGR EL. IN / OUT (ft.)	COVER IN / OUT (ft.)	COVER MINUS HY GR	COVER MINUS CROWN	INLET TYPE MANNING'S 'n'
407	147	2010+43	2010+39	0.08 19.00	0.04 15.95	15.05	4.47	5.07	0.6	0.7	12	42.0	0.0781	781.73 778.45	6.23	9.28	0.0004	781.92 779.12	784.43 782.73	2.51	1.70	CB 2-2B 0.015
147	146	2010+39	2015+24	1.27 20.27	0.88 16.83	17.71	4.12	4.56	69.4	76.7	54	481.0	0.0030	770.51 769.07	6.43	100.42	0.0020	773.62 772.60	782.73 784.10	9.11	7.72	CB 8A 0.015
141	142	3006+50	3006+03	0.17 20.44	0.15 16.98	10.00	5.32	5.97	0.8	0.9	15	60.5	0.0500	788.36 785.34	5.79	13.47	0.0003	788.59 786.15	793.61 790.70	5.02	4.00	I 3D 0.015
begin																						
142	144A	3006+03	3005+36	0.49 20.92	0.44 17.42	10.17	5.29	5.94	3.1	3.5	15	66.0	0.0230	785.31 783.79	6.40	9.13	0.0039	785.87 784.80	790.70 789.19	4.83	4.14	I 3C 0.015
144A	144	3005+36	3004+11	0.08 21.00	0.07 17.49	10.35	5.25	5.86	3.5	3.9	15	125.0	0.0173	783.79 781.63	5.92	7.92	0.0048	784.43 782.65	789.19 787.34	4.76	4.15	I 3C 0.015
143	144	3004+34	3004+11	0.32 21.32	0.29 17.78	10.00	5.32	5.99	1.5	1.7	15	42.0	0.0400	783.31 781.63	6.41	12.04	0.0009	783.64 782.52	788.56 787.34	4.92	4.00	I 3C 0.015
begin																						
144	146	3004+11	2015+24	0.00 21.32	0.00 17.78	10.70	5.18	5.84	4.9	5.5	15	59.0	0.0344	781.63 779.60	8.34	11.17	0.0098	782.28 780.70	787.34 784.10	5.06	4.46	MH 3 0.015
408	146	2015+25	2015+24	0.15 21.47	0.07 17.85	15.00	4.47	5.09	0.3	0.4	12	24.0	0.1437	783.31 779.86	6.54	12.59	0.0002	783.43 780.49	785.81 784.10	2.38	1.50	CB 2-2B 0.015
begin																						
146	138	2015+24	2020+10	1.35 22.82	0.93 18.78	18.96	3.98	4.28	74.8	80.5	54	483.0	0.0030	769.07 767.62	6.52	100.42	0.0022	772.32 771.25	784.10 786.60	11.78	10.53	CB 8A 0.015
139	138	2020+15	2020+10	3.77 26.59	3.39 22.17	10.00	5.32	5.98	18.1	20.3	27	53.0	0.0050	777.40 777.14	5.43	20.42	0.0057	779.65 779.05	789.82 786.60	10.17	10.17	MH 3 0.015
begin																						
138	137	2020+10	2025+15	0.00 26.59	0.00 22.17	20.19	3.85	4.28	85.4	95.0	54	498.0	0.0032	767.62 766.02	6.86	103.92	0.0031	771.25 769.70	786.60 785.97	15.35	14.48	MH 3 0.015

STORM SEWER SYSTEM

JUNCTION From	To	STATION From / To	ΔAREA / ΣAREA (acres)	ΔCA / ΣCA	BEGIN TIME (min.)	RAINFALL INTENSITY (10 yrs.)	(25 yrs.)	DISCHARGE (cfs.) (10 yrs.)	(25 yrs.)	PIPE DIAM. (in.)	LENGTH (ft.)	SLOPE (ft./ft.)	F/L PIPE IN / OUT (ft.)	MEAN VEL (fps.)	JUST FULL CAPACITY (cfs.)	FRICT SLOPE (ft./ft.)	HYGR EL. IN / OUT (ft.)	COVER IN / OUT (ft.)	COVER MINUS HY GR	COVER MINUS CROWN	INLET TYPE MANNING'S 'n'
137	136	2025+15	6.26	5.63	21.40	3.73	4.20	103.7	116.7	60	487.0	0.0062	765.52	9.42	191.84	0.0027	768.47	785.97	17.50	15.45	MH 3
		2030+15	32.85	27.81									762.48				766.52	778.25			0.015
410	136	2030+15	0.12	0.06	15.00	4.47	5.08	0.3	0.3	12	32.0	0.1259	779.28	5.98	11.79	0.0001	779.40	781.78	2.38	1.50	CB 2-2B
begin		2030+15	32.97	27.87									775.25				775.86	778.25			0.015
136	EXIST	2030+15	6.88	3.93	22.27	3.65	4.09	116.1	129.9	60	487.0	0.0031	762.06	7.31	136.09	0.0033	766.29	778.25	11.96	11.19	CB 8A
final		2035+02	39.85	31.79									760.53				764.66	773.28			0.015

STORM SEWER SYSTEM

PID : 95639 **Date :** 01/07/2019 **Project :** FRA-70-22.61 **Location :** Franklin County, Ohio

Description : C1 5984+20 270 988+00 Outfall to ditch, Broken Back **Designer :** REM

Rainfall Area: C **Just Full Capacity Frequency (yrs.) :** 10 **Hydraulic Gradient Frequency (yrs.) :** 25

Minimum Pipe Size : 15.00 **Tailwater Elevation (ft.):** 0.00

JUNCTION From	To	STATION From / To	ΔAREA / ΣAREA (acres)	ΔCA / ΣCA	BEGIN TIME (min.)	RAINFALL INTENSITY (10 yrs.)	(25 yrs.)	DISCHARGE (cfs.) (10 yrs.)	(25 yrs.)	PIPE DIAM. (in.)	LENGTH (ft.)	SLOPE (ft./ft.)	F/L PIPE IN / OUT (ft.)	MEAN VEL (fps.)	JUST FULL CAPACITY (cfs.)	FRICT SLOPE (ft./ft.)	HYGR EL. IN / OUT (ft.)	COVER IN / OUT (ft.)	COVER MINUS HY GR	COVER MINUS CROWN	INLET TYPE MANNING'S 'n'
176	176A	988+00	0.14	0.12	10.00	5.32	6.00	0.7	0.7	15	11.5	0.0100	778.56	3.07	6.02	0.0002	779.24	783.97	4.73	4.16	I 3D
begin		988+00	0.14	0.12									778.45				779.24	783.80			0.015
176A	176B	988+00	0.00	0.00	10.06	5.31	5.99	0.7	0.7	15	29.9	0.6662	778.45	13.26	49.16	0.0002	778.56	783.80	5.24	4.10	MH 3
		988+00	0.14	0.12									758.53				759.32	761.48			0.015
176B	177	988+00	0.00	0.00	10.10	5.30	5.98	0.7	0.7	15	16.3	0.0400	758.53	5.00	12.04	0.0002	758.75	761.42	2.67	1.64	MH 2
final		988+00	0.14	0.12									757.88				758.67	761.08			0.015

STORM SEWER SYSTEM

PID : 95639 **Date :** 01/04/2019 **Project :** FRA-70-22.61 **Location :** Franklin County, Ohio

Description : C1 5985+50 270 989+31 Outfall to ditch, Broken Back **Designer :** REM

Rainfall Area: C **Just Full Capacity Frequency (yrs.) :** 10 **Hydraulic Gradient Frequency (yrs.) :** 25

Minimum Pipe Size : 15.00 **Tailwater Elevation (ft.):** 0.00

JUNCTION From	To	STATION From / To	ΔAREA / ΣAREA (acres)	ΔCA / ΣCA	BEGIN TIME (min.)	RAINFALL INTENSITY (10 yrs.)	(25 yrs.)	DISCHARGE (cfs.) (10 yrs.)	(25 yrs.)	PIPE DIAM. (in.)	LENGTH (ft.)	SLOPE (ft./ft.)	F/L PIPE IN / OUT (ft.)	MEAN VEL (fps.)	JUST FULL CAPACITY (cfs.)	FRICT SLOPE (ft./ft.)	HYGR EL. IN / OUT (ft.)	COVER IN / OUT (ft.)	COVER MINUS HY GR	COVER MINUS CROWN	INLET TYPE MANNING'S 'n'
175	175A	989+31	0.97	0.87	10.00	5.32	6.00	4.6	5.2	18	10.8	0.0050	779.88	3.96	6.92	0.0033	781.05	785.38	4.33	4.00	I 3D
begin		989+31	0.97	0.87									779.83				781.02	785.21			0.015
175A	175B	989+31	0.00	0.00	10.05	5.31	6.00	4.6	5.2	18	32.0	0.6667	779.83	23.38	79.96	0.0033	780.10	785.21	5.11	3.88	MH 3
		989+31	0.97	0.87									758.50				759.69	761.96			0.015
175B	175C	989+31	0.00	0.00	10.07	5.31	5.99	4.6	5.2	18	16.6	0.0400	758.50	8.59	19.59	0.0033	759.08	761.96	2.88	1.96	MH 2
final		989+31	0.97	0.87									757.84				759.03	761.56			0.015

STORM SEWER SYSTEM

PID : 95639 **Date :** 01/18/2019 **Project :** FRA-70-22.61 **Location :** Franklin County, Ohio

Description : Extention of pipe under C1 6002+05 - 6001+90 RT **Designer :** REM

Rainfall Area: C **Just Full Capacity Frequency (yrs.) :** 10 **Hydraulic Gradient Frequency (yrs.) :** 25

Minimum Pipe Size : 15.00 **Tailwater Elevation (ft.):** 0.00

JUNCTION From	To	STATION From To	ΔAREA ΣAREA (acres)	ΔCA ΣCA	BEGIN TIME (min.)	RAINFALL INTENSITY (10 yrs.)	(25 yrs.)	DISCHARGE (cfs.) (10 yrs.)	(25 yrs.)	PIPE DIAM. (in.)	LENGTH (ft.)	SLOPE (ft./ft.)	F/L PIPE IN / OUT (ft.)	MEAN VEL (fps.)	JUST FULL CAPACITY (cfs.)	FRICT SLOPE (ft./ft.)	HYGR EL. IN / OUT (ft.)	COVER IN / OUT (ft.)	COVER MINUS HY GR	COVER MINUS CROWN	INLET TYPE MANNING'S 'n'
280A	280	6001+90	1.65	1.48	10.00	5.32	5.94	7.9	8.8	15	186.0	0.0329	789.66	9.14	10.92	0.0246	790.56	796.01	5.45	5.10	HW Half He
begin		6002+05	1.65	1.48									783.54				784.74	784.79			0.015

HY-8 Culvert Analysis Report
Ramp C1 – Storm Sewer Extension
Sta. 6001+80 Right

Crossing Discharge Data

Discharge Selection Method: User Defined

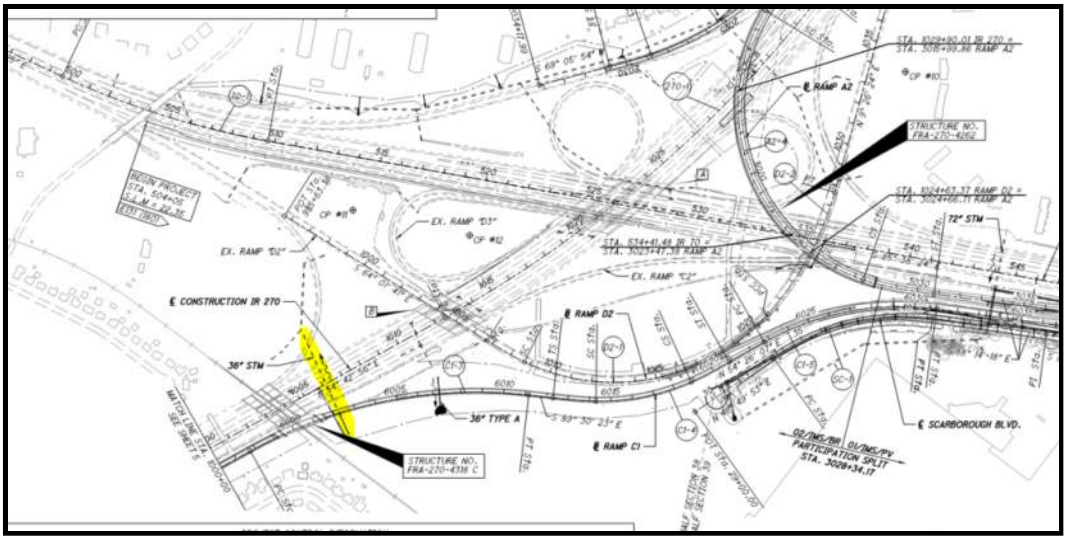


Table 1 - Summary of Culvert Flows at Crossing: Crossing 1

Headwater Elevation (ft)	Discharge Names	Total Discharge (cfs)	Culvert 1 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
765.73	10 Year	26.85	26.85	0.00	1
766.33	25 Year	37.00	37.00	0.00	1
766.91	50 Year	44.18	44.18	0.00	1
767.30	100 Year	49.89	49.89	0.00	1
800.90	Overtopping	158.48	158.48	0.00	Overtopping

Ditch Back-slope Embankment Elevation = 766.6
See HydroCAD report for flows

Rating Curve Plot for Crossing: Crossing 1

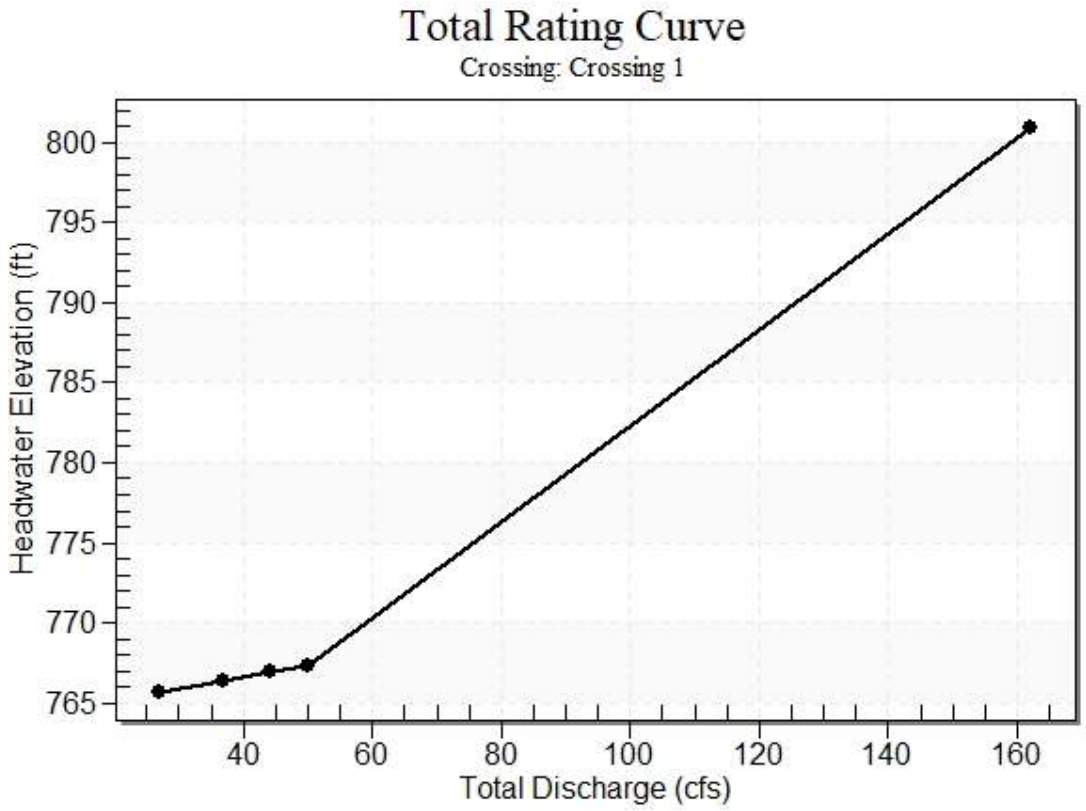


Table 2 - Culvert Summary Table: Culvert 1

Discharge Names	Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
10 Year	26.85	26.85	765.73	2.511	1.451	1-JS1f	1.553	1.674	3.000	3.000	3.798	0.000
25 Year	37.00	37.00	766.33	3.108	2.413	5-JS1f	1.903	1.978	3.000	3.000	5.234	0.000
50 Year	44.18	44.18	766.91	3.571	3.692	3-M1f	2.168	2.165	3.000	3.000	6.250	0.000
100 Year	49.89	49.89	767.30	3.985	4.076	4-FFf	2.419	2.299	3.000	3.000	7.058	0.000

****

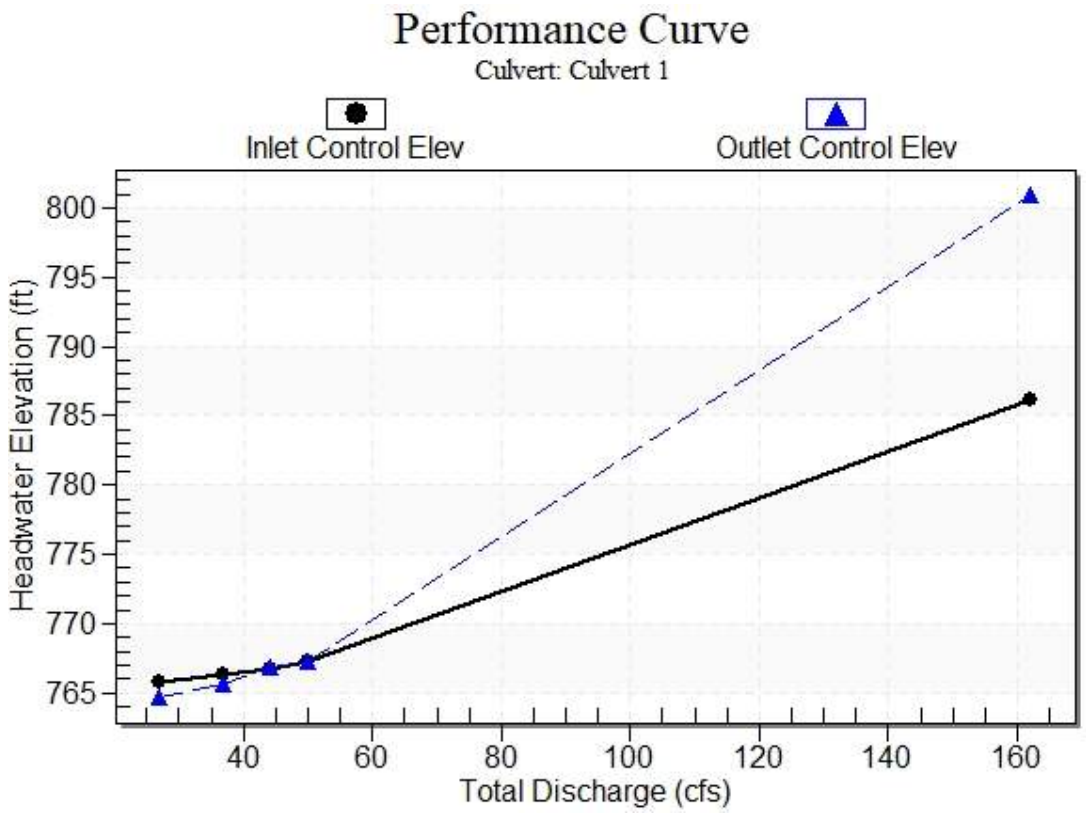
Straight Culvert

Inlet Elevation (invert): 763.22 ft, Outlet Elevation (invert): 760.60 ft

Culvert Length: 535.01 ft, Culvert Slope: 0.0049

****

Culvert Performance Curve Plot: Culvert 1



Water Surface Profile Plot for Culvert: Culvert 1

Site Data - Culvert 1

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 763.22 ft

Outlet Station: 535.00 ft

Outlet Elevation: 760.60 ft

Number of Barrels: 1

Culvert Data Summary - Culvert 1

Barrel Shape: Circular

Barrel Diameter: 3.00 ft

Barrel Material:

Embedment: 0.00 in

Barrel Manning's n: 0.0120

Culvert Type: Straight

Inlet Configuration: Square Edge with Headwall

Inlet Depression: None

Table 3 - Downstream Channel Rating Curve (Crossing: Crossing 1)

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)
26.85	763.60	3.00
37.00	763.60	3.00
44.18	763.60	3.00
49.89	763.60	3.00

Tailwater Channel Data - Crossing 1

Tailwater Channel Option: Enter Constant Tailwater Elevation

Constant Tailwater Elevation: 763.60 ft Assumed downstream pipe flowing full

Roadway Data for Crossing: Crossing 1

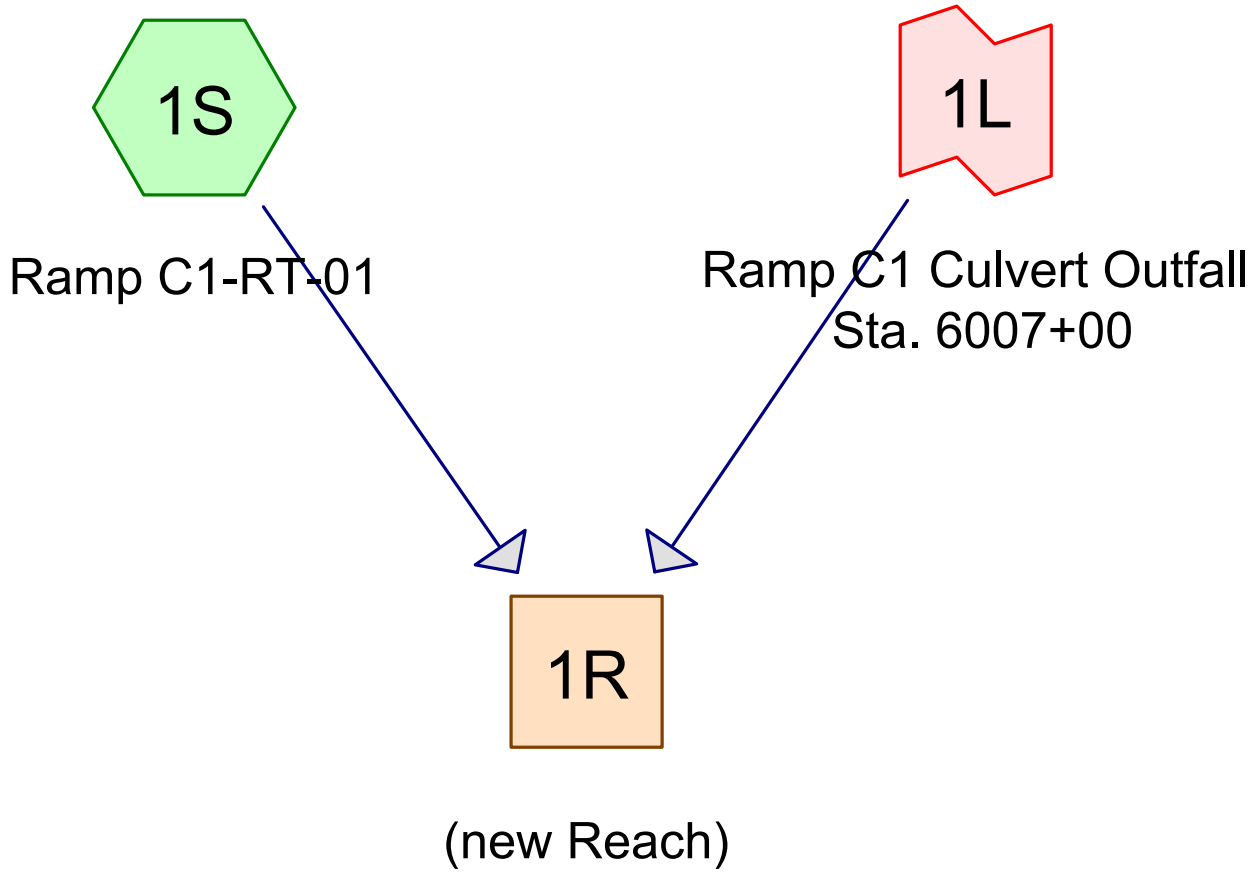
Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 100.00 ft

Crest Elevation: 800.90 ft

Roadway Surface: Paved

Roadway Top Width: 26.00 ft



Prop. Flow Rates
10 Year = 26.85 cfs
25 Year = 37.00 cfs
50 Year = 44.18 cfs
100 Year = 49.89 cfs

Subcat Reach Pond Link

Routing Diagram for FRA-70_Ramp C1 Culvert Flow Rates - Copy
Prepared by HDR, Inc, Printed 4/16/2021

Project Notes

The default Palette is empty, causing HydroCAD to build a palette on-the-fly which contains each of the basic node types. If you customize the palette by adding ANY nodes, this will override the automatic palette creation.

Rainfall Events Listing (selected events)

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	10-yr	Type II 24-hr		Default	24.00	1	3.74	2
2	25-yr	Type II 24-hr		Default	24.00	1	4.44	2
3	50-yr	Type II 24-hr		Default	24.00	1	5.02	2
4	100-yr	Type II 24-hr		Default	24.00	1	5.63	2

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.710	89	<50% Grass cover, Poor, HSG D (1S)
4.030	80	>75% Grass cover, Good, HSG D (1S)
0.850	98	Paved parking, HSG D (1S)
5.590	**84**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
0.000	HSG C	
5.590	HSG D	1S
0.000	Other	
5.590		**TOTAL AREA**

Summary for Subcatchment 1S: Ramp C1-RT-01

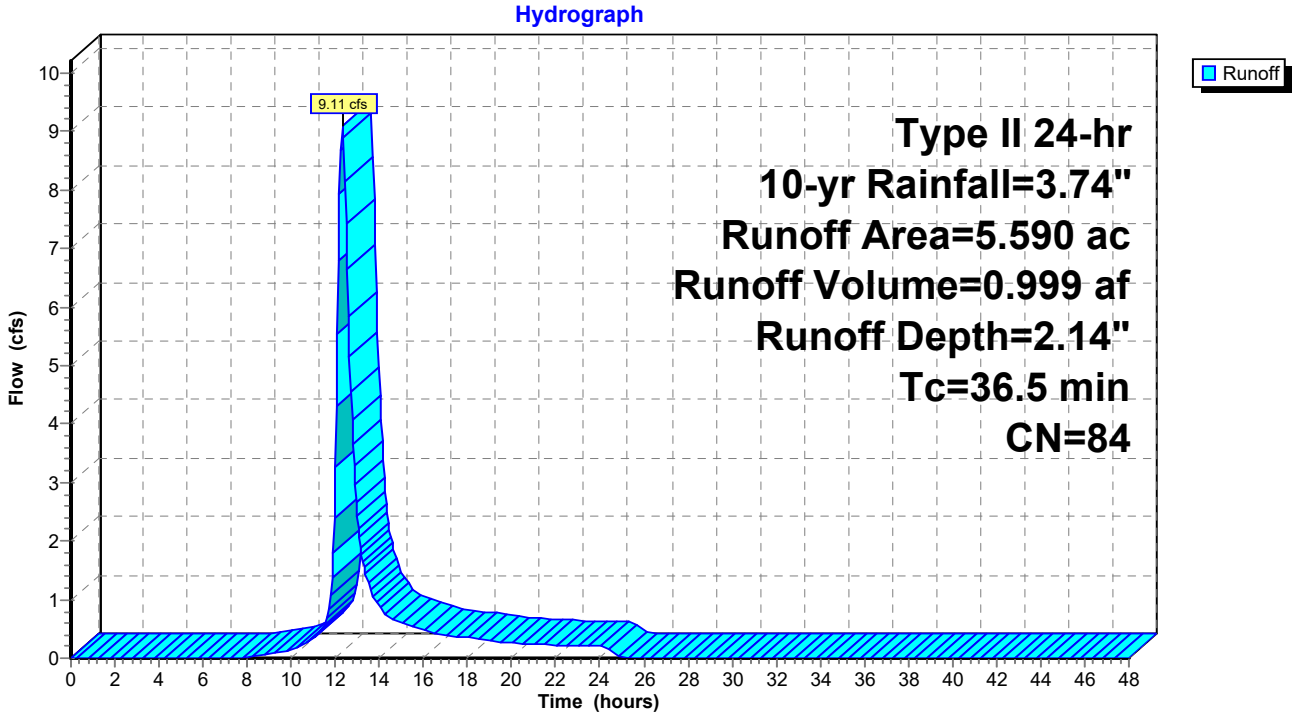
Runoff = 9.11 cfs @ 12.32 hrs, Volume= 0.999 af, Depth= 2.14"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-yr Rainfall=3.74"

Area (ac)	CN	Description
0.850	98	Paved parking, HSG D
0.710	89	<50% Grass cover, Poor, HSG D
4.030	80	>75% Grass cover, Good, HSG D
5.590	84	Weighted Average
4.740		84.79% Pervious Area
0.850		15.21% Impervious Area

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

Subcatchment 1S: Ramp C1-RT-01



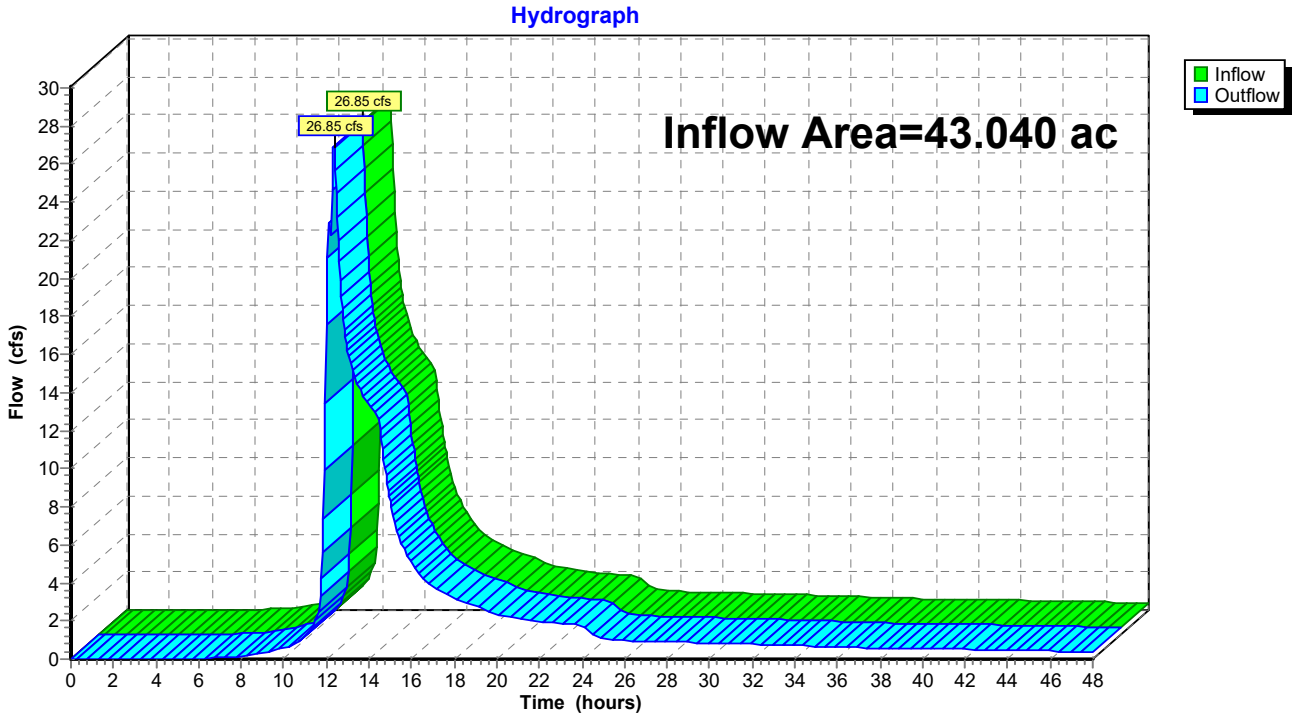
Summary for Reach 1R: (new Reach)

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 43.040 ac, 41.66% Impervious, Inflow Depth > 2.23" for 10-yr event
Inflow = 26.85 cfs @ 12.36 hrs, Volume= 8.006 af
Outflow = 26.85 cfs @ 12.36 hrs, Volume= 8.006 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Reach 1R: (new Reach)



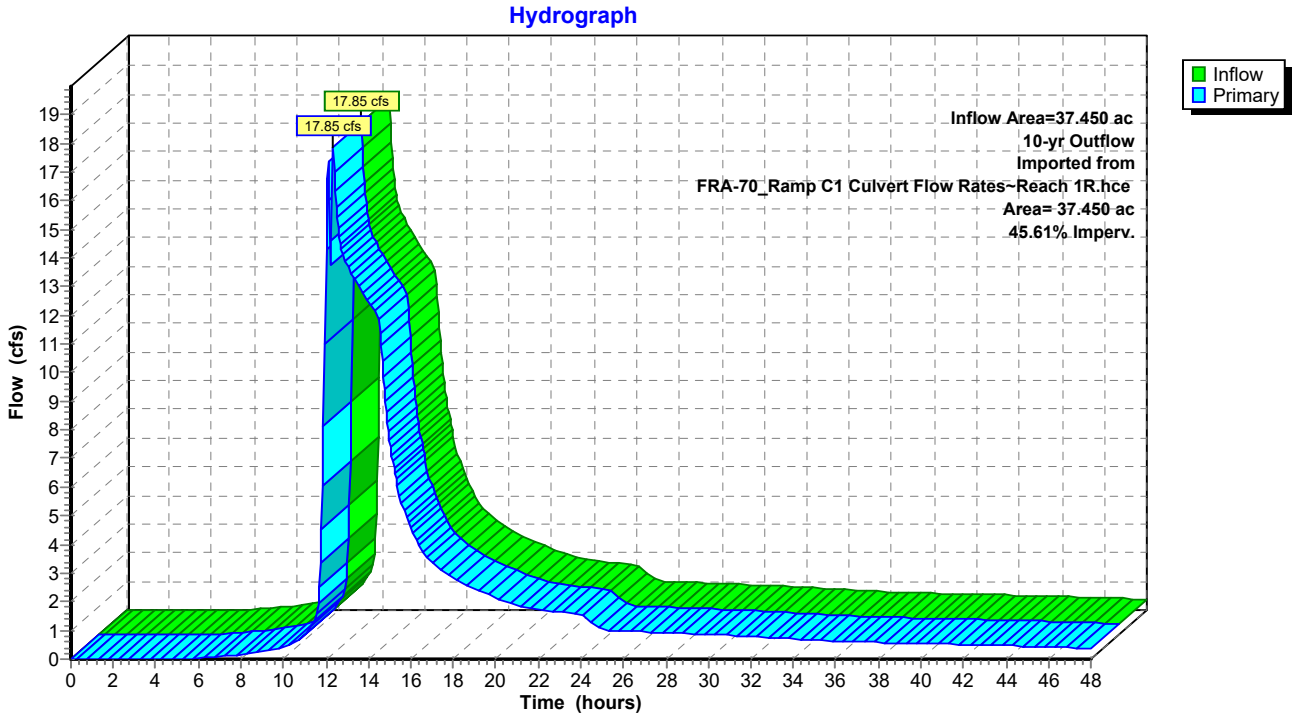
Summary for Link 1L: Ramp C1 Culvert Outfall Sta. 6007+00

Inflow Area = 37.450 ac, 45.61% Impervious, Inflow Depth > 2.25" for 10-yr event
Inflow = 17.85 cfs @ 12.36 hrs, Volume= 7.008 af
Primary = 17.85 cfs @ 12.36 hrs, Volume= 7.008 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

10-yr Outflow Imported from FRA-70_Ramp C1 Culvert Flow Rates~Reach 1R.hce

Link 1L: Ramp C1 Culvert Outfall Sta. 6007+00



Summary for Subcatchment 1S: Ramp C1-RT-01

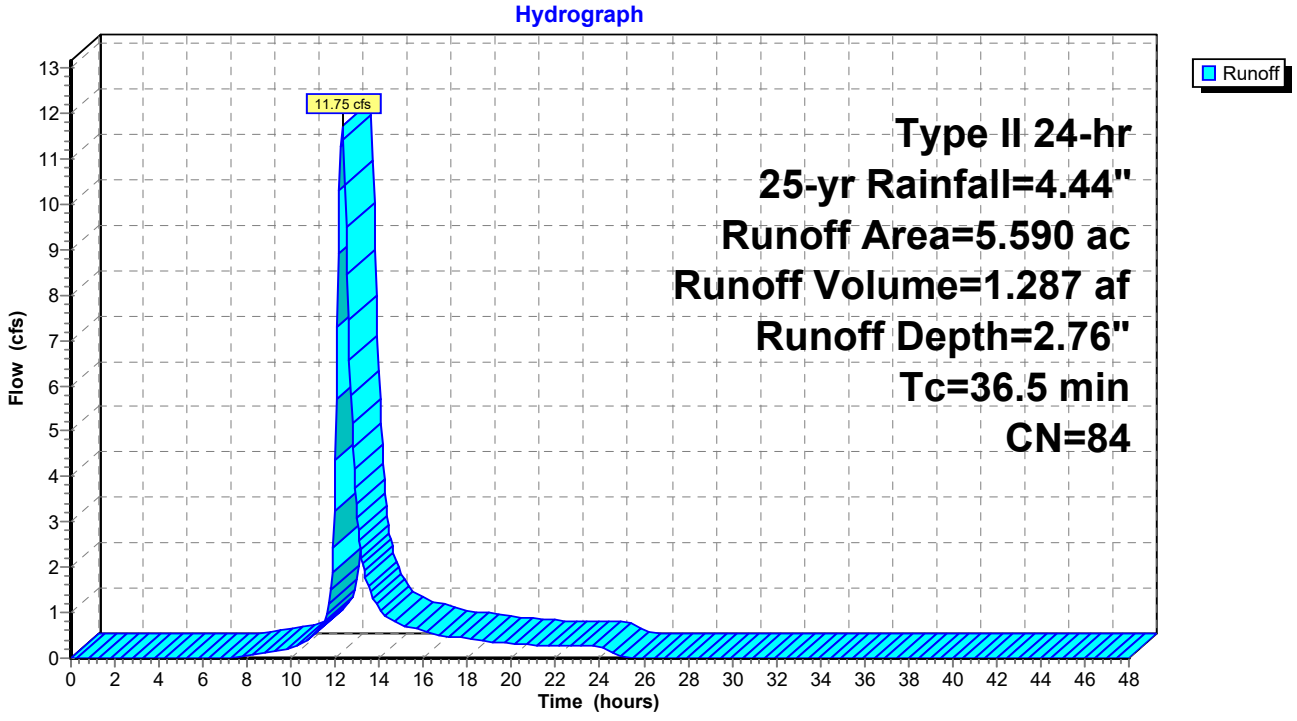
Runoff = 11.75 cfs @ 12.32 hrs, Volume= 1.287 af, Depth= 2.76"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr Rainfall=4.44"

Area (ac)	CN	Description
0.850	98	Paved parking, HSG D
0.710	89	<50% Grass cover, Poor, HSG D
4.030	80	>75% Grass cover, Good, HSG D
5.590	84	Weighted Average
4.740		84.79% Pervious Area
0.850		15.21% Impervious Area

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

Subcatchment 1S: Ramp C1-RT-01



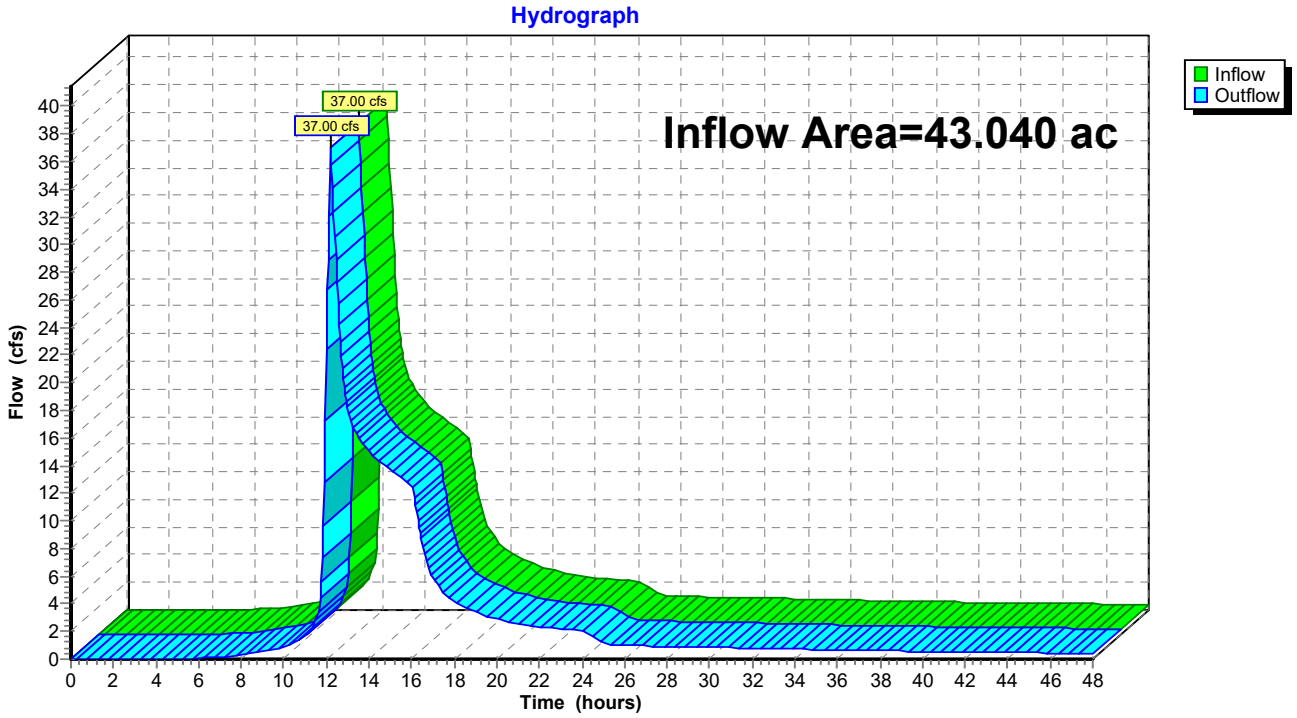
Summary for Reach 1R: (new Reach)

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 43.040 ac, 41.66% Impervious, Inflow Depth > 2.88" for 25-yr event
Inflow = 37.00 cfs @ 12.22 hrs, Volume= 10.327 af
Outflow = 37.00 cfs @ 12.22 hrs, Volume= 10.327 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Reach 1R: (new Reach)



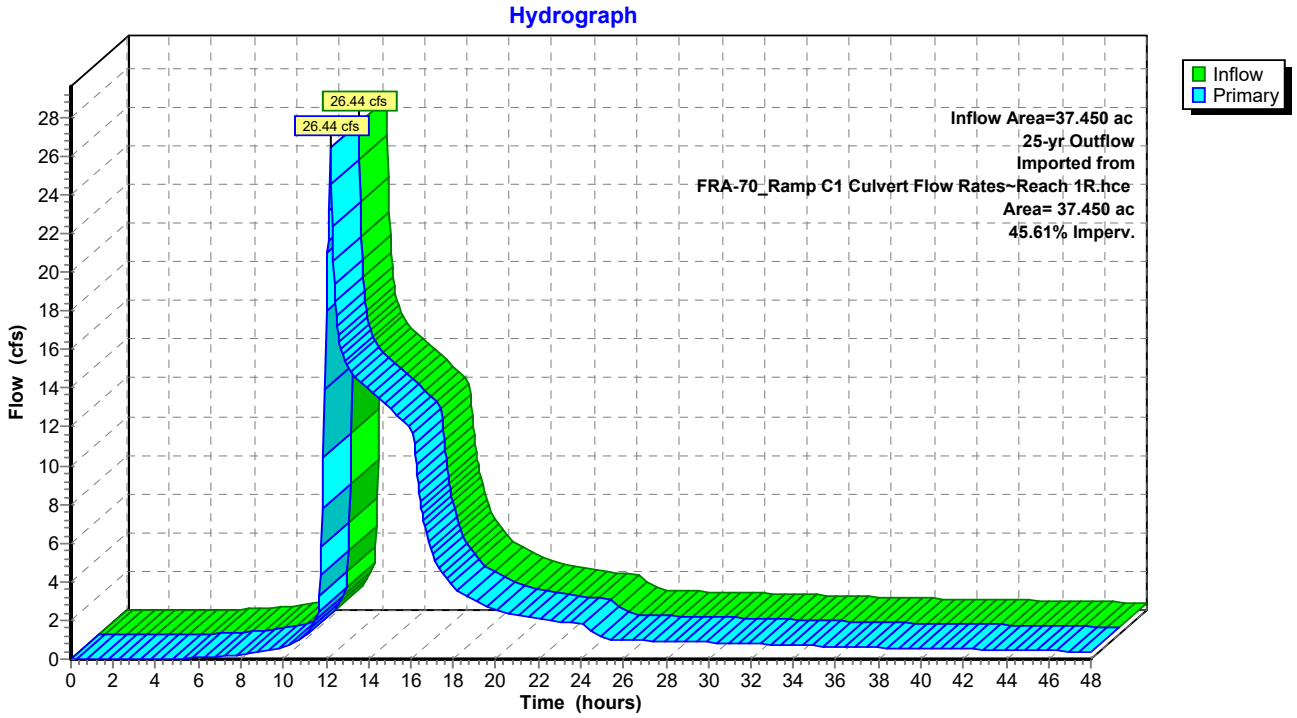
Summary for Link 1L: Ramp C1 Culvert Outfall Sta. 6007+00

Inflow Area = 37.450 ac, 45.61% Impervious, Inflow Depth > 2.90" for 25-yr event
Inflow = 26.44 cfs @ 12.21 hrs, Volume= 9.040 af
Primary = 26.44 cfs @ 12.21 hrs, Volume= 9.040 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

25-yr Outflow Imported from FRA-70_Ramp C1 Culvert Flow Rates~Reach 1R.hce

Link 1L: Ramp C1 Culvert Outfall Sta. 6007+00



Summary for Subcatchment 1S: Ramp C1-RT-01

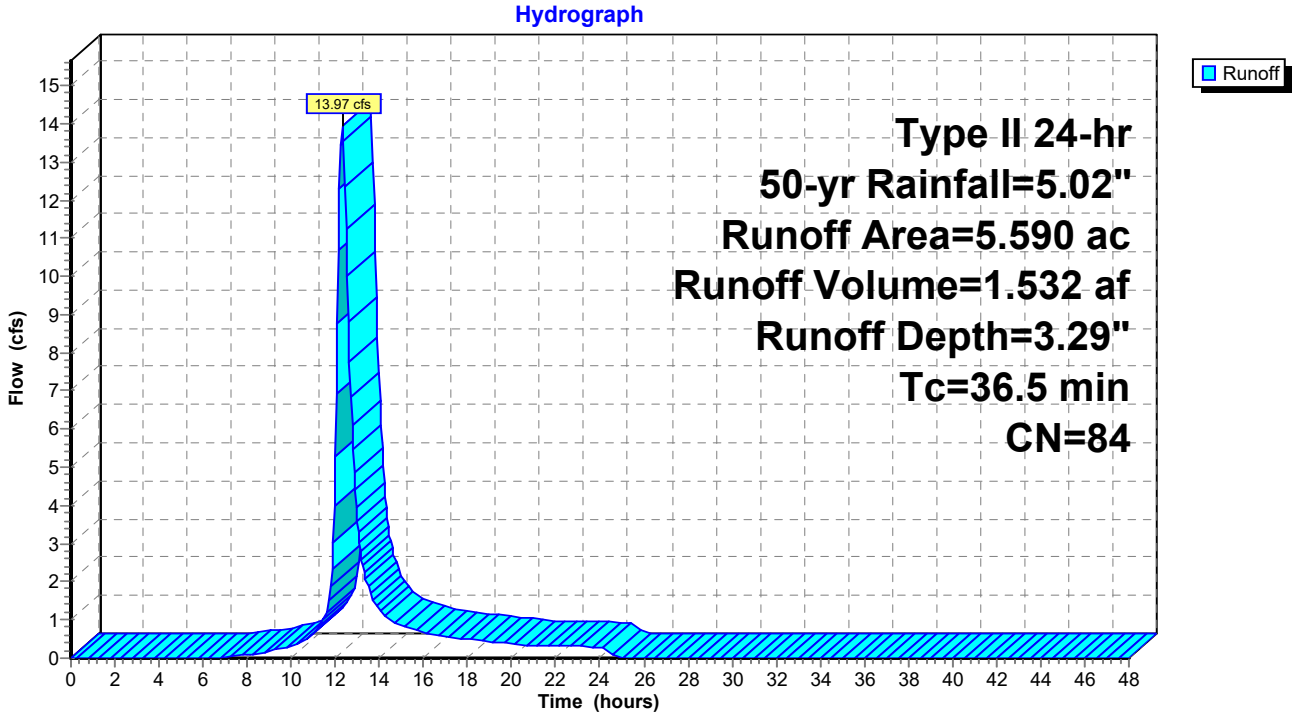
Runoff = 13.97 cfs @ 12.32 hrs, Volume= 1.532 af, Depth= 3.29"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 50-yr Rainfall=5.02"

Area (ac)	CN	Description
0.850	98	Paved parking, HSG D
0.710	89	<50% Grass cover, Poor, HSG D
4.030	80	>75% Grass cover, Good, HSG D
5.590	84	Weighted Average
4.740		84.79% Pervious Area
0.850		15.21% Impervious Area

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

Subcatchment 1S: Ramp C1-RT-01



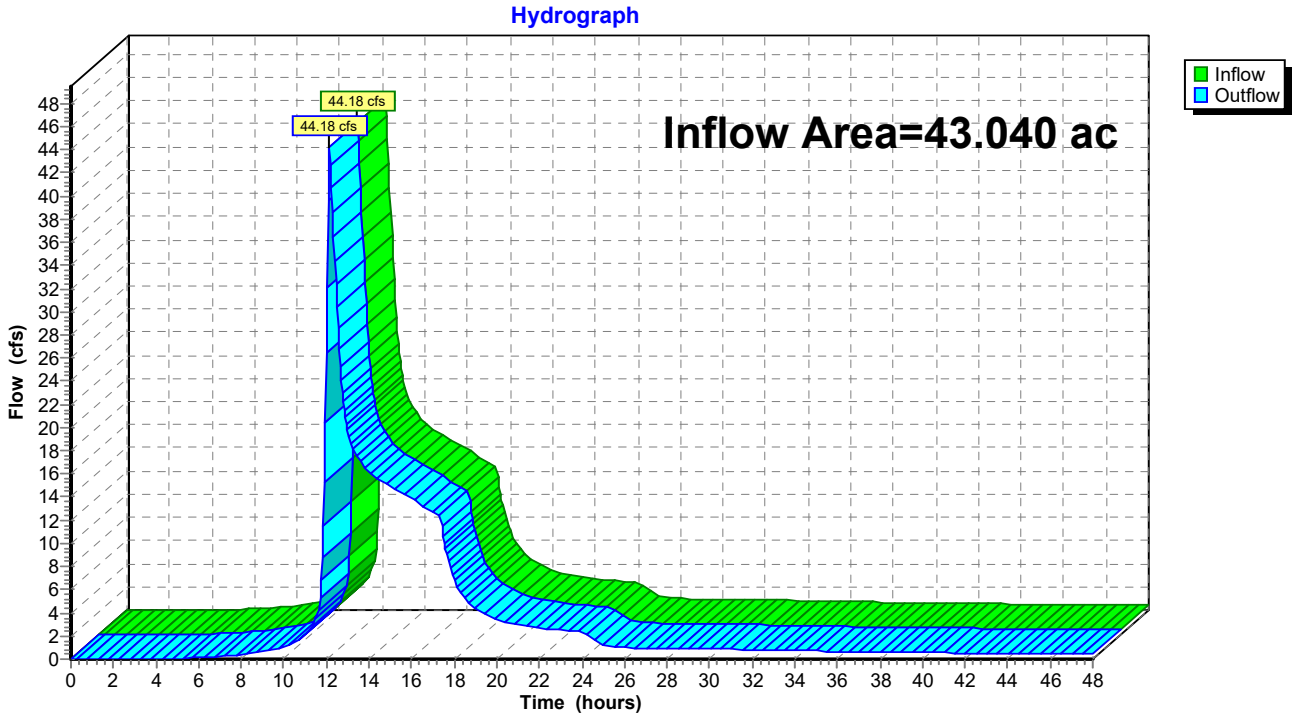
Summary for Reach 1R: (new Reach)

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 43.040 ac, 41.66% Impervious, Inflow Depth > 3.42" for 50-yr event
Inflow = 44.18 cfs @ 12.16 hrs, Volume= 12.282 af
Outflow = 44.18 cfs @ 12.16 hrs, Volume= 12.282 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Reach 1R: (new Reach)



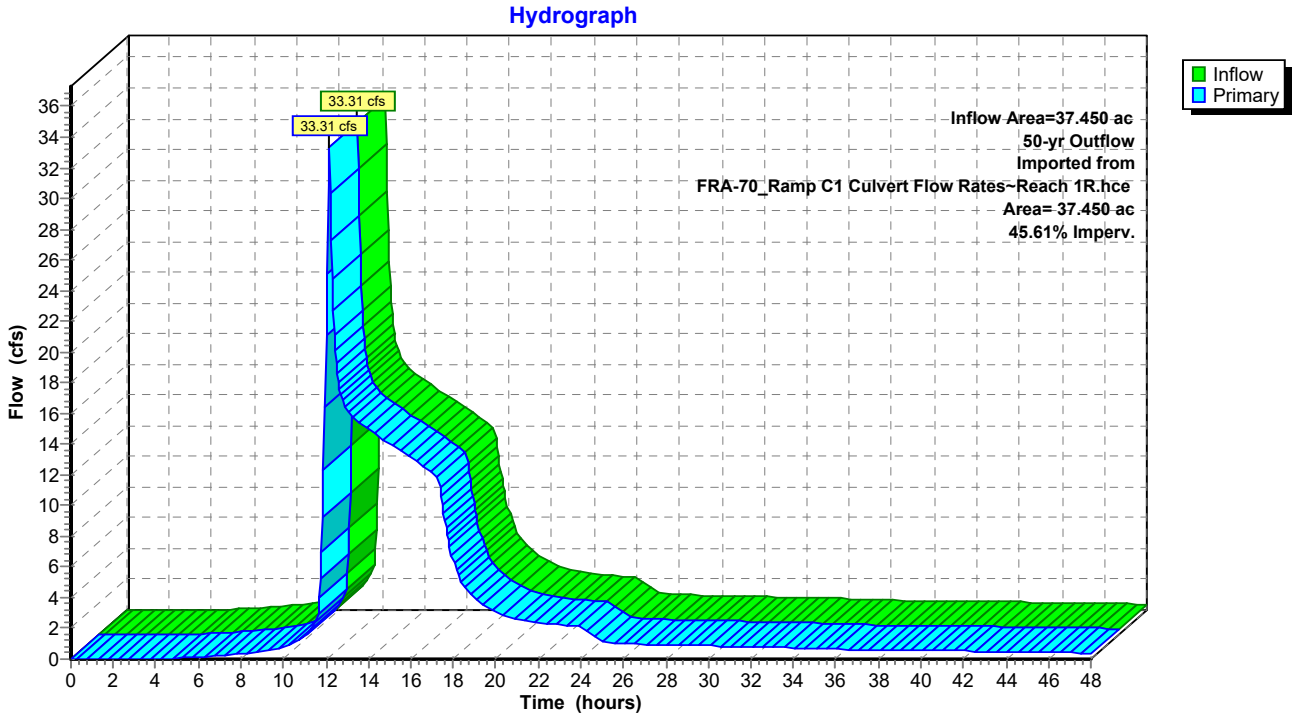
Summary for Link 1L: Ramp C1 Culvert Outfall Sta. 6007+00

Inflow Area = 37.450 ac, 45.61% Impervious, Inflow Depth > 3.44" for 50-yr event
Inflow = 33.31 cfs @ 12.15 hrs, Volume= 10.750 af
Primary = 33.31 cfs @ 12.15 hrs, Volume= 10.750 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

50-yr Outflow Imported from FRA-70_Ramp C1 Culvert Flow Rates~Reach 1R.hce

Link 1L: Ramp C1 Culvert Outfall Sta. 6007+00



Summary for Subcatchment 1S: Ramp C1-RT-01

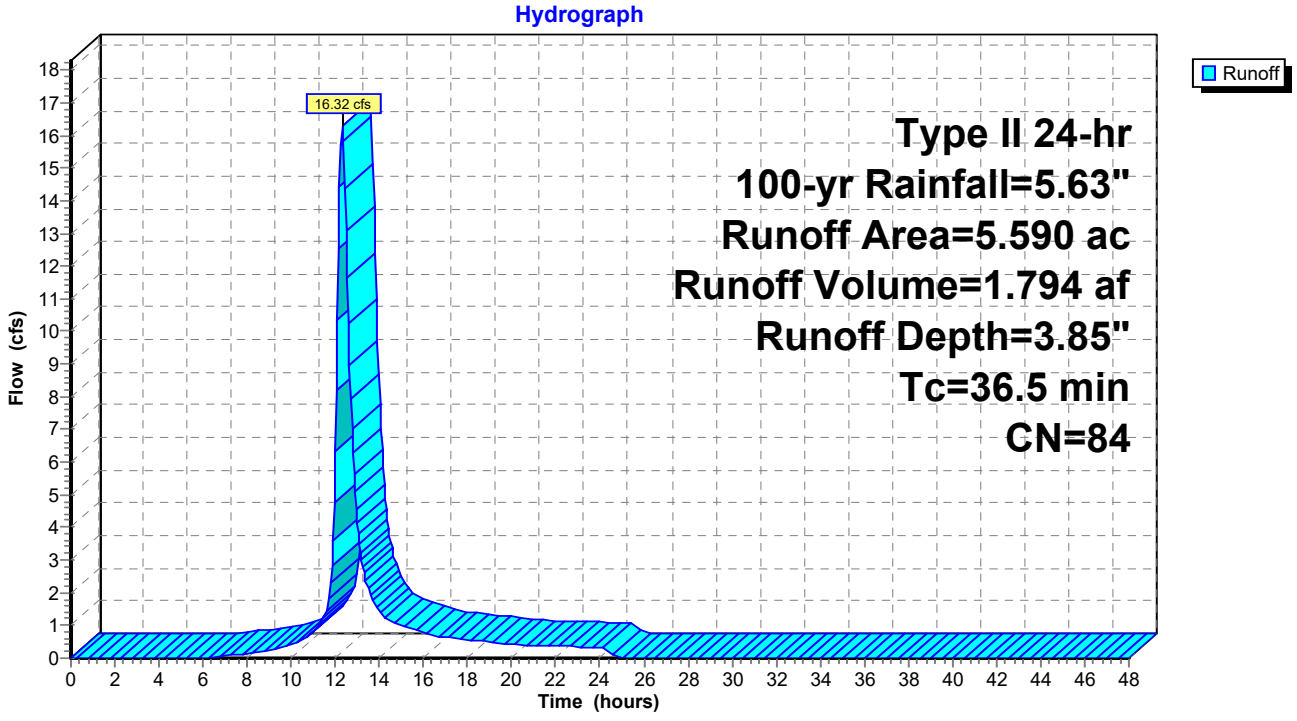
Runoff = 16.32 cfs @ 12.32 hrs, Volume= 1.794 af, Depth= 3.85"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-yr Rainfall=5.63"

Area (ac)	CN	Description
0.850	98	Paved parking, HSG D
0.710	89	<50% Grass cover, Poor, HSG D
4.030	80	>75% Grass cover, Good, HSG D
5.590	84	Weighted Average
4.740		84.79% Pervious Area
0.850		15.21% Impervious Area

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

Subcatchment 1S: Ramp C1-RT-01



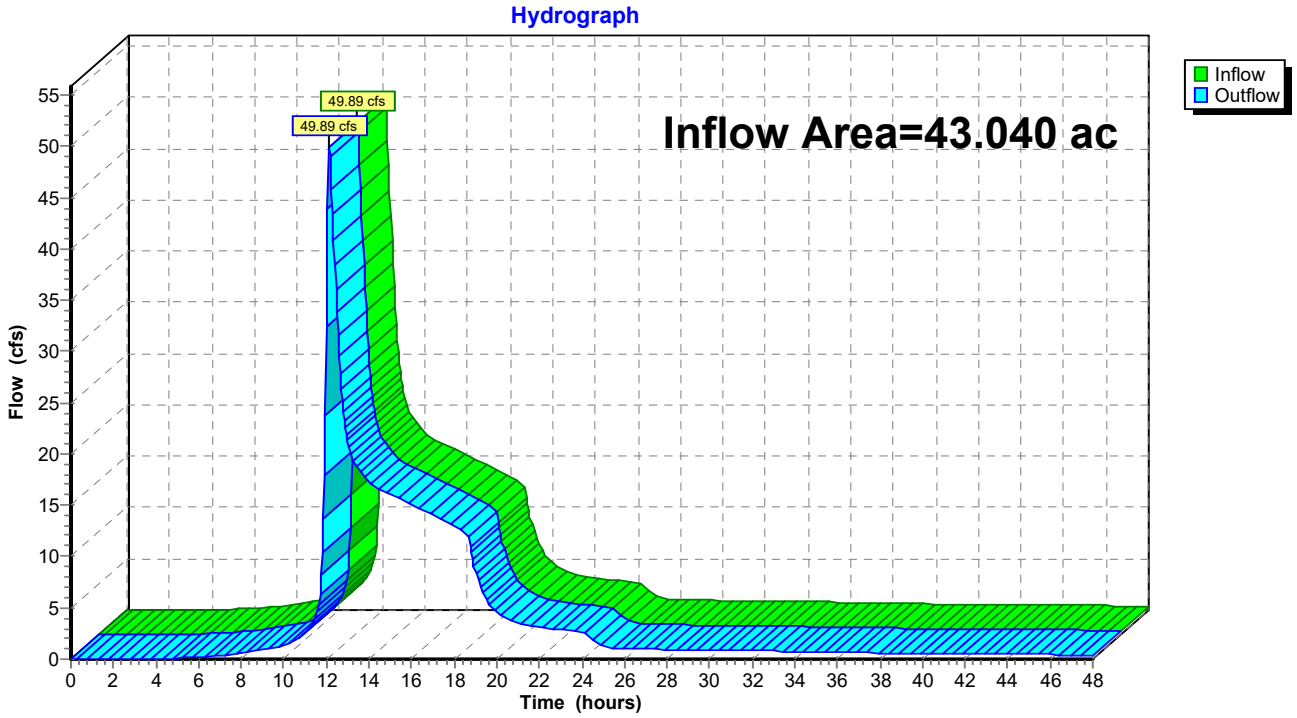
Summary for Reach 1R: (new Reach)

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 43.040 ac, 41.66% Impervious, Inflow Depth > 4.00" for 100-yr event
Inflow = 49.89 cfs @ 12.13 hrs, Volume= 14.362 af
Outflow = 49.89 cfs @ 12.13 hrs, Volume= 14.362 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Reach 1R: (new Reach)



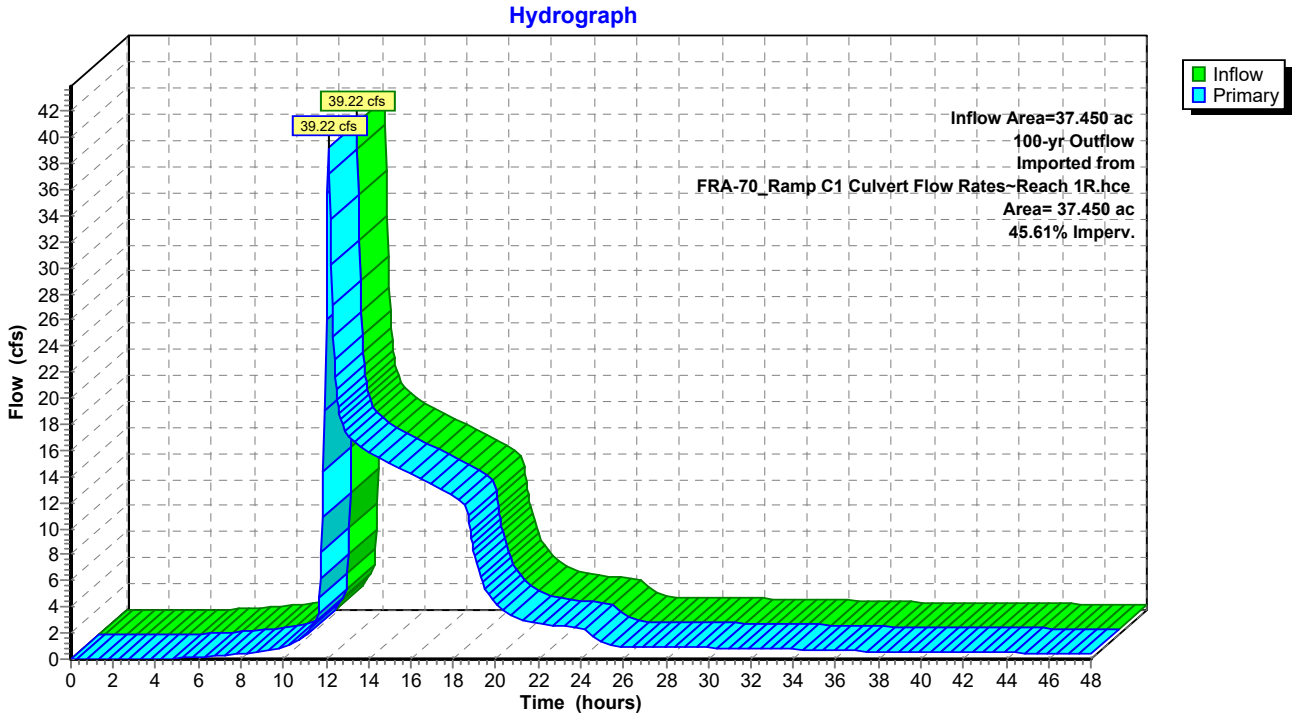
Summary for Link 1L: Ramp C1 Culvert Outfall Sta. 6007+00

Inflow Area = 37.450 ac, 45.61% Impervious, Inflow Depth > 4.03" for 100-yr event
Inflow = 39.22 cfs @ 12.11 hrs, Volume= 12.567 af
Primary = 39.22 cfs @ 12.11 hrs, Volume= 12.567 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

100-yr Outflow Imported from FRA-70_Ramp C1 Culvert Flow Rates~Reach 1R.hce

Link 1L: Ramp C1 Culvert Outfall Sta. 6007+00



STORM SEWER SYSTEM

PID : 95639 **Date :** 06/20/2018 **Project :** FRA-70-22.61 **Location :** Franklin County, Ohio

Description : C1&IR70 Sta 6054+89 - 6051+35, into existing storm pipe 84" **Designer :** REW

Rainfall Area: C **Just Full Capacity Frequency (yrs.) :** 10 **Hydraulic Gradient Frequency (yrs.) :** 25

Minimum Pipe Size : 15.00 **Tailwater Elevation (ft.):** 0.00

JUNCTION From	To	STATION From / To	ΔAREA / ΣAREA (acres)	ΔCA / ΣCA	BEGIN TIME (min.)	RAINFALL INTENSITY (10 yrs.)	(25 yrs.)	DISCHARGE (cfs.) (10 yrs.)	(25 yrs.)	PIPE DIAM. (in.)	LENGTH (ft.)	SLOPE (ft./ft.)	F/L PIPE IN / OUT (ft.)	MEAN VEL (fps.)	JUST FULL CAPACITY (cfs.)	FRICT SLOPE (ft./ft.)	HYGR EL. IN / OUT (ft.)	COVER IN / OUT (ft.)	COVER MINUS HY GR	COVER MINUS CROWN	INLET TYPE MANNING'S 'n'
83	113	6054+89	0.50	0.45	10.00	5.32	5.86	2.4	2.6	15	139.0	0.0050	788.19	3.38	4.26	0.0022	788.94	793.44	4.50	4.00	I 3C
begin		6053+50	0.50	0.45									787.50				788.45	793.25			0.015
113	84	6053+50	0.00	0.00	10.69	5.19	5.67	2.3	2.6	15	196.0	0.0050	787.50	3.36	4.26	0.0021	788.23	793.25	5.02	4.50	MH 3
		6051+54	0.50	0.45									786.52				787.47	792.26			0.015
84	85	6051+54	0.56	0.51	11.66	5.01	5.66	4.8	5.4	18	19.0	0.0050	786.27	3.99	6.92	0.0035	787.44	792.26	4.82	4.49	I 3C
final		6051+36	1.06	0.96									786.18				787.37	792.51			0.015

STORM SEWER SYSTEM

PID : 95639 **Date :** 10/23/2019 **Project :** FRA-70-22.61 **Location :** Franklin County, Ohio

Description : C1&IR70 Sta 6060+20 - 6067+16, 6 CBs, exist, to culvert **Designer :** SJB

Rainfall Area: C **Just Full Capacity Frequency (yrs.) :** 10 **Hydraulic Gradient Frequency (yrs.) :** 25

Minimum Pipe Size : 15.00 **Tailwater Elevation (ft.):** 0.00

JUNCTION From	To	STATION From To	ΔAREA ΣAREA (acres)	ΔCA ΣCA	BEGIN TIME (min.)	RAINFALL INTENSITY (10 yrs.)	(25 yrs.)	DISCHARGE (cfs.) (10 yrs.)	(25 yrs.)	PIPE DIAM. (in.)	LENGTH (ft.)	SLOPE (ft./ft.)	F/L PIPE IN / OUT (ft.)	MEAN VEL (fps.)	JUST FULL CAPACITY (cfs.)	FRICT SLOPE (ft./ft.)	HYGR EL. IN / OUT (ft.)	COVER IN / OUT (ft.)	COVER MINUS HY GR	COVER MINUS CROWN	INLET TYPE MANNING'S 'n'
70	71	6060+20	0.29	0.27	10.00	5.32	5.92	1.4	1.6	15	84.0	0.0060	786.71	3.16	4.66	0.0008	787.23	791.96	4.73	4.00	I 3D
begin		6061+04	0.29	0.27									786.21				787.08	791.67			0.015
71	72	6061+04	0.13	0.12	10.44	5.23	5.77	2.0	2.2	15	86.0	0.0050	786.21	3.24	4.26	0.0016	786.95	791.67	4.72	4.21	I 3D
		6061+90	0.43	0.38									785.78				786.81	791.98			0.015
72	73	6061+90	0.34	0.30	10.89	5.15	5.77	3.5	4.0	15	54.0	0.0050	785.78	3.65	4.26	0.0050	786.81	791.98	5.17	4.95	I 3D
		6061+90	0.77	0.69									785.51				786.54	792.31			0.015
73	76	6061+90	0.34	0.30	11.13	5.10	5.60	7.5	8.2	21	236.0	0.0050	785.01	4.45	10.45	0.0036	786.25	792.31	6.06	5.55	I 3C
		6064+36	1.10	0.99									783.83				785.24	793.74			0.015
74	75	6060+20	0.35	0.31	10.00	5.32	5.91	1.7	1.9	15	84.0	0.0050	787.05	3.09	4.26	0.0011	787.65	792.30	4.65	4.00	I 3C
begin		6061+04	1.45	1.31									786.63				787.53	793.08			0.015
75	73	6061+04	0.18	0.16	10.45	5.23	5.83	2.5	2.8	15	86.0	0.0050	786.63	3.41	4.26	0.0025	787.40	793.08	5.68	5.20	I 3C
		6062+00	1.64	1.47									786.20				787.16	792.31			0.015
76	78	6064+36	0.91	0.68	12.02	4.94	5.56	10.6	12.0	24	65.0	0.0050	783.58	4.86	14.91	0.0037	785.12	793.74	8.62	8.16	MH 3
		6065+00	2.54	2.15									783.26				784.88	794.24			0.015
77	78	6065+00	0.84	0.46	15.00	4.47	5.06	2.0	2.3	15	64.0	0.0100	786.95	4.20	6.02	0.0017	787.51	789.70	2.19	1.50	CB 2-3
begin		6065+00	3.38	2.61									786.31				787.24	794.24			0.015

STORM SEWER SYSTEM

JUNCTION From	To	STATION From To	ΔAREA ΣAREA (acres)	ΔCA ΣCA	BEGIN TIME (min.)	RAINFALL INTENSITY (10 yrs.)	(25 yrs.)	DISCHARGE (cfs.) (10 yrs.)	(25 yrs.)	PIPE DIAM. (in.)	LENGTH (ft.)	SLOPE (ft./ft.)	F/L PIPE IN / OUT (ft.)	MEAN VEL (fps.)	JUST FULL CAPACITY (cfs.)	FRICT SLOPE (ft./ft.)	HYGR EL. IN / OUT (ft.)	COVER IN / OUT (ft.)	COVER MINUS HY GR	COVER MINUS CROWN	INLET TYPE MANNING'S 'n'
78	79	6065+00	0.00	0.00	15.25	4.44	4.95	11.6	12.9	24	220.0	0.0050	783.26	4.94	14.91	0.0043	784.79	794.24	9.45	8.98	MH 3
final		6067+16	3.38	2.61									782.16				783.81	796.00			0.015

STORM SEWER SYSTEM

PID : 95639 **Date :** 11/04/2019 **Project :** FRA-70-22.61 **Location :** Franklin County, Ohio

Description : G1 8583+54 - 8581+93, outfall into culvert **Designer :** SJB

Rainfall Area: C **Just Full Capacity Frequency (yrs.) :** 10 **Hydraulic Gradient Frequency (yrs.) :** 25

Minimum Pipe Size : 15.00 **Tailwater Elevation (ft.):** 0.00

JUNCTION From	To	STATION From To	ΔAREA ΣAREA (acres)	ΔCA ΣCA	BEGIN TIME (min.)	RAINFALL INTENSITY (10 yrs.)	(25 yrs.)	DISCHARGE (cfs.) (10 yrs.)	(25 yrs.)	PIPE DIAM. (in.)	LENGTH (ft.)	SLOPE (ft./ft.)	F/L PIPE IN / OUT (ft.)	MEAN VEL (fps.)	JUST FULL CAPACITY (cfs.)	FRICT SLOPE (ft./ft.)	HYGR EL. IN / OUT (ft.)	COVER IN / OUT (ft.)	COVER MINUS HY GR	COVER MINUS CROWN	INLET TYPE MANNING'S 'n'
214	215	8583+54	0.23	0.20	10.00	5.32	5.94	1.1	1.2	15	60.0	0.0070	786.63	3.10	5.04	0.0005	787.08	792.38	5.30	4.50	I 3C
begin		8582+94	0.23	0.20									786.21				787.05	792.29			0.015
215	216	8582+94	0.13	0.12	10.32	5.26	5.81	1.7	1.9	15	42.0	0.0050	786.21	3.10	4.26	0.0011	786.97	792.29	5.32	4.83	I 3C
		8582+52	0.36	0.32									786.00				786.92	792.37			0.015
216	217	8582+52	0.81	0.73	10.55	5.21	5.81	5.5	6.1	18	103.0	0.0050	785.75	4.09	6.92	0.0045	786.92	792.37	5.45	5.12	I 3C
final		8581+93	1.17	1.05									785.24				786.46	786.74			0.015

STORM SEWER SYSTEM

PID : 95639 **Date :** 11/01/2019 **Project :** FRA-70-22.61 **Location :** Franklin County, Ohio

Description : G1 8584+82 - 8584+40, outfall proposed headwall beyond C1 **Designer :** SJB

Rainfall Area: C **Just Full Capacity Frequency (yrs.) :** 10 **Hydraulic Gradient Frequency (yrs.) :** 25

Minimum Pipe Size : 15.00 **Tailwater Elevation (ft.):** 0.00

JUNCTION From	To	STATION From / To	ΔAREA / ΣAREA (acres)	ΔCA / ΣCA	BEGIN TIME (min.)	RAINFALL INTENSITY (10 yrs.)	(25 yrs.)	DISCHARGE (cfs.) (10 yrs.)	(25 yrs.)	PIPE DIAM. (in.)	LENGTH (ft.)	SLOPE (ft./ft.)	F/L PIPE IN / OUT (ft.)	MEAN VEL (fps.)	JUST FULL CAPACITY (cfs.)	FRICT SLOPE (ft./ft.)	HYGR EL. IN / OUT (ft.)	COVER IN / OUT (ft.)	COVER MINUS HY GR	COVER MINUS CROWN	INLET TYPE MANNING'S 'n'
212	213	8584+82	1.12	1.01	10.00	5.32	5.96	5.4	6.0	15	63.0	0.0080	787.76	4.37	5.39	0.0115	789.10	793.51	4.41	4.50	I 3C
begin		8584+55	1.12	1.01									787.26				788.38	793.82			0.015
213	236	8584+55	1.80	1.37	10.24	5.27	5.89	12.5	14.0	24	83.0	0.0040	783.12	4.50	13.34	0.0051	785.12	793.82	8.70	8.70	MH 3
final		8584+40	2.92	2.38									782.79				784.46	785.99			0.015

STORM SEWER SYSTEM

PID : 95639 **Date :** 04/20/2021 **Project :** FRA-70-22.61 **Location :** Franklin County, Ohio

Description : G1 8592+00 - 8588+95, outfall into infield **Designer :** ARG

Rainfall Area: C **Just Full Capacity Frequency (yrs.) :** 10 **Hydraulic Gradient Frequency (yrs.) :** 25

Minimum Pipe Size : 15.00 **Tailwater Elevation (ft.):** 0.00

JUNCTION From	To	STATION From / To	ΔAREA / ΣAREA (acres)	ΔCA / ΣCA	BEGIN TIME (min.)	RAINFALL INTENSITY (10 yrs.)	(25 yrs.)	DISCHARGE (cfs.) (10 yrs.)	(25 yrs.)	PIPE DIAM. (in.)	LENGTH (ft.)	SLOPE (ft./ft.)	F/L PIPE IN / OUT (ft.)	MEAN VEL (fps.)	JUST FULL CAPACITY (cfs.)	FRICT SLOPE (ft./ft.)	HYGR EL. IN / OUT (ft.)	COVER IN / OUT (ft.)	COVER MINUS HY GR	COVER MINUS CROWN	INLET TYPE MANNING'S 'n'
221	222	8592+00	6.40	3.97	17.50	4.15	4.57	16.5	18.2	24	35.5	0.0100	789.53	6.99	21.09	0.0086	791.47	795.00	3.53	3.48	CB 2-3
begin		8591+71	6.40	3.97									789.17				791.17	797.02			0.015
222	223	8591+71	0.00	0.00	17.58	4.14	4.57	16.4	18.2	30	276.0	0.0020	788.67	3.67	17.07	0.0026	791.17	797.02	5.85	5.85	MH 3
		8588+95	6.40	3.97									788.12				790.09	795.69			0.015
223	223A	8588+95	6.71	4.43	18.84	4.00	4.57	33.5	38.3	36	32.0	0.0064	787.62	7.13	49.75	0.0044	790.06	795.69	5.63	5.07	MH 3
final		8588+95	13.11	8.40									787.42				789.92	794.00			0.015

STORM SEWER SYSTEM

PID : 95639 **Date :** 10/23/2019 **Project :** FRA-70-22.61 **Location :** Franklin County, Ohio

Description : IR-70 STA. 532+00 TO 537+40 LT **Designer :** SJB

Rainfall Area: C **Just Full Capacity Frequency (yrs.) :** 10 **Hydraulic Gradient Frequency (yrs.) :** 25

Minimum Pipe Size : 15.00 **Tailwater Elevation (ft.):** 0.00

JUNCTION From	To	STATION From / To	ΔAREA / ΣAREA (acres)	ΔCA / ΣCA	BEGIN TIME (min.)	RAINFALL INTENSITY (10 yrs.)	(25 yrs.)	DISCHARGE (cfs.) (10 yrs.)	(25 yrs.)	PIPE DIAM. (in.)	LENGTH (ft.)	SLOPE (ft./ft.)	F/L PIPE IN / OUT (ft.)	MEAN VEL (fps.)	JUST FULL CAPACITY (cfs.)	FRICT SLOPE (ft./ft.)	HYGR EL. IN / OUT (ft.)	COVER IN / OUT (ft.)	COVER MINUS HY GR	COVER MINUS CROWN	INLET TYPE MANNING'S 'n'
950	155	537+40	1.60	1.21	15.00	4.47	4.81	5.4	5.8	15	267.0	0.0082	775.96	4.40	5.45	0.0107	778.45	779.84	1.39	2.63	CB 2-3
begin		534+75	1.60	1.21									773.77				775.58	779.31			0.015
155	154	534+75	0.00	0.00	16.01	4.34	4.81	5.2	5.8	15	50.0	0.0082	773.77	4.70	5.45	0.0107	775.58	779.31	3.73	4.29	MH 3
		534+25	1.60	1.21									773.36				775.05	779.04			0.015
154	951	534+25	0.00	0.00	16.19	4.31	4.81	5.2	5.8	15	226.0	0.0082	773.36	4.70	5.45	0.0107	775.05	779.04	3.99	4.43	MH 3
final		532+00	1.60	1.21									771.51				772.62	775.44			0.015

FRA-70_MOD Layout_Alt 1.stsw

10-Year

Conduit FlexTable: Storm Sewer Design Hydraulics

Active Scenario: Storm Sewer Design

Label	Node Start Stop	Flow (cfs)	Diameter (in)	Length (Unified) (ft)	Slope (ft/ft)	Invert Start Stop (ft)	Manning's n	Velocity (ft/s)	Capacity (Design) (cfs)	Ground Start Stop (ft)	Hydraulic Grade Line (In) (ft)	Ground Minus HGL (Start) (ft)	Hydraulic Grade Line (Out) (ft)	Ground Minus HGL (Stop) (ft)	Cover (ft)
P-1	EX-2	7.47	15.0	100.0	0.0131	787.53	0.015	6.09	6.41	790.38	789.15	1.23	787.31	4.14	1.60
	D-92					786.22				791.45					
P-2	D-92	9.72	24.0	36.0	0.0050	785.45	0.015	4.78	13.86	791.45	786.67	4.78	786.38	5.31	4.00
	D-91					785.27				791.69					
P-3	D-91	11.40	30.0	160.0	0.0020	783.14	0.015	3.52	15.90	791.69	784.75	6.94	784.48	5.78	6.05
	D-93					782.82				790.26					
P-4	D-93	12.80	30.0	240.0	0.0020	782.82	0.015	3.60	15.90	790.26	784.48	5.78	783.91	6.75	4.94
	D-114					782.34				790.66					
P-5	D-114	12.37	30.0	161.0	0.0020	782.34	0.015	3.57	15.85	790.66	783.91	6.75	783.32	6.50	5.82
	D-94					782.02				789.82					
P-6	D-94	14.30	36.0	200.0	0.0020	781.68	0.015	3.75	25.85	789.82	783.32	6.50	783.00	6.17	5.14
	D-95					781.28				789.17					
P-7	D-95	15.12	36.0	130.0	0.0020	781.28	0.015	3.79	25.75	789.17	783.00	6.17	782.80	6.22	4.89
	D-96					781.02				789.02					
P-8	D-96	15.87	36.0	89.0	0.0020	781.02	0.015	3.86	25.99	789.02	782.80	6.22	782.67	6.28	5.00
	D-97					780.84				788.95					
P-9	D-97	23.98	36.0	29.0	0.0040	780.84	0.015	5.52	36.56	788.95	782.67	6.28	782.58	6.48	5.11
	D-102					780.72				789.06					
P-10	D-102	25.70	36.0	13.0	0.0040	780.72	0.015	5.60	36.56	789.06	782.58	6.48	782.53	7.10	5.34
	D-103					780.67				789.63					
P-11	D-103	25.67	36.0	282.0	0.0040	780.67	0.015	5.60	36.56	789.63	782.53	7.10	781.73	7.20	5.96
	D-104					779.54				788.93					
P-14	EX-1	8.60	15.0	82.0	0.0159	784.62	0.015	7.01	7.05	787.47	786.45	1.02	784.46	4.47	1.60
	D-104					783.32				788.93					
P-15	D-110	2.35	15.0	103.0	0.0050	785.59	0.015	3.35	3.94	793.08	786.29	6.79	785.77	5.52	6.24
	D-111					785.08				791.29					
P-16	D-111	2.31	15.0	219.0	0.0050	785.08	0.015	3.34	3.95	791.29	785.77	5.52	784.60	4.35	4.96
	D-97					783.99				788.95					
P-17	D-101	2.93	15.0	123.0	0.0050	782.57	0.015	3.53	3.96	786.20	783.37	2.83	782.94	4.55	2.38
	D-99					781.95				787.49					
P-18	D-99	6.45	18.0	38.0	0.0050	781.70	0.015	4.15	6.44	787.49	782.94	4.55	782.75	5.32	4.29
	D-100					781.51				788.07					
P-19	D-100	8.53	21.0	28.0	0.0050	781.26	0.015	4.55	9.71	788.07	782.75	5.32	782.67	6.28	5.06
	D-97					781.12				788.95					
P-20	D-98	3.89	15.0	100.0	0.0050	783.59	0.015	3.68	3.96	788.34	784.59	3.75	784.07	4.27	3.50
	D-115					783.09				788.34					
P-21	D-115	3.82	15.0	227.0	0.0050	783.09	0.015	3.67	3.96	788.34	784.07	4.27	782.94	4.55	4.01
	D-99					781.95				787.49					
P-22	D-90	1.74	15.0	61.0	0.0039	784.63	0.015	2.86	3.51	789.88	785.25	4.63	784.91	6.78	4.00
	D-91					784.39				791.69					
P-23	D-104	32.35	36.0	300.0	0.0040	779.54	0.015	5.84	36.56	788.93	781.73	7.20	780.44	4.86	6.39
	D-506					778.34				785.30					
P-25	D-506	34.20	36.0	300.0	0.0050	778.34	0.015	6.47	40.87	785.30	780.44	4.86	779.01	3.67	3.96
	D-505					776.84				782.68					
P-26	D-505	35.05	36.0	160.0	0.0050	776.84	0.015	6.50	40.87	782.68	779.01	3.67	778.38	1.91	2.84
	D-504					776.04				780.29					

FRA-70_MOD Layout_Alt 1.stsw

Conduit FlexTable: Storm Sewer Design Hydraulics

10-Year

Active Scenario: Storm Sewer Design

Label	Node Start Stop	Flow (cfs)	Diameter (in)	Length (Unified) (ft)	Slope (ft/ft)	Invert Start Stop (ft)	Manning's n	Velocity (ft/s)	Capacity (Design) (cfs)	Ground Start Stop (ft)	Hydraulic Grade Line (In) (ft)	Ground Minus HGL (Start) (ft)	Hydraulic Grade Line (Out) (ft)	Ground Minus HGL (Stop) (ft)	Cover (ft)
P-28	D-503	45.23	36.0	124.0	0.0049	775.25	0.015	6.40	40.54	779.20	777.89	1.31	777.03	1.53	0.95
	D-502					774.64				778.56					
P-29	D-502	49.89	42.0	105.0	0.0050	774.64	0.015	7.13	61.65	778.56	777.03	1.53	776.47	2.94	0.42
	D-501					774.12				779.41					
P-30	D-501	49.59	42.0	55.0	0.0050	774.12	0.015	7.13	61.65	779.41	776.47	2.94	776.04	-2.20	1.79
	D-500					773.84				773.84					
P-31	EX-3	5.43	18.0	13.0	0.0038	775.81	0.015	3.07	5.65	779.84	778.05	1.79	778.00	3.43	2.53
	D-155					775.76				781.43					
P-32	D-155	5.42	18.0	165.0	0.0040	775.76	0.015	3.07	5.76	781.43	778.00	3.43	777.41	2.74	4.17
	D-154					775.10				780.15					
P-33	D-154	5.27	18.0	116.0	0.0040	775.10	0.015	2.98	5.73	780.15	777.41	2.74	777.03	1.53	3.55
	D-502					774.64				778.56					
P-34	D-109	2.07	18.0	79.0	0.0040	777.96	0.015	2.99	5.76	782.29	778.59	3.70	778.39	3.70	2.83
	D-108					777.65				782.09					
P-35	D-108	2.60	18.0	79.0	0.0040	777.65	0.015	3.17	5.76	782.09	778.39	3.70	778.26	3.99	2.94
	D-107					777.33				782.25					
P-36	D-107	3.95	18.0	55.0	0.0040	777.33	0.015	3.51	5.76	782.25	778.26	3.99	778.07	3.13	3.42
	D-509					777.11				781.20					
P-37	D-509	3.53	24.0	300.0	0.0039	777.11	0.015	3.37	12.22	781.20	778.07	3.13	777.96	2.40	2.09
	D-508					775.94				780.36					
P-39	D-504	35.54	36.0	158.0	0.0050	776.04	0.015	6.51	40.87	780.29	778.38	1.91	777.89	1.31	1.25
	D-503					775.25				779.20					
P-40	D-507	4.21	24.0	146.0	-0.0040	775.36	0.015	1.34	12.42	780.00	777.96	2.04	777.89	2.47	2.64
	D-508					775.94				780.36					
P-41	D-507	4.01	36.0	20.0	0.0054	775.36	0.015	3.78	42.48	780.00	777.89	2.11	777.89	1.31	1.64
	D-503					775.25				779.20					

FRA-70_MOD Layout_Alt 1.stsw

Conduit FlexTable: Storm Sewer Analysis Hydraulics

25-Year

Active Scenario: Storm Sewer Check

Label	Node Start Stop	Roadway Station (Start) (ft)	Roadway Station (Stop) (ft)	Flow (cfs)	Diameter (in)	Length (Unified) (ft)	Slope (ft/ft)	Invert Start Stop (ft)	Manning's n	Friction Slope (ft/ft)	HGL Start Stop (ft)	Ground Start Stop (ft)	Ground Minus HGL (ft)	Cover (ft)
P-1	EX-2	(N/A)	(N/A)	9.01	15.0	100.0	0.0131	787.53	0.015	0.0258	790.02	790.38	0.36	1.60
	D-92							786.22			787.38	791.45		
P-2	D-92	(N/A)	(N/A)	11.73	24.0	36.0	0.0050	785.45	0.015	0.0058	786.83	791.45	4.62	4.00
	D-91							785.27			786.50	791.69		
P-3	D-91	(N/A)	(N/A)	13.75	30.0	160.0	0.0020	783.14	0.015	0.0015	785.12	791.69	6.57	6.05
	D-93							782.82			784.89	790.26		
P-4	D-93	(N/A)	(N/A)	15.43	30.0	240.0	0.0020	782.82	0.015	0.0018	784.89	790.26	5.37	4.94
	D-114							782.34			784.46	790.66		
P-5	D-114	(N/A)	(N/A)	14.90	30.0	161.0	0.0020	782.34	0.015	0.0016	784.46	790.66	6.20	5.82
	D-94							782.02			784.21	789.82		
P-6	D-94	(N/A)	(N/A)	17.22	36.0	200.0	0.0020	781.68	0.015	0.0008	784.21	789.82	5.61	5.14
	D-95							781.28			784.06	789.17		
P-7	D-95	(N/A)	(N/A)	18.20	36.0	130.0	0.0020	781.28	0.015	0.0009	784.06	789.17	5.11	4.89
	D-96							781.02			783.95	789.02		
P-8	D-96	(N/A)	(N/A)	19.10	36.0	89.0	0.0020	781.02	0.015	0.0010	783.95	789.02	5.07	5.00
	D-97							780.84			783.86	788.95		
P-9	D-97	(N/A)	(N/A)	28.87	36.0	29.0	0.0040	780.84	0.015	0.0025	783.86	788.95	5.09	5.11
	D-102							780.72			783.79	789.06		
P-10	D-102	(N/A)	(N/A)	30.90	36.0	13.0	0.0040	780.72	0.015	0.0029	783.79	789.06	5.27	5.34
	D-103							780.67			783.75	789.63		
P-11	D-103	(N/A)	(N/A)	30.86	36.0	282.0	0.0040	780.67	0.015	0.0029	783.75	789.63	5.88	5.96
	D-104							779.54			782.95	788.93		
P-14	EX-1	(N/A)	(N/A)	10.37	15.0	82.0	0.0159	784.62	0.015	0.0343	787.36	787.47	0.11	1.60
	D-104							783.32			784.51	788.93		
P-15	D-110	(N/A)	(N/A)	2.89	15.0	103.0	0.0050	785.59	0.015	0.0050	786.39	793.08	6.69	6.24
	D-111							785.08			785.86	791.29		
P-16	D-111	(N/A)	(N/A)	2.83	15.0	219.0	0.0050	785.08	0.015	0.0051	785.86	791.29	5.43	4.96
	D-97							783.99			784.67	788.95		
P-17	D-101	(N/A)	(N/A)	3.59	15.0	123.0	0.0050	782.57	0.015	0.0041	784.81	786.20	1.39	2.38

FRA-70_MOD Layout_Alt 1.stsw

Conduit FlexTable: Storm Sewer Analysis Hydraulics

25-Year

Active Scenario: Storm Sewer Check

Label	Node Start Stop	Roadway Station (Start) (ft)	Roadway Station (Stop) (ft)	Flow (cfs)	Diameter (in)	Length (Unified) (ft)	Slope (ft/ft)	Invert Start Stop (ft)	Manning's n	Friction Slope (ft/ft)	HGL Start Stop (ft)	Ground Start Stop (ft)	Ground Minus HGL (ft)	Cover (ft)
	D-99							781.95			784.31	787.49		
P-18	D-99	(N/A)	(N/A)	7.87	18.0	38.0	0.0050	781.70	0.015	0.0075	784.31	787.49	3.18	4.29
	D-100							781.51			784.02	788.07		
P-19	D-100	(N/A)	(N/A)	10.42	21.0	28.0	0.0050	781.26	0.015	0.0058	784.02	788.07	4.05	5.06
	D-97							781.12			783.86	788.95		
P-20	D-98	(N/A)	(N/A)	4.77	15.0	100.0	0.0050	783.59	0.015	0.0073	786.62	788.34	1.72	3.50
	D-115							783.09			785.90	788.34		
P-21	D-115	(N/A)	(N/A)	4.68	15.0	227.0	0.0050	783.09	0.015	0.0070	785.90	788.34	2.44	4.01
	D-99							781.95			784.31	787.49		
P-22	D-90	(N/A)	(N/A)	2.10	15.0	61.0	0.0039	784.63	0.015	0.0037	785.33	789.88	4.55	4.00
	D-91							784.39			785.12	791.69		
P-23	D-104	(N/A)	(N/A)	38.61	36.0	300.0	0.0040	779.54	0.015	0.0045	782.95	788.93	5.98	6.39
	D-506							778.34			781.61	785.30		
P-25	D-506	(N/A)	(N/A)	40.73	36.0	300.0	0.0050	778.34	0.015	0.0050	781.61	785.30	3.69	3.96
	D-505							776.84			780.12	782.68		
P-26	D-505	(N/A)	(N/A)	41.63	36.0	160.0	0.0050	776.84	0.015	0.0052	780.12	782.68	2.56	2.84
	D-504							776.04			779.29	780.29		
P-28	D-503	(N/A)	(N/A)	53.61	36.0	124.0	0.0049	775.25	0.015	0.0081	778.45	779.20	0.75	0.95
	D-502							774.64			777.36	778.56		
P-29	D-502	(N/A)	(N/A)	59.20	42.0	105.0	0.0050	774.64	0.015	0.0052	777.36	778.56	1.20	0.42
	D-501							774.12			776.76	779.41		
P-30	D-501	(N/A)	(N/A)	58.85	42.0	55.0	0.0050	774.12	0.015	0.0057	776.76	779.41	2.65	1.79
	D-500							773.84			776.24	773.84		
P-31	EX-3	(N/A)	(N/A)	6.55	18.0	13.0	0.0038	775.81	0.015	0.0052	778.85	779.84	0.99	2.53
	D-155							775.76			778.78	781.43		
P-32	D-155	(N/A)	(N/A)	6.54	18.0	165.0	0.0040	775.76	0.015	0.0052	778.78	781.43	2.65	4.17
	D-154							775.10			777.93	780.15		
P-33	D-154	(N/A)	(N/A)	6.37	18.0	116.0	0.0040	775.10	0.015	0.0049	777.93	780.15	2.22	3.55
	D-502							774.64			777.36	778.56		

FRA-70_MOD Layout_Alt 1.stsw

Conduit FlexTable: Storm Sewer Analysis Hydraulics

25-Year

Active Scenario: Storm Sewer Check

Label	Node Start Stop	Roadway Station (Start) (ft)	Roadway Station (Stop) (ft)	Flow (cfs)	Diameter (in)	Length (Unified) (ft)	Slope (ft/ft)	Invert Start Stop (ft)	Manning's n	Friction Slope (ft/ft)	HGL Start Stop (ft)	Ground Start Stop (ft)	Ground Minus HGL (ft)	Cover (ft)
P-34	D-109	(N/A)	(N/A)	2.53	18.0	79.0	0.0040	777.96	0.015	0.0010	778.96	782.29	3.33	2.83
	D-108							777.65			778.91	782.09		
P-35	D-108	(N/A)	(N/A)	3.18	18.0	79.0	0.0040	777.65	0.015	0.0011	778.91	782.09	3.18	2.94
	D-107							777.33			778.83	782.25		
P-36	D-107	(N/A)	(N/A)	4.83	18.0	55.0	0.0040	777.33	0.015	0.0028	778.83	782.25	3.42	3.42
	D-509							777.11			778.68	781.20		
P-37	D-509	(N/A)	(N/A)	4.24	24.0	300.0	0.0039	777.11	0.015	0.0005	778.68	781.20	2.52	2.09
	D-508							775.94			778.55	780.36		
P-39	D-504	(N/A)	(N/A)	42.17	36.0	158.0	0.0050	776.04	0.015	0.0053	779.29	780.29	1.00	1.25
	D-503							775.25			778.45	779.20		
P-40	D-507	(N/A)	(N/A)	5.05	24.0	146.0	-0.0040	775.36	0.015	0.0007	778.55	780.00	1.45	2.64
	D-508							775.94			778.45	780.36		
P-41	D-507	(N/A)	(N/A)	4.84	36.0	20.0	0.0054	775.36	0.015	0.0001	778.45	780.00	1.55	1.64
	D-503							775.25			778.45	779.20		

STORM SEWER SYSTEM

PID : 95639 **Date :** 08/24/2021 **Project :** FRA-70-22.61 **Location :** City of Columbus, Franklin County, Ohio

Description : 72-inch - IR70 & Scrbrgh Blvd; w/o JCPenney **Designer :** ARG

Rainfall Area: C **Just Full Capacity Frequency (yrs.) :** 10 **Hydraulic Gradient Frequency (yrs.) :** 50

Minimum Pipe Size : 12.00 **Tailwater Elevation (ft.):** 0.00

JUNCTION From	To	STATION From / To	ΔAREA / ΣAREA (acres)	ΔCA / ΣCA	BEGIN TIME (min.)	RAINFALL INTENSITY (10 yrs.)	(50 yrs.)	DISCHARGE (cfs.) (10 yrs.)	(50 yrs.)	PIPE DIAM. (in.)	LENGTH (ft.)	SLOPE (ft./ft.)	F/L PIPE IN / OUT (ft.)	MEAN VEL (fps.)	JUST FULL CAPACITY (cfs.)	FRICT SLOPE (ft./ft.)	HYGR EL. IN / OUT (ft.)	COVER IN / OUT (ft.)	COVER MINUS HY GR	COVER MINUS CROWN	INLET TYPE MANNING'S 'n'
04	105	544+20	167.4	81.04	46.00	2.32	2.82	187.9	228.9	72	242.0	0.0061	772.80	12.07	355.81	0.0029	779.53	782.00	2.47	3.20	HW Full He
begin		544+20	167.44	81.04									771.32				778.82	787.15			0.013
105	106	544+06	0.00	0.00	46.33	2.31	2.82	187.0	228.9	72	162.0	0.0061	771.32	12.07	356.14	0.0029	778.82	787.15	8.33	9.83	MH 3
		6033+51	167.44	81.04									770.33				778.35	782.61			0.013
300	301	55+50	0.13	0.10	10.00	5.32	6.47	0.5	0.6	12	20.0	0.0120	780.46	3.13	3.64	0.0004	780.90	785.46	4.56	4.00	CB 3A
begin		55+30	167.56	81.14									780.22				780.89	785.39			0.015
301	302	55+30	0.02	0.02	10.11	5.30	6.45	0.6	0.8	12	20.0	0.0120	780.22	3.30	3.64	0.0006	780.68	785.39	4.71	4.17	CB 3A
		55+10	167.59	81.16									779.98				780.66	785.32			0.015
302	902	55+10	0.02	0.02	10.21	5.28	6.32	0.7	0.9	12	110.0	0.0090	779.98	3.10	3.15	0.0008	780.36	785.32	4.96	4.34	CB 3A
		54+00	167.61	81.18									778.99				779.69	785.17			0.015
312	902	54+00	0.17	0.14	10.00	5.32	6.44	0.7	0.9	12	48.0	0.0090	780.06	3.12	3.14	0.0008	780.44	785.06	4.62	4.00	CB 3A
begin		54+00	167.78	81.32									779.63				780.33	785.17			0.015
303	902	54+00	0.13	0.10	10.00	5.32	6.49	0.5	0.7	12	8.0	0.0325	779.89	4.45	5.99	0.0004	780.30	784.89	4.59	4.00	CB 3A
begin		52+50	167.91	81.42									779.63				780.30	785.17			0.015
902	901	54+00	0.00	0.00	10.80	5.16	2.82	2.0	1.1	12	164.0	0.0076	778.99	3.75	2.90	0.0012	779.60	785.17	5.57	5.18	MH 3
		52+36	167.91	81.42									777.74				779.40	784.34			0.015

STORM SEWER SYSTEM

JUNCTION From	To	STATION From	To	ΔAREA ΣAREA (acres)	ΔCA ΣCA	BEGIN TIME (min.)	RAINFALL INTENSITY (10 yrs.)	(50 yrs.)	DISCHARGE (cfs.) (10 yrs.)	(50 yrs.)	PIPE DIAM. (in.)	LENGTH (ft.)	SLOPE (ft./ft.)	F/L PIPE IN / OUT (ft.)	MEAN VEL (fps.)	JUST FULL CAPACITY (cfs.)	FRICT SLOPE (ft./ft.)	HYGR EL. IN / OUT (ft.)	COVER IN / OUT (ft.)	COVER MINUS HY GR	COVER MINUS CROWN	INLET TYPE MANNING'S 'n'
304	901	52+50		0.17	0.14	10.00	5.32	6.48	0.7	0.9	12	17.0	0.0212	779.13	4.23	4.83	0.0009	779.48	784.13	4.65	4.00	CB 3A
begin		51+36		168.08	81.56									778.77				779.47	784.34			0.015
313	901	52+36		0.12	0.10	10.00	5.32	2.82	0.5	0.3	12	42.0	0.0110	779.23	3.03	3.48	0.0001	779.43	784.23	4.80	4.00	CB 3A
begin		52+36		168.20	81.66									778.77				779.40	784.34			0.015
901	900	52+36		0.00	0.00	11.53	5.03	2.82	3.1	1.7	15	89.0	0.0049	777.59	3.56	4.23	0.0010	779.40	784.34	4.94	5.50	MH 3
		51+46		168.20	81.66									777.15				779.31	783.93			0.015
305	900	51+65		0.10	0.08	10.00	5.32	2.82	0.4	0.2	12	22.0	0.0273	778.72	3.92	5.49	0.0001	779.31	783.72	4.41	4.00	CB 3A
begin		51+47		168.30	81.74									778.12				779.31	783.92			0.015
314	900	51+47		0.06	0.05	10.00	5.32	2.82	0.3	0.1	12	39.0	0.0179	778.82	2.97	4.45	0.0000	779.31	783.82	4.51	4.00	CB 3A
begin		51+47		168.36	81.79									778.12				779.31	783.93			0.015
900	899	51+47		0.00	0.00	11.94	4.95	2.82	3.7	2.1	15	59.0	0.0040	777.15	3.27	3.81	0.0014	779.31	783.93	4.62	5.53	MH 3
		50+88		168.36	81.79									776.91				779.23	783.86			0.015
306	899	50+88		0.19	0.14	10.00	5.32	2.82	0.8	0.4	12	8.0	0.0300	778.54	4.80	5.75	0.0002	779.23	783.58	4.35	4.04	CB 3
begin		50+88		168.55	81.93									778.30				779.23	783.86			0.015
315	899	50+88		0.09	0.07	10.00	5.32	2.82	0.4	0.2	12	37.0	0.0122	778.75	2.82	3.66	0.0000	779.23	783.75	4.52	4.00	CB 3
begin		50+88		168.64	82.00									778.30				779.23	783.86			0.015
899	898	50+88		0.00	0.00	12.24	4.90	2.82	4.7	2.7	18	83.0	0.0036	776.66	3.48	5.89	0.0009	779.23	783.86	4.63	5.70	MH 3
		50+05		168.64	82.00									776.36				779.15	784.06			0.015
316	898	50+05		0.03	0.03	10.00	5.32	2.82	0.1	0.1	12	34.0	0.0350	778.95	3.06	6.21	0.0000	779.15	783.95	4.80	4.00	CB 3A
begin		50+05		168.67	82.02									777.76				779.15	784.06			0.015
307	898	50+05		0.06	0.04	10.00	5.32	2.82	0.2	0.1	12	8.0	0.0250	778.78	3.14	5.25	0.0000	779.15	783.78	4.63	4.00	CB 3A
begin		50+05		168.73	82.06									778.58				779.15	784.06			0.015

STORM SEWER SYSTEM

JUNCTION From	To	STATION From To	ΔAREA ΣAREA (acres)	ΔCA ΣCA	BEGIN TIME (min.)	RAINFALL INTENSITY (10 yrs.)	(50 yrs.)	DISCHARGE (cfs.) (10 yrs.)	(50 yrs.)	PIPE DIAM. (in.)	LENGTH (ft.)	SLOPE (ft./ft.)	F/L PIPE IN / OUT (ft.)	MEAN VEL (fps.)	JUST FULL CAPACITY (cfs.)	FRICT SLOPE (ft./ft.)	HYGR EL. IN / OUT (ft.)	COVER IN / OUT (ft.)	COVER MINUS HY GR	COVER MINUS CROWN	INLET TYPE MANNING'S 'n'
898	897	50+05	0.00	0.00	12.64	4.84	2.82	5.0	2.9	18	227.0	0.0050	776.36	4.01	6.91	0.0010	779.15	784.06	4.91	6.20	MH 3
		47+78	168.73	82.06									775.23				778.92	783.47			0.015
308	897	48+00	0.17	0.14	10.00	5.32	2.82	0.7	0.4	12	22.0	0.0155	778.29	3.78	4.13	0.0002	778.93	783.29	4.36	4.00	CB 3A
begin		47+78	168.90	82.20									777.95				778.92	783.47			0.015
317	897	47+78	0.12	0.09	10.00	5.32	2.82	0.5	0.3	12	34.0	0.0121	778.36	3.04	3.65	0.0001	778.93	783.36	4.43	4.00	CB 3A
begin		47+78	169.02	82.29									777.95				778.92	783.47			0.015
897	896	47+78	0.00	0.00	13.59	4.68	2.82	5.9	3.5	18	128.0	0.0050	775.23	4.13	6.92	0.0015	778.92	783.47	4.55	6.74	MH 3
		46+50	169.02	82.29									774.59				778.73	782.85			0.015
309	896	46+50	0.16	0.12	10.00	5.32	2.82	0.6	0.3	12	8.0	0.0125	777.57	3.35	3.71	0.0001	778.73	782.57	3.84	4.00	CB 3A
begin		45+40	169.18	82.41									777.47				778.73	782.85			0.015
896	895	46+50	0.00	0.00	14.10	4.60	2.82	6.3	3.9	18	50.0	0.0050	774.59	4.15	6.92	0.0018	778.73	782.85	4.12	6.76	MH 3
		46+00	169.18	82.41									774.34				778.64	782.61			0.015
318	895	46+00	0.11	0.08	10.00	5.32	2.82	0.4	0.2	12	35.0	0.0120	777.27	2.96	3.64	0.0001	778.64	782.27	3.63	4.00	CB 3A
begin		46+00	169.29	82.49									776.85				778.64	782.61			0.015
895	894	46+00	0.00	0.00	14.30	4.57	2.82	6.6	4.1	18	60.0	0.0050	774.34	4.14	6.92	0.0020	778.64	782.61	3.97	6.77	MH 3
		45+40	169.29	82.49									774.04				778.52	782.33			0.015
310	894	45+40	0.11	0.09	10.00	5.32	2.82	0.5	0.3	12	8.0	0.0125	777.04	3.10	3.71	0.0001	778.52	782.04	3.52	4.00	CB 3A
begin		44+30	169.41	82.58									776.94				778.52	782.33			0.015
894	893	45+40	0.00	0.00	14.54	4.54	2.82	7.0	4.4	21	110.0	0.0032	770.85	3.66	8.36	0.0010	778.52	782.33	3.81	9.73	MH 3
		44+30	169.41	82.58									770.50				778.41	781.80			0.015
311	893	44+30	0.11	0.08	10.00	5.32	2.82	0.4	0.2	12	8.0	0.0475	776.50	4.75	7.24	0.0001	778.41	781.51	3.10	4.01	CB 3A
begin		44+30	169.51	82.66									776.12				778.41	781.80			0.015

STORM SEWER SYSTEM

JUNCTION From	To	STATION From	To	ΔAREA ΣAREA (acres)	ΔCA ΣCA	BEGIN TIME (min.)	RAINFALL INTENSITY (10 yrs.)	(50 yrs.)	DISCHARGE (cfs.) (10 yrs.)	(50 yrs.)	PIPE DIAM. (in.)	LENGTH (ft.)	SLOPE (ft./ft.)	F/L PIPE IN / OUT (ft.)	MEAN VEL (fps.)	JUST FULL CAPACITY (cfs.)	FRICT SLOPE (ft./ft.)	HYGR EL. IN / OUT (ft.)	COVER IN / OUT (ft.)	COVER MINUS HY GR	COVER MINUS CROWN	INLET TYPE MANNING'S 'n'
319	893	44+30		0.10	0.08	10.00	5.32	2.82	0.4	0.2	12	31.0	0.0123	776.50	2.95	3.68	0.0001	778.41	781.50	3.09	4.00	CB 3A
begin		44+30		169.61	82.74									776.12				778.41	781.80			0.015
893	106	44+30		0.00	0.00	15.04	4.47	2.82	7.6	4.8	21	46.0	0.0032	770.50	3.68	8.36	0.0012	778.41	781.80	3.39	9.55	MH 3
		43+84		169.61	82.74									770.35				778.35	781.67			0.015
106	321	43+84		0.00	0.00	46.56	2.30	2.82	190.3	233.7	72	36.0	0.0014	770.33	6.73	169.78	0.0030	778.35	781.82	3.47	5.49	MH 3
		43+50		169.61	82.74						**Warning**			770.28				778.24	781.78			0.013
324	321	43+50		0.16	0.12	10.00	5.32	2.82	0.7	0.4	18	8.0	0.0037	771.26	2.12	6.00	0.0000	778.24	781.31	3.07	8.55	CB 3
begin		43+50		169.77	82.87									771.23				778.24	781.59			0.015
320	321	43+50		0.10	0.08	10.00	5.32	2.82	0.4	0.2	12	31.0	0.0087	773.84	2.66	3.10	0.0001	778.24	781.31	3.07	6.47	CB 3
begin		43+50		169.87	82.95									773.57				778.24	781.59			0.015
321	921	43+50		0.00	0.00	46.65	2.30	2.82	190.5	234.3	72	80.0	0.0013	770.28	6.74	161.07	0.0031	778.24	781.78	3.54	5.50	MH 3
		42+70		169.87	82.95						**Warning**			770.18				778.00	781.98			0.013
323	921	42+70		0.11	0.08	10.00	5.32	2.82	0.4	0.2	12	8.0	0.0588	775.76	5.19	8.05	0.0001	778.00	781.51	3.51	4.75	CB 3A
begin		42+70		169.98	83.03									775.29				778.00	781.98			0.015
322	921	42+70		0.08	0.07	10.00	5.32	2.82	0.4	0.2	12	31.0	0.0152	775.76	3.02	4.09	0.0000	778.00	781.51	3.51	4.75	CB 3A
begin		42+70		170.06	83.10									775.29				778.00	781.98			0.015
921	330	42+70		0.00	0.00	46.84	2.29	2.82	190.3	234.7	72	170.0	0.0013	770.18	6.73	163.89	0.0031	778.00	781.98	3.98	5.80	MH 3
		41+00		170.06	83.10						**Warning**			769.96				777.48	782.29			0.013
330	928	41+00		0.00	0.00	47.27	2.28	2.82	189.1	234.7	72	150.0	0.0013	769.96	6.69	166.35	0.0031	777.48	782.29	4.81	6.33	MH 3
		39+50		170.06	83.10						**Warning**			769.76				777.02	781.56			0.013
329	928	39+50		0.17	0.12	10.00	5.32	2.82	0.6	0.3	12	14.0	0.0100	776.17	3.09	3.32	0.0001	777.02	781.17	4.15	4.00	CB 3A
begin		39+50		170.23	83.22									776.03				777.02	781.56			0.015

STORM SEWER SYSTEM

JUNCTION From	To	STATION From	To	ΔAREA ΣAREA (acres)	ΔCA ΣCA	BEGIN TIME (min.)	RAINFALL INTENSITY (10 yrs.)	(50 yrs.)	DISCHARGE (cfs.) (10 yrs.)	(50 yrs.)	PIPE DIAM. (in.)	LENGTH (ft.)	SLOPE (ft./ft.)	F/L PIPE IN / OUT (ft.)	MEAN VEL (fps.)	JUST FULL CAPACITY (cfs.)	FRICT SLOPE (ft./ft.)	HYGR EL. IN / OUT (ft.)	COVER IN / OUT (ft.)	COVER MINUS HY GR	COVER MINUS CROWN	INLET TYPE MANNING'S 'n'
333	928	39+50		0.13	0.11	10.00	5.32	2.82	0.6	0.3	12	20.0	0.0100	776.17	3.00	3.32	0.0001	777.02	781.17	4.15	4.00	CB 3A
begin		39+50		170.36	83.32									775.97				777.02	781.56			0.015
928	927	39+50		0.00	0.00	47.64	2.26	2.82	188.6	235.4	72	175.0	0.0013	769.76	6.67	161.53	0.0031	777.02	781.56	4.54	5.80	MH 3
		37+75		170.36	83.32						**Warning**			769.54				776.48	780.69			0.013
332	927	37+75		0.10	0.08	10.00	5.32	2.82	0.4	0.2	12	13.0	0.0100	775.31	2.78	3.32	0.0001	776.48	780.31	3.83	4.00	CB 3A
begin		37+75		170.46	83.41									775.18				776.48	780.69			0.015
328	927	37+75		0.16	0.11	10.00	5.32	2.82	0.6	0.3	12	13.0	0.0100	775.31	3.04	3.32	0.0001	776.48	780.31	3.83	4.00	CB 3A
begin		37+75		170.62	83.52									775.18				776.48	780.69			0.015
927	926	37+75		0.00	0.00	48.08	2.25	2.82	187.8	235.9	72	77.0	0.0013	769.54	6.64	164.18	0.0031	776.48	780.69	4.21	5.15	MH 3
		36+98		170.62	83.52						**Warning**			769.44				776.24	780.49			0.013
327	926	36+98		0.17	0.12	10.00	5.32	2.82	0.6	0.3	12	13.0	0.0100	775.11	3.08	3.32	0.0001	776.24	780.11	3.87	4.00	CB 3
begin		36+98		170.79	83.63									774.98				776.24	780.49			0.015
331	926	36+98		0.09	0.07	10.00	5.32	2.82	0.4	0.2	12	13.0	0.0100	775.11	2.66	3.32	0.0000	776.24	780.11	3.87	4.00	CB 3
begin		36+98		170.88	83.70									774.98				776.24	780.49			0.015
926	925	36+98		0.00	0.00	48.27	2.24	2.82	187.7	236.4	72	78.0	0.0013	769.44	6.64	164.26	0.0031	776.24	780.49	4.25	5.05	MH 3
		36+20		170.88	83.70						**Warning**			769.34				776.00	780.69			0.013
326	925	36+20		0.13	0.09	10.00	5.32	2.82	0.5	0.3	12	13.0	0.0100	775.31	2.85	3.32	0.0001	776.00	780.31	4.31	4.00	CB 3A
begin		36+20		171.00	83.79									775.18				776.00	780.69			0.015
325	925	36+20		0.12	0.10	10.00	5.32	2.82	0.5	0.3	12	13.0	0.0100	775.31	2.89	3.32	0.0001	776.00	780.31	4.31	4.00	CB 3A
begin		36+20		171.12	83.89									775.18				776.00	780.69			0.015
925	924	36+20		0.00	0.00	48.47	2.24	2.82	187.6	237.0	72	220.0	0.0020	769.34	7.64	203.74	0.0031	776.00	780.69	4.69	5.35	MH 3
		34+00		171.12	83.89									768.90				775.31	781.53			0.013

STORM SEWER SYSTEM

JUNCTION From	To	STATION From	To	ΔAREA ΣAREA (acres)	ΔCA ΣCA	BEGIN TIME (min.)	RAINFALL INTENSITY (10 yrs.)	(50 yrs.)	DISCHARGE (cfs.) (10 yrs.)	(50 yrs.)	PIPE DIAM. (in.)	LENGTH (ft.)	SLOPE (ft./ft.)	F/L PIPE IN / OUT (ft.)	MEAN VEL (fps.)	JUST FULL CAPACITY (cfs.)	FRICT SLOPE (ft./ft.)	HYGR EL. IN / OUT (ft.)	COVER IN / OUT (ft.)	COVER MINUS HY GR	COVER MINUS CROWN	INLET TYPE MANNING'S 'n'
924	923	35+65		0.00	0.00	48.95	2.22	2.82	186.3	237.0	72	248.0	0.0020	768.90	7.64	203.74	0.0031	775.31	781.53	6.22	6.63	MH 3
		31+52		171.12	83.89									768.40				774.53	779.97			0.013
346	923	31+52		0.15	0.12	10.00	5.32	6.48	0.6	0.8	12	13.0	0.0100	774.59	3.09	3.32	0.0006	775.15	779.59	4.44	4.00	CB 3A
begin		31+52		171.27	84.01									774.46				775.14	779.97			0.015
345	923	31+52		0.19	0.13	10.00	5.32	6.48	0.7	0.8	12	13.0	0.0100	774.33	3.16	3.32	0.0007	774.90	779.59	4.69	4.26	CB 3A
begin		31+52		171.46	84.14									774.20				774.89	779.97			0.015
923	922	31+52		0.00	0.00	49.49	2.20	2.82	185.4	237.7	72	52.0	0.0019	768.40	7.49	199.78	0.0031	774.53	779.97	5.44	5.57	MH 3
		31+00		171.46	84.14									768.30				774.37	779.59			0.013
922	341	31+00		0.00	0.00	49.60	2.20	2.82	185.1	237.7	72	57.0	0.0019	768.30	7.50	200.13	0.0031	774.37	779.59	5.22	5.29	MH 3
		30+57		171.46	84.14									768.19				774.19	778.33			0.013
344	341	30+31		0.25	0.19	10.00	5.32	2.82	1.0	0.5	12	84.0	0.0100	769.57	3.52	3.32	0.0003	774.22	778.43	4.21	7.86	CB 3
begin		30+57		171.71	84.33									768.73				774.19	778.33			0.015
341	339	30+57		0.25	0.20	49.73	2.20	2.82	185.7	238.8	72	87.0	0.0018	768.19	7.31	195.37	0.0032	774.19	778.33	4.14	4.14	CB 3
final		30+35		171.96	84.53									768.03				773.15	773.94			0.013

City of Columbus SCD: AA-S121

STORM SEWER SYSTEM

PID : 95639 **Date :** 11/04/2019 **Project :** FRA-70-22.61 **Location :** Franklin County, Ohio

Description :A1 NOISEWALL, Outfall into Ramp A1 Ditch, STA 2987+96 A2 **Designer :** CDR

Rainfall Area: C **Just Full Capacity Frequency (yrs.) :** 10 **Hydraulic Gradient Frequency (yrs.) :** 25

Minimum Pipe Size : 12.00 **Tailwater Elevation (ft.):** 0.00

JUNCTION From	To	STATION From / To	ΔAREA / ΣAREA (acres)	ΔCA / ΣCA	BEGIN TIME (min.)	RAINFALL INTENSITY (10 yrs.)	(25 yrs.)	DISCHARGE (cfs.) (10 yrs.)	(25 yrs.)	PIPE DIAM. (in.)	LENGTH (ft.)	SLOPE (ft./ft.)	F/L PIPE IN / OUT (ft.)	MEAN VEL (fps.)	JUST FULL CAPACITY (cfs.)	FRICT SLOPE (ft./ft.)	HYGR EL. IN / OUT (ft.)	COVER IN / OUT (ft.)	COVER MINUS HY GR	COVER MINUS CROWN	INLET TYPE MANNING'S 'n'
400	401	11+39	0.12	0.06	15.00	4.47	5.09	0.3	0.3	12	10.0	0.0200	786.20	3.03	4.70	0.0001	786.61	788.70	2.09	1.50	CB 2-2B
begin		11+39	0.12	0.06									786.00				786.61	788.70			0.015
401	405	11+39	0.05	0.03	15.05	4.47	5.04	0.4	0.4	12	67.0	0.0203	786.00	3.46	4.73	0.0002	786.21	788.70	2.49	1.70	CB 2-2B
final		11+39	0.17	0.09									784.64				785.28	786.14			0.015

STORM SEWER SYSTEM

PID : 95639 **Date :** 11/04/2019 **Project :** FRA-70-22.61 **Location :** Franklin County, Ohio

Description :A1 NOISEWALL, Outfall into Ramp A1 Ditch, STA 2995+64 A2 **Designer :** CDR

Rainfall Area: C **Just Full Capacity Frequency (yrs.) :** 10 **Hydraulic Gradient Frequency (yrs.) :** 25

Minimum Pipe Size : 12.00 **Tailwater Elevation (ft.):** 0.00

JUNCTION From	To	STATION From / To	ΔAREA / ΣAREA (acres)	ΔCA / ΣCA	BEGIN TIME (min.)	RAINFALL INTENSITY (10 yrs.)	(25 yrs.)	DISCHARGE (cfs.) (10 yrs.)	(25 yrs.)	PIPE DIAM. (in.)	LENGTH (ft.)	SLOPE (ft./ft.)	F/L PIPE IN / OUT (ft.)	MEAN VEL (fps.)	JUST FULL CAPACITY (cfs.)	FRICT SLOPE (ft./ft.)	HYGR EL. IN / OUT (ft.)	COVER IN / OUT (ft.)	COVER MINUS HY GR	COVER MINUS CROWN	INLET TYPE MANNING'S 'n'
402	403	19+00	0.11	0.06	15.00	4.47	5.09	0.3	0.3	12	10.0	0.0200	783.33	3.06	4.70	0.0001	783.74	785.83	2.09	1.50	CB 2-2B
begin		19+00	0.11	0.06									783.13				783.74	785.83			0.015
403	404	19+00	0.13	0.07	15.05	4.47	5.04	0.5	0.6	12	72.0	0.0196	783.13	3.75	4.65	0.0004	783.38	785.83	2.45	1.70	CB 2-2B
final		19+00	0.24	0.12									781.72				782.38	782.72			0.015

STORM SEWER SYSTEM

PID : 95639 **Date :** 11/19/2019 **Project :** FRA-70-22.61 **Location :** Franklin County, Ohio

Description :A1 NOISEWALL, Outfall into Ramp A1 Ditch, STA 2025+14 A1 **Designer :** CDR

Rainfall Area: C **Just Full Capacity Frequency (yrs.) :** 10 **Hydraulic Gradient Frequency (yrs.) :** 25

Minimum Pipe Size : 12.00 **Tailwater Elevation (ft.):** 0.00

JUNCTION From	JUNCTION To	STATION From / To	ΔAREA / ΣAREA (acres)	ΔCA / ΣCA	BEGIN TIME (min.)	RAINFALL INTENSITY (10 yrs.)	RAINFALL INTENSITY (25 yrs.)	DISCHARGE (cfs.) (10 yrs.)	DISCHARGE (cfs.) (25 yrs.)	PIPE DIAM. (in.)	PIPE LENGTH (ft.)	PIPE SLOPE (ft./ft.)	F/L PIPE IN / OUT (ft.)	MEAN VEL (fps.)	JUST FULL CAPACITY (cfs.)	FRICT SLOPE (ft./ft.)	HYGR EL. IN / OUT (ft.)	COVER IN / OUT (ft.)	COVER MINUS HY GR	COVER MINUS CROWN	INLET TYPE MANNING'S 'n'
409	418	36+55	0.10	0.05	15.00	4.47	5.05	0.2	0.3	12	56.0	0.0207	784.46	3.00	4.78	0.0001	784.63	786.96	2.33	1.50	CB 2-2B
begin		36+55	0.10	0.05									783.30				783.90	784.30			0.015

STORM SEWER SYSTEM

PID : 95639 **Date :** 11/04/2019 **Project :** FRA-70-22.61 **Location :** Franklin County, Ohio

Description :A1 NOISEWALL, Outfall into Ramp A1 Ex Ditch, STA 2036+00 A1 **Designer :** CDR

Rainfall Area: C **Just Full Capacity Frequency (yrs.) :** 10 **Hydraulic Gradient Frequency (yrs.) :** 25

Minimum Pipe Size : 12.00 **Tailwater Elevation (ft.):** 0.00

JUNCTION From	To	STATION From / To	ΔAREA / ΣAREA (acres)	ΔCA / ΣCA	BEGIN TIME (min.)	RAINFALL INTENSITY (10 yrs.)	(25 yrs.)	DISCHARGE (cfs.) (10 yrs.)	(25 yrs.)	PIPE DIAM. (in.)	LENGTH (ft.)	SLOPE (ft./ft.)	F/L PIPE IN / OUT (ft.)	MEAN VEL (fps.)	JUST FULL CAPACITY (cfs.)	FRICT SLOPE (ft./ft.)	HYGR EL. IN / OUT (ft.)	COVER IN / OUT (ft.)	COVER MINUS HY GR	COVER MINUS CROWN	INLET TYPE MANNING'S 'n'
411	412	47+50	0.14	0.07	15.00	4.47	5.09	0.3	0.4	12	10.0	0.0200	776.15	3.26	4.70	0.0001	776.58	778.65	2.07	1.50	CB 2-2B
begin		47+50	0.14	0.07									775.95				776.57	778.65			0.015
412	419	47+50	0.19	0.10	15.05	4.47	5.07	0.8	0.9	12	33.0	0.0358	775.95	5.14	6.28	0.0008	776.21	778.65	2.44	1.70	CB 2-2B
final		47+50	0.34	0.17									774.77				775.46	775.77			0.015

STORM SEWER SYSTEM

PID : 95639 **Date :** 11/04/2019 **Project :** FRA-70-22.61 **Location :** Franklin County, Ohio

Description :A1 NOISEWALL, Outfall into Ramp A1 Ex Ditch, STA 516+54 IR 70 **Designer :** CDR

Rainfall Area: C **Just Full Capacity Frequency (yrs.) :** 10 **Hydraulic Gradient Frequency (yrs.) :** 25

Minimum Pipe Size : 12.00 **Tailwater Elevation (ft.):** 0.00

JUNCTION From	To	STATION From To	ΔAREA ΣAREA (acres)	ΔCA ΣCA	BEGIN TIME (min.)	RAINFALL INTENSITY (10 yrs.)	(25 yrs.)	DISCHARGE (cfs.) (10 yrs.)	(25 yrs.)	PIPE DIAM. (in.)	LENGTH (ft.)	SLOPE (ft./ft.)	F/L PIPE IN / OUT (ft.)	MEAN VEL (fps.)	JUST FULL CAPACITY (cfs.)	FRICT SLOPE (ft./ft.)	HYGR EL. IN / OUT (ft.)	COVER IN / OUT (ft.)	COVER MINUS HY GR	COVER MINUS CROWN	INLET TYPE MANNING'S 'n'
413	420	51+00	0.10	0.05	15.00	4.47	5.07	0.2	0.3	12	36.0	0.0331	772.23	3.47	6.04	0.0001	772.37	774.73	2.36	1.50	CB 2-2B
begin		51+00	0.10	0.05									771.04				771.64	774.73			0.015

STORM SEWER SYSTEM

PID : 95639 **Date :** 11/04/2019 **Project :** FRA-70-22.61 **Location :** Franklin County, Ohio

Description :A1 NOISEWALL, Outfall into Ramp A1 Ex Ditch, STA 513+57 IR 70 **Designer :** CDR

Rainfall Area: C **Just Full Capacity Frequency (yrs.) :** 10 **Hydraulic Gradient Frequency (yrs.) :** 25

Minimum Pipe Size : 12.00 **Tailwater Elevation (ft.):** 0.00

JUNCTION From	To	STATION From To	ΔAREA ΣAREA (acres)	ΔCA ΣCA	BEGIN TIME (min.)	RAINFALL INTENSITY (10 yrs.)	(25 yrs.)	DISCHARGE (cfs.) (10 yrs.)	(25 yrs.)	PIPE DIAM. (in.)	LENGTH (ft.)	SLOPE (ft./ft.)	F/L PIPE IN / OUT (ft.)	MEAN VEL (fps.)	JUST FULL CAPACITY (cfs.)	FRICT SLOPE (ft./ft.)	HYGR EL. IN / OUT (ft.)	COVER IN / OUT (ft.)	COVER MINUS HY GR	COVER MINUS CROWN	INLET TYPE MANNING'S 'n'
414	421	54+00	0.06	0.03	15.00	4.47	5.04	0.1	0.2	12	66.0	0.0315	770.08	2.97	5.90	0.0000	770.19	772.58	2.39	1.50	CB 2-2B
begin		54+00	0.06	0.03									768.00				768.58	769.00			0.015

STORM SEWER SYSTEM

PID : 95639 **Date :** 11/04/2019 **Project :** FRA-70-22.61 **Location :** Franklin County, Ohio

Description :A1 NOISEWALL, Outfall into Ramp A1 Ex Ditch, STA 509+00 IR 70 **Designer :** CDR

Rainfall Area: C **Just Full Capacity Frequency (yrs.) :** 10 **Hydraulic Gradient Frequency (yrs.) :** 25

Minimum Pipe Size : 12.00 **Tailwater Elevation (ft.):** 0.00

JUNCTION From	To	STATION From / To	ΔAREA / ΣAREA (acres)	ΔCA / ΣCA	BEGIN TIME (min.)	RAINFALL INTENSITY (10 yrs.)	(25 yrs.)	DISCHARGE (cfs.) (10 yrs.)	(25 yrs.)	PIPE DIAM. (in.)	LENGTH (ft.)	SLOPE (ft./ft.)	F/L PIPE IN / OUT (ft.)	MEAN VEL (fps.)	JUST FULL CAPACITY (cfs.)	FRICT SLOPE (ft./ft.)	HYGR EL. IN / OUT (ft.)	COVER IN / OUT (ft.)	COVER MINUS HY GR	COVER MINUS CROWN	INLET TYPE MANNING'S 'n'
415	417	58+50	0.19	0.09	15.00	4.47	5.09	0.4	0.5	12	10.0	0.0100	764.90	2.74	3.32	0.0002	765.44	767.40	1.96	1.50	CB 2-2B
begin		58+50	0.18	0.09									764.80				765.44	767.40			0.015
417	416	58+50	0.07	0.04	15.06	4.47	5.06	0.6	0.7	12	54.0	0.0250	764.80	4.18	5.25	0.0004	765.05	767.40	2.35	1.60	CB 2-2B
final		58+50	0.26	0.13									763.45				764.12	764.45			0.015

Appendix F – BMP Calculations and Maps

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4 / 1	FRA-70-22.61	DRAINAGE AREA MAP BMP PROJECT EDA	CALCULATED REM CHECKED PHF	0 400 200 800 HORIZONTAL SCALE IN FEET

LEGEND

EXISTING IMPERVIOUS AREA IN PROJECT EARTH DISTURBED AREA = Aix = 67.8 AC

NEW IMPERVIOUS AREA IN PROJECT EARTH DISTURBED AREA = Ain = 2.2 AC

EXISTING IMPERVIOUS AREA IN PROJECT EARTH DISTURBED AREA REMOVED = Ain REMOVED = 0.3 AC

T% = (Aix * 20% + Ain * 100%) / (Aix + Ain)
T% = (67.8 * 20% + 1.9 * 100%) / (67.8 + 1.9)
T% = 22.2%

QUALITY TREATMENT
TR = TREATMENT REQUIREMENT = EDA * T%
TR = (44.2 * 22.2%) * 100
TR = 9.8 AC

QUALITY AND QUANTITY TREATMENT
TR = TREATMENT REQUIREMENT = EDA * T%
TR = (32.0 * 22.2%) * 100
TR = 7.1 AC

SEE MATCH LINE A-A

℄ RAMP A1

℄ RAMP A2

℄ IR 70

℄ IR 270

DETENTION BASIN

℄ RAMP D2

℄ RAMP C1

NORFOLK SOUTHERN RR

SCARBOROUGH BLVD

SEE MAP 2 OF 2

SEE MATCH LINE B-B

Ex LA-R/W

Ex R/W

Ex RR

M.N.S.

0 100 200 400 HORIZONTAL SCALE IN FEET

CALCULATED REM CHECKED PHF

DRAINAGE AREA MAP
BMP TREATMENT PERCENTAGE 1 OF 2

FRA-70-22.61

2 / 4

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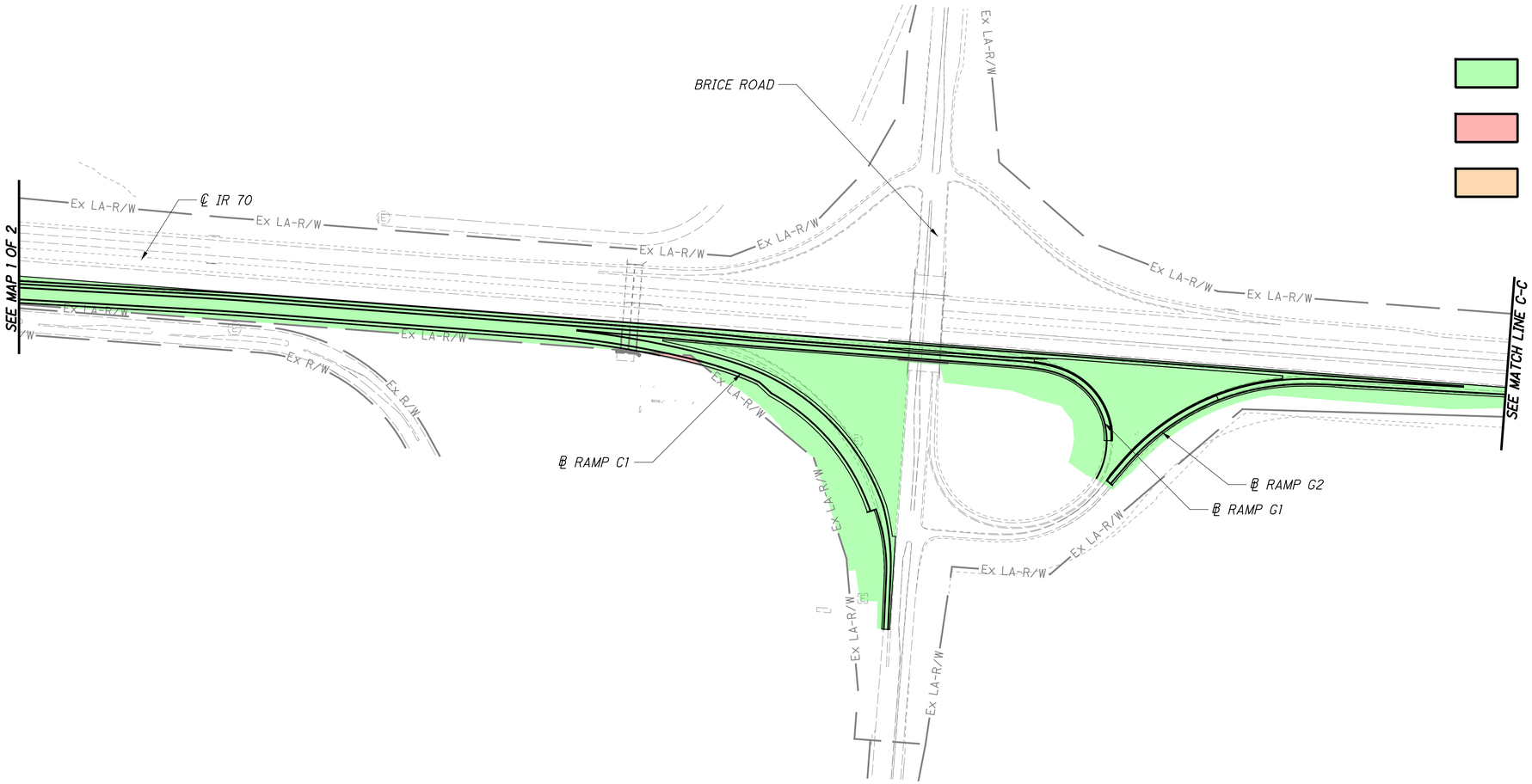

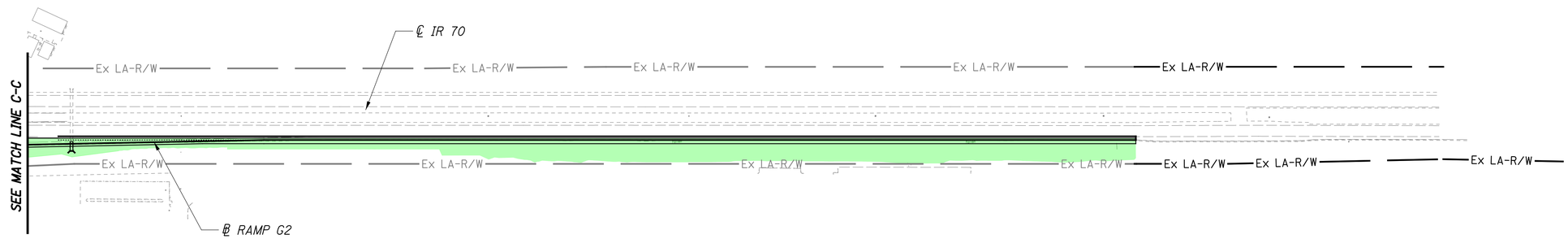

0 100 200 400
HORIZONTAL SCALE IN FEET

CALCULATED REM
CHECKED PHF

DRAINAGE AREA MAP
BMP TREATMENT PERCENTAGE 2 OF 2

FRA-70-22.61

3
4

LEGEND

DETENTION BASIN DRAINAGE AREA = 31.3 AC

SEE MATCH LINE A-A

℄ RAMP A1

℄ RAMP A2

℄ IR 70

℄ IR 270

℄ RAMP C1

℄ RAMP D2

DETENTION BASIN

SCARBOROUGH BLVD

NORFOLK SOUTHERN RR

Ex LA-R/W

Ex LA

Ex R/W

Ex RR

N

0 100 200 400

HORIZONTAL SCALE IN FEET

CALCULATED PDG

CHECKED KAG

DRAINAGE AREA MAP
BMP TREATMENT AREA

FRA-70-22.61

4
4

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PROJECT EDA

PROJECT EDA = 76.2 acres

Earth Disturbing Activity is any activity that exposes bare ground or an erodible material to storm water or anywhere Item 659 Seeding or Item 660 Sodding is being furnished

POST-CONSTRUCTION BMP QUALITY VS QUANTITY

PROVIDE POST CONSTRUCTION BMP FOR ALL PROJECTS EXCEEDING 1 ACRE OF PROJECT EDA EXCEPT FOR ROUTINE MAINTENANCE PROJECTS AS DEFINED IN SECTION 1112.2 OF THE L&D VOL. 2

POST-CONSTRUCTION BMP REQUIRED FOR WATER QUALITY => YES

IMPERVIOUS AREA

Aix =	67.8	acres	Area in the existing right of way within the limits of the Project EDA
Ain =	1.9	acres	New impervious area inside new permanent right of way.
Ain (New) =	2.2	acres	New impervious area inside new permanent right of way.
Ain (Removed)=	0.3	acres	Impervious area that is removed inside new permanent right of way.

PROVIDE POST CONSTRUCTION BMP TO ADDRESS *QUANTITY* WHEN ONE ACRE OR MORE OF NEW IMPERVIOUS AREA IS CREATED IN NEW PERMANENT RIGHT OF WAY BEING ACQUIRED FOR THE PROJECT EXCEPT IF PROJECT IS IN ULTRA-URBAN SETTING OR WHERE SITES DISCHARGE DIRECTLY TO A LARGE RIVER (SEE SECTION 1115.3 OF L&D VOL 2)

POST-CONSTRUCTION BMP REQUIRED FOR WATER QUANTITY => YES
EXCLUDED FOR ULTRA-URBAN SETTING? NO
EXCLUDED FOR DISCHARGING TO LARGE RIVER? PARTIAL

44.2	acres	Project EDA draining to Large River, exempt from quantity treatment
32.0	acres	Project EDA requiring quantity & quality treatment

REDEVELOPMENT VS NEW CONSTRUCTION

PROJECTS THAT DO NOT ADD NEW PAVEMENT OUTSIDE EXISTING RIGHT OF WAY ARE CONSIDERED REDEVELOPMENT

NEW CONSTRUCTION

TREATMENT PERCENT & REQUIREMENT

TREATMENT PERCENT

$$T\% = \frac{(Aix * 20) + (Ain * 100)}{(Aix + Ain)}$$

$$T\% = \frac{1546}{69.7} = \mathbf{22.18}\ \%$$

TREATMENT REQUIREMENT

Quality Only: TR = T% * EDA
TR = 9.8 acres

Quantity & Quality: TR = T% * EDA
TR = 7.1 acres

Project: FRA-70-22.61
Subject: POST CONSTRUCTION BMP
Task: TREATMENT TOTAL
PID #: 95639

Computed by: Shrestha, Sajan
Checked by: Gruver, Kathryn
Workbook: 95369_BMP_Treatment.xlsx, TREATMENT TOTALS
Page: 1 of 1
Date:4/8/2021

PROJECT TREATMENT

BMP	*ROADWAY*	*STATION*	*TOTAL TRIBUTARY AREA*	*TOTAL TRIBUTARY AREA IN R/W*	*QUALITY ONLY OR BOTH*	*TREATMENT CREDIT - QUALITY*	*TREATMENT CREDIT- QUANTITY*
			AC	*AC*		*AC*	*AC*
DETENTION BASIN	RAMP C1	6010+34	31.3	31.3	BOTH	31.3	31.3
TREATMENT TOTAL						**31.3**	**31.3**
						QUALITY	**QUANTITY**
TREATMENT REQUIREMENT						**16.9**	**7.1**
TREATMENT REQUIREMENT MET SURPLUS AREA						**14.4**	**24.2**

Project: FRA-70
Subject:Drainage Mod
Task: BMP Ramp C1 BMP
Job #:

Originated: PDG 4/2/2021
Checked: KAG 4/5/2021
Changes Made: PDG 4/7/21
Corrections Verified: KAG 4/7/21

Water Quantity Control Preliminary Sizing

Outfall Station:
Ramp C1 Basin

Description		A	C	CA	ROW C
Impervious		16.89	0.9	15.20	0.9
Berms and slopes < 4:1		12.25	0.5	11.03	
Berms and slopes > 4:1		2.25	0.7	2.03	
Total		**31.39**			
				28.25	

All area within ROW is assumed impervious for WQv calculation

$WQ_V = (R_V * P * A) / 12$

Where:
WQ_V = Water Quality Volume (acre-feet)
R_V = Volumetric Runoff Coefficient: 0.05 + 0.9 * i
P = Precipitation (0.90 inches)
A = Contributing Drainage Area to the BMP (acres)
i = impervious area divided by the total area (within the BMP drainage area)

P	0.9	in
A	31.39	acres
Rv	0.95	
WQ_V =	2.24	ac ft
WQ_V =	97,400	cubic feet

Proposed

i	Rv
1.00	0.95

$WQ_V = (R_V * P * A) / 12$

Where:
WQ_V = Water Quality Volume (acre-feet)
R_V = Volumetric Runoff Coefficient: 0.05 + 0.9 * i
P = Precipitation (0.90 inches)
A = Contributing Drainage Area to the BMP (acres)
i = impervious area divided by the total area (within the BMP drainage area)

Required Treatment 1.2 x WQV For above ground add 20%
Req'd Volume 116,900 cubic feet
Volume 2.684 ac ft 10% of Vol: 9,740

Contour	Area	Area	Avg Area	Delta V	Volume		
						>10% of vol:	Micropool 10,000
	(sf)	(ac)	SF	Cu Ft	Cu Ft		Forebay
						>10% of vol:	10,000
772	62323.03	1.431	31162	0	0		
773	67523.30	1.550	64923	64923	64923	WQV	97400
774	72872.79	1.673	70198	70198	135121	**773.46**	
775	109199.01	2.507	91036	91036	226157	$^1/_2$ WQV	48700
776	140189.59	3.218	124694	124694	350851	**772.75**	

Project: FRA-70
Subject:Drainage Mod
Task: BMP Ramp C1 BMP
Job #:

Originated: PDG 4/2/2021
Checked: KAG 4/5/2021
Changes Made: PDG 4/7/21
Corrections Verified: KAG 4/7/21

Weir equation: $Q = C*L*H^{1.5}$

- C = 3
- H = 0.5
- L = ?

Length of a weir: $L = \frac{Q}{C * H^{1.5}}$

Emergency Overflow Weir:

100 Year Q =	78.33	cfs
C =	3	
H =	2	ft
L =	9.231279	ft

Provide a 10 foot wide weir

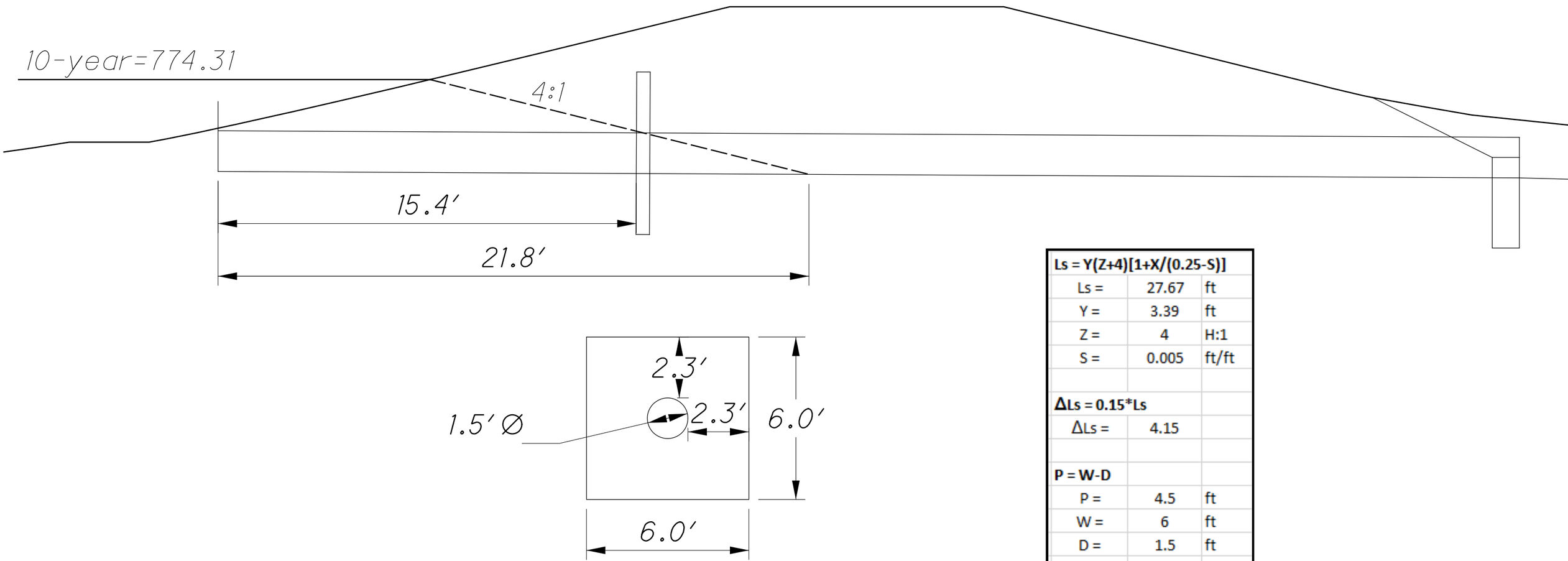
Forebay Overflow Weir:

10 Year Q =	46.2	cfs
C =	3	
H =	1.5	ft
L =	8.382698	ft

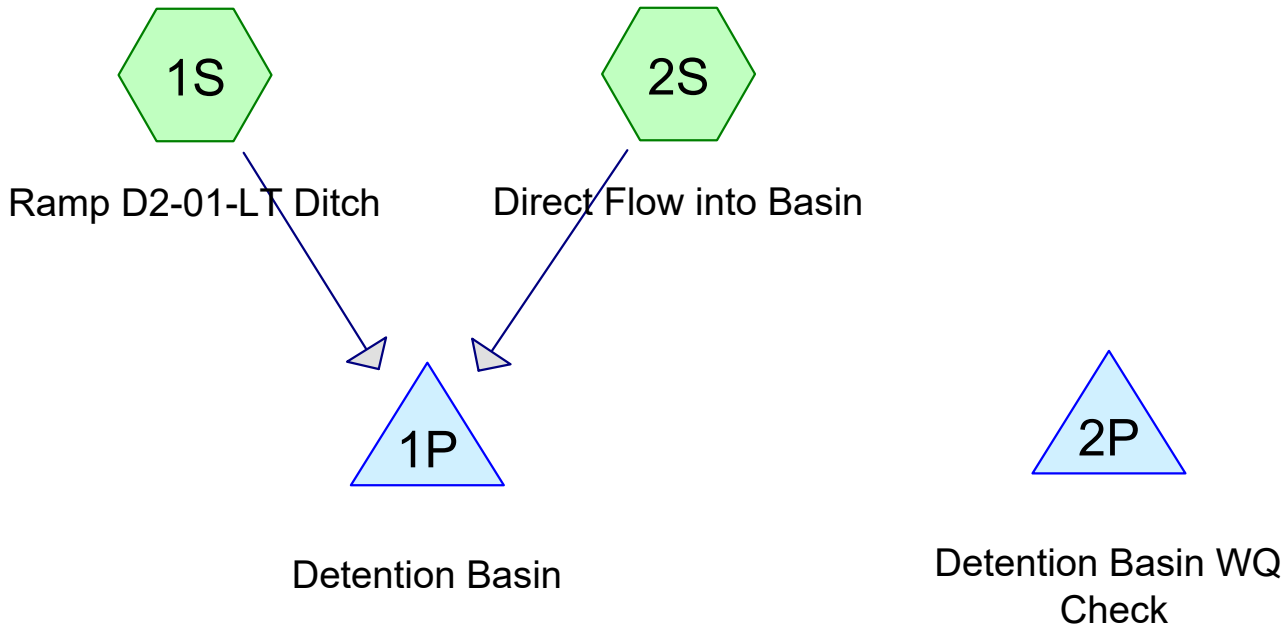
Provide a 16 foot wide weir

Project: FRA-70
Subject:Drainage Mod
Task: BMP Ramp C1 BMP
Job #:

Originated: PDG 4/2/2021
Checked: KAG 4/5/2021
Changes Made: PDG 4/7/21
Corrections Verified: KAG 4/7/21



Ls = Y(Z+4)[1+X/(0.25-S)]		
Ls =	27.67	ft
Y =	3.39	ft
Z =	4	H:1
S =	0.005	ft/ft
ΔLs = 0.15*Ls		
ΔLs =	4.15	
P = W-D		
P =	4.5	ft
W =	6	ft
D =	1.5	ft
No. of Collars = ΔLs / P		
# Req. =	0.92	



Subcat Reach Pond Link

Routing Diagram for FRA-70_Detention Basin
Prepared by HDR, Inc, Printed 4/20/2021

Rainfall Events Listing (selected events)

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	10-yr	Type II 24-hr		Default	24.00	1	3.74	2
2	25-yr	Type II 24-hr		Default	24.00	1	4.44	2
3	50-yr	Type II 24-hr		Default	24.00	1	5.02	2
4	100-yr	Type II 24-hr		Default	24.00	1	5.63	2

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	1P	770.92	770.64	55.5	0.0050	0.013	18.0	0.0	0.0

Summary for Subcatchment 1S: Ramp D2-01-LT Ditch

[49] Hint: Tc<2dt may require smaller dt

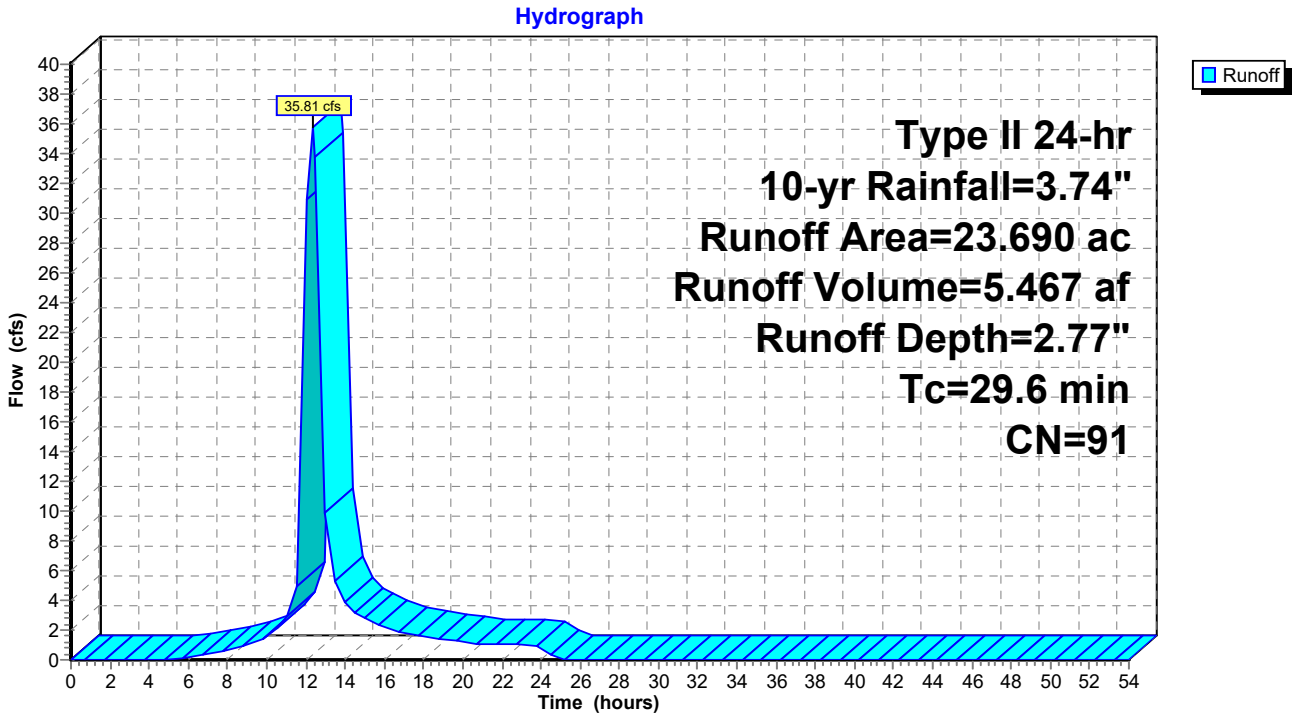
Runoff = 35.81 cfs @ 12.30 hrs, Volume= 5.467 af, Depth= 2.77"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-54.00 hrs, dt= 0.50 hrs
Type II 24-hr 10-yr Rainfall=3.74"

Area (ac)	CN	Description
14.270	98	Paved roads w/curbs & sewers, HSG D
8.560	80	>75% Grass cover, Good, HSG D
0.860	89	<50% Grass cover, Poor, HSG D
23.690	91	Weighted Average
9.420		39.76% Pervious Area
14.270		60.24% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
29.6					**Direct Entry, TC from Ditch Calc**

Subcatchment 1S: Ramp D2-01-LT Ditch



Hydrograph for Subcatchment 1S: Ramp D2-01-LT Ditch

Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)
0.00	0.00	0.00	0.00
1.00	0.04	0.00	0.00
2.00	0.08	0.00	0.00
3.00	0.13	0.00	0.00
4.00	0.18	0.00	0.00
5.00	0.24	0.00	0.04
6.00	0.30	0.01	0.20
7.00	0.37	0.03	0.40
8.00	0.45	0.05	0.61
9.00	0.55	0.09	1.02
10.00	0.68	0.16	1.54
11.00	0.88	0.28	2.98
12.00	2.48	1.59	**30.95**
13.00	2.89	1.97	**9.88**
14.00	3.07	2.13	3.91
15.00	3.19	2.25	2.79
16.00	3.29	2.34	2.20
17.00	3.37	2.42	1.82
18.00	3.44	2.49	1.62
19.00	3.51	2.55	1.41
20.00	3.56	2.60	1.20
21.00	3.61	2.64	1.08
22.00	3.65	2.69	1.04
23.00	3.70	2.73	1.00
24.00	**3.74**	**2.77**	0.94
25.00	3.74	2.77	0.03
26.00	3.74	2.77	0.00
27.00	3.74	2.77	0.00
28.00	3.74	2.77	0.00
29.00	3.74	2.77	0.00
30.00	3.74	2.77	0.00
31.00	3.74	2.77	0.00
32.00	3.74	2.77	0.00
33.00	3.74	2.77	0.00
34.00	3.74	2.77	0.00
35.00	3.74	2.77	0.00
36.00	3.74	2.77	0.00
37.00	3.74	2.77	0.00
38.00	3.74	2.77	0.00
39.00	3.74	2.77	0.00
40.00	3.74	2.77	0.00
41.00	3.74	2.77	0.00
42.00	3.74	2.77	0.00
43.00	3.74	2.77	0.00
44.00	3.74	2.77	0.00
45.00	3.74	2.77	0.00
46.00	3.74	2.77	0.00
47.00	3.74	2.77	0.00
48.00	3.74	2.77	0.00
49.00	3.74	2.77	0.00
50.00	3.74	2.77	0.00
51.00	3.74	2.77	0.00
52.00	3.74	2.77	0.00
53.00	3.74	2.77	0.00
54.00	3.74	2.77	0.00

Summary for Subcatchment 2S: Direct Flow into Basin

[49] Hint: Tc<2dt may require smaller dt

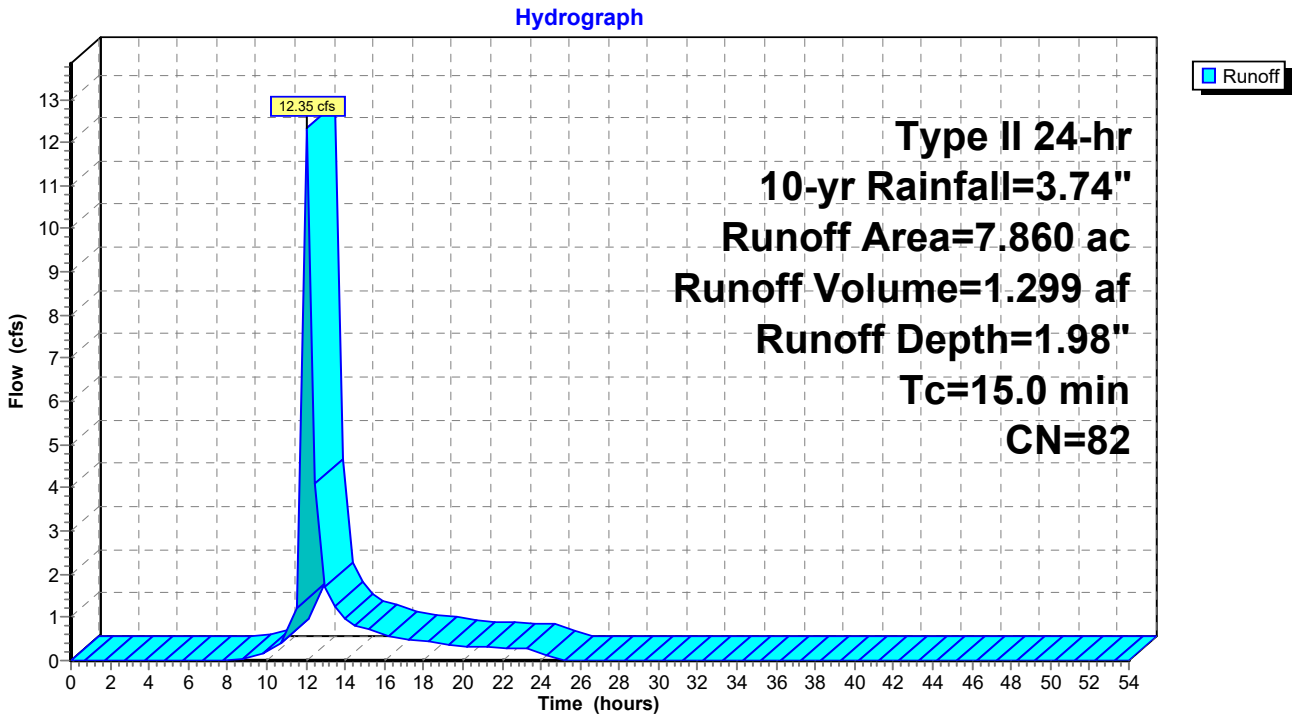
Runoff = 12.35 cfs @ 12.04 hrs, Volume= 1.299 af, Depth= 1.98"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-54.00 hrs, dt= 0.50 hrs
Type II 24-hr 10-yr Rainfall=3.74"

Area (ac)	CN	Description
1.060	98	Paved roads w/curbs & sewers, HSG D
6.800	80	>75% Grass cover, Good, HSG D
7.860	82	Weighted Average
6.800		86.51% Pervious Area
1.060		13.49% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.0					**Direct Entry, Direct flow into Basin**

Subcatchment 2S: Direct Flow into Basin



Hydrograph for Subcatchment 2S: Direct Flow into Basin

Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)
0.00	0.00	0.00	0.00
1.00	0.04	0.00	0.00
2.00	0.08	0.00	0.00
3.00	0.13	0.00	0.00
4.00	0.18	0.00	0.00
5.00	0.24	0.00	0.00
6.00	0.30	0.00	0.00
7.00	0.37	0.00	0.00
8.00	0.45	0.00	0.00
9.00	0.55	0.01	0.06
10.00	0.68	0.02	0.18
11.00	0.88	0.07	0.52
12.00	2.48	0.98	**12.30**
13.00	2.89	1.29	1.70
14.00	3.07	1.43	0.98
15.00	3.19	1.53	0.75
16.00	3.29	1.61	0.59
17.00	3.37	1.68	0.51
18.00	3.44	1.74	0.45
19.00	3.51	1.79	0.39
20.00	3.56	1.83	0.33
21.00	3.61	1.87	0.31
22.00	3.65	1.91	0.30
23.00	3.70	1.95	0.29
24.00	**3.74**	**1.98**	0.25
25.00	3.74	1.98	0.00
26.00	3.74	1.98	0.00
27.00	3.74	1.98	0.00
28.00	3.74	1.98	0.00
29.00	3.74	1.98	0.00
30.00	3.74	1.98	0.00
31.00	3.74	1.98	0.00
32.00	3.74	1.98	0.00
33.00	3.74	1.98	0.00
34.00	3.74	1.98	0.00
35.00	3.74	1.98	0.00
36.00	3.74	1.98	0.00
37.00	3.74	1.98	0.00
38.00	3.74	1.98	0.00
39.00	3.74	1.98	0.00
40.00	3.74	1.98	0.00
41.00	3.74	1.98	0.00
42.00	3.74	1.98	0.00
43.00	3.74	1.98	0.00
44.00	3.74	1.98	0.00
45.00	3.74	1.98	0.00
46.00	3.74	1.98	0.00
47.00	3.74	1.98	0.00
48.00	3.74	1.98	0.00
49.00	3.74	1.98	0.00
50.00	3.74	1.98	0.00
51.00	3.74	1.98	0.00
52.00	3.74	1.98	0.00
53.00	3.74	1.98	0.00
54.00	3.74	1.98	0.00

Summary for Pond 1P: Detention Basin

Inflow Area = 31.550 ac, 48.59% Impervious, Inflow Depth = 2.57" for 10-yr event
Inflow = 46.20 cfs @ 12.19 hrs, Volume= 6.765 af
Outflow = 13.38 cfs @ 13.20 hrs, Volume= 5.777 af, Atten= 71%, Lag= 61.1 min
Primary = 13.38 cfs @ 13.20 hrs, Volume= 5.777 af

Routing by Stor-Ind method, Time Span= 0.00-54.00 hrs, dt= 0.50 hrs
Peak Elev= 774.31' @ 13.14 hrs Surf.Area= 1.933 ac Storage= 3.663 af

Plug-Flow detention time= 482.0 min calculated for 5.777 af (85% of inflow)
Center-of-Mass det. time= 416.1 min (1,234.9 - 818.9)

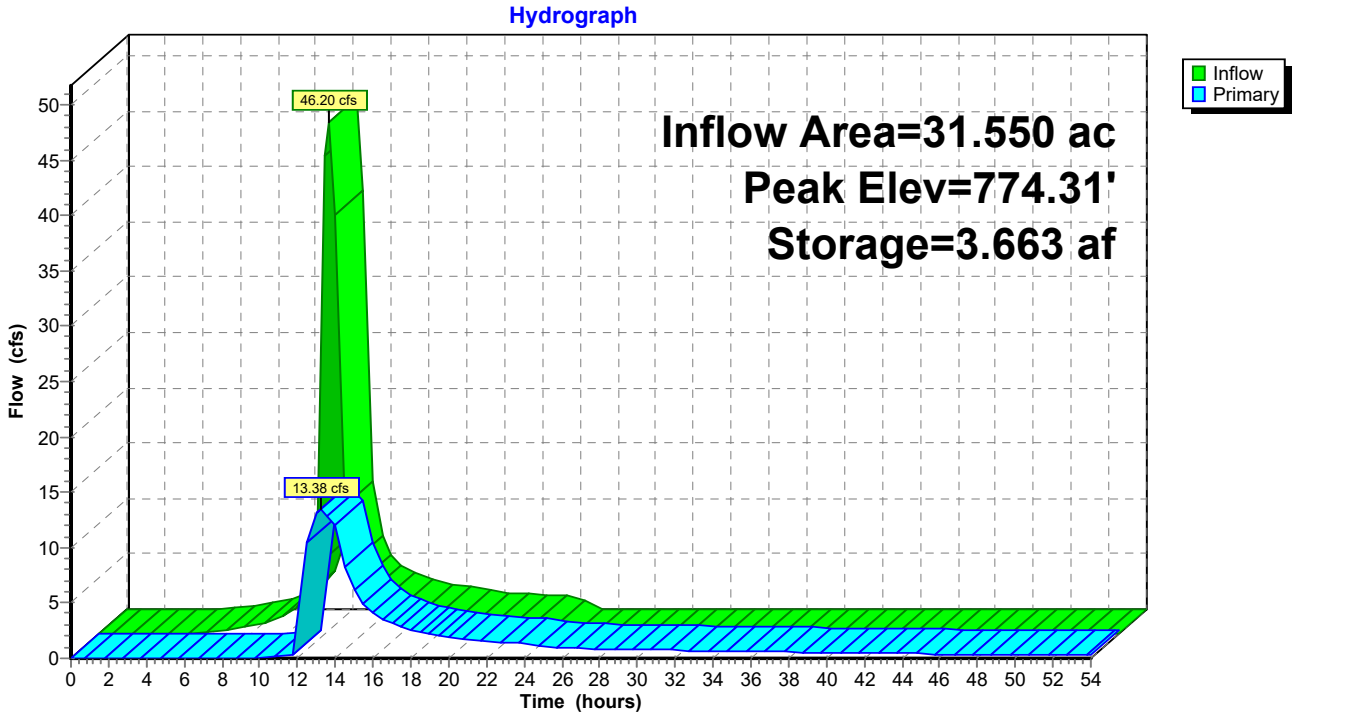
Volume	Invert	Avail.Storage	Storage Description
#1	772.00'	8.055 af	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
772.00	1.431	0.000	0.000
773.00	1.550	1.490	1.490
774.00	1.673	1.611	3.102
775.00	2.507	2.090	5.192
776.00	3.218	2.862	8.055

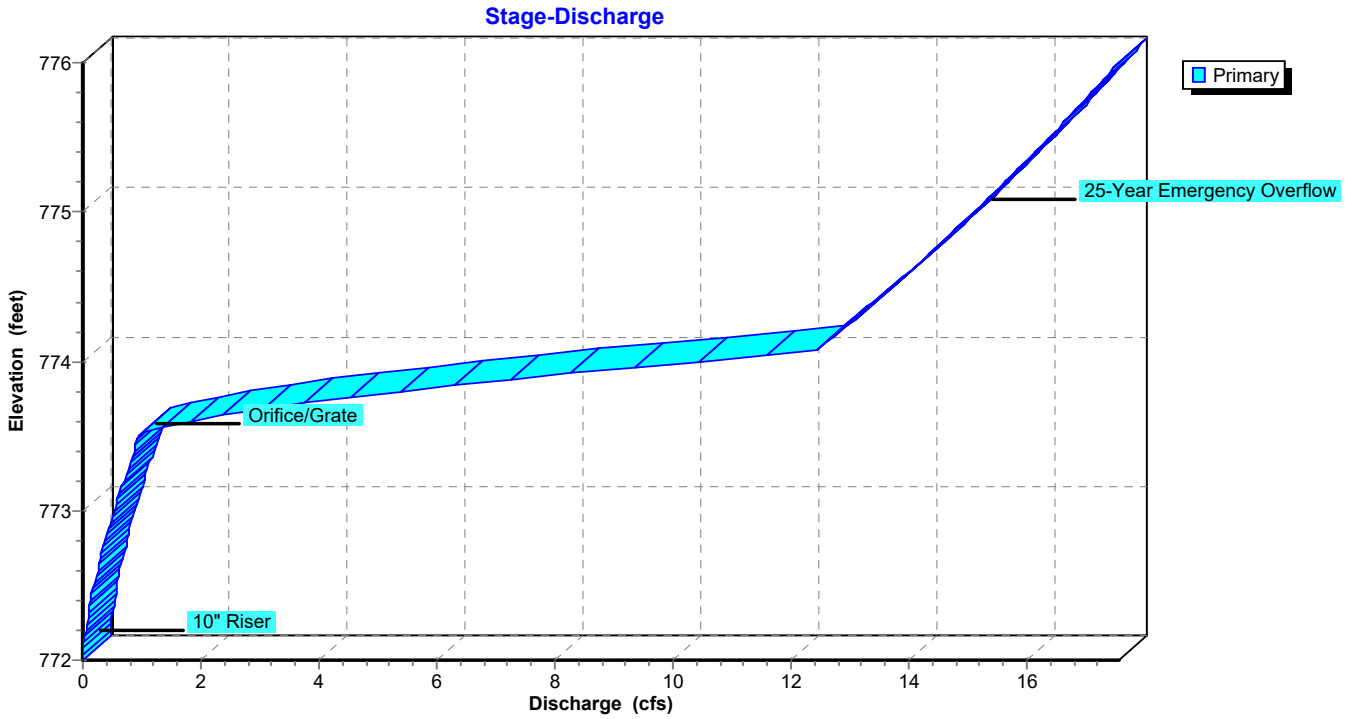
Device	Routing	Invert	Outlet Devices
#1	Device 2	772.12'	**1.0" Vert. 10" Riser X 10.00 columns** X 4 rows with 4.0" cc spacing C= 0.600 Limited to weir flow at low heads
#2	Primary	770.92'	**18.0" Round Culvert** L= 55.5' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 770.92' / 770.64' S= 0.0050 '/' Cc= 0.900 n= 0.013, Flow Area= 1.77 sf
#3	Device 2	773.50'	**24.0" x 24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Device 2	775.00'	**10.0' long x 18.0' breadth 25-Year Emergency Overflow** 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=13.03 cfs @ 13.20 hrs HW=774.26' (Free Discharge)
└**2=Culvert** (Barrel Controls 13.03 cfs @ 7.37 fps)
  ├**1=10" Riser** (Passes < 1.32 cfs potential flow)
  ├**3=Orifice/Grate** (Passes < 16.81 cfs potential flow)
  └**4=25-Year Emergency Overflow** (Controls 0.00 cfs)

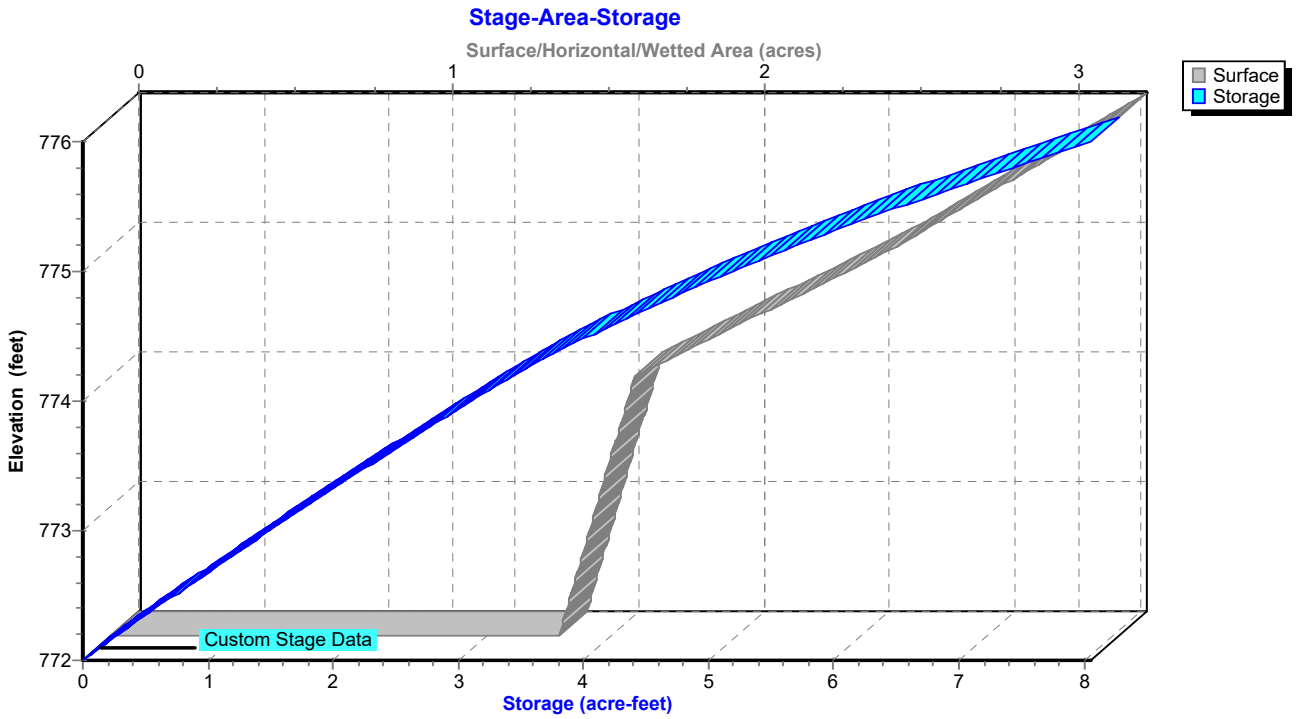
Pond 1P: Detention Basin



Pond 1P: Detention Basin



Pond 1P: Detention Basin



Hydrograph for Pond 1P: Detention Basin

Time (hours)	Inflow (cfs)	Storage (acre-feet)	Elevation (feet)	Primary (cfs)
0.00	0.00	0.000	772.00	0.00
2.50	0.00	0.000	772.00	0.00
5.00	0.04	0.001	772.00	0.00
7.50	0.50	0.053	772.04	0.00
10.00	**1.72**	0.258	772.18	0.03
12.50	**37.82**	**3.103**	**774.00**	**10.46**
15.00	3.54	**2.823**	**773.83**	**6.14**
17.50	2.20	2.552	773.67	2.83
20.00	1.53	2.455	773.61	1.93
22.50	1.31	2.396	773.57	1.49
25.00	0.03	2.318	773.52	1.04
27.50	0.00	2.128	773.40	0.87
30.00	0.00	1.956	773.30	0.79
32.50	0.00	1.802	773.20	0.70
35.00	0.00	1.669	773.11	0.60
37.50	0.00	1.549	773.04	0.56
40.00	0.00	1.438	772.97	0.51
42.50	0.00	1.337	772.90	0.46
45.00	0.00	1.247	772.84	0.40
47.50	0.00	1.170	772.79	0.35
50.00	0.00	1.099	772.75	0.33
52.50	0.00	1.033	772.70	0.31

Stage-Discharge for Pond 1P: Detention Basin

Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)
772.00	0.00	773.04	0.56	774.08	12.46	775.12	15.44
772.02	0.00	773.06	0.57	774.10	12.52	775.14	15.49
772.04	0.00	773.08	0.58	774.12	12.58	775.16	15.54
772.06	0.00	773.10	0.60	774.14	12.65	775.18	15.59
772.08	0.00	773.12	0.61	774.16	12.71	775.20	15.64
772.10	0.00	773.14	0.62	774.18	12.77	775.22	15.69
772.12	0.00	773.16	0.65	774.20	12.83	775.24	15.74
772.14	0.00	773.18	0.67	774.22	12.90	775.26	15.80
772.16	0.02	773.20	0.70	774.24	12.96	775.28	15.85
772.18	0.04	773.22	0.72	774.26	13.02	775.30	15.90
772.20	0.05	773.24	0.74	774.28	13.08	775.32	15.95
772.22	0.06	773.26	0.76	774.30	13.14	775.34	16.00
772.24	0.07	773.28	0.78	774.32	13.20	775.36	16.05
772.26	0.08	773.30	0.79	774.34	13.26	775.38	16.10
772.28	0.09	773.32	0.81	774.36	13.32	775.40	16.15
772.30	0.10	773.34	0.83	774.38	13.38	775.42	16.20
772.32	0.10	773.36	0.84	774.40	13.44	775.44	16.24
772.34	0.11	773.38	0.85	774.42	13.50	775.46	16.29
772.36	0.12	773.40	0.87	774.44	13.56	775.48	16.34
772.38	0.12	773.42	0.88	774.46	13.62	775.50	16.39
772.40	0.13	773.44	0.90	774.48	13.68	775.52	16.44
772.42	0.13	773.46	0.91	774.50	13.74	775.54	16.49
772.44	0.14	773.48	0.92	774.52	13.80	775.56	16.54
772.46	0.14	773.50	0.94	774.54	13.85	775.58	16.59
772.48	0.16	773.52	1.02	774.56	13.91	775.60	16.63
772.50	0.18	773.54	1.17	774.58	13.97	775.62	16.68
772.52	0.20	773.56	1.36	774.60	14.03	775.64	16.73
772.54	0.22	773.58	1.58	774.62	14.08	775.66	16.78
772.56	0.23	773.60	1.82	774.64	14.14	775.68	16.82
772.58	0.25	773.62	2.09	774.66	14.20	775.70	16.87
772.60	0.26	773.64	2.39	774.68	14.25	775.72	16.92
772.62	0.27	773.66	2.70	774.70	14.31	775.74	16.97
772.64	0.28	773.68	3.04	774.72	14.36	775.76	17.01
772.66	0.29	773.70	3.39	774.74	14.42	775.78	17.06
772.68	0.30	773.72	3.76	774.76	14.47	775.80	17.11
772.70	0.31	773.74	4.15	774.78	14.53	775.82	17.15
772.72	0.32	773.76	4.55	774.80	14.58	775.84	17.20
772.74	0.33	773.78	4.97	774.82	14.64	775.86	17.25
772.76	0.34	773.80	5.40	774.84	14.69	775.88	17.29
772.78	0.35	773.82	5.85	774.86	14.75	775.90	17.34
772.80	0.36	773.84	6.31	774.88	14.80	775.92	17.39
772.82	0.38	773.86	6.79	774.90	14.86	775.94	17.43
772.84	0.40	773.88	7.27	774.92	14.91	775.96	17.48
772.86	0.42	773.90	7.77	774.94	14.96	775.98	17.52
772.88	0.45	773.92	8.29	774.96	15.02	776.00	**17.57**
772.90	0.46	773.94	8.81	774.98	15.07		
772.92	0.48	773.96	9.35	775.00	15.12		
772.94	0.49	773.98	9.89	775.02	15.18		
772.96	0.51	774.00	10.45	775.04	15.23		
772.98	0.52	774.02	11.02	775.06	15.28		
773.00	0.54	774.04	11.60	775.08	15.33		
773.02	0.55	774.06	12.19	775.10	15.38		

Stage-Area-Storage for Pond 1P: Detention Basin

Elevation (feet)	Surface (acres)	Storage (acre-feet)
772.00	1.431	0.000
772.05	1.437	0.072
772.10	1.443	0.144
772.15	1.449	0.216
772.20	1.455	0.289
772.25	1.461	0.361
772.30	1.467	0.435
772.35	1.473	0.508
772.40	1.479	0.582
772.45	1.485	0.656
772.50	1.490	0.730
772.55	1.496	0.805
772.60	1.502	0.880
772.65	1.508	0.955
772.70	1.514	1.031
772.75	1.520	1.107
772.80	1.526	1.183
772.85	1.532	1.259
772.90	1.538	1.336
772.95	1.544	1.413
773.00	1.550	1.490
773.05	1.556	1.568
773.10	1.562	1.646
773.15	1.568	1.724
773.20	1.575	1.803
773.25	1.581	1.882
773.30	1.587	1.961
773.35	1.593	2.041
773.40	1.599	2.120
773.45	1.605	2.200
773.50	1.611	2.281
773.55	1.618	2.362
773.60	1.624	2.443
773.65	1.630	2.524
773.70	1.636	2.606
773.75	1.642	2.688
773.80	1.648	2.770
773.85	1.655	2.852
773.90	1.661	2.935
773.95	1.667	3.019
774.00	1.673	3.102
774.05	1.715	3.187
774.10	1.756	3.273
774.15	1.798	3.362
774.20	1.840	3.453
774.25	1.881	3.546
774.30	1.923	3.641
774.35	1.965	3.739
774.40	2.007	3.838
774.45	2.048	3.939
774.50	2.090	4.043
774.55	2.132	4.148
774.60	2.173	4.256
774.65	2.215	4.366
774.70	2.257	4.477
774.75	2.298	4.591
774.80	2.340	4.707
774.85	2.382	4.825
774.90	2.424	4.945
774.95	2.465	5.068
775.00	2.507	5.192
775.05	2.543	5.318
775.10	2.578	5.446
775.15	2.614	5.576
775.20	2.649	5.708
775.25	2.685	5.841
775.30	2.720	5.976
775.35	2.756	6.113
775.40	2.791	6.252
775.45	2.827	6.392
775.50	2.862	6.534
775.55	2.898	6.678
775.60	2.934	6.824
775.65	2.969	6.972
775.70	3.005	7.121
775.75	3.040	7.272
775.80	3.076	7.425
775.85	3.111	7.580
775.90	3.147	7.736
775.95	3.182	7.894
776.00	**3.218**	**8.055**

Summary for Pond 2P: Detention Basin WQ Check

Inflow	=	0.00 cfs @	0.00 hrs,	Volume=	0.000 af
Outflow	=	0.94 cfs @	0.00 hrs,	Volume=	1.719 af, Atten= 0%, Lag= 0.0 min
Primary	=	0.94 cfs @	0.00 hrs,	Volume=	1.719 af

Routing by Stor-Ind method, Time Span= 0.00-54.00 hrs, dt= 0.50 hrs
Starting Elev= 773.50' Surf.Area= 1.611 ac Storage= 2.281 af
Peak Elev= 773.50' @ 0.00 hrs Surf.Area= 1.611 ac Storage= 2.281 af

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= (not calculated: no inflow)

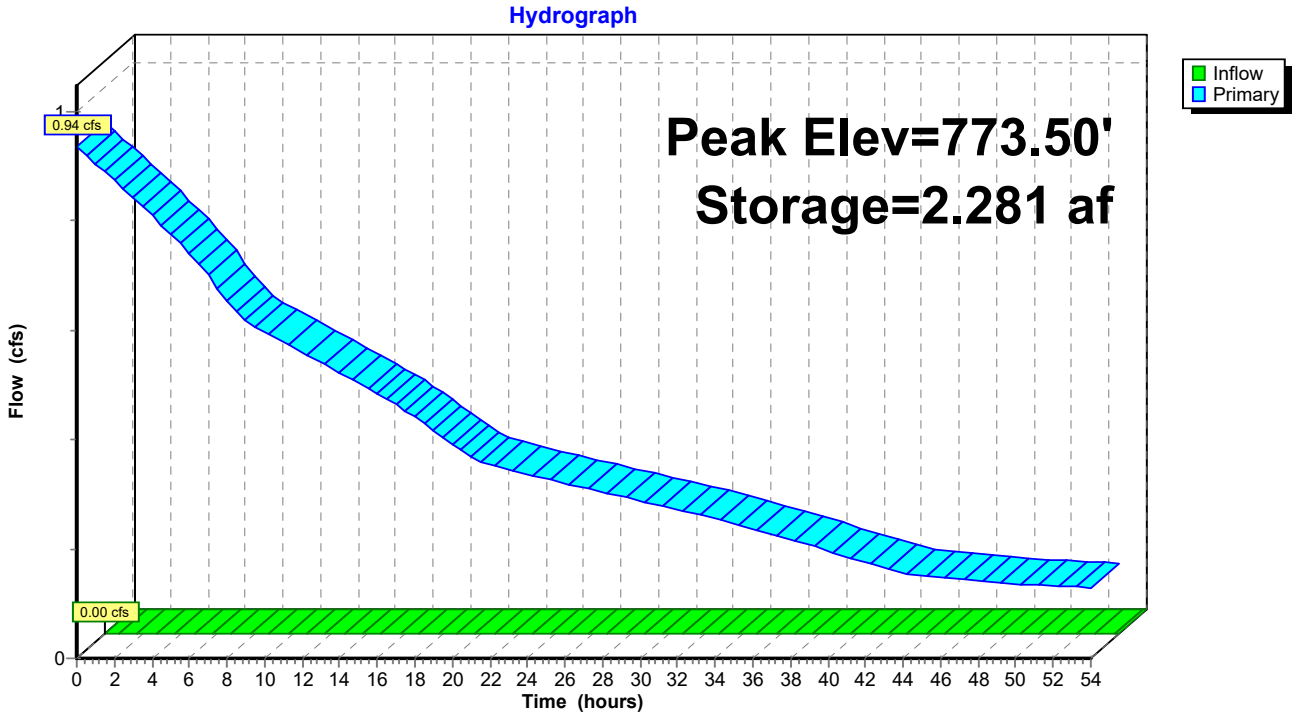
Volume	Invert	Avail.Storage	Storage Description
#1	772.00'	8.055 af	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
772.00	1.431	0.000	0.000
773.00	1.550	1.491	1.491
774.00	1.673	1.611	3.102
775.00	2.507	2.090	5.192
776.00	3.218	2.863	8.055

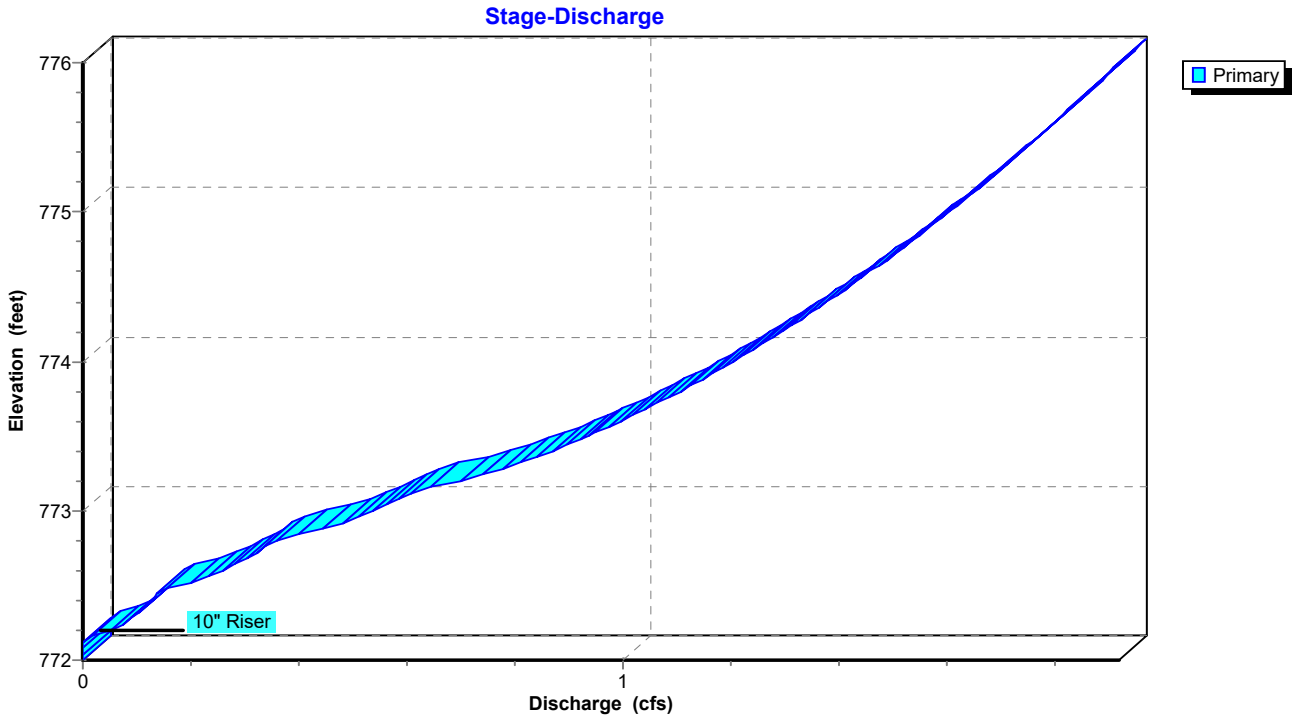
Device	Routing	Invert	Outlet Devices
#1	Primary	772.12'	**1.0" Vert. 10" Riser X 10.00 columns** X 4 rows with 4.0" cc spacing C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.94 cfs @ 0.00 hrs HW=773.50' (Free Discharge)
↑—**1=10" Riser** (Orifice Controls 0.94 cfs @ 4.29 fps)

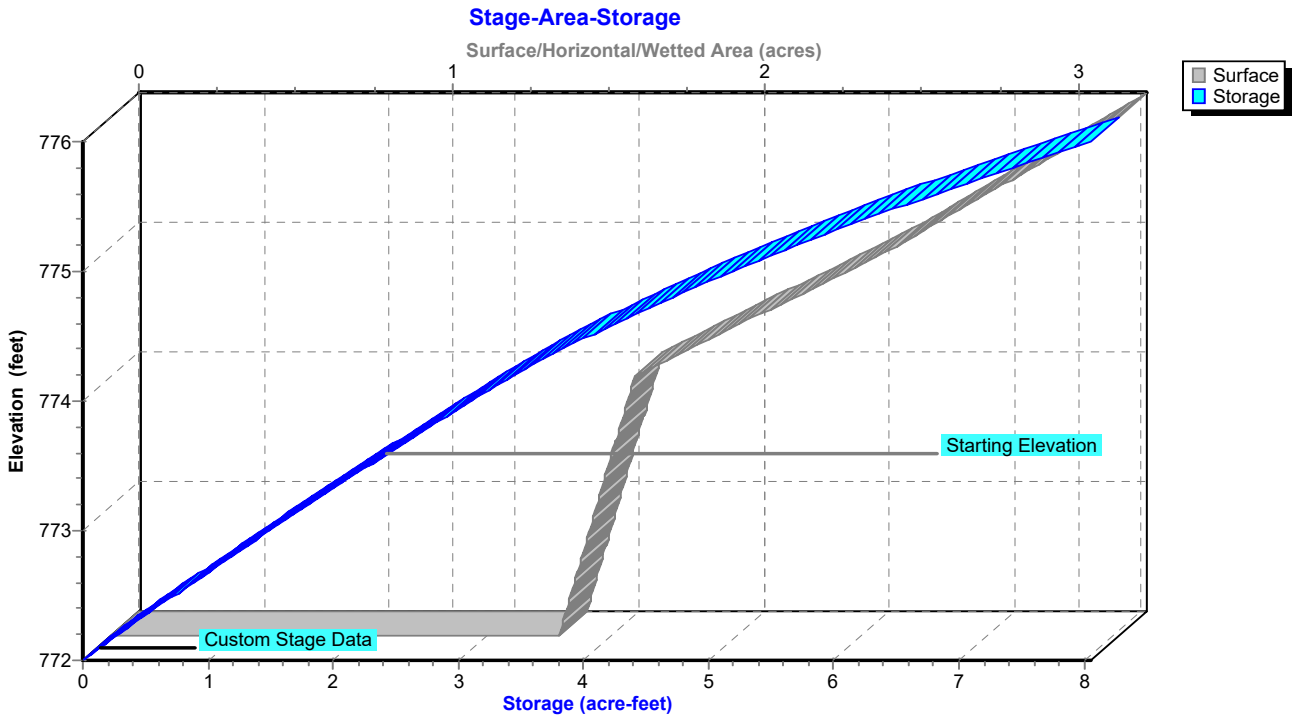
Pond 2P: Detention Basin WQ Check



Pond 2P: Detention Basin WQ Check



Pond 2P: Detention Basin WQ Check



Hydrograph for Pond 2P: Detention Basin WQ Check

Time (hours)	Inflow (cfs)	Storage (acre-feet)	Elevation (feet)	Primary (cfs)
0.00	**0.00**	**2.281**	**773.50**	**0.94**
2.50	0.00	2.096	773.38	0.86
5.00	0.00	1.927	773.28	0.78
7.50	0.00	1.776	773.18	0.68
10.00	0.00	1.646	773.10	0.60
12.50	0.00	1.528	773.02	0.55
15.00	0.00	1.419	772.95	0.50
17.50	0.00	1.320	772.89	0.45
20.00	0.00	1.232	772.83	0.39
22.50	0.00	1.157	772.78	0.35
25.00	0.00	1.087	772.74	0.33
27.50	0.00	1.021	772.69	0.31
30.00	0.00	0.959	772.65	0.29
32.50	0.00	0.902	772.61	0.27
35.00	0.00	0.849	772.58	0.25
37.50	0.00	0.801	772.55	0.22
40.00	0.00	0.757	772.52	0.20
42.50	0.00	0.720	772.49	0.17
45.00	0.00	0.687	772.47	0.15
47.50	0.00	0.656	772.45	0.14
50.00	0.00	0.627	772.43	0.14
52.50	0.00	0.600	772.41	0.13

16 hours, half WQv remains in basin

After 48 hours basin still discharging

Stage-Discharge for Pond 2P: Detention Basin WQ Check

Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)
772.00	0.00	773.04	0.56	774.08	1.24	775.12	1.64
772.02	0.00	773.06	0.57	774.10	1.25	775.14	1.65
772.04	0.00	773.08	0.58	774.12	1.26	775.16	1.66
772.06	0.00	773.10	0.60	774.14	1.27	775.18	1.66
772.08	0.00	773.12	0.61	774.16	1.28	775.20	1.67
772.10	0.00	773.14	0.62	774.18	1.28	775.22	1.68
772.12	0.00	773.16	0.65	774.20	1.29	775.24	1.68
772.14	0.00	773.18	0.67	774.22	1.30	775.26	1.69
772.16	0.02	773.20	0.70	774.24	1.31	775.28	1.70
772.18	0.04	773.22	0.72	774.26	1.32	775.30	1.70
772.20	0.05	773.24	0.74	774.28	1.33	775.32	1.71
772.22	0.06	773.26	0.76	774.30	1.34	775.34	1.71
772.24	0.07	773.28	0.78	774.32	1.34	775.36	1.72
772.26	0.08	773.30	0.79	774.34	1.35	775.38	1.73
772.28	0.09	773.32	0.81	774.36	1.36	775.40	1.73
772.30	0.10	773.34	0.83	774.38	1.37	775.42	1.74
772.32	0.10	773.36	0.84	774.40	1.38	775.44	1.75
772.34	0.11	773.38	0.85	774.42	1.38	775.46	1.75
772.36	0.12	773.40	0.87	774.44	1.39	775.48	1.76
772.38	0.12	773.42	0.88	774.46	1.40	775.50	1.77
772.40	0.13	773.44	0.90	774.48	1.41	775.52	1.77
772.42	0.13	773.46	0.91	774.50	1.42	775.54	1.78
772.44	0.14	773.48	0.92	774.52	1.42	775.56	1.78
772.46	0.14	773.50	0.94	774.54	1.43	775.58	1.79
772.48	0.16	773.52	0.95	774.56	1.44	775.60	1.80
772.50	0.18	773.54	0.96	774.58	1.45	775.62	1.80
772.52	0.20	773.56	0.97	774.60	1.46	775.64	1.81
772.54	0.22	773.58	0.98	774.62	1.46	775.66	1.82
772.56	0.23	773.60	1.00	774.64	1.47	775.68	1.82
772.58	0.25	773.62	1.01	774.66	1.48	775.70	1.83
772.60	0.26	773.64	1.02	774.68	1.49	775.72	1.83
772.62	0.27	773.66	1.03	774.70	1.49	775.74	1.84
772.64	0.28	773.68	1.04	774.72	1.50	775.76	1.85
772.66	0.29	773.70	1.05	774.74	1.51	775.78	1.85
772.68	0.30	773.72	1.06	774.76	1.52	775.80	1.86
772.70	0.31	773.74	1.07	774.78	1.52	775.82	1.86
772.72	0.32	773.76	1.08	774.80	1.53	775.84	1.87
772.74	0.33	773.78	1.09	774.82	1.54	775.86	1.88
772.76	0.34	773.80	1.10	774.84	1.54	775.88	1.88
772.78	0.35	773.82	1.12	774.86	1.55	775.90	1.89
772.80	0.36	773.84	1.13	774.88	1.56	775.92	1.89
772.82	0.38	773.86	1.14	774.90	1.57	775.94	1.90
772.84	0.40	773.88	1.15	774.92	1.57	775.96	1.90
772.86	0.42	773.90	1.16	774.94	1.58	775.98	1.91
772.88	0.45	773.92	1.16	774.96	1.59	776.00	**1.92**
772.90	0.46	773.94	1.17	774.98	1.59		
772.92	0.48	773.96	1.18	775.00	1.60		
772.94	0.49	773.98	1.19	775.02	1.61		
772.96	0.51	774.00	1.20	775.04	1.61		
772.98	0.52	774.02	1.21	775.06	1.62		
773.00	0.54	774.04	1.22	775.08	1.63		
773.02	0.55	774.06	1.23	775.10	1.64		

Stage-Area-Storage for Pond 2P: Detention Basin WQ Check

Elevation (feet)	Surface (acres)	Storage (acre-feet)
772.00	1.431	0.000
772.05	1.437	0.072
772.10	1.443	0.144
772.15	1.449	0.216
772.20	1.455	0.289
772.25	1.461	0.361
772.30	1.467	0.435
772.35	1.473	0.508
772.40	1.479	0.582
772.45	1.485	0.656
772.50	1.491	0.730
772.55	1.496	0.805
772.60	1.502	0.880
772.65	1.508	0.955
772.70	1.514	1.031
772.75	1.520	1.107
772.80	1.526	1.183
772.85	1.532	1.259
772.90	1.538	1.336
772.95	1.544	1.413
773.00	1.550	1.491
773.05	1.556	1.568
773.10	1.562	1.646
773.15	1.568	1.724
773.20	1.575	1.803
773.25	1.581	1.882
773.30	1.587	1.961
773.35	1.593	2.041
773.40	1.599	2.120
773.45	1.605	2.200
773.50	1.611	2.281
773.55	1.618	2.362
773.60	1.624	2.443
773.65	1.630	2.524
773.70	1.636	2.606
773.75	1.642	2.688
773.80	1.648	2.770
773.85	1.655	2.852
773.90	1.661	2.935
773.95	1.667	3.019
774.00	1.673	3.102
774.05	1.715	3.187
774.10	1.756	3.273
774.15	1.798	3.362
774.20	1.840	3.453
774.25	1.882	3.546
774.30	1.923	3.641
774.35	1.965	3.739
774.40	2.007	3.838
774.45	2.048	3.939
774.50	2.090	4.043
774.55	2.132	4.148
774.60	2.173	4.256
774.65	2.215	4.366
774.70	2.257	4.477
774.75	2.298	4.591
774.80	2.340	4.707
774.85	2.382	4.825
774.90	2.424	4.945
774.95	2.465	5.068
775.00	2.507	5.192
775.05	2.543	5.318
775.10	2.578	5.446
775.15	2.614	5.576
775.20	2.649	5.708
775.25	2.685	5.841
775.30	2.720	5.976
775.35	2.756	6.113
775.40	2.791	6.252
775.45	2.827	6.392
775.50	2.863	6.534
775.55	2.898	6.678
775.60	2.934	6.824
775.65	2.969	6.972
775.70	3.005	7.121
775.75	3.040	7.272
775.80	3.076	7.425
775.85	3.111	7.580
775.90	3.147	7.736
775.95	3.182	7.894
776.00	**3.218**	**8.055**

Summary for Subcatchment 1S: Ramp D2-01-LT Ditch

[49] Hint: Tc<2dt may require smaller dt

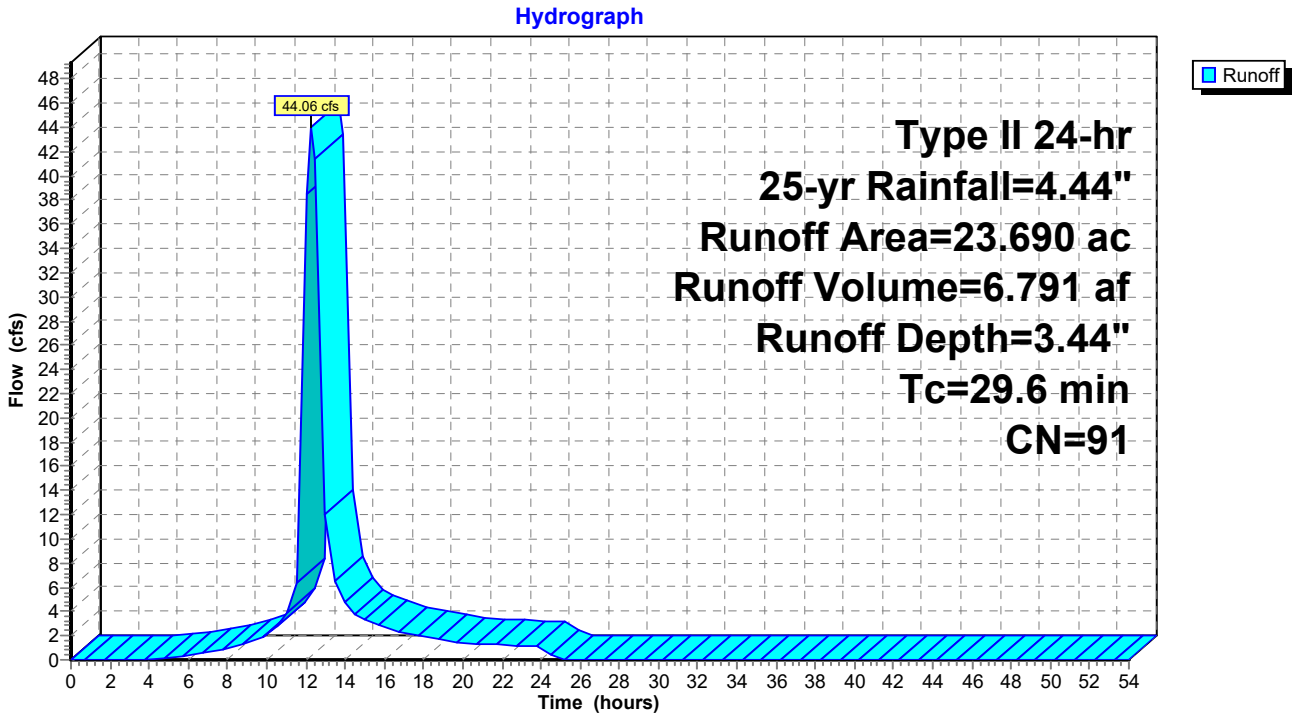
Runoff = 44.06 cfs @ 12.29 hrs, Volume= 6.791 af, Depth= 3.44"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-54.00 hrs, dt= 0.50 hrs
Type II 24-hr 25-yr Rainfall=4.44"

Area (ac)	CN	Description
14.270	98	Paved roads w/curbs & sewers, HSG D
8.560	80	>75% Grass cover, Good, HSG D
0.860	89	<50% Grass cover, Poor, HSG D
23.690	91	Weighted Average
9.420		39.76% Pervious Area
14.270		60.24% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
29.6					**Direct Entry, TC from Ditch Calc**

Subcatchment 1S: Ramp D2-01-LT Ditch



Hydrograph for Subcatchment 1S: Ramp D2-01-LT Ditch

Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)
0.00	0.00	0.00	0.00
1.00	0.05	0.00	0.00
2.00	0.10	0.00	0.00
3.00	0.15	0.00	0.00
4.00	0.21	0.00	0.00
5.00	0.28	0.01	0.15
6.00	0.36	0.02	0.38
7.00	0.44	0.05	0.63
8.00	0.53	0.08	0.90
9.00	0.65	0.14	1.43
10.00	0.80	0.23	2.08
11.00	1.04	0.39	3.91
12.00	2.94	2.02	**38.51**
13.00	3.43	2.47	**12.01**
14.00	3.64	2.67	4.73
15.00	3.79	2.82	3.36
16.00	3.91	2.93	2.65
17.00	4.00	3.02	2.20
18.00	4.09	3.10	1.95
19.00	4.16	3.17	1.69
20.00	4.23	3.23	1.44
21.00	4.28	3.29	1.30
22.00	4.34	3.34	1.25
23.00	4.39	3.39	1.20
24.00	**4.44**	**3.44**	1.13
25.00	4.44	3.44	0.04
26.00	4.44	3.44	0.00
27.00	4.44	3.44	0.00
28.00	4.44	3.44	0.00
29.00	4.44	3.44	0.00
30.00	4.44	3.44	0.00
31.00	4.44	3.44	0.00
32.00	4.44	3.44	0.00
33.00	4.44	3.44	0.00
34.00	4.44	3.44	0.00
35.00	4.44	3.44	0.00
36.00	4.44	3.44	0.00
37.00	4.44	3.44	0.00
38.00	4.44	3.44	0.00
39.00	4.44	3.44	0.00
40.00	4.44	3.44	0.00
41.00	4.44	3.44	0.00
42.00	4.44	3.44	0.00
43.00	4.44	3.44	0.00
44.00	4.44	3.44	0.00
45.00	4.44	3.44	0.00
46.00	4.44	3.44	0.00
47.00	4.44	3.44	0.00
48.00	4.44	3.44	0.00
49.00	4.44	3.44	0.00
50.00	4.44	3.44	0.00
51.00	4.44	3.44	0.00
52.00	4.44	3.44	0.00
53.00	4.44	3.44	0.00
54.00	4.44	3.44	0.00

Summary for Subcatchment 2S: Direct Flow into Basin

[49] Hint: Tc<2dt may require smaller dt

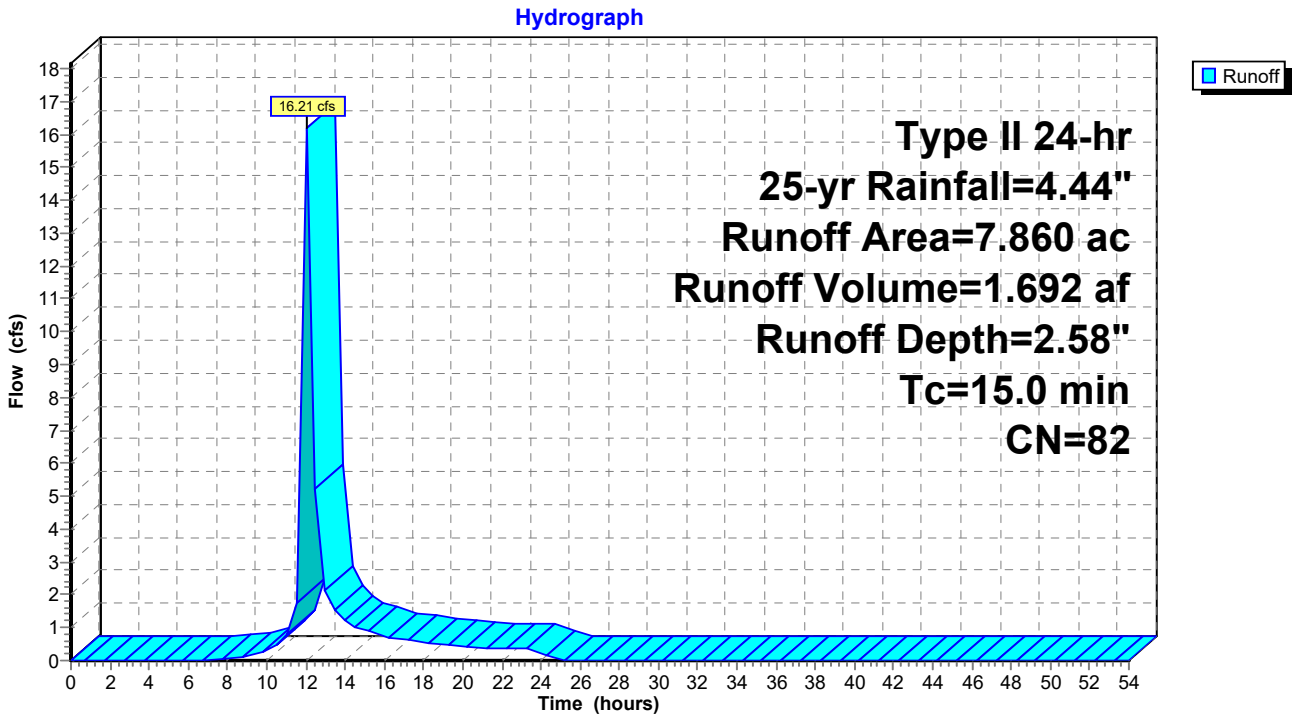
Runoff = 16.21 cfs @ 12.03 hrs, Volume= 1.692 af, Depth= 2.58"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-54.00 hrs, dt= 0.50 hrs
Type II 24-hr 25-yr Rainfall=4.44"

Area (ac)	CN	Description
1.060	98	Paved roads w/curbs & sewers, HSG D
6.800	80	>75% Grass cover, Good, HSG D
7.860	82	Weighted Average
6.800		86.51% Pervious Area
1.060		13.49% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.0					**Direct Entry, Direct flow into Basin**

Subcatchment 2S: Direct Flow into Basin



Hydrograph for Subcatchment 2S: Direct Flow into Basin

Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)
0.00	0.00	0.00	0.00
1.00	0.05	0.00	0.00
2.00	0.10	0.00	0.00
3.00	0.15	0.00	0.00
4.00	0.21	0.00	0.00
5.00	0.28	0.00	0.00
6.00	0.36	0.00	0.00
7.00	0.44	0.00	0.00
8.00	0.53	0.00	0.05
9.00	0.65	0.02	0.15
10.00	0.80	0.05	0.31
11.00	1.04	0.13	0.79
12.00	2.94	1.33	**16.16**
13.00	3.43	1.72	2.13
14.00	3.64	1.90	1.22
15.00	3.79	2.02	0.94
16.00	3.91	2.12	0.74
17.00	4.00	2.21	0.63
18.00	4.09	2.28	0.56
19.00	4.16	2.34	0.49
20.00	4.23	2.40	0.41
21.00	4.28	2.45	0.39
22.00	4.34	2.49	0.37
23.00	4.39	2.54	0.36
24.00	**4.44**	**2.58**	0.31
25.00	4.44	2.58	0.00
26.00	4.44	2.58	0.00
27.00	4.44	2.58	0.00
28.00	4.44	2.58	0.00
29.00	4.44	2.58	0.00
30.00	4.44	2.58	0.00
31.00	4.44	2.58	0.00
32.00	4.44	2.58	0.00
33.00	4.44	2.58	0.00
34.00	4.44	2.58	0.00
35.00	4.44	2.58	0.00
36.00	4.44	2.58	0.00
37.00	4.44	2.58	0.00
38.00	4.44	2.58	0.00
39.00	4.44	2.58	0.00
40.00	4.44	2.58	0.00
41.00	4.44	2.58	0.00
42.00	4.44	2.58	0.00
43.00	4.44	2.58	0.00
44.00	4.44	2.58	0.00
45.00	4.44	2.58	0.00
46.00	4.44	2.58	0.00
47.00	4.44	2.58	0.00
48.00	4.44	2.58	0.00
49.00	4.44	2.58	0.00
50.00	4.44	2.58	0.00
51.00	4.44	2.58	0.00
52.00	4.44	2.58	0.00
53.00	4.44	2.58	0.00
54.00	4.44	2.58	0.00

Summary for Pond 1P: Detention Basin

Inflow Area = 31.550 ac, 48.59% Impervious, Inflow Depth = 3.23" for 25-yr event
Inflow = 58.04 cfs @ 12.18 hrs, Volume= 8.484 af
Outflow = 14.52 cfs @ 13.00 hrs, Volume= 7.488 af, Atten= 75%, Lag= 49.5 min
Primary = 14.52 cfs @ 13.00 hrs, Volume= 7.488 af

Routing by Stor-Ind method, Time Span= 0.00-54.00 hrs, dt= 0.50 hrs
Peak Elev= 774.80' @ 13.17 hrs Surf.Area= 2.339 ac Storage= 4.703 af

Plug-Flow detention time= 413.8 min calculated for 7.488 af (88% of inflow)
Center-of-Mass det. time= 357.4 min (1,170.0 - 812.7)

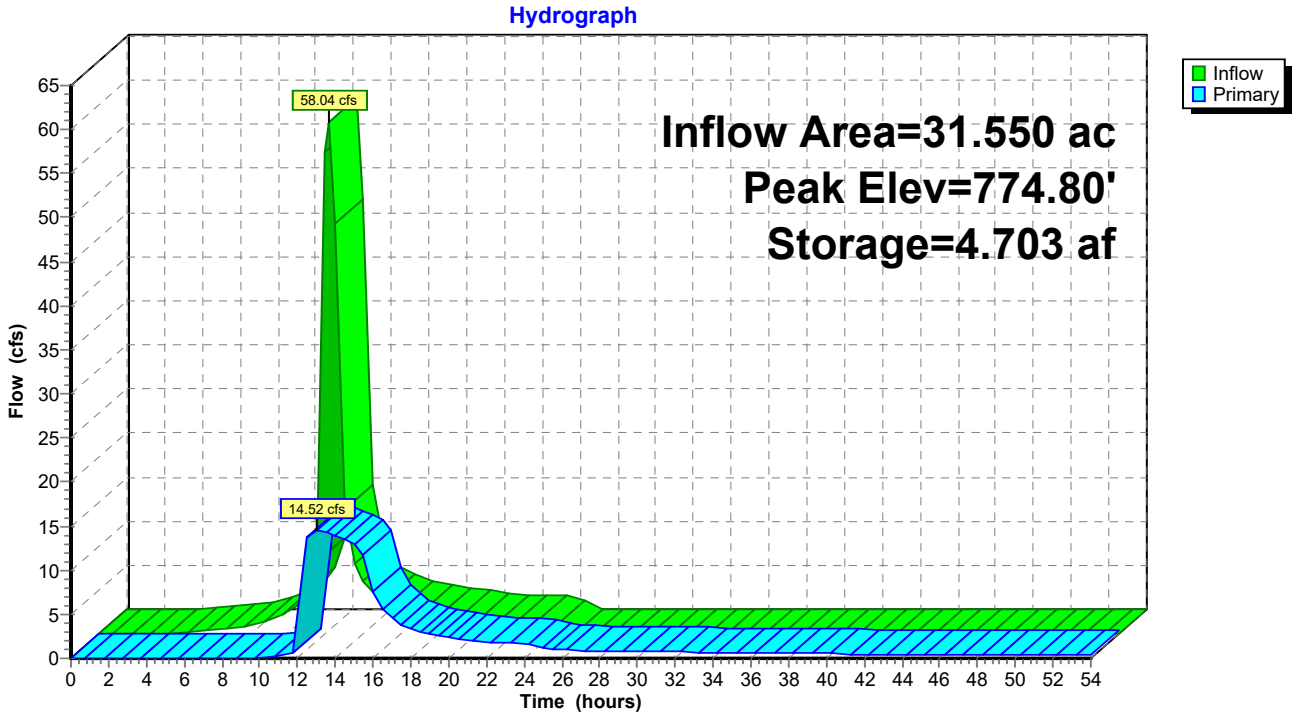
Volume	Invert	Avail.Storage	Storage Description
#1	772.00'	8.055 af	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
772.00	1.431	0.000	0.000
773.00	1.550	1.490	1.490
774.00	1.673	1.611	3.102
775.00	2.507	2.090	5.192
776.00	3.218	2.862	8.055

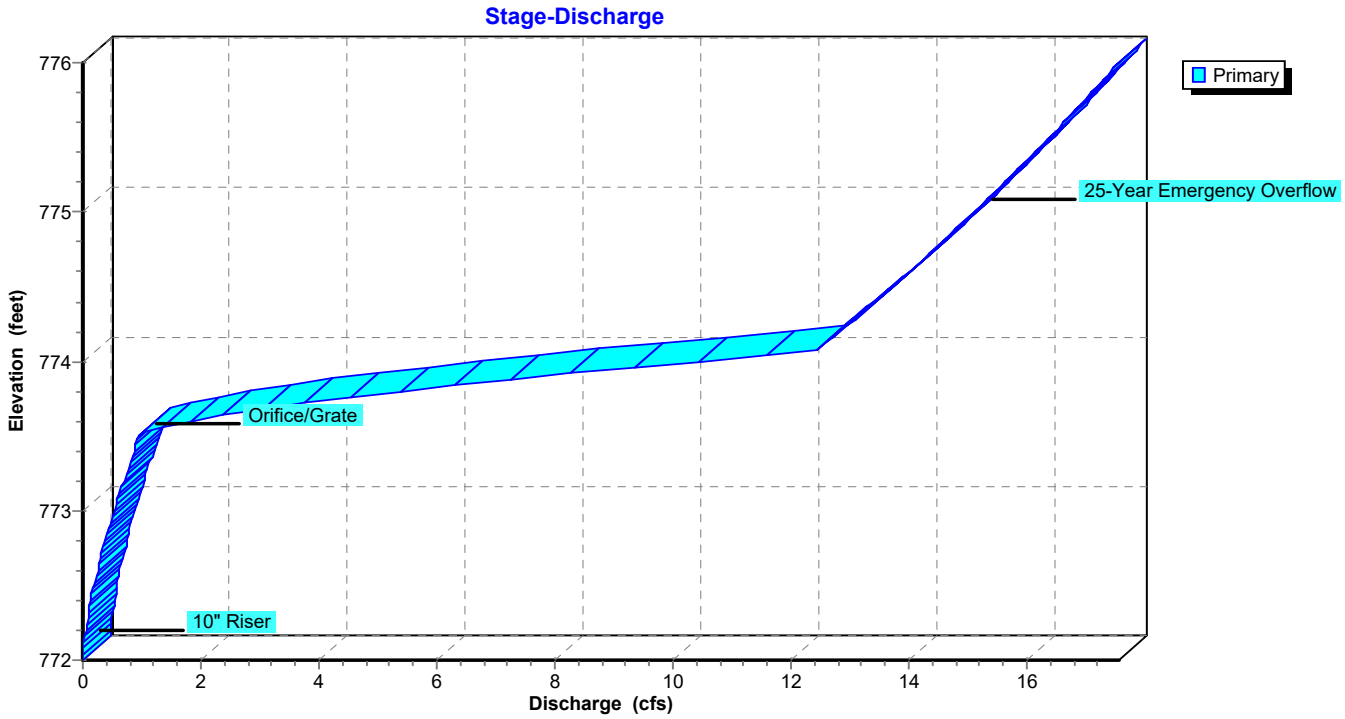
Device	Routing	Invert	Outlet Devices
#1	Device 2	772.12'	**1.0" Vert. 10" Riser X 10.00 columns** X 4 rows with 4.0" cc spacing C= 0.600 Limited to weir flow at low heads
#2	Primary	770.92'	**18.0" Round Culvert** L= 55.5' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 770.92' / 770.64' S= 0.0050 '/' Cc= 0.900 n= 0.013, Flow Area= 1.77 sf
#3	Device 2	773.50'	**24.0" x 24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Device 2	775.00'	**10.0' long x 18.0' breadth 25-Year Emergency Overflow** 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=14.52 cfs @ 13.00 hrs HW=774.78' (Free Discharge)
└**2=Culvert** (Barrel Controls 14.52 cfs @ 8.22 fps)
  ├**1=10" Riser** (Passes < 1.52 cfs potential flow)
  ├**3=Orifice/Grate** (Passes < 21.77 cfs potential flow)
  └**4=25-Year Emergency Overflow** (Controls 0.00 cfs)

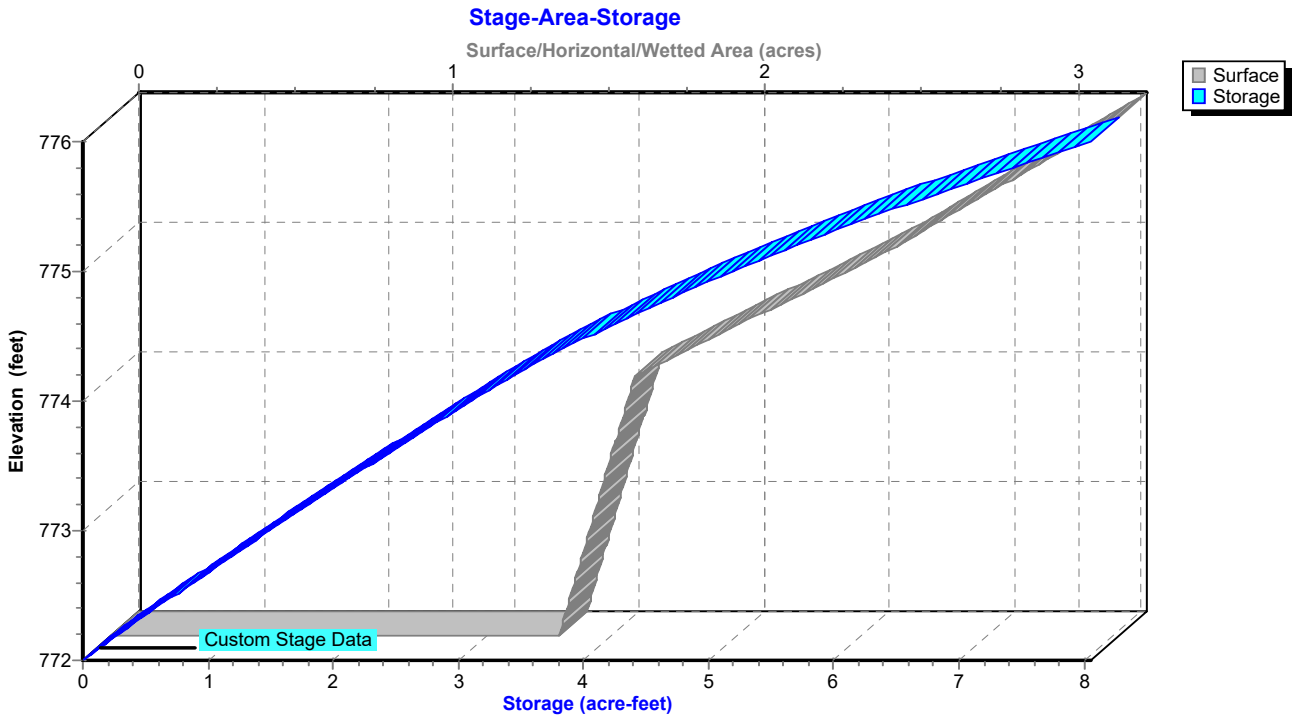
Pond 1P: Detention Basin



Pond 1P: Detention Basin



Pond 1P: Detention Basin



Hydrograph for Pond 1P: Detention Basin

Time (hours)	Inflow (cfs)	Storage (acre-feet)	Elevation (feet)	Primary (cfs)
0.00	0.00	0.000	772.00	0.00
2.50	0.00	0.000	772.00	0.00
5.00	0.15	0.006	772.00	0.00
7.50	0.78	0.098	772.07	0.00
10.00	**2.40**	0.395	772.27	0.09
12.50	**46.54**	**3.983**	**774.47**	**13.65**
15.00	4.30	**3.517**	**774.23**	**12.94**
17.50	2.67	2.641	773.72	3.79
20.00	1.85	2.501	773.64	2.33
22.50	1.59	2.436	773.60	1.77
25.00	0.04	2.347	773.54	1.20
27.50	0.00	2.151	773.42	0.88
30.00	0.00	1.977	773.31	0.80
32.50	0.00	1.820	773.21	0.71
35.00	0.00	1.684	773.12	0.61
37.50	0.00	1.563	773.05	0.56
40.00	0.00	1.451	772.97	0.52
42.50	0.00	1.349	772.91	0.47
45.00	0.00	1.258	772.85	0.41
47.50	0.00	1.179	772.80	0.36
50.00	0.00	1.108	772.75	0.33
52.50	0.00	1.041	772.71	0.31

Stage-Discharge for Pond 1P: Detention Basin

Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)
772.00	0.00	773.04	0.56	774.08	12.46	775.12	15.44
772.02	0.00	773.06	0.57	774.10	12.52	775.14	15.49
772.04	0.00	773.08	0.58	774.12	12.58	775.16	15.54
772.06	0.00	773.10	0.60	774.14	12.65	775.18	15.59
772.08	0.00	773.12	0.61	774.16	12.71	775.20	15.64
772.10	0.00	773.14	0.62	774.18	12.77	775.22	15.69
772.12	0.00	773.16	0.65	774.20	12.83	775.24	15.74
772.14	0.00	773.18	0.67	774.22	12.90	775.26	15.80
772.16	0.02	773.20	0.70	774.24	12.96	775.28	15.85
772.18	0.04	773.22	0.72	774.26	13.02	775.30	15.90
772.20	0.05	773.24	0.74	774.28	13.08	775.32	15.95
772.22	0.06	773.26	0.76	774.30	13.14	775.34	16.00
772.24	0.07	773.28	0.78	774.32	13.20	775.36	16.05
772.26	0.08	773.30	0.79	774.34	13.26	775.38	16.10
772.28	0.09	773.32	0.81	774.36	13.32	775.40	16.15
772.30	0.10	773.34	0.83	774.38	13.38	775.42	16.20
772.32	0.10	773.36	0.84	774.40	13.44	775.44	16.24
772.34	0.11	773.38	0.85	774.42	13.50	775.46	16.29
772.36	0.12	773.40	0.87	774.44	13.56	775.48	16.34
772.38	0.12	773.42	0.88	774.46	13.62	775.50	16.39
772.40	0.13	773.44	0.90	774.48	13.68	775.52	16.44
772.42	0.13	773.46	0.91	774.50	13.74	775.54	16.49
772.44	0.14	773.48	0.92	774.52	13.80	775.56	16.54
772.46	0.14	773.50	0.94	774.54	13.85	775.58	16.59
772.48	0.16	773.52	1.02	774.56	13.91	775.60	16.63
772.50	0.18	773.54	1.17	774.58	13.97	775.62	16.68
772.52	0.20	773.56	1.36	774.60	14.03	775.64	16.73
772.54	0.22	773.58	1.58	774.62	14.08	775.66	16.78
772.56	0.23	773.60	1.82	774.64	14.14	775.68	16.82
772.58	0.25	773.62	2.09	774.66	14.20	775.70	16.87
772.60	0.26	773.64	2.39	774.68	14.25	775.72	16.92
772.62	0.27	773.66	2.70	774.70	14.31	775.74	16.97
772.64	0.28	773.68	3.04	774.72	14.36	775.76	17.01
772.66	0.29	773.70	3.39	774.74	14.42	775.78	17.06
772.68	0.30	773.72	3.76	774.76	14.47	775.80	17.11
772.70	0.31	773.74	4.15	774.78	14.53	775.82	17.15
772.72	0.32	773.76	4.55	774.80	14.58	775.84	17.20
772.74	0.33	773.78	4.97	774.82	14.64	775.86	17.25
772.76	0.34	773.80	5.40	774.84	14.69	775.88	17.29
772.78	0.35	773.82	5.85	774.86	14.75	775.90	17.34
772.80	0.36	773.84	6.31	774.88	14.80	775.92	17.39
772.82	0.38	773.86	6.79	774.90	14.86	775.94	17.43
772.84	0.40	773.88	7.27	774.92	14.91	775.96	17.48
772.86	0.42	773.90	7.77	774.94	14.96	775.98	17.52
772.88	0.45	773.92	8.29	774.96	15.02	776.00	**17.57**
772.90	0.46	773.94	8.81	774.98	15.07		
772.92	0.48	773.96	9.35	775.00	15.12		
772.94	0.49	773.98	9.89	775.02	15.18		
772.96	0.51	774.00	10.45	775.04	15.23		
772.98	0.52	774.02	11.02	775.06	15.28		
773.00	0.54	774.04	11.60	775.08	15.33		
773.02	0.55	774.06	12.19	775.10	15.38		

Stage-Area-Storage for Pond 1P: Detention Basin

Elevation (feet)	Surface (acres)	Storage (acre-feet)
772.00	1.431	0.000
772.05	1.437	0.072
772.10	1.443	0.144
772.15	1.449	0.216
772.20	1.455	0.289
772.25	1.461	0.361
772.30	1.467	0.435
772.35	1.473	0.508
772.40	1.479	0.582
772.45	1.485	0.656
772.50	1.490	0.730
772.55	1.496	0.805
772.60	1.502	0.880
772.65	1.508	0.955
772.70	1.514	1.031
772.75	1.520	1.107
772.80	1.526	1.183
772.85	1.532	1.259
772.90	1.538	1.336
772.95	1.544	1.413
773.00	1.550	1.490
773.05	1.556	1.568
773.10	1.562	1.646
773.15	1.568	1.724
773.20	1.575	1.803
773.25	1.581	1.882
773.30	1.587	1.961
773.35	1.593	2.041
773.40	1.599	2.120
773.45	1.605	2.200
773.50	1.611	2.281
773.55	1.618	2.362
773.60	1.624	2.443
773.65	1.630	2.524
773.70	1.636	2.606
773.75	1.642	2.688
773.80	1.648	2.770
773.85	1.655	2.852
773.90	1.661	2.935
773.95	1.667	3.019
774.00	1.673	3.102
774.05	1.715	3.187
774.10	1.756	3.273
774.15	1.798	3.362
774.20	1.840	3.453
774.25	1.881	3.546
774.30	1.923	3.641
774.35	1.965	3.739
774.40	2.007	3.838
774.45	2.048	3.939
774.50	2.090	4.043
774.55	2.132	4.148
774.60	2.173	4.256
774.65	2.215	4.366
774.70	2.257	4.477
774.75	2.298	4.591
774.80	2.340	4.707
774.85	2.382	4.825
774.90	2.424	4.945
774.95	2.465	5.068
775.00	2.507	5.192
775.05	2.543	5.318
775.10	2.578	5.446
775.15	2.614	5.576
775.20	2.649	5.708
775.25	2.685	5.841
775.30	2.720	5.976
775.35	2.756	6.113
775.40	2.791	6.252
775.45	2.827	6.392
775.50	2.862	6.534
775.55	2.898	6.678
775.60	2.934	6.824
775.65	2.969	6.972
775.70	3.005	7.121
775.75	3.040	7.272
775.80	3.076	7.425
775.85	3.111	7.580
775.90	3.147	7.736
775.95	3.182	7.894
776.00	**3.218**	**8.055**

Summary for Pond 2P: Detention Basin WQ Check

Inflow	=	0.00 cfs @	0.00 hrs,	Volume=	0.000 af
Outflow	=	0.94 cfs @	0.00 hrs,	Volume=	1.719 af, Atten= 0%, Lag= 0.0 min
Primary	=	0.94 cfs @	0.00 hrs,	Volume=	1.719 af

Routing by Stor-Ind method, Time Span= 0.00-54.00 hrs, dt= 0.50 hrs
Starting Elev= 773.50' Surf.Area= 1.611 ac Storage= 2.281 af
Peak Elev= 773.50' @ 0.00 hrs Surf.Area= 1.611 ac Storage= 2.281 af

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= (not calculated: no inflow)

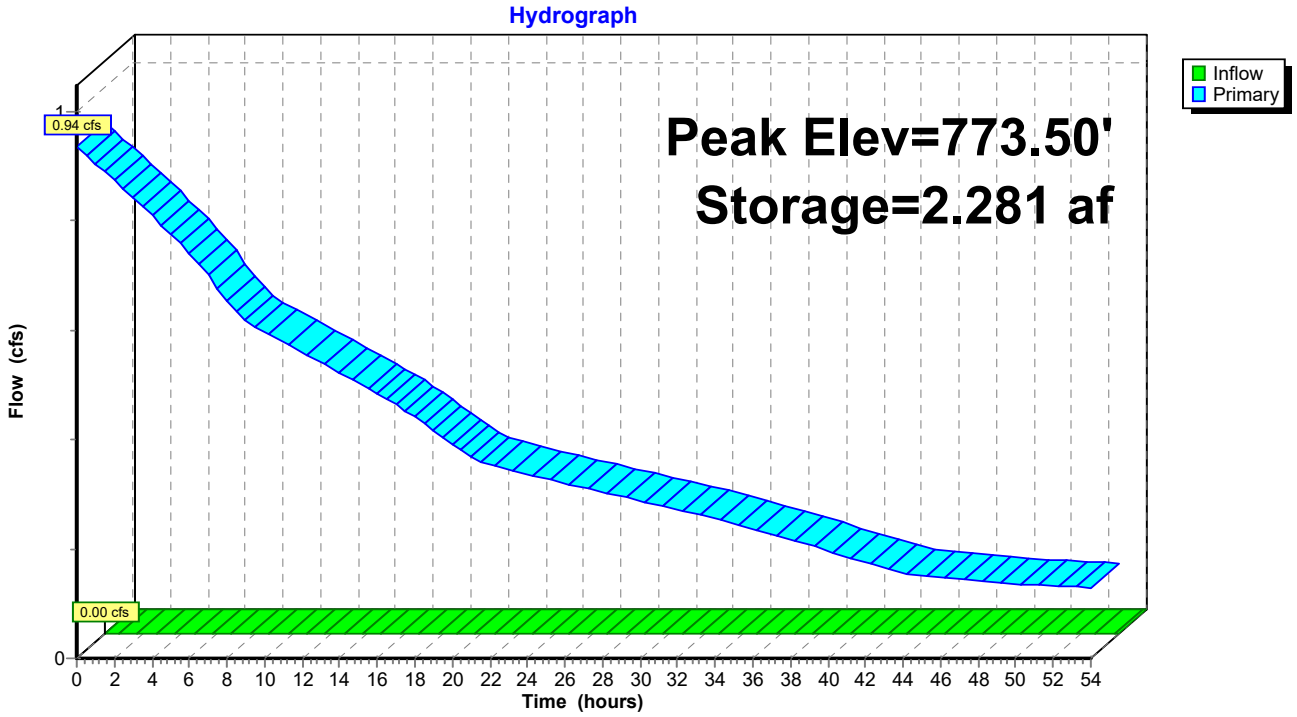
Volume	Invert	Avail.Storage	Storage Description
#1	772.00'	8.055 af	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
772.00	1.431	0.000	0.000
773.00	1.550	1.491	1.491
774.00	1.673	1.611	3.102
775.00	2.507	2.090	5.192
776.00	3.218	2.863	8.055

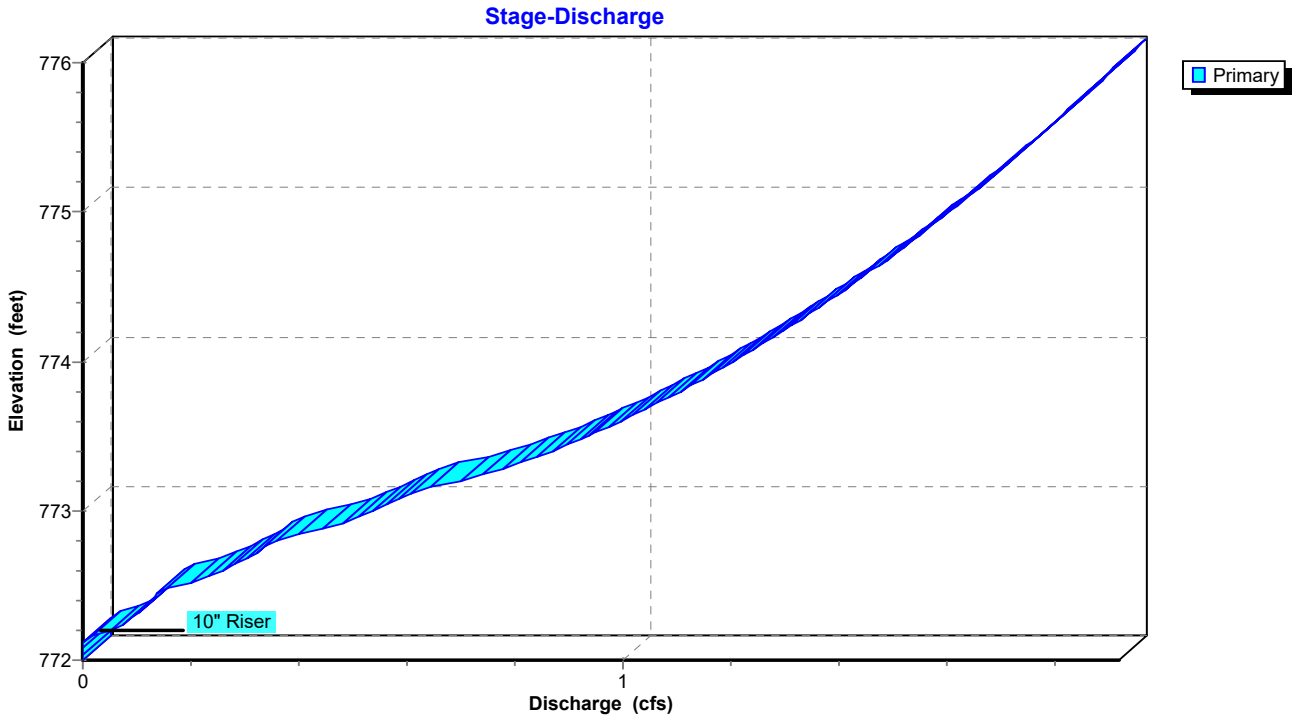
Device	Routing	Invert	Outlet Devices
#1	Primary	772.12'	**1.0" Vert. 10" Riser X 10.00 columns** X 4 rows with 4.0" cc spacing C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.94 cfs @ 0.00 hrs HW=773.50' (Free Discharge)
↑—**1=10" Riser** (Orifice Controls 0.94 cfs @ 4.29 fps)

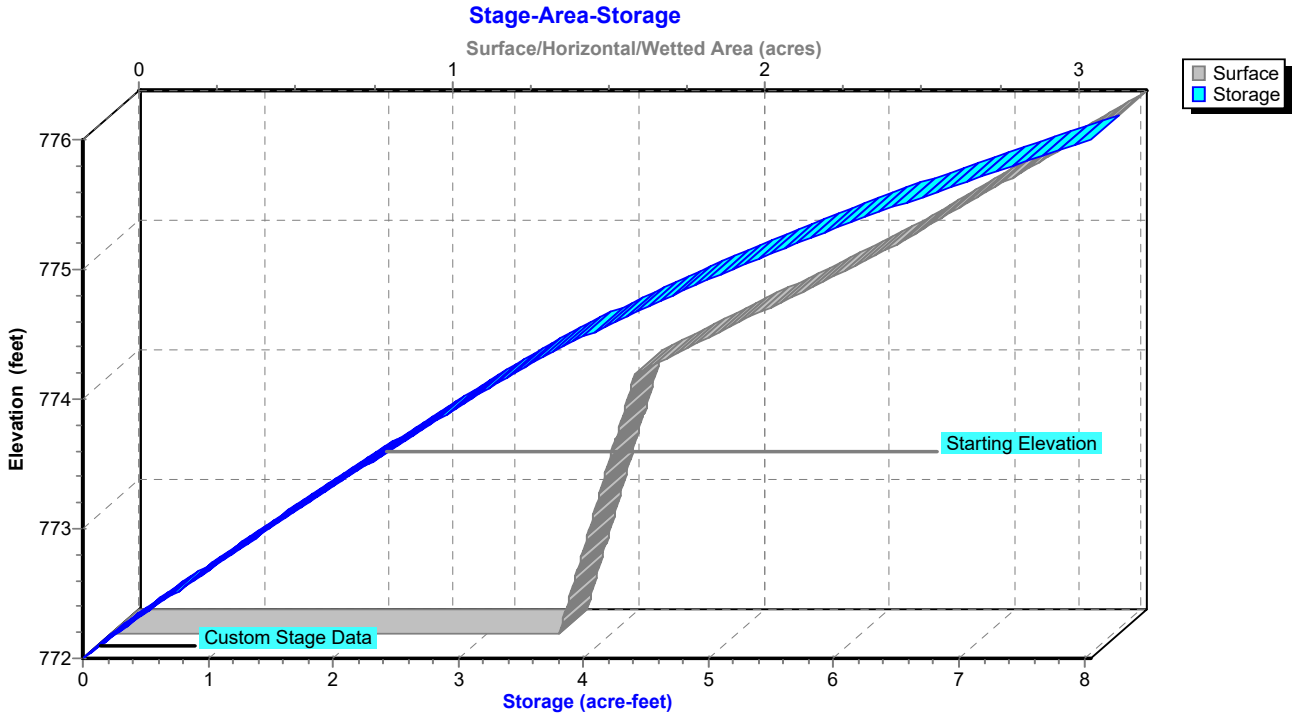
Pond 2P: Detention Basin WQ Check



Pond 2P: Detention Basin WQ Check



Pond 2P: Detention Basin WQ Check



Hydrograph for Pond 2P: Detention Basin WQ Check

Time (hours)	Inflow (cfs)	Storage (acre-feet)	Elevation (feet)	Primary (cfs)
0.00	**0.00**	**2.281**	**773.50**	**0.94**
2.50	0.00	2.096	773.38	0.86
5.00	0.00	1.927	773.28	0.78
7.50	0.00	1.776	773.18	0.68
10.00	0.00	1.646	773.10	0.60
12.50	0.00	1.528	773.02	0.55
15.00	0.00	1.419	772.95	0.50
17.50	0.00	1.320	772.89	0.45
20.00	0.00	1.232	772.83	0.39
22.50	0.00	1.157	772.78	0.35
25.00	0.00	1.087	772.74	0.33
27.50	0.00	1.021	772.69	0.31
30.00	0.00	0.959	772.65	0.29
32.50	0.00	0.902	772.61	0.27
35.00	0.00	0.849	772.58	0.25
37.50	0.00	0.801	772.55	0.22
40.00	0.00	0.757	772.52	0.20
42.50	0.00	0.720	772.49	0.17
45.00	0.00	0.687	772.47	0.15
47.50	0.00	0.656	772.45	0.14
50.00	0.00	0.627	772.43	0.14
52.50	0.00	0.600	772.41	0.13

Stage-Discharge for Pond 2P: Detention Basin WQ Check

Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)
772.00	0.00	773.04	0.56	774.08	1.24	775.12	1.64
772.02	0.00	773.06	0.57	774.10	1.25	775.14	1.65
772.04	0.00	773.08	0.58	774.12	1.26	775.16	1.66
772.06	0.00	773.10	0.60	774.14	1.27	775.18	1.66
772.08	0.00	773.12	0.61	774.16	1.28	775.20	1.67
772.10	0.00	773.14	0.62	774.18	1.28	775.22	1.68
772.12	0.00	773.16	0.65	774.20	1.29	775.24	1.68
772.14	0.00	773.18	0.67	774.22	1.30	775.26	1.69
772.16	0.02	773.20	0.70	774.24	1.31	775.28	1.70
772.18	0.04	773.22	0.72	774.26	1.32	775.30	1.70
772.20	0.05	773.24	0.74	774.28	1.33	775.32	1.71
772.22	0.06	773.26	0.76	774.30	1.34	775.34	1.71
772.24	0.07	773.28	0.78	774.32	1.34	775.36	1.72
772.26	0.08	773.30	0.79	774.34	1.35	775.38	1.73
772.28	0.09	773.32	0.81	774.36	1.36	775.40	1.73
772.30	0.10	773.34	0.83	774.38	1.37	775.42	1.74
772.32	0.10	773.36	0.84	774.40	1.38	775.44	1.75
772.34	0.11	773.38	0.85	774.42	1.38	775.46	1.75
772.36	0.12	773.40	0.87	774.44	1.39	775.48	1.76
772.38	0.12	773.42	0.88	774.46	1.40	775.50	1.77
772.40	0.13	773.44	0.90	774.48	1.41	775.52	1.77
772.42	0.13	773.46	0.91	774.50	1.42	775.54	1.78
772.44	0.14	773.48	0.92	774.52	1.42	775.56	1.78
772.46	0.14	773.50	0.94	774.54	1.43	775.58	1.79
772.48	0.16	773.52	0.95	774.56	1.44	775.60	1.80
772.50	0.18	773.54	0.96	774.58	1.45	775.62	1.80
772.52	0.20	773.56	0.97	774.60	1.46	775.64	1.81
772.54	0.22	773.58	0.98	774.62	1.46	775.66	1.82
772.56	0.23	773.60	1.00	774.64	1.47	775.68	1.82
772.58	0.25	773.62	1.01	774.66	1.48	775.70	1.83
772.60	0.26	773.64	1.02	774.68	1.49	775.72	1.83
772.62	0.27	773.66	1.03	774.70	1.49	775.74	1.84
772.64	0.28	773.68	1.04	774.72	1.50	775.76	1.85
772.66	0.29	773.70	1.05	774.74	1.51	775.78	1.85
772.68	0.30	773.72	1.06	774.76	1.52	775.80	1.86
772.70	0.31	773.74	1.07	774.78	1.52	775.82	1.86
772.72	0.32	773.76	1.08	774.80	1.53	775.84	1.87
772.74	0.33	773.78	1.09	774.82	1.54	775.86	1.88
772.76	0.34	773.80	1.10	774.84	1.54	775.88	1.88
772.78	0.35	773.82	1.12	774.86	1.55	775.90	1.89
772.80	0.36	773.84	1.13	774.88	1.56	775.92	1.89
772.82	0.38	773.86	1.14	774.90	1.57	775.94	1.90
772.84	0.40	773.88	1.15	774.92	1.57	775.96	1.90
772.86	0.42	773.90	1.16	774.94	1.58	775.98	1.91
772.88	0.45	773.92	1.16	774.96	1.59	776.00	**1.92**
772.90	0.46	773.94	1.17	774.98	1.59		
772.92	0.48	773.96	1.18	775.00	1.60		
772.94	0.49	773.98	1.19	775.02	1.61		
772.96	0.51	774.00	1.20	775.04	1.61		
772.98	0.52	774.02	1.21	775.06	1.62		
773.00	0.54	774.04	1.22	775.08	1.63		
773.02	0.55	774.06	1.23	775.10	1.64		

Stage-Area-Storage for Pond 2P: Detention Basin WQ Check

Elevation (feet)	Surface (acres)	Storage (acre-feet)
772.00	1.431	0.000
772.05	1.437	0.072
772.10	1.443	0.144
772.15	1.449	0.216
772.20	1.455	0.289
772.25	1.461	0.361
772.30	1.467	0.435
772.35	1.473	0.508
772.40	1.479	0.582
772.45	1.485	0.656
772.50	1.491	0.730
772.55	1.496	0.805
772.60	1.502	0.880
772.65	1.508	0.955
772.70	1.514	1.031
772.75	1.520	1.107
772.80	1.526	1.183
772.85	1.532	1.259
772.90	1.538	1.336
772.95	1.544	1.413
773.00	1.550	1.491
773.05	1.556	1.568
773.10	1.562	1.646
773.15	1.568	1.724
773.20	1.575	1.803
773.25	1.581	1.882
773.30	1.587	1.961
773.35	1.593	2.041
773.40	1.599	2.120
773.45	1.605	2.200
773.50	1.611	2.281
773.55	1.618	2.362
773.60	1.624	2.443
773.65	1.630	2.524
773.70	1.636	2.606
773.75	1.642	2.688
773.80	1.648	2.770
773.85	1.655	2.852
773.90	1.661	2.935
773.95	1.667	3.019
774.00	1.673	3.102
774.05	1.715	3.187
774.10	1.756	3.273
774.15	1.798	3.362
774.20	1.840	3.453
774.25	1.882	3.546
774.30	1.923	3.641
774.35	1.965	3.739
774.40	2.007	3.838
774.45	2.048	3.939
774.50	2.090	4.043
774.55	2.132	4.148
774.60	2.173	4.256
774.65	2.215	4.366
774.70	2.257	4.477
774.75	2.298	4.591
774.80	2.340	4.707
774.85	2.382	4.825
774.90	2.424	4.945
774.95	2.465	5.068
775.00	2.507	5.192
775.05	2.543	5.318
775.10	2.578	5.446
775.15	2.614	5.576
775.20	2.649	5.708
775.25	2.685	5.841
775.30	2.720	5.976
775.35	2.756	6.113
775.40	2.791	6.252
775.45	2.827	6.392
775.50	2.863	6.534
775.55	2.898	6.678
775.60	2.934	6.824
775.65	2.969	6.972
775.70	3.005	7.121
775.75	3.040	7.272
775.80	3.076	7.425
775.85	3.111	7.580
775.90	3.147	7.736
775.95	3.182	7.894
776.00	**3.218**	**8.055**

Summary for Subcatchment 1S: Ramp D2-01-LT Ditch

[49] Hint: Tc<2dt may require smaller dt

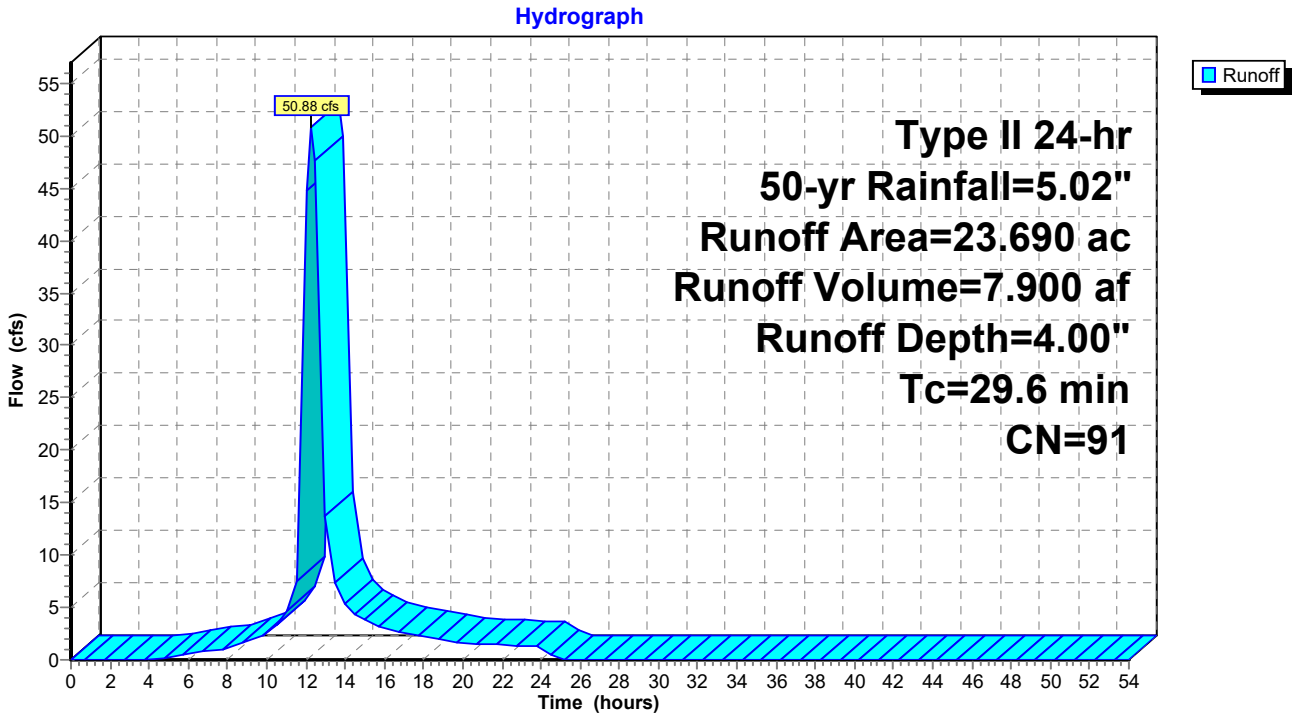
Runoff = 50.88 cfs @ 12.29 hrs, Volume= 7.900 af, Depth= 4.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-54.00 hrs, dt= 0.50 hrs
Type II 24-hr 50-yr Rainfall=5.02"

Area (ac)	CN	Description
14.270	98	Paved roads w/curbs & sewers, HSG D
8.560	80	>75% Grass cover, Good, HSG D
0.860	89	<50% Grass cover, Poor, HSG D
23.690	91	Weighted Average
9.420		39.76% Pervious Area
14.270		60.24% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
29.6					**Direct Entry, TC from Ditch Calc**

Subcatchment 1S: Ramp D2-01-LT Ditch



Hydrograph for Subcatchment 1S: Ramp D2-01-LT Ditch

Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)
0.00	0.00	0.00	0.00
1.00	0.05	0.00	0.00
2.00	0.11	0.00	0.00
3.00	0.17	0.00	0.00
4.00	0.24	0.00	0.05
5.00	0.32	0.01	0.27
6.00	0.40	0.03	0.54
7.00	0.50	0.07	0.84
8.00	0.60	0.12	1.16
9.00	0.74	0.19	1.79
10.00	0.91	0.30	2.55
11.00	1.18	0.49	4.70
12.00	3.33	2.38	**44.76**
13.00	3.88	2.90	**13.76**
14.00	4.12	3.13	5.40
15.00	4.28	3.29	3.84
16.00	4.42	3.42	3.03
17.00	4.53	3.52	2.51
18.00	4.62	3.62	2.22
19.00	4.71	3.70	1.93
20.00	4.78	3.77	1.64
21.00	4.84	3.83	1.48
22.00	4.90	3.89	1.42
23.00	4.96	3.95	1.36
24.00	**5.02**	**4.00**	1.29
25.00	5.02	4.00	0.05
26.00	5.02	4.00	0.00
27.00	5.02	4.00	0.00
28.00	5.02	4.00	0.00
29.00	5.02	4.00	0.00
30.00	5.02	4.00	0.00
31.00	5.02	4.00	0.00
32.00	5.02	4.00	0.00
33.00	5.02	4.00	0.00
34.00	5.02	4.00	0.00
35.00	5.02	4.00	0.00
36.00	5.02	4.00	0.00
37.00	5.02	4.00	0.00
38.00	5.02	4.00	0.00
39.00	5.02	4.00	0.00
40.00	5.02	4.00	0.00
41.00	5.02	4.00	0.00
42.00	5.02	4.00	0.00
43.00	5.02	4.00	0.00
44.00	5.02	4.00	0.00
45.00	5.02	4.00	0.00
46.00	5.02	4.00	0.00
47.00	5.02	4.00	0.00
48.00	5.02	4.00	0.00
49.00	5.02	4.00	0.00
50.00	5.02	4.00	0.00
51.00	5.02	4.00	0.00
52.00	5.02	4.00	0.00
53.00	5.02	4.00	0.00
54.00	5.02	4.00	0.00

Summary for Subcatchment 2S: Direct Flow into Basin

[49] Hint: Tc<2dt may require smaller dt

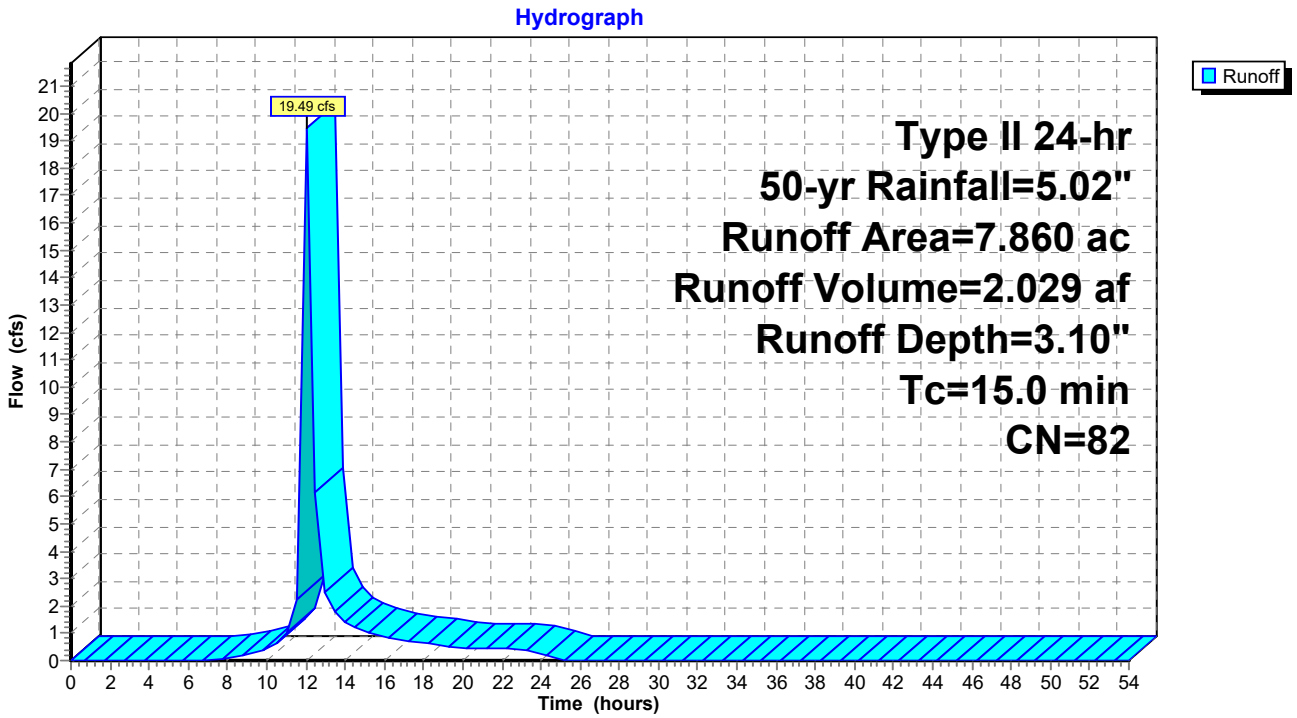
Runoff = 19.49 cfs @ 12.03 hrs, Volume= 2.029 af, Depth= 3.10"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-54.00 hrs, dt= 0.50 hrs
Type II 24-hr 50-yr Rainfall=5.02"

Area (ac)	CN	Description
1.060	98	Paved roads w/curbs & sewers, HSG D
6.800	80	>75% Grass cover, Good, HSG D
7.860	82	Weighted Average
6.800		86.51% Pervious Area
1.060		13.49% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.0					**Direct Entry, Direct flow into Basin**

Subcatchment 2S: Direct Flow into Basin



Hydrograph for Subcatchment 2S: Direct Flow into Basin

Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)
0.00	0.00	0.00	0.00
1.00	0.05	0.00	0.00
2.00	0.11	0.00	0.00
3.00	0.17	0.00	0.00
4.00	0.24	0.00	0.00
5.00	0.32	0.00	0.00
6.00	0.40	0.00	0.00
7.00	0.50	0.00	0.02
8.00	0.60	0.01	0.10
9.00	0.74	0.04	0.24
10.00	0.91	0.08	0.43
11.00	1.18	0.19	1.04
12.00	3.33	1.64	**19.42**
13.00	3.88	2.10	2.50
14.00	4.12	2.30	1.43
15.00	4.28	2.45	1.09
16.00	4.42	2.56	0.86
17.00	4.53	2.66	0.74
18.00	4.62	2.74	0.65
19.00	4.71	2.82	0.57
20.00	4.78	2.88	0.48
21.00	4.84	2.94	0.45
22.00	4.90	2.99	0.43
23.00	4.96	3.05	0.41
24.00	**5.02**	**3.10**	0.35
25.00	5.02	3.10	0.00
26.00	5.02	3.10	0.00
27.00	5.02	3.10	0.00
28.00	5.02	3.10	0.00
29.00	5.02	3.10	0.00
30.00	5.02	3.10	0.00
31.00	5.02	3.10	0.00
32.00	5.02	3.10	0.00
33.00	5.02	3.10	0.00
34.00	5.02	3.10	0.00
35.00	5.02	3.10	0.00
36.00	5.02	3.10	0.00
37.00	5.02	3.10	0.00
38.00	5.02	3.10	0.00
39.00	5.02	3.10	0.00
40.00	5.02	3.10	0.00
41.00	5.02	3.10	0.00
42.00	5.02	3.10	0.00
43.00	5.02	3.10	0.00
44.00	5.02	3.10	0.00
45.00	5.02	3.10	0.00
46.00	5.02	3.10	0.00
47.00	5.02	3.10	0.00
48.00	5.02	3.10	0.00
49.00	5.02	3.10	0.00
50.00	5.02	3.10	0.00
51.00	5.02	3.10	0.00
52.00	5.02	3.10	0.00
53.00	5.02	3.10	0.00
54.00	5.02	3.10	0.00

Summary for Pond 1P: Detention Basin

Inflow Area = 31.550 ac, 48.59% Impervious, Inflow Depth = 3.78" for 50-yr event
Inflow = 67.92 cfs @ 12.17 hrs, Volume= 9.928 af
Outflow = 15.44 cfs @ 13.00 hrs, Volume= 8.927 af, Atten= 77%, Lag= 49.8 min
Primary = 15.44 cfs @ 13.00 hrs, Volume= 8.927 af

Routing by Stor-Ind method, Time Span= 0.00-54.00 hrs, dt= 0.50 hrs
Peak Elev= 775.15' @ 13.19 hrs Surf.Area= 2.614 ac Storage= 5.576 af

Plug-Flow detention time= 382.1 min calculated for 8.927 af (90% of inflow)
Center-of-Mass det. time= 331.8 min (1,140.2 - 808.4)

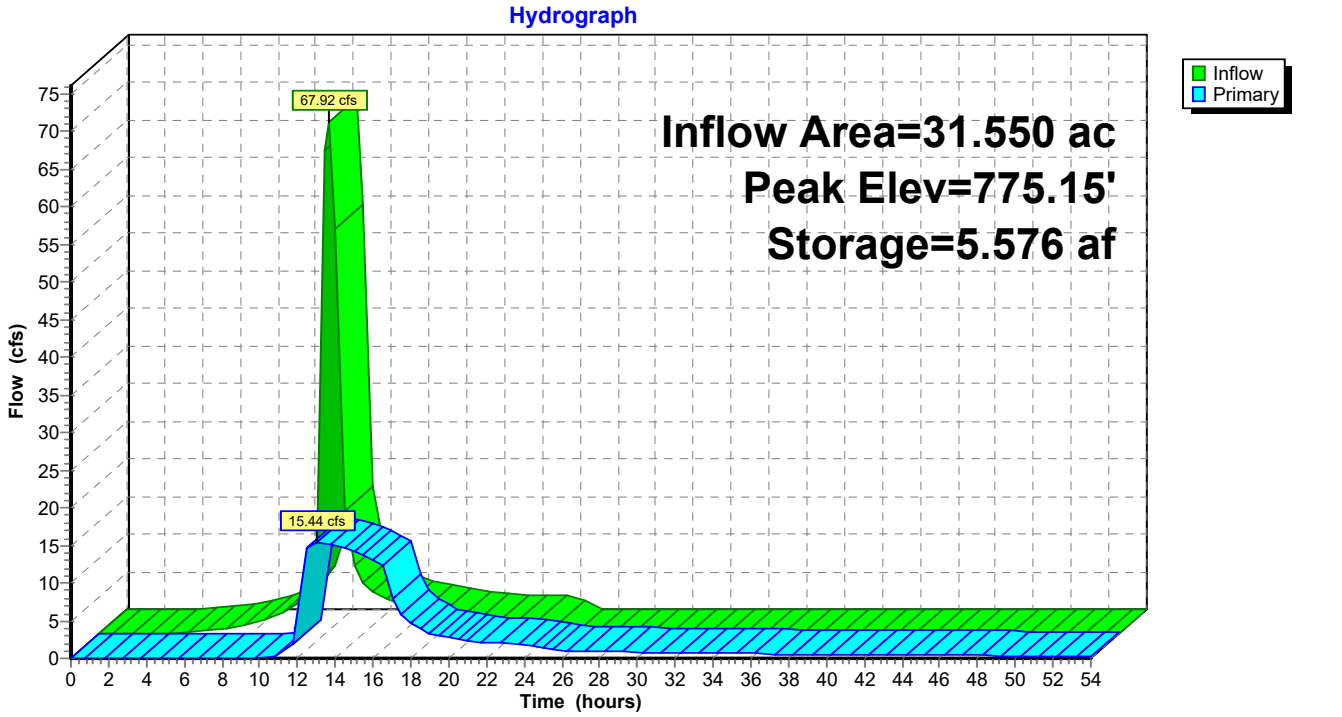
Volume	Invert	Avail.Storage	Storage Description
#1	772.00'	8.055 af	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
772.00	1.431	0.000	0.000
773.00	1.550	1.490	1.490
774.00	1.673	1.611	3.102
775.00	2.507	2.090	5.192
776.00	3.218	2.862	8.055

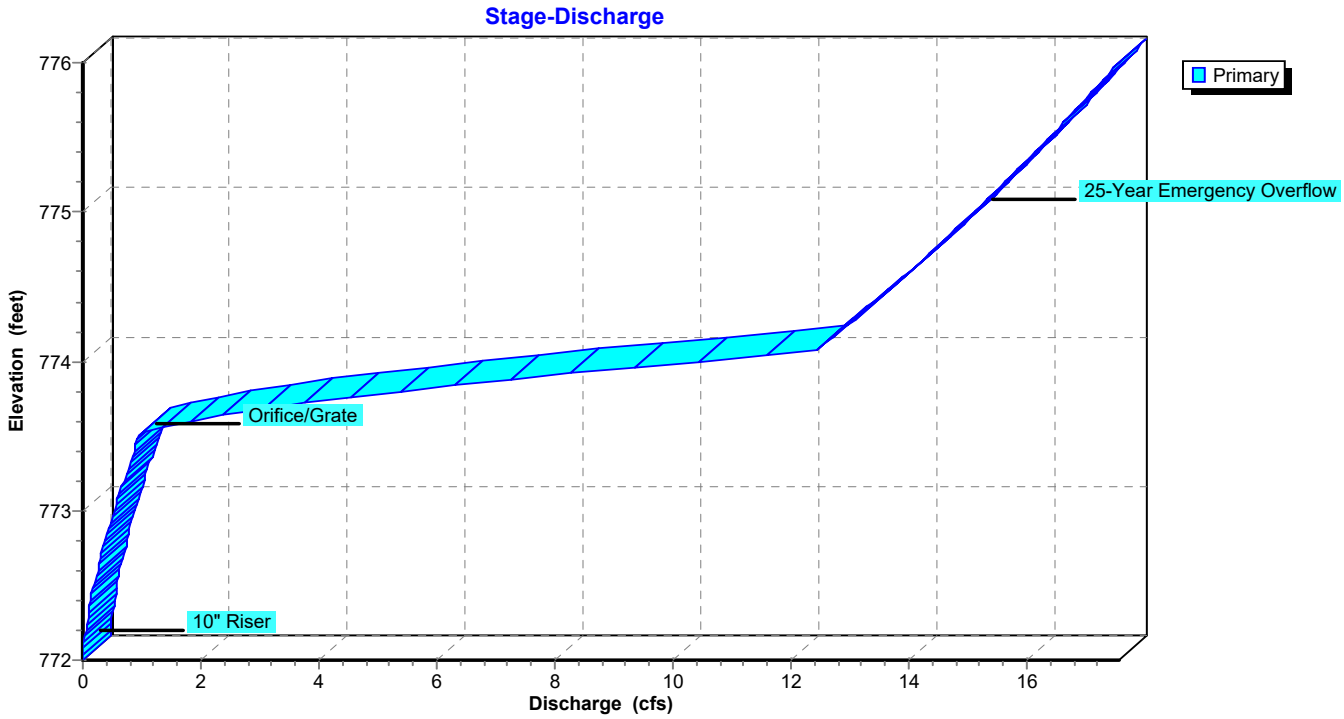
Device	Routing	Invert	Outlet Devices
#1	Device 2	772.12'	**1.0" Vert. 10" Riser X 10.00 columns** X 4 rows with 4.0" cc spacing C= 0.600 Limited to weir flow at low heads
#2	Primary	770.92'	**18.0" Round Culvert** L= 55.5' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 770.92' / 770.64' S= 0.0050 '/' Cc= 0.900 n= 0.013, Flow Area= 1.77 sf
#3	Device 2	773.50'	**24.0" x 24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Device 2	775.00'	**10.0' long x 18.0' breadth 25-Year Emergency Overflow** 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=15.44 cfs @ 13.00 hrs HW=775.12' (Free Discharge)
└**2=Culvert** (Barrel Controls 15.44 cfs @ 8.74 fps)
  ├**1=10" Riser** (Passes < 1.64 cfs potential flow)
  ├**3=Orifice/Grate** (Passes < 24.52 cfs potential flow)
  └**4=25-Year Emergency Overflow** (Passes < 1.13 cfs potential flow)

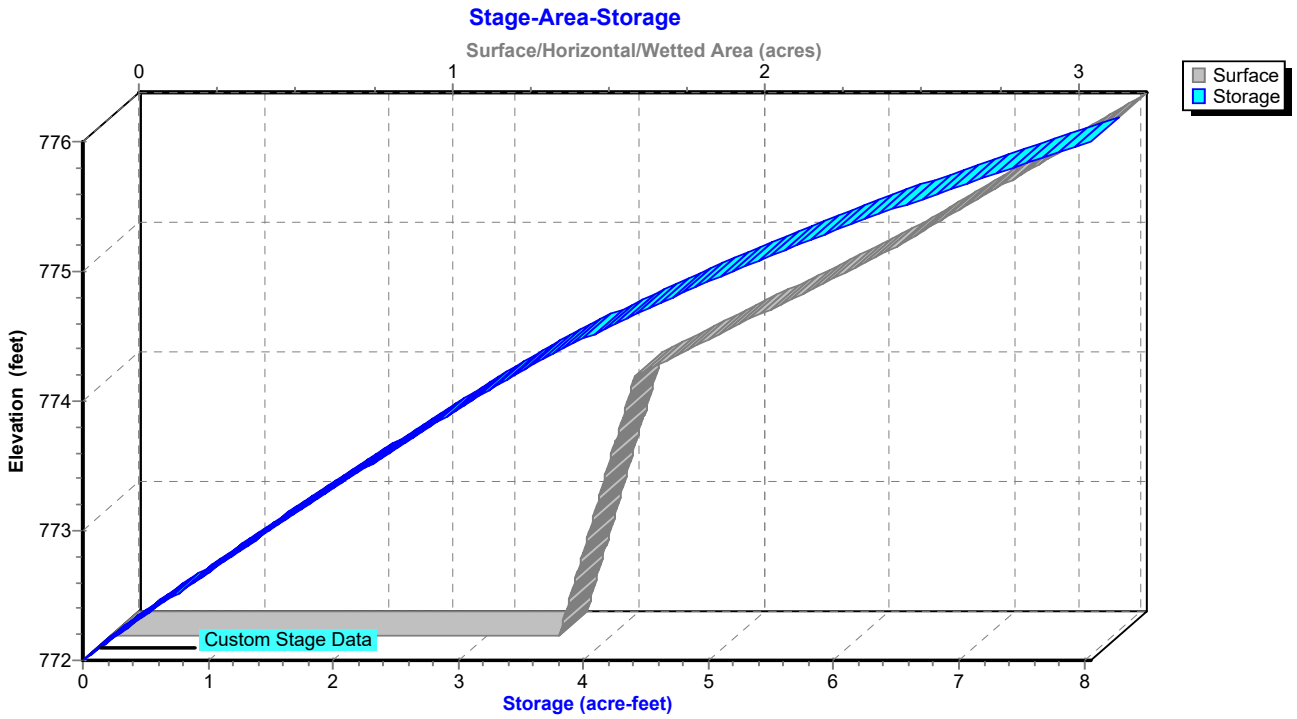
Pond 1P: Detention Basin



Pond 1P: Detention Basin



Pond 1P: Detention Basin



Hydrograph for Pond 1P: Detention Basin

Time (hours)	Inflow (cfs)	Storage (acre-feet)	Elevation (feet)	Primary (cfs)
0.00	0.00	0.000	772.00	0.00
2.50	0.00	0.000	772.00	0.00
5.00	0.27	0.014	772.01	0.00
7.50	1.06	0.144	772.10	0.00
10.00	**2.99**	0.521	772.36	0.12
12.50	**53.75**	**4.675**	**774.79**	**14.55**
15.00	4.93	**4.361**	**774.65**	**14.16**
17.50	3.05	2.794	773.81	5.73
20.00	2.12	2.543	773.66	2.74
22.50	1.81	2.465	773.61	2.02
25.00	0.05	2.368	773.55	1.31
27.50	0.00	2.166	773.43	0.89
30.00	0.00	1.991	773.32	0.81
32.50	0.00	1.833	773.22	0.72
35.00	0.00	1.695	773.13	0.62
37.50	0.00	1.573	773.05	0.57
40.00	0.00	1.460	772.98	0.52
42.50	0.00	1.357	772.91	0.47
45.00	0.00	1.265	772.85	0.42
47.50	0.00	1.185	772.80	0.36
50.00	0.00	1.114	772.75	0.34
52.50	0.00	1.046	772.71	0.32

Stage-Discharge for Pond 1P: Detention Basin

Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)
772.00	0.00	773.04	0.56	774.08	12.46	775.12	15.44
772.02	0.00	773.06	0.57	774.10	12.52	775.14	15.49
772.04	0.00	773.08	0.58	774.12	12.58	775.16	15.54
772.06	0.00	773.10	0.60	774.14	12.65	775.18	15.59
772.08	0.00	773.12	0.61	774.16	12.71	775.20	15.64
772.10	0.00	773.14	0.62	774.18	12.77	775.22	15.69
772.12	0.00	773.16	0.65	774.20	12.83	775.24	15.74
772.14	0.00	773.18	0.67	774.22	12.90	775.26	15.80
772.16	0.02	773.20	0.70	774.24	12.96	775.28	15.85
772.18	0.04	773.22	0.72	774.26	13.02	775.30	15.90
772.20	0.05	773.24	0.74	774.28	13.08	775.32	15.95
772.22	0.06	773.26	0.76	774.30	13.14	775.34	16.00
772.24	0.07	773.28	0.78	774.32	13.20	775.36	16.05
772.26	0.08	773.30	0.79	774.34	13.26	775.38	16.10
772.28	0.09	773.32	0.81	774.36	13.32	775.40	16.15
772.30	0.10	773.34	0.83	774.38	13.38	775.42	16.20
772.32	0.10	773.36	0.84	774.40	13.44	775.44	16.24
772.34	0.11	773.38	0.85	774.42	13.50	775.46	16.29
772.36	0.12	773.40	0.87	774.44	13.56	775.48	16.34
772.38	0.12	773.42	0.88	774.46	13.62	775.50	16.39
772.40	0.13	773.44	0.90	774.48	13.68	775.52	16.44
772.42	0.13	773.46	0.91	774.50	13.74	775.54	16.49
772.44	0.14	773.48	0.92	774.52	13.80	775.56	16.54
772.46	0.14	773.50	0.94	774.54	13.85	775.58	16.59
772.48	0.16	773.52	1.02	774.56	13.91	775.60	16.63
772.50	0.18	773.54	1.17	774.58	13.97	775.62	16.68
772.52	0.20	773.56	1.36	774.60	14.03	775.64	16.73
772.54	0.22	773.58	1.58	774.62	14.08	775.66	16.78
772.56	0.23	773.60	1.82	774.64	14.14	775.68	16.82
772.58	0.25	773.62	2.09	774.66	14.20	775.70	16.87
772.60	0.26	773.64	2.39	774.68	14.25	775.72	16.92
772.62	0.27	773.66	2.70	774.70	14.31	775.74	16.97
772.64	0.28	773.68	3.04	774.72	14.36	775.76	17.01
772.66	0.29	773.70	3.39	774.74	14.42	775.78	17.06
772.68	0.30	773.72	3.76	774.76	14.47	775.80	17.11
772.70	0.31	773.74	4.15	774.78	14.53	775.82	17.15
772.72	0.32	773.76	4.55	774.80	14.58	775.84	17.20
772.74	0.33	773.78	4.97	774.82	14.64	775.86	17.25
772.76	0.34	773.80	5.40	774.84	14.69	775.88	17.29
772.78	0.35	773.82	5.85	774.86	14.75	775.90	17.34
772.80	0.36	773.84	6.31	774.88	14.80	775.92	17.39
772.82	0.38	773.86	6.79	774.90	14.86	775.94	17.43
772.84	0.40	773.88	7.27	774.92	14.91	775.96	17.48
772.86	0.42	773.90	7.77	774.94	14.96	775.98	17.52
772.88	0.45	773.92	8.29	774.96	15.02	776.00	**17.57**
772.90	0.46	773.94	8.81	774.98	15.07		
772.92	0.48	773.96	9.35	775.00	15.12		
772.94	0.49	773.98	9.89	775.02	15.18		
772.96	0.51	774.00	10.45	775.04	15.23		
772.98	0.52	774.02	11.02	775.06	15.28		
773.00	0.54	774.04	11.60	775.08	15.33		
773.02	0.55	774.06	12.19	775.10	15.38		

Stage-Area-Storage for Pond 1P: Detention Basin

Elevation (feet)	Surface (acres)	Storage (acre-feet)
772.00	1.431	0.000
772.05	1.437	0.072
772.10	1.443	0.144
772.15	1.449	0.216
772.20	1.455	0.289
772.25	1.461	0.361
772.30	1.467	0.435
772.35	1.473	0.508
772.40	1.479	0.582
772.45	1.485	0.656
772.50	1.490	0.730
772.55	1.496	0.805
772.60	1.502	0.880
772.65	1.508	0.955
772.70	1.514	1.031
772.75	1.520	1.107
772.80	1.526	1.183
772.85	1.532	1.259
772.90	1.538	1.336
772.95	1.544	1.413
773.00	1.550	1.490
773.05	1.556	1.568
773.10	1.562	1.646
773.15	1.568	1.724
773.20	1.575	1.803
773.25	1.581	1.882
773.30	1.587	1.961
773.35	1.593	2.041
773.40	1.599	2.120
773.45	1.605	2.200
773.50	1.611	2.281
773.55	1.618	2.362
773.60	1.624	2.443
773.65	1.630	2.524
773.70	1.636	2.606
773.75	1.642	2.688
773.80	1.648	2.770
773.85	1.655	2.852
773.90	1.661	2.935
773.95	1.667	3.019
774.00	1.673	3.102
774.05	1.715	3.187
774.10	1.756	3.273
774.15	1.798	3.362
774.20	1.840	3.453
774.25	1.881	3.546
774.30	1.923	3.641
774.35	1.965	3.739
774.40	2.007	3.838
774.45	2.048	3.939
774.50	2.090	4.043
774.55	2.132	4.148
774.60	2.173	4.256
774.65	2.215	4.366
774.70	2.257	4.477
774.75	2.298	4.591
774.80	2.340	4.707
774.85	2.382	4.825
774.90	2.424	4.945
774.95	2.465	5.068
775.00	2.507	5.192
775.05	2.543	5.318
775.10	2.578	5.446
775.15	2.614	5.576
775.20	2.649	5.708
775.25	2.685	5.841
775.30	2.720	5.976
775.35	2.756	6.113
775.40	2.791	6.252
775.45	2.827	6.392
775.50	2.862	6.534
775.55	2.898	6.678
775.60	2.934	6.824
775.65	2.969	6.972
775.70	3.005	7.121
775.75	3.040	7.272
775.80	3.076	7.425
775.85	3.111	7.580
775.90	3.147	7.736
775.95	3.182	7.894
776.00	**3.218**	**8.055**

Summary for Pond 2P: Detention Basin WQ Check

Inflow	=	0.00 cfs @	0.00 hrs,	Volume=	0.000 af
Outflow	=	0.94 cfs @	0.00 hrs,	Volume=	1.719 af, Atten= 0%, Lag= 0.0 min
Primary	=	0.94 cfs @	0.00 hrs,	Volume=	1.719 af

Routing by Stor-Ind method, Time Span= 0.00-54.00 hrs, dt= 0.50 hrs
Starting Elev= 773.50' Surf.Area= 1.611 ac Storage= 2.281 af
Peak Elev= 773.50' @ 0.00 hrs Surf.Area= 1.611 ac Storage= 2.281 af

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= (not calculated: no inflow)

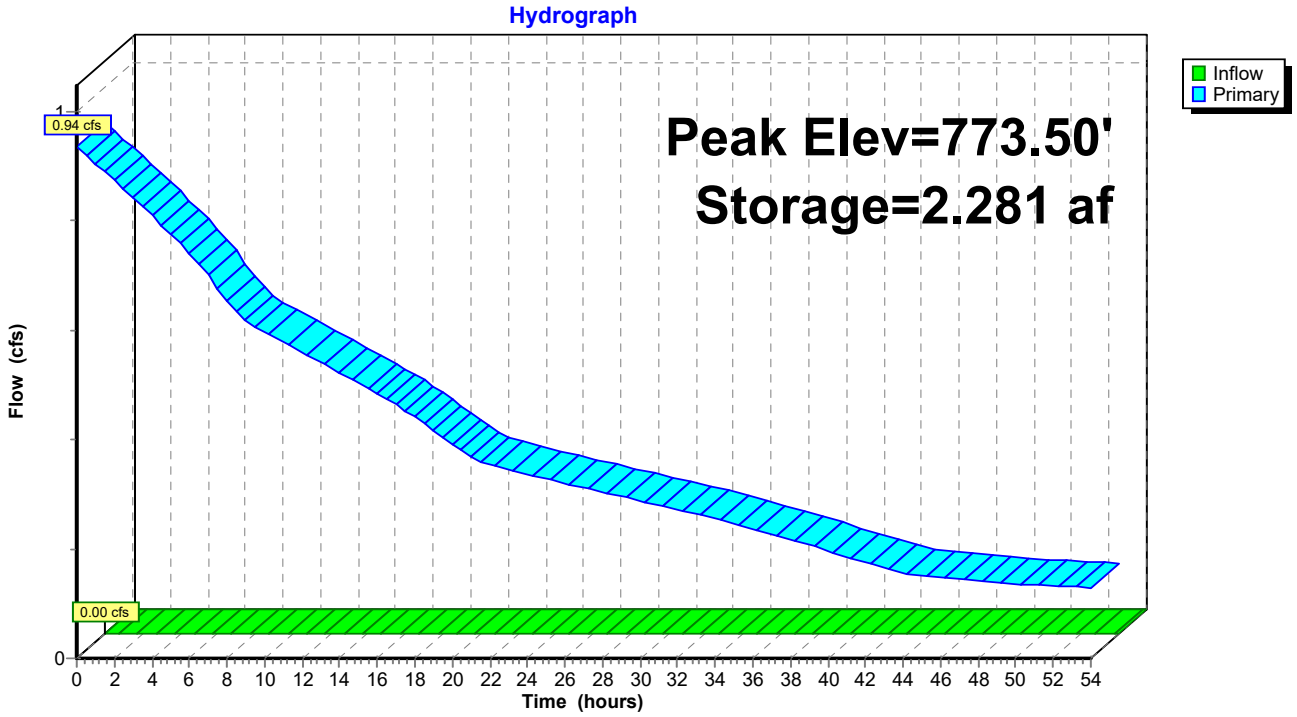
Volume	Invert	Avail.Storage	Storage Description
#1	772.00'	8.055 af	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
772.00	1.431	0.000	0.000
773.00	1.550	1.491	1.491
774.00	1.673	1.611	3.102
775.00	2.507	2.090	5.192
776.00	3.218	2.863	8.055

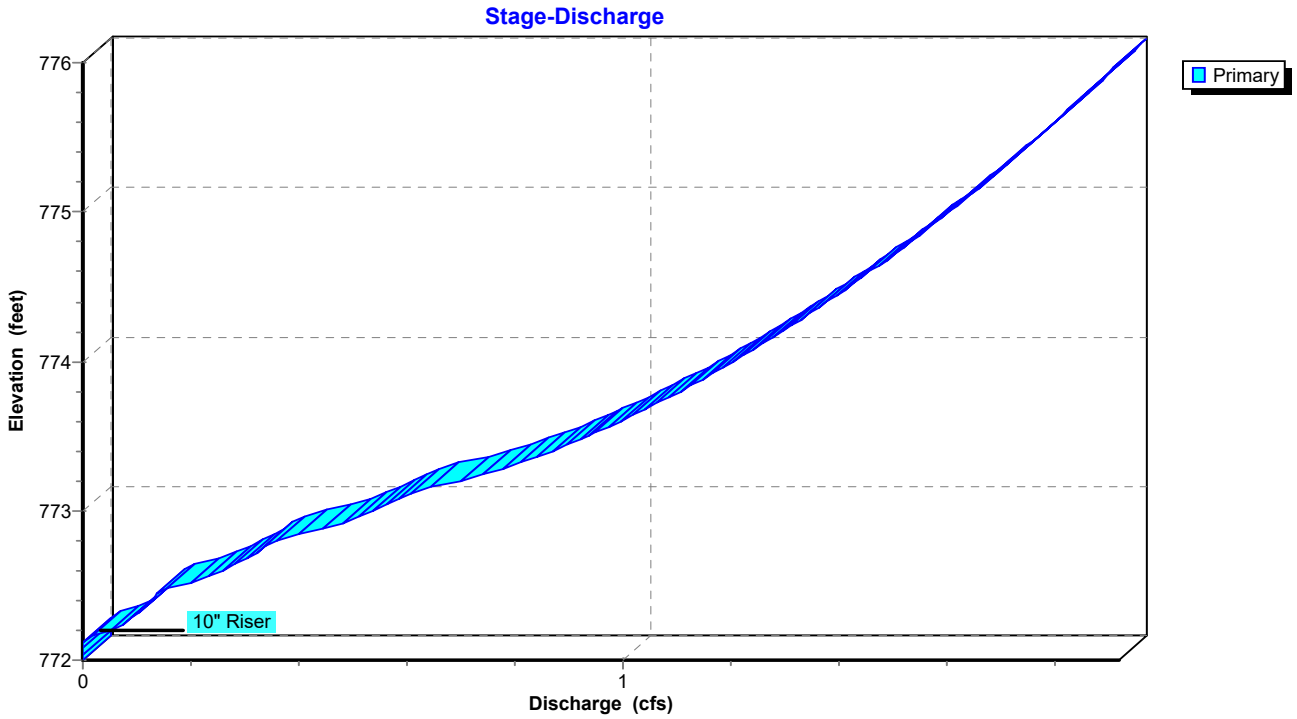
Device	Routing	Invert	Outlet Devices
#1	Primary	772.12'	**1.0" Vert. 10" Riser X 10.00 columns** X 4 rows with 4.0" cc spacing C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.94 cfs @ 0.00 hrs HW=773.50' (Free Discharge)
↑—**1=10" Riser** (Orifice Controls 0.94 cfs @ 4.29 fps)

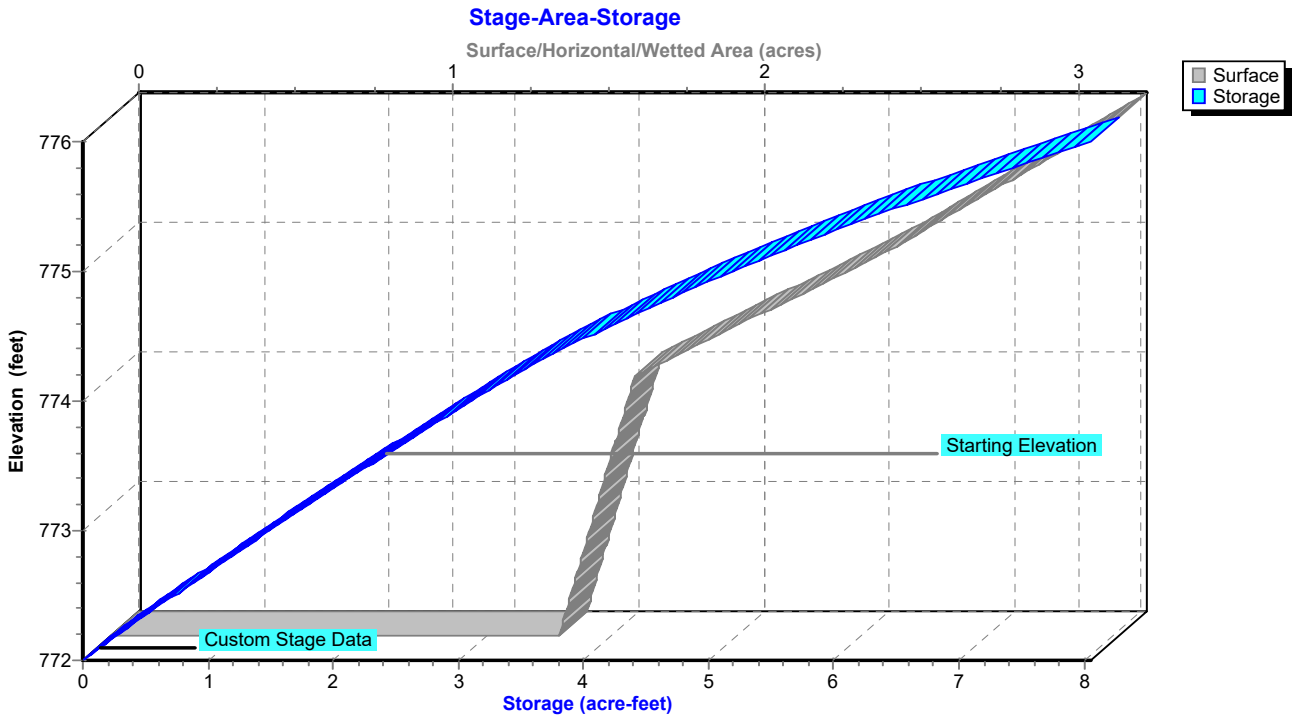
Pond 2P: Detention Basin WQ Check



Pond 2P: Detention Basin WQ Check



Pond 2P: Detention Basin WQ Check



Hydrograph for Pond 2P: Detention Basin WQ Check

Time (hours)	Inflow (cfs)	Storage (acre-feet)	Elevation (feet)	Primary (cfs)
0.00	**0.00**	**2.281**	**773.50**	**0.94**
2.50	0.00	2.096	773.38	0.86
5.00	0.00	1.927	773.28	0.78
7.50	0.00	1.776	773.18	0.68
10.00	0.00	1.646	773.10	0.60
12.50	0.00	1.528	773.02	0.55
15.00	0.00	1.419	772.95	0.50
17.50	0.00	1.320	772.89	0.45
20.00	0.00	1.232	772.83	0.39
22.50	0.00	1.157	772.78	0.35
25.00	0.00	1.087	772.74	0.33
27.50	0.00	1.021	772.69	0.31
30.00	0.00	0.959	772.65	0.29
32.50	0.00	0.902	772.61	0.27
35.00	0.00	0.849	772.58	0.25
37.50	0.00	0.801	772.55	0.22
40.00	0.00	0.757	772.52	0.20
42.50	0.00	0.720	772.49	0.17
45.00	0.00	0.687	772.47	0.15
47.50	0.00	0.656	772.45	0.14
50.00	0.00	0.627	772.43	0.14
52.50	0.00	0.600	772.41	0.13

Stage-Discharge for Pond 2P: Detention Basin WQ Check

Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)
772.00	0.00	773.04	0.56	774.08	1.24	775.12	1.64
772.02	0.00	773.06	0.57	774.10	1.25	775.14	1.65
772.04	0.00	773.08	0.58	774.12	1.26	775.16	1.66
772.06	0.00	773.10	0.60	774.14	1.27	775.18	1.66
772.08	0.00	773.12	0.61	774.16	1.28	775.20	1.67
772.10	0.00	773.14	0.62	774.18	1.28	775.22	1.68
772.12	0.00	773.16	0.65	774.20	1.29	775.24	1.68
772.14	0.00	773.18	0.67	774.22	1.30	775.26	1.69
772.16	0.02	773.20	0.70	774.24	1.31	775.28	1.70
772.18	0.04	773.22	0.72	774.26	1.32	775.30	1.70
772.20	0.05	773.24	0.74	774.28	1.33	775.32	1.71
772.22	0.06	773.26	0.76	774.30	1.34	775.34	1.71
772.24	0.07	773.28	0.78	774.32	1.34	775.36	1.72
772.26	0.08	773.30	0.79	774.34	1.35	775.38	1.73
772.28	0.09	773.32	0.81	774.36	1.36	775.40	1.73
772.30	0.10	773.34	0.83	774.38	1.37	775.42	1.74
772.32	0.10	773.36	0.84	774.40	1.38	775.44	1.75
772.34	0.11	773.38	0.85	774.42	1.38	775.46	1.75
772.36	0.12	773.40	0.87	774.44	1.39	775.48	1.76
772.38	0.12	773.42	0.88	774.46	1.40	775.50	1.77
772.40	0.13	773.44	0.90	774.48	1.41	775.52	1.77
772.42	0.13	773.46	0.91	774.50	1.42	775.54	1.78
772.44	0.14	773.48	0.92	774.52	1.42	775.56	1.78
772.46	0.14	773.50	0.94	774.54	1.43	775.58	1.79
772.48	0.16	773.52	0.95	774.56	1.44	775.60	1.80
772.50	0.18	773.54	0.96	774.58	1.45	775.62	1.80
772.52	0.20	773.56	0.97	774.60	1.46	775.64	1.81
772.54	0.22	773.58	0.98	774.62	1.46	775.66	1.82
772.56	0.23	773.60	1.00	774.64	1.47	775.68	1.82
772.58	0.25	773.62	1.01	774.66	1.48	775.70	1.83
772.60	0.26	773.64	1.02	774.68	1.49	775.72	1.83
772.62	0.27	773.66	1.03	774.70	1.49	775.74	1.84
772.64	0.28	773.68	1.04	774.72	1.50	775.76	1.85
772.66	0.29	773.70	1.05	774.74	1.51	775.78	1.85
772.68	0.30	773.72	1.06	774.76	1.52	775.80	1.86
772.70	0.31	773.74	1.07	774.78	1.52	775.82	1.86
772.72	0.32	773.76	1.08	774.80	1.53	775.84	1.87
772.74	0.33	773.78	1.09	774.82	1.54	775.86	1.88
772.76	0.34	773.80	1.10	774.84	1.54	775.88	1.88
772.78	0.35	773.82	1.12	774.86	1.55	775.90	1.89
772.80	0.36	773.84	1.13	774.88	1.56	775.92	1.89
772.82	0.38	773.86	1.14	774.90	1.57	775.94	1.90
772.84	0.40	773.88	1.15	774.92	1.57	775.96	1.90
772.86	0.42	773.90	1.16	774.94	1.58	775.98	1.91
772.88	0.45	773.92	1.16	774.96	1.59	776.00	**1.92**
772.90	0.46	773.94	1.17	774.98	1.59		
772.92	0.48	773.96	1.18	775.00	1.60		
772.94	0.49	773.98	1.19	775.02	1.61		
772.96	0.51	774.00	1.20	775.04	1.61		
772.98	0.52	774.02	1.21	775.06	1.62		
773.00	0.54	774.04	1.22	775.08	1.63		
773.02	0.55	774.06	1.23	775.10	1.64		

Stage-Area-Storage for Pond 2P: Detention Basin WQ Check

Elevation (feet)	Surface (acres)	Storage (acre-feet)
772.00	1.431	0.000
772.05	1.437	0.072
772.10	1.443	0.144
772.15	1.449	0.216
772.20	1.455	0.289
772.25	1.461	0.361
772.30	1.467	0.435
772.35	1.473	0.508
772.40	1.479	0.582
772.45	1.485	0.656
772.50	1.491	0.730
772.55	1.496	0.805
772.60	1.502	0.880
772.65	1.508	0.955
772.70	1.514	1.031
772.75	1.520	1.107
772.80	1.526	1.183
772.85	1.532	1.259
772.90	1.538	1.336
772.95	1.544	1.413
773.00	1.550	1.491
773.05	1.556	1.568
773.10	1.562	1.646
773.15	1.568	1.724
773.20	1.575	1.803
773.25	1.581	1.882
773.30	1.587	1.961
773.35	1.593	2.041
773.40	1.599	2.120
773.45	1.605	2.200
773.50	1.611	2.281
773.55	1.618	2.362
773.60	1.624	2.443
773.65	1.630	2.524
773.70	1.636	2.606
773.75	1.642	2.688
773.80	1.648	2.770
773.85	1.655	2.852
773.90	1.661	2.935
773.95	1.667	3.019
774.00	1.673	3.102
774.05	1.715	3.187
774.10	1.756	3.273
774.15	1.798	3.362
774.20	1.840	3.453
774.25	1.882	3.546
774.30	1.923	3.641
774.35	1.965	3.739
774.40	2.007	3.838
774.45	2.048	3.939
774.50	2.090	4.043
774.55	2.132	4.148
774.60	2.173	4.256
774.65	2.215	4.366
774.70	2.257	4.477
774.75	2.298	4.591
774.80	2.340	4.707
774.85	2.382	4.825
774.90	2.424	4.945
774.95	2.465	5.068
775.00	2.507	5.192
775.05	2.543	5.318
775.10	2.578	5.446
775.15	2.614	5.576
775.20	2.649	5.708
775.25	2.685	5.841
775.30	2.720	5.976
775.35	2.756	6.113
775.40	2.791	6.252
775.45	2.827	6.392
775.50	2.863	6.534
775.55	2.898	6.678
775.60	2.934	6.824
775.65	2.969	6.972
775.70	3.005	7.121
775.75	3.040	7.272
775.80	3.076	7.425
775.85	3.111	7.580
775.90	3.147	7.736
775.95	3.182	7.894
776.00	**3.218**	**8.055**

Summary for Subcatchment 1S: Ramp D2-01-LT Ditch

[49] Hint: Tc<2dt may require smaller dt

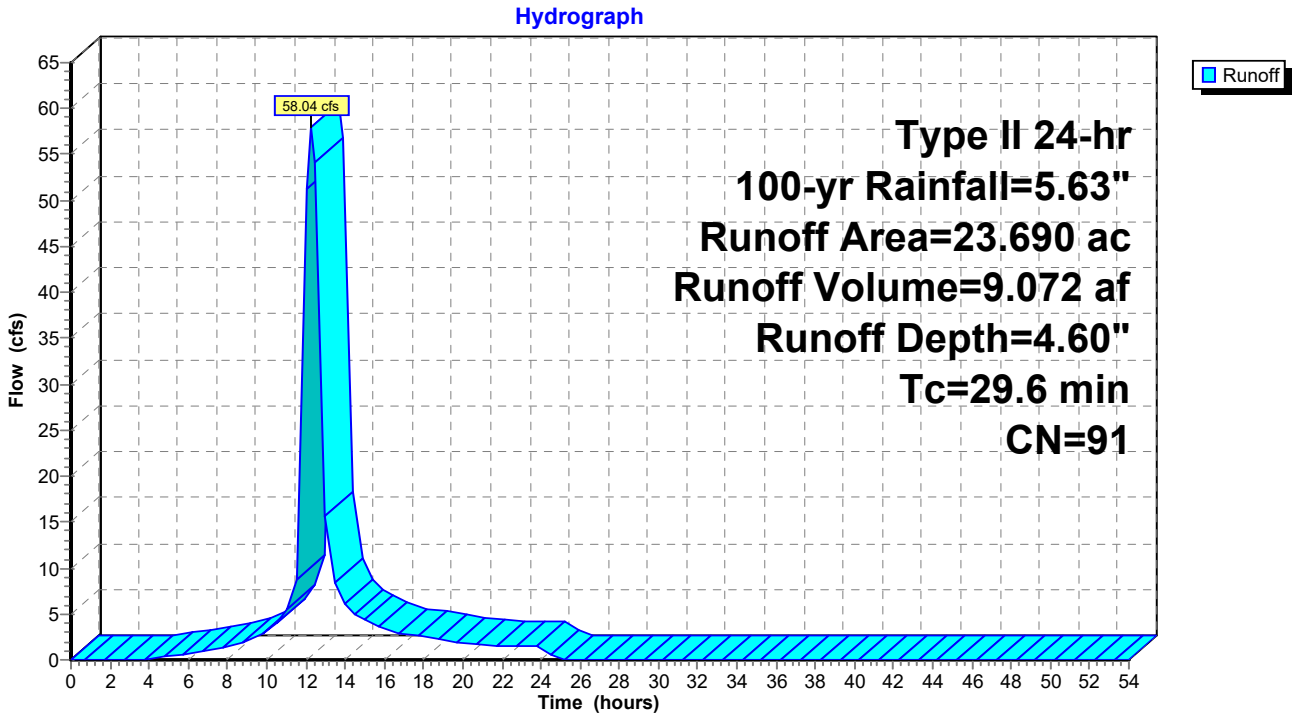
Runoff = 58.04 cfs @ 12.28 hrs, Volume= 9.072 af, Depth= 4.60"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-54.00 hrs, dt= 0.50 hrs
Type II 24-hr 100-yr Rainfall=5.63"

Area (ac)	CN	Description
14.270	98	Paved roads w/curbs & sewers, HSG D
8.560	80	>75% Grass cover, Good, HSG D
0.860	89	<50% Grass cover, Poor, HSG D
23.690	91	Weighted Average
9.420		39.76% Pervious Area
14.270		60.24% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
29.6					**Direct Entry, TC from Ditch Calc**

Subcatchment 1S: Ramp D2-01-LT Ditch



Hydrograph for Subcatchment 1S: Ramp D2-01-LT Ditch

Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)
0.00	0.00	0.00	0.00
1.00	0.06	0.00	0.00
2.00	0.12	0.00	0.00
3.00	0.19	0.00	0.00
4.00	0.27	0.00	0.13
5.00	0.35	0.02	0.41
6.00	0.45	0.05	0.73
7.00	0.56	0.10	1.08
8.00	0.68	0.16	1.44
9.00	0.83	0.25	2.18
10.00	1.02	0.37	3.06
11.00	1.32	0.60	5.54
12.00	3.73	2.76	**51.33**
13.00	4.35	3.35	**15.60**
14.00	4.62	3.61	6.10
15.00	4.81	3.79	4.33
16.00	4.95	3.94	3.42
17.00	5.08	4.06	2.83
18.00	5.19	4.16	2.50
19.00	5.28	4.25	2.18
20.00	5.36	4.33	1.85
21.00	5.43	4.40	1.67
22.00	5.50	4.47	1.60
23.00	5.57	4.53	1.54
24.00	**5.63**	**4.60**	1.45
25.00	5.63	4.60	0.05
26.00	5.63	4.60	0.00
27.00	5.63	4.60	0.00
28.00	5.63	4.60	0.00
29.00	5.63	4.60	0.00
30.00	5.63	4.60	0.00
31.00	5.63	4.60	0.00
32.00	5.63	4.60	0.00
33.00	5.63	4.60	0.00
34.00	5.63	4.60	0.00
35.00	5.63	4.60	0.00
36.00	5.63	4.60	0.00
37.00	5.63	4.60	0.00
38.00	5.63	4.60	0.00
39.00	5.63	4.60	0.00
40.00	5.63	4.60	0.00
41.00	5.63	4.60	0.00
42.00	5.63	4.60	0.00
43.00	5.63	4.60	0.00
44.00	5.63	4.60	0.00
45.00	5.63	4.60	0.00
46.00	5.63	4.60	0.00
47.00	5.63	4.60	0.00
48.00	5.63	4.60	0.00
49.00	5.63	4.60	0.00
50.00	5.63	4.60	0.00
51.00	5.63	4.60	0.00
52.00	5.63	4.60	0.00
53.00	5.63	4.60	0.00
54.00	5.63	4.60	0.00

Summary for Subcatchment 2S: Direct Flow into Basin

[49] Hint: Tc<2dt may require smaller dt

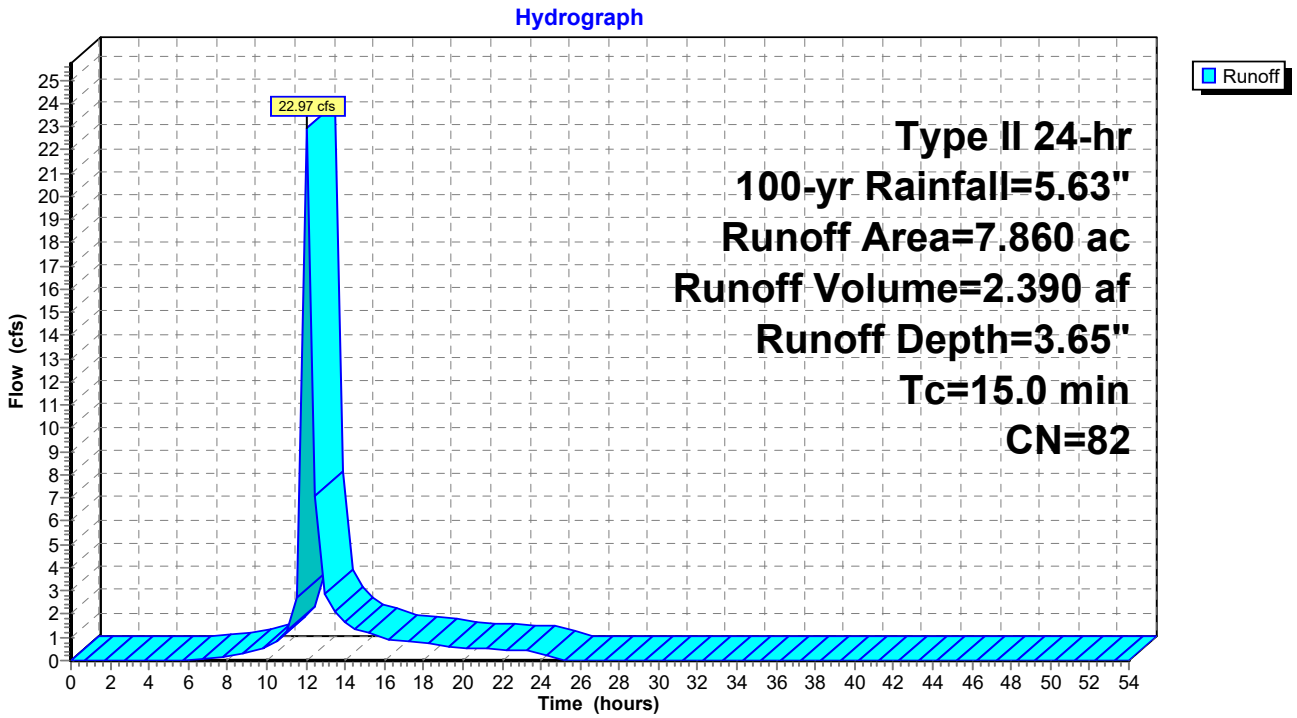
Runoff = 22.97 cfs @ 12.03 hrs, Volume= 2.390 af, Depth= 3.65"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-54.00 hrs, dt= 0.50 hrs
Type II 24-hr 100-yr Rainfall=5.63"

Area (ac)	CN	Description
1.060	98	Paved roads w/curbs & sewers, HSG D
6.800	80	>75% Grass cover, Good, HSG D
7.860	82	Weighted Average
6.800		86.51% Pervious Area
1.060		13.49% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.0					**Direct Entry, Direct flow into Basin**

Subcatchment 2S: Direct Flow into Basin



Hydrograph for Subcatchment 2S: Direct Flow into Basin

Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)
0.00	0.00	0.00	0.00
1.00	0.06	0.00	0.00
2.00	0.12	0.00	0.00
3.00	0.19	0.00	0.00
4.00	0.27	0.00	0.00
5.00	0.35	0.00	0.00
6.00	0.45	0.00	0.00
7.00	0.56	0.01	0.07
8.00	0.68	0.02	0.16
9.00	0.83	0.06	0.34
10.00	1.02	0.12	0.57
11.00	1.32	0.25	1.31
12.00	3.73	1.98	**22.90**
13.00	4.35	2.50	2.88
14.00	4.62	2.74	1.64
15.00	4.81	2.91	1.25
16.00	4.95	3.04	0.98
17.00	5.08	3.15	0.84
18.00	5.19	3.25	0.75
19.00	5.28	3.33	0.65
20.00	5.36	3.40	0.55
21.00	5.43	3.47	0.51
22.00	5.50	3.53	0.49
23.00	5.57	3.59	0.47
24.00	**5.63**	**3.65**	0.40
25.00	5.63	3.65	0.00
26.00	5.63	3.65	0.00
27.00	5.63	3.65	0.00
28.00	5.63	3.65	0.00
29.00	5.63	3.65	0.00
30.00	5.63	3.65	0.00
31.00	5.63	3.65	0.00
32.00	5.63	3.65	0.00
33.00	5.63	3.65	0.00
34.00	5.63	3.65	0.00
35.00	5.63	3.65	0.00
36.00	5.63	3.65	0.00
37.00	5.63	3.65	0.00
38.00	5.63	3.65	0.00
39.00	5.63	3.65	0.00
40.00	5.63	3.65	0.00
41.00	5.63	3.65	0.00
42.00	5.63	3.65	0.00
43.00	5.63	3.65	0.00
44.00	5.63	3.65	0.00
45.00	5.63	3.65	0.00
46.00	5.63	3.65	0.00
47.00	5.63	3.65	0.00
48.00	5.63	3.65	0.00
49.00	5.63	3.65	0.00
50.00	5.63	3.65	0.00
51.00	5.63	3.65	0.00
52.00	5.63	3.65	0.00
53.00	5.63	3.65	0.00
54.00	5.63	3.65	0.00

Summary for Pond 1P: Detention Basin

Inflow Area = 31.550 ac, 48.59% Impervious, Inflow Depth = 4.36" for 100-yr event
Inflow = 78.33 cfs @ 12.16 hrs, Volume= 11.462 af
Outflow = 16.19 cfs @ 13.00 hrs, Volume= 10.456 af, Atten= 79%, Lag= 50.1 min
Primary = 16.19 cfs @ 13.00 hrs, Volume= 10.456 af

Routing by Stor-Ind method, Time Span= 0.00-54.00 hrs, dt= 0.50 hrs
Peak Elev= 775.46' @ 13.22 hrs Surf.Area= 2.832 ac Storage= 6.412 af

Plug-Flow detention time= 344.6 min calculated for 10.360 af (90% of inflow)
Center-of-Mass det. time= 314.8 min (1,119.3 - 804.5)

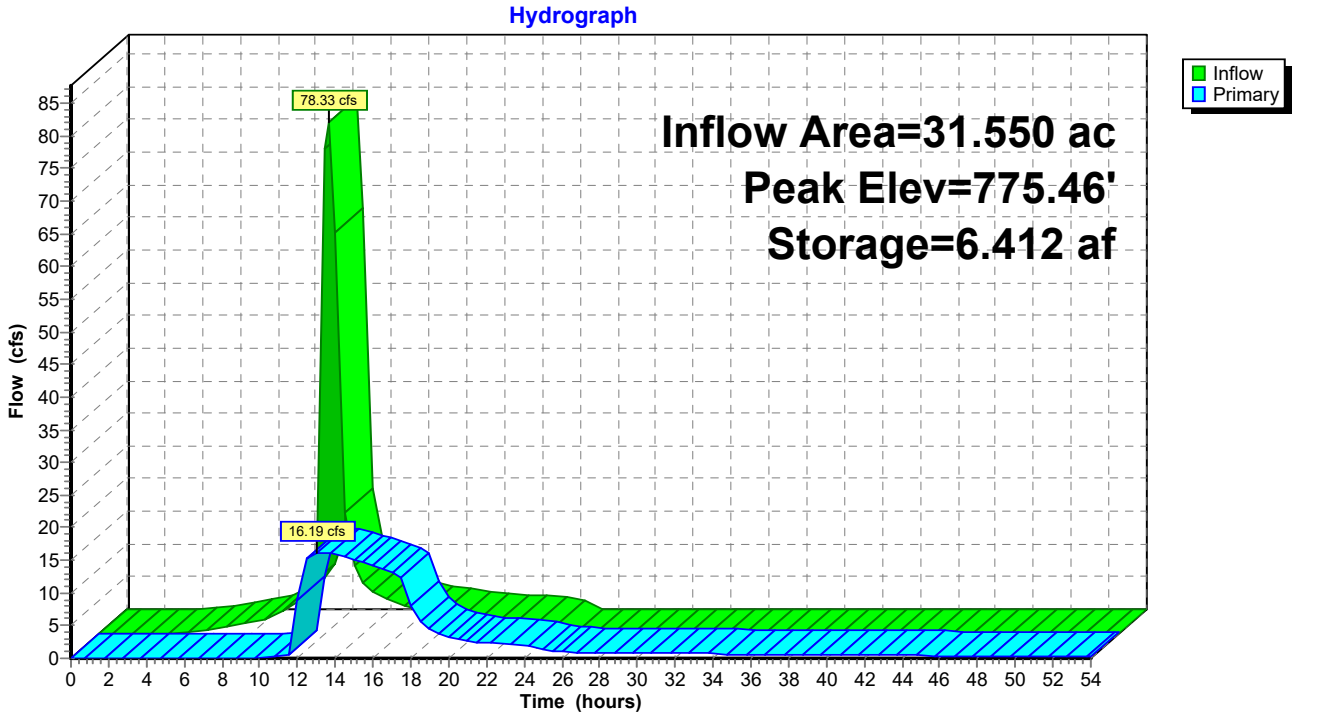
Volume	Invert	Avail.Storage	Storage Description
#1	772.00'	8.055 af	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
772.00	1.431	0.000	0.000
773.00	1.550	1.490	1.490
774.00	1.673	1.611	3.102
775.00	2.507	2.090	5.192
776.00	3.218	2.862	8.055

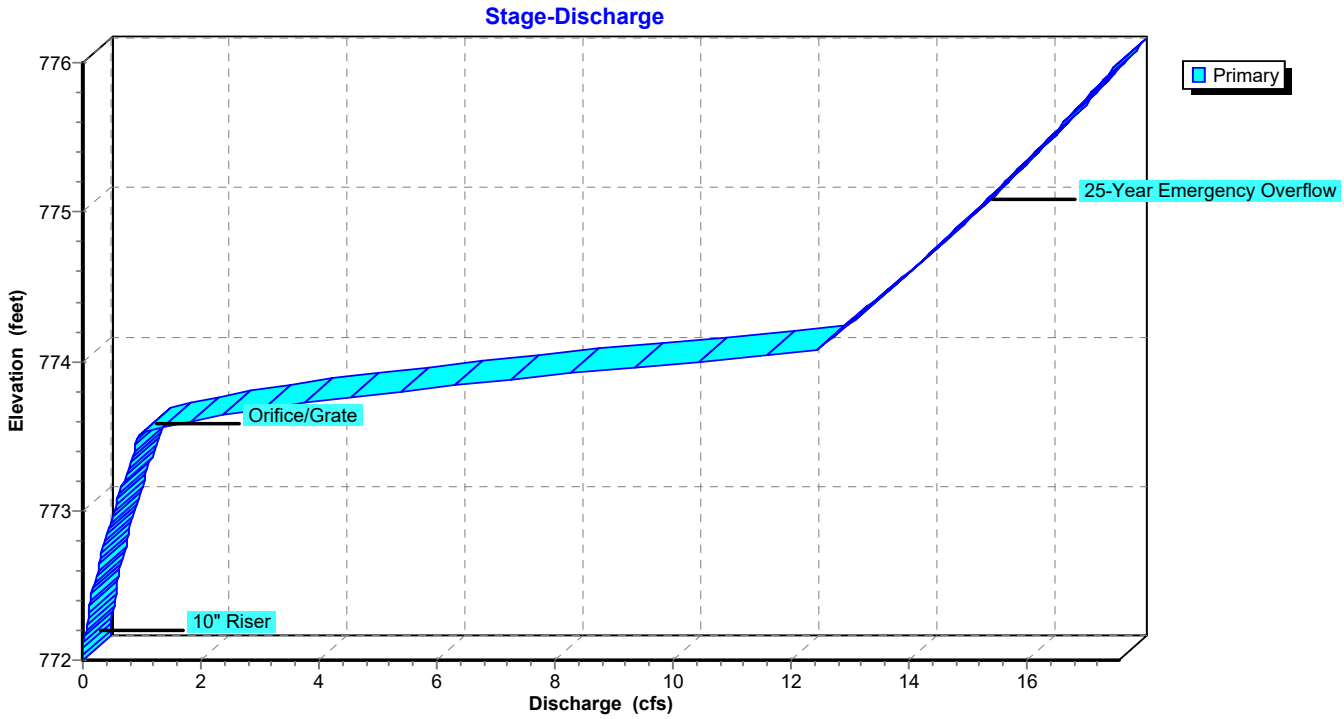
Device	Routing	Invert	Outlet Devices
#1	Device 2	772.12'	**1.0" Vert. 10" Riser X 10.00 columns** X 4 rows with 4.0" cc spacing C= 0.600 Limited to weir flow at low heads
#2	Primary	770.92'	**18.0" Round Culvert** L= 55.5' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 770.92' / 770.64' S= 0.0050 '/' Cc= 0.900 n= 0.013, Flow Area= 1.77 sf
#3	Device 2	773.50'	**24.0" x 24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Device 2	775.00'	**10.0' long x 18.0' breadth 25-Year Emergency Overflow** 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=16.19 cfs @ 13.00 hrs HW=775.42' (Free Discharge)
└**2=Culvert** (Barrel Controls 16.19 cfs @ 9.16 fps)
  ├**1=10" Riser** (Passes < 1.74 cfs potential flow)
  ├**3=Orifice/Grate** (Passes < 26.68 cfs potential flow)
  └**4=25-Year Emergency Overflow** (Passes < 7.33 cfs potential flow)

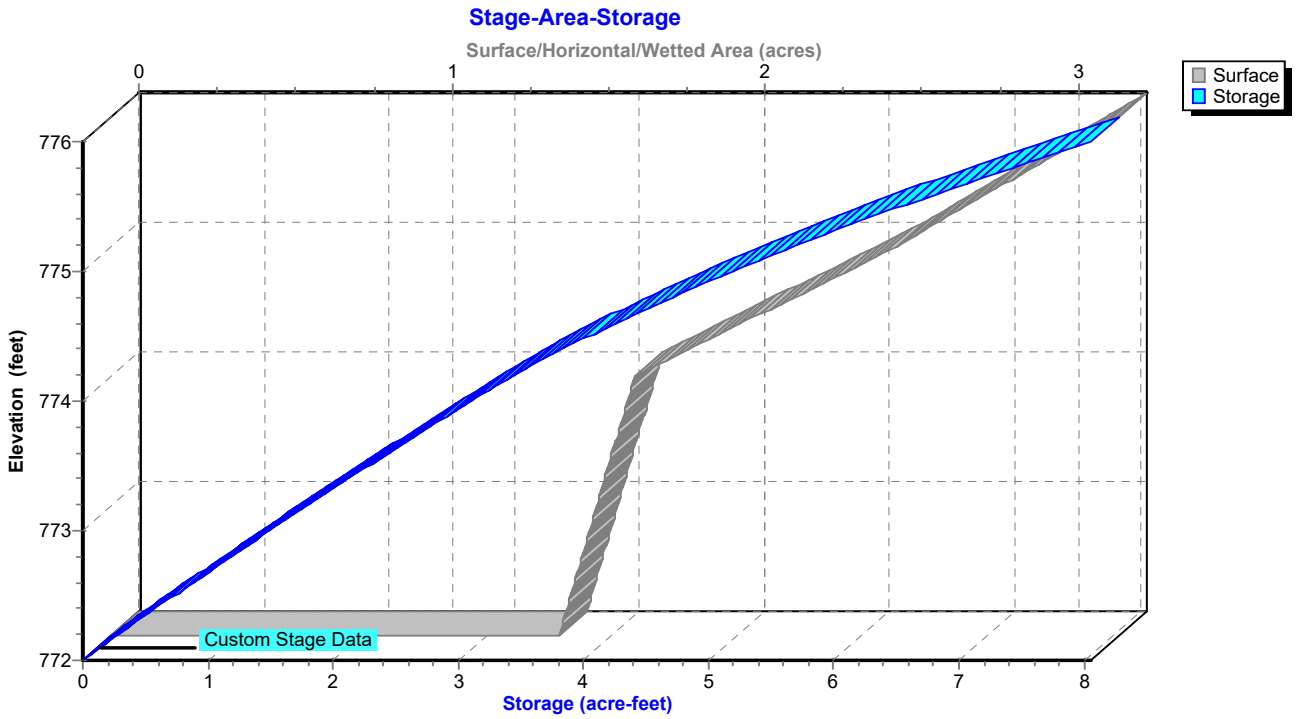
Pond 1P: Detention Basin



Pond 1P: Detention Basin



Pond 1P: Detention Basin



Hydrograph for Pond 1P: Detention Basin

Time (hours)	Inflow (cfs)	Storage (acre-feet)	Elevation (feet)	Primary (cfs)
0.00	0.00	0.000	772.00	0.00
2.50	0.00	0.000	772.00	0.00
5.00	0.41	0.026	772.02	0.00
7.50	1.37	0.202	772.14	0.01
10.00	**3.63**	0.667	772.46	0.15
12.50	**61.31**	**5.307**	**775.05**	**15.24**
15.00	5.58	**5.202**	**775.00**	**15.13**
17.50	3.46	3.225	774.07	12.28
20.00	2.40	2.599	773.70	3.32
22.50	2.05	2.496	773.63	2.29
25.00	0.05	2.388	773.57	1.43
27.50	0.00	2.179	773.44	0.89
30.00	0.00	2.002	773.33	0.81
32.50	0.00	1.843	773.23	0.73
35.00	0.00	1.704	773.14	0.62
37.50	0.00	1.581	773.06	0.57
40.00	0.00	1.467	772.99	0.53
42.50	0.00	1.364	772.92	0.48
45.00	0.00	1.271	772.86	0.42
47.50	0.00	1.190	772.80	0.36
50.00	0.00	1.118	772.76	0.34
52.50	0.00	1.051	772.71	0.32

Stage-Discharge for Pond 1P: Detention Basin

Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)
772.00	0.00	773.04	0.56	774.08	12.46	775.12	15.44
772.02	0.00	773.06	0.57	774.10	12.52	775.14	15.49
772.04	0.00	773.08	0.58	774.12	12.58	775.16	15.54
772.06	0.00	773.10	0.60	774.14	12.65	775.18	15.59
772.08	0.00	773.12	0.61	774.16	12.71	775.20	15.64
772.10	0.00	773.14	0.62	774.18	12.77	775.22	15.69
772.12	0.00	773.16	0.65	774.20	12.83	775.24	15.74
772.14	0.00	773.18	0.67	774.22	12.90	775.26	15.80
772.16	0.02	773.20	0.70	774.24	12.96	775.28	15.85
772.18	0.04	773.22	0.72	774.26	13.02	775.30	15.90
772.20	0.05	773.24	0.74	774.28	13.08	775.32	15.95
772.22	0.06	773.26	0.76	774.30	13.14	775.34	16.00
772.24	0.07	773.28	0.78	774.32	13.20	775.36	16.05
772.26	0.08	773.30	0.79	774.34	13.26	775.38	16.10
772.28	0.09	773.32	0.81	774.36	13.32	775.40	16.15
772.30	0.10	773.34	0.83	774.38	13.38	775.42	16.20
772.32	0.10	773.36	0.84	774.40	13.44	775.44	16.24
772.34	0.11	773.38	0.85	774.42	13.50	775.46	16.29
772.36	0.12	773.40	0.87	774.44	13.56	775.48	16.34
772.38	0.12	773.42	0.88	774.46	13.62	775.50	16.39
772.40	0.13	773.44	0.90	774.48	13.68	775.52	16.44
772.42	0.13	773.46	0.91	774.50	13.74	775.54	16.49
772.44	0.14	773.48	0.92	774.52	13.80	775.56	16.54
772.46	0.14	773.50	0.94	774.54	13.85	775.58	16.59
772.48	0.16	773.52	1.02	774.56	13.91	775.60	16.63
772.50	0.18	773.54	1.17	774.58	13.97	775.62	16.68
772.52	0.20	773.56	1.36	774.60	14.03	775.64	16.73
772.54	0.22	773.58	1.58	774.62	14.08	775.66	16.78
772.56	0.23	773.60	1.82	774.64	14.14	775.68	16.82
772.58	0.25	773.62	2.09	774.66	14.20	775.70	16.87
772.60	0.26	773.64	2.39	774.68	14.25	775.72	16.92
772.62	0.27	773.66	2.70	774.70	14.31	775.74	16.97
772.64	0.28	773.68	3.04	774.72	14.36	775.76	17.01
772.66	0.29	773.70	3.39	774.74	14.42	775.78	17.06
772.68	0.30	773.72	3.76	774.76	14.47	775.80	17.11
772.70	0.31	773.74	4.15	774.78	14.53	775.82	17.15
772.72	0.32	773.76	4.55	774.80	14.58	775.84	17.20
772.74	0.33	773.78	4.97	774.82	14.64	775.86	17.25
772.76	0.34	773.80	5.40	774.84	14.69	775.88	17.29
772.78	0.35	773.82	5.85	774.86	14.75	775.90	17.34
772.80	0.36	773.84	6.31	774.88	14.80	775.92	17.39
772.82	0.38	773.86	6.79	774.90	14.86	775.94	17.43
772.84	0.40	773.88	7.27	774.92	14.91	775.96	17.48
772.86	0.42	773.90	7.77	774.94	14.96	775.98	17.52
772.88	0.45	773.92	8.29	774.96	15.02	776.00	**17.57**
772.90	0.46	773.94	8.81	774.98	15.07		
772.92	0.48	773.96	9.35	775.00	15.12		
772.94	0.49	773.98	9.89	775.02	15.18		
772.96	0.51	774.00	10.45	775.04	15.23		
772.98	0.52	774.02	11.02	775.06	15.28		
773.00	0.54	774.04	11.60	775.08	15.33		
773.02	0.55	774.06	12.19	775.10	15.38		

Stage-Area-Storage for Pond 1P: Detention Basin

Elevation (feet)	Surface (acres)	Storage (acre-feet)
772.00	1.431	0.000
772.05	1.437	0.072
772.10	1.443	0.144
772.15	1.449	0.216
772.20	1.455	0.289
772.25	1.461	0.361
772.30	1.467	0.435
772.35	1.473	0.508
772.40	1.479	0.582
772.45	1.485	0.656
772.50	1.490	0.730
772.55	1.496	0.805
772.60	1.502	0.880
772.65	1.508	0.955
772.70	1.514	1.031
772.75	1.520	1.107
772.80	1.526	1.183
772.85	1.532	1.259
772.90	1.538	1.336
772.95	1.544	1.413
773.00	1.550	1.490
773.05	1.556	1.568
773.10	1.562	1.646
773.15	1.568	1.724
773.20	1.575	1.803
773.25	1.581	1.882
773.30	1.587	1.961
773.35	1.593	2.041
773.40	1.599	2.120
773.45	1.605	2.200
773.50	1.611	2.281
773.55	1.618	2.362
773.60	1.624	2.443
773.65	1.630	2.524
773.70	1.636	2.606
773.75	1.642	2.688
773.80	1.648	2.770
773.85	1.655	2.852
773.90	1.661	2.935
773.95	1.667	3.019
774.00	1.673	3.102
774.05	1.715	3.187
774.10	1.756	3.273
774.15	1.798	3.362
774.20	1.840	3.453
774.25	1.881	3.546
774.30	1.923	3.641
774.35	1.965	3.739
774.40	2.007	3.838
774.45	2.048	3.939
774.50	2.090	4.043
774.55	2.132	4.148
774.60	2.173	4.256
774.65	2.215	4.366
774.70	2.257	4.477
774.75	2.298	4.591
774.80	2.340	4.707
774.85	2.382	4.825
774.90	2.424	4.945
774.95	2.465	5.068
775.00	2.507	5.192
775.05	2.543	5.318
775.10	2.578	5.446
775.15	2.614	5.576
775.20	2.649	5.708
775.25	2.685	5.841
775.30	2.720	5.976
775.35	2.756	6.113
775.40	2.791	6.252
775.45	2.827	6.392
775.50	2.862	6.534
775.55	2.898	6.678
775.60	2.934	6.824
775.65	2.969	6.972
775.70	3.005	7.121
775.75	3.040	7.272
775.80	3.076	7.425
775.85	3.111	7.580
775.90	3.147	7.736
775.95	3.182	7.894
776.00	**3.218**	**8.055**

Summary for Pond 2P: Detention Basin WQ Check

Inflow	=	0.00 cfs @	0.00 hrs,	Volume=	0.000 af
Outflow	=	0.94 cfs @	0.00 hrs,	Volume=	1.719 af, Atten= 0%, Lag= 0.0 min
Primary	=	0.94 cfs @	0.00 hrs,	Volume=	1.719 af

Routing by Stor-Ind method, Time Span= 0.00-54.00 hrs, dt= 0.50 hrs
Starting Elev= 773.50' Surf.Area= 1.611 ac Storage= 2.281 af
Peak Elev= 773.50' @ 0.00 hrs Surf.Area= 1.611 ac Storage= 2.281 af

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= (not calculated: no inflow)

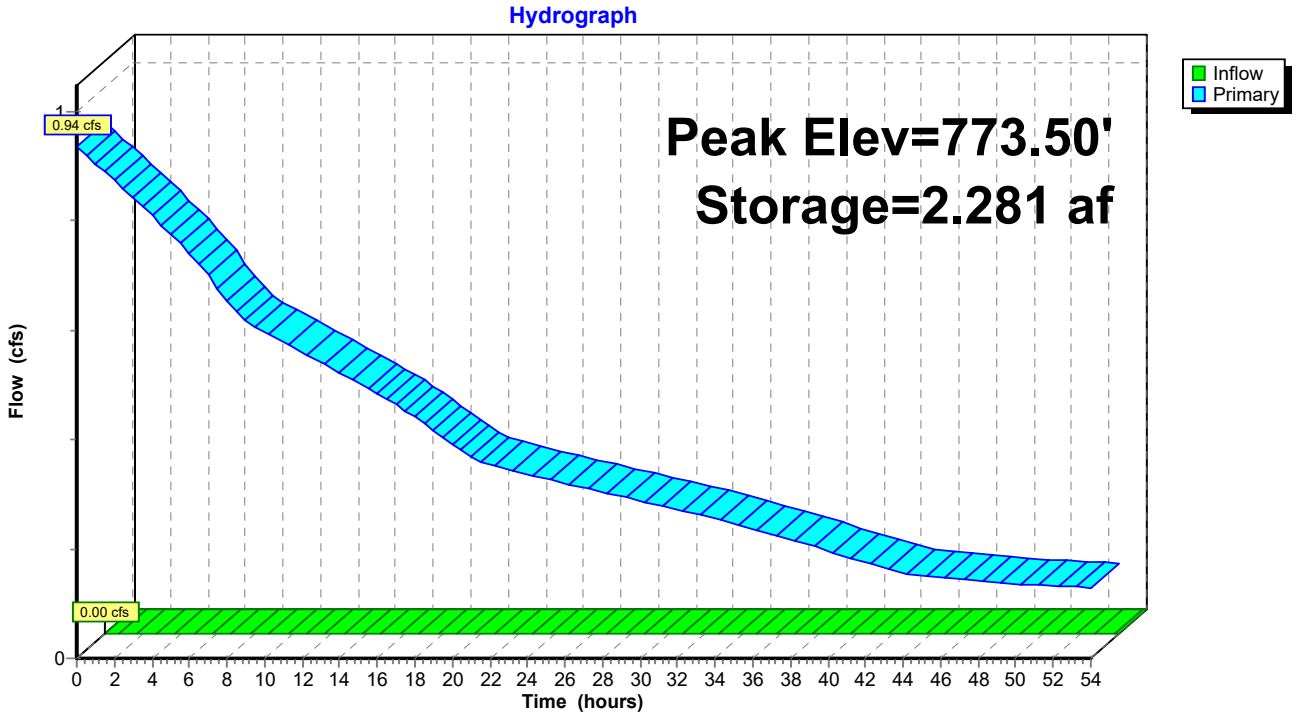
Volume	Invert	Avail.Storage	Storage Description
#1	772.00'	8.055 af	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
772.00	1.431	0.000	0.000
773.00	1.550	1.491	1.491
774.00	1.673	1.611	3.102
775.00	2.507	2.090	5.192
776.00	3.218	2.863	8.055

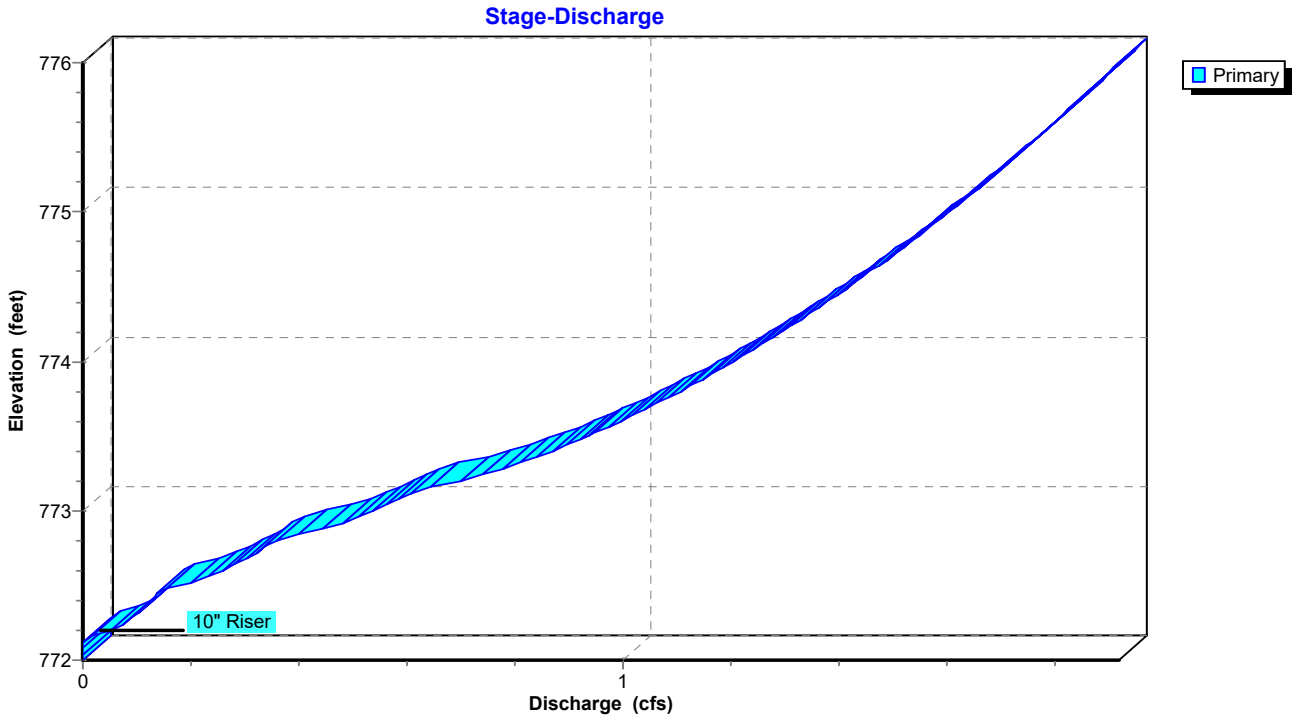
Device	Routing	Invert	Outlet Devices
#1	Primary	772.12'	**1.0" Vert. 10" Riser X 10.00 columns** X 4 rows with 4.0" cc spacing C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.94 cfs @ 0.00 hrs HW=773.50' (Free Discharge)
↑—**1=10" Riser** (Orifice Controls 0.94 cfs @ 4.29 fps)

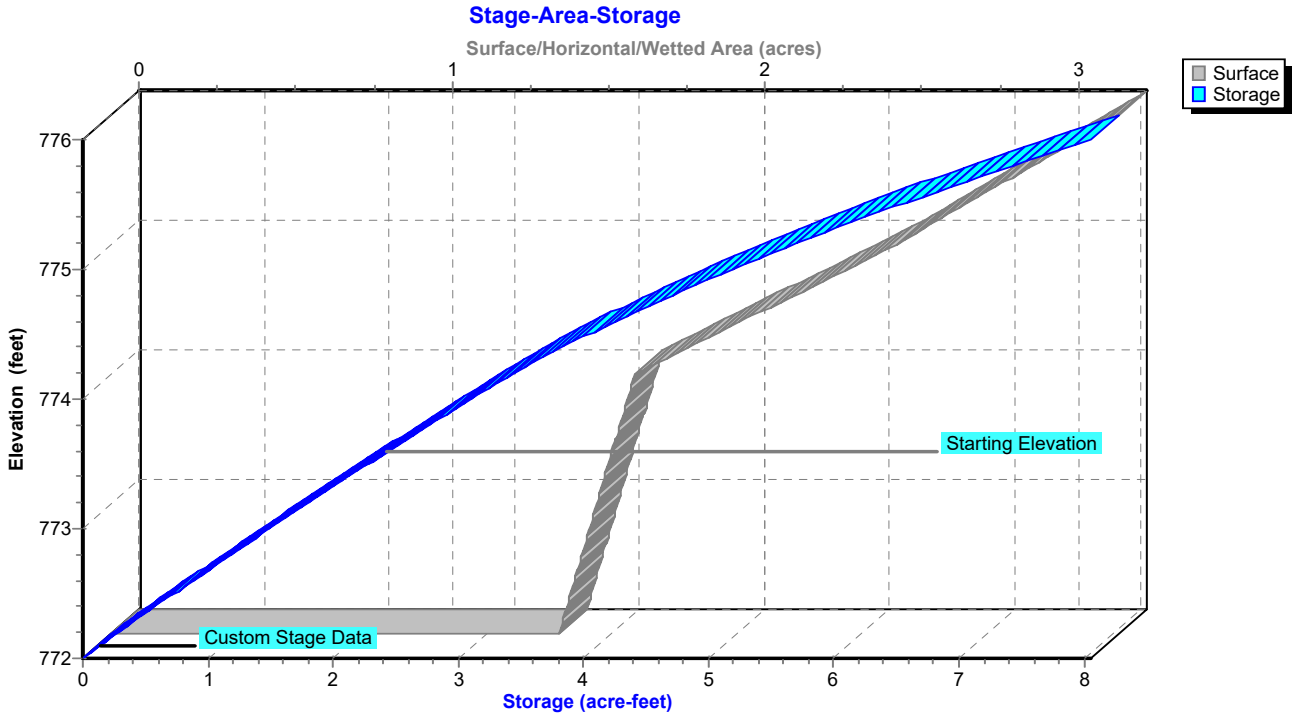
Pond 2P: Detention Basin WQ Check



Pond 2P: Detention Basin WQ Check



Pond 2P: Detention Basin WQ Check



Hydrograph for Pond 2P: Detention Basin WQ Check

Time (hours)	Inflow (cfs)	Storage (acre-feet)	Elevation (feet)	Primary (cfs)
0.00	**0.00**	**2.281**	**773.50**	**0.94**
2.50	0.00	2.096	773.38	0.86
5.00	0.00	1.927	773.28	0.78
7.50	0.00	1.776	773.18	0.68
10.00	0.00	1.646	773.10	0.60
12.50	0.00	1.528	773.02	0.55
15.00	0.00	1.419	772.95	0.50
17.50	0.00	1.320	772.89	0.45
20.00	0.00	1.232	772.83	0.39
22.50	0.00	1.157	772.78	0.35
25.00	0.00	1.087	772.74	0.33
27.50	0.00	1.021	772.69	0.31
30.00	0.00	0.959	772.65	0.29
32.50	0.00	0.902	772.61	0.27
35.00	0.00	0.849	772.58	0.25
37.50	0.00	0.801	772.55	0.22
40.00	0.00	0.757	772.52	0.20
42.50	0.00	0.720	772.49	0.17
45.00	0.00	0.687	772.47	0.15
47.50	0.00	0.656	772.45	0.14
50.00	0.00	0.627	772.43	0.14
52.50	0.00	0.600	772.41	0.13

Stage-Discharge for Pond 2P: Detention Basin WQ Check

Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)
772.00	0.00	773.04	0.56	774.08	1.24	775.12	1.64
772.02	0.00	773.06	0.57	774.10	1.25	775.14	1.65
772.04	0.00	773.08	0.58	774.12	1.26	775.16	1.66
772.06	0.00	773.10	0.60	774.14	1.27	775.18	1.66
772.08	0.00	773.12	0.61	774.16	1.28	775.20	1.67
772.10	0.00	773.14	0.62	774.18	1.28	775.22	1.68
772.12	0.00	773.16	0.65	774.20	1.29	775.24	1.68
772.14	0.00	773.18	0.67	774.22	1.30	775.26	1.69
772.16	0.02	773.20	0.70	774.24	1.31	775.28	1.70
772.18	0.04	773.22	0.72	774.26	1.32	775.30	1.70
772.20	0.05	773.24	0.74	774.28	1.33	775.32	1.71
772.22	0.06	773.26	0.76	774.30	1.34	775.34	1.71
772.24	0.07	773.28	0.78	774.32	1.34	775.36	1.72
772.26	0.08	773.30	0.79	774.34	1.35	775.38	1.73
772.28	0.09	773.32	0.81	774.36	1.36	775.40	1.73
772.30	0.10	773.34	0.83	774.38	1.37	775.42	1.74
772.32	0.10	773.36	0.84	774.40	1.38	775.44	1.75
772.34	0.11	773.38	0.85	774.42	1.38	775.46	1.75
772.36	0.12	773.40	0.87	774.44	1.39	775.48	1.76
772.38	0.12	773.42	0.88	774.46	1.40	775.50	1.77
772.40	0.13	773.44	0.90	774.48	1.41	775.52	1.77
772.42	0.13	773.46	0.91	774.50	1.42	775.54	1.78
772.44	0.14	773.48	0.92	774.52	1.42	775.56	1.78
772.46	0.14	773.50	0.94	774.54	1.43	775.58	1.79
772.48	0.16	773.52	0.95	774.56	1.44	775.60	1.80
772.50	0.18	773.54	0.96	774.58	1.45	775.62	1.80
772.52	0.20	773.56	0.97	774.60	1.46	775.64	1.81
772.54	0.22	773.58	0.98	774.62	1.46	775.66	1.82
772.56	0.23	773.60	1.00	774.64	1.47	775.68	1.82
772.58	0.25	773.62	1.01	774.66	1.48	775.70	1.83
772.60	0.26	773.64	1.02	774.68	1.49	775.72	1.83
772.62	0.27	773.66	1.03	774.70	1.49	775.74	1.84
772.64	0.28	773.68	1.04	774.72	1.50	775.76	1.85
772.66	0.29	773.70	1.05	774.74	1.51	775.78	1.85
772.68	0.30	773.72	1.06	774.76	1.52	775.80	1.86
772.70	0.31	773.74	1.07	774.78	1.52	775.82	1.86
772.72	0.32	773.76	1.08	774.80	1.53	775.84	1.87
772.74	0.33	773.78	1.09	774.82	1.54	775.86	1.88
772.76	0.34	773.80	1.10	774.84	1.54	775.88	1.88
772.78	0.35	773.82	1.12	774.86	1.55	775.90	1.89
772.80	0.36	773.84	1.13	774.88	1.56	775.92	1.89
772.82	0.38	773.86	1.14	774.90	1.57	775.94	1.90
772.84	0.40	773.88	1.15	774.92	1.57	775.96	1.90
772.86	0.42	773.90	1.16	774.94	1.58	775.98	1.91
772.88	0.45	773.92	1.16	774.96	1.59	776.00	**1.92**
772.90	0.46	773.94	1.17	774.98	1.59		
772.92	0.48	773.96	1.18	775.00	1.60		
772.94	0.49	773.98	1.19	775.02	1.61		
772.96	0.51	774.00	1.20	775.04	1.61		
772.98	0.52	774.02	1.21	775.06	1.62		
773.00	0.54	774.04	1.22	775.08	1.63		
773.02	0.55	774.06	1.23	775.10	1.64		

Stage-Area-Storage for Pond 2P: Detention Basin WQ Check

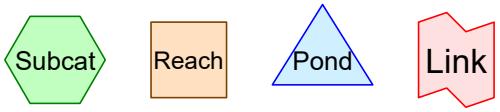
Elevation (feet)	Surface (acres)	Storage (acre-feet)
772.00	1.431	0.000
772.05	1.437	0.072
772.10	1.443	0.144
772.15	1.449	0.216
772.20	1.455	0.289
772.25	1.461	0.361
772.30	1.467	0.435
772.35	1.473	0.508
772.40	1.479	0.582
772.45	1.485	0.656
772.50	1.491	0.730
772.55	1.496	0.805
772.60	1.502	0.880
772.65	1.508	0.955
772.70	1.514	1.031
772.75	1.520	1.107
772.80	1.526	1.183
772.85	1.532	1.259
772.90	1.538	1.336
772.95	1.544	1.413
773.00	1.550	1.491
773.05	1.556	1.568
773.10	1.562	1.646
773.15	1.568	1.724
773.20	1.575	1.803
773.25	1.581	1.882
773.30	1.587	1.961
773.35	1.593	2.041
773.40	1.599	2.120
773.45	1.605	2.200
773.50	1.611	2.281
773.55	1.618	2.362
773.60	1.624	2.443
773.65	1.630	2.524
773.70	1.636	2.606
773.75	1.642	2.688
773.80	1.648	2.770
773.85	1.655	2.852
773.90	1.661	2.935
773.95	1.667	3.019
774.00	1.673	3.102
774.05	1.715	3.187
774.10	1.756	3.273
774.15	1.798	3.362
774.20	1.840	3.453
774.25	1.882	3.546
774.30	1.923	3.641
774.35	1.965	3.739
774.40	2.007	3.838
774.45	2.048	3.939
774.50	2.090	4.043
774.55	2.132	4.148
774.60	2.173	4.256
774.65	2.215	4.366
774.70	2.257	4.477
774.75	2.298	4.591
774.80	2.340	4.707
774.85	2.382	4.825
774.90	2.424	4.945
774.95	2.465	5.068
775.00	2.507	5.192
775.05	2.543	5.318
775.10	2.578	5.446
775.15	2.614	5.576
775.20	2.649	5.708
775.25	2.685	5.841
775.30	2.720	5.976
775.35	2.756	6.113
775.40	2.791	6.252
775.45	2.827	6.392
775.50	2.863	6.534
775.55	2.898	6.678
775.60	2.934	6.824
775.65	2.969	6.972
775.70	3.005	7.121
775.75	3.040	7.272
775.80	3.076	7.425
775.85	3.111	7.580
775.90	3.147	7.736
775.95	3.182	7.894
776.00	**3.218**	**8.055**

Appendix G – Peak flow Rate – Outlet 2B

IR-270 Ex. 36" Storm Inlet - Proposed Conditions

IR-270 Ex. 36" Storm - Existing Conditions

Pre. vs Post.
10-Year: 44.49 cfs vs. 25.52 cfs
25-Year: 57.01 cfs vs. 32.57 cfs
100-Year: 78.59 cfs vs. 48.54 cfs



Routing Diagram for FRA-70_Ramp C1 Storm Inlet flow rates
Prepared by HDR, Inc, Printed 4/27/2021

Rainfall Events Listing (selected events)

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	10-yr	Type II 24-hr		Default	24.00	1	3.74	2
2	25-yr	Type II 24-hr		Default	24.00	1	4.44	2
3	100-yr	Type II 24-hr		Default	24.00	1	5.63	2

Area Listing (selected nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.000	**0**	**TOTAL AREA**

Soil Listing (selected nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
0.000	HSG C	
0.000	HSG D	
0.000	Other	
0.000		**TOTAL AREA**

Ground Covers (selected nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**TOTAL AREA**	

Time span=0.00-48.00 hrs, dt=0.05 hrs, 961 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Reach 1R: IR-270 Ex. 36" Storm Inlet - Proposed Conditions Inflow=25.52 cfs 7.876 af
Outflow=25.52 cfs 7.876 af

Reach 2R: IR-270 Ex. 36" Storm - Existing Conditions Inflow=44.49 cfs 5.196 af
Outflow=44.49 cfs 5.196 af

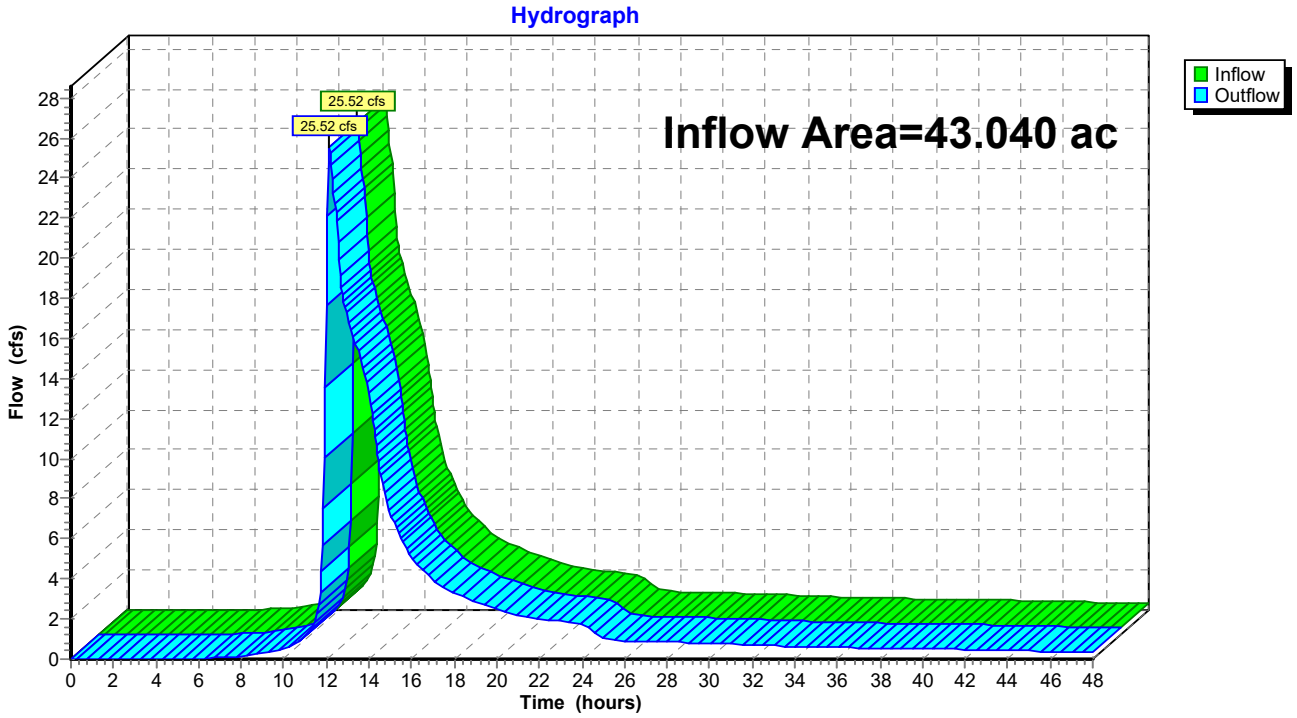
Summary for Reach 1R: IR-270 Ex. 36" Storm Inlet - Proposed Conditions

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 43.040 ac, 41.66% Impervious, Inflow Depth > 2.20" for 10-yr event
Inflow = 25.52 cfs @ 12.16 hrs, Volume= 7.876 af
Outflow = 25.52 cfs @ 12.16 hrs, Volume= 7.876 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Reach 1R: IR-270 Ex. 36" Storm Inlet - Proposed Conditions



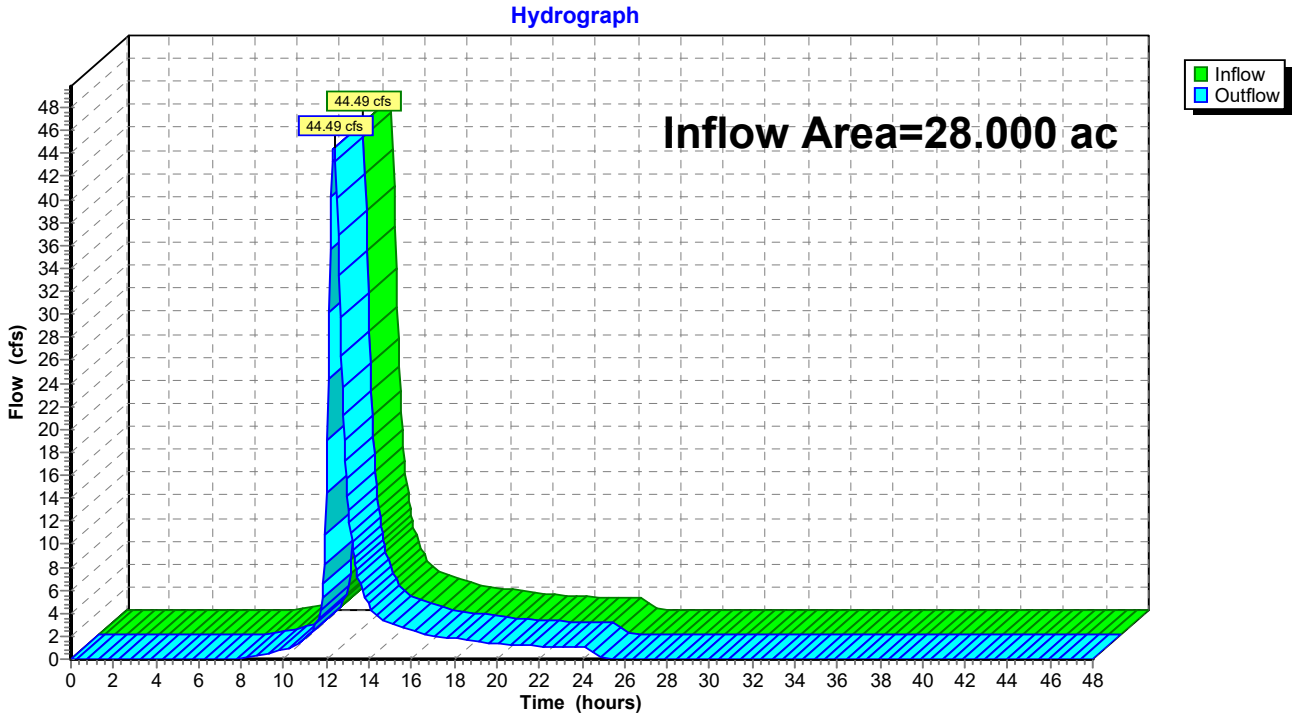
Summary for Reach 2R: IR-270 Ex. 36" Storm - Existing Conditions

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 28.000 ac, 22.68% Impervious, Inflow Depth = 2.23" for 10-yr event
Inflow = 44.49 cfs @ 12.37 hrs, Volume= 5.196 af
Outflow = 44.49 cfs @ 12.37 hrs, Volume= 5.196 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Reach 2R: IR-270 Ex. 36" Storm - Existing Conditions



Time span=0.00-48.00 hrs, dt=0.05 hrs, 961 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Reach 1R: IR-270 Ex. 36" Storm Inlet - Proposed Conditions Inflow=32.57 cfs 10.197 af
Outflow=32.57 cfs 10.197 af

Reach 2R: IR-270 Ex. 36" Storm - Existing Conditions Inflow=57.01 cfs 6.661 af
Outflow=57.01 cfs 6.661 af

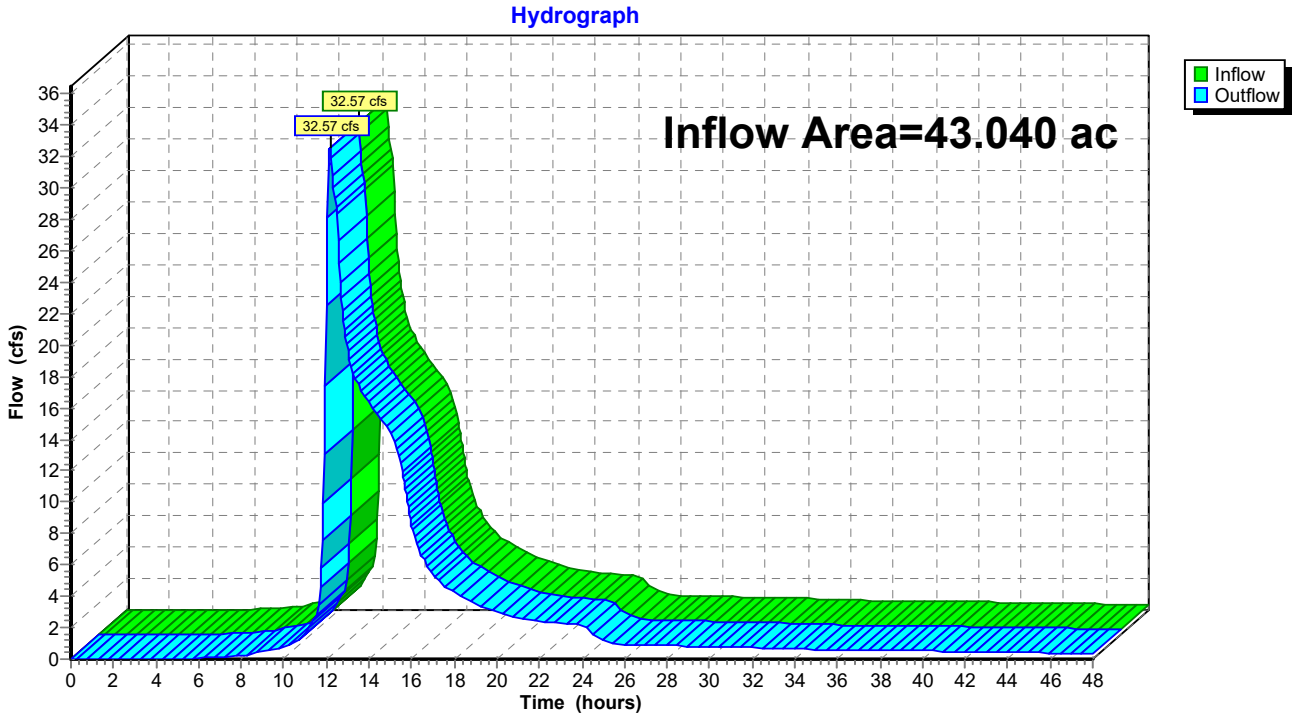
Summary for Reach 1R: IR-270 Ex. 36" Storm Inlet - Proposed Conditions

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 43.040 ac, 41.66% Impervious, Inflow Depth > 2.84" for 25-yr event
Inflow = 32.57 cfs @ 12.17 hrs, Volume= 10.197 af
Outflow = 32.57 cfs @ 12.17 hrs, Volume= 10.197 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Reach 1R: IR-270 Ex. 36" Storm Inlet - Proposed Conditions



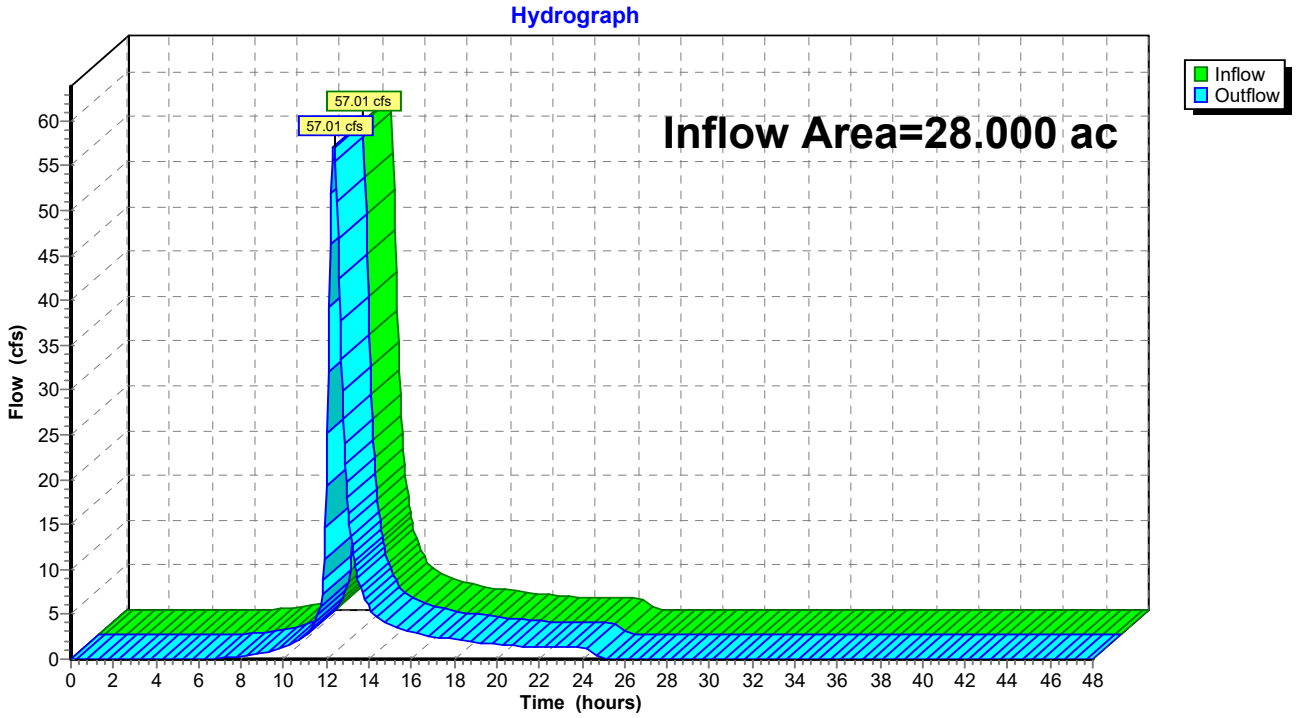
Summary for Reach 2R: IR-270 Ex. 36" Storm - Existing Conditions

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 28.000 ac, 22.68% Impervious, Inflow Depth = 2.85" for 25-yr event
Inflow = 57.01 cfs @ 12.36 hrs, Volume= 6.661 af
Outflow = 57.01 cfs @ 12.36 hrs, Volume= 6.661 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Reach 2R: IR-270 Ex. 36" Storm - Existing Conditions



Time span=0.00-48.00 hrs, dt=0.05 hrs, 961 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Reach 1R: IR-270 Ex. 36" Storm Inlet - Proposed Conditions Inflow=48.54 cfs 14.230 af
Outflow=48.54 cfs 14.230 af

Reach 2R: IR-270 Ex. 36" Storm - Existing Conditions Inflow=78.59 cfs 9.227 af
Outflow=78.59 cfs 9.227 af

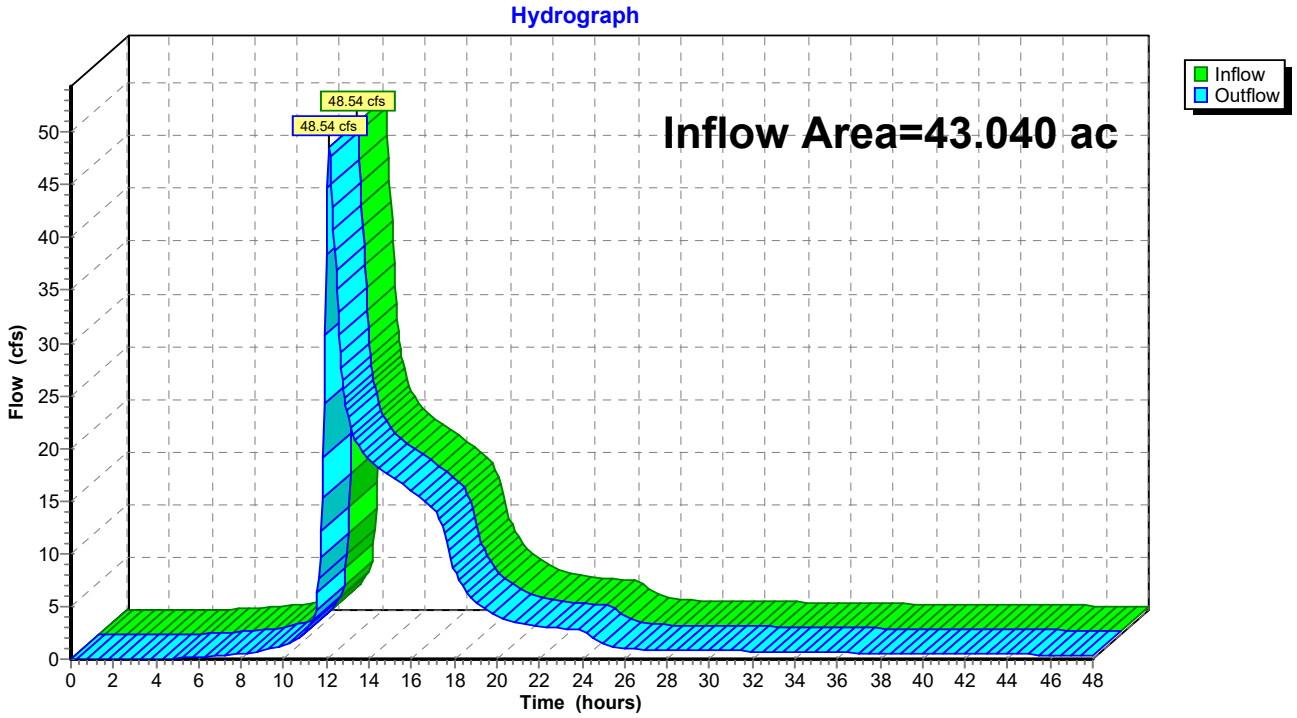
Summary for Reach 1R: IR-270 Ex. 36" Storm Inlet - Proposed Conditions

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 43.040 ac, 41.66% Impervious, Inflow Depth > 3.97" for 100-yr event
Inflow = 48.54 cfs @ 12.14 hrs, Volume= 14.230 af
Outflow = 48.54 cfs @ 12.14 hrs, Volume= 14.230 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Reach 1R: IR-270 Ex. 36" Storm Inlet - Proposed Conditions



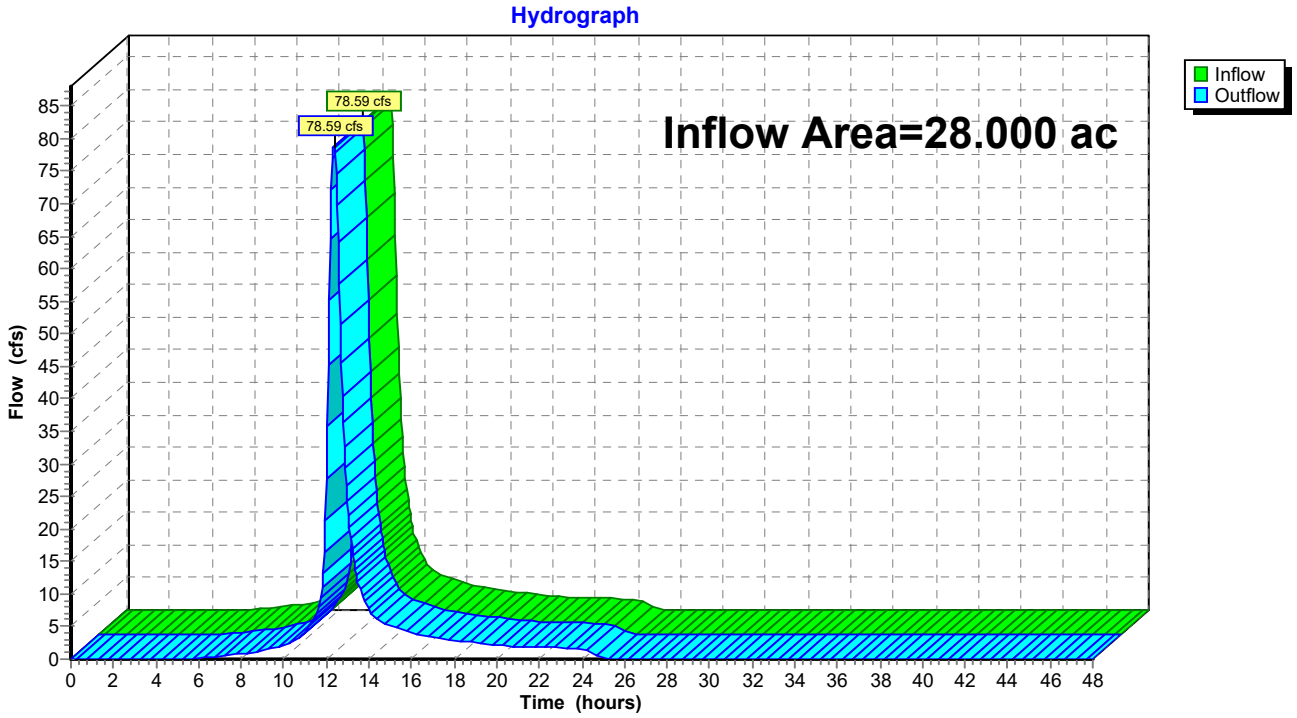
Summary for Reach 2R: IR-270 Ex. 36" Storm - Existing Conditions

[40] Hint: Not Described (Outflow=Inflow)

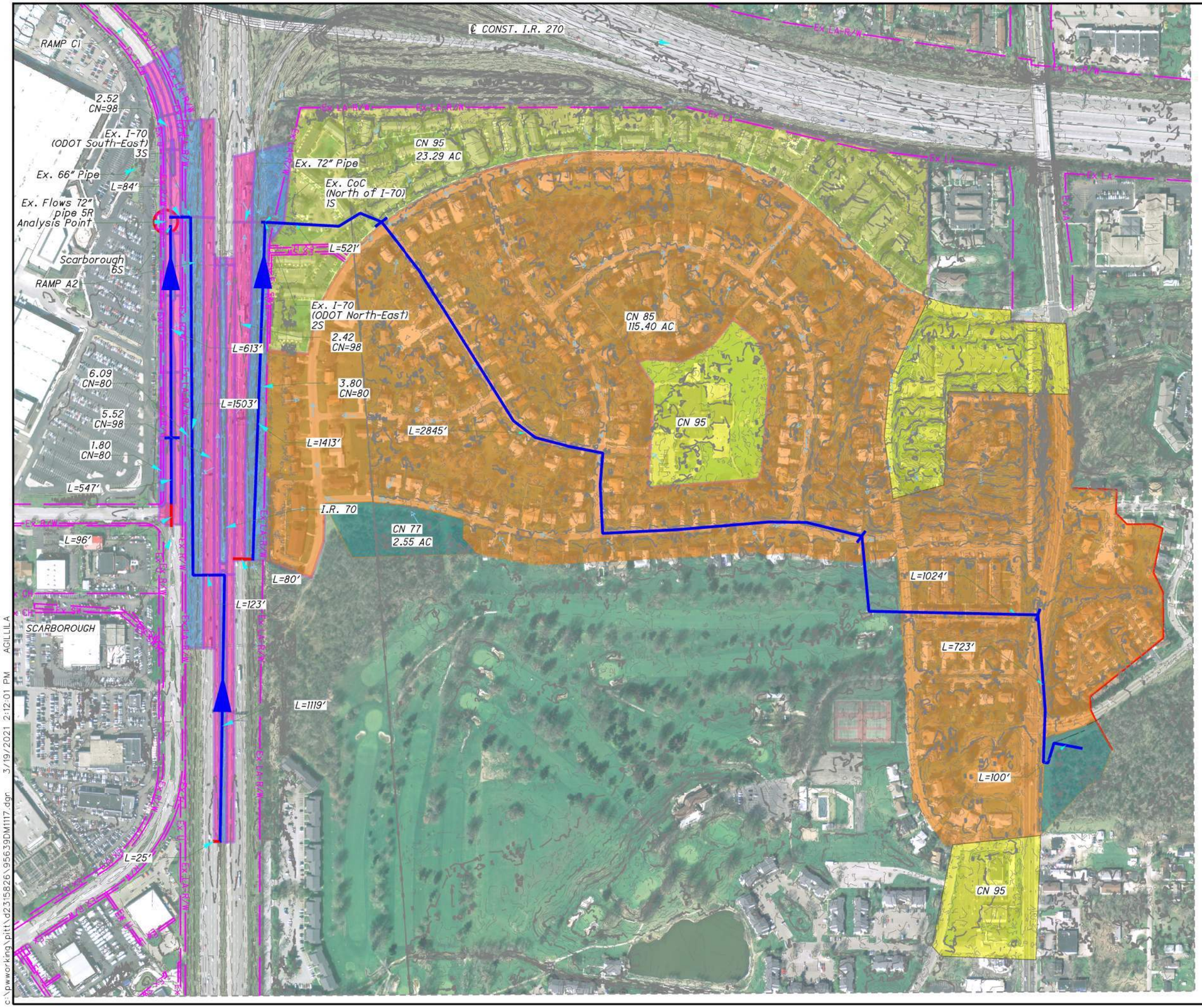
Inflow Area = 28.000 ac, 22.68% Impervious, Inflow Depth = 3.95" for 100-yr event
Inflow = 78.59 cfs @ 12.36 hrs, Volume= 9.227 af
Outflow = 78.59 cfs @ 12.36 hrs, Volume= 9.227 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Reach 2R: IR-270 Ex. 36" Storm - Existing Conditions



Appendix H – Peak flow Rate – Outlet 4



EXISTING DRAINAGE AREA MAP DOWNSTREAM 72" CONDUIT

FRA-70-22.61

1 1

HORIZONTAL SCALE IN FEET
0 100 200 400

CALCULATED SS CHECKED KAG

c:\pwworking\pitt\d2315826\i95639DM1117.dgn 3/19/2021 2:12:01 PM AGILILLA

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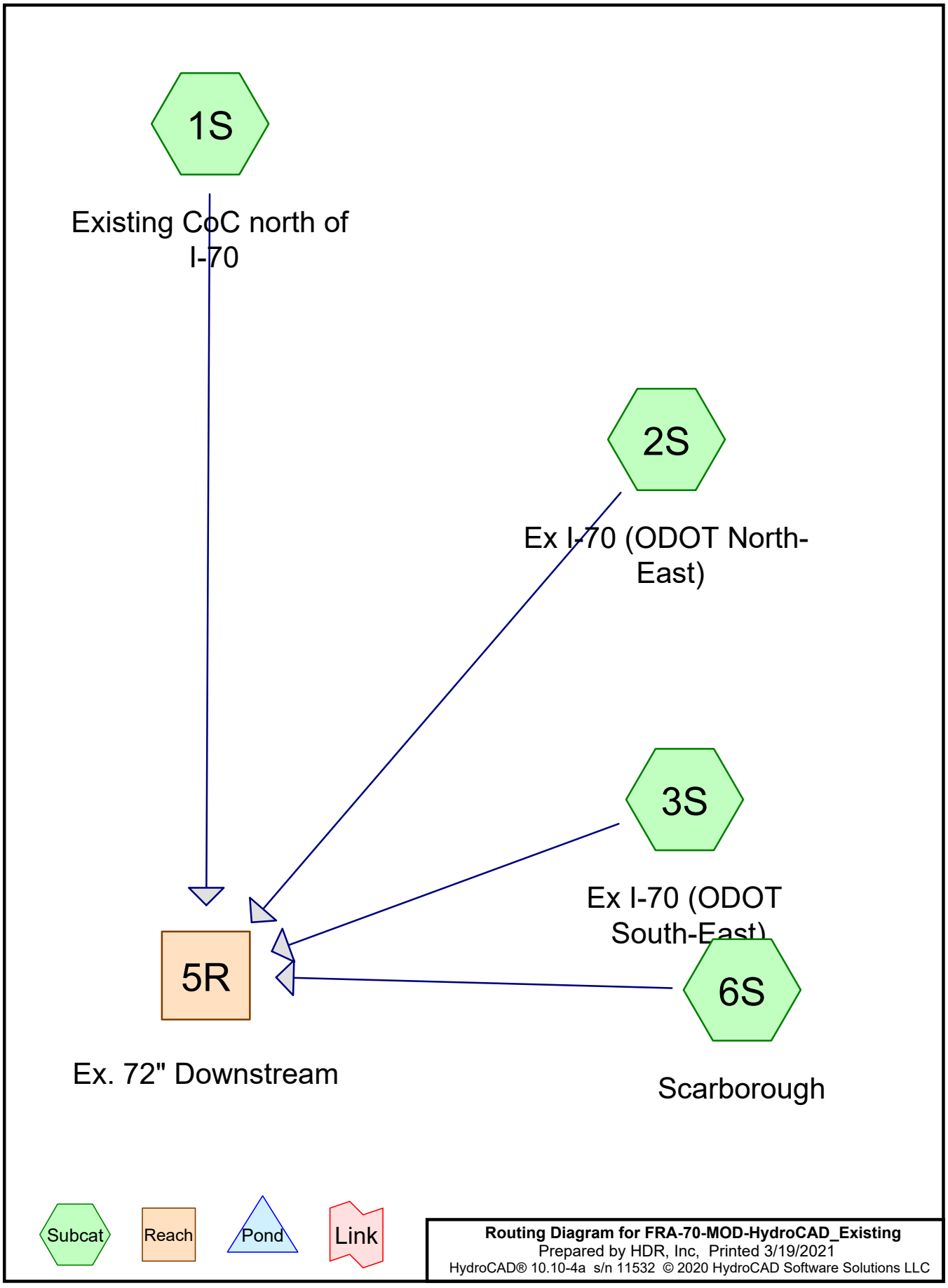


Routing Diagram for FRA-70-MOD-HydroCAD_Existing
Prepared by HDR, Inc, Printed 3/19/2021

Rainfall Events Listing (selected events)

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	2-yr	Type II 24-hr		Default	24.00	1	2.63	2
2	5-yr	Type II 24-hr		Default	24.00	1	3.24	2
3	10-yr	Type II 24-hr		Default	24.00	1	3.74	2
4	25-yr	Type II 24-hr		Default	24.00	1	4.44	2
5	50-yr	Type II 24-hr		Default	24.00	1	5.02	2
6	100-yr	Type II 24-hr		Default	24.00	1	5.63	2

Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcat Numbe
0.000	0.000	0.000	0.000	42.010	42.010	Business Complex (Apartment)&School	
0.000	0.000	0.000	4.942	0.000	4.942	Impervious Area	
0.000	0.000	0.000	0.000	5.522	5.522	Impervious area	
0.000	0.000	0.000	0.000	114.820	114.820	Residential	
0.000	0.000	0.000	1.800	6.087	7.887	Vegetative	
0.000	0.000	0.000	0.000	4.390	4.390	Woods	
0.000	0.000	0.000	3.805	0.000	3.805	Woods, Poor	
0.000	**0.000**	**0.000**	**10.547**	**172.829**	**183.376**	**TOTAL AREA**	

Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 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: Existing CoC north of Runoff Area=161.220 ac 0.00% Impervious Runoff Depth>1.29"
Flow Length=5,213' Tc=46.0 min CN=87 Runoff=147.58 cfs 17.372 af

Subcatchment2S: Ex I-70 (ODOT North- Runoff Area=6.227 ac 38.90% Impervious Runoff Depth>1.31"
Flow Length=1,493' Tc=16.2 min CN=87 Runoff=10.95 cfs 0.679 af

Subcatchment3S: Ex I-70 (ODOT Runoff Area=11.609 ac 47.57% Impervious Runoff Depth>1.44"
Flow Length=2,854' Tc=30.1 min CN=89 Runoff=15.74 cfs 1.397 af

Subcatchment6S: Scarborough Runoff Area=4.320 ac 58.33% Impervious Runoff Depth>1.61"
Flow Length=1,256' Tc=8.0 min CN=91 Runoff=11.93 cfs 0.580 af

Reach 5R: Ex. 72" Downstream Inflow=163.23 cfs 20.028 af
Outflow=163.23 cfs 20.028 af

Total Runoff Area = 183.376 ac Runoff Volume = 20.028 af Average Runoff Depth = 1.31"
94.29% Pervious = 172.912 ac 5.71% Impervious = 10.464 ac

Summary for Subcatchment 1S: Existing CoC north of I-70

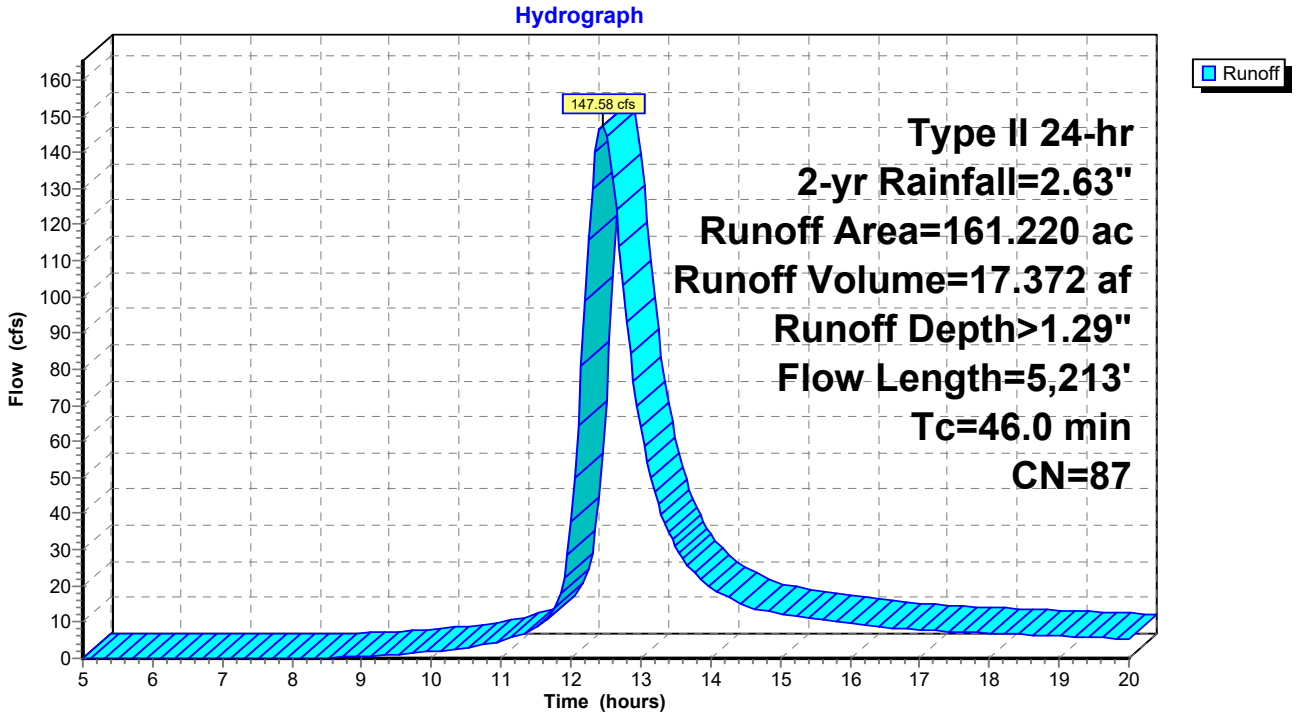
Runoff = 147.58 cfs @ 12.45 hrs, Volume= 17.372 af, Depth> 1.29"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 2-yr Rainfall=2.63"

	Area (ac)	CN	Description
*	4.390	77	Woods
*	114.820	85	Residential
*	42.010	95	Business Complex (Apartment)&School
	161.220	87	Weighted Average
	161.220		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
31.2	100	0.0100	0.05		**Sheet Flow, sheet flow** Woods: Light underbrush n= 0.400 P2= 2.64"
1.6	723	0.0223	7.34	5.76	**Pipe Channel, CMP_Round 12"** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.012 Concrete pipe, finished
2.3	1,024	0.0090	7.40	23.25	**Pipe Channel, CMP_Round 24"** 24.0" Round Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.012 Concrete pipe, finished
8.8	2,845	0.0028	5.41	38.23	**Pipe Channel, CMP_Round 36"** 36.0" Round Area= 7.1 sf Perim= 9.4' r= 0.75' n= 0.012 Concrete pipe, finished
2.1	521	0.0008	4.06	79.80	**Pipe Channel, CMP_Round 60"** 60.0" Round Area= 19.6 sf Perim= 15.7' r= 1.25' n= 0.012 Concrete pipe, finished
46.0	5,213	Total			

Subcatchment 1S: Existing CoC north of I-70



Summary for Subcatchment 2S: Ex I-70 (ODOT North- East)

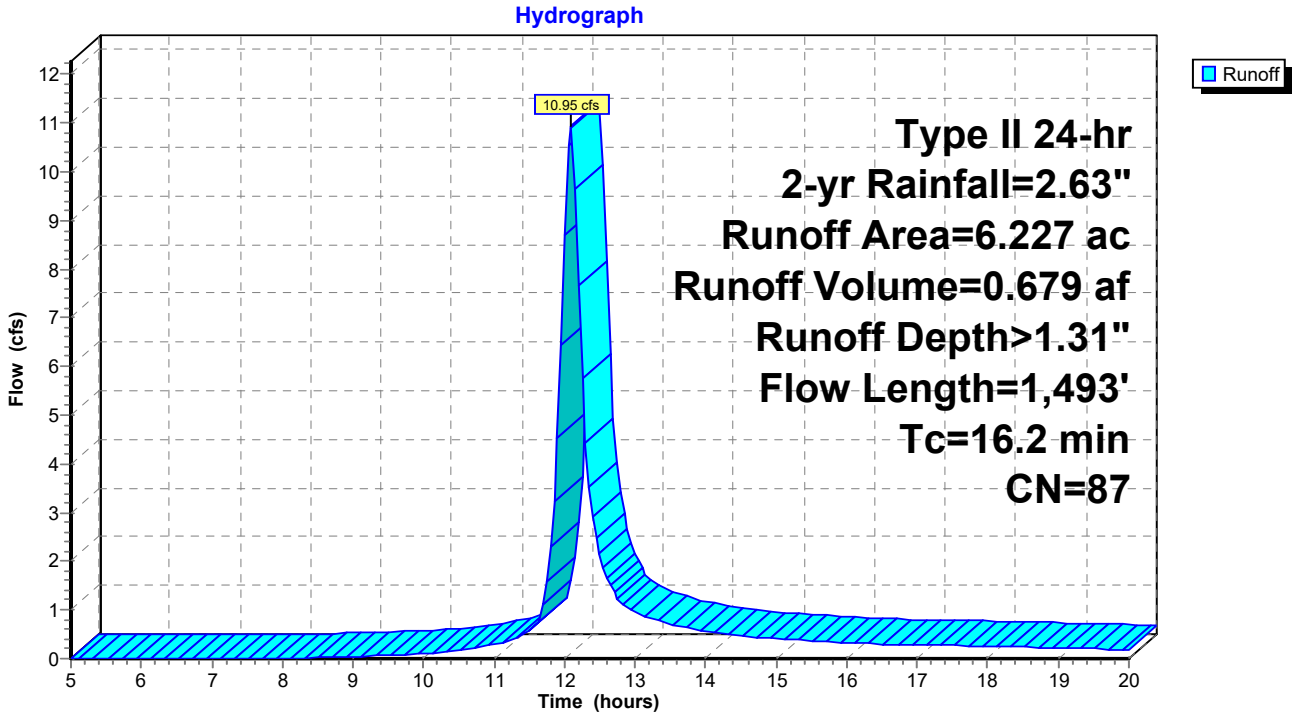
Runoff = 10.95 cfs @ 12.09 hrs, Volume= 0.679 af, Depth> 1.31"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 2-yr Rainfall=2.63"

	Area (ac)	CN	Description
*	2.422	98	Impervious Area, HSG D
*	3.805	80	Woods, Poor, HSG D
	6.227	87	Weighted Average
	3.805		61.10% Pervious Area
	2.422		38.90% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.7	80	0.0600	1.85		**Sheet Flow, Sheet Flow** Smooth surfaces n= 0.011 P2= 2.64"
15.5	1,413	0.0103	1.52		**Shallow Concentrated Flow, Roadside ditch** Grassed Waterway Kv= 15.0 fps
16.2	1,493	Total			

Subcatchment 2S: Ex I-70 (ODOT North- East)



Summary for Subcatchment 3S: Ex I-70 (ODOT South-East)

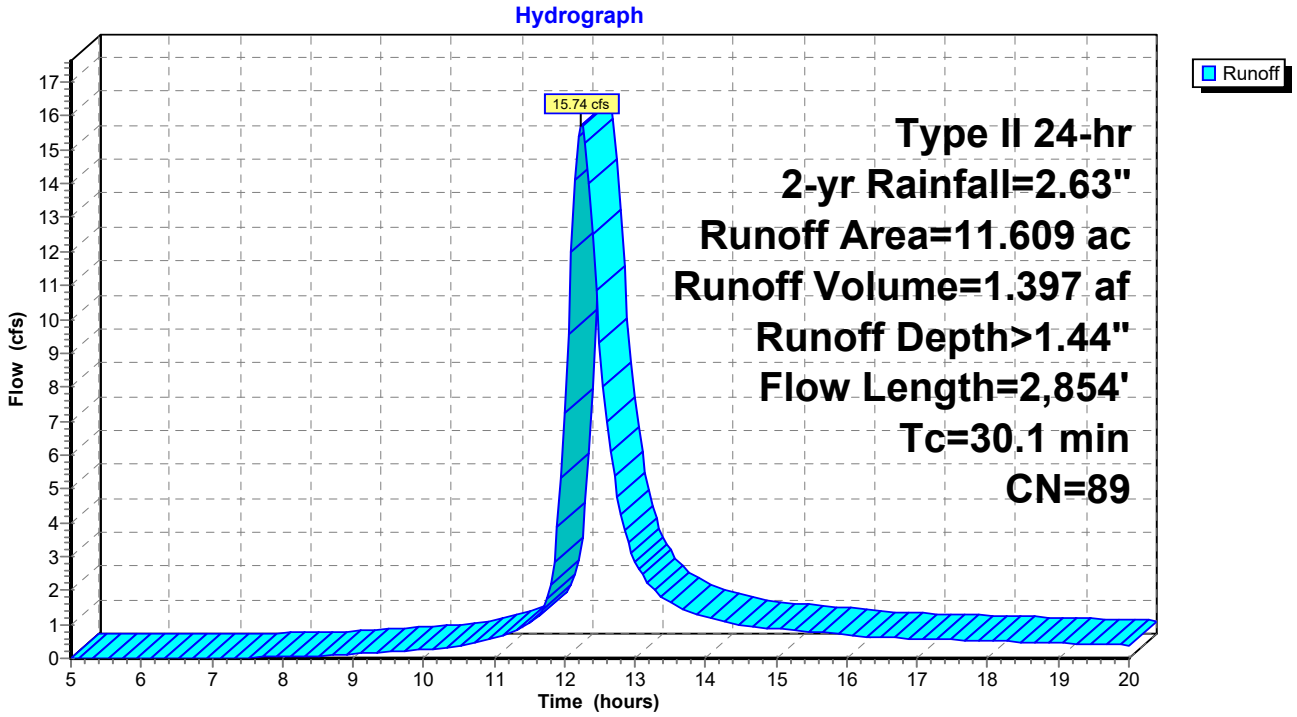
Runoff = 15.74 cfs @ 12.24 hrs, Volume= 1.397 af, Depth> 1.44"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 2-yr Rainfall=2.63"

	Area (ac)	CN	Description
*	5.522	98	Impervious area
*	6.087	80	Vegetative
	11.609	89	Weighted Average
	6.087		52.43% Pervious Area
	5.522		47.57% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.5	25	0.0186	0.92		**Sheet Flow, Sheet flow** Smooth surfaces n= 0.011 P2= 2.64"
12.4	1,119	0.0100	1.50		**Shallow Concentrated Flow, Grassed Median** Grassed Waterway Kv= 15.0 fps
0.3	123	0.0271	8.09	6.35	**Pipe Channel, CMP_Round 12"** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.012 Concrete pipe, finished
16.7	1,503	0.0100	1.50		**Shallow Concentrated Flow, Roadside ditch** Grassed Waterway Kv= 15.0 fps
0.2	84	0.0201	6.97	5.47	**Pipe Channel, CMP_Round 12"** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.012 Concrete pipe, finished
30.1	2,854	Total			

Subcatchment 3S: Ex I-70 (ODOT South-East)



Summary for Subcatchment 6S: Scarborough

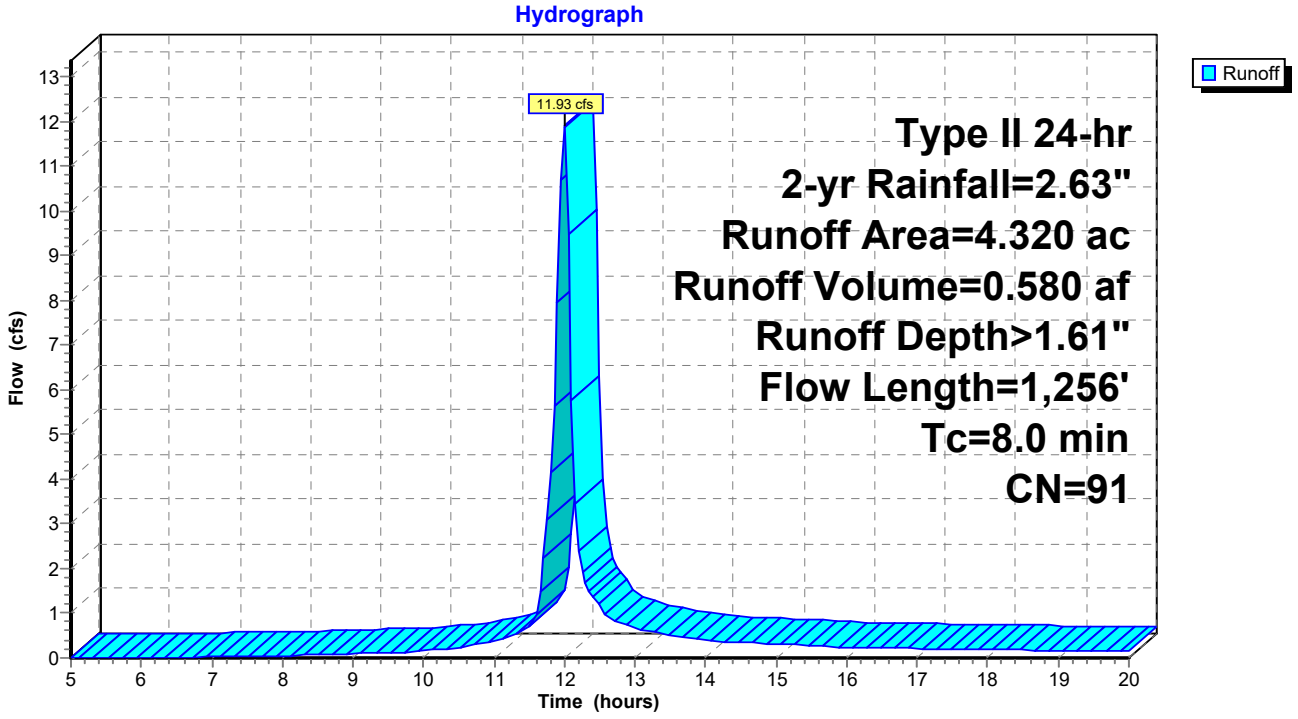
Runoff = 11.93 cfs @ 11.99 hrs, Volume= 0.580 af, Depth> 1.61"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 2-yr Rainfall=2.63"

	Area (ac)	CN	Description
*	2.520	98	Impervious Area, HSG D
*	1.800	80	Vegetative, HSG D
	4.320	91	Weighted Average
	1.800		41.67% Pervious Area
	2.520		58.33% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.2	96	0.0055	0.74		**Sheet Flow, Sheet flow** Smooth surfaces n= 0.011 P2= 2.64"
1.7	613	0.0092	6.18	10.92	**Pipe Channel, CMP_Round 18"** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.012 Concrete pipe, finished
4.1	547	0.0121	2.23		**Shallow Concentrated Flow, pavement** Paved Kv= 20.3 fps
8.0	1,256	Total			

Subcatchment 6S: Scarborough

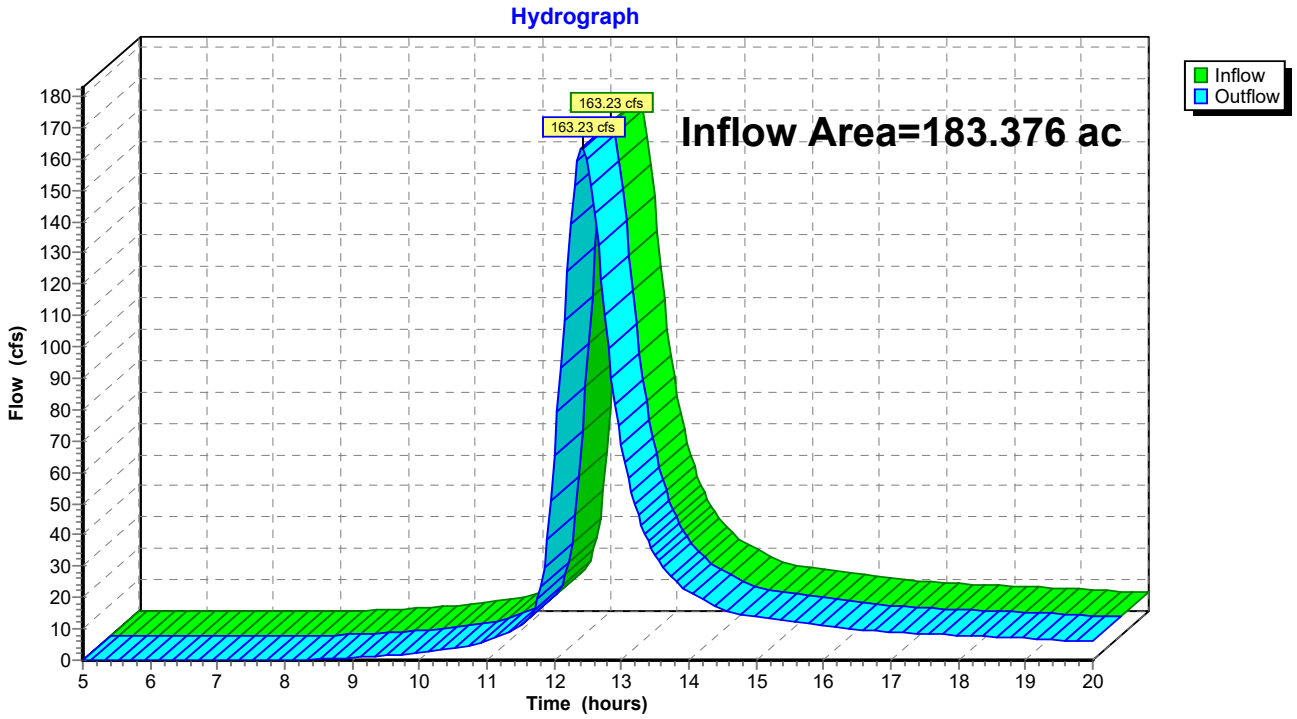


Summary for Reach 5R: Ex. 72" Downstream

Inflow Area = 183.376 ac, 5.71% Impervious, Inflow Depth > 1.31" for 2-yr event
Inflow = 163.23 cfs @ 12.42 hrs, Volume= 20.028 af
Outflow = 163.23 cfs @ 12.42 hrs, Volume= 20.028 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Reach 5R: Ex. 72" Downstream



Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 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: Existing CoC north of Runoff Area=161.220 ac 0.00% Impervious Runoff Depth>1.79"
Flow Length=5,213' Tc=46.0 min CN=87 Runoff=203.53 cfs 23.990 af

Subcatchment2S: Ex I-70 (ODOT North- Runoff Area=6.227 ac 38.90% Impervious Runoff Depth>1.80"
Flow Length=1,493' Tc=16.2 min CN=87 Runoff=14.98 cfs 0.936 af

Subcatchment3S: Ex I-70 (ODOT Runoff Area=11.609 ac 47.57% Impervious Runoff Depth>1.96"
Flow Length=2,854' Tc=30.1 min CN=89 Runoff=21.19 cfs 1.895 af

Subcatchment6S: Scarborough Runoff Area=4.320 ac 58.33% Impervious Runoff Depth>2.15"
Flow Length=1,256' Tc=8.0 min CN=91 Runoff=15.62 cfs 0.773 af

Reach 5R: Ex. 72" Downstream Inflow=224.66 cfs 27.594 af
Outflow=224.66 cfs 27.594 af

Total Runoff Area = 183.376 ac Runoff Volume = 27.594 af Average Runoff Depth = 1.81"
94.29% Pervious = 172.912 ac 5.71% Impervious = 10.464 ac

Summary for Subcatchment 1S: Existing CoC north of I-70

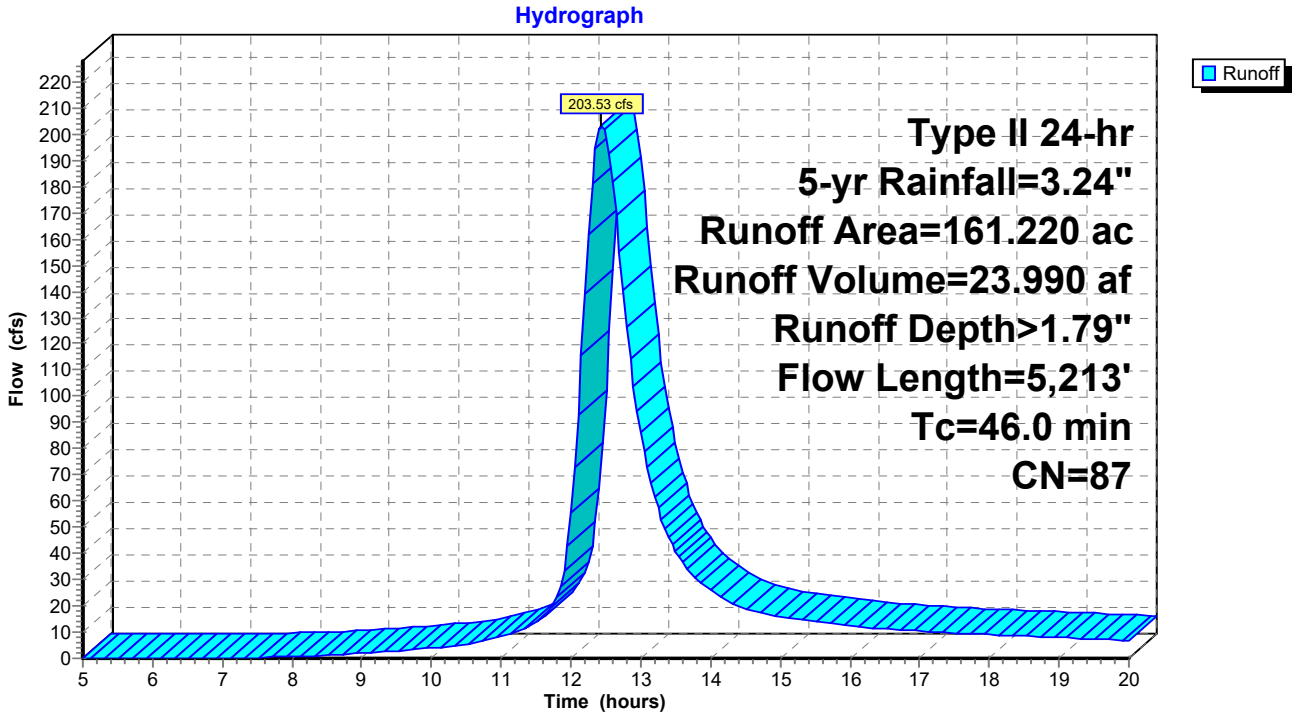
Runoff = 203.53 cfs @ 12.44 hrs, Volume= 23.990 af, Depth> 1.79"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 5-yr Rainfall=3.24"

	Area (ac)	CN	Description
*	4.390	77	Woods
*	114.820	85	Residential
*	42.010	95	Business Complex (Apartment)&School
	161.220	87	Weighted Average
	161.220		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
31.2	100	0.0100	0.05		**Sheet Flow, sheet flow** Woods: Light underbrush n= 0.400 P2= 2.64"
1.6	723	0.0223	7.34	5.76	**Pipe Channel, CMP_Round 12"** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.012 Concrete pipe, finished
2.3	1,024	0.0090	7.40	23.25	**Pipe Channel, CMP_Round 24"** 24.0" Round Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.012 Concrete pipe, finished
8.8	2,845	0.0028	5.41	38.23	**Pipe Channel, CMP_Round 36"** 36.0" Round Area= 7.1 sf Perim= 9.4' r= 0.75' n= 0.012 Concrete pipe, finished
2.1	521	0.0008	4.06	79.80	**Pipe Channel, CMP_Round 60"** 60.0" Round Area= 19.6 sf Perim= 15.7' r= 1.25' n= 0.012 Concrete pipe, finished
46.0	5,213	Total			

Subcatchment 1S: Existing CoC north of I-70



Summary for Subcatchment 2S: Ex I-70 (ODOT North- East)

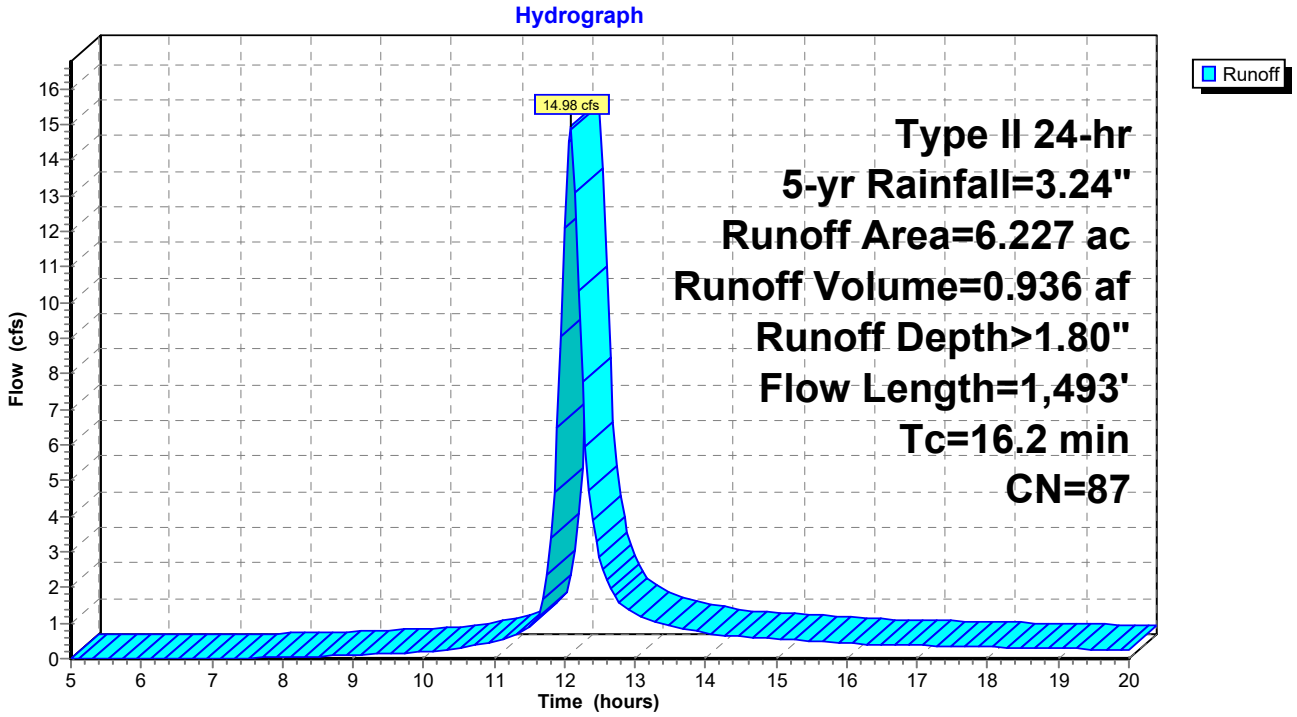
Runoff = 14.98 cfs @ 12.08 hrs, Volume= 0.936 af, Depth> 1.80"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 5-yr Rainfall=3.24"

	Area (ac)	CN	Description
*	2.422	98	Impervious Area, HSG D
*	3.805	80	Woods, Poor, HSG D
	6.227	87	Weighted Average
	3.805		61.10% Pervious Area
	2.422		38.90% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.7	80	0.0600	1.85		**Sheet Flow, Sheet Flow** Smooth surfaces n= 0.011 P2= 2.64"
15.5	1,413	0.0103	1.52		**Shallow Concentrated Flow, Roadside ditch** Grassed Waterway Kv= 15.0 fps
16.2	1,493	Total			

Subcatchment 2S: Ex I-70 (ODOT North- East)



Summary for Subcatchment 3S: Ex I-70 (ODOT South-East)

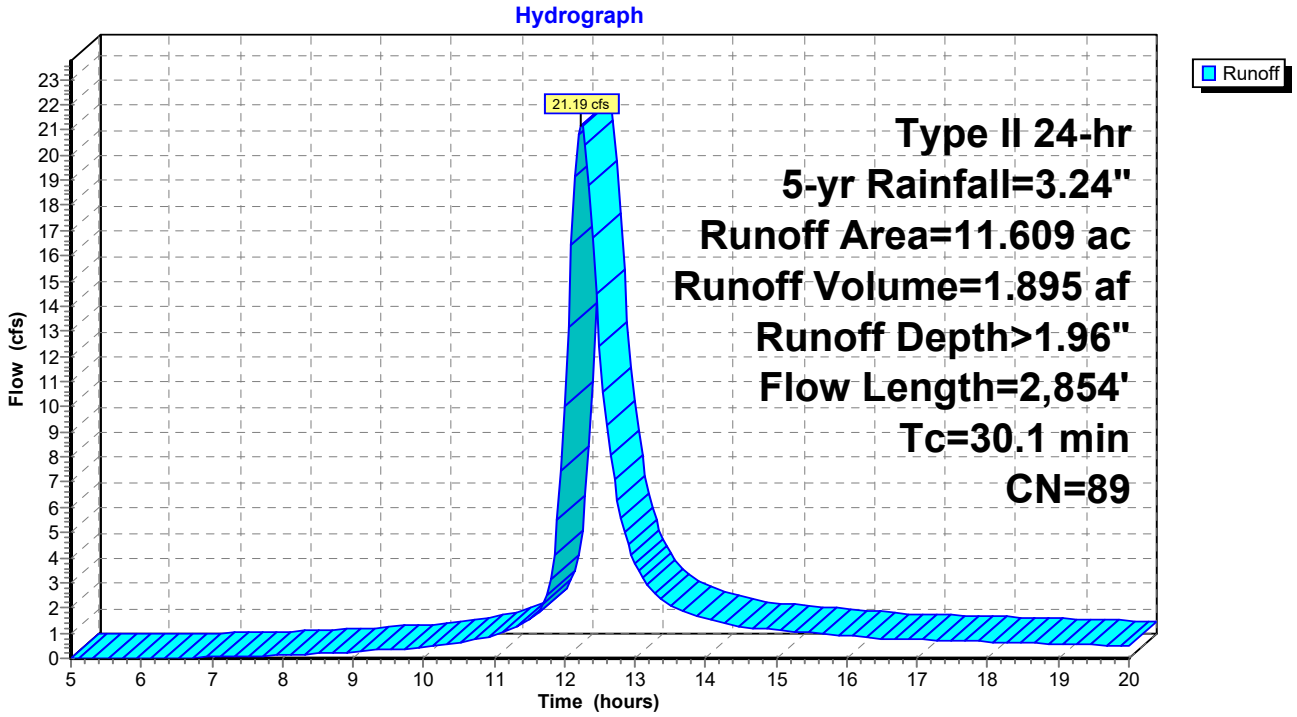
Runoff = 21.19 cfs @ 12.24 hrs, Volume= 1.895 af, Depth> 1.96"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 5-yr Rainfall=3.24"

	Area (ac)	CN	Description
*	5.522	98	Impervious area
*	6.087	80	Vegetative
	11.609	89	Weighted Average
	6.087		52.43% Pervious Area
	5.522		47.57% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.5	25	0.0186	0.92		**Sheet Flow, Sheet flow** Smooth surfaces n= 0.011 P2= 2.64"
12.4	1,119	0.0100	1.50		**Shallow Concentrated Flow, Grassed Median** Grassed Waterway Kv= 15.0 fps
0.3	123	0.0271	8.09	6.35	**Pipe Channel, CMP_Round 12"** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.012 Concrete pipe, finished
16.7	1,503	0.0100	1.50		**Shallow Concentrated Flow, Roadside ditch** Grassed Waterway Kv= 15.0 fps
0.2	84	0.0201	6.97	5.47	**Pipe Channel, CMP_Round 12"** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.012 Concrete pipe, finished
30.1	2,854	Total			

Subcatchment 3S: Ex I-70 (ODOT South-East)



Summary for Subcatchment 6S: Scarborough

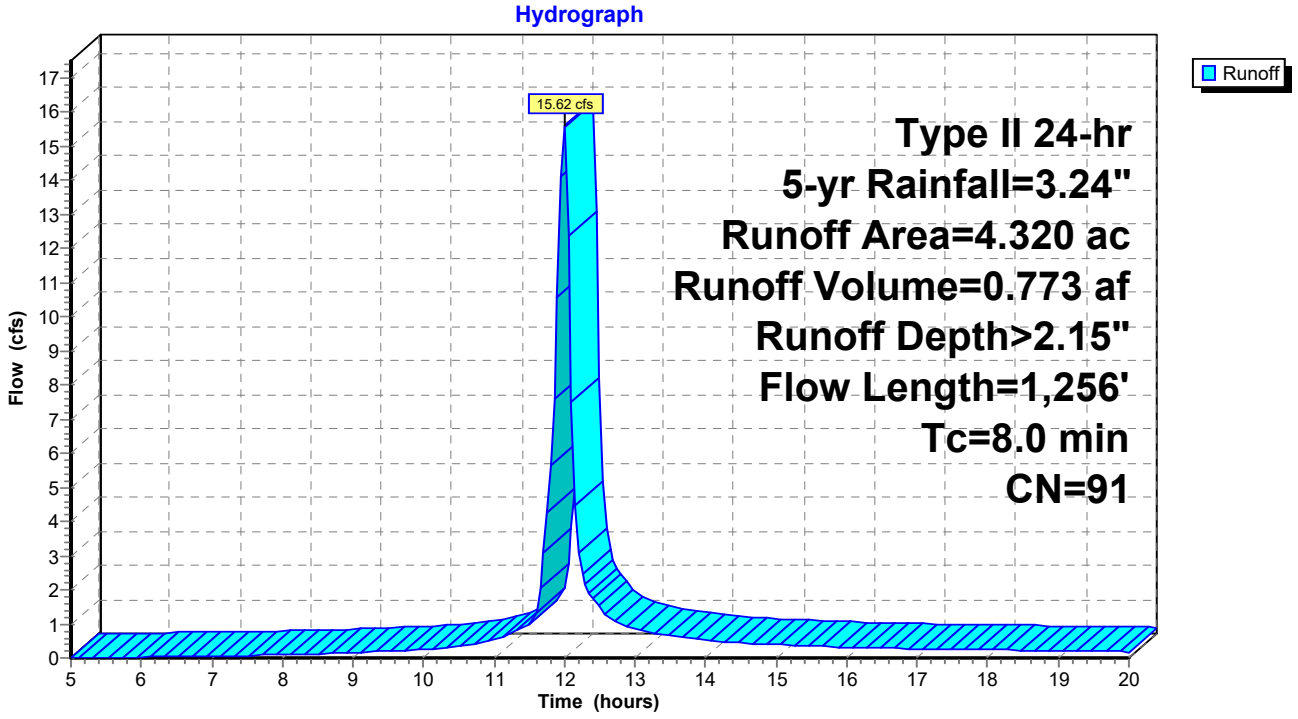
Runoff = 15.62 cfs @ 11.99 hrs, Volume= 0.773 af, Depth> 2.15"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 5-yr Rainfall=3.24"

	Area (ac)	CN	Description
*	2.520	98	Impervious Area, HSG D
*	1.800	80	Vegetative, HSG D
	4.320	91	Weighted Average
	1.800		41.67% Pervious Area
	2.520		58.33% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.2	96	0.0055	0.74		**Sheet Flow, Sheet flow** Smooth surfaces n= 0.011 P2= 2.64"
1.7	613	0.0092	6.18	10.92	**Pipe Channel, CMP_Round 18"** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.012 Concrete pipe, finished
4.1	547	0.0121	2.23		**Shallow Concentrated Flow, pavement** Paved Kv= 20.3 fps
8.0	1,256	Total			

Subcatchment 6S: Scarborough

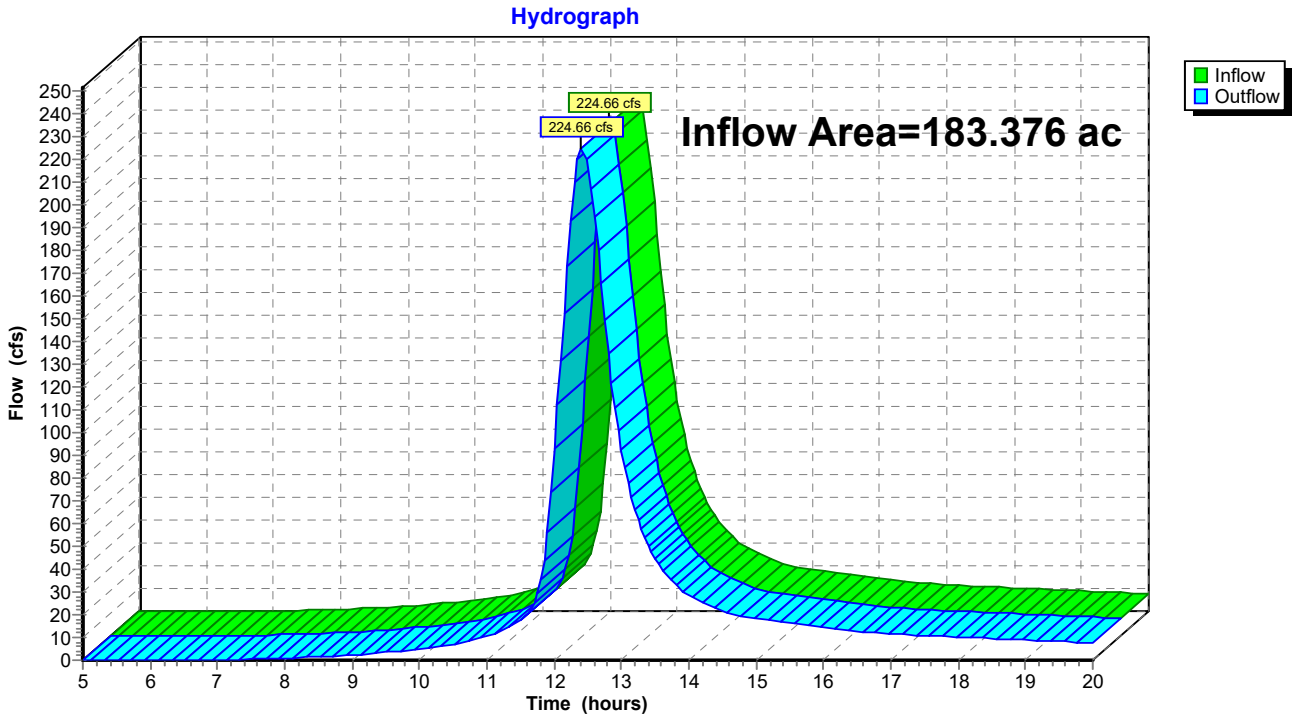


Summary for Reach 5R: Ex. 72" Downstream

Inflow Area = 183.376 ac, 5.71% Impervious, Inflow Depth > 1.81" for 5-yr event
Inflow = 224.66 cfs @ 12.41 hrs, Volume= 27.594 af
Outflow = 224.66 cfs @ 12.41 hrs, Volume= 27.594 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Reach 5R: Ex. 72" Downstream



Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 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: Existing CoC north of Runoff Area=161.220 ac 0.00% Impervious Runoff Depth>2.20"
Flow Length=5,213' Tc=46.0 min CN=87 Runoff=250.39 cfs 29.616 af

Subcatchment2S: Ex I-70 (ODOT North- Runoff Area=6.227 ac 38.90% Impervious Runoff Depth>2.23"
Flow Length=1,493' Tc=16.2 min CN=87 Runoff=18.35 cfs 1.155 af

Subcatchment3S: Ex I-70 (ODOT Runoff Area=11.609 ac 47.57% Impervious Runoff Depth>2.39"
Flow Length=2,854' Tc=30.1 min CN=89 Runoff=25.71 cfs 2.314 af

Subcatchment6S: Scarborough Runoff Area=4.320 ac 58.33% Impervious Runoff Depth>2.59"
Flow Length=1,256' Tc=8.0 min CN=91 Runoff=18.64 cfs 0.933 af

Reach 5R: Ex. 72" Downstream Inflow=276.07 cfs 34.019 af
Outflow=276.07 cfs 34.019 af

Total Runoff Area = 183.376 ac Runoff Volume = 34.019 af Average Runoff Depth = 2.23"
94.29% Pervious = 172.912 ac 5.71% Impervious = 10.464 ac

Summary for Subcatchment 1S: Existing CoC north of I-70

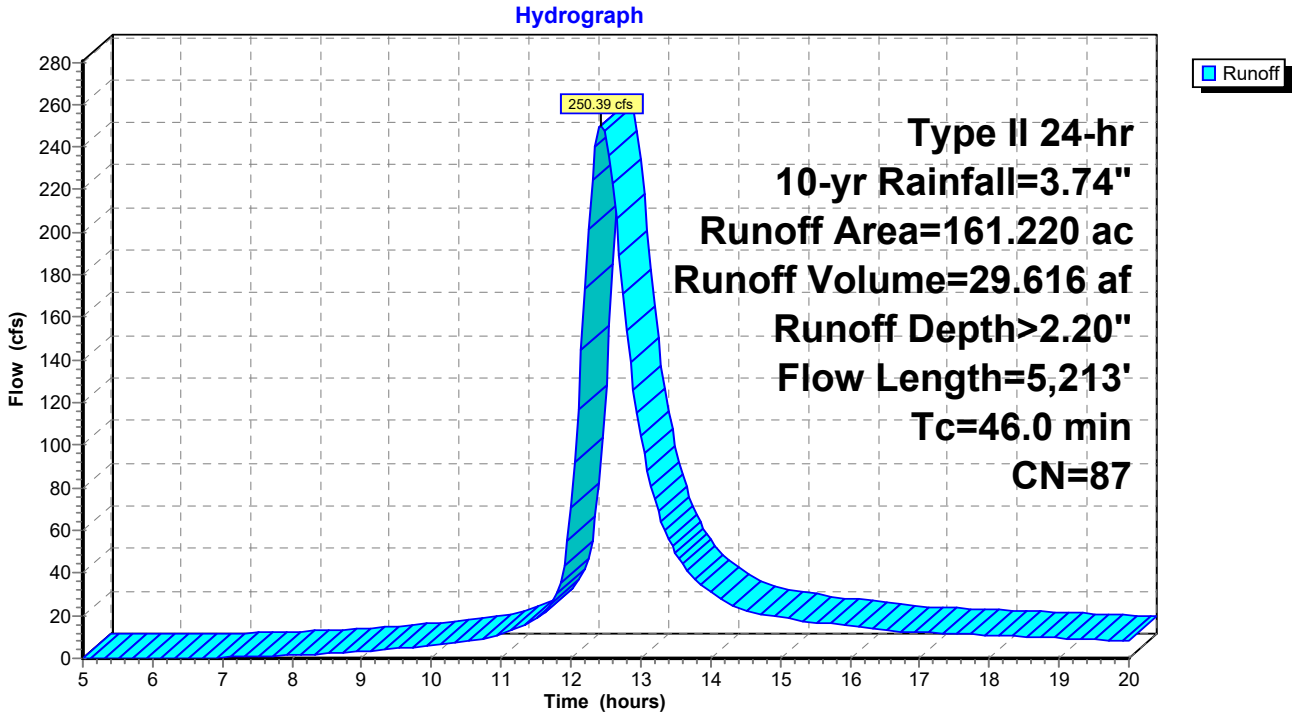
Runoff = 250.39 cfs @ 12.43 hrs, Volume= 29.616 af, Depth> 2.20"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-yr Rainfall=3.74"

	Area (ac)	CN	Description
*	4.390	77	Woods
*	114.820	85	Residential
*	42.010	95	Business Complex (Apartment)&School
	161.220	87	Weighted Average
	161.220		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
31.2	100	0.0100	0.05		**Sheet Flow, sheet flow** Woods: Light underbrush n= 0.400 P2= 2.64"
1.6	723	0.0223	7.34	5.76	**Pipe Channel, CMP_Round 12"** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.012 Concrete pipe, finished
2.3	1,024	0.0090	7.40	23.25	**Pipe Channel, CMP_Round 24"** 24.0" Round Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.012 Concrete pipe, finished
8.8	2,845	0.0028	5.41	38.23	**Pipe Channel, CMP_Round 36"** 36.0" Round Area= 7.1 sf Perim= 9.4' r= 0.75' n= 0.012 Concrete pipe, finished
2.1	521	0.0008	4.06	79.80	**Pipe Channel, CMP_Round 60"** 60.0" Round Area= 19.6 sf Perim= 15.7' r= 1.25' n= 0.012 Concrete pipe, finished
46.0	5,213	Total			

Subcatchment 1S: Existing CoC north of I-70



Summary for Subcatchment 2S: Ex I-70 (ODOT North- East)

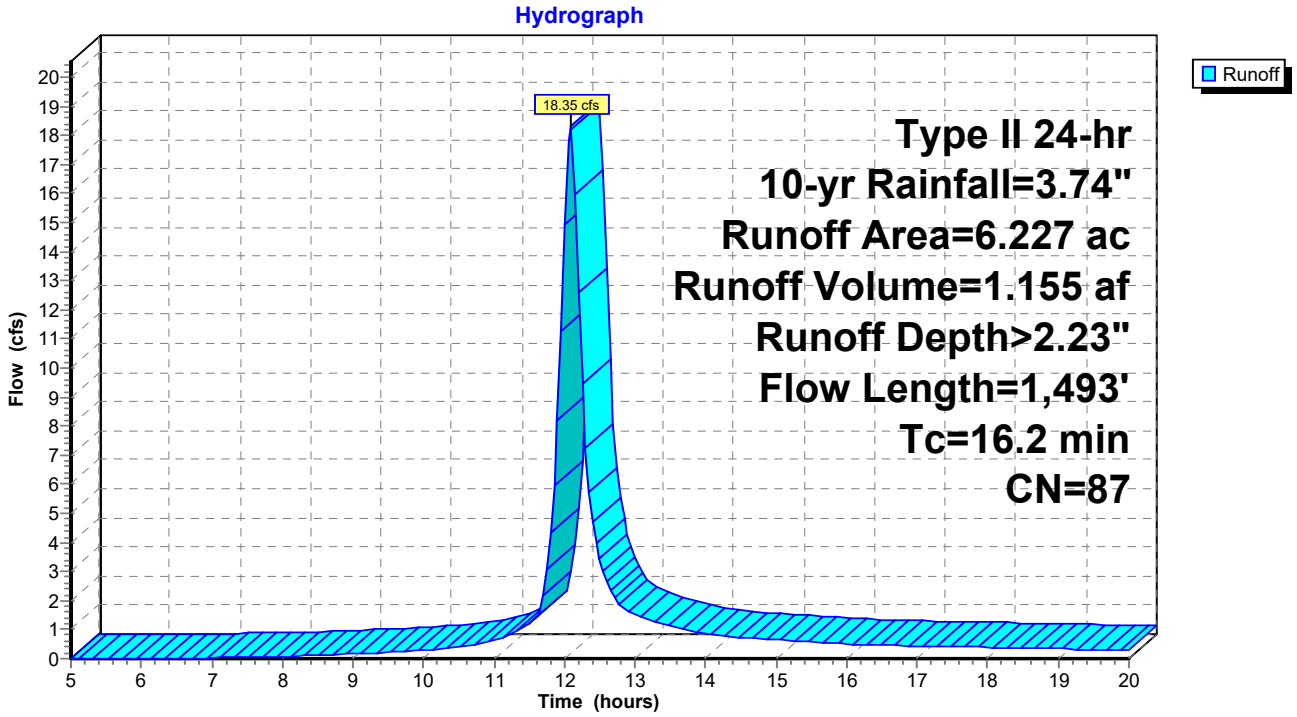
Runoff = 18.35 cfs @ 12.08 hrs, Volume= 1.155 af, Depth> 2.23"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-yr Rainfall=3.74"

	Area (ac)	CN	Description
*	2.422	98	Impervious Area, HSG D
*	3.805	80	Woods, Poor, HSG D
	6.227	87	Weighted Average
	3.805		61.10% Pervious Area
	2.422		38.90% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.7	80	0.0600	1.85		**Sheet Flow, Sheet Flow** Smooth surfaces n= 0.011 P2= 2.64"
15.5	1,413	0.0103	1.52		**Shallow Concentrated Flow, Roadside ditch** Grassed Waterway Kv= 15.0 fps
16.2	1,493	Total			

Subcatchment 2S: Ex I-70 (ODOT North- East)



Summary for Subcatchment 3S: Ex I-70 (ODOT South-East)

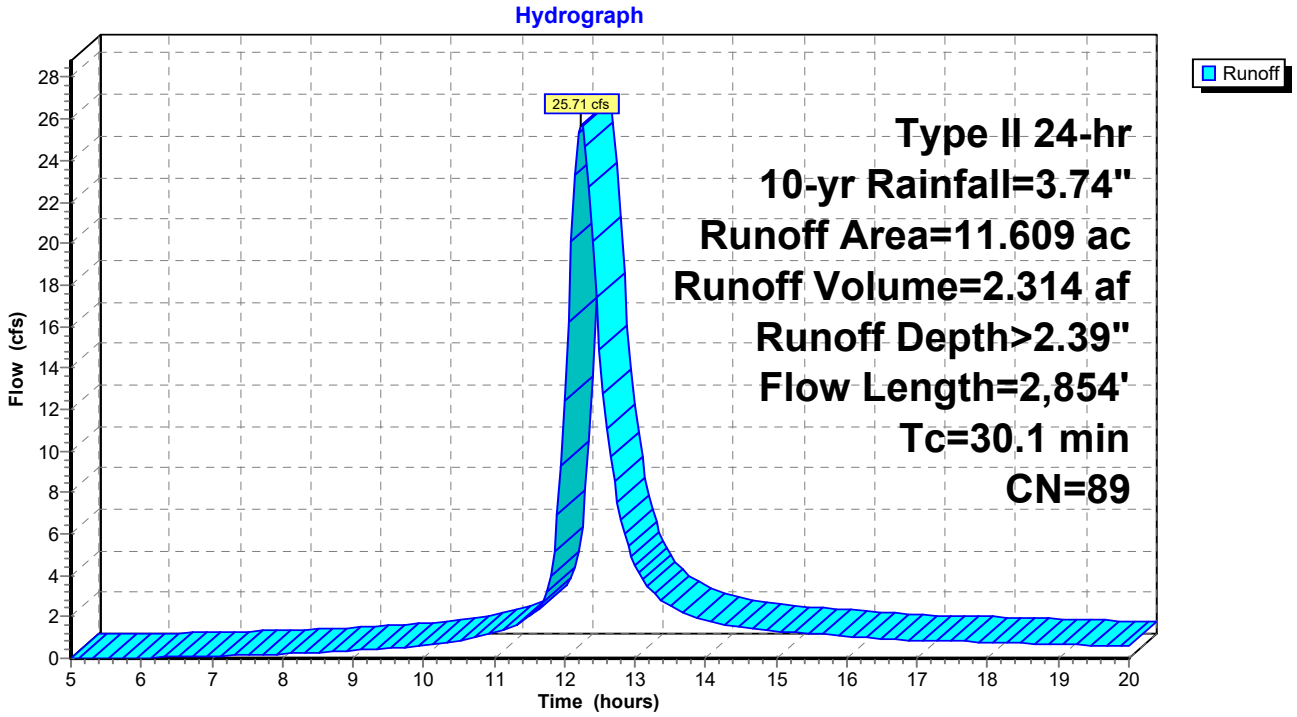
Runoff = 25.71 cfs @ 12.24 hrs, Volume= 2.314 af, Depth> 2.39"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-yr Rainfall=3.74"

	Area (ac)	CN	Description
*	5.522	98	Impervious area
*	6.087	80	Vegetative
	11.609	89	Weighted Average
	6.087		52.43% Pervious Area
	5.522		47.57% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.5	25	0.0186	0.92		**Sheet Flow, Sheet flow** Smooth surfaces n= 0.011 P2= 2.64"
12.4	1,119	0.0100	1.50		**Shallow Concentrated Flow, Grassed Median** Grassed Waterway Kv= 15.0 fps
0.3	123	0.0271	8.09	6.35	**Pipe Channel, CMP_Round 12"** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.012 Concrete pipe, finished
16.7	1,503	0.0100	1.50		**Shallow Concentrated Flow, Roadside ditch** Grassed Waterway Kv= 15.0 fps
0.2	84	0.0201	6.97	5.47	**Pipe Channel, CMP_Round 12"** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.012 Concrete pipe, finished
30.1	2,854	Total			

Subcatchment 3S: Ex I-70 (ODOT South-East)



Summary for Subcatchment 6S: Scarborough

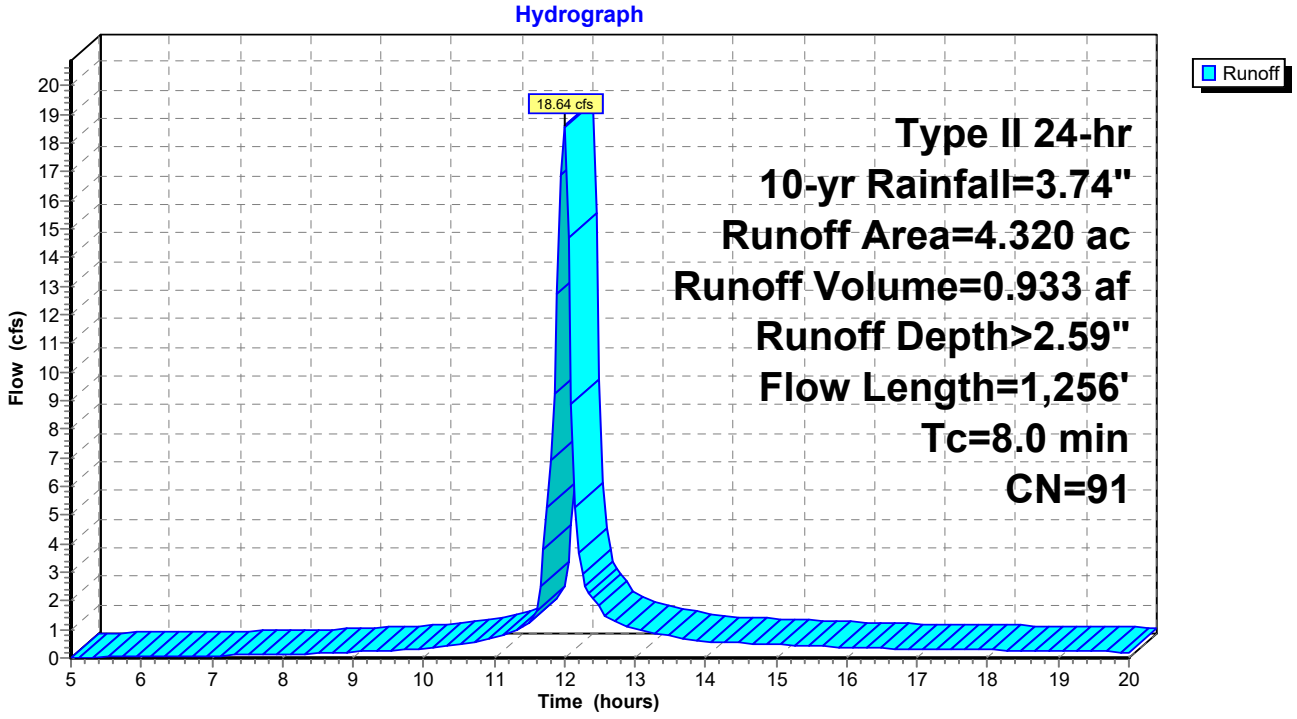
Runoff = 18.64 cfs @ 11.99 hrs, Volume= 0.933 af, Depth> 2.59"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-yr Rainfall=3.74"

	Area (ac)	CN	Description
*	2.520	98	Impervious Area, HSG D
*	1.800	80	Vegetative, HSG D
	4.320	91	Weighted Average
	1.800		41.67% Pervious Area
	2.520		58.33% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.2	96	0.0055	0.74		**Sheet Flow, Sheet flow** Smooth surfaces n= 0.011 P2= 2.64"
1.7	613	0.0092	6.18	10.92	**Pipe Channel, CMP_Round 18"** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.012 Concrete pipe, finished
4.1	547	0.0121	2.23		**Shallow Concentrated Flow, pavement** Paved Kv= 20.3 fps
8.0	1,256	Total			

Subcatchment 6S: Scarborough

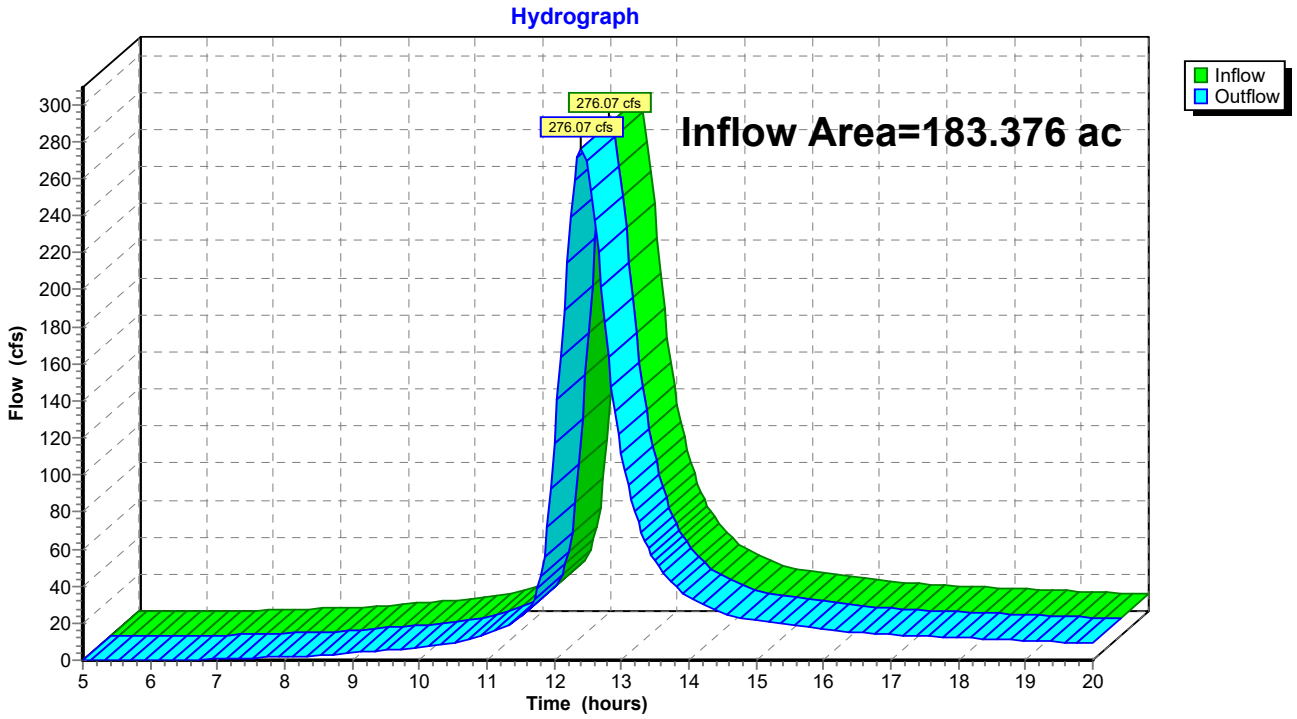


Summary for Reach 5R: Ex. 72" Downstream

Inflow Area = 183.376 ac, 5.71% Impervious, Inflow Depth > 2.23" for 10-yr event
Inflow = 276.07 cfs @ 12.41 hrs, Volume= 34.019 af
Outflow = 276.07 cfs @ 12.41 hrs, Volume= 34.019 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Reach 5R: Ex. 72" Downstream



Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 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: Existing CoC north of Runoff Area=161.220 ac 0.00% Impervious Runoff Depth>2.81"
Flow Length=5,213' Tc=46.0 min CN=87 Runoff=316.77 cfs 37.699 af

Subcatchment2S: Ex I-70 (ODOT North- Runoff Area=6.227 ac 38.90% Impervious Runoff Depth>2.83"
Flow Length=1,493' Tc=16.2 min CN=87 Runoff=23.10 cfs 1.470 af

Subcatchment3S: Ex I-70 (ODOT Runoff Area=11.609 ac 47.57% Impervious Runoff Depth>3.01"
Flow Length=2,854' Tc=30.1 min CN=89 Runoff=32.07 cfs 2.913 af

Subcatchment6S: Scarborough Runoff Area=4.320 ac 58.33% Impervious Runoff Depth>3.22"
Flow Length=1,256' Tc=8.0 min CN=91 Runoff=22.86 cfs 1.161 af

Reach 5R: Ex. 72" Downstream Inflow=348.85 cfs 43.243 af
Outflow=348.85 cfs 43.243 af

Total Runoff Area = 183.376 ac Runoff Volume = 43.243 af Average Runoff Depth = 2.83"
94.29% Pervious = 172.912 ac 5.71% Impervious = 10.464 ac

Summary for Subcatchment 1S: Existing CoC north of I-70

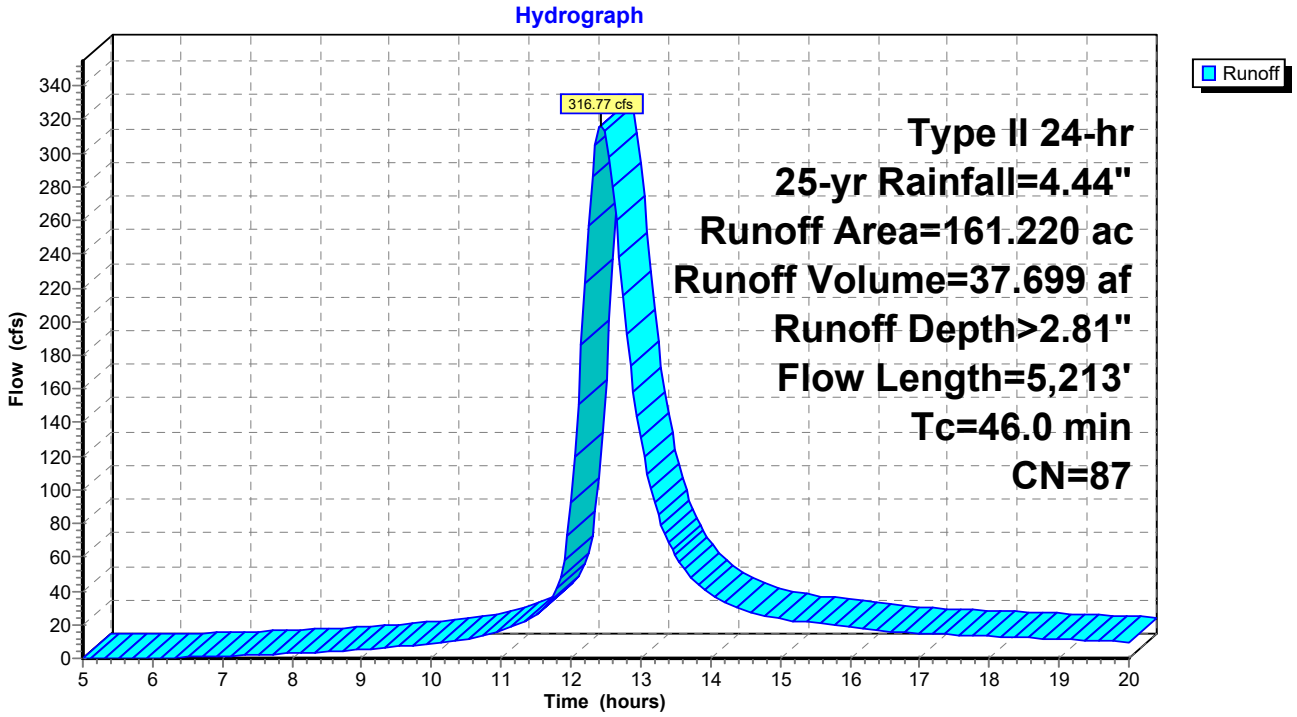
Runoff = 316.77 cfs @ 12.43 hrs, Volume= 37.699 af, Depth> 2.81"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr Rainfall=4.44"

	Area (ac)	CN	Description
*	4.390	77	Woods
*	114.820	85	Residential
*	42.010	95	Business Complex (Apartment)&School
	161.220	87	Weighted Average
	161.220		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
31.2	100	0.0100	0.05		**Sheet Flow, sheet flow** Woods: Light underbrush n= 0.400 P2= 2.64"
1.6	723	0.0223	7.34	5.76	**Pipe Channel, CMP_Round 12"** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.012 Concrete pipe, finished
2.3	1,024	0.0090	7.40	23.25	**Pipe Channel, CMP_Round 24"** 24.0" Round Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.012 Concrete pipe, finished
8.8	2,845	0.0028	5.41	38.23	**Pipe Channel, CMP_Round 36"** 36.0" Round Area= 7.1 sf Perim= 9.4' r= 0.75' n= 0.012 Concrete pipe, finished
2.1	521	0.0008	4.06	79.80	**Pipe Channel, CMP_Round 60"** 60.0" Round Area= 19.6 sf Perim= 15.7' r= 1.25' n= 0.012 Concrete pipe, finished
46.0	5,213	Total			

Subcatchment 1S: Existing CoC north of I-70



Summary for Subcatchment 2S: Ex I-70 (ODOT North- East)

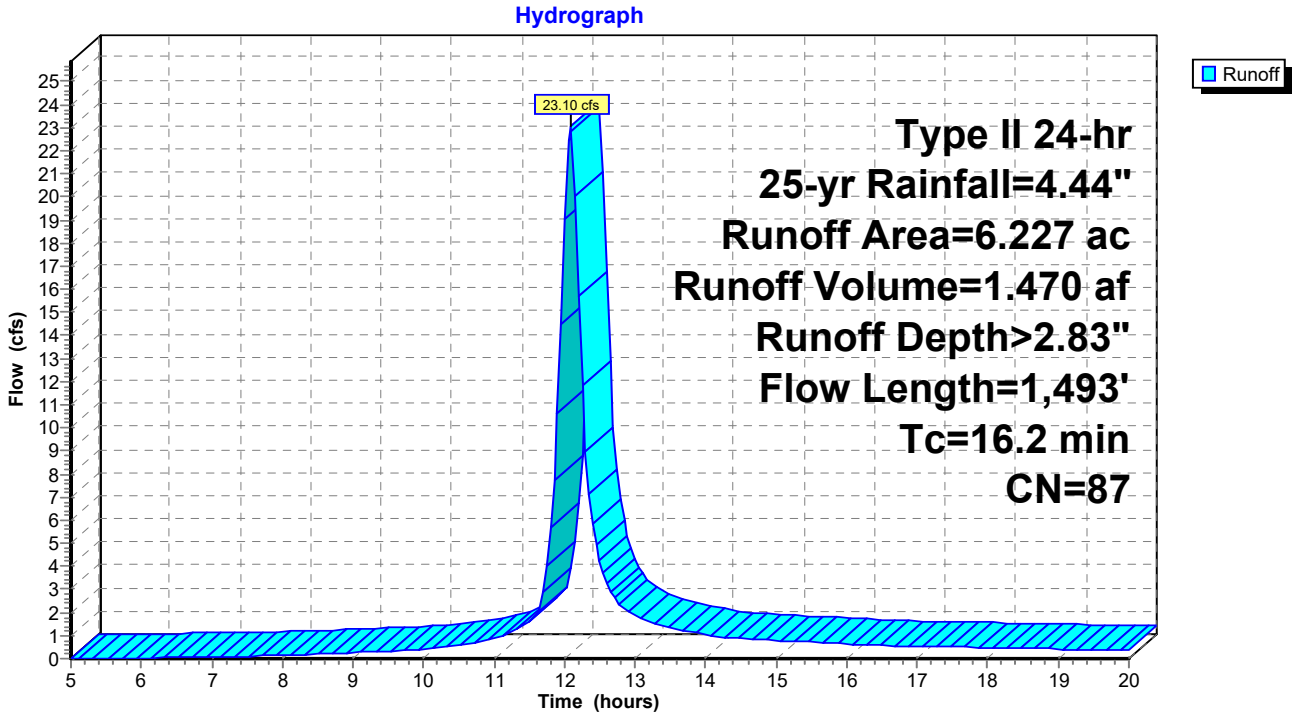
Runoff = 23.10 cfs @ 12.08 hrs, Volume= 1.470 af, Depth> 2.83"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr Rainfall=4.44"

	Area (ac)	CN	Description
*	2.422	98	Impervious Area, HSG D
*	3.805	80	Woods, Poor, HSG D
	6.227	87	Weighted Average
	3.805		61.10% Pervious Area
	2.422		38.90% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.7	80	0.0600	1.85		**Sheet Flow, Sheet Flow** Smooth surfaces n= 0.011 P2= 2.64"
15.5	1,413	0.0103	1.52		**Shallow Concentrated Flow, Roadside ditch** Grassed Waterway Kv= 15.0 fps
16.2	1,493	Total			

Subcatchment 2S: Ex I-70 (ODOT North- East)



Summary for Subcatchment 3S: Ex I-70 (ODOT South-East)

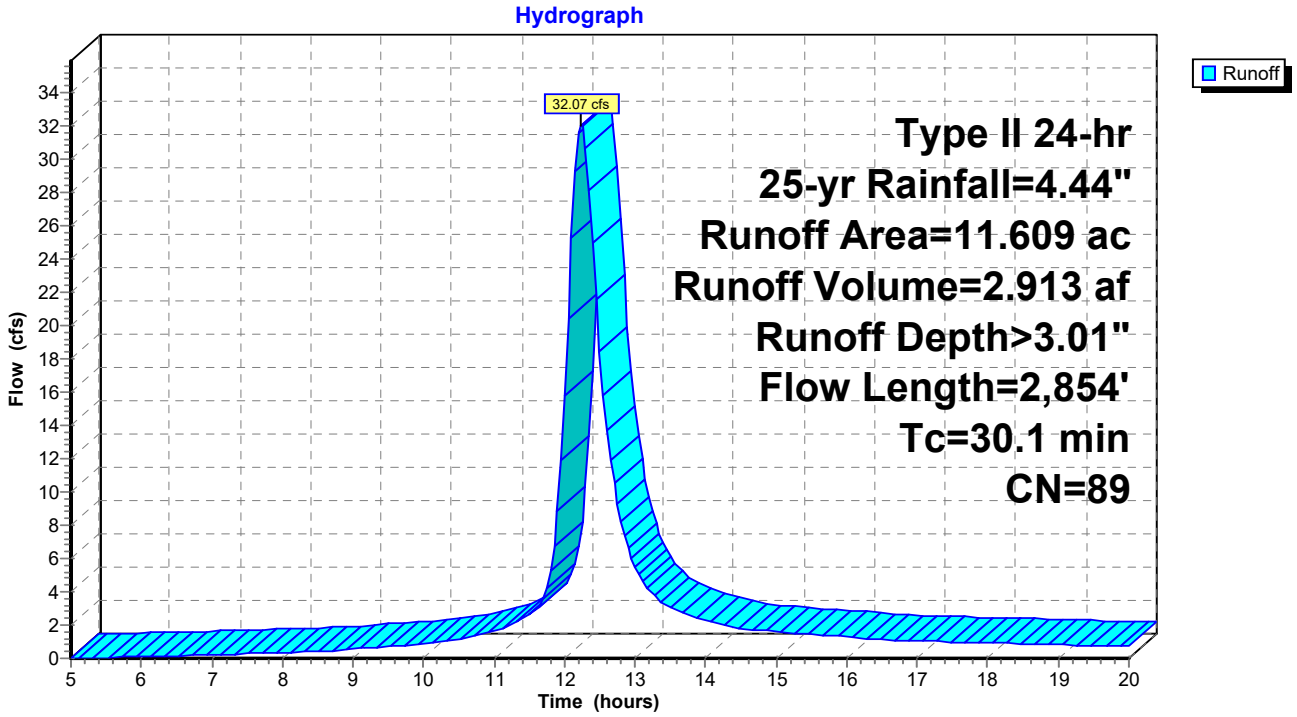
Runoff = 32.07 cfs @ 12.24 hrs, Volume= 2.913 af, Depth> 3.01"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr Rainfall=4.44"

	Area (ac)	CN	Description
*	5.522	98	Impervious area
*	6.087	80	Vegetative
	11.609	89	Weighted Average
	6.087		52.43% Pervious Area
	5.522		47.57% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.5	25	0.0186	0.92		**Sheet Flow, Sheet flow** Smooth surfaces n= 0.011 P2= 2.64"
12.4	1,119	0.0100	1.50		**Shallow Concentrated Flow, Grassed Median** Grassed Waterway Kv= 15.0 fps
0.3	123	0.0271	8.09	6.35	**Pipe Channel, CMP_Round 12"** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.012 Concrete pipe, finished
16.7	1,503	0.0100	1.50		**Shallow Concentrated Flow, Roadside ditch** Grassed Waterway Kv= 15.0 fps
0.2	84	0.0201	6.97	5.47	**Pipe Channel, CMP_Round 12"** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.012 Concrete pipe, finished
30.1	2,854	Total			

Subcatchment 3S: Ex I-70 (ODOT South-East)



Summary for Subcatchment 6S: Scarborough

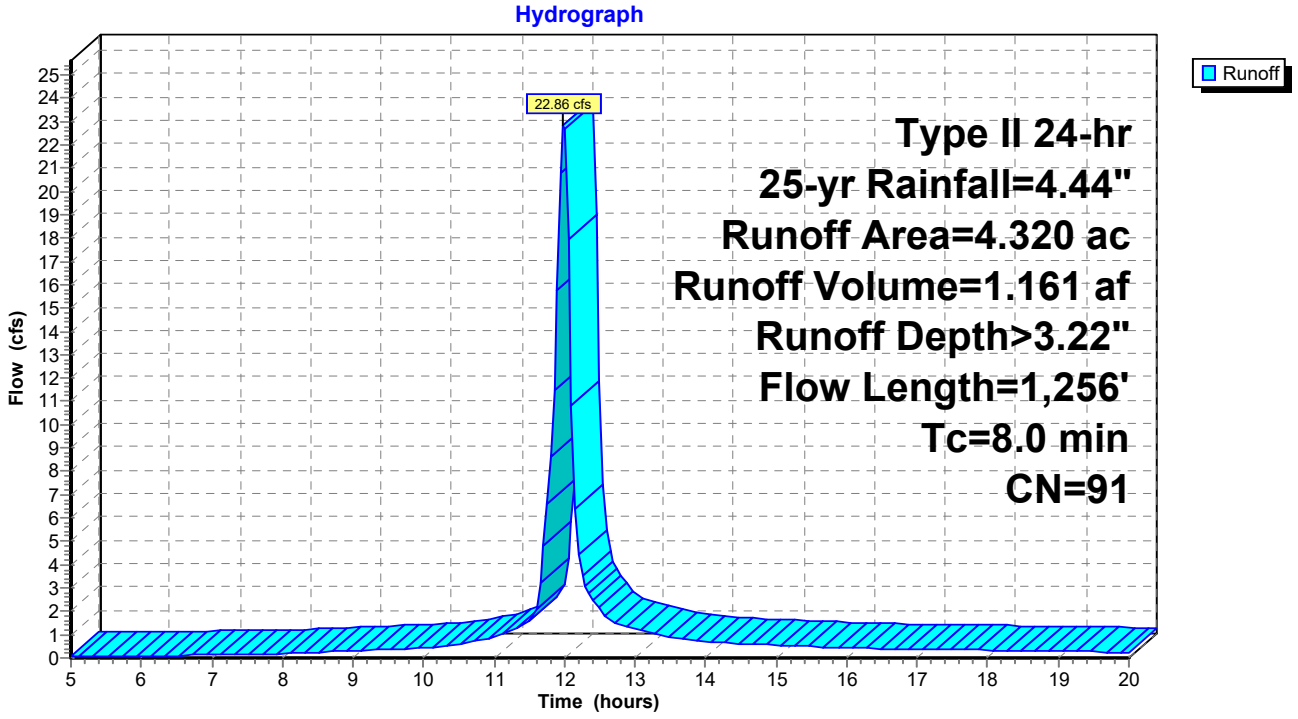
Runoff = 22.86 cfs @ 11.99 hrs, Volume= 1.161 af, Depth> 3.22"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr Rainfall=4.44"

	Area (ac)	CN	Description
*	2.520	98	Impervious Area, HSG D
*	1.800	80	Vegetative, HSG D
	4.320	91	Weighted Average
	1.800		41.67% Pervious Area
	2.520		58.33% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.2	96	0.0055	0.74		**Sheet Flow, Sheet flow** Smooth surfaces n= 0.011 P2= 2.64"
1.7	613	0.0092	6.18	10.92	**Pipe Channel, CMP_Round 18"** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.012 Concrete pipe, finished
4.1	547	0.0121	2.23		**Shallow Concentrated Flow, pavement** Paved Kv= 20.3 fps
8.0	1,256	Total			

Subcatchment 6S: Scarborough

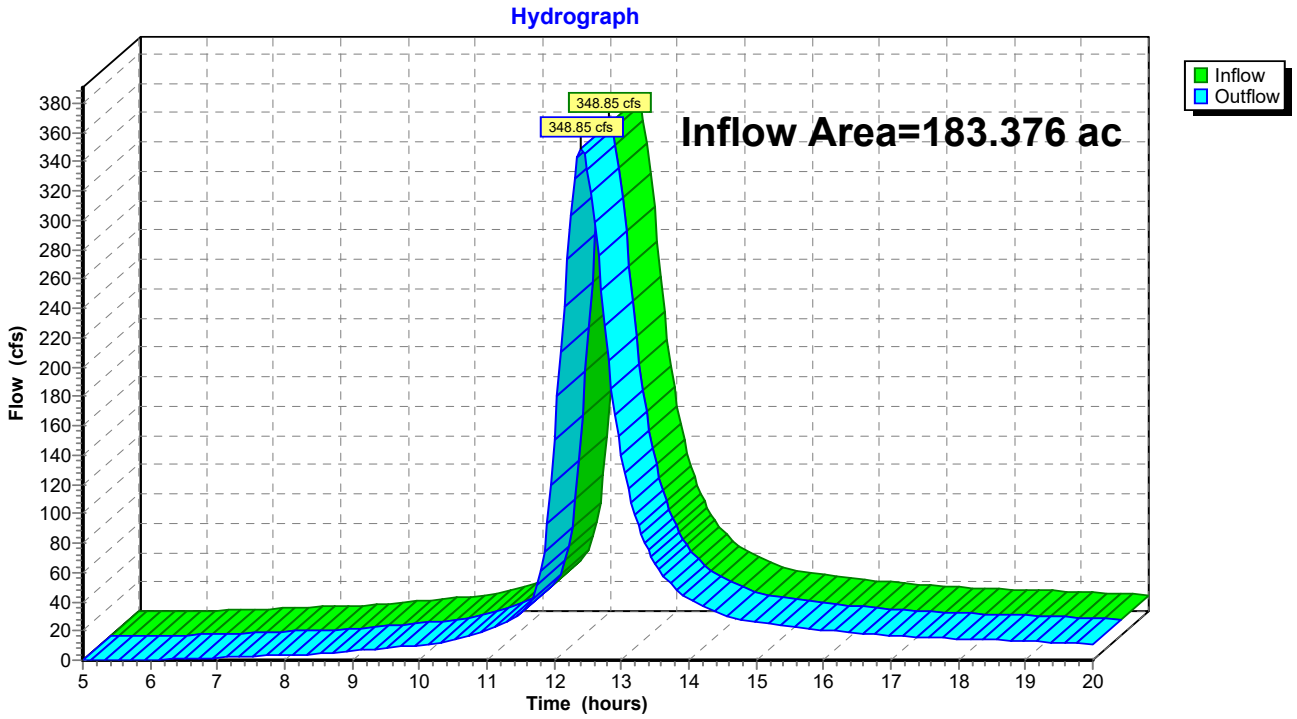


Summary for Reach 5R: Ex. 72" Downstream

Inflow Area = 183.376 ac, 5.71% Impervious, Inflow Depth > 2.83" for 25-yr event
Inflow = 348.85 cfs @ 12.41 hrs, Volume= 43.243 af
Outflow = 348.85 cfs @ 12.41 hrs, Volume= 43.243 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Reach 5R: Ex. 72" Downstream



Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 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: Existing CoC north of Runoff Area=161.220 ac 0.00% Impervious Runoff Depth>3.31"
Flow Length=5,213' Tc=46.0 min CN=87 Runoff=372.10 cfs 44.527 af

Subcatchment2S: Ex I-70 (ODOT North- Runoff Area=6.227 ac 38.90% Impervious Runoff Depth>3.35"
Flow Length=1,493' Tc=16.2 min CN=87 Runoff=27.04 cfs 1.736 af

Subcatchment3S: Ex I-70 (ODOT Runoff Area=11.609 ac 47.57% Impervious Runoff Depth>3.53"
Flow Length=2,854' Tc=30.1 min CN=89 Runoff=37.34 cfs 3.416 af

Subcatchment6S: Scarborough Runoff Area=4.320 ac 58.33% Impervious Runoff Depth>3.75"
Flow Length=1,256' Tc=8.0 min CN=91 Runoff=26.34 cfs 1.350 af

Reach 5R: Ex. 72" Downstream Inflow=409.49 cfs 51.030 af
Outflow=409.49 cfs 51.030 af

Total Runoff Area = 183.376 ac Runoff Volume = 51.030 af Average Runoff Depth = 3.34"
94.29% Pervious = 172.912 ac 5.71% Impervious = 10.464 ac

Summary for Subcatchment 1S: Existing CoC north of I-70

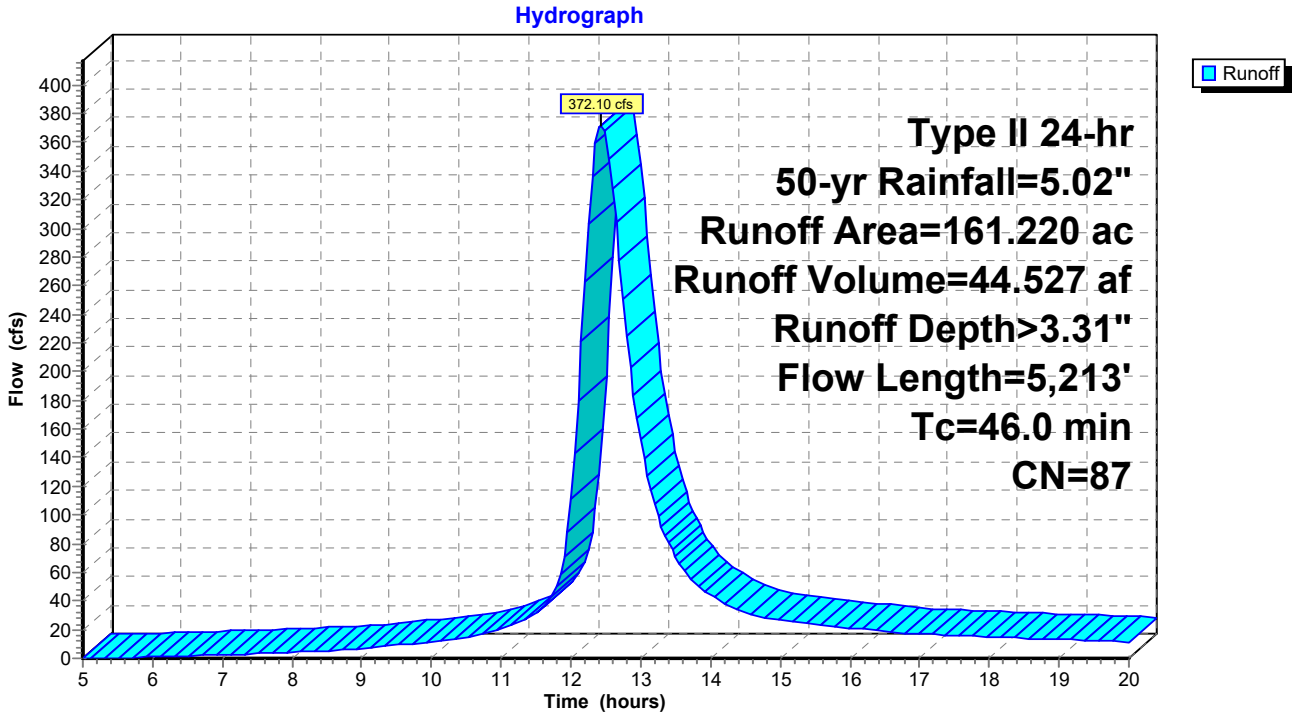
Runoff = 372.10 cfs @ 12.43 hrs, Volume= 44.527 af, Depth> 3.31"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 50-yr Rainfall=5.02"

	Area (ac)	CN	Description
*	4.390	77	Woods
*	114.820	85	Residential
*	42.010	95	Business Complex (Apartment)&School
	161.220	87	Weighted Average
	161.220		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
31.2	100	0.0100	0.05		**Sheet Flow, sheet flow** Woods: Light underbrush n= 0.400 P2= 2.64"
1.6	723	0.0223	7.34	5.76	**Pipe Channel, CMP_Round 12"** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.012 Concrete pipe, finished
2.3	1,024	0.0090	7.40	23.25	**Pipe Channel, CMP_Round 24"** 24.0" Round Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.012 Concrete pipe, finished
8.8	2,845	0.0028	5.41	38.23	**Pipe Channel, CMP_Round 36"** 36.0" Round Area= 7.1 sf Perim= 9.4' r= 0.75' n= 0.012 Concrete pipe, finished
2.1	521	0.0008	4.06	79.80	**Pipe Channel, CMP_Round 60"** 60.0" Round Area= 19.6 sf Perim= 15.7' r= 1.25' n= 0.012 Concrete pipe, finished
46.0	5,213	Total			

Subcatchment 1S: Existing CoC north of I-70



Summary for Subcatchment 2S: Ex I-70 (ODOT North- East)

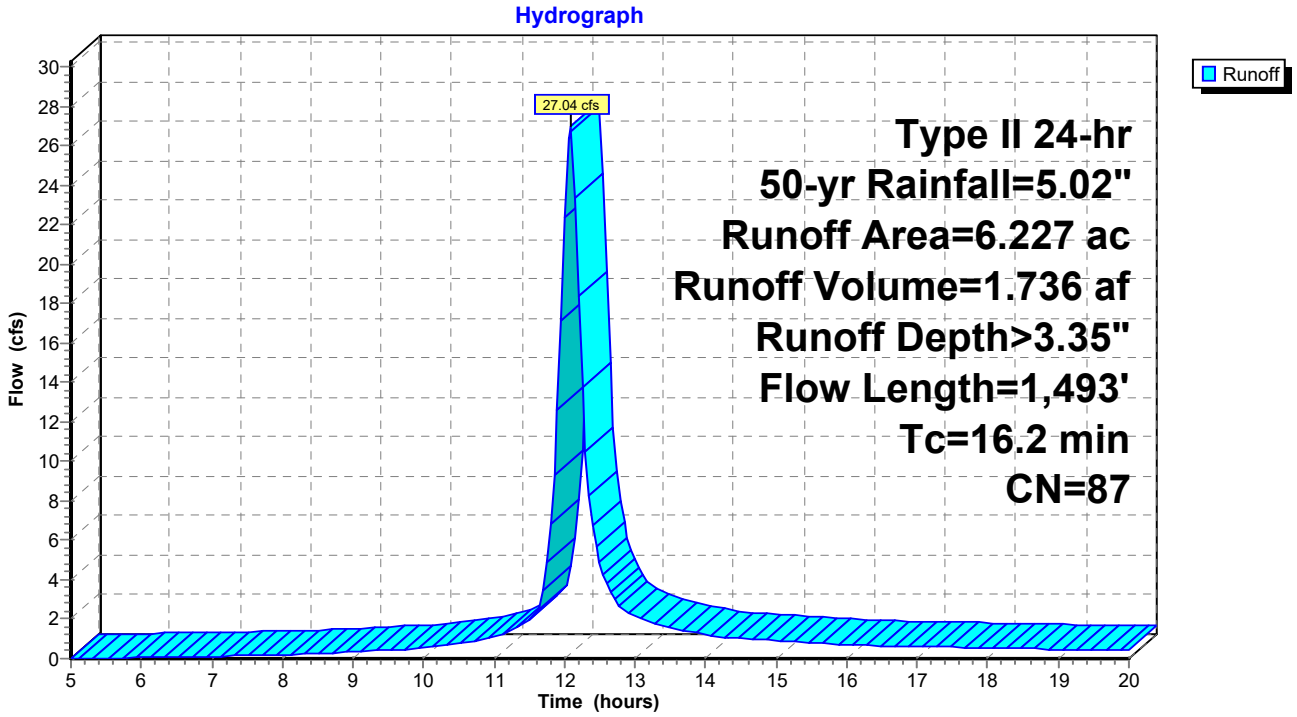
Runoff = 27.04 cfs @ 12.08 hrs, Volume= 1.736 af, Depth> 3.35"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 50-yr Rainfall=5.02"

	Area (ac)	CN	Description
*	2.422	98	Impervious Area, HSG D
*	3.805	80	Woods, Poor, HSG D
	6.227	87	Weighted Average
	3.805		61.10% Pervious Area
	2.422		38.90% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.7	80	0.0600	1.85		**Sheet Flow, Sheet Flow** Smooth surfaces n= 0.011 P2= 2.64"
15.5	1,413	0.0103	1.52		**Shallow Concentrated Flow, Roadside ditch** Grassed Waterway Kv= 15.0 fps
16.2	1,493	Total			

Subcatchment 2S: Ex I-70 (ODOT North- East)



Summary for Subcatchment 3S: Ex I-70 (ODOT South-East)

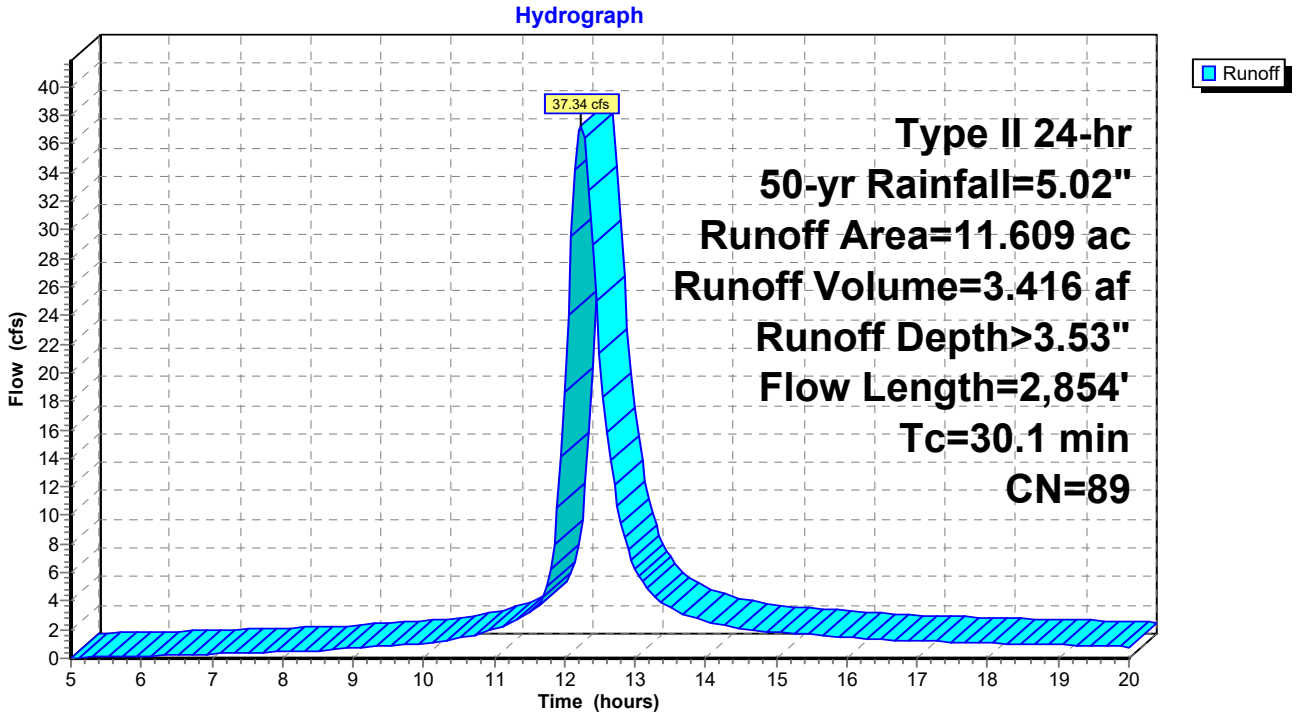
Runoff = 37.34 cfs @ 12.23 hrs, Volume= 3.416 af, Depth> 3.53"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 50-yr Rainfall=5.02"

	Area (ac)	CN	Description
*	5.522	98	Impervious area
*	6.087	80	Vegetative
	11.609	89	Weighted Average
	6.087		52.43% Pervious Area
	5.522		47.57% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.5	25	0.0186	0.92		**Sheet Flow, Sheet flow** Smooth surfaces n= 0.011 P2= 2.64"
12.4	1,119	0.0100	1.50		**Shallow Concentrated Flow, Grassed Median** Grassed Waterway Kv= 15.0 fps
0.3	123	0.0271	8.09	6.35	**Pipe Channel, CMP_Round 12"** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.012 Concrete pipe, finished
16.7	1,503	0.0100	1.50		**Shallow Concentrated Flow, Roadside ditch** Grassed Waterway Kv= 15.0 fps
0.2	84	0.0201	6.97	5.47	**Pipe Channel, CMP_Round 12"** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.012 Concrete pipe, finished
30.1	2,854	Total			

Subcatchment 3S: Ex I-70 (ODOT South-East)



Summary for Subcatchment 6S: Scarborough

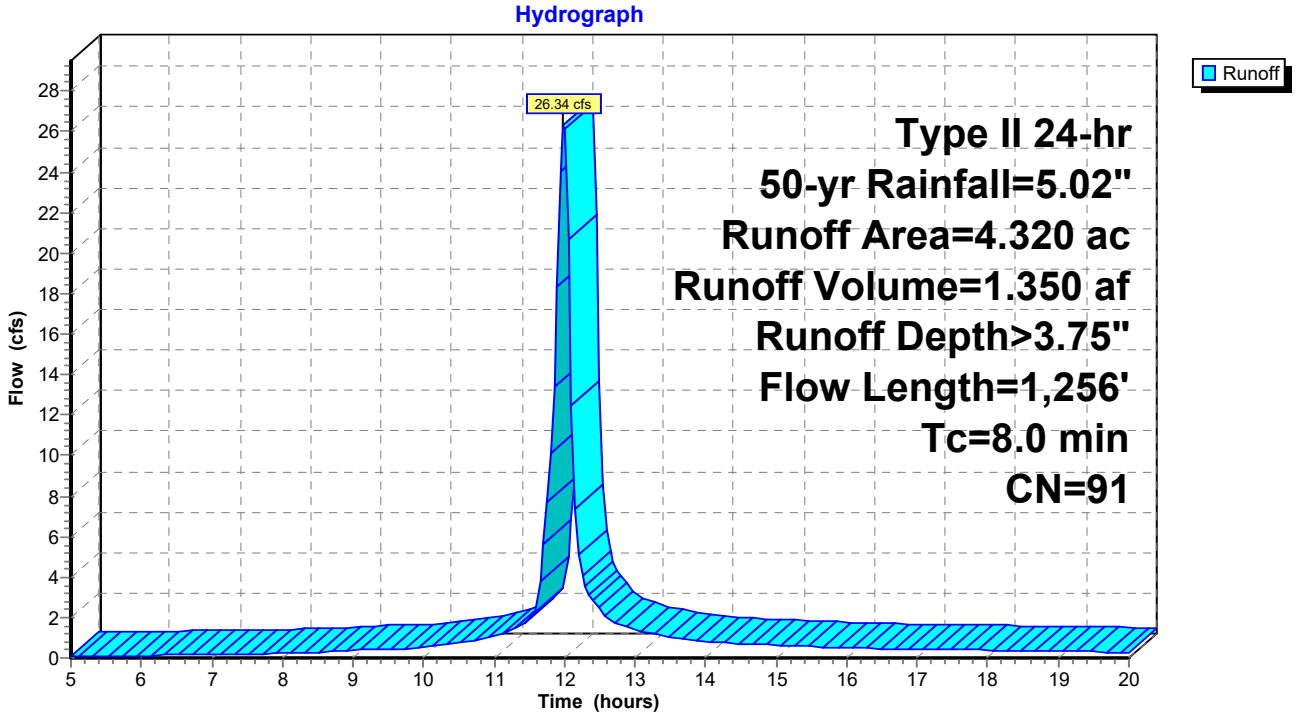
Runoff = 26.34 cfs @ 11.99 hrs, Volume= 1.350 af, Depth> 3.75"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 50-yr Rainfall=5.02"

	Area (ac)	CN	Description
*	2.520	98	Impervious Area, HSG D
*	1.800	80	Vegetative, HSG D
	4.320	91	Weighted Average
	1.800		41.67% Pervious Area
	2.520		58.33% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.2	96	0.0055	0.74		**Sheet Flow, Sheet flow** Smooth surfaces n= 0.011 P2= 2.64"
1.7	613	0.0092	6.18	10.92	**Pipe Channel, CMP_Round 18"** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.012 Concrete pipe, finished
4.1	547	0.0121	2.23		**Shallow Concentrated Flow, pavement** Paved Kv= 20.3 fps
8.0	1,256	Total			

Subcatchment 6S: Scarborough

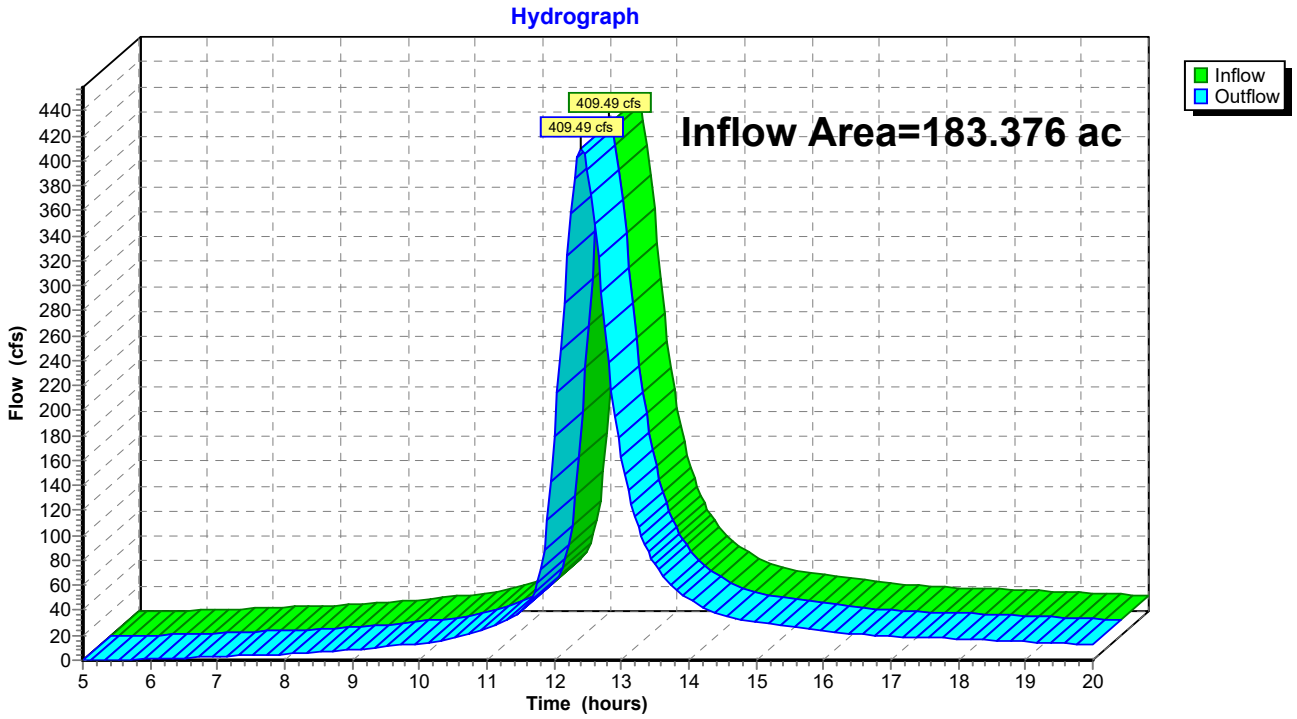


Summary for Reach 5R: Ex. 72" Downstream

Inflow Area = 183.376 ac, 5.71% Impervious, Inflow Depth > 3.34" for 50-yr event
Inflow = 409.49 cfs @ 12.40 hrs, Volume= 51.030 af
Outflow = 409.49 cfs @ 12.40 hrs, Volume= 51.030 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Reach 5R: Ex. 72" Downstream



Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 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: Existing CoC north of Runoff Area=161.220 ac 0.00% Impervious Runoff Depth>3.86"
Flow Length=5,213' Tc=46.0 min CN=87 Runoff=430.41 cfs 51.801 af

Subcatchment2S: Ex I-70 (ODOT North- Runoff Area=6.227 ac 38.90% Impervious Runoff Depth>3.89"
Flow Length=1,493' Tc=16.2 min CN=87 Runoff=31.20 cfs 2.019 af

Subcatchment3S: Ex I-70 (ODOT Runoff Area=11.609 ac 47.57% Impervious Runoff Depth>4.08"
Flow Length=2,854' Tc=30.1 min CN=89 Runoff=42.87 cfs 3.948 af

Subcatchment6S: Scarborough Runoff Area=4.320 ac 58.33% Impervious Runoff Depth>4.31"
Flow Length=1,256' Tc=8.0 min CN=91 Runoff=29.98 cfs 1.550 af

Reach 5R: Ex. 72" Downstream Inflow=473.36 cfs 59.319 af
Outflow=473.36 cfs 59.319 af

Total Runoff Area = 183.376 ac Runoff Volume = 59.319 af Average Runoff Depth = 3.88"
94.29% Pervious = 172.912 ac 5.71% Impervious = 10.464 ac

Summary for Subcatchment 1S: Existing CoC north of I-70

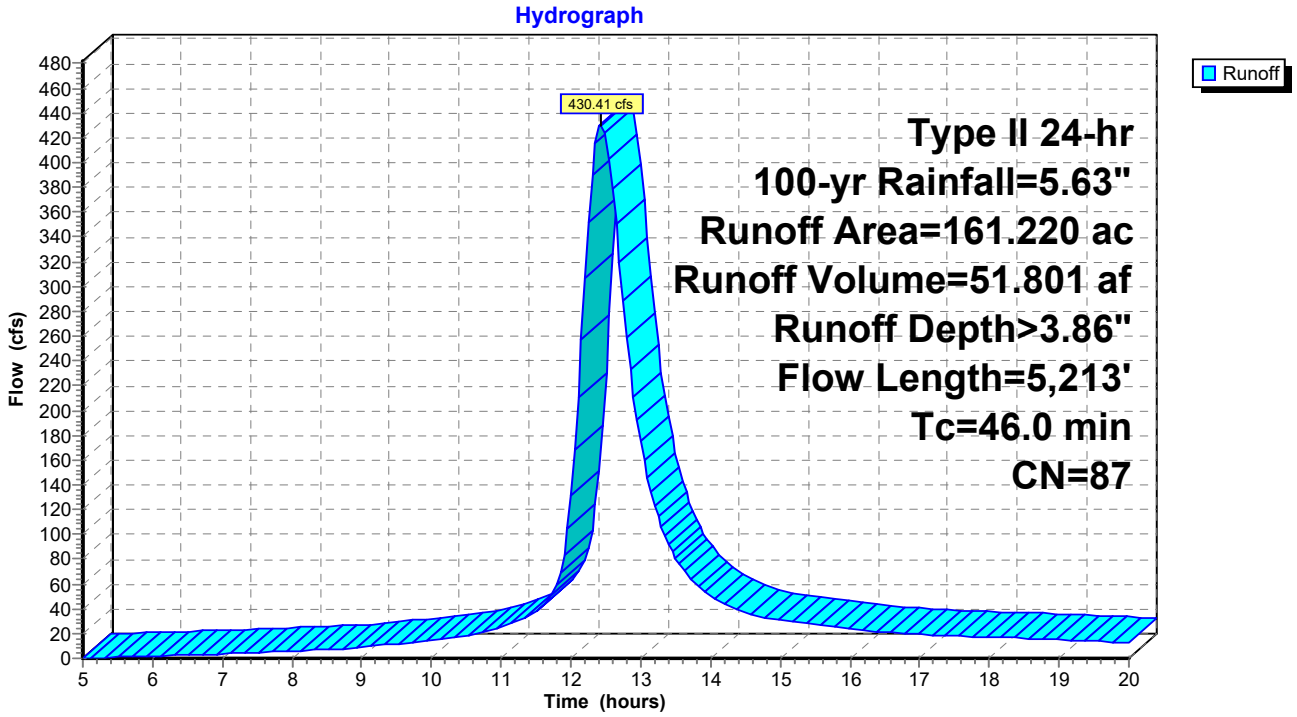
Runoff = 430.41 cfs @ 12.43 hrs, Volume= 51.801 af, Depth> 3.86"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-yr Rainfall=5.63"

	Area (ac)	CN	Description
*	4.390	77	Woods
*	114.820	85	Residential
*	42.010	95	Business Complex (Apartment)&School
	161.220	87	Weighted Average
	161.220		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
31.2	100	0.0100	0.05		**Sheet Flow, sheet flow** Woods: Light underbrush n= 0.400 P2= 2.64"
1.6	723	0.0223	7.34	5.76	**Pipe Channel, CMP_Round 12"** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.012 Concrete pipe, finished
2.3	1,024	0.0090	7.40	23.25	**Pipe Channel, CMP_Round 24"** 24.0" Round Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.012 Concrete pipe, finished
8.8	2,845	0.0028	5.41	38.23	**Pipe Channel, CMP_Round 36"** 36.0" Round Area= 7.1 sf Perim= 9.4' r= 0.75' n= 0.012 Concrete pipe, finished
2.1	521	0.0008	4.06	79.80	**Pipe Channel, CMP_Round 60"** 60.0" Round Area= 19.6 sf Perim= 15.7' r= 1.25' n= 0.012 Concrete pipe, finished
46.0	5,213	Total			

Subcatchment 1S: Existing CoC north of I-70



Summary for Subcatchment 2S: Ex I-70 (ODOT North- East)

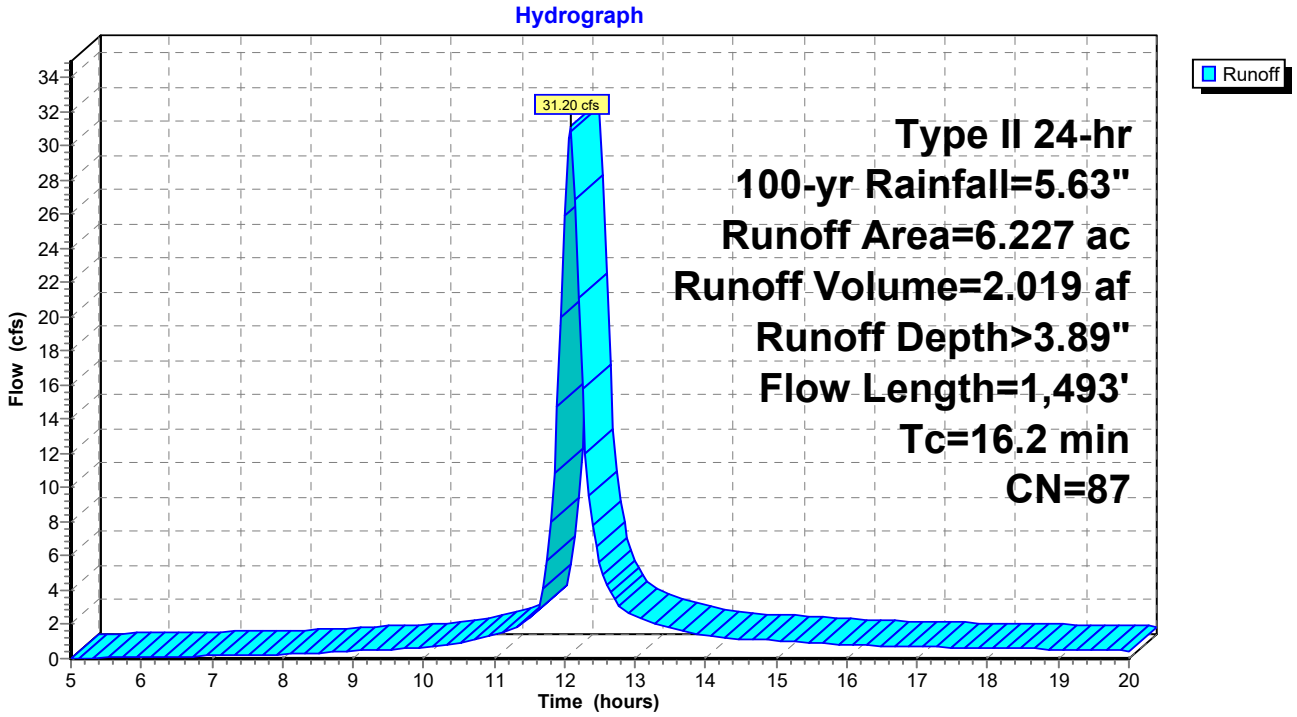
Runoff = 31.20 cfs @ 12.08 hrs, Volume= 2.019 af, Depth> 3.89"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-yr Rainfall=5.63"

	Area (ac)	CN	Description
*	2.422	98	Impervious Area, HSG D
*	3.805	80	Woods, Poor, HSG D
	6.227	87	Weighted Average
	3.805		61.10% Pervious Area
	2.422		38.90% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.7	80	0.0600	1.85		**Sheet Flow, Sheet Flow** Smooth surfaces n= 0.011 P2= 2.64"
15.5	1,413	0.0103	1.52		**Shallow Concentrated Flow, Roadside ditch** Grassed Waterway Kv= 15.0 fps
16.2	1,493	Total			

Subcatchment 2S: Ex I-70 (ODOT North- East)



Summary for Subcatchment 3S: Ex I-70 (ODOT South-East)

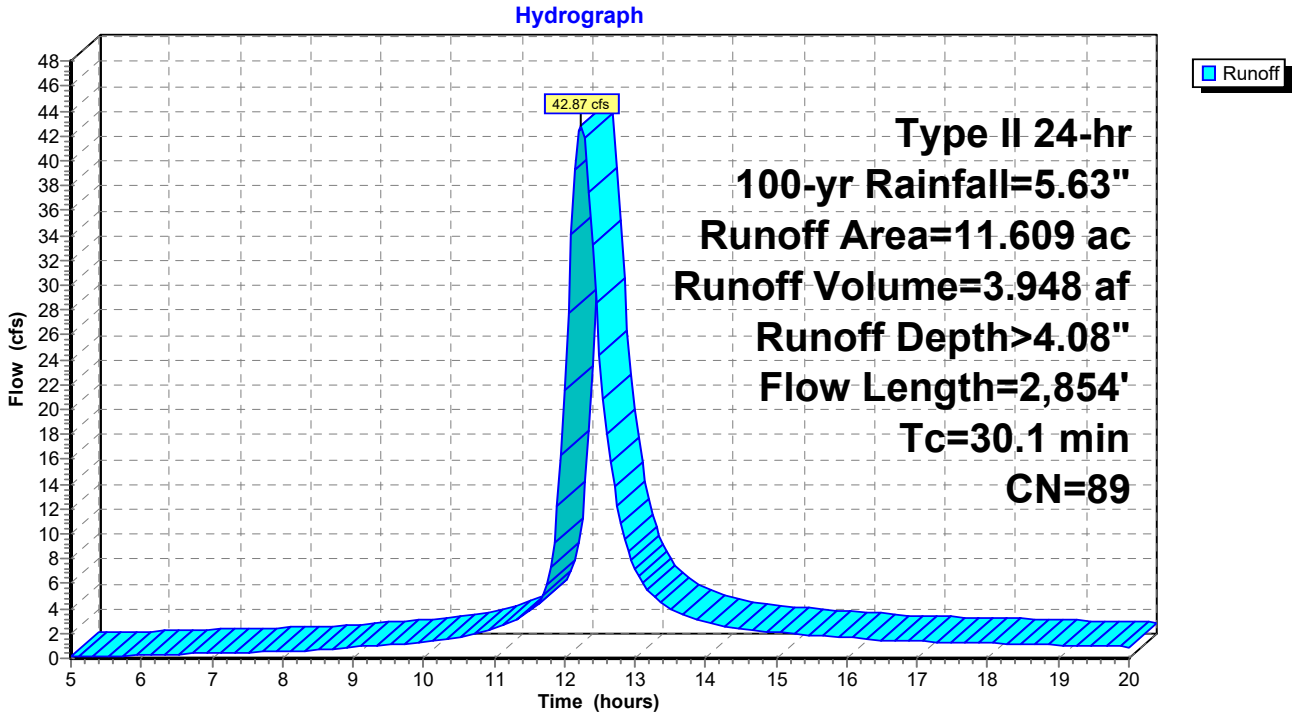
Runoff = 42.87 cfs @ 12.23 hrs, Volume= 3.948 af, Depth> 4.08"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-yr Rainfall=5.63"

	Area (ac)	CN	Description
*	5.522	98	Impervious area
*	6.087	80	Vegetative
	11.609	89	Weighted Average
	6.087		52.43% Pervious Area
	5.522		47.57% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.5	25	0.0186	0.92		**Sheet Flow, Sheet flow** Smooth surfaces n= 0.011 P2= 2.64"
12.4	1,119	0.0100	1.50		**Shallow Concentrated Flow, Grassed Median** Grassed Waterway Kv= 15.0 fps
0.3	123	0.0271	8.09	6.35	**Pipe Channel, CMP_Round 12"** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.012 Concrete pipe, finished
16.7	1,503	0.0100	1.50		**Shallow Concentrated Flow, Roadside ditch** Grassed Waterway Kv= 15.0 fps
0.2	84	0.0201	6.97	5.47	**Pipe Channel, CMP_Round 12"** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.012 Concrete pipe, finished
30.1	2,854	Total			

Subcatchment 3S: Ex I-70 (ODOT South-East)



Summary for Subcatchment 6S: Scarborough

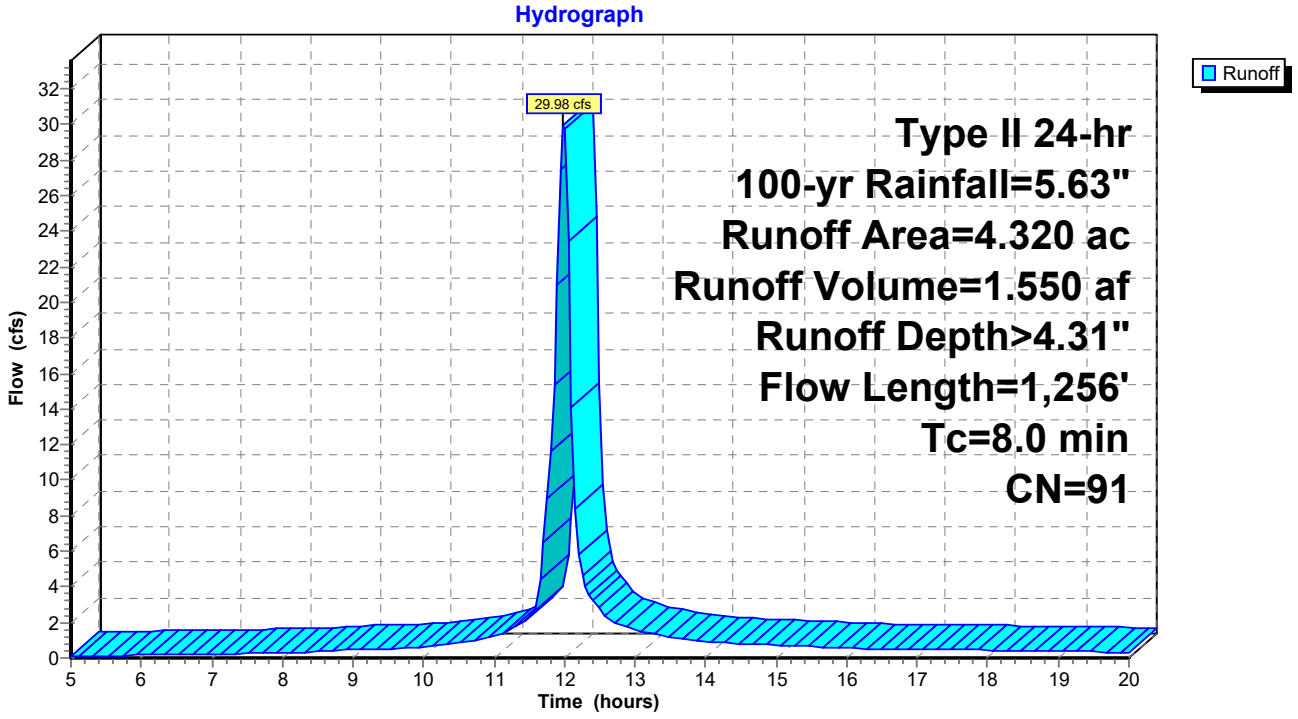
Runoff = 29.98 cfs @ 11.99 hrs, Volume= 1.550 af, Depth> 4.31"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-yr Rainfall=5.63"

	Area (ac)	CN	Description
*	2.520	98	Impervious Area, HSG D
*	1.800	80	Vegetative, HSG D
	4.320	91	Weighted Average
	1.800		41.67% Pervious Area
	2.520		58.33% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.2	96	0.0055	0.74		**Sheet Flow, Sheet flow** Smooth surfaces n= 0.011 P2= 2.64"
1.7	613	0.0092	6.18	10.92	**Pipe Channel, CMP_Round 18"** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.012 Concrete pipe, finished
4.1	547	0.0121	2.23		**Shallow Concentrated Flow, pavement** Paved Kv= 20.3 fps
8.0	1,256	Total			

Subcatchment 6S: Scarborough

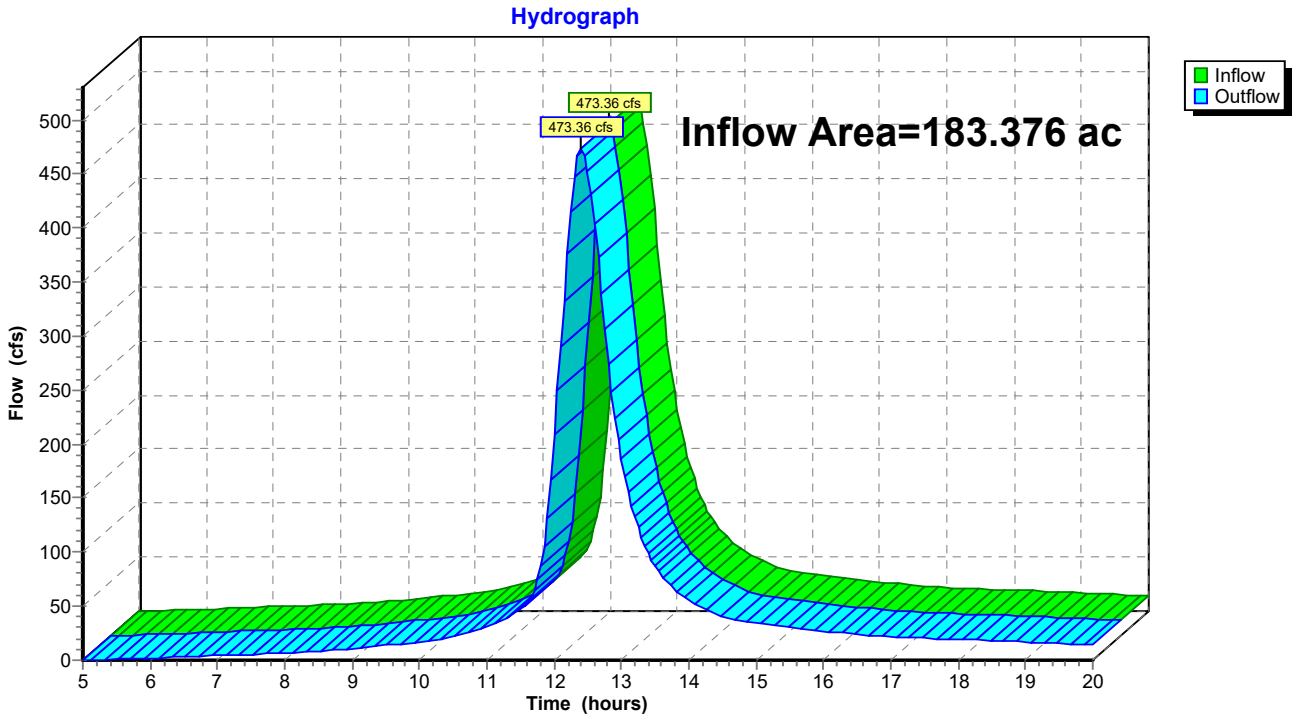


Summary for Reach 5R: Ex. 72" Downstream

Inflow Area = 183.376 ac, 5.71% Impervious, Inflow Depth > 3.88" for 100-yr event
Inflow = 473.36 cfs @ 12.40 hrs, Volume= 59.319 af
Outflow = 473.36 cfs @ 12.40 hrs, Volume= 59.319 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Reach 5R: Ex. 72" Downstream



Events for Subcatchment 1S: Existing CoC north of I-70

Event	Rainfall (inches)	Runoff (cfs)	Volume (acre-feet)	Depth (inches)
2-yr	2.63	147.58	17.372	1.29
5-yr	3.24	203.53	23.990	1.79
10-yr	3.74	250.39	29.616	2.20
25-yr	4.44	316.77	37.699	2.81
50-yr	5.02	372.10	44.527	3.31
100-yr	**5.63**	**430.41**	**51.801**	**3.86**

Events for Subcatchment 2S: Ex I-70 (ODOT North- East)

Event	Rainfall (inches)	Runoff (cfs)	Volume (acre-feet)	Depth (inches)
2-yr	2.63	10.95	0.679	1.31
5-yr	3.24	14.98	0.936	1.80
10-yr	3.74	18.35	1.155	2.23
25-yr	4.44	23.10	1.470	2.83
50-yr	5.02	27.04	1.736	3.35
100-yr	**5.63**	**31.20**	**2.019**	**3.89**

Events for Subcatchment 3S: Ex I-70 (ODOT South-East)

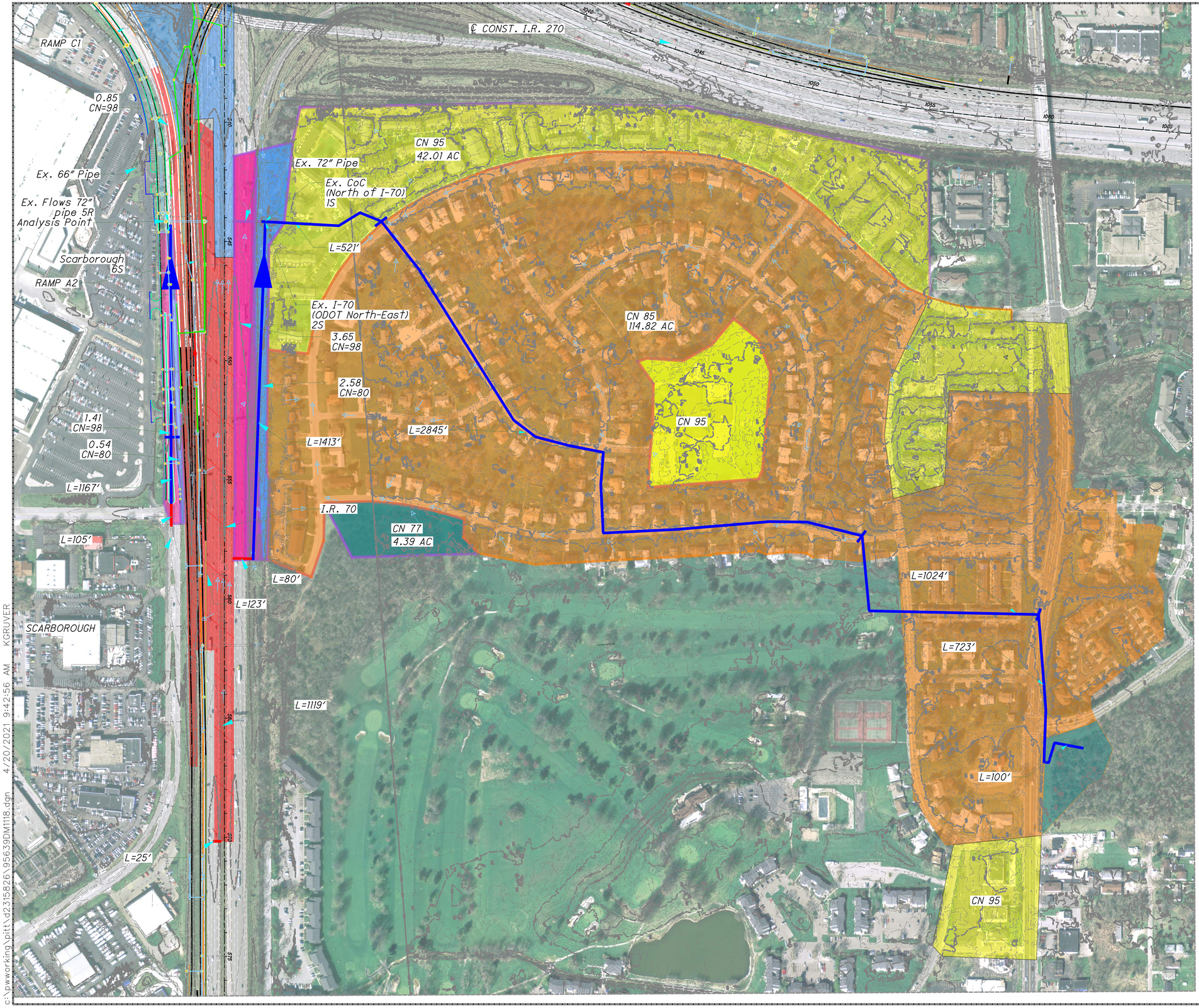
Event	Rainfall (inches)	Runoff (cfs)	Volume (acre-feet)	Depth (inches)
2-yr	2.63	15.74	1.397	1.44
5-yr	3.24	21.19	1.895	1.96
10-yr	3.74	25.71	2.314	2.39
25-yr	4.44	32.07	2.913	3.01
50-yr	5.02	37.34	3.416	3.53
100-yr	**5.63**	**42.87**	**3.948**	**4.08**

Events for Subcatchment 6S: Scarborough

Event	Rainfall (inches)	Runoff (cfs)	Volume (acre-feet)	Depth (inches)
2-yr	2.63	11.93	0.580	1.61
5-yr	3.24	15.62	0.773	2.15
10-yr	3.74	18.64	0.933	2.59
25-yr	4.44	22.86	1.161	3.22
50-yr	5.02	26.34	1.350	3.75
100-yr	**5.63**	**29.98**	**1.550**	**4.31**

Events for Reach 5R: Ex. 72" Downstream

Event	Inflow (cfs)	Outflow (cfs)	Elevation (feet)	Storage (cubic-feet)
2-yr	163.23	163.23	**0.00**	**0**
5-yr	224.66	224.66	0.00	0
10-yr	276.07	276.07	0.00	0
25-yr	348.85	348.85	0.00	0
50-yr	409.49	409.49	0.00	0
100-yr	**473.36**	**473.36**	0.00	0



Flow Path

ODOT NE Flow time	16.2 Mins
COC Flow time	46.0 Mins
Scarborough Flow time	8.0 Mins

Ex. 70 (ODOT North - East) 2S

Group D Vegetative	3.65 Acres
Group D Impervious Area	2.58 Acres
Total	6.23 Acres

Ex. CoC (North of I-70) 1S

Group D Residential Areas	114.82 Acres
Group D Business Complex	42.01 Acres
Group D Woods	4.39 Acres
Total	161.22 Acres

SCARBOROUGH 6S

Group D Vegetative	0.54 Acres
Group D Impervious Area	1.41 Acres

Total of ODOT+COC+SCAR	169.40 Acres

ODOT AREA REMOVED FROM 72"

AREA REMOVED	12.71 Acres

N

0 100 200 400 HORIZONTAL SCALE IN FEET

CALCULATED SS CHECKED KAG

PROPOSED DRAINAGE AREA MAP DOWNSTREAM 72" CONDUIT

FRA-70-22.61

1 1

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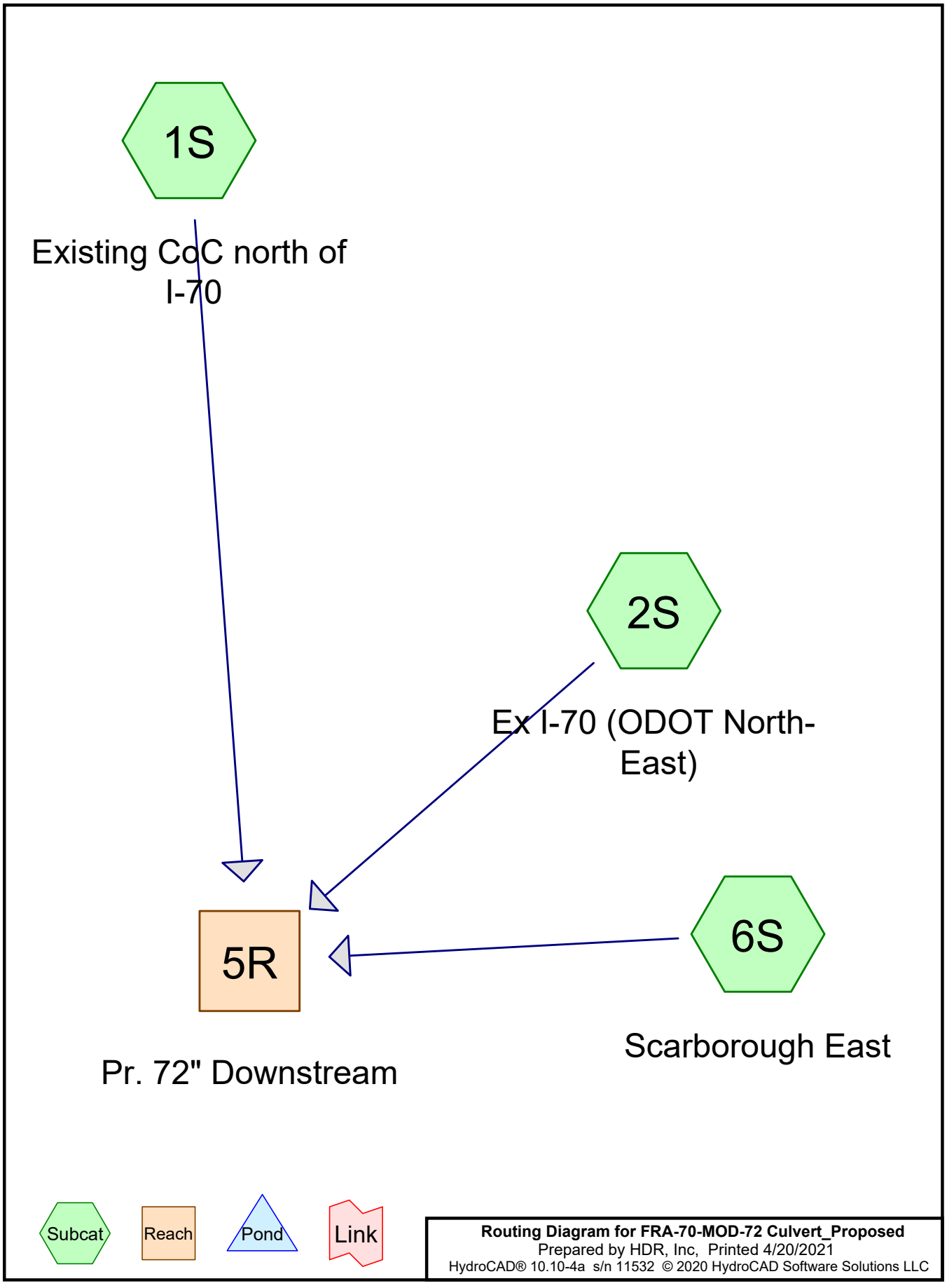

1S
Existing CoC north of I-70
2S
Ex I-70 (ODOT North-East)
5R
Pr. 72" Downstream
6S
Scarborough East
Subcat
Reach
Pond
Link
Routing Diagram for FRA-70-MOD-72 Culvert_Proposed
Prepared by HDR, Inc, Printed 4/20/2021
HydroCAD® 10.10-4a s/n 11532 © 2020 HydroCAD Software Solutions LLC

Project Notes

Defined 10 rainfall events from OH-Columbus IDF

Rainfall Events Listing (selected events)

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	2-yr	Type II 24-hr		Default	24.00	1	2.63	2
2	5-yr	Type II 24-hr		Default	24.00	1	3.24	2
3	10-yr	Type II 24-hr		Default	24.00	1	3.74	2
4	25-yr	Type II 24-hr		Default	24.00	1	4.44	2
5	50-yr	Type II 24-hr		Default	24.00	1	5.02	2
6	100-yr	Type II 24-hr		Default	24.00	1	5.63	2
7	200-yr	Type II 24-hr		Default	24.00	1	6.28	2

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
42.010	95	Business Complex (Apartment)&School (1S)
3.650	98	Impervious Area, HSG D (2S)
1.410	98	Impervious area (6S)
114.820	85	Residential (1S)
0.540	80	Vegetative (6S)
4.390	77	Woods (1S)
2.580	80	Woods, Poor, HSG D (2S)
169.400	**88**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
0.000	HSG C	
6.230	HSG D	2S
163.170	Other	1S, 6S
169.400		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcat Numbe
0.000	0.000	0.000	0.000	42.010	42.010	Business Complex (Apartment)&School	
0.000	0.000	0.000	3.650	0.000	3.650	Impervious Area	
0.000	0.000	0.000	0.000	1.410	1.410	Impervious area	
0.000	0.000	0.000	0.000	114.820	114.820	Residential	
0.000	0.000	0.000	0.000	0.540	0.540	Vegetative	
0.000	0.000	0.000	0.000	4.390	4.390	Woods	
0.000	0.000	0.000	2.580	0.000	2.580	Woods, Poor	
0.000	**0.000**	**0.000**	**6.230**	**163.170**	**169.400**	**TOTAL AREA**	

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	1S	0.00	0.00	723.0	0.0223	0.012	12.0	0.0	0.0
2	1S	0.00	0.00	1,024.0	0.0090	0.012	24.0	0.0	0.0
3	1S	0.00	0.00	2,845.0	0.0028	0.012	36.0	0.0	0.0
4	1S	0.00	0.00	521.0	0.0008	0.012	60.0	0.0	0.0
5	6S	0.00	0.00	1,167.0	0.0064	0.012	18.0	0.0	0.0

Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 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: Existing CoC north of Runoff Area=161.220 ac 0.00% Impervious Runoff Depth>1.29"
Flow Length=5,213' Tc=46.0 min CN=87 Runoff=147.58 cfs 17.372 af

Subcatchment2S: Ex I-70 (ODOT North- Runoff Area=6.230 ac 58.59% Impervious Runoff Depth>1.61"
Flow Length=1,493' Tc=16.2 min CN=91 Runoff=13.20 cfs 0.834 af

Subcatchment6S: Scarborough East Runoff Area=1.950 ac 72.31% Impervious Runoff Depth>1.78"
Flow Length=1,272' Tc=4.4 min CN=93 Runoff=6.51 cfs 0.289 af

Reach 5R: Pr. 72" Downstream Inflow=151.06 cfs 18.496 af
Outflow=151.06 cfs 18.496 af

Total Runoff Area = 169.400 ac Runoff Volume = 18.496 af Average Runoff Depth = 1.31"
97.01% Pervious = 164.340 ac 2.99% Impervious = 5.060 ac

Summary for Subcatchment 1S: Existing CoC north of I-70

[47] Hint: Peak is 2561% of capacity of segment #2
[47] Hint: Peak is 635% of capacity of segment #3
[47] Hint: Peak is 386% of capacity of segment #4
[47] Hint: Peak is 185% of capacity of segment #5

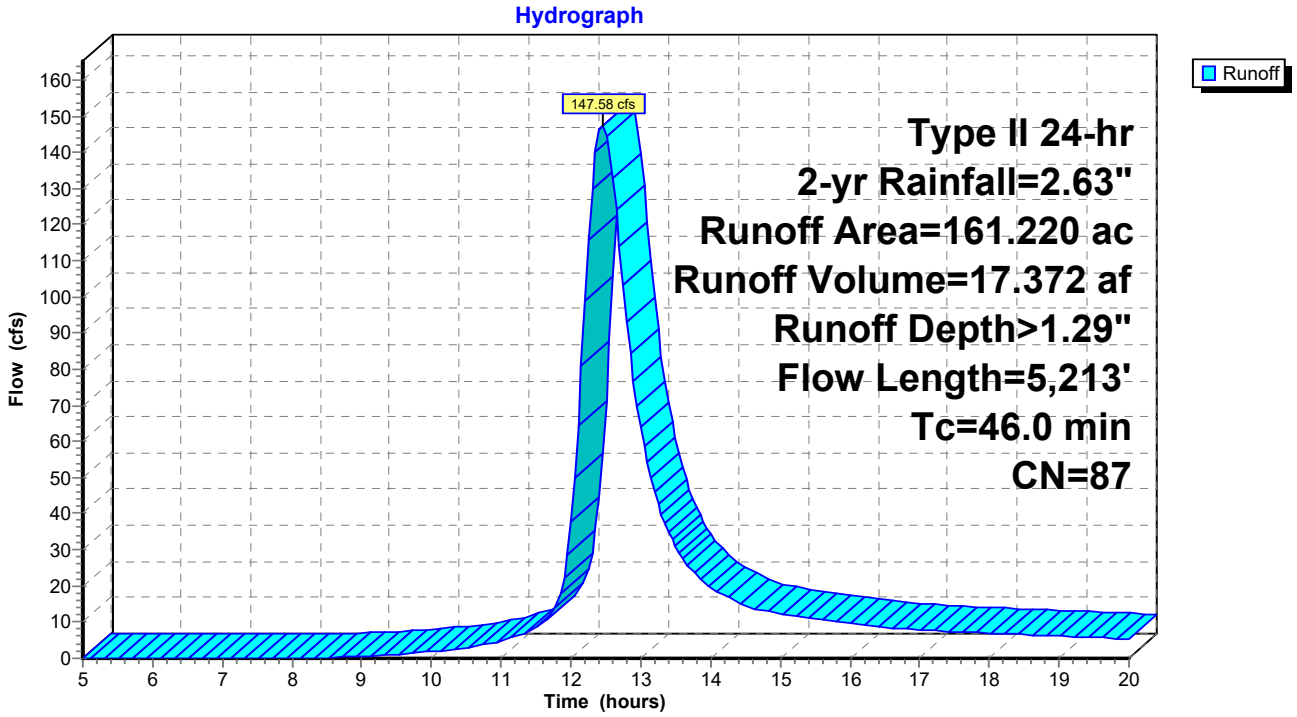
Runoff = 147.58 cfs @ 12.45 hrs, Volume= 17.372 af, Depth> 1.29"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 2-yr Rainfall=2.63"

	Area (ac)	CN	Description
*	4.390	77	Woods
*	114.820	85	Residential
*	42.010	95	Business Complex (Apartment)&School
	161.220	87	Weighted Average
	161.220		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
31.2	100	0.0100	0.05		**Sheet Flow, sheet flow** Woods: Light underbrush n= 0.400 P2= 2.64"
1.6	723	0.0223	7.34	5.76	**Pipe Channel, CMP_Round 12"** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.012 Concrete pipe, finished
2.3	1,024	0.0090	7.40	23.25	**Pipe Channel, CMP_Round 24"** 24.0" Round Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.012 Concrete pipe, finished
8.8	2,845	0.0028	5.41	38.23	**Pipe Channel, CMP_Round 36"** 36.0" Round Area= 7.1 sf Perim= 9.4' r= 0.75' n= 0.012 Concrete pipe, finished
2.1	521	0.0008	4.06	79.80	**Pipe Channel, CMP_Round 60"** 60.0" Round Area= 19.6 sf Perim= 15.7' r= 1.25' n= 0.012 Concrete pipe, finished
46.0	5,213	Total			

Subcatchment 1S: Existing CoC north of I-70



Summary for Subcatchment 2S: Ex I-70 (ODOT North- East)

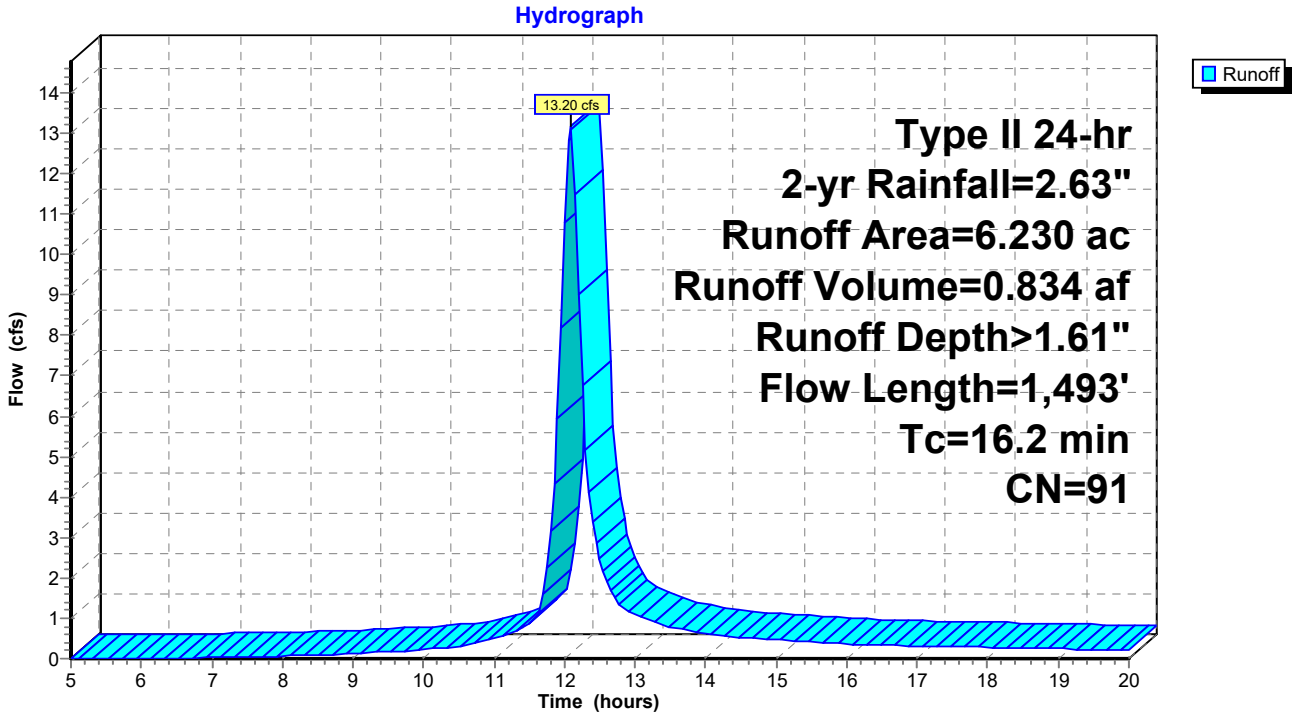
Runoff = 13.20 cfs @ 12.08 hrs, Volume= 0.834 af, Depth> 1.61"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 2-yr Rainfall=2.63"

	Area (ac)	CN	Description
*	3.650	98	Impervious Area, HSG D
*	2.580	80	Woods, Poor, HSG D
	6.230	91	Weighted Average
	2.580		41.41% Pervious Area
	3.650		58.59% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.7	80	0.0600	1.85		**Sheet Flow, Sheet Flow** Smooth surfaces n= 0.011 P2= 2.64"
15.5	1,413	0.0103	1.52		**Shallow Concentrated Flow, Roadside ditch** Grassed Waterway Kv= 15.0 fps
16.2	1,493	Total			

Subcatchment 2S: Ex I-70 (ODOT North- East)



Summary for Subcatchment 6S: Scarborough East

[49] Hint: Tc<2dt may require smaller dt

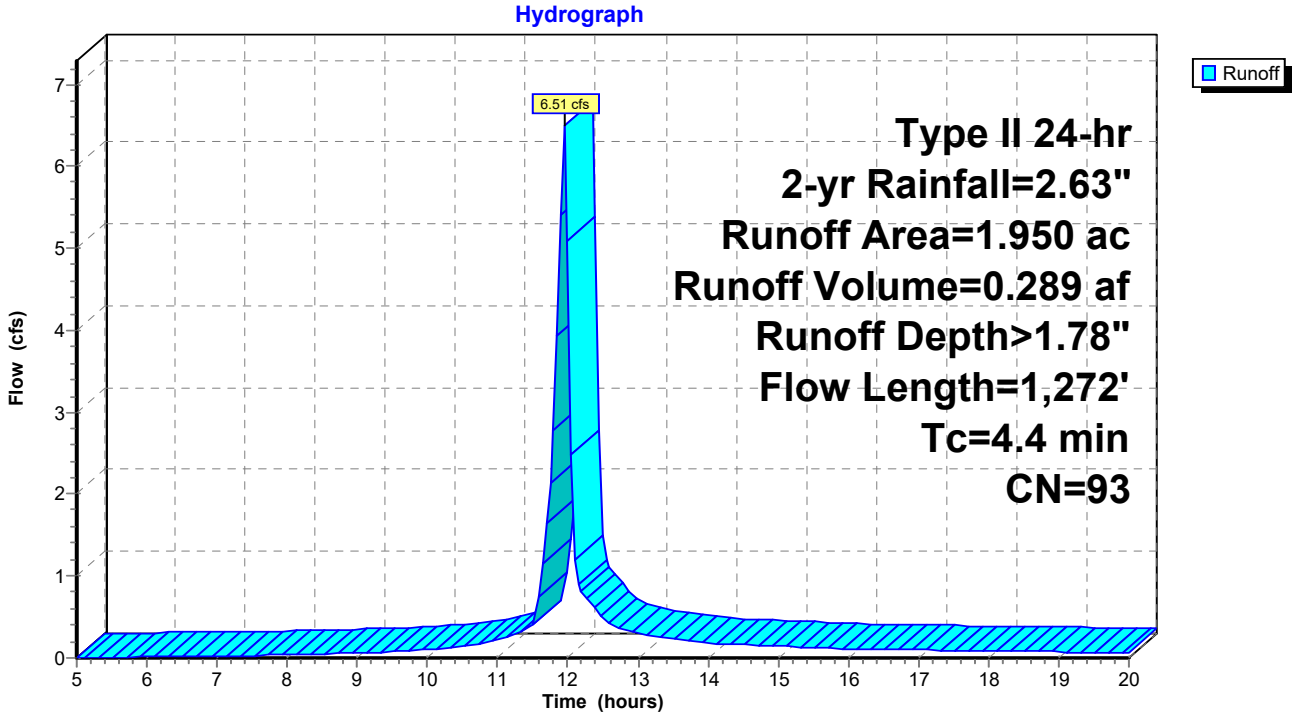
Runoff = 6.51 cfs @ 11.95 hrs, Volume= 0.289 af, Depth> 1.78"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 2-yr Rainfall=2.63"

	Area (ac)	CN	Description
*	1.410	98	Impervious area
*	0.540	80	Vegetative
	1.950	93	Weighted Average
	0.540		27.69% Pervious Area
	1.410		72.31% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.6	105	0.1880	3.09		**Sheet Flow, Sheet flow** Smooth surfaces n= 0.011 P2= 2.64"
3.8	1,167	0.0064	5.15	9.10	**Pipe Channel, CMP_Round 18"** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.012 Concrete pipe, finished
4.4	1,272	Total			

Subcatchment 6S: Scarborough East



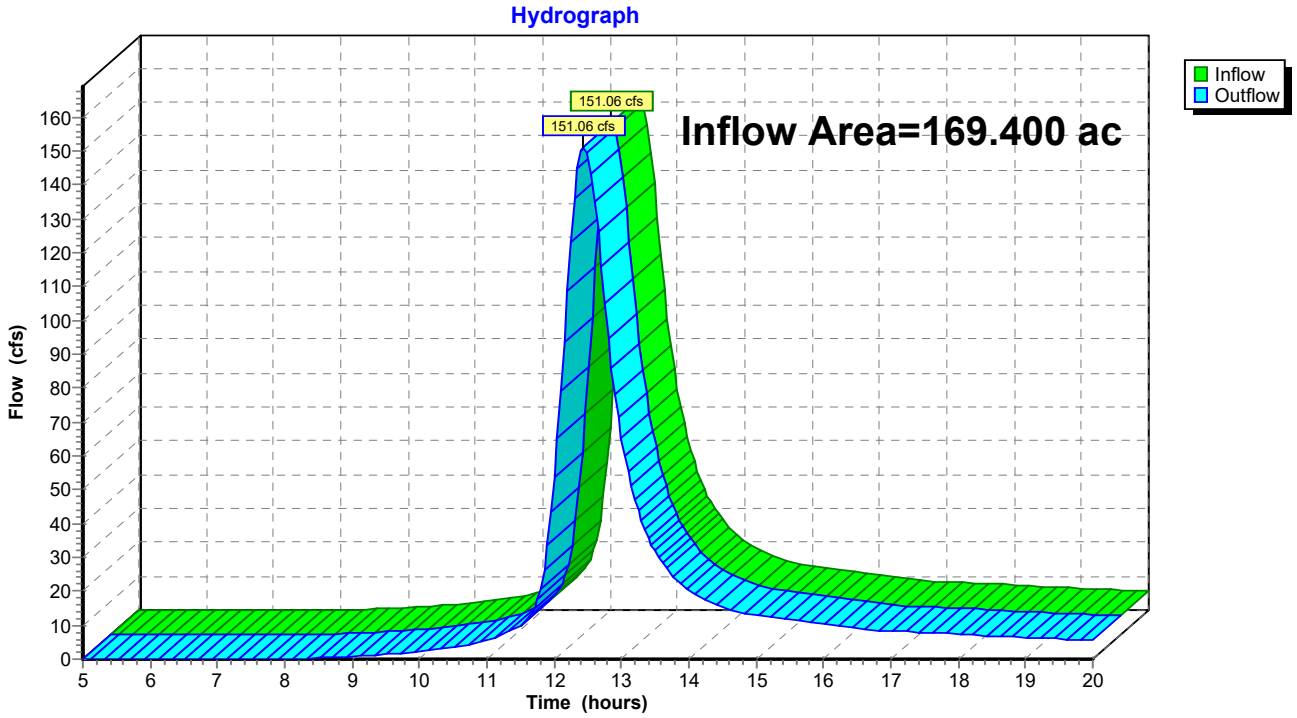
Summary for Reach 5R: Pr. 72" Downstream

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 169.400 ac, 2.99% Impervious, Inflow Depth > 1.31" for 2-yr event
Inflow = 151.06 cfs @ 12.44 hrs, Volume= 18.496 af
Outflow = 151.06 cfs @ 12.44 hrs, Volume= 18.496 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Reach 5R: Pr. 72" Downstream



Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 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: Existing CoC north of Runoff Area=161.220 ac 0.00% Impervious Runoff Depth>1.79"
Flow Length=5,213' Tc=46.0 min CN=87 Runoff=203.53 cfs 23.990 af

Subcatchment2S: Ex I-70 (ODOT North- Runoff Area=6.230 ac 58.59% Impervious Runoff Depth>2.14"
Flow Length=1,493' Tc=16.2 min CN=91 Runoff=17.35 cfs 1.111 af

Subcatchment6S: Scarborough East Runoff Area=1.950 ac 72.31% Impervious Runoff Depth>2.33"
Flow Length=1,272' Tc=4.4 min CN=93 Runoff=8.36 cfs 0.379 af

Reach 5R: Pr. 72" Downstream Inflow=208.10 cfs 25.480 af
Outflow=208.10 cfs 25.480 af

Total Runoff Area = 169.400 ac Runoff Volume = 25.480 af Average Runoff Depth = 1.80"
97.01% Pervious = 164.340 ac 2.99% Impervious = 5.060 ac

Summary for Subcatchment 1S: Existing CoC north of I-70

[47] Hint: Peak is 3531% of capacity of segment #2
[47] Hint: Peak is 875% of capacity of segment #3
[47] Hint: Peak is 532% of capacity of segment #4
[47] Hint: Peak is 255% of capacity of segment #5

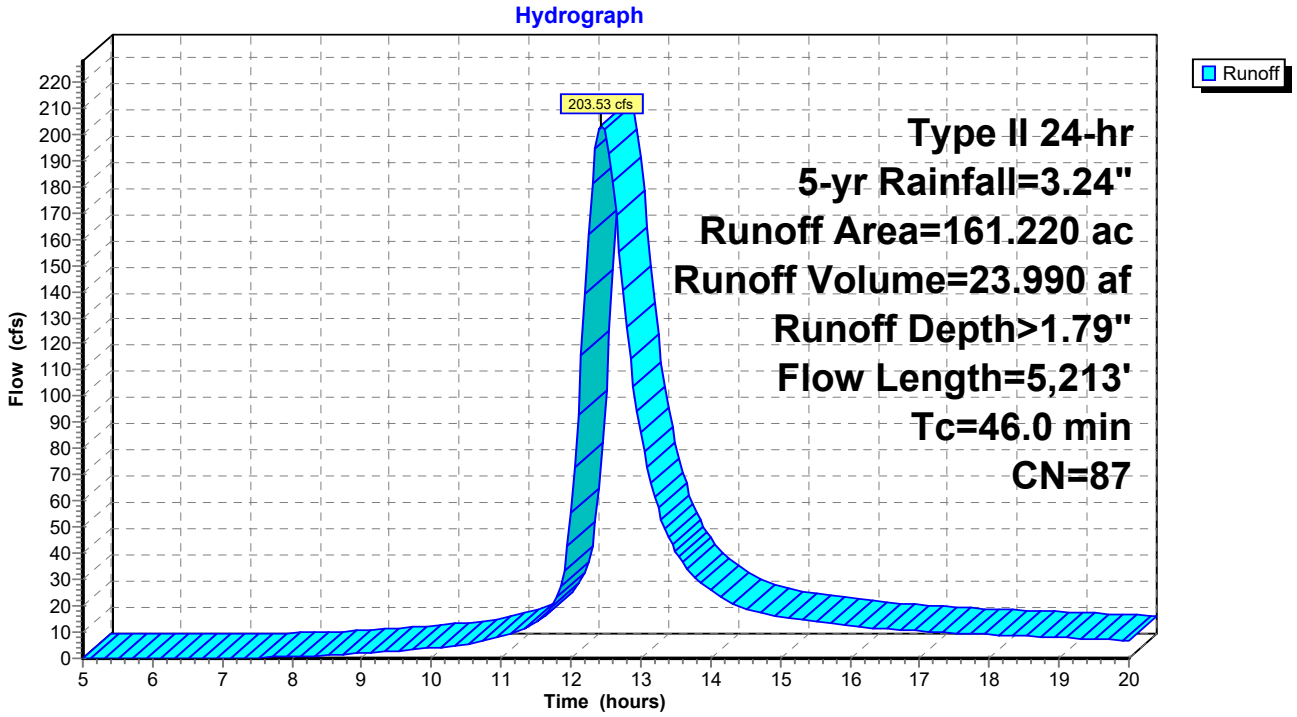
Runoff = 203.53 cfs @ 12.44 hrs, Volume= 23.990 af, Depth> 1.79"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 5-yr Rainfall=3.24"

	Area (ac)	CN	Description
*	4.390	77	Woods
*	114.820	85	Residential
*	42.010	95	Business Complex (Apartment)&School
	161.220	87	Weighted Average
	161.220		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
31.2	100	0.0100	0.05		**Sheet Flow, sheet flow** Woods: Light underbrush n= 0.400 P2= 2.64"
1.6	723	0.0223	7.34	5.76	**Pipe Channel, CMP_Round 12"** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.012 Concrete pipe, finished
2.3	1,024	0.0090	7.40	23.25	**Pipe Channel, CMP_Round 24"** 24.0" Round Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.012 Concrete pipe, finished
8.8	2,845	0.0028	5.41	38.23	**Pipe Channel, CMP_Round 36"** 36.0" Round Area= 7.1 sf Perim= 9.4' r= 0.75' n= 0.012 Concrete pipe, finished
2.1	521	0.0008	4.06	79.80	**Pipe Channel, CMP_Round 60"** 60.0" Round Area= 19.6 sf Perim= 15.7' r= 1.25' n= 0.012 Concrete pipe, finished
46.0	5,213	Total			

Subcatchment 1S: Existing CoC north of I-70



Summary for Subcatchment 2S: Ex I-70 (ODOT North- East)

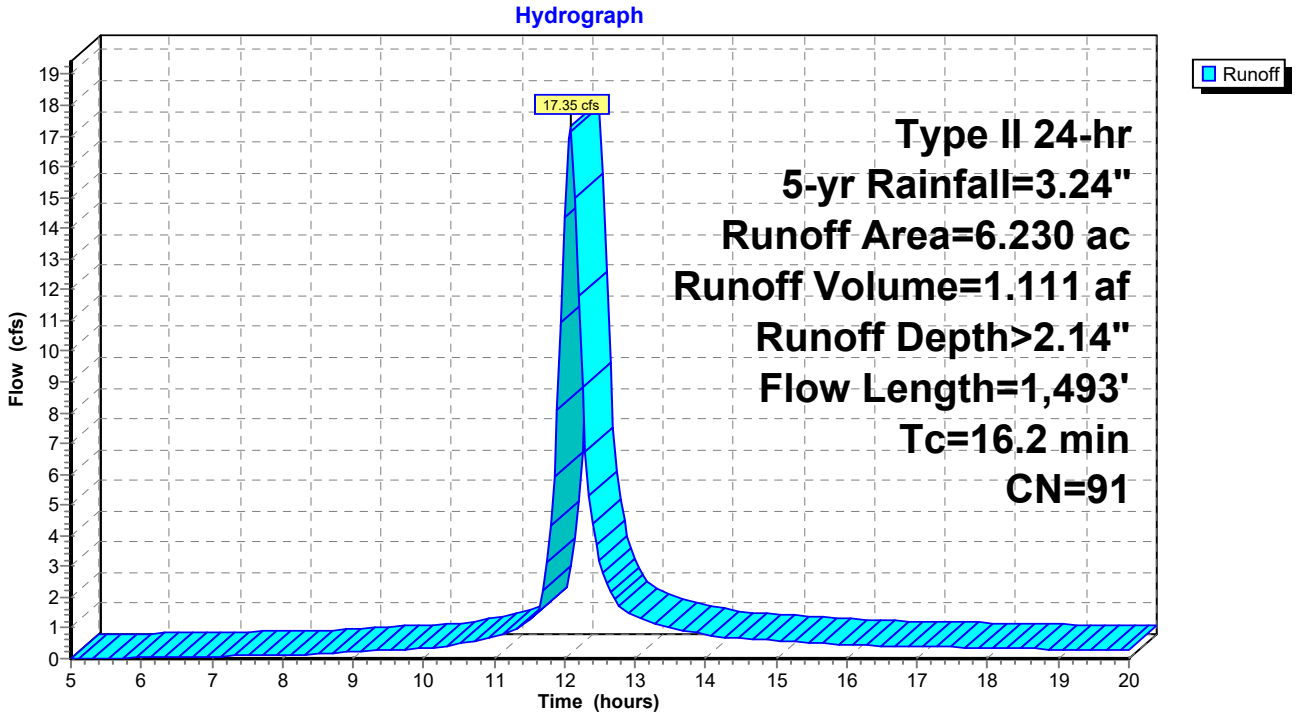
Runoff = 17.35 cfs @ 12.08 hrs, Volume= 1.111 af, Depth> 2.14"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 5-yr Rainfall=3.24"

	Area (ac)	CN	Description
*	3.650	98	Impervious Area, HSG D
*	2.580	80	Woods, Poor, HSG D
	6.230	91	Weighted Average
	2.580		41.41% Pervious Area
	3.650		58.59% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.7	80	0.0600	1.85		**Sheet Flow, Sheet Flow** Smooth surfaces n= 0.011 P2= 2.64"
15.5	1,413	0.0103	1.52		**Shallow Concentrated Flow, Roadside ditch** Grassed Waterway Kv= 15.0 fps
16.2	1,493	Total			

Subcatchment 2S: Ex I-70 (ODOT North- East)



Summary for Subcatchment 6S: Scarborough East

[49] Hint: Tc<2dt may require smaller dt

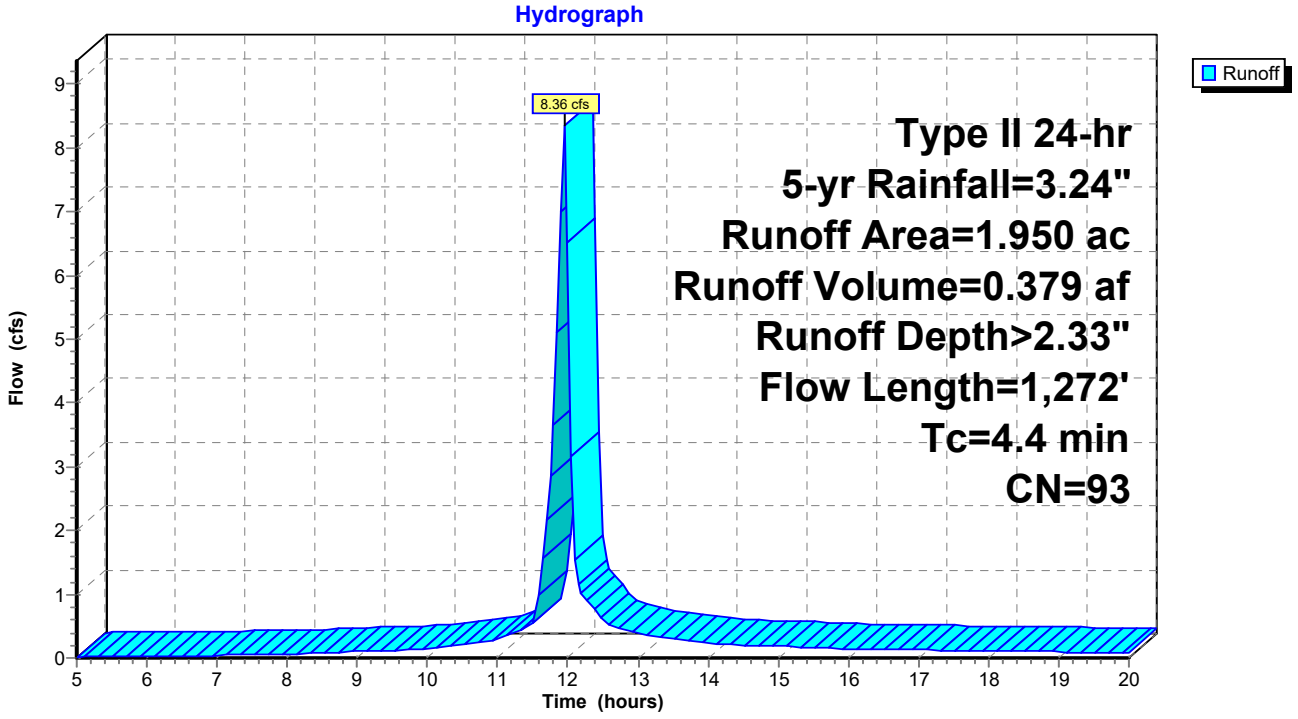
Runoff = 8.36 cfs @ 11.95 hrs, Volume= 0.379 af, Depth> 2.33"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 5-yr Rainfall=3.24"

	Area (ac)	CN	Description
*	1.410	98	Impervious area
*	0.540	80	Vegetative
	1.950	93	Weighted Average
	0.540		27.69% Pervious Area
	1.410		72.31% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.6	105	0.1880	3.09		**Sheet Flow, Sheet flow** Smooth surfaces n= 0.011 P2= 2.64"
3.8	1,167	0.0064	5.15	9.10	**Pipe Channel, CMP_Round 18"** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.012 Concrete pipe, finished
4.4	1,272	Total			

Subcatchment 6S: Scarborough East



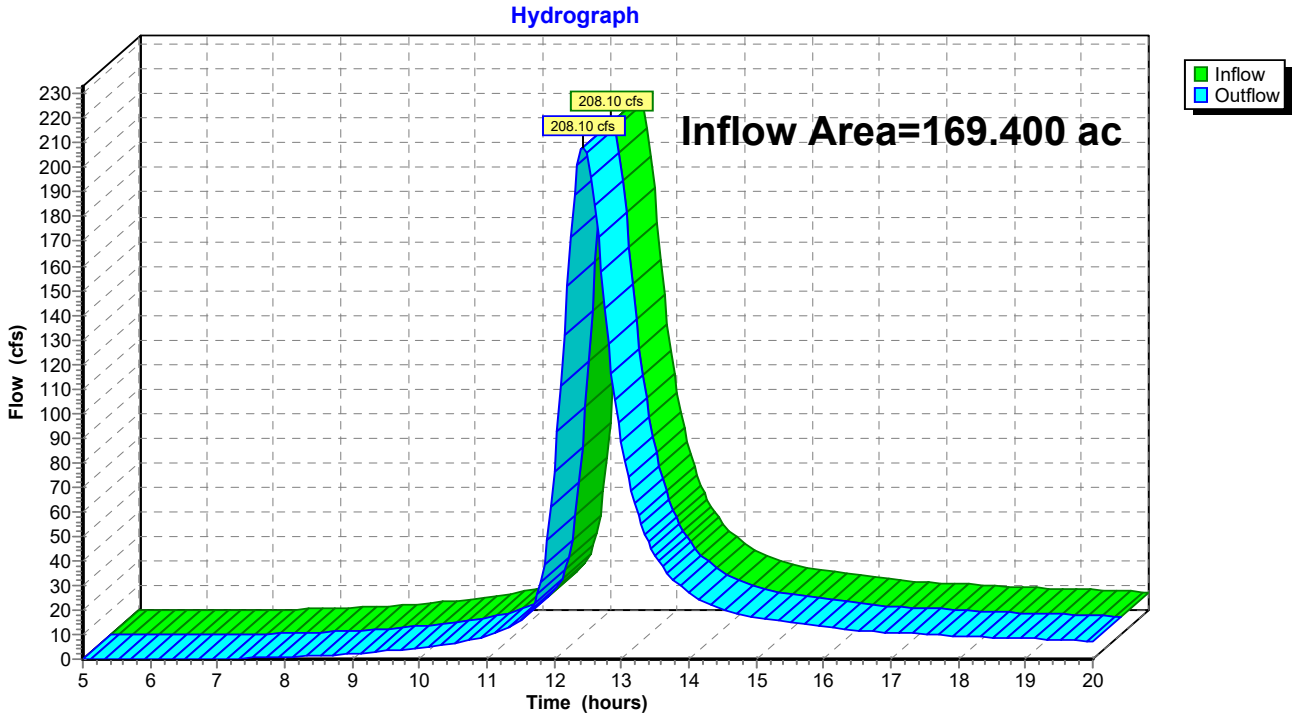
Summary for Reach 5R: Pr. 72" Downstream

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 169.400 ac, 2.99% Impervious, Inflow Depth > 1.80" for 5-yr event
Inflow = 208.10 cfs @ 12.43 hrs, Volume= 25.480 af
Outflow = 208.10 cfs @ 12.43 hrs, Volume= 25.480 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Reach 5R: Pr. 72" Downstream



Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 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: Existing CoC north of Runoff Area=161.220 ac 0.00% Impervious Runoff Depth>2.20"
Flow Length=5,213' Tc=46.0 min CN=87 Runoff=250.39 cfs 29.616 af

Subcatchment2S: Ex I-70 (ODOT North- Runoff Area=6.230 ac 58.59% Impervious Runoff Depth>2.59"
Flow Length=1,493' Tc=16.2 min CN=91 Runoff=20.75 cfs 1.343 af

Subcatchment6S: Scarborough East Runoff Area=1.950 ac 72.31% Impervious Runoff Depth>2.78"
Flow Length=1,272' Tc=4.4 min CN=93 Runoff=9.87 cfs 0.452 af

Reach 5R: Pr. 72" Downstream Inflow=255.86 cfs 31.411 af
Outflow=255.86 cfs 31.411 af

Total Runoff Area = 169.400 ac Runoff Volume = 31.411 af Average Runoff Depth = 2.23"
97.01% Pervious = 164.340 ac 2.99% Impervious = 5.060 ac

Summary for Subcatchment 1S: Existing CoC north of I-70

[47] Hint: Peak is 4344% of capacity of segment #2
[47] Hint: Peak is 1077% of capacity of segment #3
[47] Hint: Peak is 655% of capacity of segment #4
[47] Hint: Peak is 314% of capacity of segment #5

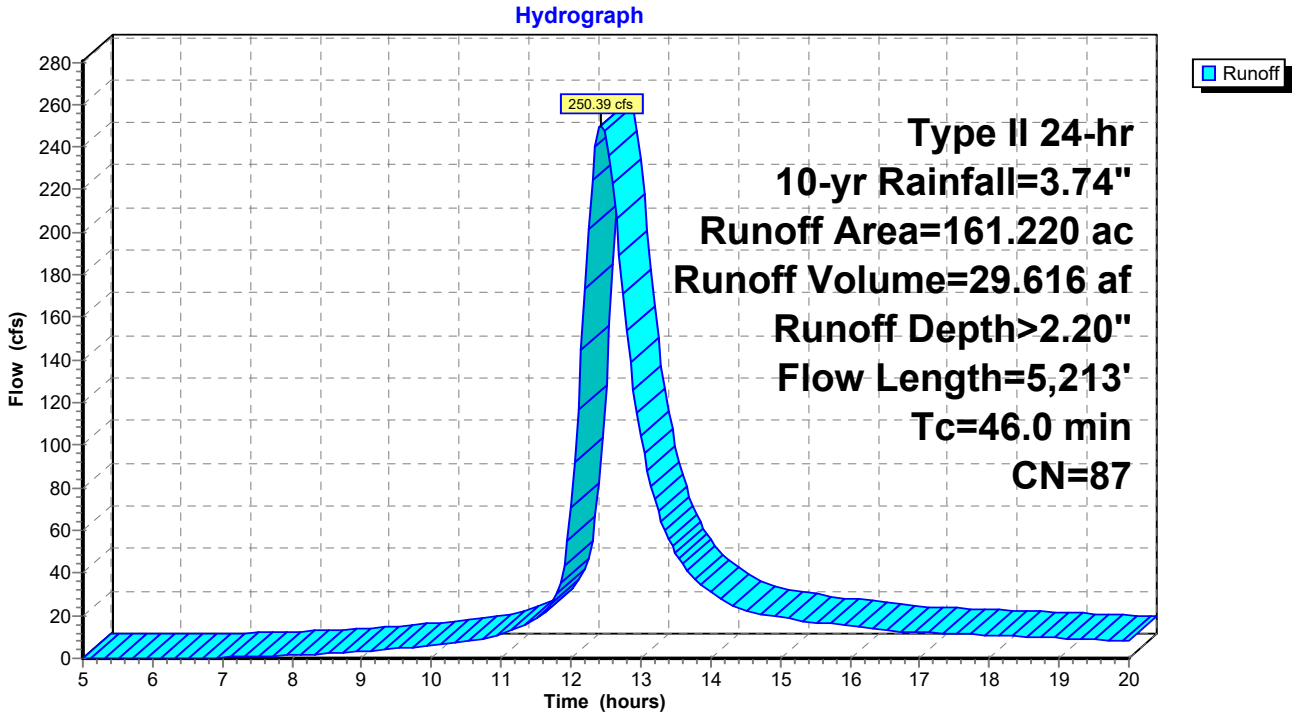
Runoff = 250.39 cfs @ 12.43 hrs, Volume= 29.616 af, Depth> 2.20"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-yr Rainfall=3.74"

	Area (ac)	CN	Description
*	4.390	77	Woods
*	114.820	85	Residential
*	42.010	95	Business Complex (Apartment)&School
	161.220	87	Weighted Average
	161.220		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
31.2	100	0.0100	0.05		**Sheet Flow, sheet flow** Woods: Light underbrush n= 0.400 P2= 2.64"
1.6	723	0.0223	7.34	5.76	**Pipe Channel, CMP_Round 12"** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.012 Concrete pipe, finished
2.3	1,024	0.0090	7.40	23.25	**Pipe Channel, CMP_Round 24"** 24.0" Round Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.012 Concrete pipe, finished
8.8	2,845	0.0028	5.41	38.23	**Pipe Channel, CMP_Round 36"** 36.0" Round Area= 7.1 sf Perim= 9.4' r= 0.75' n= 0.012 Concrete pipe, finished
2.1	521	0.0008	4.06	79.80	**Pipe Channel, CMP_Round 60"** 60.0" Round Area= 19.6 sf Perim= 15.7' r= 1.25' n= 0.012 Concrete pipe, finished
46.0	5,213	Total			

Subcatchment 1S: Existing CoC north of I-70



Summary for Subcatchment 2S: Ex I-70 (ODOT North- East)

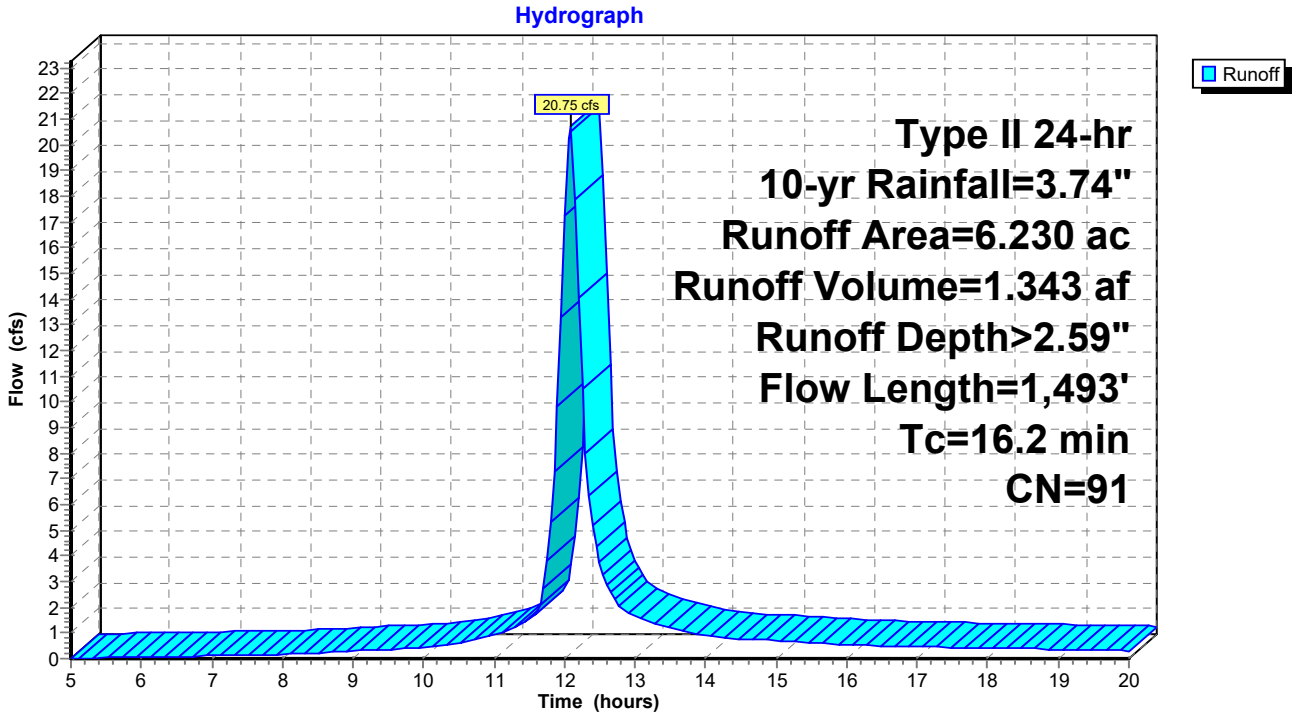
Runoff = 20.75 cfs @ 12.08 hrs, Volume= 1.343 af, Depth> 2.59"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-yr Rainfall=3.74"

	Area (ac)	CN	Description
*	3.650	98	Impervious Area, HSG D
*	2.580	80	Woods, Poor, HSG D
	6.230	91	Weighted Average
	2.580		41.41% Pervious Area
	3.650		58.59% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.7	80	0.0600	1.85		**Sheet Flow, Sheet Flow** Smooth surfaces n= 0.011 P2= 2.64"
15.5	1,413	0.0103	1.52		**Shallow Concentrated Flow, Roadside ditch** Grassed Waterway Kv= 15.0 fps
16.2	1,493	Total			

Subcatchment 2S: Ex I-70 (ODOT North- East)



Summary for Subcatchment 6S: Scarborough East

[49] Hint: Tc<2dt may require smaller dt
[47] Hint: Peak is 108% of capacity of segment #2

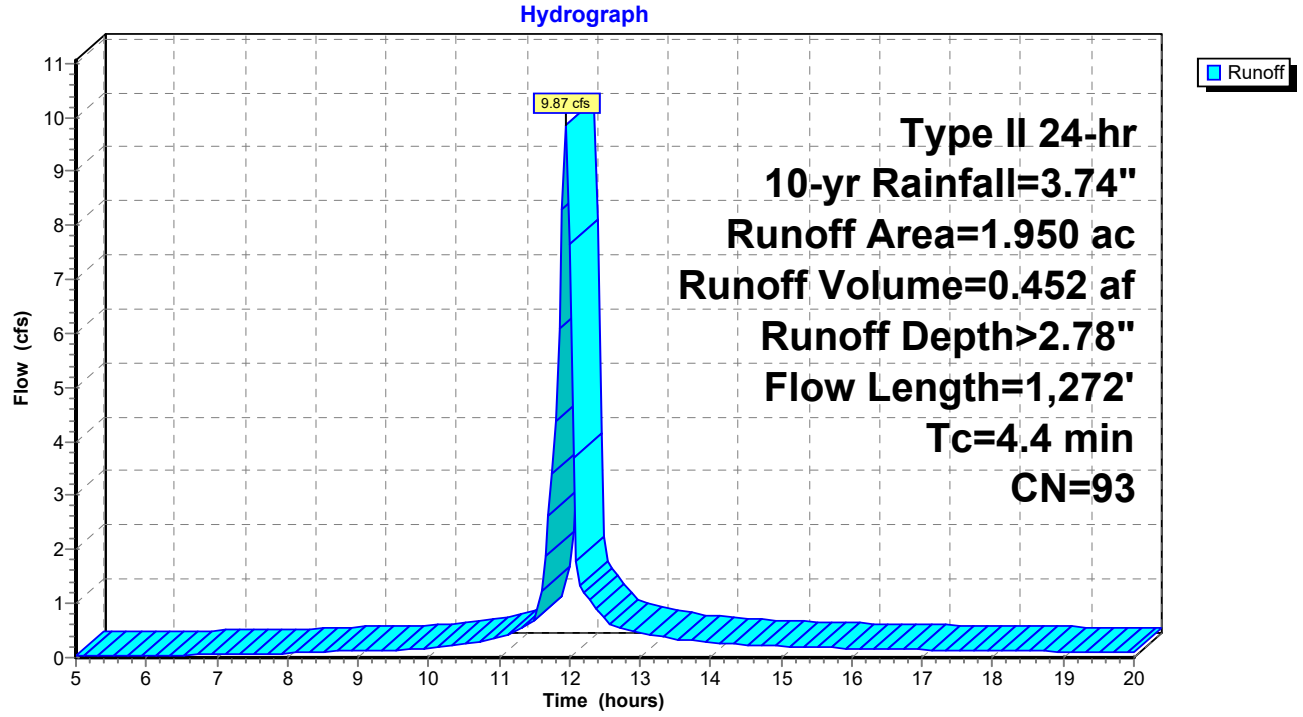
Runoff = 9.87 cfs @ 11.95 hrs, Volume= 0.452 af, Depth> 2.78"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-yr Rainfall=3.74"

	Area (ac)	CN	Description
*	1.410	98	Impervious area
*	0.540	80	Vegetative
	1.950	93	Weighted Average
	0.540		27.69% Pervious Area
	1.410		72.31% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.6	105	0.1880	3.09		**Sheet Flow, Sheet flow** Smooth surfaces n= 0.011 P2= 2.64"
3.8	1,167	0.0064	5.15	9.10	**Pipe Channel, CMP_Round 18"** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.012 Concrete pipe, finished
4.4	1,272	Total			

Subcatchment 6S: Scarborough East



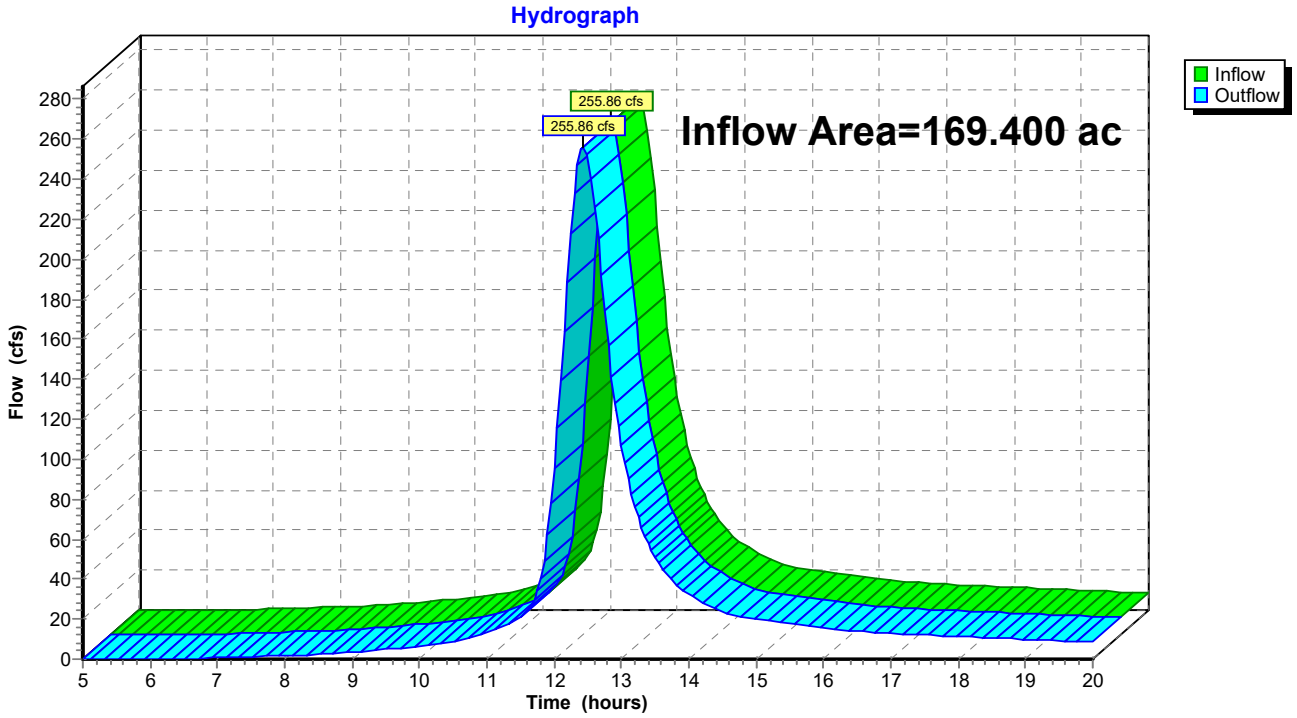
Summary for Reach 5R: Pr. 72" Downstream

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 169.400 ac, 2.99% Impervious, Inflow Depth > 2.23" for 10-yr event
Inflow = 255.86 cfs @ 12.43 hrs, Volume= 31.411 af
Outflow = 255.86 cfs @ 12.43 hrs, Volume= 31.411 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Reach 5R: Pr. 72" Downstream



Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 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: Existing CoC north of Runoff Area=161.220 ac 0.00% Impervious Runoff Depth>2.81"
Flow Length=5,213' Tc=46.0 min CN=87 Runoff=316.77 cfs 37.699 af

Subcatchment2S: Ex I-70 (ODOT North- Runoff Area=6.230 ac 58.59% Impervious Runoff Depth>3.22"
Flow Length=1,493' Tc=16.2 min CN=91 Runoff=25.51 cfs 1.671 af

Subcatchment6S: Scarborough East Runoff Area=1.950 ac 72.31% Impervious Runoff Depth>3.42"
Flow Length=1,272' Tc=4.4 min CN=93 Runoff=11.97 cfs 0.556 af

Reach 5R: Pr. 72" Downstream Inflow=323.82 cfs 39.925 af
Outflow=323.82 cfs 39.925 af

Total Runoff Area = 169.400 ac Runoff Volume = 39.925 af Average Runoff Depth = 2.83"
97.01% Pervious = 164.340 ac 2.99% Impervious = 5.060 ac

Summary for Subcatchment 1S: Existing CoC north of I-70

[47] Hint: Peak is 5496% of capacity of segment #2
[47] Hint: Peak is 1362% of capacity of segment #3
[47] Hint: Peak is 828% of capacity of segment #4
[47] Hint: Peak is 397% of capacity of segment #5

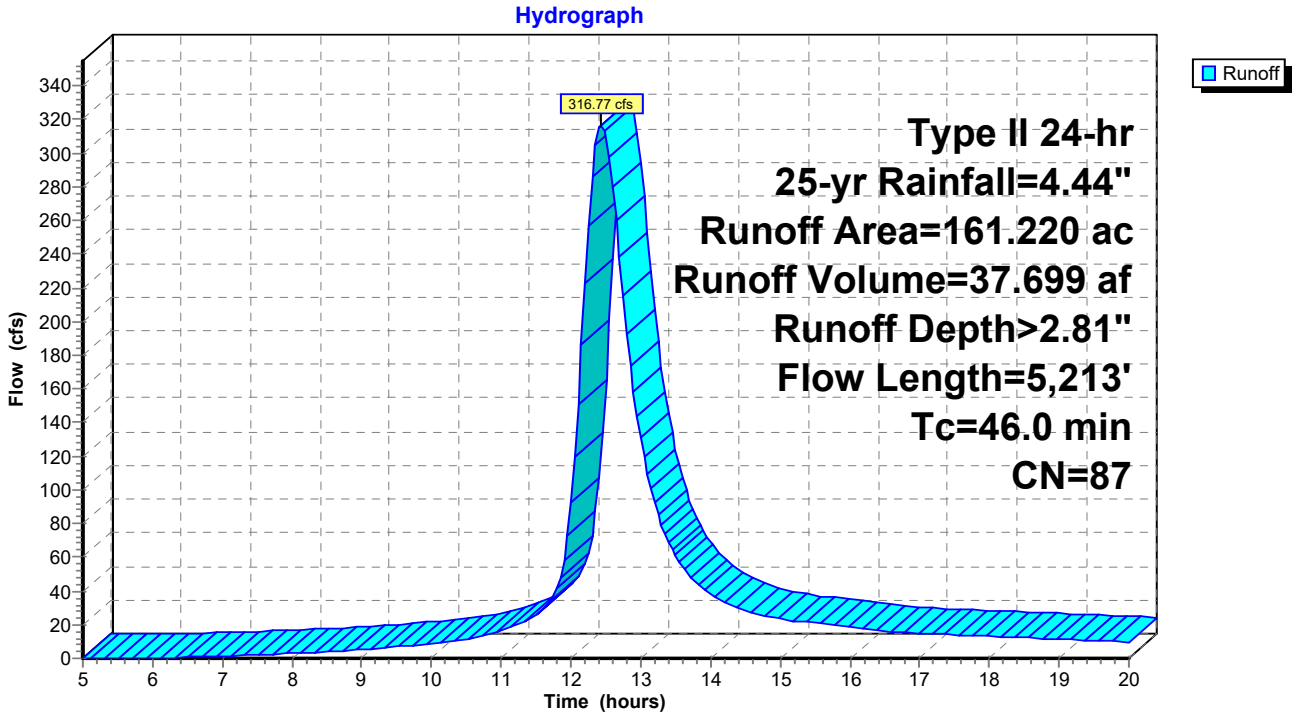
Runoff = 316.77 cfs @ 12.43 hrs, Volume= 37.699 af, Depth> 2.81"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr Rainfall=4.44"

	Area (ac)	CN	Description
*	4.390	77	Woods
*	114.820	85	Residential
*	42.010	95	Business Complex (Apartment)&School
	161.220	87	Weighted Average
	161.220		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
31.2	100	0.0100	0.05		**Sheet Flow, sheet flow** Woods: Light underbrush n= 0.400 P2= 2.64"
1.6	723	0.0223	7.34	5.76	**Pipe Channel, CMP_Round 12"** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.012 Concrete pipe, finished
2.3	1,024	0.0090	7.40	23.25	**Pipe Channel, CMP_Round 24"** 24.0" Round Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.012 Concrete pipe, finished
8.8	2,845	0.0028	5.41	38.23	**Pipe Channel, CMP_Round 36"** 36.0" Round Area= 7.1 sf Perim= 9.4' r= 0.75' n= 0.012 Concrete pipe, finished
2.1	521	0.0008	4.06	79.80	**Pipe Channel, CMP_Round 60"** 60.0" Round Area= 19.6 sf Perim= 15.7' r= 1.25' n= 0.012 Concrete pipe, finished
46.0	5,213	Total			

Subcatchment 1S: Existing CoC north of I-70



Summary for Subcatchment 2S: Ex I-70 (ODOT North- East)

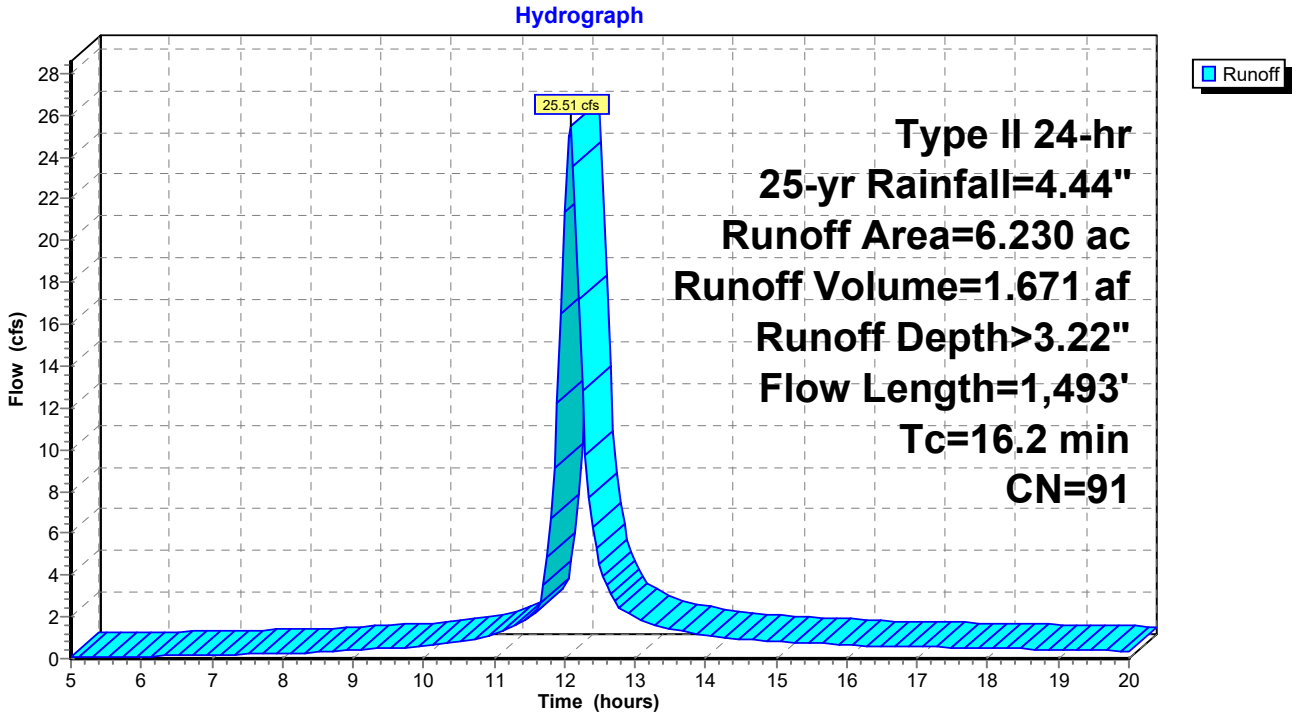
Runoff = 25.51 cfs @ 12.08 hrs, Volume= 1.671 af, Depth> 3.22"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr Rainfall=4.44"

	Area (ac)	CN	Description
*	3.650	98	Impervious Area, HSG D
*	2.580	80	Woods, Poor, HSG D
	6.230	91	Weighted Average
	2.580		41.41% Pervious Area
	3.650		58.59% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.7	80	0.0600	1.85		**Sheet Flow, Sheet Flow** Smooth surfaces n= 0.011 P2= 2.64"
15.5	1,413	0.0103	1.52		**Shallow Concentrated Flow, Roadside ditch** Grassed Waterway Kv= 15.0 fps
16.2	1,493	Total			

Subcatchment 2S: Ex I-70 (ODOT North- East)



Summary for Subcatchment 6S: Scarborough East

[49] Hint: Tc<2dt may require smaller dt
[47] Hint: Peak is 131% of capacity of segment #2

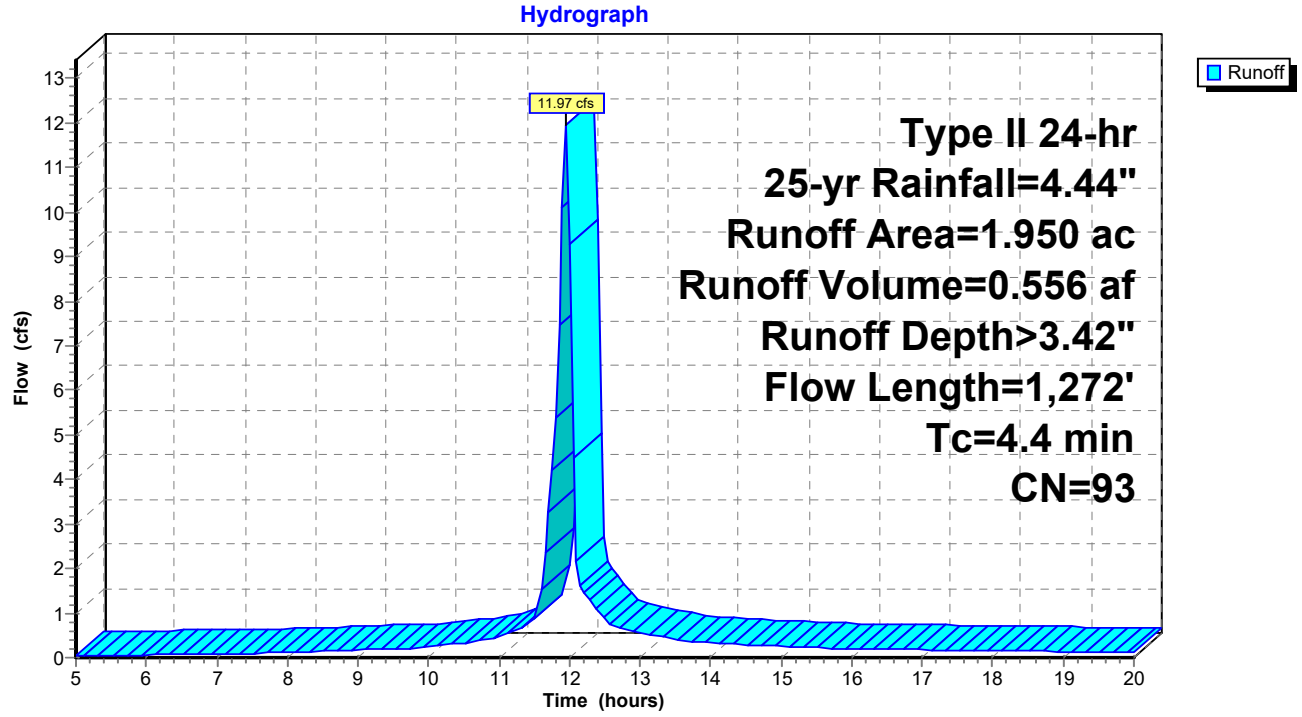
Runoff = 11.97 cfs @ 11.95 hrs, Volume= 0.556 af, Depth> 3.42"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr Rainfall=4.44"

	Area (ac)	CN	Description
*	1.410	98	Impervious area
*	0.540	80	Vegetative
	1.950	93	Weighted Average
	0.540		27.69% Pervious Area
	1.410		72.31% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.6	105	0.1880	3.09		**Sheet Flow, Sheet flow** Smooth surfaces n= 0.011 P2= 2.64"
3.8	1,167	0.0064	5.15	9.10	**Pipe Channel, CMP_Round 18"** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.012 Concrete pipe, finished
4.4	1,272	Total			

Subcatchment 6S: Scarborough East



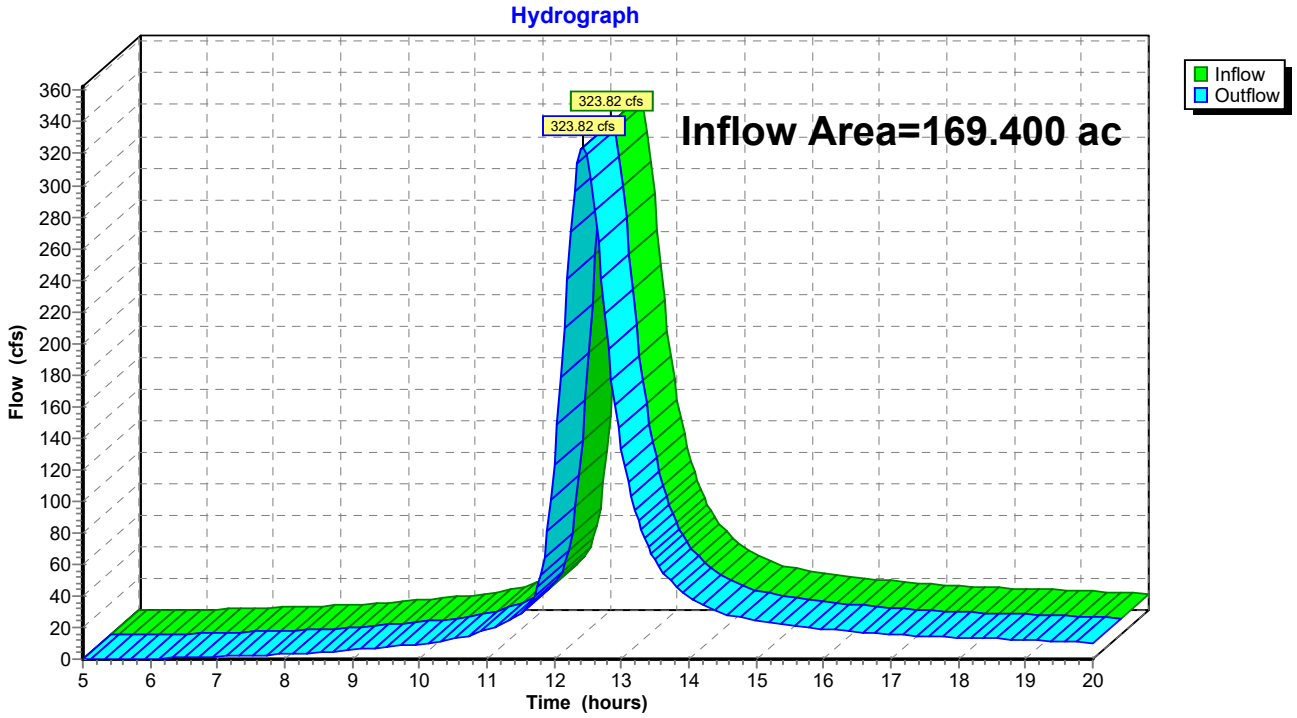
Summary for Reach 5R: Pr. 72" Downstream

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 169.400 ac, 2.99% Impervious, Inflow Depth > 2.83" for 25-yr event
Inflow = 323.82 cfs @ 12.42 hrs, Volume= 39.925 af
Outflow = 323.82 cfs @ 12.42 hrs, Volume= 39.925 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Reach 5R: Pr. 72" Downstream



Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 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: Existing CoC north of Runoff Area=161.220 ac 0.00% Impervious Runoff Depth>3.31"
Flow Length=5,213' Tc=46.0 min CN=87 Runoff=372.10 cfs 44.527 af

Subcatchment2S: Ex I-70 (ODOT North- Runoff Area=6.230 ac 58.59% Impervious Runoff Depth>3.74"
Flow Length=1,493' Tc=16.2 min CN=91 Runoff=29.44 cfs 1.944 af

Subcatchment6S: Scarborough East Runoff Area=1.950 ac 72.31% Impervious Runoff Depth>3.95"
Flow Length=1,272' Tc=4.4 min CN=93 Runoff=13.70 cfs 0.642 af

Reach 5R: Pr. 72" Downstream Inflow=380.25 cfs 47.113 af
Outflow=380.25 cfs 47.113 af

Total Runoff Area = 169.400 ac Runoff Volume = 47.113 af Average Runoff Depth = 3.34"
97.01% Pervious = 164.340 ac 2.99% Impervious = 5.060 ac

Summary for Subcatchment 1S: Existing CoC north of I-70

[47] Hint: Peak is 6456% of capacity of segment #2
[47] Hint: Peak is 1600% of capacity of segment #3
[47] Hint: Peak is 973% of capacity of segment #4
[47] Hint: Peak is 466% of capacity of segment #5

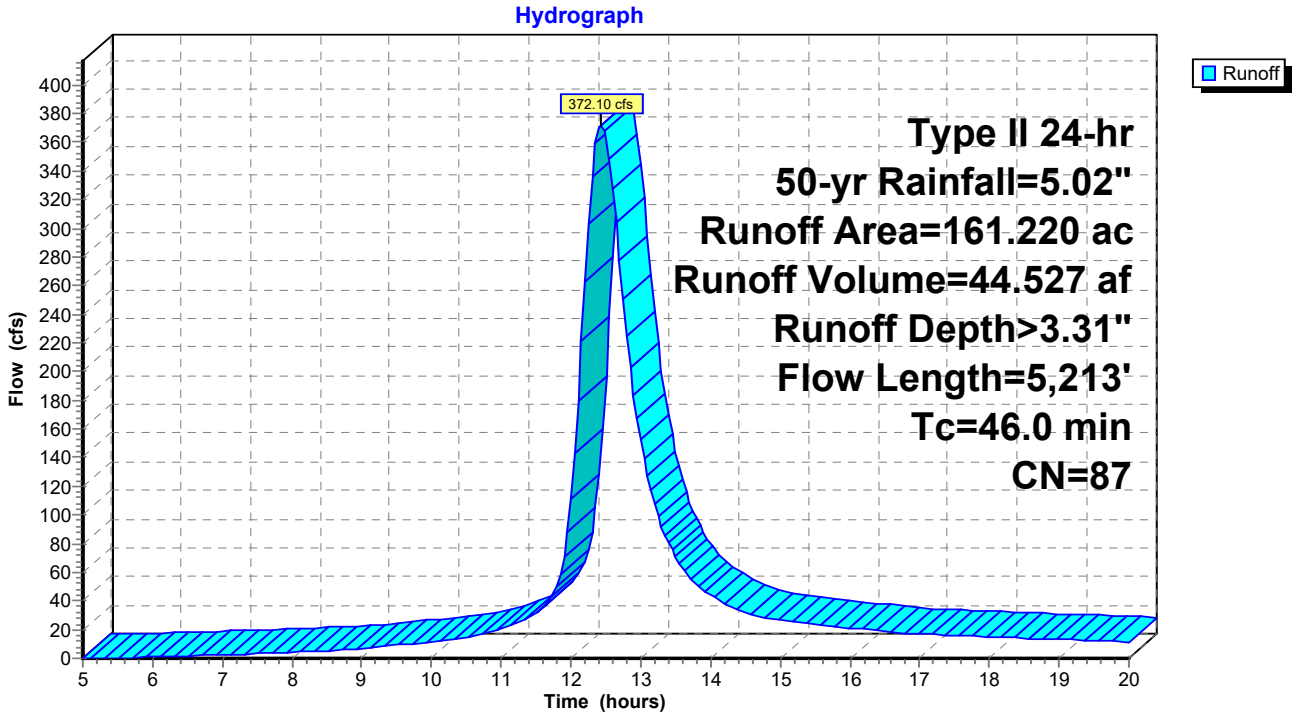
Runoff = 372.10 cfs @ 12.43 hrs, Volume= 44.527 af, Depth> 3.31"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 50-yr Rainfall=5.02"

	Area (ac)	CN	Description
*	4.390	77	Woods
*	114.820	85	Residential
*	42.010	95	Business Complex (Apartment)&School
	161.220	87	Weighted Average
	161.220		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
31.2	100	0.0100	0.05		**Sheet Flow, sheet flow** Woods: Light underbrush n= 0.400 P2= 2.64"
1.6	723	0.0223	7.34	5.76	**Pipe Channel, CMP_Round 12"** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.012 Concrete pipe, finished
2.3	1,024	0.0090	7.40	23.25	**Pipe Channel, CMP_Round 24"** 24.0" Round Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.012 Concrete pipe, finished
8.8	2,845	0.0028	5.41	38.23	**Pipe Channel, CMP_Round 36"** 36.0" Round Area= 7.1 sf Perim= 9.4' r= 0.75' n= 0.012 Concrete pipe, finished
2.1	521	0.0008	4.06	79.80	**Pipe Channel, CMP_Round 60"** 60.0" Round Area= 19.6 sf Perim= 15.7' r= 1.25' n= 0.012 Concrete pipe, finished
46.0	5,213	Total			

Subcatchment 1S: Existing CoC north of I-70



Summary for Subcatchment 2S: Ex I-70 (ODOT North- East)

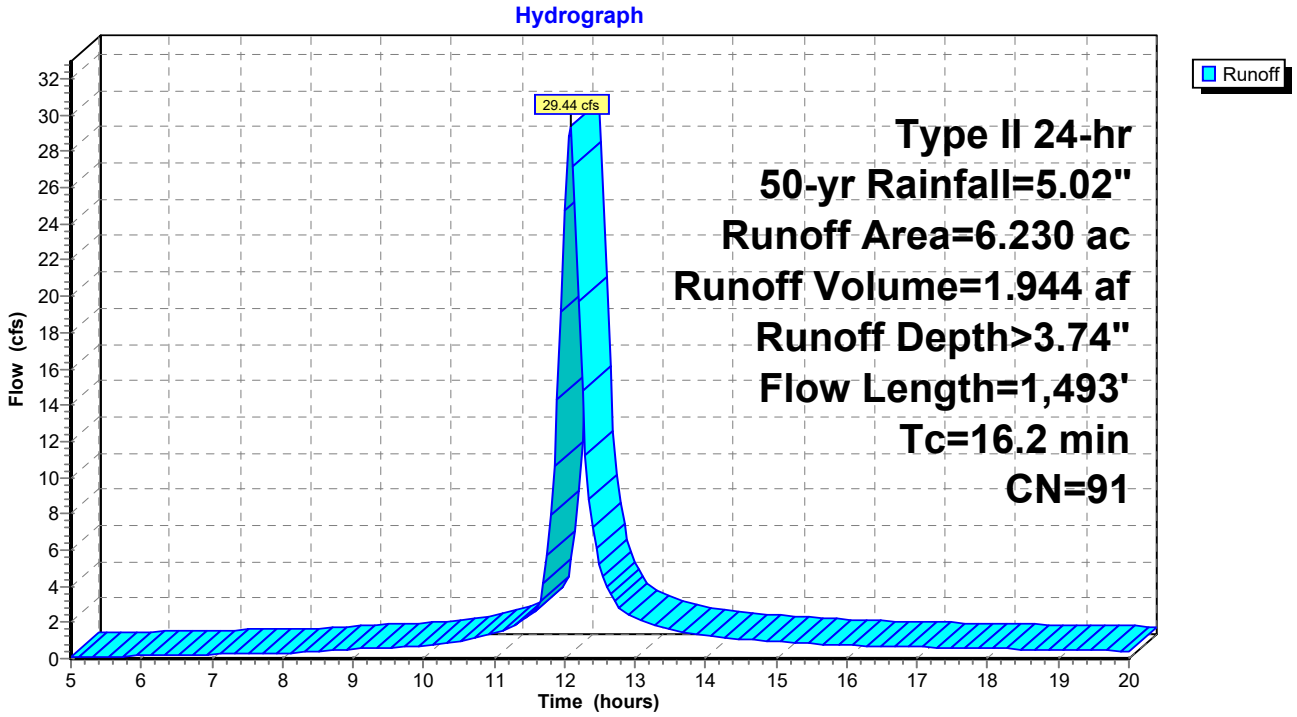
Runoff = 29.44 cfs @ 12.08 hrs, Volume= 1.944 af, Depth> 3.74"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 50-yr Rainfall=5.02"

	Area (ac)	CN	Description
*	3.650	98	Impervious Area, HSG D
*	2.580	80	Woods, Poor, HSG D
	6.230	91	Weighted Average
	2.580		41.41% Pervious Area
	3.650		58.59% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.7	80	0.0600	1.85		**Sheet Flow, Sheet Flow** Smooth surfaces n= 0.011 P2= 2.64"
15.5	1,413	0.0103	1.52		**Shallow Concentrated Flow, Roadside ditch** Grassed Waterway Kv= 15.0 fps
16.2	1,493	Total			

Subcatchment 2S: Ex I-70 (ODOT North- East)



Summary for Subcatchment 6S: Scarborough East

[49] Hint: Tc<2dt may require smaller dt
[47] Hint: Peak is 150% of capacity of segment #2

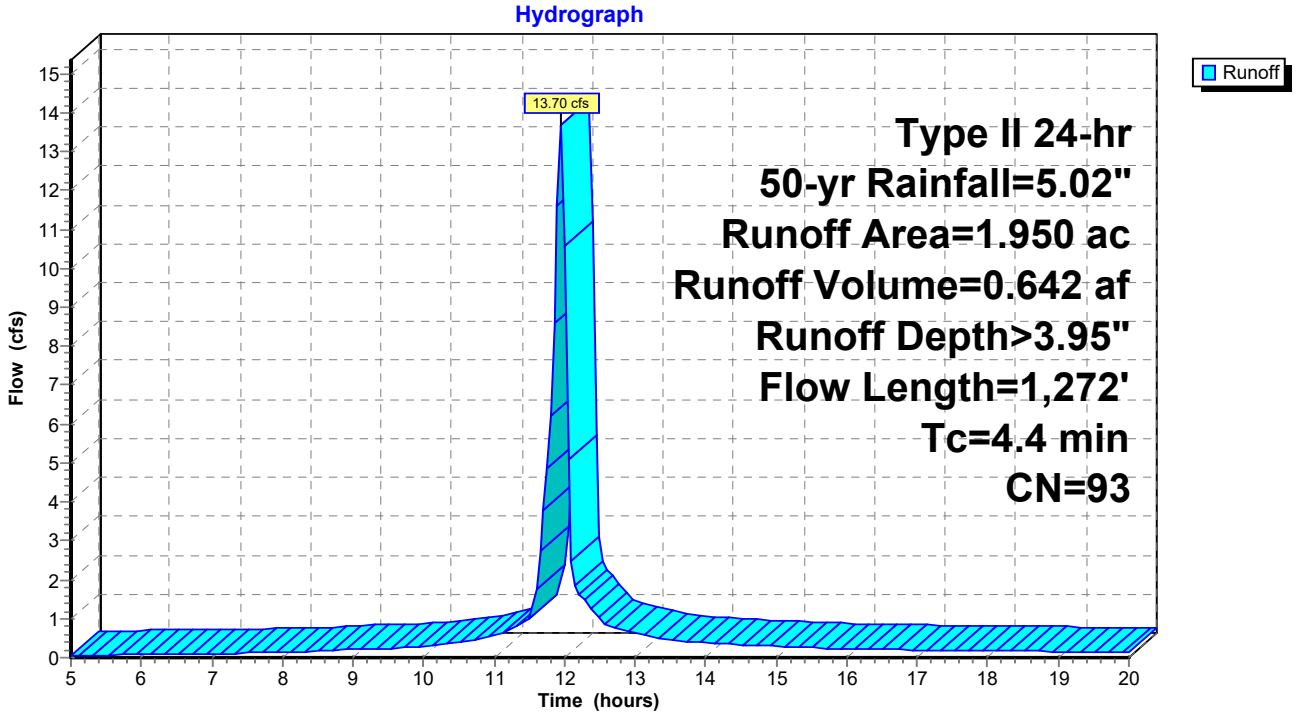
Runoff = 13.70 cfs @ 11.95 hrs, Volume= 0.642 af, Depth> 3.95"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 50-yr Rainfall=5.02"

	Area (ac)	CN	Description
*	1.410	98	Impervious area
*	0.540	80	Vegetative
	1.950	93	Weighted Average
	0.540		27.69% Pervious Area
	1.410		72.31% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.6	105	0.1880	3.09		**Sheet Flow, Sheet flow** Smooth surfaces n= 0.011 P2= 2.64"
3.8	1,167	0.0064	5.15	9.10	**Pipe Channel, CMP_Round 18"** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.012 Concrete pipe, finished
4.4	1,272	Total			

Subcatchment 6S: Scarborough East



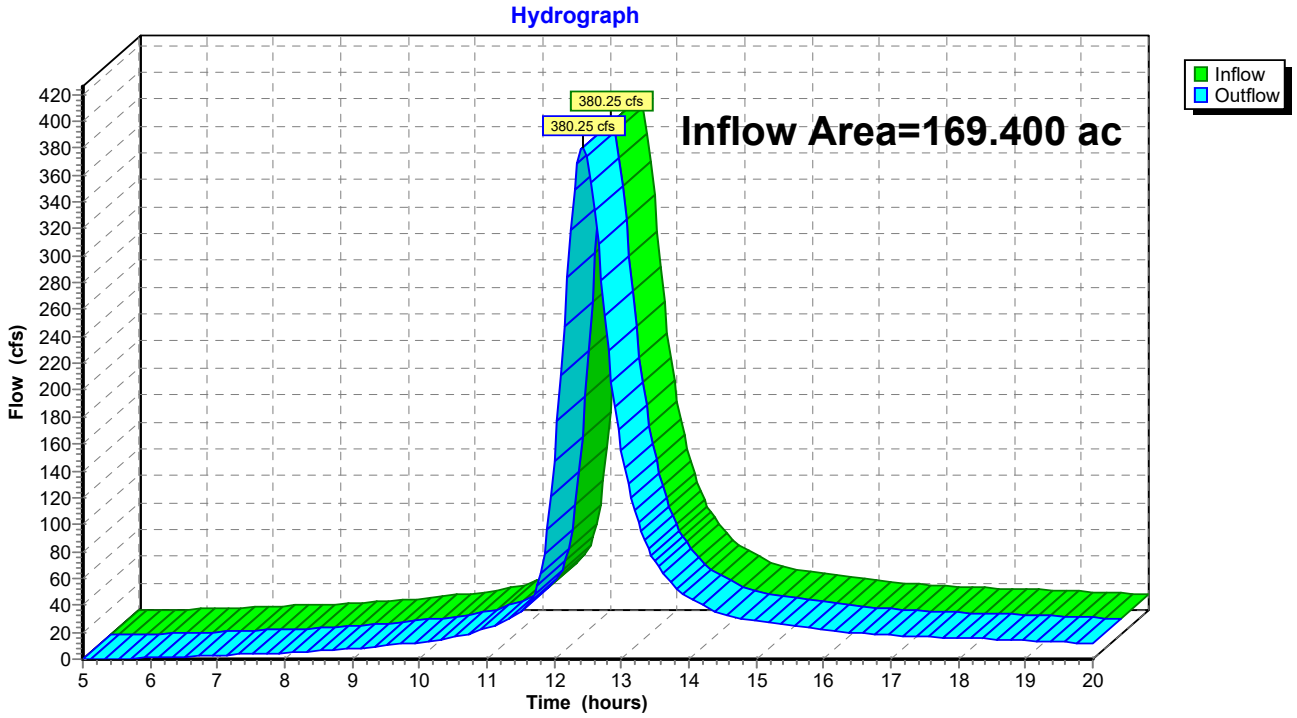
Summary for Reach 5R: Pr. 72" Downstream

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 169.400 ac, 2.99% Impervious, Inflow Depth > 3.34" for 50-yr event
Inflow = 380.25 cfs @ 12.42 hrs, Volume= 47.113 af
Outflow = 380.25 cfs @ 12.42 hrs, Volume= 47.113 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Reach 5R: Pr. 72" Downstream



Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 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: Existing CoC north of Runoff Area=161.220 ac 0.00% Impervious Runoff Depth>3.86"
Flow Length=5,213' Tc=46.0 min CN=87 Runoff=430.41 cfs 51.801 af

Subcatchment2S: Ex I-70 (ODOT North- Runoff Area=6.230 ac 58.59% Impervious Runoff Depth>4.30"
Flow Length=1,493' Tc=16.2 min CN=91 Runoff=33.55 cfs 2.232 af

Subcatchment6S: Scarborough East Runoff Area=1.950 ac 72.31% Impervious Runoff Depth>4.51"
Flow Length=1,272' Tc=4.4 min CN=93 Runoff=15.51 cfs 0.733 af

Reach 5R: Pr. 72" Downstream Inflow=439.70 cfs 54.766 af
Outflow=439.70 cfs 54.766 af

Total Runoff Area = 169.400 ac Runoff Volume = 54.766 af Average Runoff Depth = 3.88"
97.01% Pervious = 164.340 ac 2.99% Impervious = 5.060 ac

Summary for Subcatchment 1S: Existing CoC north of I-70

[47] Hint: Peak is 7468% of capacity of segment #2
[47] Hint: Peak is 1851% of capacity of segment #3
[47] Hint: Peak is 1126% of capacity of segment #4
[47] Hint: Peak is 539% of capacity of segment #5

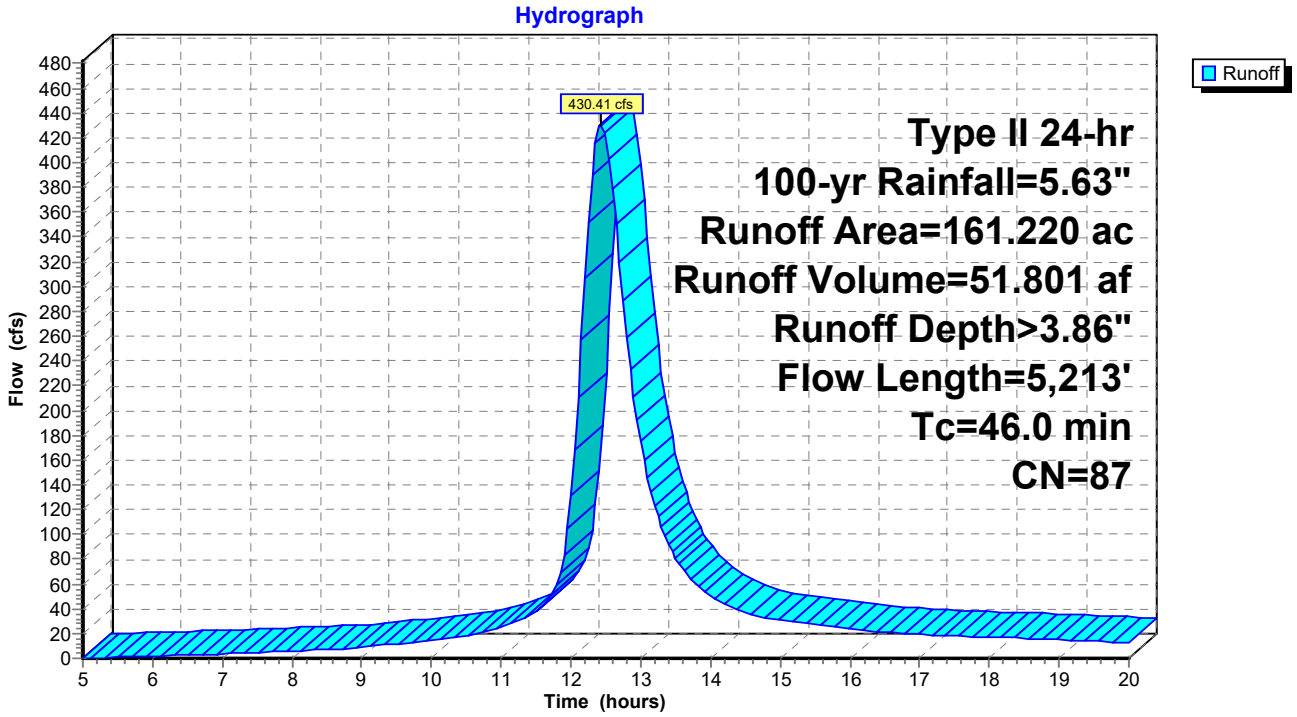
Runoff = 430.41 cfs @ 12.43 hrs, Volume= 51.801 af, Depth> 3.86"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-yr Rainfall=5.63"

	Area (ac)	CN	Description
*	4.390	77	Woods
*	114.820	85	Residential
*	42.010	95	Business Complex (Apartment)&School
	161.220	87	Weighted Average
	161.220		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
31.2	100	0.0100	0.05		**Sheet Flow, sheet flow** Woods: Light underbrush n= 0.400 P2= 2.64"
1.6	723	0.0223	7.34	5.76	**Pipe Channel, CMP_Round 12"** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.012 Concrete pipe, finished
2.3	1,024	0.0090	7.40	23.25	**Pipe Channel, CMP_Round 24"** 24.0" Round Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.012 Concrete pipe, finished
8.8	2,845	0.0028	5.41	38.23	**Pipe Channel, CMP_Round 36"** 36.0" Round Area= 7.1 sf Perim= 9.4' r= 0.75' n= 0.012 Concrete pipe, finished
2.1	521	0.0008	4.06	79.80	**Pipe Channel, CMP_Round 60"** 60.0" Round Area= 19.6 sf Perim= 15.7' r= 1.25' n= 0.012 Concrete pipe, finished
46.0	5,213	Total			

Subcatchment 1S: Existing CoC north of I-70



Summary for Subcatchment 2S: Ex I-70 (ODOT North- East)

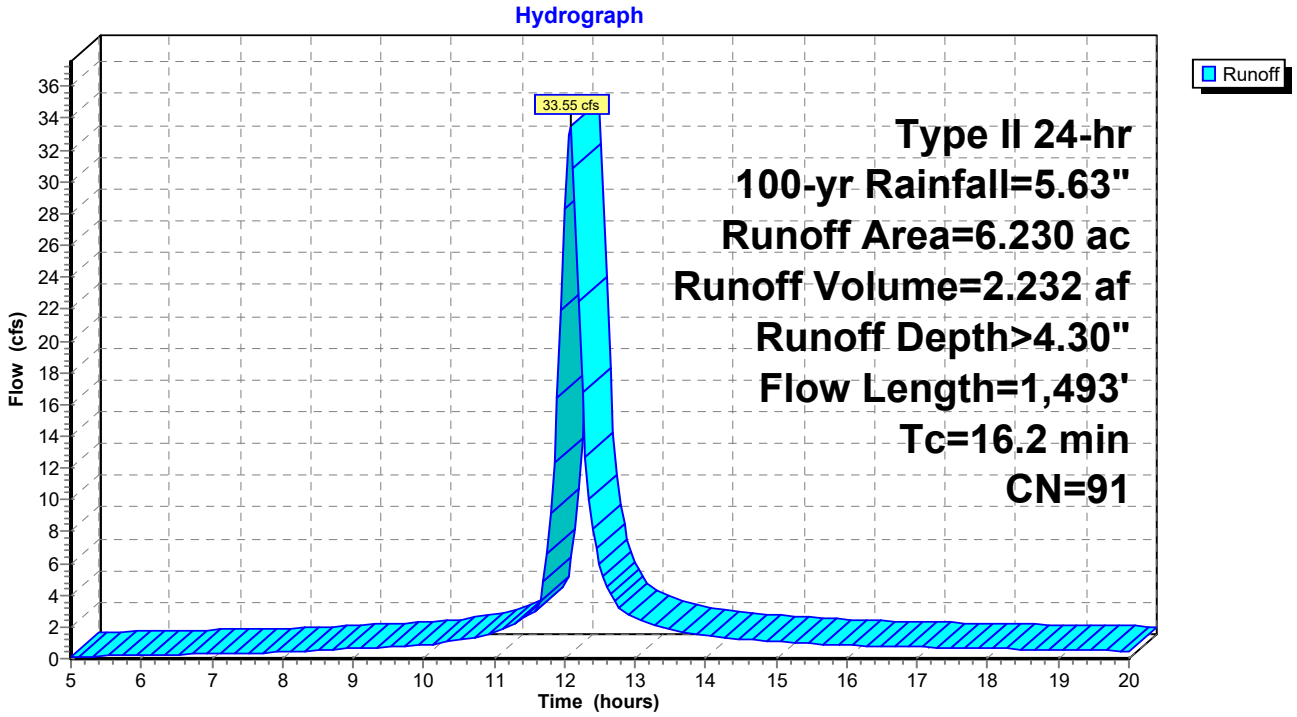
Runoff = 33.55 cfs @ 12.08 hrs, Volume= 2.232 af, Depth> 4.30"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-yr Rainfall=5.63"

	Area (ac)	CN	Description
*	3.650	98	Impervious Area, HSG D
*	2.580	80	Woods, Poor, HSG D
	6.230	91	Weighted Average
	2.580		41.41% Pervious Area
	3.650		58.59% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.7	80	0.0600	1.85		**Sheet Flow, Sheet Flow** Smooth surfaces n= 0.011 P2= 2.64"
15.5	1,413	0.0103	1.52		**Shallow Concentrated Flow, Roadside ditch** Grassed Waterway Kv= 15.0 fps
16.2	1,493	Total			

Subcatchment 2S: Ex I-70 (ODOT North- East)



Summary for Subcatchment 6S: Scarborough East

[49] Hint: Tc<2dt may require smaller dt
[47] Hint: Peak is 170% of capacity of segment #2

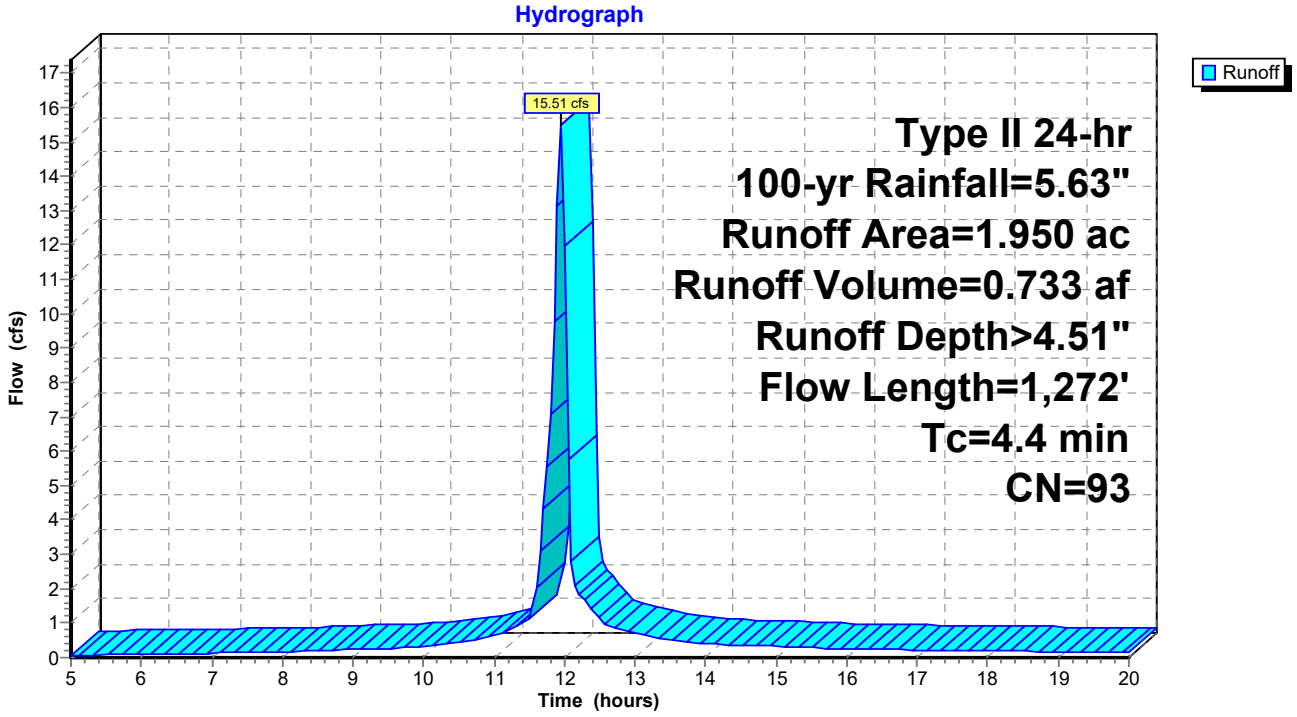
Runoff = 15.51 cfs @ 11.94 hrs, Volume= 0.733 af, Depth> 4.51"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-yr Rainfall=5.63"

	Area (ac)	CN	Description
*	1.410	98	Impervious area
*	0.540	80	Vegetative
	1.950	93	Weighted Average
	0.540		27.69% Pervious Area
	1.410		72.31% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.6	105	0.1880	3.09		**Sheet Flow, Sheet flow** Smooth surfaces n= 0.011 P2= 2.64"
3.8	1,167	0.0064	5.15	9.10	**Pipe Channel, CMP_Round 18"** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.012 Concrete pipe, finished
4.4	1,272	Total			

Subcatchment 6S: Scarborough East



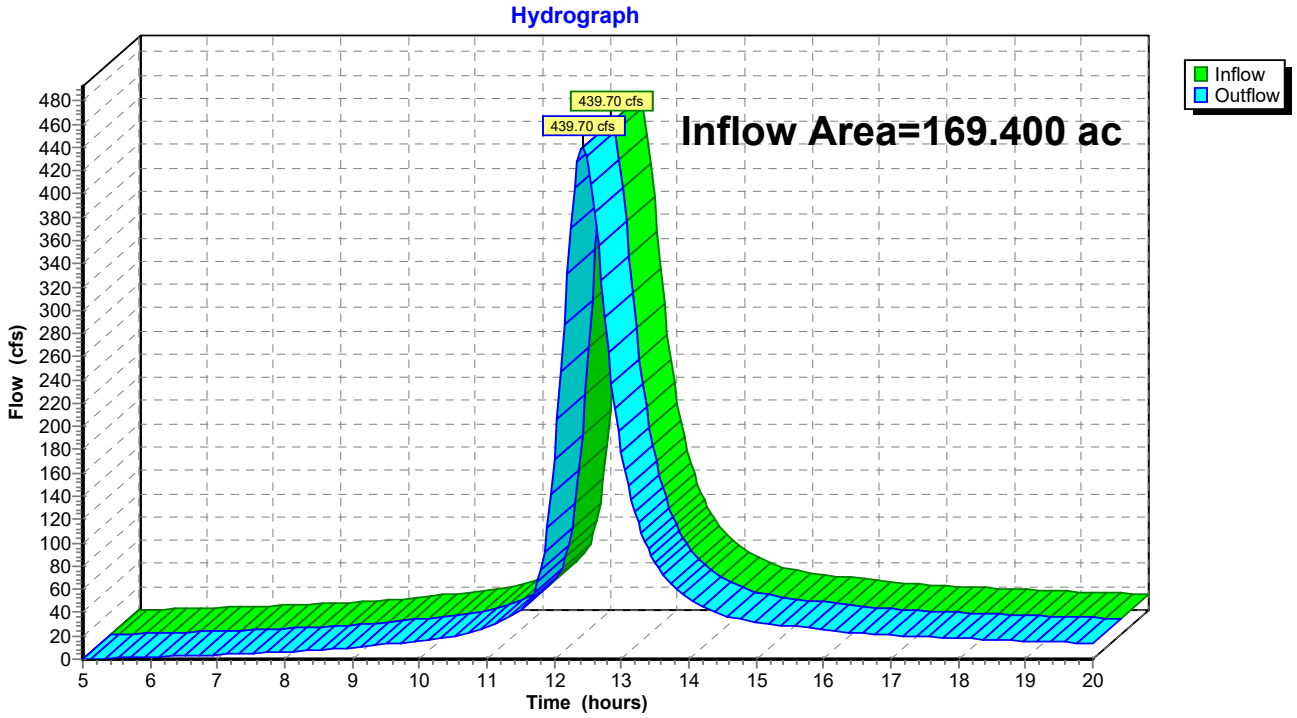
Summary for Reach 5R: Pr. 72" Downstream

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 169.400 ac, 2.99% Impervious, Inflow Depth > 3.88" for 100-yr event
Inflow = 439.70 cfs @ 12.42 hrs, Volume= 54.766 af
Outflow = 439.70 cfs @ 12.42 hrs, Volume= 54.766 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Reach 5R: Pr. 72" Downstream



Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 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: Existing CoC north of Runoff Area=161.220 ac 0.00% Impervious Runoff Depth>4.44"
Flow Length=5,213' Tc=46.0 min CN=87 Runoff=493.07 cfs 59.622 af

Subcatchment2S: Ex I-70 (ODOT North- Runoff Area=6.230 ac 58.59% Impervious Runoff Depth>4.89"
Flow Length=1,493' Tc=16.2 min CN=91 Runoff=37.92 cfs 2.540 af

Subcatchment6S: Scarborough East Runoff Area=1.950 ac 72.31% Impervious Runoff Depth>5.10"
Flow Length=1,272' Tc=4.4 min CN=93 Runoff=17.43 cfs 0.829 af

Reach 5R: Pr. 72" Downstream Inflow=503.04 cfs 62.991 af
Outflow=503.04 cfs 62.991 af

Total Runoff Area = 169.400 ac Runoff Volume = 62.991 af Average Runoff Depth = 4.46"
97.01% Pervious = 164.340 ac 2.99% Impervious = 5.060 ac

Summary for Subcatchment 1S: Existing CoC north of I-70

[47] Hint: Peak is 8555% of capacity of segment #2
[47] Hint: Peak is 2121% of capacity of segment #3
[47] Hint: Peak is 1290% of capacity of segment #4
[47] Hint: Peak is 618% of capacity of segment #5

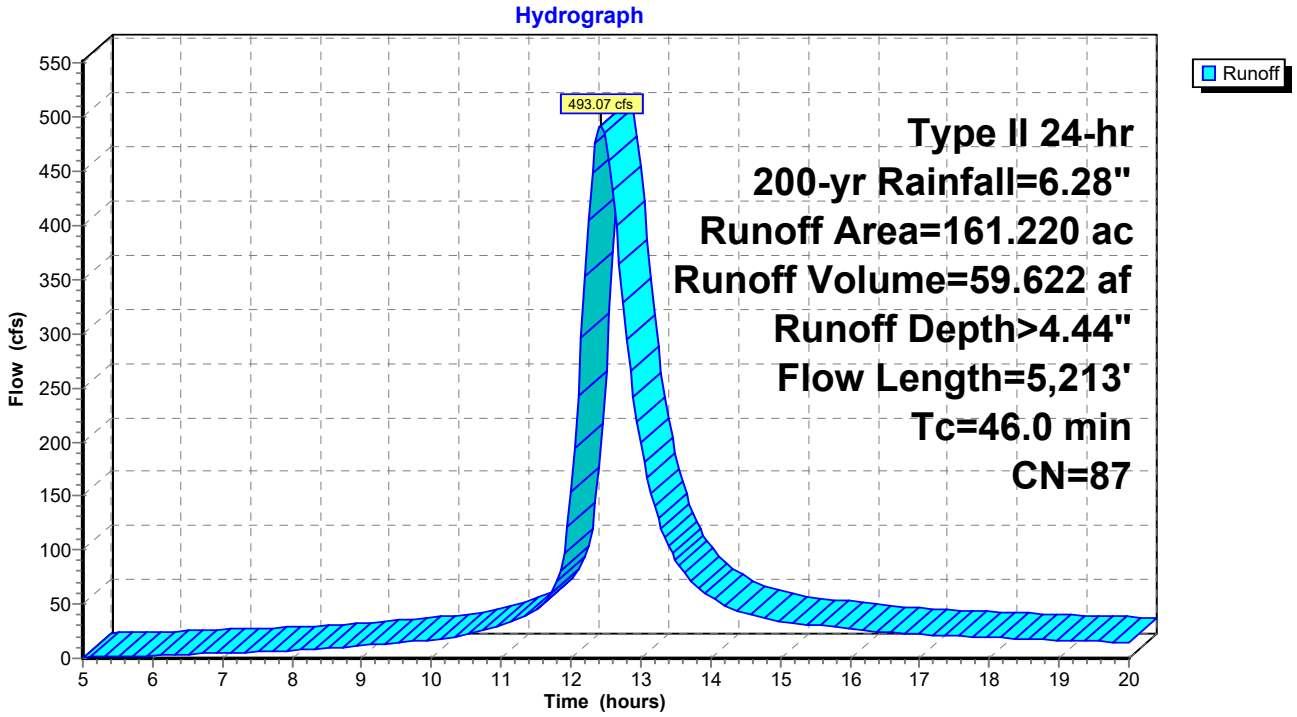
Runoff = 493.07 cfs @ 12.42 hrs, Volume= 59.622 af, Depth> 4.44"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 200-yr Rainfall=6.28"

	Area (ac)	CN	Description
*	4.390	77	Woods
*	114.820	85	Residential
*	42.010	95	Business Complex (Apartment)&School
	161.220	87	Weighted Average
	161.220		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
31.2	100	0.0100	0.05		**Sheet Flow, sheet flow** Woods: Light underbrush n= 0.400 P2= 2.64"
1.6	723	0.0223	7.34	5.76	**Pipe Channel, CMP_Round 12"** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.012 Concrete pipe, finished
2.3	1,024	0.0090	7.40	23.25	**Pipe Channel, CMP_Round 24"** 24.0" Round Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.012 Concrete pipe, finished
8.8	2,845	0.0028	5.41	38.23	**Pipe Channel, CMP_Round 36"** 36.0" Round Area= 7.1 sf Perim= 9.4' r= 0.75' n= 0.012 Concrete pipe, finished
2.1	521	0.0008	4.06	79.80	**Pipe Channel, CMP_Round 60"** 60.0" Round Area= 19.6 sf Perim= 15.7' r= 1.25' n= 0.012 Concrete pipe, finished
46.0	5,213	Total			

Subcatchment 1S: Existing CoC north of I-70



Summary for Subcatchment 2S: Ex I-70 (ODOT North- East)

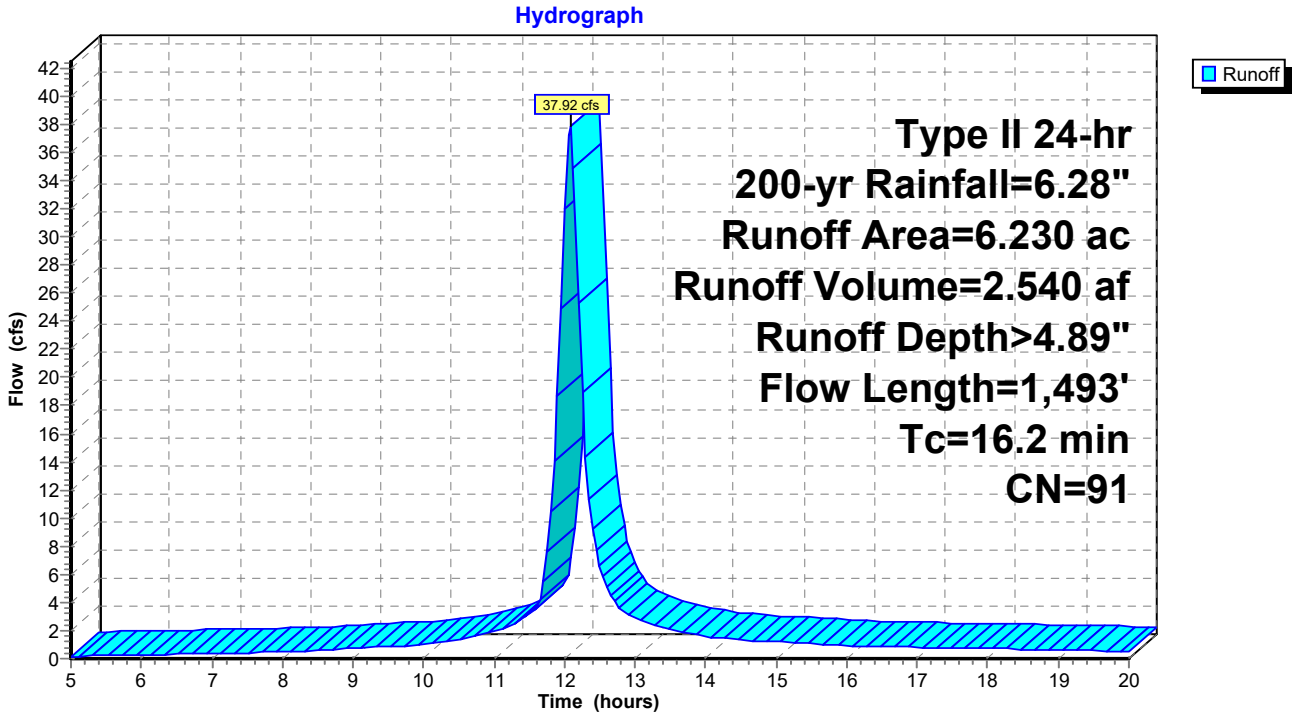
Runoff = 37.92 cfs @ 12.08 hrs, Volume= 2.540 af, Depth> 4.89"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 200-yr Rainfall=6.28"

	Area (ac)	CN	Description
*	3.650	98	Impervious Area, HSG D
*	2.580	80	Woods, Poor, HSG D
	6.230	91	Weighted Average
	2.580		41.41% Pervious Area
	3.650		58.59% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.7	80	0.0600	1.85		**Sheet Flow, Sheet Flow** Smooth surfaces n= 0.011 P2= 2.64"
15.5	1,413	0.0103	1.52		**Shallow Concentrated Flow, Roadside ditch** Grassed Waterway Kv= 15.0 fps
16.2	1,493	Total			

Subcatchment 2S: Ex I-70 (ODOT North- East)



Summary for Subcatchment 6S: Scarborough East

[49] Hint: Tc<2dt may require smaller dt
[47] Hint: Peak is 192% of capacity of segment #2

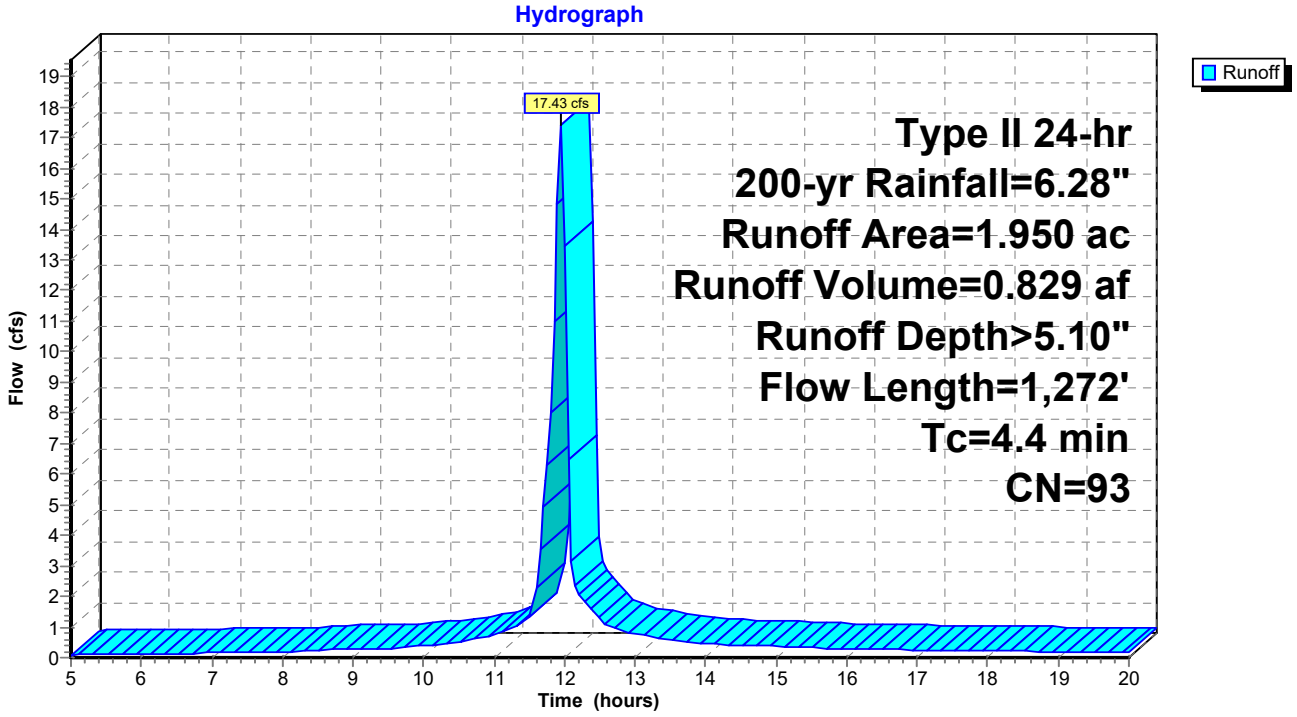
Runoff = 17.43 cfs @ 11.94 hrs, Volume= 0.829 af, Depth> 5.10"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 200-yr Rainfall=6.28"

	Area (ac)	CN	Description
*	1.410	98	Impervious area
*	0.540	80	Vegetative
	1.950	93	Weighted Average
	0.540		27.69% Pervious Area
	1.410		72.31% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.6	105	0.1880	3.09		**Sheet Flow, Sheet flow** Smooth surfaces n= 0.011 P2= 2.64"
3.8	1,167	0.0064	5.15	9.10	**Pipe Channel, CMP_Round 18"** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.012 Concrete pipe, finished
4.4	1,272	Total			

Subcatchment 6S: Scarborough East



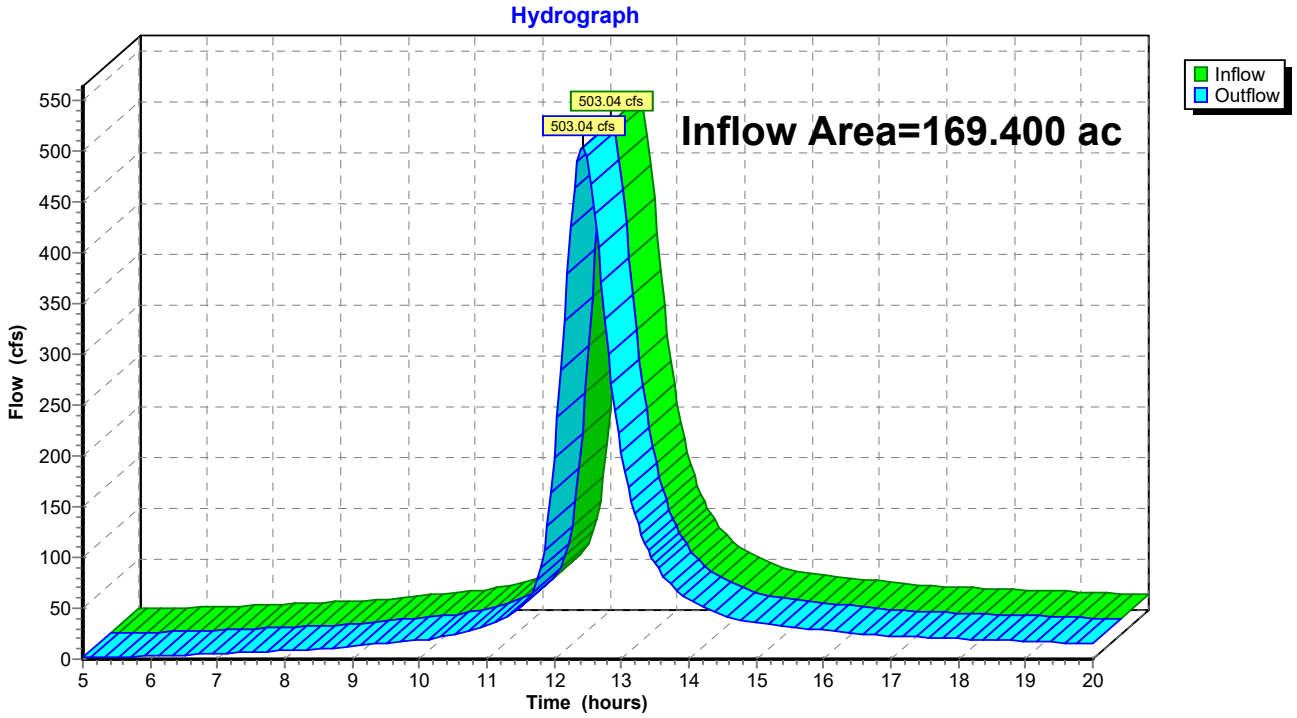
Summary for Reach 5R: Pr. 72" Downstream

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 169.400 ac, 2.99% Impervious, Inflow Depth > 4.46" for 200-yr event
Inflow = 503.04 cfs @ 12.42 hrs, Volume= 62.991 af
Outflow = 503.04 cfs @ 12.42 hrs, Volume= 62.991 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Reach 5R: Pr. 72" Downstream



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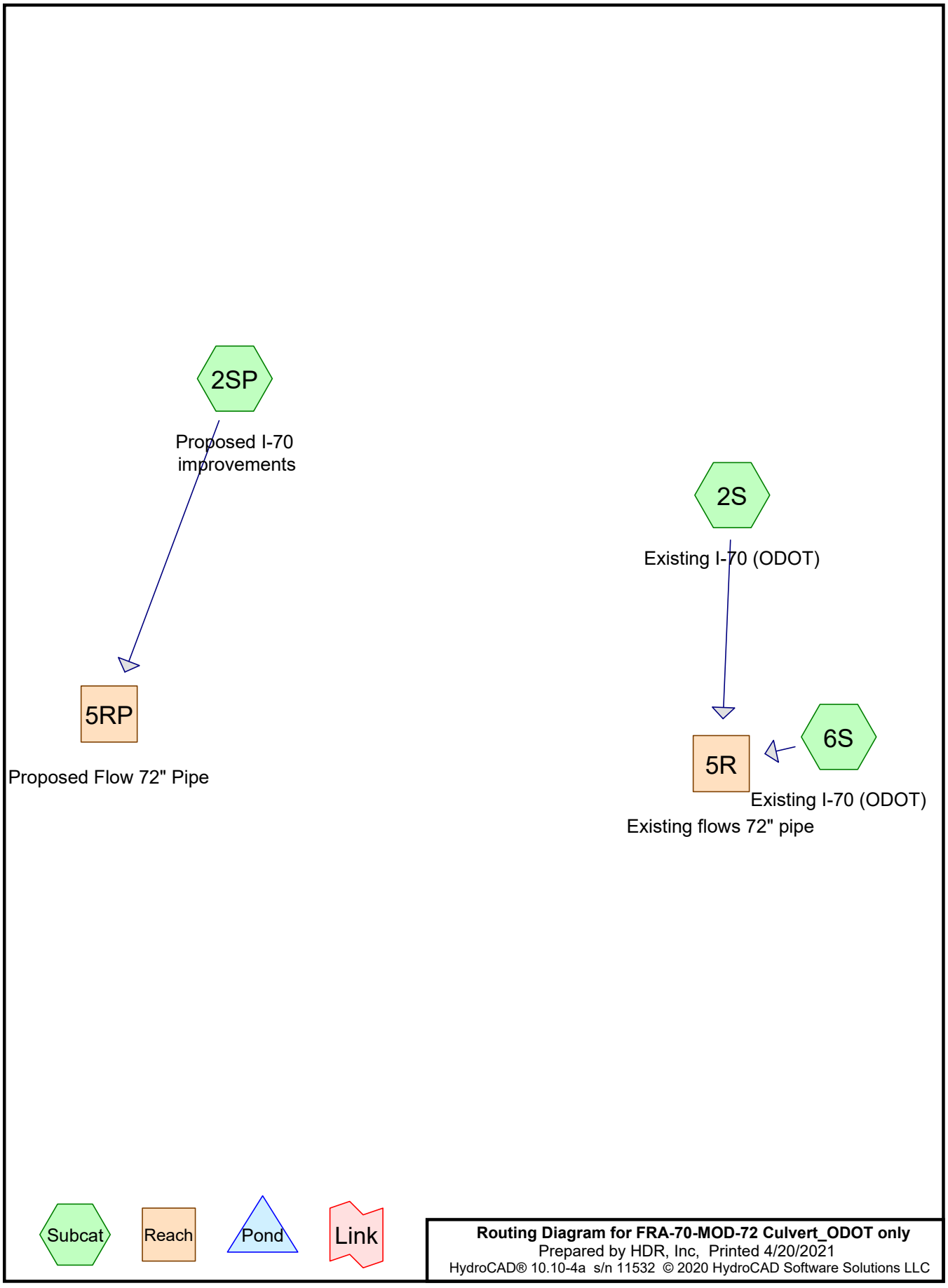


Routing Diagram for FRA-70-MOD-72 Culvert_ODOT only
Prepared by HDR, Inc, Printed 4/20/2021

Project Notes

Defined 10 rainfall events from OH-Columbus IDF

Rainfall Events Listing (selected events)

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	10-yr	Type II 24-hr		Default	24.00	1	3.74	2
2	100-yr	Type II 24-hr		Default	24.00	1	5.63	2
3	200-yr	Type II 24-hr		Default	24.00	1	6.28	2
4	500-yr	Type II 24-hr		Default	24.00	1	7.19	2
5	1000-yr	Type II 24-hr		Default	24.00	1	7.92	2

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
11.594	98	Impervious area (2S, 2SP, 6S)
12.472	80	Vegetative (2S, 2SP, 6S)
24.066	**89**	**TOTAL AREA**

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	
24.066	Other	2S, 2SP, 6S
24.066		**TOTAL AREA**

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	11.594	11.594	Impervious area	2S, 2SP, 6S
0.000	0.000	0.000	0.000	12.472	12.472	Vegetative	2S, 2SP, 6S
0.000	**0.000**	**0.000**	**0.000**	**24.066**	**24.066**	**TOTAL AREA**	

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	6S	0.00	0.00	123.0	0.0271	0.012	12.0	0.0	0.0
2	6S	0.00	0.00	84.0	0.0201	0.012	12.0	0.0	0.0
3	5R	700.00	690.00	500.0	0.0200	0.011	72.0	0.0	0.0

Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 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: Existing I-70 (ODOT) Runoff Area=6.227 ac 38.90% Impervious Runoff Depth>2.23"
Flow Length=1,493' Tc=16.2 min CN=87 Runoff=18.35 cfs 1.155 af

Subcatchment2SP: Proposed I-70 Runoff Area=6.230 ac 58.59% Impervious Runoff Depth>2.59"
Flow Length=1,493' Tc=16.2 min CN=91 Runoff=20.75 cfs 1.343 af

Subcatchment6S: Existing I-70 (ODOT) Runoff Area=11.609 ac 47.57% Impervious Runoff Depth>2.39"
Flow Length=2,854' Tc=30.1 min CN=89 Runoff=25.71 cfs 2.314 af

Reach 5R: Existing flows 72" pipe Avg. Flow Depth=0.96' Max Vel=13.46 fps Inflow=39.32 cfs 3.470 af
72.0" Round Pipe n=0.011 L=500.0' S=0.0200 '/' Capacity=707.83 cfs Outflow=39.12 cfs 3.467 af

Reach 5RP: Proposed Flow 72" Pipe Inflow=20.75 cfs 1.343 af
Outflow=20.75 cfs 1.343 af

Total Runoff Area = 24.066 ac Runoff Volume = 4.813 af Average Runoff Depth = 2.40"
51.82% Pervious = 12.472 ac 48.18% Impervious = 11.594 ac

Summary for Subcatchment 2S: Existing I-70 (ODOT)

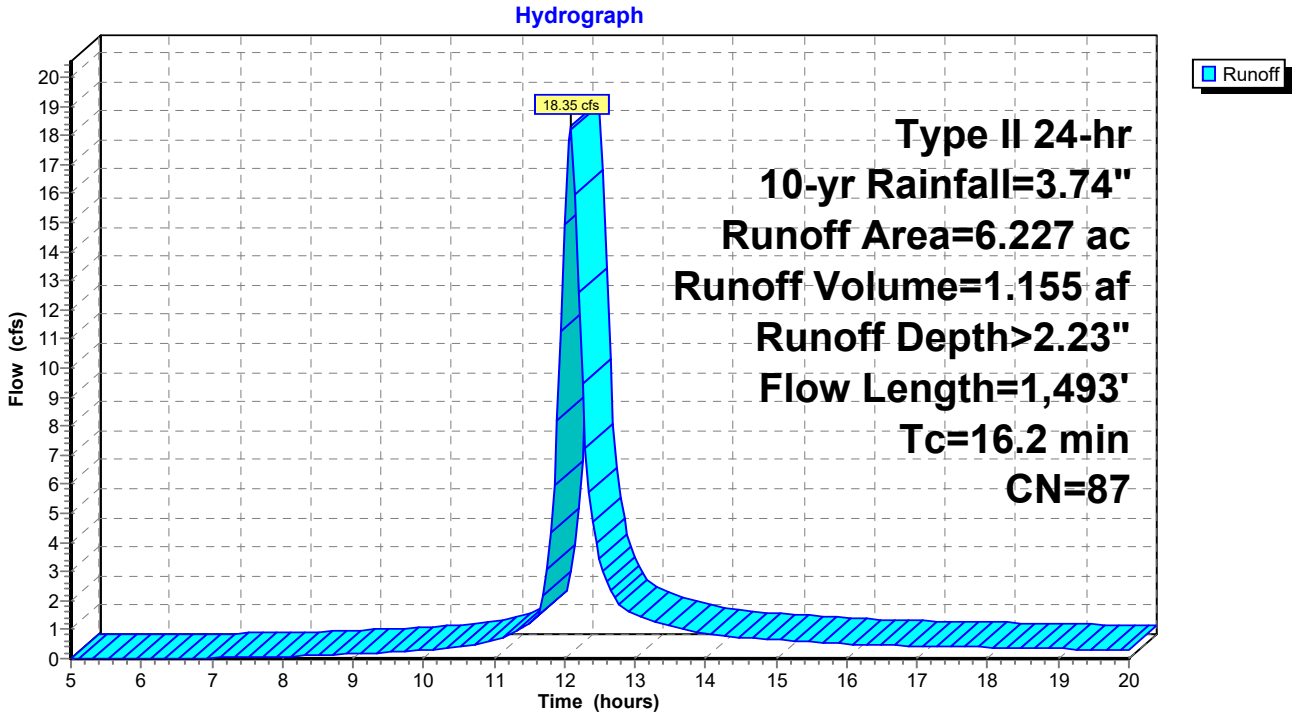
Runoff = 18.35 cfs @ 12.08 hrs, Volume= 1.155 af, Depth> 2.23"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-yr Rainfall=3.74"

	Area (ac)	CN	Description
*	2.422	98	Impervious area
*	3.805	80	Vegetative
	6.227	87	Weighted Average
	3.805		61.10% Pervious Area
	2.422		38.90% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.7	80	0.0600	1.85		**Sheet Flow, Sheet flow** Smooth surfaces n= 0.011 P2= 2.64"
15.5	1,413	0.0103	1.52		**Shallow Concentrated Flow, Ditch** Grassed Waterway Kv= 15.0 fps
16.2	1,493	Total			

Subcatchment 2S: Existing I-70 (ODOT)



Summary for Subcatchment 2SP: Proposed I-70 improvements

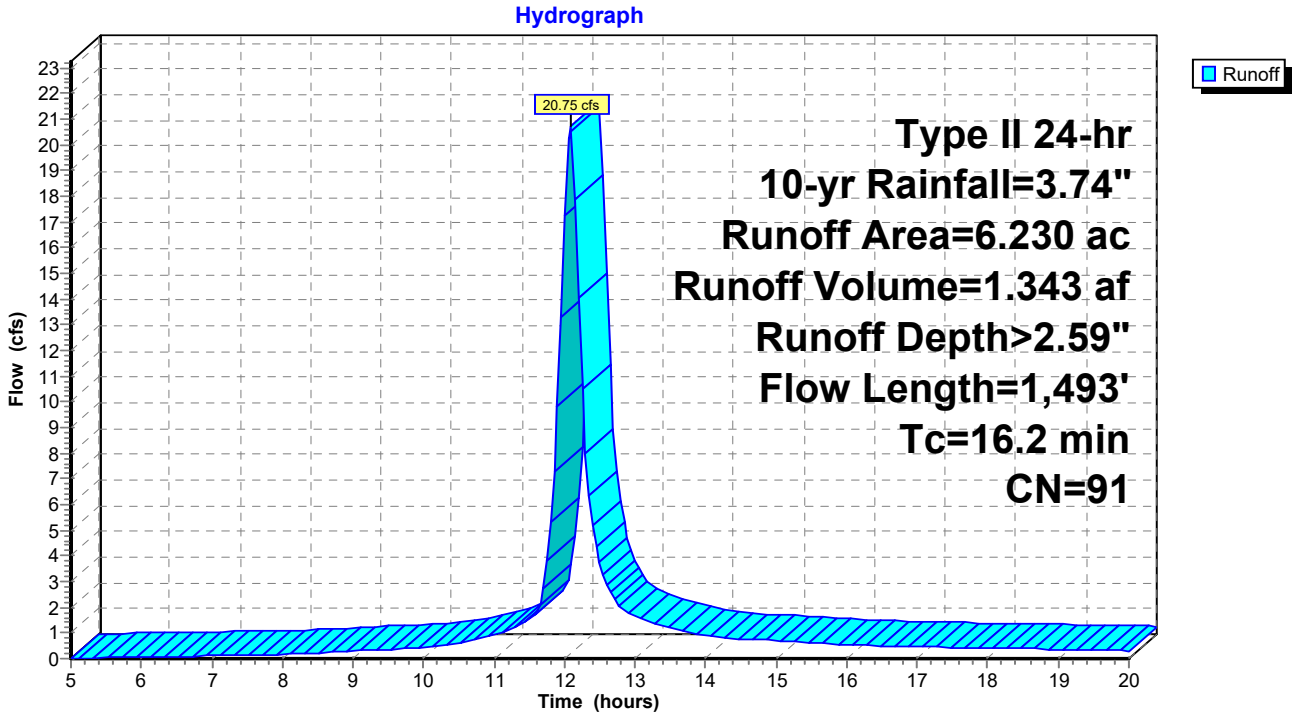
Runoff = 20.75 cfs @ 12.08 hrs, Volume= 1.343 af, Depth> 2.59"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-yr Rainfall=3.74"

	Area (ac)	CN	Description
*	3.650	98	Impervious area
*	2.580	80	Vegetative
	6.230	91	Weighted Average
	2.580		41.41% Pervious Area
	3.650		58.59% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.7	80	0.0600	1.85		**Sheet Flow, Sheet flow** Smooth surfaces n= 0.011 P2= 2.64"
15.5	1,413	0.0103	1.52		**Shallow Concentrated Flow, Ditch** Grassed Waterway Kv= 15.0 fps
16.2	1,493	Total			

Subcatchment 2SP: Proposed I-70 improvements



Summary for Subcatchment 6S: Existing I-70 (ODOT)

[47] Hint: Peak is 405% of capacity of segment #2
[47] Hint: Peak is 470% of capacity of segment #3

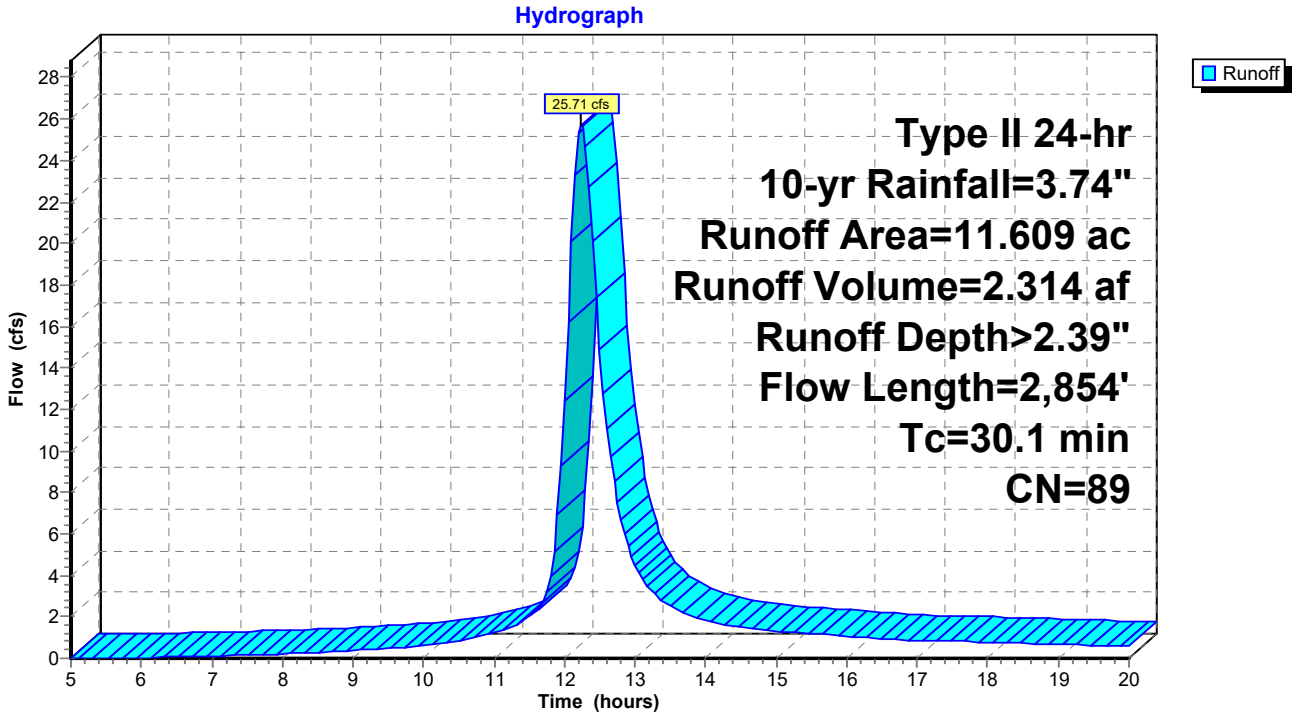
Runoff = 25.71 cfs @ 12.24 hrs, Volume= 2.314 af, Depth> 2.39"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-yr Rainfall=3.74"

	Area (ac)	CN	Description
*	5.522	98	Impervious area
*	6.087	80	Vegetative
	11.609	89	Weighted Average
	6.087		52.43% Pervious Area
	5.522		47.57% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.5	25	0.0186	0.92		**Sheet Flow, Sheet flow** Smooth surfaces n= 0.011 P2= 2.64"
0.3	123	0.0271	8.09	6.35	**Pipe Channel, CMP_Round 12"** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.012 Concrete pipe, finished
0.2	84	0.0201	6.97	5.47	**Pipe Channel, CMP_Round 12"** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.012 Concrete pipe, finished
12.4	1,119	0.0100	1.50		**Shallow Concentrated Flow, Median Ditch** Grassed Waterway Kv= 15.0 fps
16.7	1,503	0.0100	1.50		**Shallow Concentrated Flow, Roadside ditch** Grassed Waterway Kv= 15.0 fps
30.1	2,854	Total			

Subcatchment 6S: Existing I-70 (ODOT)



Summary for Reach 5R: Existing flows 72" pipe

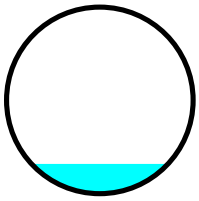
[52] Hint: Inlet/Outlet conditions not evaluated

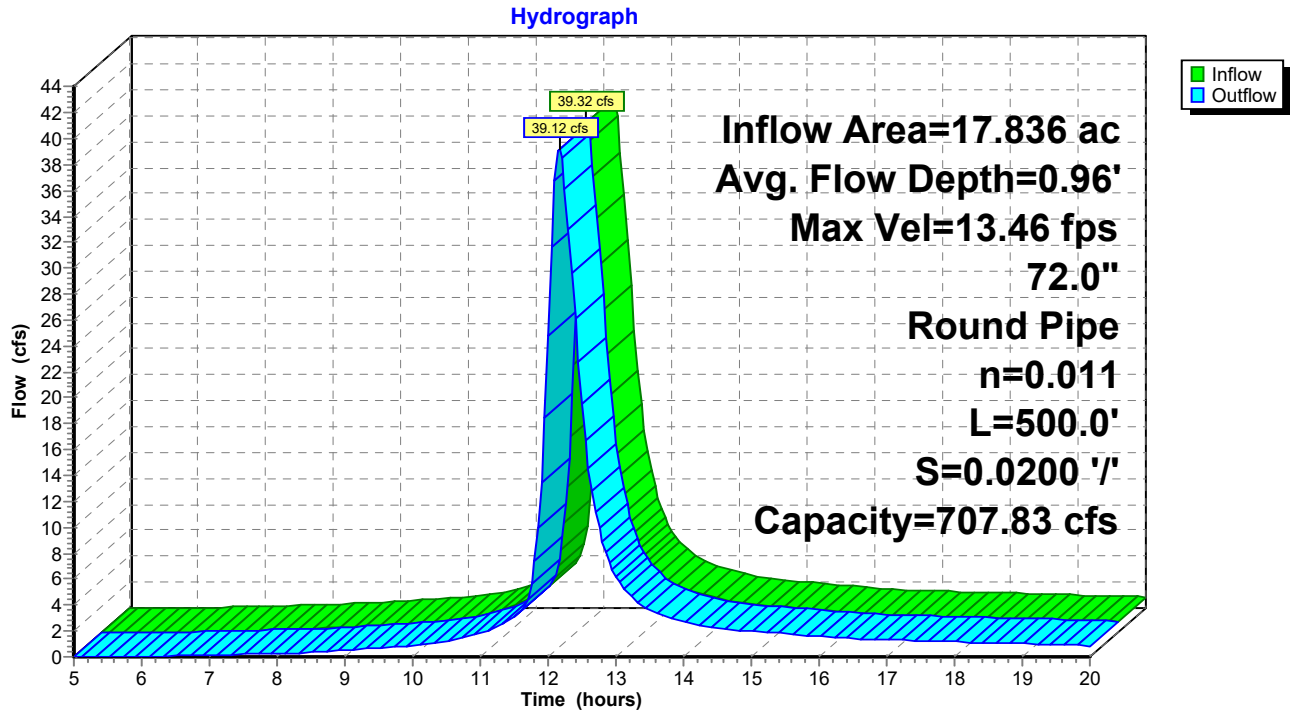
Inflow Area = 17.836 ac, 44.54% Impervious, Inflow Depth > 2.33" for 10-yr event
Inflow = 39.32 cfs @ 12.15 hrs, Volume= 3.470 af
Outflow = 39.12 cfs @ 12.16 hrs, Volume= 3.467 af, Atten= 0%, Lag= 1.1 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 13.46 fps, Min. Travel Time= 0.6 min
Avg. Velocity = 4.99 fps, Avg. Travel Time= 1.7 min

Peak Storage= 1,461 cf @ 12.15 hrs
Average Depth at Peak Storage= 0.96' , Surface Width= 4.40'
Bank-Full Depth= 6.00' Flow Area= 28.3 sf, Capacity= 707.83 cfs

72.0" Round Pipe
n= 0.011 Concrete pipe, straight & clean
Length= 500.0' Slope= 0.0200 '/'
Inlet Invert= 700.00', Outlet Invert= 690.00'





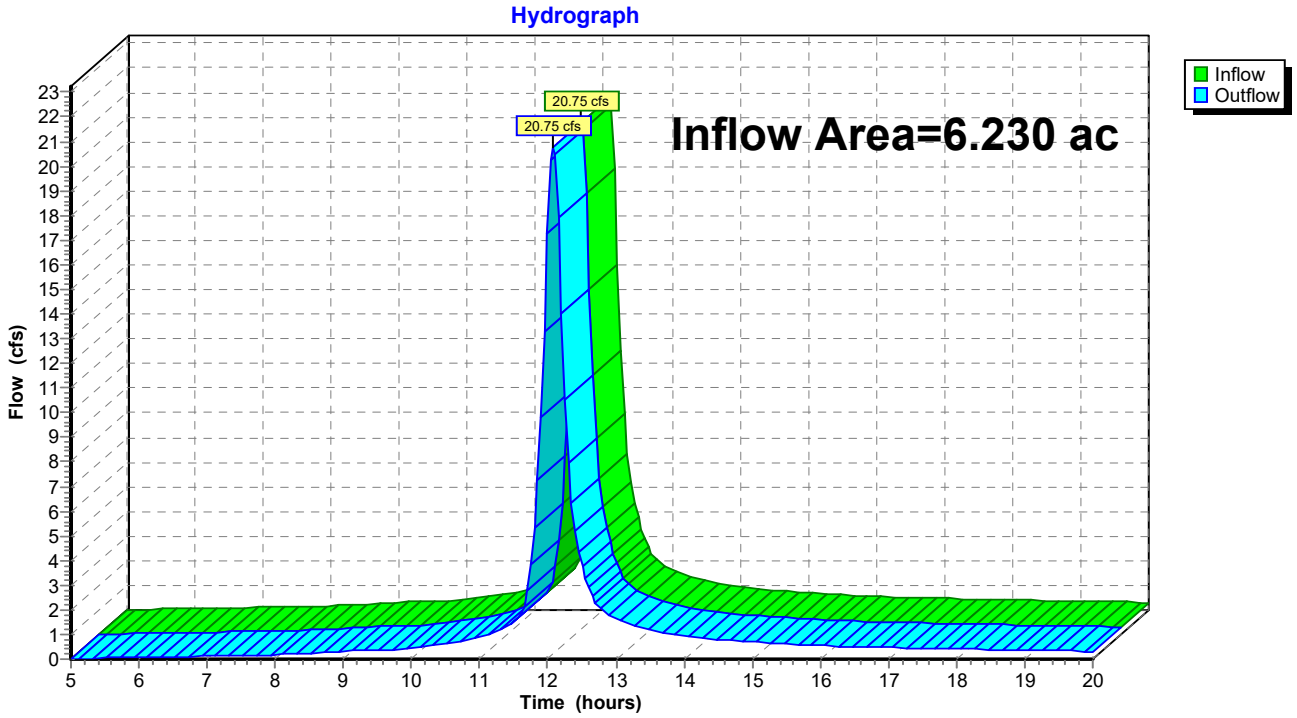
Summary for Reach 5RP: Proposed Flow 72" Pipe

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 6.230 ac, 58.59% Impervious, Inflow Depth > 2.59" for 10-yr event
Inflow = 20.75 cfs @ 12.08 hrs, Volume= 1.343 af
Outflow = 20.75 cfs @ 12.08 hrs, Volume= 1.343 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Reach 5RP: Proposed Flow 72" Pipe



Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 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: Existing I-70 (ODOT) Runoff Area=6.227 ac 38.90% Impervious Runoff Depth>3.89"
Flow Length=1,493' Tc=16.2 min CN=87 Runoff=31.20 cfs 2.019 af

Subcatchment2SP: Proposed I-70 Runoff Area=6.230 ac 58.59% Impervious Runoff Depth>4.30"
Flow Length=1,493' Tc=16.2 min CN=91 Runoff=33.55 cfs 2.232 af

Subcatchment6S: Existing I-70 (ODOT) Runoff Area=11.609 ac 47.57% Impervious Runoff Depth>4.08"
Flow Length=2,854' Tc=30.1 min CN=89 Runoff=42.87 cfs 3.948 af

Reach 5R: Existing flows 72" pipe Avg. Flow Depth=1.24' Max Vel=15.71 fps Inflow=66.27 cfs 5.967 af
72.0" Round Pipe n=0.011 L=500.0' S=0.0200 '/' Capacity=707.83 cfs Outflow=65.99 cfs 5.963 af

Reach 5RP: Proposed Flow 72" Pipe Inflow=33.55 cfs 2.232 af
Outflow=33.55 cfs 2.232 af

Total Runoff Area = 24.066 ac Runoff Volume = 8.199 af Average Runoff Depth = 4.09"
51.82% Pervious = 12.472 ac 48.18% Impervious = 11.594 ac

Summary for Subcatchment 2S: Existing I-70 (ODOT)

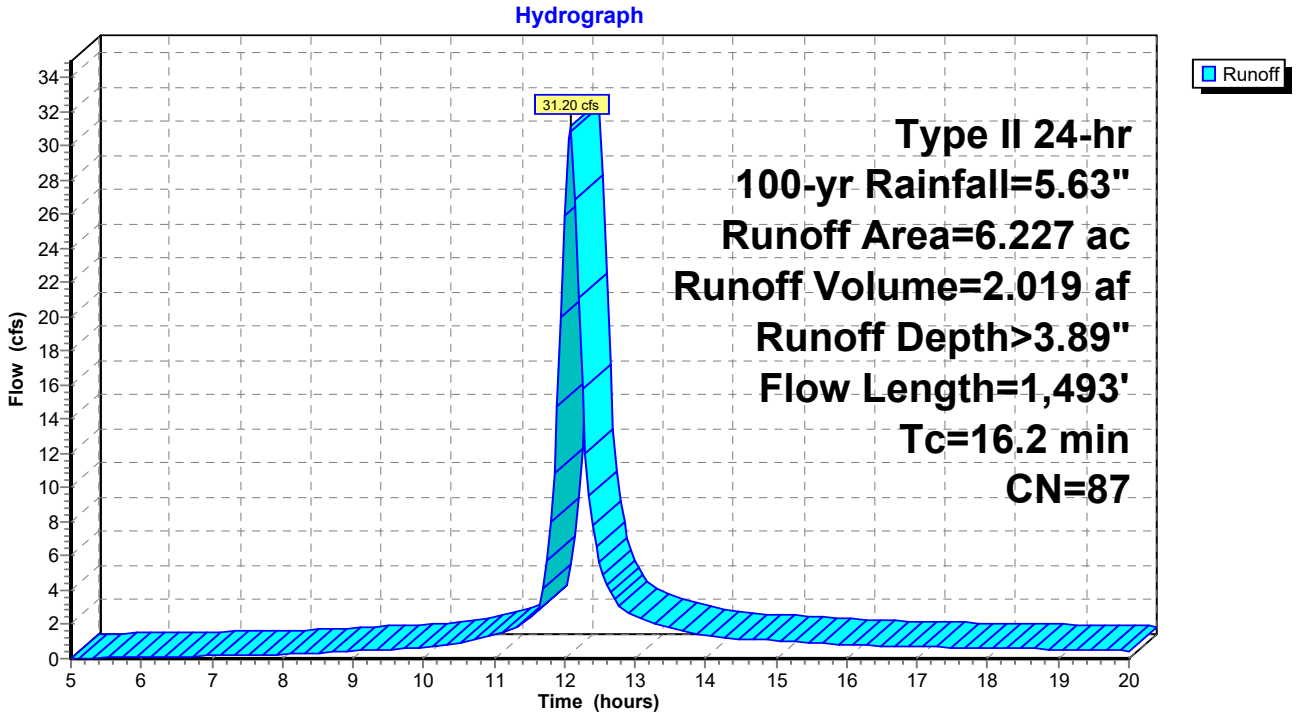
Runoff = 31.20 cfs @ 12.08 hrs, Volume= 2.019 af, Depth> 3.89"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-yr Rainfall=5.63"

	Area (ac)	CN	Description
*	2.422	98	Impervious area
*	3.805	80	Vegetative
	6.227	87	Weighted Average
	3.805		61.10% Pervious Area
	2.422		38.90% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.7	80	0.0600	1.85		**Sheet Flow, Sheet flow** Smooth surfaces n= 0.011 P2= 2.64"
15.5	1,413	0.0103	1.52		**Shallow Concentrated Flow, Ditch** Grassed Waterway Kv= 15.0 fps
16.2	1,493	Total			

Subcatchment 2S: Existing I-70 (ODOT)



Summary for Subcatchment 2SP: Proposed I-70 improvements

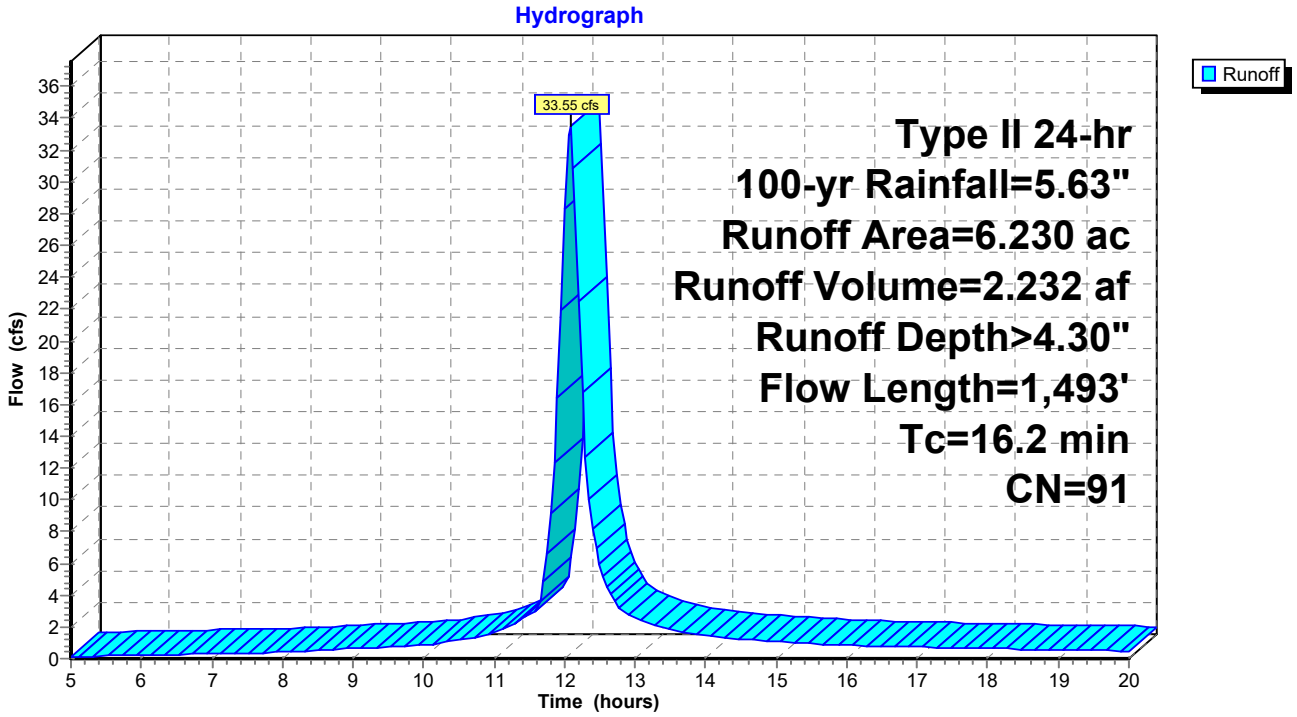
Runoff = 33.55 cfs @ 12.08 hrs, Volume= 2.232 af, Depth> 4.30"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-yr Rainfall=5.63"

	Area (ac)	CN	Description
*	3.650	98	Impervious area
*	2.580	80	Vegetative
	6.230	91	Weighted Average
	2.580		41.41% Pervious Area
	3.650		58.59% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.7	80	0.0600	1.85		**Sheet Flow, Sheet flow** Smooth surfaces n= 0.011 P2= 2.64"
15.5	1,413	0.0103	1.52		**Shallow Concentrated Flow, Ditch** Grassed Waterway Kv= 15.0 fps
16.2	1,493	Total			

Subcatchment 2SP: Proposed I-70 improvements



Summary for Subcatchment 6S: Existing I-70 (ODOT)

[47] Hint: Peak is 675% of capacity of segment #2
[47] Hint: Peak is 783% of capacity of segment #3

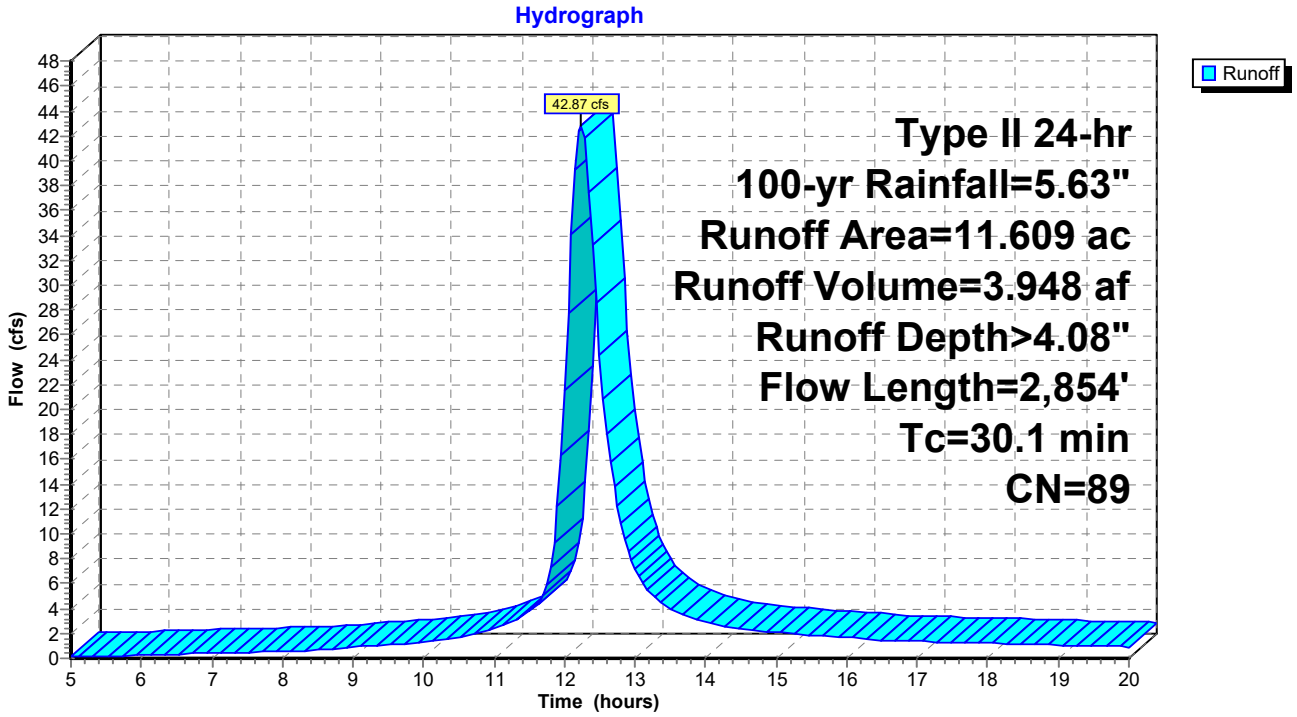
Runoff = 42.87 cfs @ 12.23 hrs, Volume= 3.948 af, Depth> 4.08"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-yr Rainfall=5.63"

	Area (ac)	CN	Description
*	5.522	98	Impervious area
*	6.087	80	Vegetative
	11.609	89	Weighted Average
	6.087		52.43% Pervious Area
	5.522		47.57% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.5	25	0.0186	0.92		**Sheet Flow, Sheet flow** Smooth surfaces n= 0.011 P2= 2.64"
0.3	123	0.0271	8.09	6.35	**Pipe Channel, CMP_Round 12"** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.012 Concrete pipe, finished
0.2	84	0.0201	6.97	5.47	**Pipe Channel, CMP_Round 12"** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.012 Concrete pipe, finished
12.4	1,119	0.0100	1.50		**Shallow Concentrated Flow, Median Ditch** Grassed Waterway Kv= 15.0 fps
16.7	1,503	0.0100	1.50		**Shallow Concentrated Flow, Roadside ditch** Grassed Waterway Kv= 15.0 fps
30.1	2,854	Total			

Subcatchment 6S: Existing I-70 (ODOT)



Summary for Reach 5R: Existing flows 72" pipe

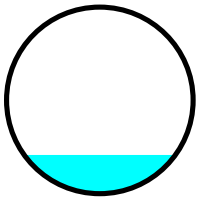
[52] Hint: Inlet/Outlet conditions not evaluated
[82] Warning: Early inflow requires earlier time span

Inflow Area = 17.836 ac, 44.54% Impervious, Inflow Depth > 4.01" for 100-yr event
Inflow = 66.27 cfs @ 12.14 hrs, Volume= 5.967 af
Outflow = 65.99 cfs @ 12.16 hrs, Volume= 5.963 af, Atten= 0%, Lag= 1.0 min

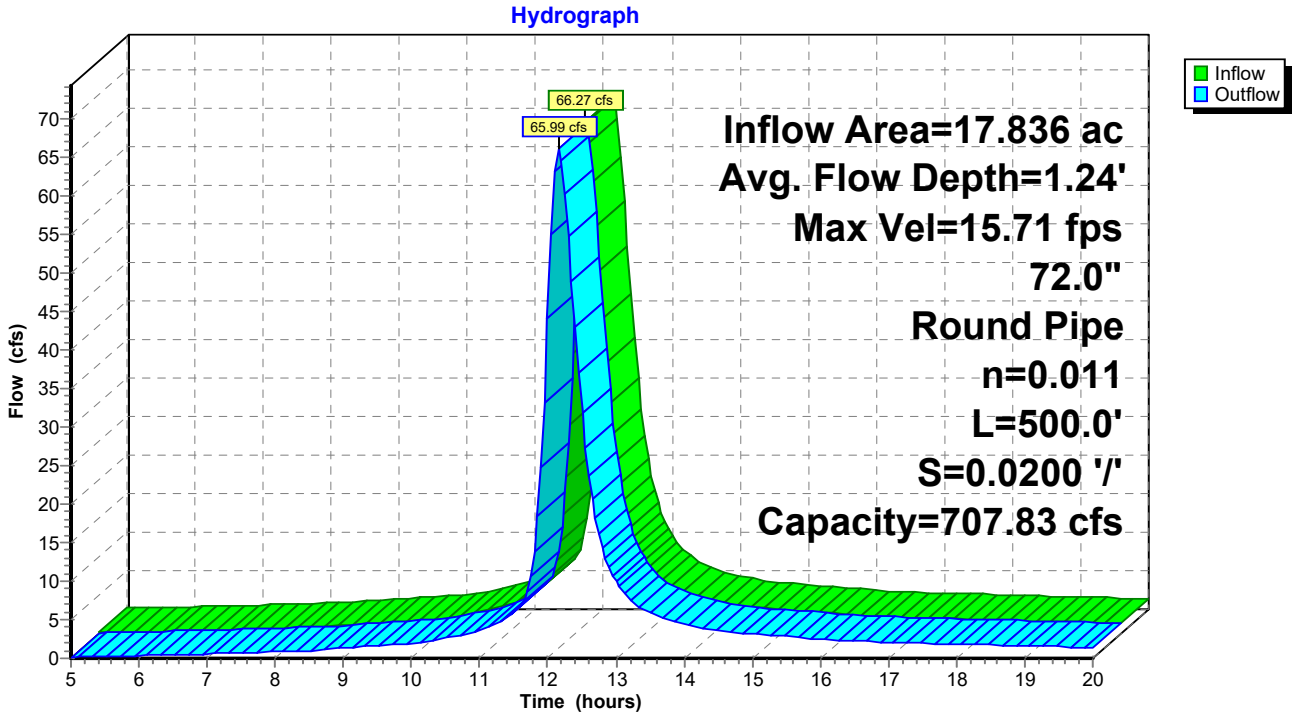
Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 15.71 fps, Min. Travel Time= 0.5 min
Avg. Velocity = 5.93 fps, Avg. Travel Time= 1.4 min

Peak Storage= 2,110 cf @ 12.15 hrs
Average Depth at Peak Storage= 1.24' , Surface Width= 4.86'
Bank-Full Depth= 6.00' Flow Area= 28.3 sf, Capacity= 707.83 cfs

72.0" Round Pipe
n= 0.011 Concrete pipe, straight & clean
Length= 500.0' Slope= 0.0200 '/'
Inlet Invert= 700.00', Outlet Invert= 690.00'



Reach 5R: Existing flows 72" pipe



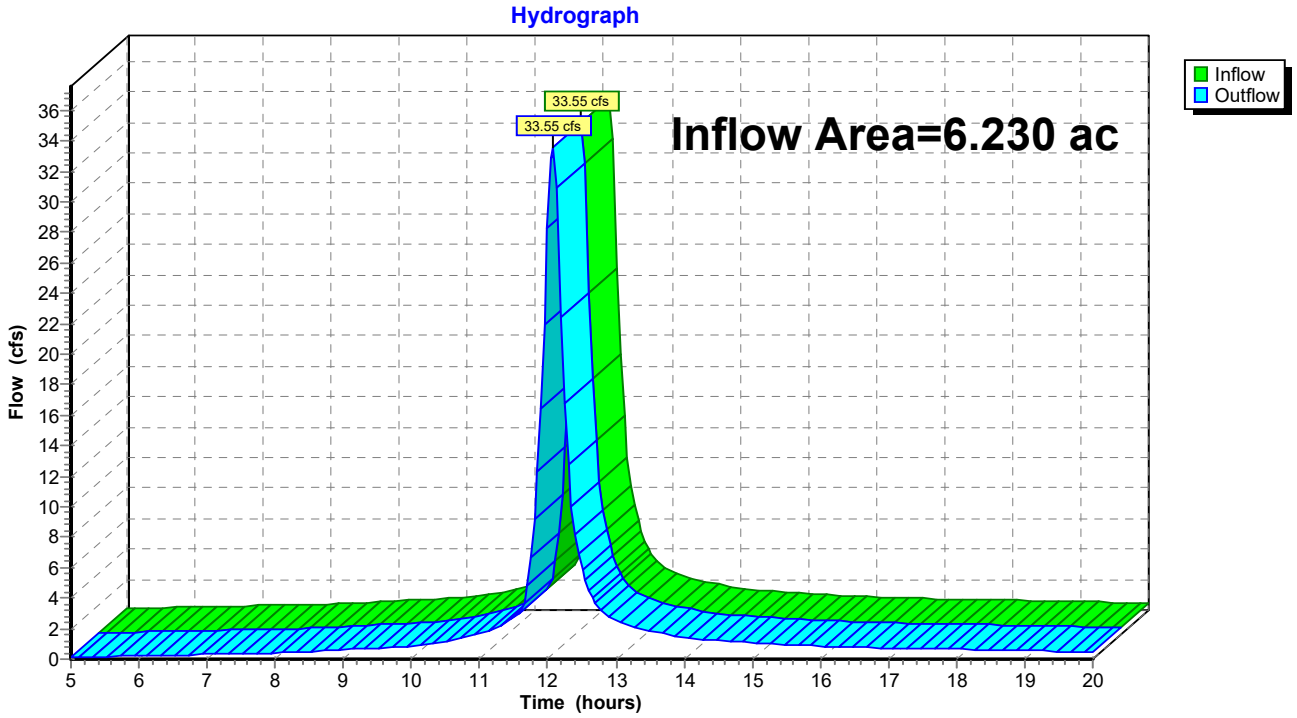
Summary for Reach 5RP: Proposed Flow 72" Pipe

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 6.230 ac, 58.59% Impervious, Inflow Depth > 4.30" for 100-yr event
Inflow = 33.55 cfs @ 12.08 hrs, Volume= 2.232 af
Outflow = 33.55 cfs @ 12.08 hrs, Volume= 2.232 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Reach 5RP: Proposed Flow 72" Pipe



Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 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: Existing I-70 (ODOT) Runoff Area=6.227 ac 38.90% Impervious Runoff Depth>4.48"
Flow Length=1,493' Tc=16.2 min CN=87 Runoff=35.62 cfs 2.322 af

Subcatchment2SP: Proposed I-70 Runoff Area=6.230 ac 58.59% Impervious Runoff Depth>4.89"
Flow Length=1,493' Tc=16.2 min CN=91 Runoff=37.92 cfs 2.540 af

Subcatchment6S: Existing I-70 (ODOT) Runoff Area=11.609 ac 47.57% Impervious Runoff Depth>4.67"
Flow Length=2,854' Tc=30.1 min CN=89 Runoff=48.75 cfs 4.518 af

Reach 5R: Existing flows 72" pipe Avg. Flow Depth=1.32' Max Vel=16.32 fps Inflow=75.52 cfs 6.840 af
72.0" Round Pipe n=0.011 L=500.0' S=0.0200 '/' Capacity=707.83 cfs Outflow=75.22 cfs 6.835 af

Reach 5RP: Proposed Flow 72" Pipe Inflow=37.92 cfs 2.540 af
Outflow=37.92 cfs 2.540 af

Total Runoff Area = 24.066 ac Runoff Volume = 9.380 af Average Runoff Depth = 4.68"
51.82% Pervious = 12.472 ac 48.18% Impervious = 11.594 ac

Summary for Subcatchment 2S: Existing I-70 (ODOT)

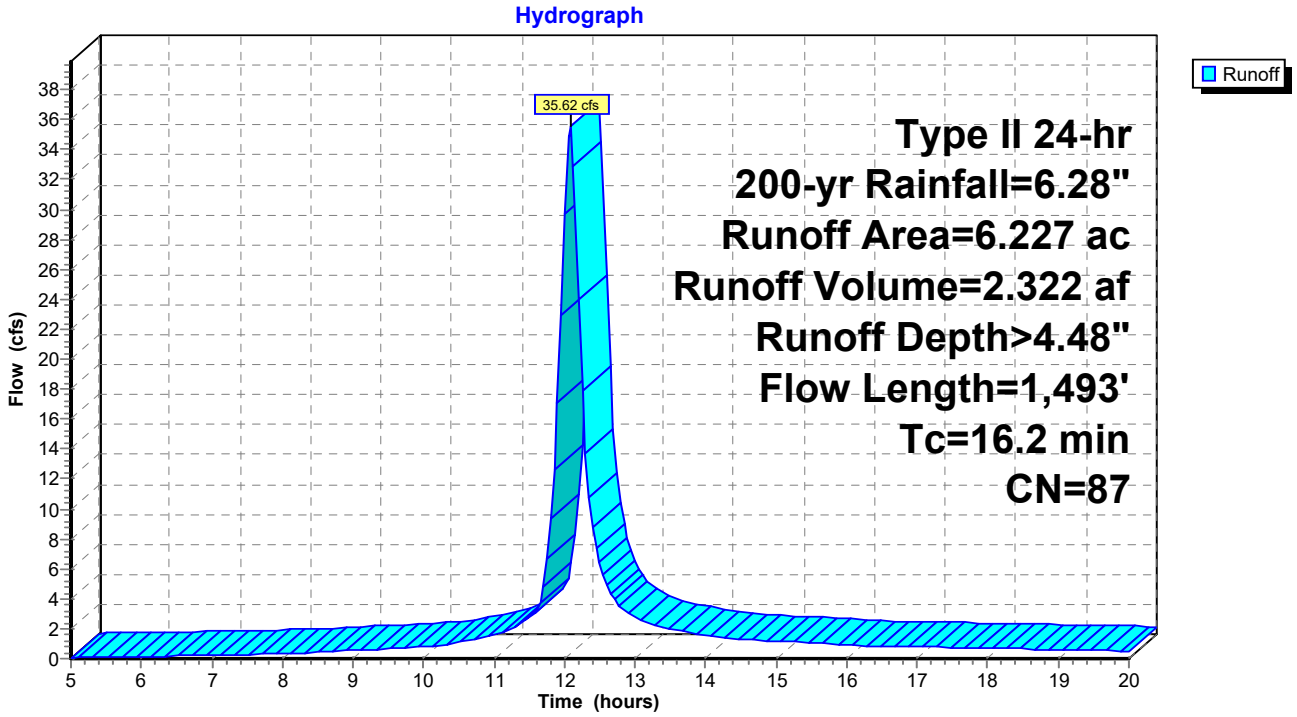
Runoff = 35.62 cfs @ 12.08 hrs, Volume= 2.322 af, Depth> 4.48"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 200-yr Rainfall=6.28"

	Area (ac)	CN	Description
*	2.422	98	Impervious area
*	3.805	80	Vegetative
	6.227	87	Weighted Average
	3.805		61.10% Pervious Area
	2.422		38.90% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.7	80	0.0600	1.85		**Sheet Flow, Sheet flow** Smooth surfaces n= 0.011 P2= 2.64"
15.5	1,413	0.0103	1.52		**Shallow Concentrated Flow, Ditch** Grassed Waterway Kv= 15.0 fps
16.2	1,493	Total			

Subcatchment 2S: Existing I-70 (ODOT)



Summary for Subcatchment 2SP: Proposed I-70 improvements

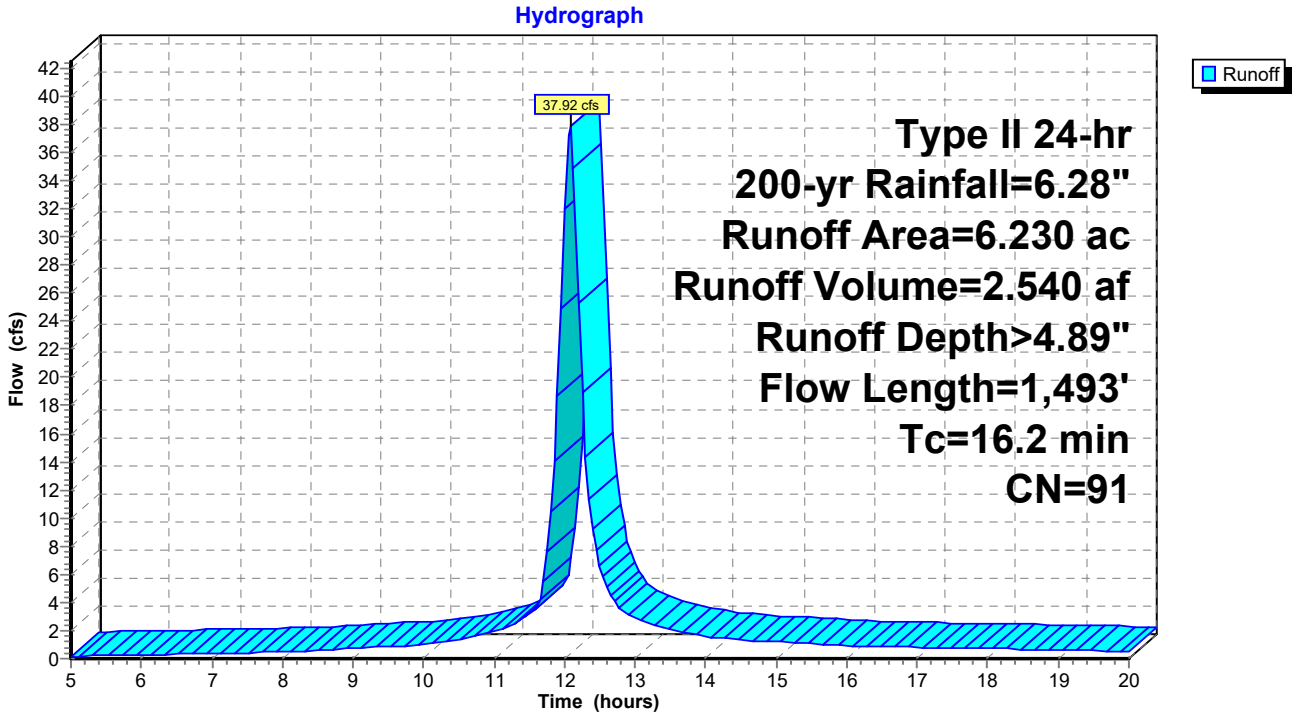
Runoff = 37.92 cfs @ 12.08 hrs, Volume= 2.540 af, Depth> 4.89"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 200-yr Rainfall=6.28"

	Area (ac)	CN	Description
*	3.650	98	Impervious area
*	2.580	80	Vegetative
	6.230	91	Weighted Average
	2.580		41.41% Pervious Area
	3.650		58.59% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.7	80	0.0600	1.85		**Sheet Flow, Sheet flow** Smooth surfaces n= 0.011 P2= 2.64"
15.5	1,413	0.0103	1.52		**Shallow Concentrated Flow, Ditch** Grassed Waterway Kv= 15.0 fps
16.2	1,493	Total			

Subcatchment 2SP: Proposed I-70 improvements



Summary for Subcatchment 6S: Existing I-70 (ODOT)

[47] Hint: Peak is 767% of capacity of segment #2
[47] Hint: Peak is 891% of capacity of segment #3

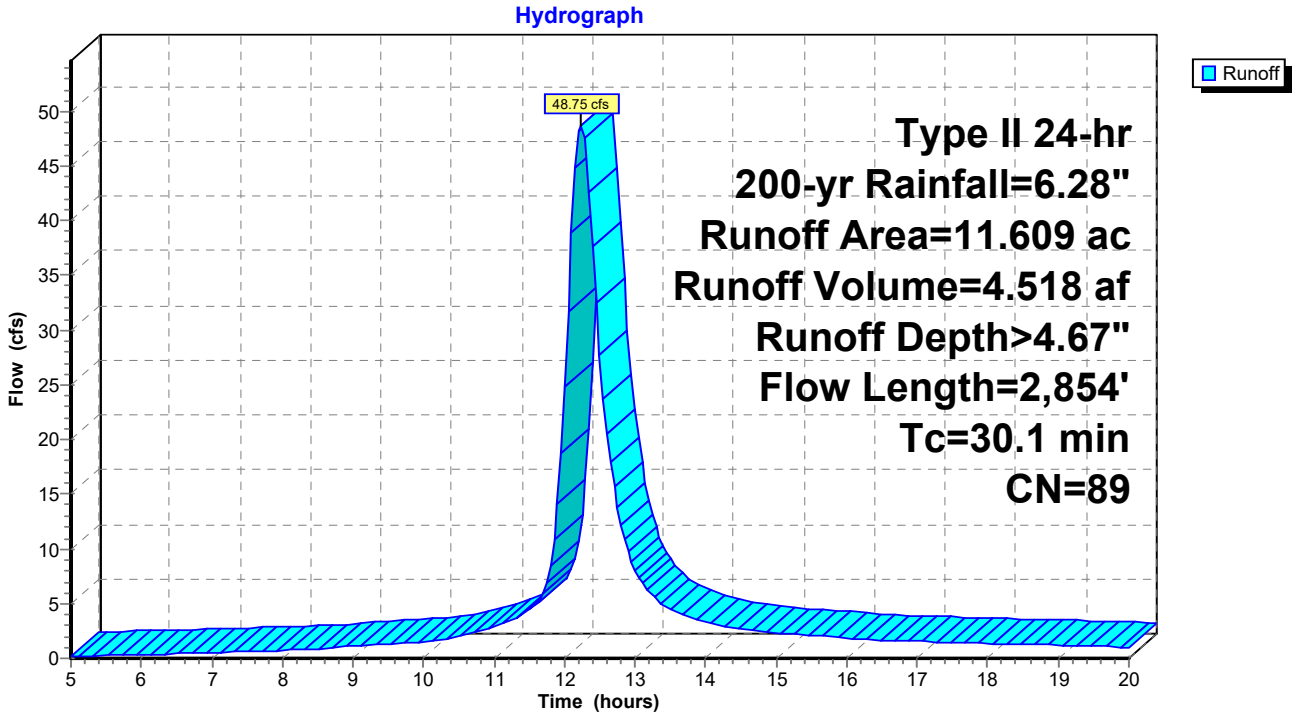
Runoff = 48.75 cfs @ 12.23 hrs, Volume= 4.518 af, Depth> 4.67"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 200-yr Rainfall=6.28"

	Area (ac)	CN	Description
*	5.522	98	Impervious area
*	6.087	80	Vegetative
	11.609	89	Weighted Average
	6.087		52.43% Pervious Area
	5.522		47.57% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.5	25	0.0186	0.92		**Sheet Flow, Sheet flow** Smooth surfaces n= 0.011 P2= 2.64"
0.3	123	0.0271	8.09	6.35	**Pipe Channel, CMP_Round 12"** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.012 Concrete pipe, finished
0.2	84	0.0201	6.97	5.47	**Pipe Channel, CMP_Round 12"** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.012 Concrete pipe, finished
12.4	1,119	0.0100	1.50		**Shallow Concentrated Flow, Median Ditch** Grassed Waterway Kv= 15.0 fps
16.7	1,503	0.0100	1.50		**Shallow Concentrated Flow, Roadside ditch** Grassed Waterway Kv= 15.0 fps
30.1	2,854	Total			

Subcatchment 6S: Existing I-70 (ODOT)



Summary for Reach 5R: Existing flows 72" pipe

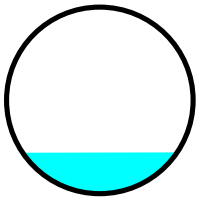
[52] Hint: Inlet/Outlet conditions not evaluated
[82] Warning: Early inflow requires earlier time span

Inflow Area = 17.836 ac, 44.54% Impervious, Inflow Depth > 4.60" for 200-yr event
Inflow = 75.52 cfs @ 12.14 hrs, Volume= 6.840 af
Outflow = 75.22 cfs @ 12.16 hrs, Volume= 6.835 af, Atten= 0%, Lag= 1.0 min

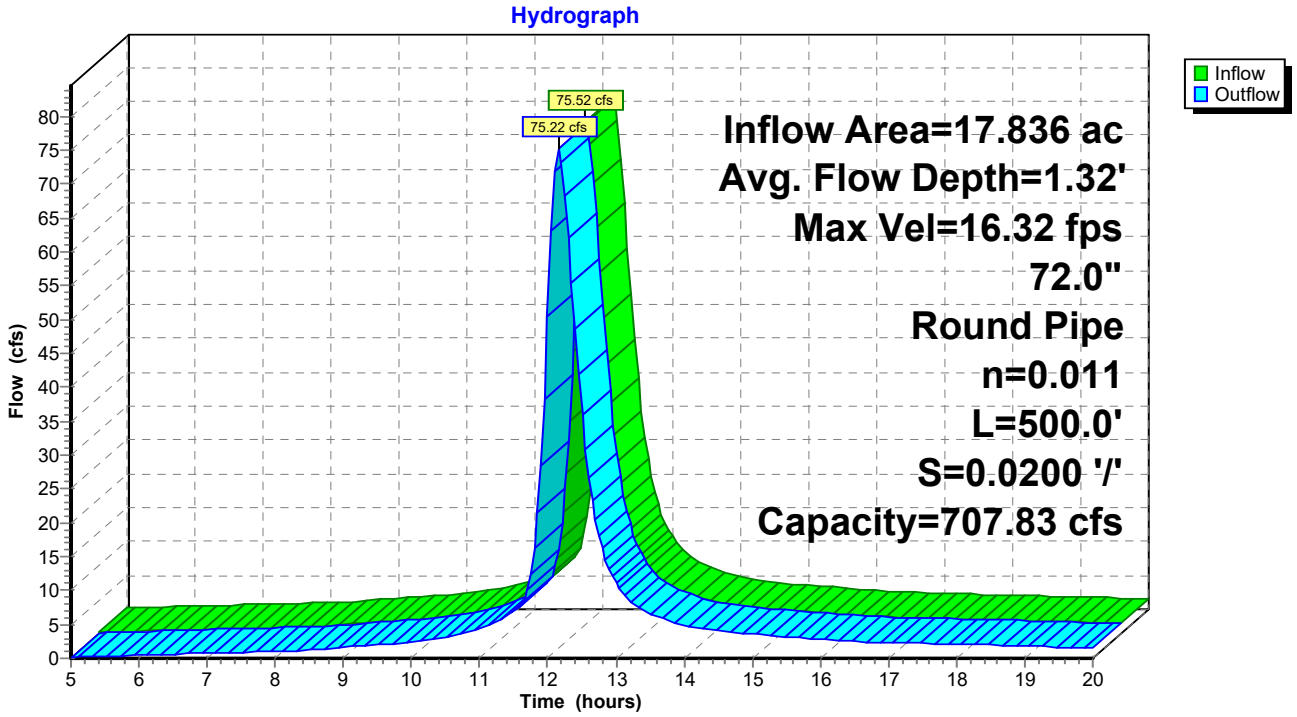
Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 16.32 fps, Min. Travel Time= 0.5 min
Avg. Velocity = 6.21 fps, Avg. Travel Time= 1.3 min

Peak Storage= 2,315 cf @ 12.15 hrs
Average Depth at Peak Storage= 1.32' , Surface Width= 4.98'
Bank-Full Depth= 6.00' Flow Area= 28.3 sf, Capacity= 707.83 cfs

72.0" Round Pipe
n= 0.011 Concrete pipe, straight & clean
Length= 500.0' Slope= 0.0200 '/'
Inlet Invert= 700.00', Outlet Invert= 690.00'



Reach 5R: Existing flows 72" pipe



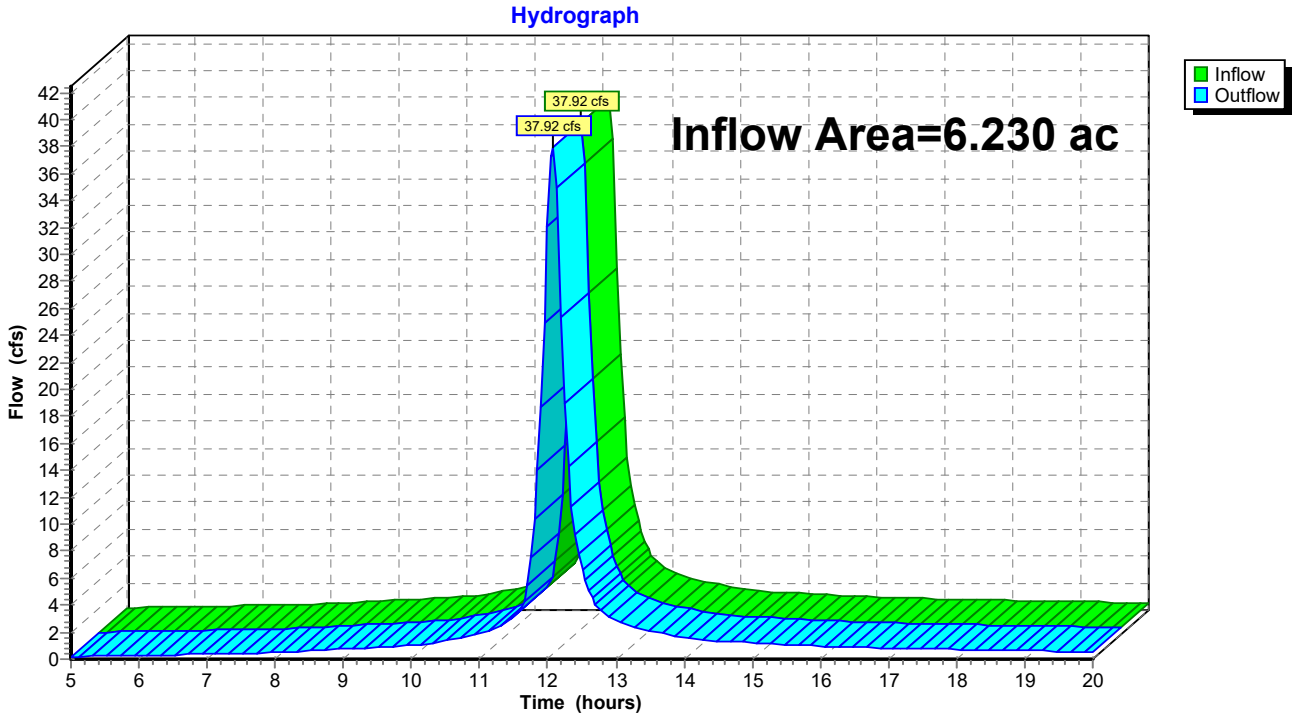
Summary for Reach 5RP: Proposed Flow 72" Pipe

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 6.230 ac, 58.59% Impervious, Inflow Depth > 4.89" for 200-yr event
Inflow = 37.92 cfs @ 12.08 hrs, Volume= 2.540 af
Outflow = 37.92 cfs @ 12.08 hrs, Volume= 2.540 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Reach 5RP: Proposed Flow 72" Pipe



Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 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: Existing I-70 (ODOT) Runoff Area=6.227 ac 38.90% Impervious Runoff Depth>5.30"
Flow Length=1,493' Tc=16.2 min CN=87 Runoff=41.78 cfs 2.750 af

Subcatchment2SP: Proposed I-70 Runoff Area=6.230 ac 58.59% Impervious Runoff Depth>5.72"
Flow Length=1,493' Tc=16.2 min CN=91 Runoff=44.00 cfs 2.971 af

Subcatchment6S: Existing I-70 (ODOT) Runoff Area=11.609 ac 47.57% Impervious Runoff Depth>5.50"
Flow Length=2,854' Tc=30.1 min CN=89 Runoff=56.96 cfs 5.318 af

Reach 5R: Existing flows 72" pipe Avg. Flow Depth=1.43' Max Vel=17.08 fps Inflow=88.44 cfs 8.068 af
72.0" Round Pipe n=0.011 L=500.0' S=0.0200 '/' Capacity=707.83 cfs Outflow=88.09 cfs 8.063 af

Reach 5RP: Proposed Flow 72" Pipe Inflow=44.00 cfs 2.971 af
Outflow=44.00 cfs 2.971 af

Total Runoff Area = 24.066 ac Runoff Volume = 11.040 af Average Runoff Depth = 5.50"
51.82% Pervious = 12.472 ac 48.18% Impervious = 11.594 ac

Summary for Subcatchment 2S: Existing I-70 (ODOT)

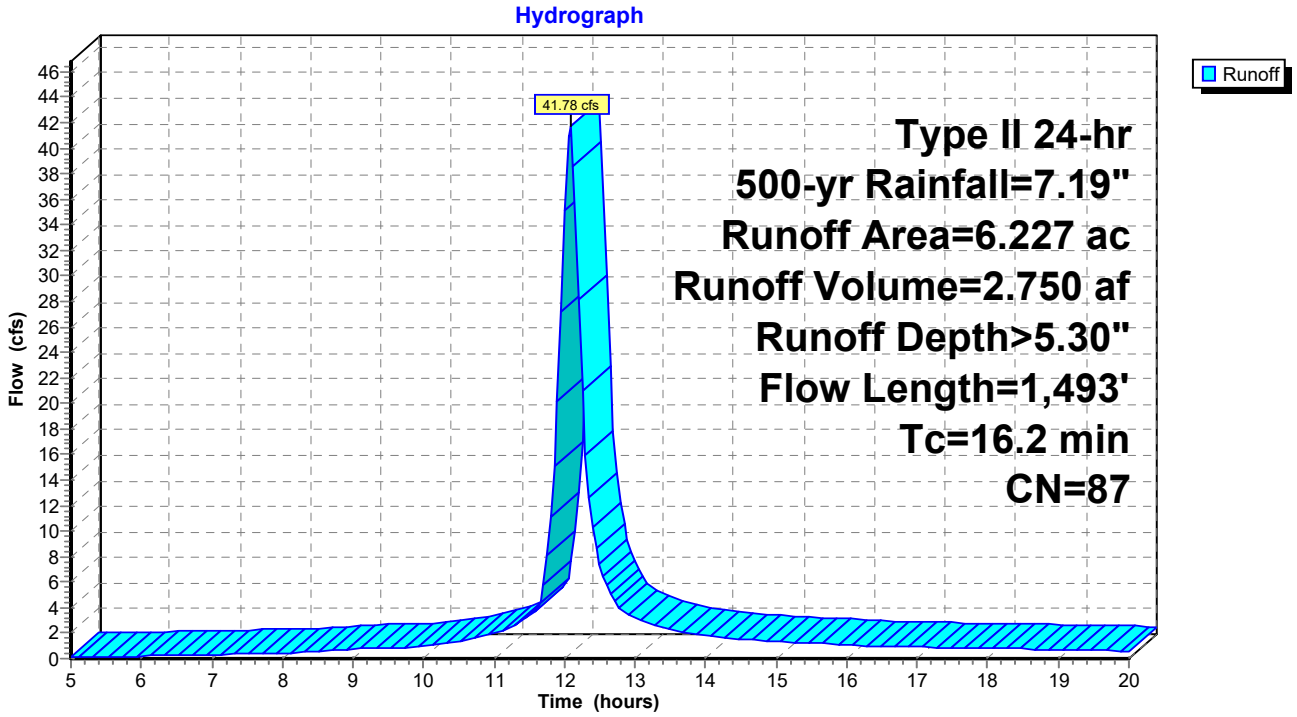
Runoff = 41.78 cfs @ 12.08 hrs, Volume= 2.750 af, Depth> 5.30"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 500-yr Rainfall=7.19"

	Area (ac)	CN	Description
*	2.422	98	Impervious area
*	3.805	80	Vegetative
	6.227	87	Weighted Average
	3.805		61.10% Pervious Area
	2.422		38.90% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.7	80	0.0600	1.85		**Sheet Flow, Sheet flow** Smooth surfaces n= 0.011 P2= 2.64"
15.5	1,413	0.0103	1.52		**Shallow Concentrated Flow, Ditch** Grassed Waterway Kv= 15.0 fps
16.2	1,493	Total			

Subcatchment 2S: Existing I-70 (ODOT)



Summary for Subcatchment 2SP: Proposed I-70 improvements

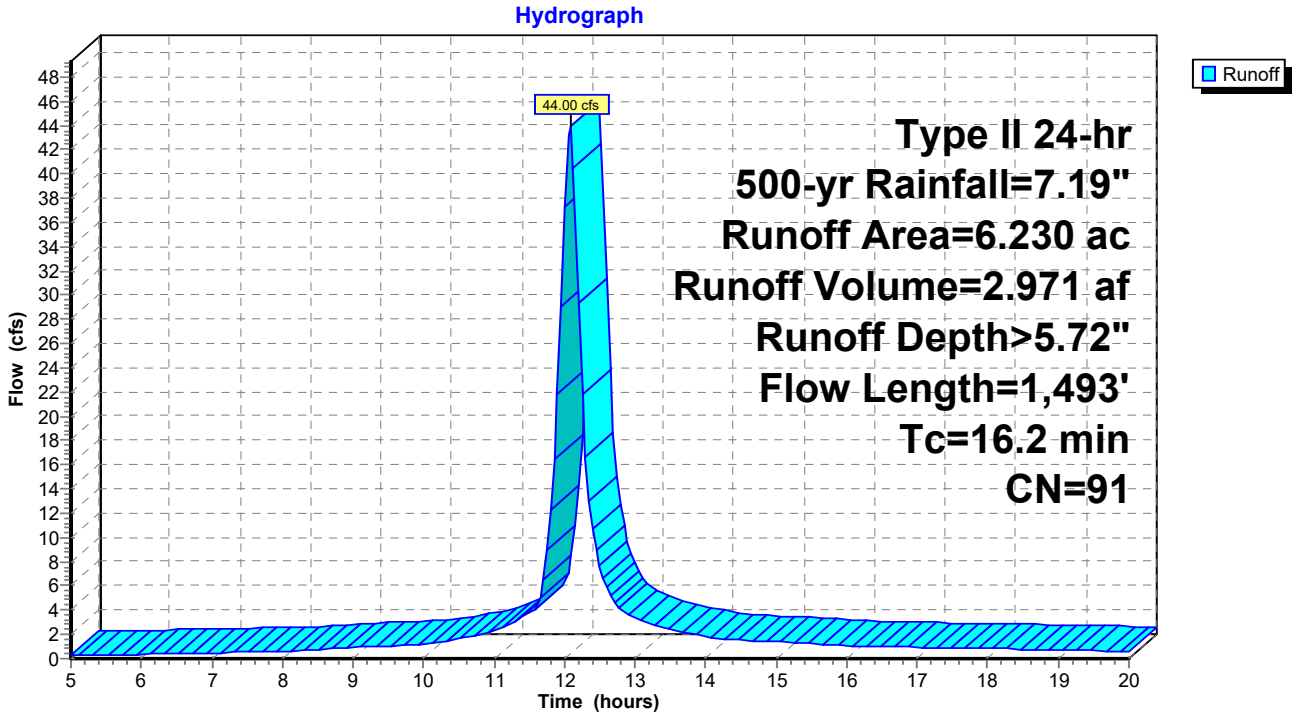
Runoff = 44.00 cfs @ 12.08 hrs, Volume= 2.971 af, Depth> 5.72"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 500-yr Rainfall=7.19"

	Area (ac)	CN	Description
*	3.650	98	Impervious area
*	2.580	80	Vegetative
	6.230	91	Weighted Average
	2.580		41.41% Pervious Area
	3.650		58.59% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.7	80	0.0600	1.85		**Sheet Flow, Sheet flow** Smooth surfaces n= 0.011 P2= 2.64"
15.5	1,413	0.0103	1.52		**Shallow Concentrated Flow, Ditch** Grassed Waterway Kv= 15.0 fps
16.2	1,493	Total			

Subcatchment 2SP: Proposed I-70 improvements



Summary for Subcatchment 6S: Existing I-70 (ODOT)

[47] Hint: Peak is 896% of capacity of segment #2
[47] Hint: Peak is 1041% of capacity of segment #3

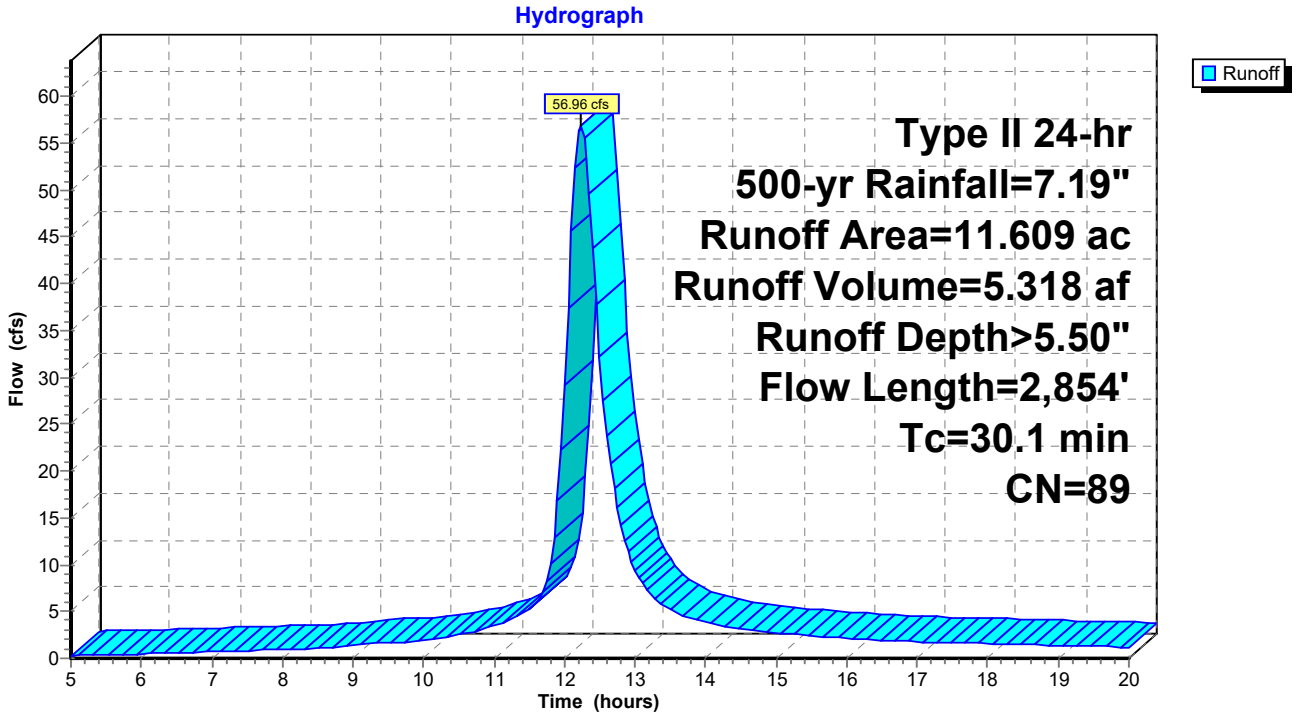
Runoff = 56.96 cfs @ 12.23 hrs, Volume= 5.318 af, Depth> 5.50"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 500-yr Rainfall=7.19"

	Area (ac)	CN	Description
*	5.522	98	Impervious area
*	6.087	80	Vegetative
	11.609	89	Weighted Average
	6.087		52.43% Pervious Area
	5.522		47.57% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.5	25	0.0186	0.92		**Sheet Flow, Sheet flow** Smooth surfaces n= 0.011 P2= 2.64"
0.3	123	0.0271	8.09	6.35	**Pipe Channel, CMP_Round 12"** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.012 Concrete pipe, finished
0.2	84	0.0201	6.97	5.47	**Pipe Channel, CMP_Round 12"** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.012 Concrete pipe, finished
12.4	1,119	0.0100	1.50		**Shallow Concentrated Flow, Median Ditch** Grassed Waterway Kv= 15.0 fps
16.7	1,503	0.0100	1.50		**Shallow Concentrated Flow, Roadside ditch** Grassed Waterway Kv= 15.0 fps
30.1	2,854	Total			

Subcatchment 6S: Existing I-70 (ODOT)



Summary for Reach 5R: Existing flows 72" pipe

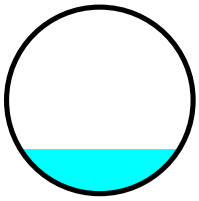
[52] Hint: Inlet/Outlet conditions not evaluated
[82] Warning: Early inflow requires earlier time span

Inflow Area = 17.836 ac, 44.54% Impervious, Inflow Depth > 5.43" for 500-yr event
Inflow = 88.44 cfs @ 12.14 hrs, Volume= 8.068 af
Outflow = 88.09 cfs @ 12.15 hrs, Volume= 8.063 af, Atten= 0%, Lag= 0.9 min

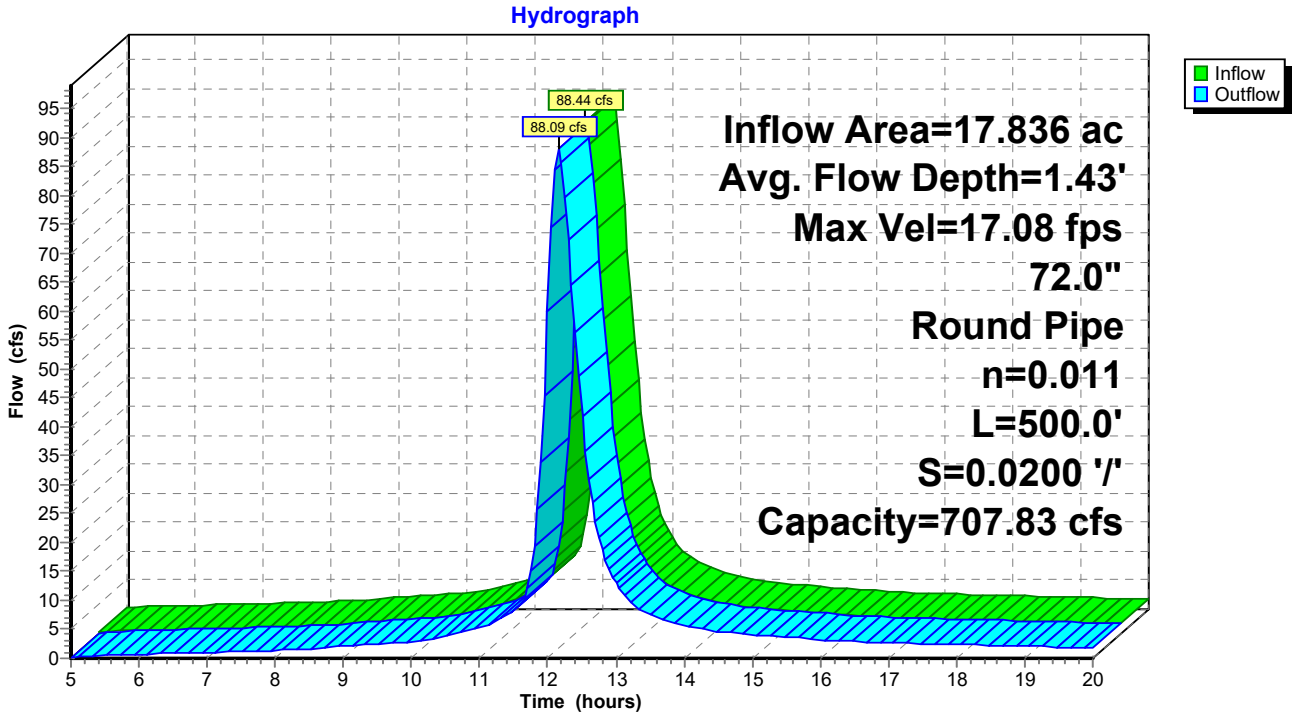
Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 17.08 fps, Min. Travel Time= 0.5 min
Avg. Velocity = 6.57 fps, Avg. Travel Time= 1.3 min

Peak Storage= 2,589 cf @ 12.15 hrs
Average Depth at Peak Storage= 1.43' , Surface Width= 5.12'
Bank-Full Depth= 6.00' Flow Area= 28.3 sf, Capacity= 707.83 cfs

72.0" Round Pipe
n= 0.011 Concrete pipe, straight & clean
Length= 500.0' Slope= 0.0200 '/'
Inlet Invert= 700.00', Outlet Invert= 690.00'



Reach 5R: Existing flows 72" pipe



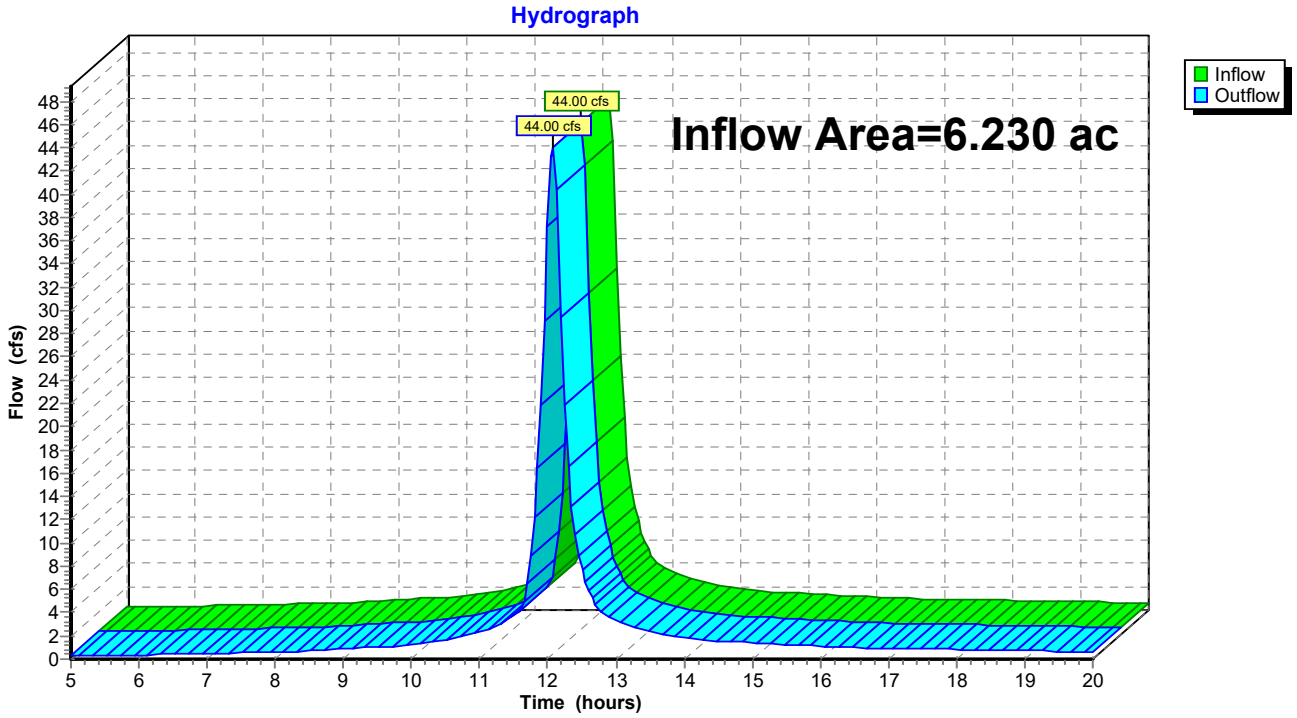
Summary for Reach 5RP: Proposed Flow 72" Pipe

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 6.230 ac, 58.59% Impervious, Inflow Depth > 5.72" for 500-yr event
Inflow = 44.00 cfs @ 12.08 hrs, Volume= 2.971 af
Outflow = 44.00 cfs @ 12.08 hrs, Volume= 2.971 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Reach 5RP: Proposed Flow 72" Pipe



Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 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: Existing I-70 (ODOT) Runoff Area=6.227 ac 38.90% Impervious Runoff Depth>5.96"
Flow Length=1,493' Tc=16.2 min CN=87 Runoff=46.72 cfs 3.094 af

Subcatchment2SP: Proposed I-70 Runoff Area=6.230 ac 58.59% Impervious Runoff Depth>6.39"
Flow Length=1,493' Tc=16.2 min CN=91 Runoff=48.87 cfs 3.318 af

Subcatchment6S: Existing I-70 (ODOT) Runoff Area=11.609 ac 47.57% Impervious Runoff Depth>6.16"
Flow Length=2,854' Tc=30.1 min CN=89 Runoff=63.51 cfs 5.962 af

Reach 5R: Existing flows 72" pipe Avg. Flow Depth=1.51' Max Vel=17.64 fps Inflow=98.76 cfs 9.056 af
72.0" Round Pipe n=0.011 L=500.0' S=0.0200 '/' Capacity=707.83 cfs Outflow=98.39 cfs 9.050 af

Reach 5RP: Proposed Flow 72" Pipe Inflow=48.87 cfs 3.318 af
Outflow=48.87 cfs 3.318 af

Total Runoff Area = 24.066 ac Runoff Volume = 12.374 af Average Runoff Depth = 6.17"
51.82% Pervious = 12.472 ac 48.18% Impervious = 11.594 ac

Summary for Subcatchment 2S: Existing I-70 (ODOT)

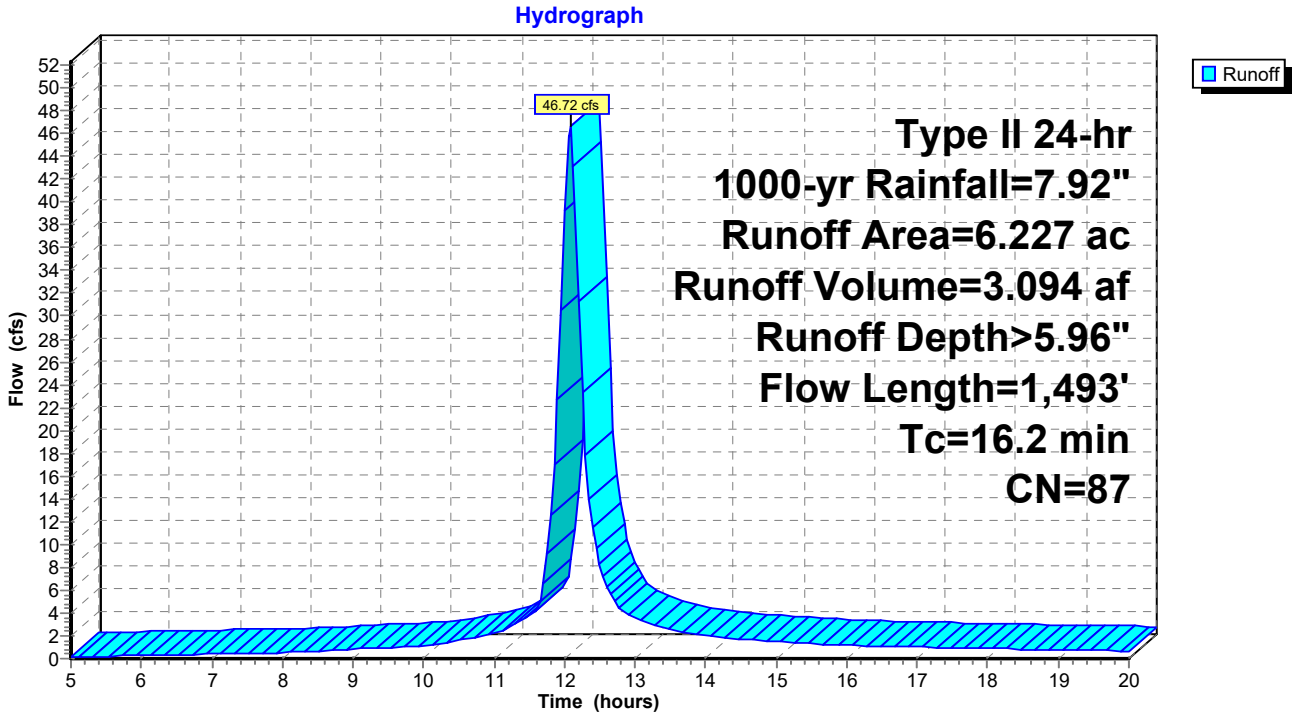
Runoff = 46.72 cfs @ 12.08 hrs, Volume= 3.094 af, Depth> 5.96"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 1000-yr Rainfall=7.92"

	Area (ac)	CN	Description
*	2.422	98	Impervious area
*	3.805	80	Vegetative
	6.227	87	Weighted Average
	3.805		61.10% Pervious Area
	2.422		38.90% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.7	80	0.0600	1.85		**Sheet Flow, Sheet flow** Smooth surfaces n= 0.011 P2= 2.64"
15.5	1,413	0.0103	1.52		**Shallow Concentrated Flow, Ditch** Grassed Waterway Kv= 15.0 fps
16.2	1,493	Total			

Subcatchment 2S: Existing I-70 (ODOT)



Summary for Subcatchment 2SP: Proposed I-70 improvements

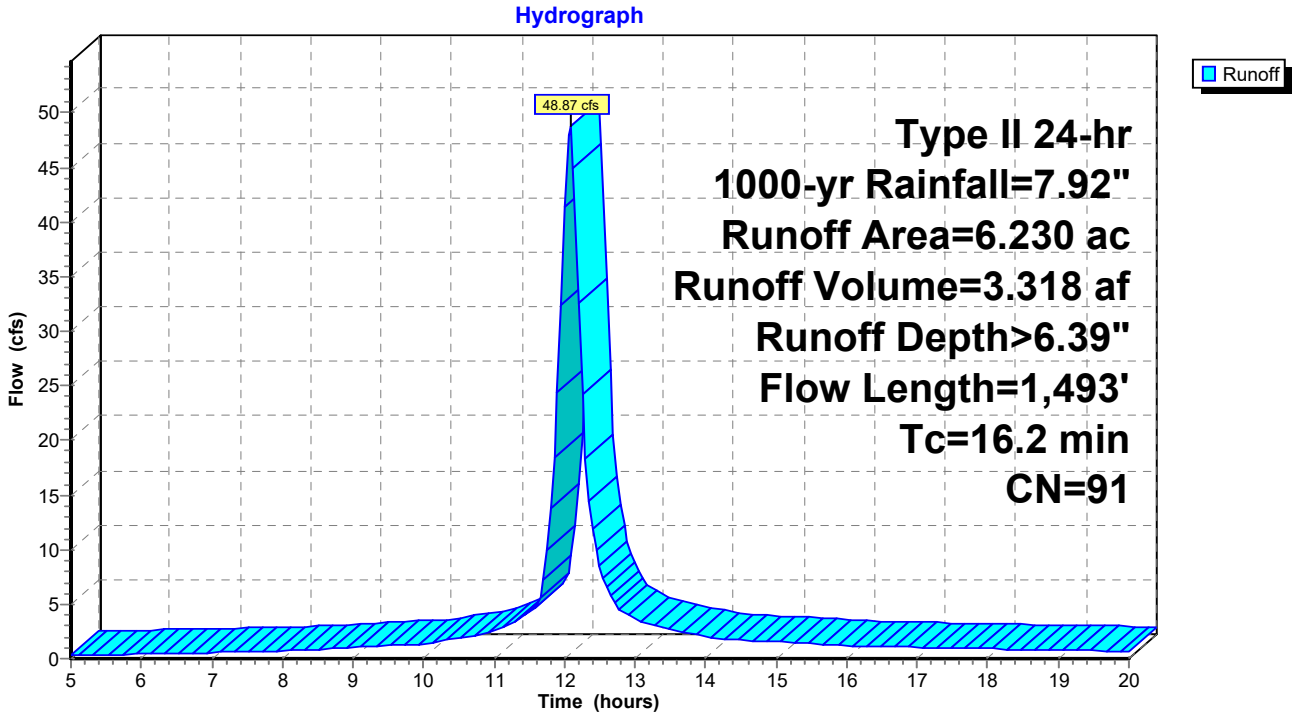
Runoff = 48.87 cfs @ 12.08 hrs, Volume= 3.318 af, Depth> 6.39"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 1000-yr Rainfall=7.92"

	Area (ac)	CN	Description
*	3.650	98	Impervious area
*	2.580	80	Vegetative
	6.230	91	Weighted Average
	2.580		41.41% Pervious Area
	3.650		58.59% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.7	80	0.0600	1.85		**Sheet Flow, Sheet flow** Smooth surfaces n= 0.011 P2= 2.64"
15.5	1,413	0.0103	1.52		**Shallow Concentrated Flow, Ditch** Grassed Waterway Kv= 15.0 fps
16.2	1,493	Total			

Subcatchment 2SP: Proposed I-70 improvements



Summary for Subcatchment 6S: Existing I-70 (ODOT)

[47] Hint: Peak is 1000% of capacity of segment #2
[47] Hint: Peak is 1161% of capacity of segment #3

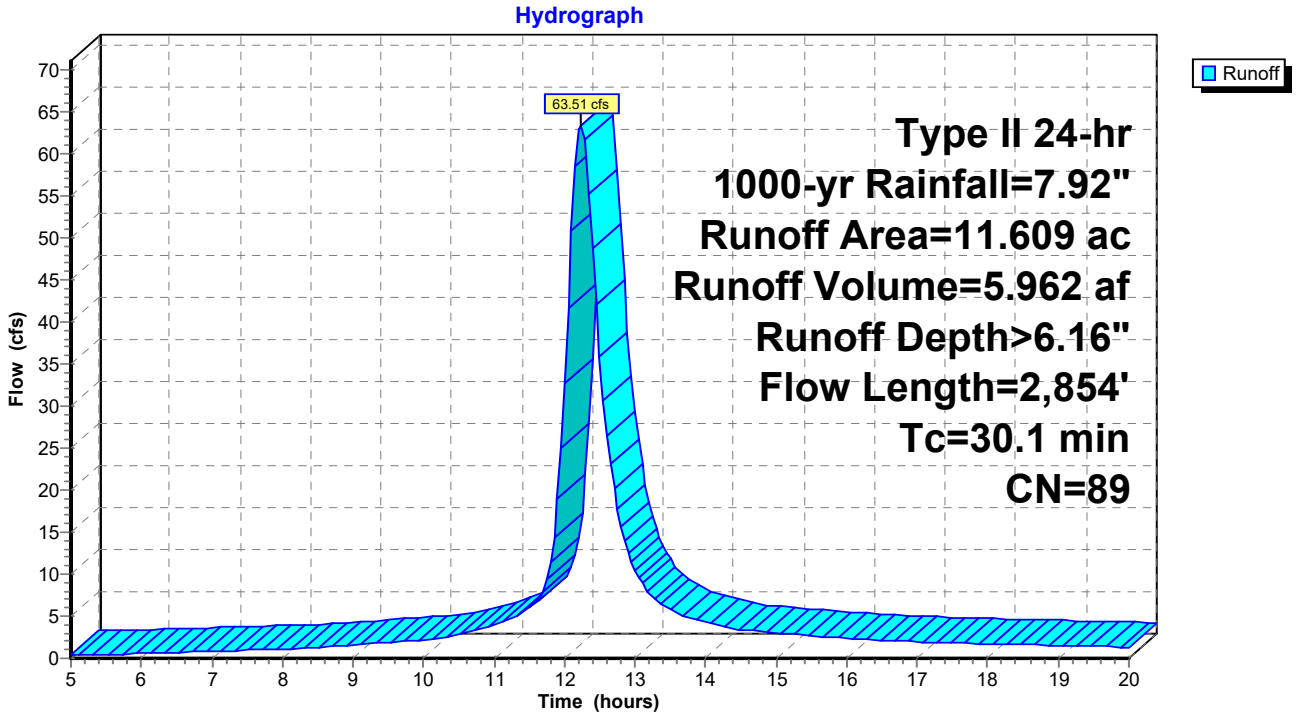
Runoff = 63.51 cfs @ 12.23 hrs, Volume= 5.962 af, Depth> 6.16"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 1000-yr Rainfall=7.92"

	Area (ac)	CN	Description
*	5.522	98	Impervious area
*	6.087	80	Vegetative
	11.609	89	Weighted Average
	6.087		52.43% Pervious Area
	5.522		47.57% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.5	25	0.0186	0.92		**Sheet Flow, Sheet flow** Smooth surfaces n= 0.011 P2= 2.64"
0.3	123	0.0271	8.09	6.35	**Pipe Channel, CMP_Round 12"** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.012 Concrete pipe, finished
0.2	84	0.0201	6.97	5.47	**Pipe Channel, CMP_Round 12"** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.012 Concrete pipe, finished
12.4	1,119	0.0100	1.50		**Shallow Concentrated Flow, Median Ditch** Grassed Waterway Kv= 15.0 fps
16.7	1,503	0.0100	1.50		**Shallow Concentrated Flow, Roadside ditch** Grassed Waterway Kv= 15.0 fps
30.1	2,854	Total			

Subcatchment 6S: Existing I-70 (ODOT)



Summary for Reach 5R: Existing flows 72" pipe

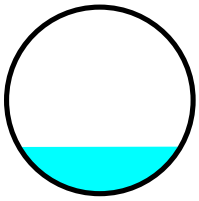
[52] Hint: Inlet/Outlet conditions not evaluated
[82] Warning: Early inflow requires earlier time span

Inflow Area = 17.836 ac, 44.54% Impervious, Inflow Depth > 6.09" for 1000-yr event
Inflow = 98.76 cfs @ 12.14 hrs, Volume= 9.056 af
Outflow = 98.39 cfs @ 12.15 hrs, Volume= 9.050 af, Atten= 0%, Lag= 0.9 min

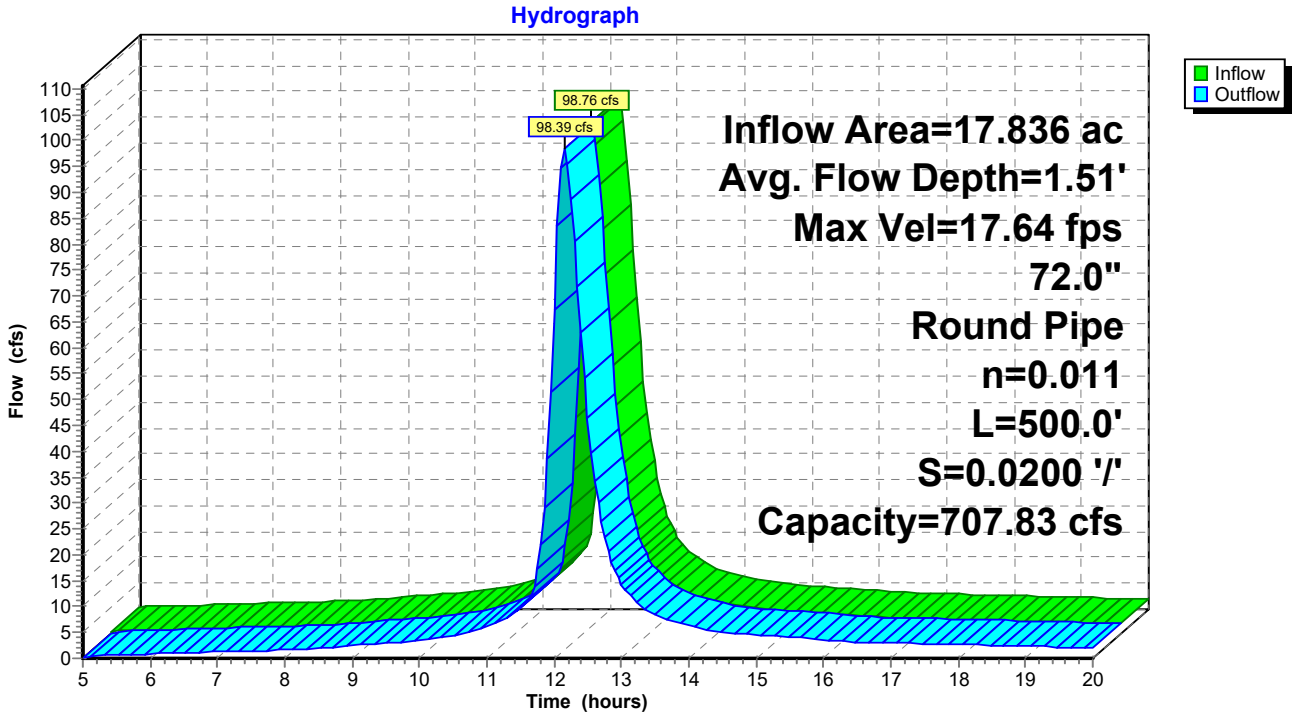
Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 17.64 fps, Min. Travel Time= 0.5 min
Avg. Velocity = 6.83 fps, Avg. Travel Time= 1.2 min

Peak Storage= 2,801 cf @ 12.14 hrs
Average Depth at Peak Storage= 1.51' , Surface Width= 5.21'
Bank-Full Depth= 6.00' Flow Area= 28.3 sf, Capacity= 707.83 cfs

72.0" Round Pipe
n= 0.011 Concrete pipe, straight & clean
Length= 500.0' Slope= 0.0200 '/'
Inlet Invert= 700.00', Outlet Invert= 690.00'



Reach 5R: Existing flows 72" pipe



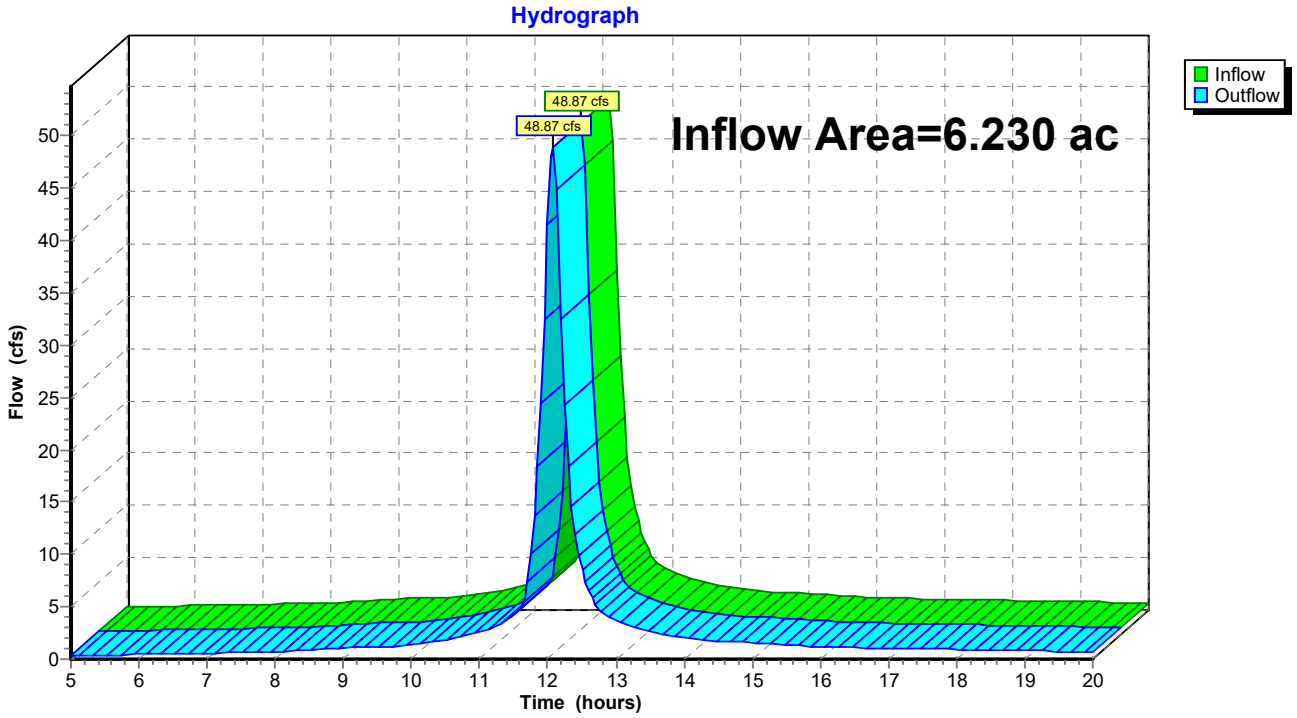
Summary for Reach 5RP: Proposed Flow 72" Pipe

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 6.230 ac, 58.59% Impervious, Inflow Depth > 6.39" for 1000-yr event
Inflow = 48.87 cfs @ 12.08 hrs, Volume= 3.318 af
Outflow = 48.87 cfs @ 12.08 hrs, Volume= 3.318 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Reach 5RP: Proposed Flow 72" Pipe



Appendix I – FRA-70-2347 Bridge Waterway Hydraulic Analysis Report

Bridge Waterway Hydraulic and Scour Analysis Report

PID 95639 – FRA-70-22.61

FRA-70-2374, SFN: 2505681

IR 70 over Powell Ditch

Columbus, Ohio

September 23, 2016

2800 Corporate Exchange Drive, Suite 100
Columbus, OH 43231-1666
(614) 839-5770

Contents

Figures

Appendices

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1 Executive Summary

The proposed interchange improvements, PID 95639 – FRA-70-22.61, will impact the existing double barrel 22 feet x 8 feet precast concrete box culvert, FRA-70-2374, SFN: 2505681, located at Sta 578+05.19. The culvert is located outside the FEMA designated Flood Zones as indicated on the Flood Insurance Rate Map, 39049C0362K, dated 06/17/2008. The outlet (southern) end of the existing 205 feet long culvert that crosses under I.R. 70 will need to be extended 68 feet to accommodate proposed and future (full build) ramp alignments. The downstream channel will also require grading modifications along the east bank and the removal of the existing non-vehicular two lane bridge in order to transition the stream bed from the nominally 44 feet wide culvert opening to the existing channel bottom width of approximately 24 feet.

The hydrology portion of the study initially utilized Stream Stats to determine the estimated peak discharges which were then increased to be compatible with information on the record drawings regarding the original channel design. The existing and proposed culvert and downstream channel hydraulic analysis was performed using the US Army Corps of Engineer River Analysis System (HEC-RAS) modeling program, version 5.10. The comparison of the results from the Existing and Proposed condition analysis indicates that the headwater elevations at the inlet (north) end and the tailwater at the outlet (south) end decrease approximately 0.5 and 0.2 feet, respectively from the existing condition. Additionally, the calculated water surface elevations return to the existing conditions within the analysis (channel cross section) limits.

The proposed design is the simplest and most reasonable alternative and meets the requirements of the ODOT Location and Design Manual, Volume 2. The length of permanent impact to the existing stream below the ordinary high-water mark is less than 200 feet which is within the limit of the 404 Permit USACE Nationwide No. 14. Additionally, a temporary access fill may be necessary to construct the dual box extension. ODOT District 6 is preparing the environmental documentation for this project. Therefore, the proposed design is recommended for approval.

2 Introduction

2.1 Project Background:

The Ohio Department of Transportation (ODOT) has implemented a comprehensive strategy for rebuilding and modernizing the Far East Freeway. The Interchange Modification Study, *Far East Freeway, FRA-70-16.17,* PID No. 76997, describes the various alternatives and preferred alternatives for various interchanges along the I-70 corridor between James Road and SR-310. The purpose of the proposed corridor improvements is to reduce congestion and improve safety along I-70 for a length of approximately 13.6 miles, reducing the number of crashes resulting from roadway design, capacity, and geometric deficiencies, and to enhance transportation opportunities for pedestrian and bicycle traffic. The interchanges of James Road and SR-310 along I-70 as well as the interchanges of U.S. 40 and US 33 along I-270 were included in the study to gauge impact of the improvements to the up/down stream interchanges.

The study compared alternatives to arrive at a balanced solution that best meets the measures stated in the Purpose and Need; to reduce congestion and improve the overall safety of the interchanges within the study area. The Preferred Alternative will reduce congestion in the project study area and will correct nearly all of the design deficiencies in the corridor. These two elements will greatly reduce crashes and provide an improvement in the overall safety of the corridor.

2.2 Project Description:

The IR-70 at IR-270 Interchange Reconstruction - Project 1, PID: 95639, FRA-70-22.61, is the first construction project from the *Far East Freeway Study* (PID No. 76997) and the first construction project (of four) for the reconstruction of the IR-70 at IR-270 interchange. Project 1 includes partially reconfiguring the system to system interchange of IR-70 and IR-270 and the system to service interchange of IR-70 and Brice Road by removing major weaving movements. The reconfiguration will separate the through and local traffic from IR-270 and IR-70 headed eastbound and to Brice Road. System to system traffic will utilize two new directional fly-over ramps from north and south bound IR-270 to eastbound IR-70. Exits for Brice Road will occur on IR-270 north and south bound and on IR-70 before IR-270; funneling local traffic onto a collector- distributor exit ramp. As part of this project (PID No. 95639), two existing bridges are proposed to be rehabilitated, there are six proposed new bridges, and one existing double cell box culvert is proposed to be extended. In addition, there are 14 proposed retaining walls associated with this project. This project also includes the associated drainage, lighting, traffic control, utility relocation, and noise abatement.

2.3 Project Impact:

This report was prepared for the Stage 1 Plan Review submittal. The proposed interchange improvements, PID 95639 – FRA-70-22.61, will impact the existing double barrel 22 feet x 8 feet precast concrete box culvert, FRA-70-2374, SFN: 2505681, located at Sta 578+05.19. Due to the span of the existing structure it is classified as a bridge however its length and shape the structure has the hydraulic function of a culvert as a result either reference is used interchangeably within this report. The

existing is 205 feet long culvert that crosses under IR-70 will need to be extended 68 feet to accommodate proposed and future (full build) ramp alignments at the outlet (southern) end. A hydrology and hydraulics study of Powell Ditch, a tributary to Big Walnut Creek was performed to confirm that the proposed culvert extension will not adversely impact the existing upstream or downstream channel conditions and that the proposed conditions comply with the criteria provided in the ODOT Location and Design Manual, Volume 2.

This study included reviewing flood insurance rate maps and existing record drawings, visiting the site, surveying the existing culvert and downstream channel, determining the tributary area, estimating the peak discharges, preparing a computer model of the existing and proposed conditions using the US Army Corps of Engineer River Analysis System (HEC RAS), analyzing the results of the existing and proposed conditions and preparing this report to summarize the study and recommend approval of the proposed design.

3 Location

The project location is located approximately 10 miles east of downtown Columbus, Ohio at the Interchange of IR-70 with IR-270. The existing culvert is located under IR-70 just west of the IR-70 Interchange with Brice Road in Columbus, Ohio See Figure 3-1 Location Map.

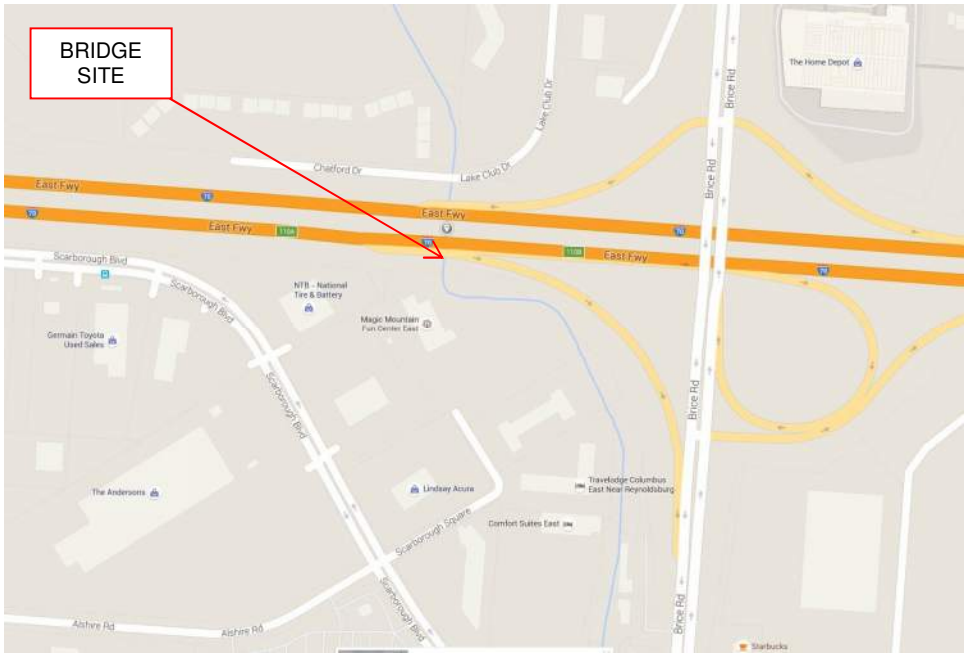


Figure 1. Location Map

4 Existing Conditions

The existing bridge to be to be extended is a double barrel 22 feet x 8 feet precast concrete box culvert which was constructed circa 1999. Approximately 60 feet downstream of the existing culvert is a three span bridge which measures 53 feet span by 32 feet wide deck with an under clearance of 4' and was constructed circa 1966 for Service Road "A" which no longer exists. The existing downstream channel, south of the Limited Access Right-of-Way and downstream of the existing Service Road "A" bridge, is located in an existing channel easement.

A records review indicates the following history at the site:

- According to FRA-70-21.29, plans dated 1966, the tributary was relocated to its present location and was spanned with three, three span slab bridges, (Westbound Lanes and Shoulders, Eastbound Lanes and Shoulders, and Service Road "A").
- According to the FRA-70-23.92, plans dated, 1974, the ramps to Brice Road were modified from the 1966 design to the existing geometry. The existing IR 70 Eastbound exit ramp to Brice Road southbound left the Service Road "A" bridge in place however removed the portion of Service Road "A" located east of the existing bridge.
- According to FRA-70-14.69, plans dated 1999, the existing mainline bridges were proposed for rehabilitation however from ODOT inventory documentation received from District 6 and a site visit, the constructed (now existing) structure consists of two 22' x 8' precast box culverts, side by side for a length of 205' crossing under IR-70. The pertinent plan sheets are provided in Appendix A.
- It also appears that the Service Road "A" right-of-way has since been vacated and / or used by the properties that abut the LA-R/W westward from the stream to Scarborough Blvd.

The existing downstream channel alignment appears remain the same as when it was constructed as per the 1966 plans. The channel shape according to the record plans is a 24 feet wide bottom with 2:1 side slopes, with 4.5 feet depth, on a 0.20 percent slope. The plans indicate that rock channel protection was to be placed along the side slopes from the toe existing ground line. From the basemapping and the channel survey sections the existing channel appears to be consistent with the 1966 plan with the exception of the bottom width has evolved into a 10 feet wide meandering bottom width channel within the original 24 feet wide bottom ditch. Additionally, rock channel protection is visible in some locations.

The land to the north and east of the downstream channel is grass and varies from intermittently placed tress to densely spaced trees. The land immediately south and west of the downstream channel is commercial land use. Along the top of bank there is an approximately 20 feet wide berm with ponds immediately adjacent.

To create the HEC-RAS model, a detailed survey of the Powell Ditch was preformed to obtain the existing elevations of the inlet and outlet ends of the culvert, the existing service road bridge, and various channel cross sections for approximately 140 feet downstream. The sections for the upstream channel were taken from the basemapping since there are no proposed improvements for the upstream channel

the accuracy of the basemap was sufficient for comparison of the calculated water surface elevations. The survey was performed by Barr Engineering on behalf of HDR during April 2016.

From the survey it was determined that the existing double barrel culvert is on a 0.0% profile grade. The basemapping indicates that the low flow is aligned to be conveyed through the western barrel and the downstream channel at the eastern barrel outlet end is filled to approximately 1 foot above the western barrel flowline elevation.

On August 8, 2016 HDR performed a site visit to confirm the dimensions of the hydraulic opening and other measurements relative to the design of the extension.

Photographs of the aerial view, the downstream end of the culvert and the service road bridge are provided in Figures 2 to 4.

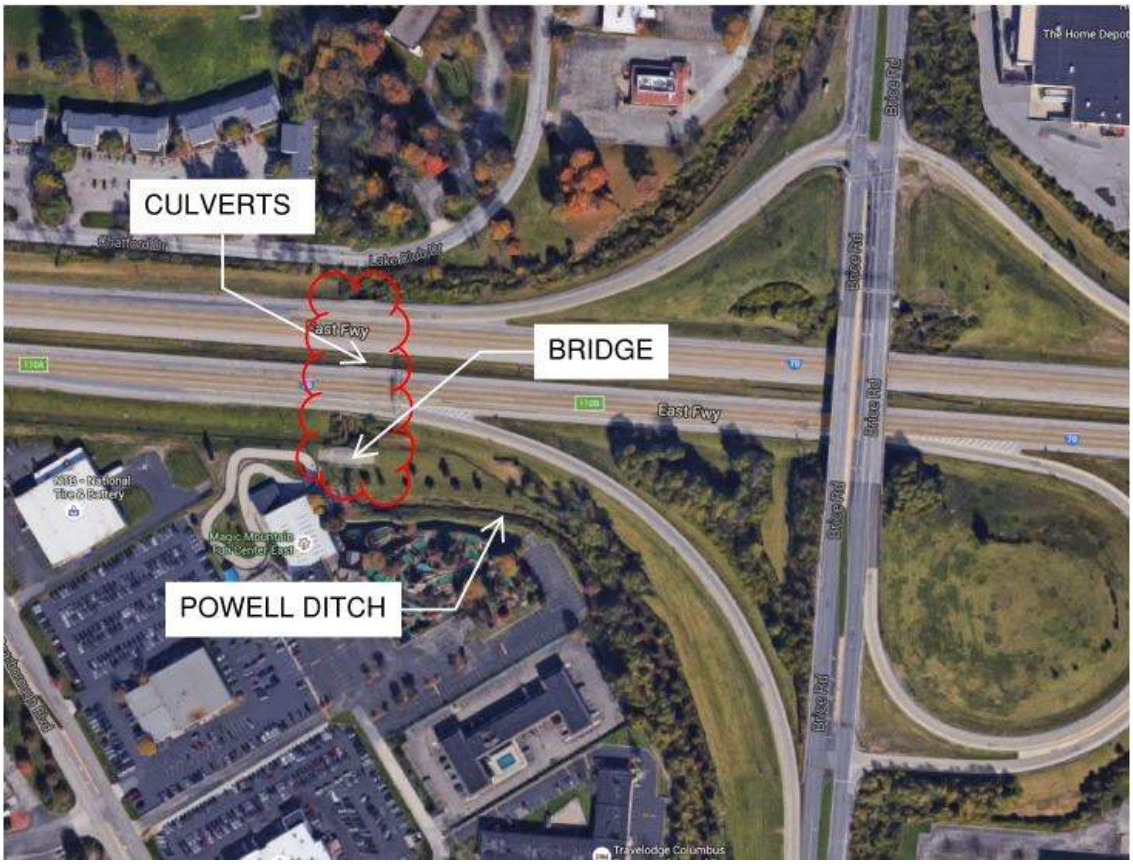


Figure 2. Aerial View

Figure 3. Existing Culvert Outlet End (looking upstream)

Figure 4. Existing Service Road Bridge (looking upstream)

5 Proposed Conditions

The existing dual barrel culvert will be extended 68 feet downstream to accommodate the limits of the proposed and future roadway. At the existing outlet end the proposed cover is 1.61 feet to the pavement surface. At the proposed outlet end the proposed cover is 0.94 feet. Similarly, the future (full build condition) the future covers are 1.86 and 1.28 feet, respectively. The culvert was extended sufficient length to account for future condition as well as allow for the proposed Concrete Barrier to be separate from the proposed headwall and wingwalls to simplify design and construction thereby minimizing costs.

The existing service road bridge located just downstream of the culvert will be removed due to the extension and necessary transitional re-grading along the east channel bank.

According to Figure 3 there appears to be existing instrumentation that will also be impacted by the project.

6 Hydrology

The initial tributary delineation and peak discharges were determined using USGS Stream Stats, Version 3.0. The Stream Stats delineation indicates that the tributary area generally extends northward along Brice Road, approximately 0.3 miles north of Livingston Ave to near Roselawn Avenue and eastward along Livingston Avenue, approximately 0.8 miles east of Brice to east of Rosehill Road. Table 6-1 USGS Stream Stats Results provides the tributary area and the peak discharges for the various storm events. Most of this area's land use is commercial and residential.

Table 6-1 USGS Stream Stats Results

Tributary Area	Recurrence Interval	2-year (50%)	5-year (20%)	10-year (10%)	25-year (4%)	50-year (2%)	100-year (1%)	500-year (0.2%)
0.7 (square miles) / 488 (acres)	Peak Discharge (cfs)	84	151	201	267	316	366	486

These results were compared to the 1966 FRA-70-21.29 original bridge plans which indicate that the tributary area is 1.04 square miles and a design high water elevation of 787.9 (normal depth 4.7 feet). It was determined that the tributary area delineation should be verified via another means.

To check the tributary area considering the urbanized nature and presence of storm sewers the tributary area was also delineated using the City of Columbus, Sewer Atlas

Maps. The resulting tributary area was determined to be 0.6 square miles or 380 acres. Based upon this delineation it was determined to proceed with the tributary area of 0.7 square miles provided by Stream Stats for estimating the peak discharges.

It was also noted that the 1966 record plans indicated a design high water elevation on the Bridge Site Plans. The 1966 plans provide a channel design having a bottom width, 24 feet with 2:1 side slopes on a 0.2% profile grade and a normal depth of 4.7 feet using the design high water elevation. Using the record channel information and the Manning's Equation, it was determined that the design high water peak discharge is 480 cfs when a Manning's Roughness coefficient of 0.05 is assumed which is an average value according to ODOT Location and Design Manual Volume 2, Table 1102-2 and appropriate for this channel. This result is relatively close to the 500-year (0.2% Chance), 486 cfs, Peak Discharge Estimated by Stream Stats.

The Design Year Frequency of 50-year with a 100-year Frequency Check Storm was selected according to Section 1004.2 the ODOT Location and Design Manual, Volume 2 as the criteria for the analysis. This selection deviates from the criteria indicated for bridges in Section 1118.2.1 which indicates a analysis for the 100-Year and 500-Year events. The deviation from the criteria seems reasonable based upon the following conditions for this site:

- The existing structure was more likely to be the designed for the 50-Year event as that was the probable criterion at that time since the 1966 design pre-dates the original FEMA Flood Insurance Studies;
- The existing structure is not located in the FEMA designated Flood Zones;
- The exciting structure consists of two conduits and functions like a culvert rather than a bridge;
- The structure should be hydraulically adequate for the 50-Year and 100-Year, design and check storm frequency, respectively since the structure is outside the FEMA Designated Flood Zones.

Since it was determined that the original structure and channel design may have been based upon a 50-year storm and the original design flow was calculated to be 480 cfs which is greater than the 316 cfs calculated by Stream Stats. It was determined that the Stream Stats calculated peak discharges should not be used for the hydraulic analysis. For comparison purposes the same tributary area and basin characteristics were entered into the regression equations from both:

- ESTIMATED PEAK DISCHARGES OF UNREGULATED RURAL STREAMS IN OHIO, U.S. GEOLOGICAL SURVEY WATER-RESOURCES INVESTIGATIONS REPORT 03-4164
- ESTIMATED PEAK DISCHARGES OF SMALL URBAN STREAMS IN OHIO, U.S. GEOLOGICAL SURVEY WATER-RESOURCES INVESTIGATIONS REPORT 93-135, SEPTEMBER 1991

The rural regression equations yielded results higher than but comparable to Stream Stats. Since the tributary is currently urbanized the urban regression equations were used varying the Basin Development Factor (BDF) until the calculated 50-year peak discharge was comparable to the 480 cfs original channel design. A BDF equal to 4

results in a peak discharge of 483 cfs. Therefore the peak discharge results of urban equations were used for the hydraulic analysis.

In order to determine the Ordinary High Water Mark (OHWM) the Bankfull Flow was calculated using the U.S. Department of Transportation, Federal Highway Administration, Bankfull Characteristics of Ohio Streams and Their Relation to Peak Streamflows, Scientific Investigations Report 2005-5153. Based upon the equations for Region A the bankfull discharge was calculated to be 79 cfs; the banfull width is 16.3 feet, the bankfull mean depth is 1.4 feet and the bankfull cross section area is 22.9 square feet.

Although not required all storm events were included in the HEC-RAS analysis for the purposes of having the calculated water surface elevations available for coordination purposes regarding waterway permits or other proposed storm water facilities. Table 6-2 Hydrology Data is the data that was used in the HEC-RAS analysis.

Table 6-2 Hydrology Data

Tributary Area	Recurrence Interval	2-year (50%)	5-year (20%)	10-year (10%)	25-year (4%)	50-year (2%)	100-year (1%)	Bankfull
0.7 (square miles) / 488 (acres)	Peak Discharge (cfs)	117	221	296	404	483	574	79

7 Hydraulic Analysis

7.1 Existing Conditions:

The existing and proposed culvert and downstream channel hydraulic analysis was performed using the US Army Corps of Engineer River Analysis System (HEC-RAS) modeling program, version 5.10. Figure 5 shows the plan view of the site with the channel section locations that were used for the HEC-RAS analysis. Table 7-1 provides the calculated results for the existing conditions. The existing hydraulic analysis revealed that the existing culvert has sufficient capacity to convey the 100-Year Recurrence Interval Storm with approximately 2 feet of freeboard inside the conduits.

7.2 Proposed Conditions:

The proposed conditions extend the dual barrel structure, removes the existing Service Road “A” bridge and clears and widens the existing downstream channel bottom for approximately 80 feet, from the outlet to where the existing channel turns southeasterly. Table 7-1 provides the calculated results for the proposed conditions and the difference between the existing and proposed calculated water surface elevations. These proposed changes results in a proposed calculated 100-Year water surface elevation that is approximately 0.5 feet lower than the existing condition at the first cross section

upstream of the existing inlet end and 0.2 feet lower than the existing condition at the first cross section downstream from the proposed outlet end.

Table 7-1 Hydraulic Analysis Results

River Sta	Q (cfs)	W.S. Elev (ft)			Max. Depth (ft)			Vel Chnl (ft/s)			Flow Area (sq ft)		
		EX	PROP	DELTA	EX	PROP	DELTA	EX	PROP	DELTA	EX	PROP	DELTA
9+59	117	787.30	787.30	0.00	3.0	3.0	0.0	2.3	2.3	0.0	50.6	50.5	0.1
9+59	221	788.14	788.14	0.00	3.9	3.9	0.0	2.9	2.9	0.0	75.6	75.6	0.0
9+59	296	788.58	788.58	0.00	4.3	4.3	0.0	3.3	3.3	0.0	89.6	89.6	0.0
9+59	404	789.11	789.11	0.00	4.8	4.8	0.0	3.8	3.8	0.0	106.8	106.7	0.0
9+59	483	789.46	789.46	0.00	5.2	5.2	0.0	4.1	4.1	0.0	117.8	117.8	0.0
9+59	574	789.81	789.81	0.00	5.5	5.5	0.0	4.5	4.5	0.0	129.1	129.1	0.0
9+59	79	786.87	786.87	0.00	2.6	2.6	0.0	2.0	2.0	0.0	39.3	39.3	-0.1
7+75	117	785.54	785.54	0.00	1.6	1.6	0.0	5.7	5.7	0.0	20.4	20.4	0.0
7+75	221	786.11	786.11	0.00	2.1	2.1	0.0	6.6	6.6	0.0	33.3	33.3	0.0
7+75	296	786.44	786.44	0.00	2.5	2.5	0.0	7.1	7.1	0.0	41.8	41.8	0.0
7+75	404	786.83	786.83	0.00	2.9	2.9	0.0	7.6	7.6	0.0	53.3	53.2	0.0
7+75	483	787.09	787.09	0.00	3.1	3.1	0.0	7.9	7.9	0.0	61.2	61.2	0.0
7+75	574	787.37	787.37	0.00	3.4	3.4	0.0	8.1	8.1	0.0	70.6	70.6	0.0
7+75	79	785.27	785.27	0.00	1.3	1.3	0.0	5.2	5.2	0.0	15.2	15.2	0.0
7+32	117	784.33	783.96	0.37	2.7	2.4	0.4	1.6	2.2	-0.6	72.2	53.3	18.9
7+32	221	785.43	785.01	0.42	3.8	3.4	0.4	1.6	2.0	-0.4	135.5	110.0	25.6
7+32	296	786.02	785.56	0.46	4.4	4.0	0.5	1.7	2.1	-0.3	171.9	144.0	27.9
7+32	404	786.71	786.23	0.48	5.1	4.6	0.5	1.9	2.2	-0.3	214.8	185.1	29.7
7+32	483	787.14	786.65	0.49	5.5	5.1	0.5	2.0	2.3	-0.3	241.8	210.9	30.8
7+32	574	787.59	787.07	0.52	6.0	5.5	0.5	2.1	2.4	-0.3	269.5	237.2	32.3
7+32	79	783.78	783.42	0.36	2.2	1.8	0.4	1.8	2.9	-1.1	44.4	27.8	16.6
7+12	117	784.33	783.96	0.37	2.8	2.4	0.4	1.1	1.3	-0.2	106.7	90.0	16.7
7+12	221	785.42	785.00	0.42	3.9	3.5	0.4	1.4	1.6	-0.2	156.6	137.3	19.3
7+12	296	786.00	785.55	0.45	4.5	4.0	0.5	1.6	1.8	-0.2	183.4	162.6	20.8
7+12	404	786.69	786.21	0.48	5.2	4.7	0.5	1.9	2.1	-0.2	214.9	192.7	22.2
7+12	483	787.12	786.62	0.50	5.6	5.1	0.5	2.1	2.3	-0.2	234.7	211.7	23.0
7+12	574	787.56	787.04	0.52	6.0	5.5	0.5	2.3	2.5	-0.2	255.1	230.9	24.1
7+12	79	783.78	783.44	0.34	2.2	1.9	0.3	1.0	1.2	-0.2	81.8	66.4	15.5
7+11	Culvert												
4+45	Bridge												
4+27	117		783.95						0.9			127.1	
4+27	221		784.98						1.2			186.1	
4+27	296		785.53						1.4			219.1	
4+27	404		786.18						1.6			259.4	
4+27	483		786.58						1.7			285.4	
4+27	574		786.99						1.8			312.2	

Table 7-1 Hydraulic Analysis Results

River Sta	Q (cfs)	W.S. Elev (ft)			Max. Depth (ft)			Vel Chnl (ft/s)			Flow Area (sq ft)		
		EX	PROP	DELTA	EX	PROP	DELTA	EX	PROP	DELTA	EX	PROP	DELTA
4+27	79		783.43						0.8			98.8	
4+07	117	784.12	783.94	0.18	3.5	2.7	0.8	1.9	0.9	0.9	63.0	125.3	-62.3
4+07	221	785.16	784.97	0.19	4.5	3.7	0.8	2.4	1.2	1.1	94.1	178.6	-84.5
4+07	296	785.71	785.52	0.19	5.1	4.3	0.8	2.6	1.4	1.2	113.3	208.4	-95.1
4+07	404	786.35	786.16	0.19	5.7	4.9	0.8	2.9	1.7	1.3	138.2	244.7	-106.5
4+07	483	786.75	786.57	0.18	6.1	5.3	0.8	3.1	1.8	1.3	156.8	268.1	-111.3
4+07	574	787.17	786.97	0.20	6.5	5.7	0.8	3.3	2.0	1.4	179.0	292.1	-113.1
4+07	79	783.59	783.43	0.16	2.9	2.2	0.7	1.6	0.8	0.8	49.6	99.6	-50.0
3+64	117	783.91	783.93	-0.02	3.1	3.1	0.0	3.0	1.0	2.0	38.6	118.7	-80.1
3+64	221	784.90	784.95	-0.05	4.1	4.2	0.0	3.6	1.3	2.2	62.2	166.5	-104.4
3+64	296	785.43	785.49	-0.06	4.6	4.7	-0.1	3.9	1.5	2.3	76.9	193.9	-117.0
3+64	404	786.04	786.13	-0.09	5.3	5.3	-0.1	4.2	1.8	2.5	95.7	227.8	-132.0
3+64	483	786.41	786.54	-0.13	5.6	5.8	-0.1	4.5	1.9	2.6	107.8	254.0	-146.1
3+64	574	786.79	786.94	-0.15	6.0	6.2	-0.1	4.8	2.1	2.7	120.1	285.4	-165.3
3+64	79	783.40	783.41	-0.01	2.6	2.6	0.0	2.7	0.8	1.9	28.8	96.3	-67.5
3+18	117	783.85	783.85	0.00	4.1	4.1	0.0	2.0	2.0	0.0	58.4	58.4	0.0
3+18	221	784.82	784.82	0.00	5.0	5.0	0.0	2.7	2.7	0.0	83.2	83.2	0.0
3+18	296	785.34	785.34	0.00	5.6	5.6	0.0	3.0	3.0	0.0	98.2	98.2	0.0
3+18	404	785.93	785.93	0.00	6.1	6.1	0.0	3.5	3.5	0.0	116.2	116.2	0.0
3+18	483	786.30	786.30	0.00	6.5	6.5	0.0	3.8	3.8	0.0	127.7	127.7	0.0
3+18	574	786.67	786.67	0.00	6.9	6.9	0.0	4.1	4.1	0.0	139.1	139.1	0.0
3+18	79	783.36	783.36	0.00	3.6	3.6	0.0	1.7	1.7	0.0	47.8	47.8	0.0
2+41	117	783.68	783.68	0.00	3.3	3.3	0.0	2.4	2.4	0.0	49.7	49.7	0.0
2+41	221	784.59	784.59	0.00	4.2	4.2	0.0	3.0	3.0	0.0	73.5	73.5	0.0
2+41	296	785.08	785.08	0.00	4.7	4.7	0.0	3.4	3.4	0.0	88.0	88.0	0.0
2+41	404	785.65	785.65	0.00	5.2	5.2	0.0	3.8	3.8	0.0	106.6	106.6	0.0
2+41	483	786.01	786.01	0.00	5.6	5.6	0.0	4.1	4.1	0.0	119.7	119.7	0.0
2+41	574	786.36	786.36	0.00	6.0	6.0	0.0	4.4	4.4	0.0	133.7	133.7	0.0
2+41	79	783.22	783.22	0.00	2.8	2.8	0.0	2.0	2.0	0.0	39.4	39.4	0.0
1+00	117	782.34	782.34	0.00	2.3	2.3	0.0	6.2	6.2	0.0	21.1	21.1	0.0
1+00	221	782.93	782.93	0.00	2.9	2.9	0.0	7.5	7.5	0.0	33.6	33.6	0.0
1+00	296	783.30	783.30	0.00	3.3	3.3	0.0	8.0	8.0	0.0	42.8	42.8	0.0
1+00	404	783.74	783.74	0.00	3.7	3.7	0.0	8.6	8.6	0.0	55.0	55.0	0.0
1+00	483	784.00	784.00	0.00	4.0	4.0	0.0	9.1	9.1	0.0	62.8	62.8	0.0
1+00	574	784.29	784.29	0.00	4.2	4.2	0.0	9.6	9.6	0.0	72.0	72.0	0.0
1+00	79	781.98	781.98	0.00	1.9	1.9	0.0	5.8	5.8	0.0	14.6	14.6	0.0

8 Design Criteria

The ODOT Location and Design Manual, Volume 2 provides a variety of criteria for both culverts and bridges. The existing culvert and proposed extension is classified as a bridge due to the span length however the criteria for both were evaluated. Table 8-1 provides a brief summary of the most applicable or noteworthy comments regarding these criteria. Additionally, Tables 8-2 provides the hydraulic data to be and 8-3 shown on the Bridge Site Plan. Table 8-3 provides the downstream water surface elevation at the existing cross section located just downstream of the proposed channel improvements. The downstream water surface elevation are the same for both existing and proposed conditions therefore there is no adverse impact to the downstream channel.

Table 8-1 Hydraulic Design Criteria Summary

Criteria Reference	Comment
1006.2.1 Design Storm Controls	Meets the criteria for the 50-year storm, (6.0 feet below the edge of pavement elevation).
1006.2.2 Check Storm Controls	Meets the criteria for the 100-year storm, (2.5 feet below the edge of pavement elevation).
1008.5.2 Height of Cover	The maximum height of cover is less than 10 feet.
1105.2 Stream Protection	Since this is a very large existing culvert (classifies as a bridge) that is being extended; the freeboard inside the culvert is approximately 2 feet; and the calculated velocities are 2.5 fps or less, the stream protection measures are not reasonably applicable to the site conditions.
1105.6.9 Maximum Allowable Outlet Velocity	According to Figure 1107-1, rock channel protection is not required. Regardless, Rock Channel Protection, Type C, 2'-0" Thick will be provided within the limits of the proposed wingwalls.
1106.2 Headwall Types	A special design due to structure size and proposed and future needs. The outlet end will require concrete barrier due to current and future geometry. A concrete barrier is separated from headwall to allow adaption to future ramp alignment adjustments. No work at the inlet is proposed with this project.

Table 8-2 Hydraulic Design Data (for Bridge Site Plan)

DRAINAGE AREA =			488 ACRES			0.7 SQUARE MILES		
PEAK DISCHARGE			HEADWATER ELEVATIONS			OUTLET VELOCITY		
Q_{50} =	483	CFS	HW_{50} =	786.6	FEET	V_{50} =	2.3	FPS
Q_{100} =	574	CFS	HW_{100} =	787.1	FEET	V_{100} =	2.5	FPS
CONDUIT DESIGN DATA								
pH = 7.5 - 8.0			SERVICE LIFE = 75 YEARS			ABRASIVE SITE = NO		

Table 8-3 Downstream Channel Data

ELEVATIONS			FLOW DEPTH			VELOCITY		
OHWM =	783.5	FEET	Y_{OHWM} =	2.2	FEET	V_{OHWM} =	0.8	FPS
TW_{50} =	786.6	FEET	Y_{50} =	5.4	FEET	V_{50} =	1.8	FPS
TW_{100} =	787.0	FEET	Y_{100} =	5.8	FEET	V_{100} =	2.0	FPS

9 Scour

The ODOT Location and Design Manual, Volume 2 in Section 1008.10 Bridge Foundations, provides the requirements for bridge scour. These requirements are not applicable to this site since the existing structure and proposed extension is a precast concrete box culvert.

Although the outlet velocities do not warrant protection according to the results indicated in the proposed hydraulic analysis results provided in Table 7-1, the maximum outlet velocity at the culvert outlet is 2.0 feet per second. Using the Table provided in Section 1107.3 Bridge RCP, of the ODOT Location and Design Manual, Volume 2, Rock Channel Protection, Type C 2'-0" Thick with Filter Fabric should be provided at the outlet, along the channel bottom and in front of the wingwalls for the limits of the wingwalls in plan view and up to Elevation 788.0, 1 foot above the calculated water surface elevation.

Using the Manual's equation for Shear Stress, the maximum shear stress in the downstream channel is 1.25 psi. The allowable shear for Rock Channel Protection , Type C is 4 psi therefore the channel banks where modified by this protect may be lined with this type of rock channel protection.

10 Conclusion

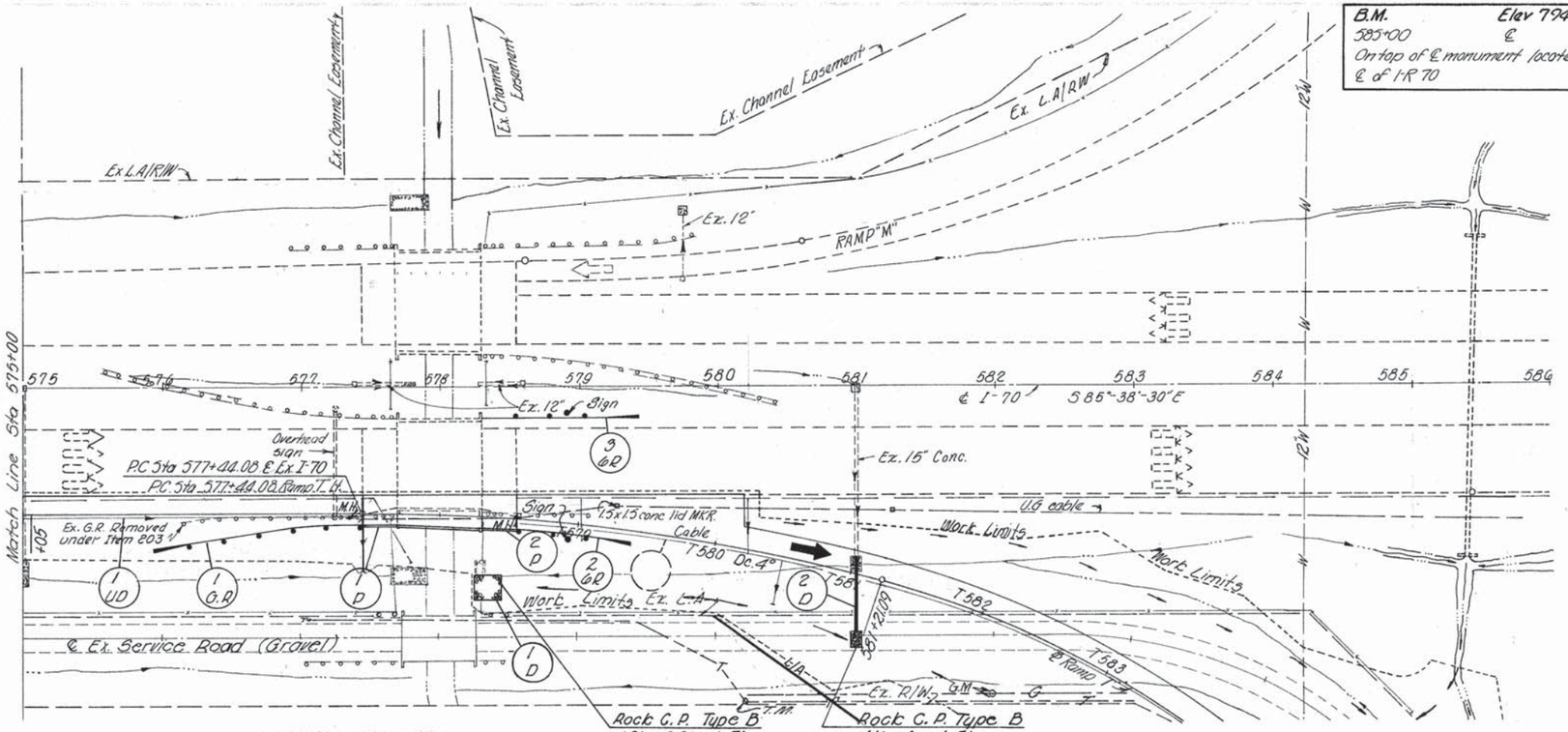
The proposed improvement to the existing culvert and modification to the existing channel:

- Comply with the ODOT Location and Design Manual, Volume 2 design criteria in regards to hydrology, hydraulic and scour analysis for culverts and bridges.
- The proposed stream impact length is less than 200 feet which complies with the USACE 404, Nationwide Permit 14.
- The calculated proposed water surface elevations within the study limits match the existing condition calculated water surface elevations at the study limits.
- The calculated water surface elevations at the inlet and outlet ends for the culvert are lower than exiting conditions. Therefore having no adverse impact on either the upstream or downstream property owners.
- The proposed design will accommodate the future full build ramp alignments without modification to this proposed structure. Future ramp alignment modifications will only require change to the pavement width and the location of the Type D concrete barrier.

11 Recommendation

The proposed design of extending the existing 22 feet by 8 feet precast concrete box, 68 feet southward is recommended for approval to move forward with Stage 2 through Final Design.

Appendix A. Existing Information



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CHK: PCB 3-74

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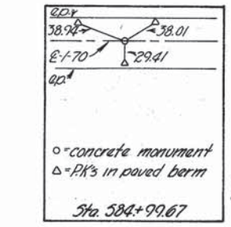
FRANKLIN COUNTY
BRICE ROAD INTERCHANGE
FRA-70-23.92

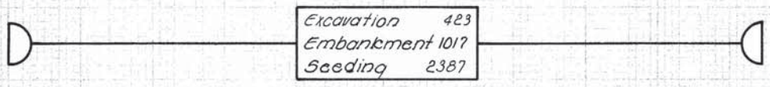


CALCULATIONS

1-D G01 18'x 20'x 2 ÷ 27 = 26.6 C.Y.
2-D G01 11'x 4'x 2' ÷ 27 = 3.3 C.Y.

NOTES
1. For Ramp "T" Plan, See sheet no. 48.
2. For Ramp "T" Profile, See sheet no. 49.
3. Pavement details, Ramp "T" Exist, See sheet no. 57.
4. For Underdrain Details See Sheet No. 5.

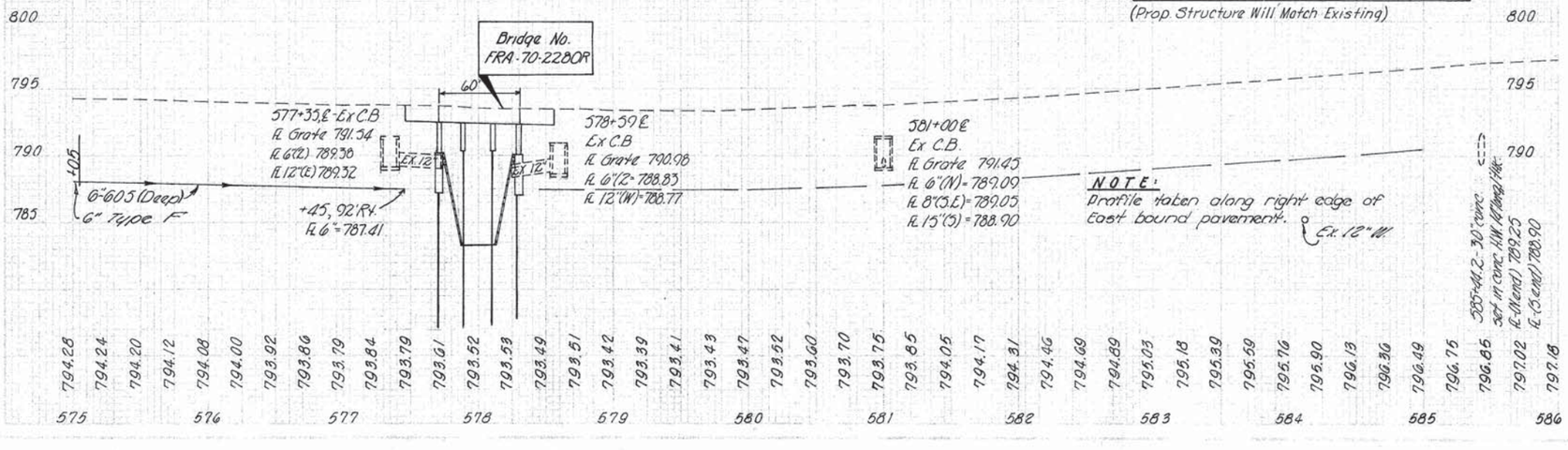
COLUMBUS LAND INVESTMENT COMPANY



EXISTING STRUCTURES

TYPE: Continuous reinf. conc. slab bridges with capped pile substructures
SPANS: 18.0'-22.5'-18.0'
ROADWAY: Lt-Variable
Rt - 64'-0" Flr parapet railings
LOADING: CE 2000 (57)
WEARING SURFACE: 1" monolithic concrete
SKEW: None
APPROACH SLAB: AS-1-54 (25'-0" long)
ALIGNMENT: Tangent
SUPERELEVATION: None
AVERAGE DAILY TRAFFIC: DDHV=4250 (1985)

(Prop. Structure Will Match Existing)



NOTE:
Profile taken along right edge of East bound pavement.

* 706.01 or 706.02

Ref.	Station to Station	Side	202 Portion of Str. Remv'd C.Y.	G01 Rock C.P. Type B C.Y.	G02 Conc. Masonry C.Y.	G03 *15" Type B L.F.	G03 6" Type F L.F.	G03 6" Type B* L.F.	G05 6" Deep U.D. L.F.	Bends & Branches For Details See Sheet No.
1-D	578+24 to 578+44	Rt.		27						
2-D	581+00	℄-Rt.	0.3	4	0.3	50				
1-UD	575+00 to 577+45	Rt.					15	12	27.2	2 5
Total				31	0.3	50	15	12	27.2	

Ref.	Station to Station	Side	G06 Guard Rail Type 5 L.F.	G06 Anchor Ass'y Type 4 Ea.	G06 Br. Term Ass'y Type A Ea.	G09 Curb Type G L.F.
1-GR	575+95 to 577+70	Rt	125	1	1	
2-GR	578+36 to 579+42.5		87.5	1	1	
3-GR	578+30 to 579+42.5		87.5	1	1	
1-P	577+44 to 577+70	Rt				26
2-P	578+30 to 578+56	Rt				26
Total			300	3	3	52

Note: Centerline Survey Plat FRA-70-21.29
Recorded in Plat Book 35, Page 52 Franklin
County Recorders' Office

TRURO TWP. FRANKLIN CO.

SEC. 23, ½ SEC. 40, T-12, R-21

REFUGEE TRACT

0 25 50 100 150

Scale in Feet

SUMMARY OF ADDITIONAL RIGHT-OF-WAY REQUIRED

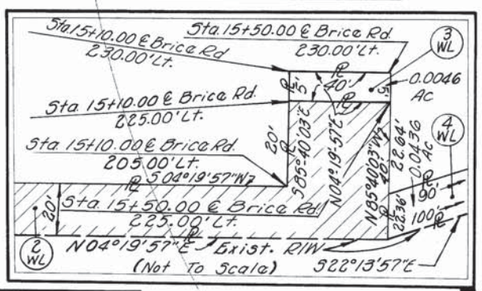
PARCEL NO.	OWNER	TYPE FUND	RECORDED BOOK	RECORDED PAGE	TOTAL TAKE	P.R.O. IN TAKE	NET TAKE	DEED AREA	NET RESIDUE
1-WL	Columbus Land Investment Co.		3003	442-444	3.4264 Ac.	1.9733 Ac.	1.4531 Ac.	94.1914 Ac.	92.5452 Ac.
2-WL	Columbus Land Investment Co. ⅓		3003	442-444	0.1449 Ac.	——	0.1449 Ac.	0.455 Ac.	.3101 Ac.
	Mobil Oil Corporation ⅓		3041	346, 347					
	Marathon Oil Company ⅓		3033	429-431					
3-WL	Columbus Land Investment ⅔		3003	442-444	0.0046 Ac.	——	0.0046 Ac.	0.0046 Ac.	
	Marathon Oil Company ⅓		3033	429-431					
4-WL	Columbus Land Investment ⅔		3003	442-444	0.0436 Ac.	——	0.0436 Ac.	0.0436 Ac.	
	Marathon Oil Company ⅓		3033	429-431					

Denotes Proposed Pavement

ITEM 607		
RIGHT-OF-WAY	FENCE	TOTALS
CHAIN LINK	= 1,222	LIN. FT.

601 RCP TY. B = 55 cu.yds.

Denotes Existing Centerline Reference Monument



CURVE DATA RAMP "T"

CURVE 1	CURVE 2	CURVE 3
P.I. Sta. 590+39.43	P.I. Sta. 585+99.29	P.I. Sta. 579+33.68
Δ = 6°00'00"	Δ = 67°27'42"	Δ = 15°04'49"
Dc = 4°00'00"	Dc = 8°00'00"	Dc = 4°00'00"
R = 1432.39'	R = 716.20'	R = 1432.39'
T = 75.07'	T = 478.20'	T = 189.60'
L = 150.00'	L = 843.27'	L = 377.01'
E = 1.97'	E = 144.97'	E = 12.49'

NOTE: Crosshatched Area Indicates Ownership Boundary of Parcel No. 2 Only

1 COLUMBUS LAND INVESTMENT COMPANY

1 WL Cont-1.4531 Acres
P.R.O.-1.9733 Acres
Total-3.4264 Acres

Sta 584+00.00 & I.R 70
450.00' Rt.

Sta 8+50.00 & Brice Rd
119.00' Lt.

Sta. 12+50.00 & Brice Rd
185.00' Lt.

Sta 12+98.78 & Brice Rd
205.00' Lt.

Mobil Oil Co. Sign

Tele. Marker

Field Drive

Ex. 15" Log

R/W

Work Limits

O.B.T.

Gas Line

I.A.P.A.

Type C.L.

Existing Brice Road "A"

Existing L.A.

N 17°57'42" W
324.24
I.A-R/W
211.52'
211.22'
N 67°46'03" E
200.00'
0.1449 Ac.
N 22°13'57" W
R 90.00'
R 100.00'
C.P.A.
N 05°02'13" W
40541"
N 04°19'57" E
S 22°13'57" E
Curve 2
687
S 40°39'29" E
Lighting Control Center
Guy
Ex. 30"
Sta. 16+39.44 & Brice Rd.
229.72' Lt.
Sta. 16+72.06 & Brice Rd
119.00' Lt.
Sta 15+50.00 & Brice Rd, 207.36' Lt.
Sta 15+50.00 & Brice Rd
185.00' Lt
Sta 16+30.30 & Brice Rd
247.61' Lt.
N 04°19'57" E
℄ Monument 16+50 ℄ Brice Rd.
R.P.C.C. ℄ Ramp "T" Sta. 589+64.36
R.P.C.C. ℄ Ramp T Sta. 581+21.09
R.P.T. ℄ Ramp "T" Sta. 591+14.36 = ℄ Brice Rd. Sta. 11+12.51, 56.00' Lt.
℄ Monument @ Sta. 3+99.93
Curve 1
℄ Ramp "T"
PROPOSED RAMP "T"
Sign
Exist. Conc. Median
SEC. 23 - ½ SEC. 40
SEC. 24 - ½ SEC. 41
℄ Brice Rd.

℄ Ramp "T" Sta. 577+44.08 = ℄ I-70 Sta. 577+44.08, 90.00' Rt.
Existing Channel Easement
Sta 580+00.00 & I.R 70
164.00' Rt.
Existing R/W
Existing L.A.
Work Limits
Curve 3
℄ Ramp "T"
Cable Marker
Existing ℄ Reference Monument @ Sta 570+00.00 & I.R 70
80' Type 1 Stream Crossing
Gas Line
Type 1 Stream
Sta 583+00.00 & I.R 70
130.00' Rt.
Exist. C.L.
Underground Cable
Sta 584+25.00 & I.R 70
164.00' Rt.
Survey I.R 70 (1964)
Sta. 587+07.80 = Sta. 19+99.86 & Brice Rd.
Ramp "M"
Exist. C.L. fence
Ex. 12"

FHWA REGION 5 | STATE OHIO | PROJECT U-70-3.35/1.6

113 / 113

2 / 2

FRANKLIN COUNTY
FRA - 70 - 23.92
LIMITED ACCESS

TROY ENTERPRISES INC.

REV	DATE	DESCRIPTION
	3-14-74	Completed

TYPE I UNO

RIGHT-OF-WAY BRICE ROAD INTERCHANGE

PROPERTY MAP

TRURO TWP. FRANKLIN CO.
SECTION 23,24,25,26
½ SECTION 40 & 41
REFUGEE TRACT

0 100 200 400 600
SCALE IN FEET

FHWA REGION	STATE	PROJECT	
5	OHIO	UI-70-3(55)116	

112
113
1
2

FRANKLIN COUNTY
FRA-70-23.92

BEGIN PROJECT	END PROJECT
FRA-70-23.92	FRA-70-23.92
Sta. 587+07.80	Sta. 587+07.80
S.L.M. 23.92	S.L.M. 23.92

CITY OF REYNOLDSBURG

CITY OF COLUMBUS CORP.

CITY OF REYNOLDSBURG CORP.

Ex. LA-RIW

RELOC. RAMP "M"

565 570 575 580 585 590 595 600 605 610

N 85° 38' 30" W

℄ I-70

PROP. RAMP "T"

℄ Ex. LIA

℄ Ex. RIW

Ex. Service Rd "A" (To Be Vacated)

Prop. LA-RIW

Ex. Channel Easement

3 WL

4 WL

1 WL

2 WL

Columbus Land Inv. Company 2/3 & Marathon Oil Company 1/3

RAMP "P"

N 04° 19' 58" E 15

Railroad Saving & Loan Company

J.C. PENNY PROPERTIES INC.

PARK CRESCENT

WESTERN LAND INVESTMENT CO.

Columbus Land Investment Company

Ex. RIW

SCARBOROUGH BLVD.

H. Robert Gimbel

Columbus Land Inv. Company 1/3, Marathon Oil Company 1/3, & Mobile Oil Company 1/3

Ex. LIA

½ Sec. 41 ½ Sec. 40

Ex. LA-RIW

CITY OF COLUMBUS

TRURO TOWNSHIP

ALSHIRE ROAD

Mobile Oil Company

Marathon Oil Company

Sec. 83 Sec. 84

TUSSING ROAD

Section 23
Section 26
Section 24
Section 25

Ex. Brice Rd

TRURO TOWNSHIP

UTILITIES:

Ohio Bell Telephone Company
111 N. Fourth St.
Columbus, Ohio 43216

Columbus & Southern Ohio Electric Company
215 N. Front St.
Columbus, Ohio 43215

Columbia Gas of Ohio, Inc.
99 N. Front St.
Columbus, Ohio 43215

Water Division, City of Columbus
90 W. Broad St.
Columbus, Ohio 43215

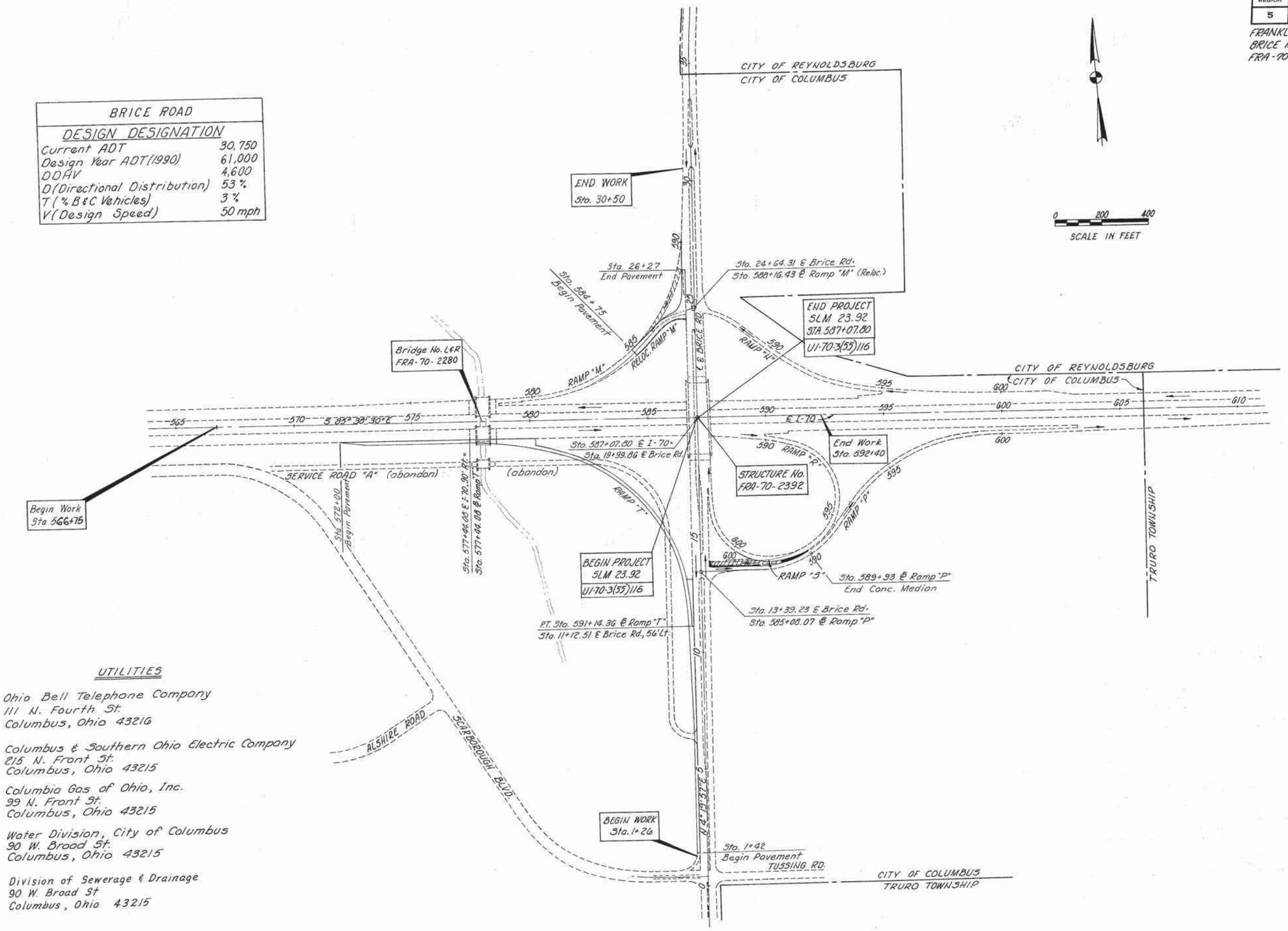
PROPERTY MAP ~ BRICE ROAD INTERCHANGE

FHWA REGION	STATE	PROJECT	
5	OHIO	UI-70-3(55)116	

2
113

FRANKLIN COUNTY
BRICE ROAD INTERCHANGE
FRA-70-23.92

BRICE ROAD	
DESIGN DESIGNATION	
Current ADT	30,750
Design Year ADT(1990)	61,000
DDHV	4,600
D(Directional Distribution)	53 %
T(% B&C Vehicles)	3 %
V(Design Speed)	50 mph



UTILITIES

Ohio Bell Telephone Company
111 N. Fourth St.
Columbus, Ohio 43216

Columbus & Southern Ohio Electric Company
215 N. Front St.
Columbus, Ohio 43215

Columbia Gas of Ohio, Inc.
99 N. Front St.
Columbus, Ohio 43215

Water Division, City of Columbus
90 W. Broad St.
Columbus, Ohio 43215

Division of Sewerage & Drainage
90 W. Broad St
Columbus, Ohio 43215

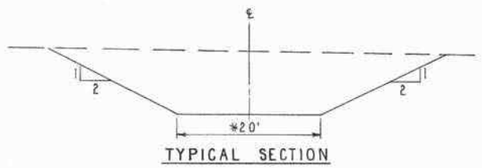
SHEET NO.	NAME			159
2	GRID			255

FRANKLIN COUNTY
FRA.-70-21.29

CURVE DATA
P.I. STA. 13+26.19
Δ = 67°00'
R = 100.00'
T = 66.19'
L = 116.94'

CURVE DATA
P.I. STA. 17+37.41
Δ = 71°00'
R = 100.00'
T = 71.33'
L = 123.92'

CURVE DATA
P.I. STA. 23+07
Δ = 31°30'
Dc = 22°55'
R = 250.00'
T = 70.51'
L = 137.46'



TYPICAL SECTION

NOTE:
* TRANSITION BOTTOM WIDTH 5' TO 20' STATION 12+55 TO STATION 13+77 AND 20' TO 5' STATION 22+36 TO STATION 24+00

TRANSITION BOTTOM WIDTH 20' TO 24' STATION 17+00 TO STATION 17+50 AND 24' TO 20' STATION 21+50 TO STATION 22+00.

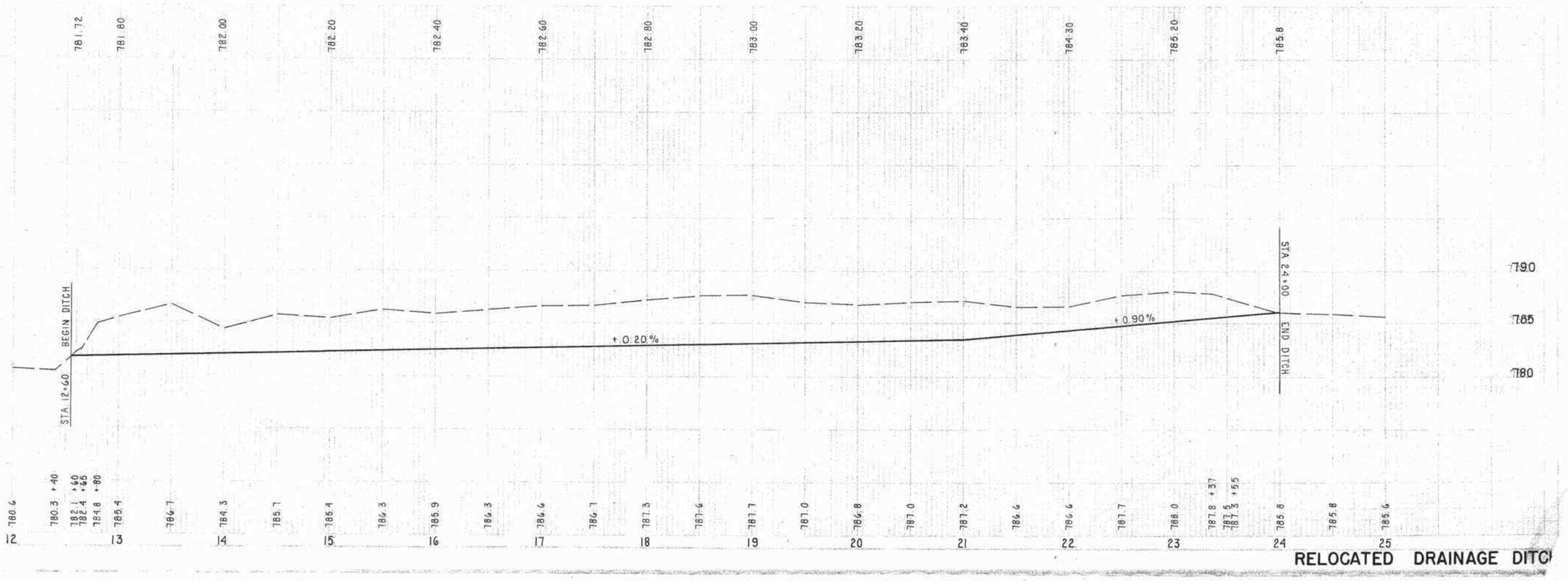
LIMITS OF DUMPED ROCK CHANNEL PROTECTION
STA. 12+60 TO STA. 13+77
FOR ESTIMATED QUANTITIES, SEE SHEET NO. 144
L= 117' D= 2.5' WIDTH AS SHOWN

LIMITS OF DUMPED ROCK CHANNEL PROTECTION
STA. 16+66 TO STA. 17+90
FOR ESTIMATED QUANTITIES, SEE SHEET NO. 144

STA. 18+20 ℄ PROP. DITCH =
STA. 18+00 SERVICE RD. "A"

STA. 578+00 I.R.-70 =
STA. 20+00 ℄ DITCH

P.C. STA. 12+60
100' R
P.T. STA. 13+76.94
P.C. STA. 16+66.08
100' R
P.T. STA. 17+90.00
P.C. STA. 22+36.49
250' R
P.T. STA. 23+73.94
WORK LIMITS
WORK LIMITS
℄ SURVEY SERVICE ROAD "A"
℄ SURVEY LINE -70-
12" FIELD TILE
IRON PIN
S 85° 38' 30" E
N 04° 21' 30" E
S 85° 38' 30" E
577
578
579
580



RELOCATED DRAINAGE DITCH

FRANKLIN COUNTY
FRA—70—21.29

100 80 60 40 20 0 20 40 60 80 100

38
40G
35
90
35 STA. 13+77 AHEAD
27 STA. 13+77 BACK
227
26
80

782.20
16+00
785.4

782.0
14+00
784.3

END DUMPED ROCK CHANNEL PROTECTION
STA. 13+77

781.80
13+00
785.4

780 83 0
261 0
780 58 0
228 0
780 65 0
131 0

10 STA. 12+60 AHEAD
15 STA. 12+60 BACK
5
0 STA. 12+55

781.72
12+60
782.1

BEGIN DUMPED ROCK CHANNEL PROTECTION
STA. 12+60

BEGIN DITCH
STATION 12+55
'0' EARTHWORK STA. 12+55

12+40
784.0

12+00
784.5

780 6 0
11 0
0 0
780
780

100 80 60 40 20 0 20 40 60 80 100

RELOCATED DRAINAGE DITCH STA. 12+00 TO STA. 15+00

FRANKLIN COUNTY
FRA-70-21.29

100 80 60 40 20 0 20 40 60 80 100

41
45G
41
4G1
42
478
44
49
44 STA. 17+90 AHEAD
32 STA. 17+90 BACK
320
32
121
32 STA. 16+66 AHEAD
39 STA. 16+66 BACK
286
39
427
38 STA. 15+00

783.40
21+00
787.2

783.20
20+00
786.8

783.00
19+00
787.1

782.80
18+00
787.3

END DUMPED ROCK CHANNEL PROTECTION STA. 17+90

782.60
17+00
786.6

BEGIN DUMPED ROCK CHANNEL PROTECTION STA. 16+66

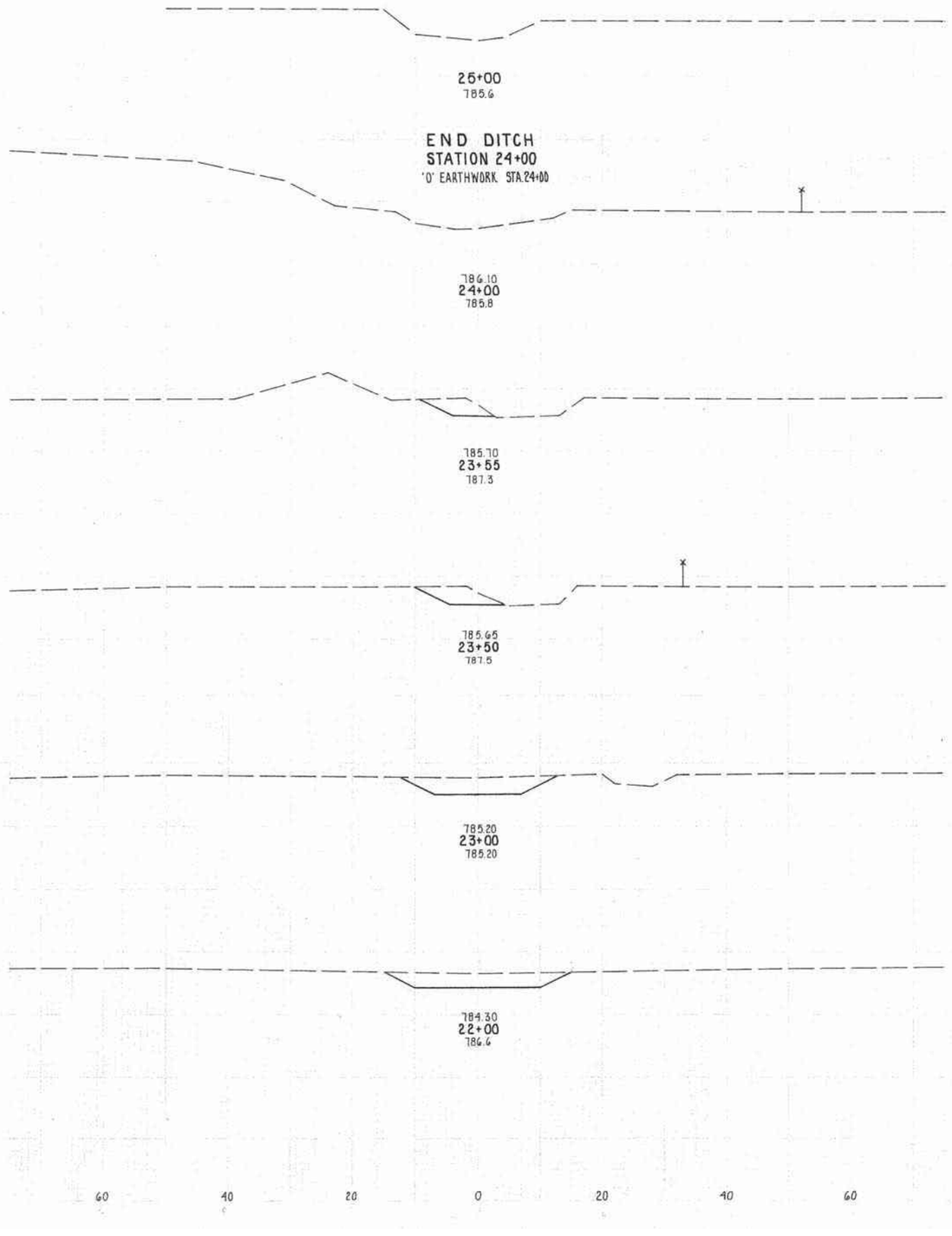
782.40
16+00
785.9

780	104	0	
			369 0
780	95	0	
			420 0
780	132	0	
			500 0
780	138	0	
			441 0
780	100	0	
			348 0
780	88	0	
			317 0
STA. 15+00	83	0	

RELOCATED DRAINAGE DITCH STA.16+00 TO STA.21+00

FRANKLIN COUNTY
FRA-70-21.29

100 80 60 40 20 0 20 40 60 80 100



0 STA. 24+00
42
17
10
19
139
372
36
427
41 STA. 21+00

780
780 0 0
33 0
18 0
780
78 0
24 0
780
144 0
54 0
780
284 0
56 0
780
296 0
STA. 21+00 104 0

RELOCATED DRAINAGE DITCH STA.22+00 TO STA.25+00

FED. RD. DIVISION	STATE	PROJECT	
2	OHIO		

246 / 255

12 / 21

FRANKLIN COUNTY
FRA-70-21.29
LIMITED ACCESS

TRURO TWP., FRANKLIN CO.
SEC. 23, ½ SEC. 40, T-12, R-21
REFUGEE TRACT

RAMP "M" CURVE DATA
P.I. STA 58G+27.93
Δ = 86° 03' 30" LT
Dc = 8° 0'
Rc = 716.20'
Ls = 200.00'
Θs = 8° 00'
P = 2.93'
K = 99.93'
Xc = 199.61'
Yc = 9.30'
Tg = 768.32'
T = 810.89'
Δc = 78° 03' 30"
Lc = 975.13'

THE COLUMBUS TUBERCULOSIS SOCIETY
225 WL CONT. 3.61 AC.
P.R.O. 0.62 AC.
225 X CONT. 1.78 AC.
RES. 15.65 AC.

221 X CONT. 0.40 AC.
WALNUT HILL, INC.

VIOLA M. RAWN, NAOMI R. GREENFIELD, MABLE M. MOTTS, HAROLD P. RAWN, AND W. PERRY RAWN

CONT. 1.19 AC. 224 Y-1

COLUMBUS CORP. LINE
S 85° 36' 40" E
N 85° 36' 30" W 908.80'
N 85° 36' 30" W 607.80'

CONSTR. LIMITS
PROP. L.A.
PROP. R/W
R/W
L.A.
PVM'T
WOODS
DEEP DITCH
L.A. FENCE LINE
BASE LINE RAMP "M"
TYPE 2 CROSSING
IRON PIN
20" WALNUT
16" WALNUT
(TILE TO BE ABANDONED)
EXISTING 12" TILE
℄ SURVEY I.R. 70 (1964)
℄ SURVEY SERVICE RD. 'A'
℄ CHANNEL

P.I. STA. 23+07.00
R = 250.00'
Δ = 31° 30'

P.I. STA. 17+37.41
R = 100'
Δ = 71° 00'

P.I. STA. 13+26.19
R = 100'
Δ = 61° 00'

P.C. STA. 82+92.49

577+30.00 400.00'
577+99.00 400.00'
577+30.00 149.00'
577+99.00 149.00'
577+65.00 147.00' C.P.A.
577+00.00 147.00' P.P.A.
578+35.00 125.00' E.P.A.
578+40.00 180.00'
580+00.00 180.00'
581+00.00 145.00'
581+01.00 147.00' P.P.A.
582+00.00 300.00'
582+50.00 300.00'
582+50.00 210.00'
583+00.00 230.00'
583+50.00 300.00'
584+26.00 162.00' C.P.A.
584+25.00 164.00'
577+10.00 162.00' C.P.A.
578+20.00 162.00' C.P.A.
572+00.00 162.00' P.P.A.
577+50.00 230.00'
577+50.00 300.00'
579+00.00 230.00'
579+00.00 260.00'
581+00.00 420.00'
581+90.00 510.00'
582+50.00 510.00'
17+00.00 BRICE 260.00'

N 04° 21' 30" E 251.00'
S 04° 21' 30" W 251.00'
S 06° 11' 50" E 223.79'
N 68° 44' 00" E 277.31'
N 53° 03' 20" E 303.24'
N 43° 43' 30" E
N 68° 31' 50" E
S 66° 43' 00" E 370.00'
N 66° 43' 00" W 370.00'
N 40° 38' 30" W 127.28'
N 04° 21' 30" W 130.00'
N 85° 38' 30" W 60.00'
N 60° 20' 35" W 163.42'
S 04° 21' 30" W 30.00'
10.00' N 04° 21' 30" E
231.65'
L.A. 277.74'
L.A. 301.00'
160.30' S 85° 36' 30" E
69.00' S 85° 36' 30" E
69.00' S 85° 36' 30" E
251.00'
223.79'
2321.18'
2446.21'

STA. 570+00
STA. 585+00
STA. 86+00

570 571 572 573 574 575 576 577 578 579 580 581 582 583 584 585

SEE SHEET 11
SEE SHEET 13
SEE SHEET 14
BEGIN SHEET
END SHEET
MATCH LINE FOR CONTINUATION SEE SHEET 13 STA. 585+00
MATCH LINE FOR CONTINUATION SEE SHEET 14 STA. 86+00

NOTE: CONNECT FENCE TO ABUTMENTS AS PER STD. DRWG. F-3

ITEM 607 FENCE CHAIN LINK STA. 570+00 TO STA. 585+00 BOTH SIDES = 3,220 LIN.FT.

TYPE FUNDS: I

COMPLETION DATE: 6-30-65 SCALE 1" = 50'			
NO.	REVISION	BY	DATE

RIGHT OF WAY STA. 570+00 TO STA. 585+00

FED. RD. DIVISION	STATE	PROJECT	
2	OHIO		

219
255

FRANKLIN COUNTY
FRA —70 —21.29

575 576 577 ℄ PROPOSED I.R. 70 578 579 S-85° 38' 30" E 580

790 788 786

EASTBOUND LANES

8:1 7:1 6:1 2:1 24:1 4:1 5:1 3:1

19+00 18+00 17+00

FLOW

24'-0"

75 76 ℄ SURVEY SERVICE ROAD 'A' 77 78 79 S-85° 38' 30" E 80

(TYP.) 3'-0" BENCH

GUARD RAIL POST STA. 77+68.60

GUARD RAIL POST STA. 78+31.10

BEGIN APPROACH SLAB STA. 78+24.75

END APPROACH SLAB STA. 77+73.25

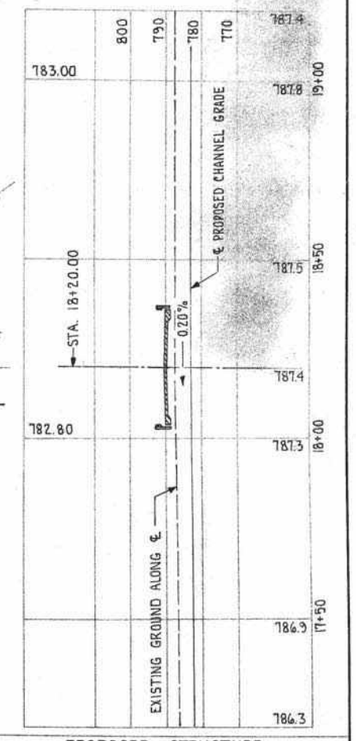
STA. 78+00.00 SERVICE RD. 'A' = STA. 18+20.00 ℄ CHANNEL

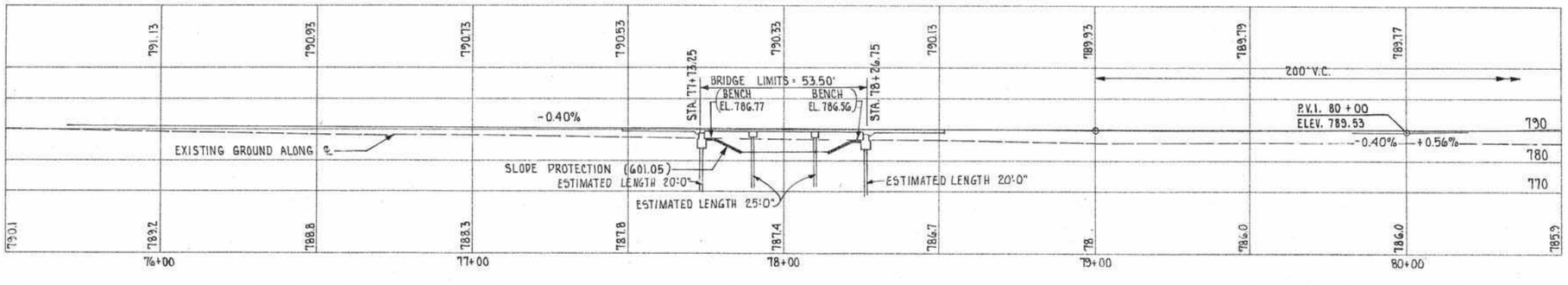
SLOPE PROTECTION (601.05) WITHIN THESE LIMITS AT EACH END OF BRIDGE

100' R.

DRAINAGE AREA = 1.04 SQ. MILES

792 790 788 786





PROPOSED STRUCTURE

TYPE: CONTINUOUS REINFORCED CONCRETE SLAB WITH CAPPED PILE SUBSTRUCTURE
SPAN: 16.0'- 20.0'- 16.0'
ROADWAY: 32'-0" F/F GUARD RAIL
LOAD FREQUENCY RATING: CF 130 (57)
SKEW: NONE
ALIGNMENT: TANGENT
WEARING SURFACE: 1" MONOLITHIC CONCRETE
APPROACH SLAB: 25'-0" LONG AS-1-54

DODSON, KINNEY & LINDBLOM
CONSULTING ENGINEERS
COLUMBUS, OHIO

SITE PLAN

BRIDGE NO. FRA-70-2280A
PROPOSED SERVICE RD. "A" OVER DRAINAGE DITCH

SEC. FRA-70-21.29
SCALE: 1" = 20'
PROPOSED SERVICE RD. "A" STA. 78+00

PRESENT TOPOGRAPHY		PROPOSED WORK			
SURVEYED:	DRAWN:	DESIGNED:	DRAWN:	CHECKED:	REVISED:
R.D.M.	R.D.M	W.G.	J.E.E.	W.G.	

FED. RD. DIVISION	STATE	PROJECT	
2	OHIO		

212
259

FRANKLIN COUNTY
FRA – 70 – 21.29

WOODS

RAMP 'M'

WEST BOUND LANES

EAST BOUND LANES

73'-11 3/16" F/F PARAPETS AT ℄ OF BEARING

74'-4 7/16" F/F PARAPETS AT ℄ OF BEARING

END APPROACH SLAB
STA. 577 + 70.00

BEGIN APPROACH SLAB
STA. 578 + 30.00

STA. 578+00 ℄ SURVEY PROP. IR 70
= STA. 20+00 ℄ PROP. CHANNEL

T.S. STA. 578 + 59.61

S.C. STA. 580 + 59.61

580 S-85°38'30"-E

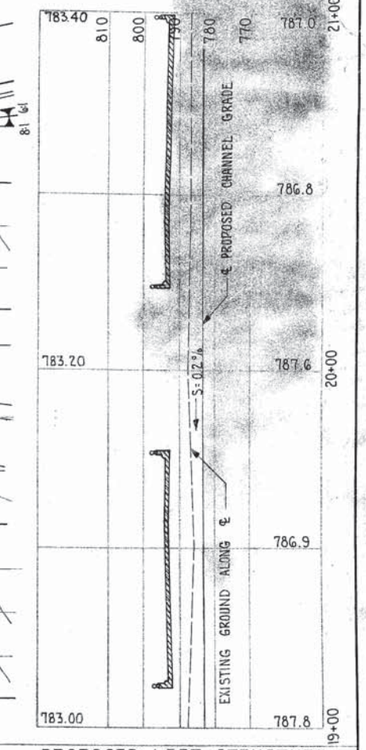
3'-0" (TYP. BENCH)

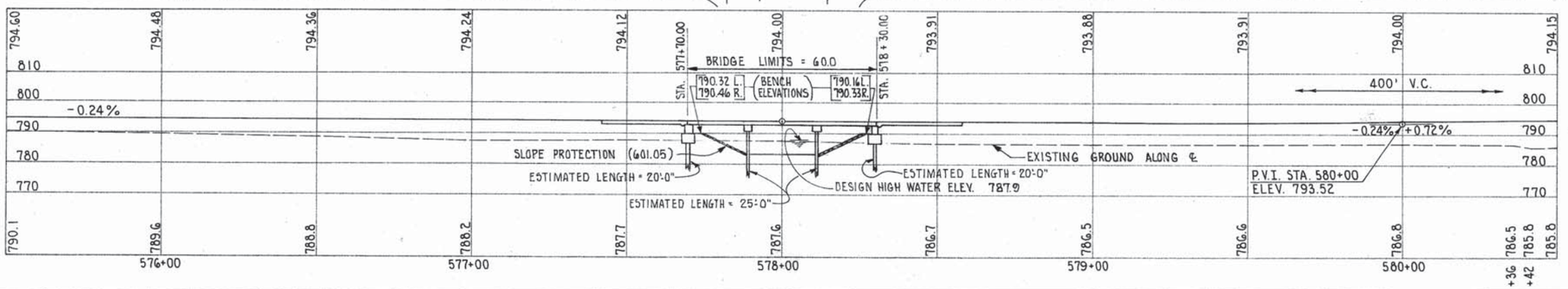
SLOPE PROTECTION (601.05) WITHIN THESE LIMITS AT EACH END OF BRIDGE

DRAINAGE AREA = 1.04 SQ. MILES

FLOW

24'-0"





PROPOSED LEFT STRUCTURE

TYPE: CONTINUOUS REINFORCED CONCRETE SLAB WITH CAPPED PILE SUBSTRUCTURE
SPAN: 18.0' – 22.5' – 18.0'
ROADWAY: VARIABLE
LOAD FREQUENCY RATING: CF 2000 (57) "ADEQUATE FOR A55HO ALTERNATE LOADING"
SKEW: NONE
ALIGNMENT: TANGENT
WEARING SURFACE: 1" MONOLITHIC CONCRETE
APPROACH SLAB: 25'-0" LONG A5 1-54

PROPOSED RIGHT STRUCTURE

TYPE: CONTINUOUS REINFORCED CONCRETE SLAB WITH CAPPED PILE SUBSTRUCTURE
SPAN: 18'-0" – 22.5' – 18.0'
ROADWAY: 64'-0" E/F PARAPET RAILINGS
LOAD FREQUENCY RATING: CF 2000 (57) "ADEQUATE FOR A55HO ALTERNATE LOADING"
SKEW: NONE
ALIGNMENT: TANGENT
WEARING SURFACE: 1" MONOLITHIC CONCRETE
APPROACH SLAB: 25'-0" LONG A5-1-54

1985 D.D.H.V. = 4,250

DODSON, KINNEY & LINDBLOM
CONSULTING ENGINEERS
COLUMBUS, OHIO

SITE PLAN

BRIDGE NO. FRA-70-2280 L&R
PROPOSED I.R. 70 OVER
DRAINAGE DITCH

SEC. FRA-70-21.29
SCALE 1" = 20'

PROPOSED I.R. 70
STA. 578+00

PRESENT TOPOGRAPHY		PROPOSED WORK			
SURVEYED:	DRAWN:	DESIGNED:	DRAWN:	CHECKED:	REVISED:
R.D.M.	R.D.M.	W.G.	J.E.E.	W.G.	

District: 06 | County: FRANKLIN | (101) Location: WEST OF BRICE ROAD | (102) Facility Carried: I-70
(2) FIPS Code: FRA-M-18000-COLUMBUS | (103) Route On Bridge: STATE (ODOT) (TOLL FR | (104) Route Under Bridge: NON HIGHWAY TRAFFIC ON BRIDGE
(9) Direction of Traffic: 2-WAY TRAFFIC | (10) Temporary: | (11) Truck Network: 1 | (12) Parallel: N
(100) Type Serv: (On): HIGHWAY | (Under): WATERWAY

Inventory Route Data

(3) Route On/Under: ROUTE CARRIED "ON" THE STR | Hwy Sys: INTERSTATE HIGHWAY
Route No: 00070 | Dir: NOT APPLICABLE | Des: MAINLINE | Pref: N
(4) Feature Intersected: OVER DRAINAGE DITCH
(5) County: FRA | Mileage: 23740 | Special Desig: N
(6)Avg. Daily Traffic(ADT): 120,649 | (7) ADT Year: 2010
(8) Truck Traf: 11,515 | (14) NHS: NHS BRIDGE - 1 | (15) Corridor: Y
(16) Functional Class: URBAN - PRINCIPAL ARTERIAL - INTER | (19) Strahnt: STRAHNET INTERSTATE

Intersected Route Data

(22) Route On/Under: | Hwy Sys:
Route No: | Dir: | Des: | Pref:
(23) Feature Intersected:
(24) County: | Mileage: 0000 | Special Desig:
(25)Avg. Daily Traffic(ADT): | (26) ADT Year:
(27) Truck Traf: | (28) NHS: - | (29) Corridor: Y
(30) Functional Class: | (36) Strahnt:

Clearance On the Bridge

(154) Min. Hriz on Bridge: NC: 0.0 | Card: 50.0 Ft
(155) Prac Max Vert On Brg: 9999.9 Ft
(67) Min Vrt Clr On Brg: NC: 0.0 | Card: 9999.9 Ft
(80) Min Latl Clr: NC: 0.0/0.0 Ft | Card: 0.0/0.0 Ft
(81) Vrt Clr Lft: 0.0 Ft

Structure Information

(38) Bypass Length: 05 Miles
(39) Latitude: 39 Deg 55 Min 58.93 Sec | Longitude: 82 Deg 50 Min 02.51 Sec
(40) Toll: ON FREE ROAD, THE STRUCTU
(41) Date Built: 6/20/2003 | (42) Major Rehabilitation:
(43) No. Lanes On: 6 | No. Lanes Under: 0
(44) Horiz Curve: 00D00M | (45) Skew: 0 Deg
(49) App. Rdw Width: 50 Ft | (50) Brg. Rdw Width: 0.0 Ft
(51) Deck Width: 0.0 Ft | Deck Area: 1098 Sq. Ft
(52) Median Type: NONE/NON BARRIER/NO JOINT
(53) Bridge Median: NO MEDIAN
(54) Sidewalks: | (left) 0.0 Ft | (right) 0.0 Ft
(55) Type Curb or Sidewalks:
(Left) Matl: NONE | Type: NONE OR N/A (RR, PEDESTRIAN, ETC.)
(Right) Matl: NONE | Type: NONE OR N/A (RR, PEDESTRIAN, ETC.)
(56) Flared: 0 | (57) Composite: N - NON COMPOSITE
(58) Railing: NONE
(59) Deck Drainage: NONE
(60) Deck Type: NONE
(61) Deck Protection: External: NOT APPLICABLE (ONLY FOR BRIDGES FOR NO
Internal: NOT APPLICABLE (APPLIES ONLY TO BRIDGES
(62) Wearing Surface: NOT APPLICABLE (CULVERT UNDER FILL ETC.)
Thickness: 0.0 in | (119) Date of Wearing Surface: 6/20/2003
Slope Protection: NONE

(63) Main Spans Number: 2 | Type: CONCRETE/CULVERT/FILLED
Approach Spans Number: 0 | Type: NONE/NONE/NONE
Total Spans: 2 | (65) Max Span: 22 Ft | (66) Overall Leng: 22 Ft

(70) Substructure		(71) Foundation and Scour Information	
Abut-Rear	Matl: NONE	Type: NONE	Fnd: NONE (SUCH AS MOST CULVERTS)
Abut-Fwd	Matl: NONE	Type: NONE	Fnd: NONE (SUCH AS MOST CULVERTS)
Pier-Pred	Matl: NONE	Type: NONE	Fnd: NONE (SUCH AS MOST CULVERTS)
Pier-Other	Matl: NONE	Type: NONE	Fnd: NONE (SUCH AS MOST CULVERTS)
Pier-Other	Matl: NONE	Type: NONE	Fnd: NONE (SUCH AS MOST CULVERTS)

No of Piers Predominate: | Other: | Other:
(86) Stream Velocity: 003.6 | (74) Scour: SCOUR WITHIN LIMITS OF FOOTING OR PILES.
(189) Dive: N Freq: 0 | Probe: N Freq: 0 | (75) Chan Prot: OTHER (GRASS, BUSHES, TREES)
(189) Date of last Dive Insp: | (152) Drainage Area: 002 Sq Mi

Clearance Under the Bridge

(156) Min. Horiz Under Clear: NC: 0.0 Ft | Card: 0.0 Ft
(157) Prac Max Vrt Under Clear: 0.0 Ft
(77) Min Vert Under Clear: NC: 0.0 Ft | Card: 0.0 Ft
(78) Min Lat Under Clear: NC: 0.0/0.0 Ft | Card: 0.0/0.0 Ft

Load Rating Information

(48) Design Load: HS20-44 & ALTERNATE MILITARY LOADING
Opr Rat Fact: 1.450 LD:
Inv Rat Fact: 0.870 LD:
(83) Ohio Percent of Legal Load: 150
Year of Rating: 2012
(84) Analysis: LOAD FACTOR (LF) RATING REPORTED BY RF U
(85) Rate Soft: BRASS
Analysis on Bars: NOT ON BARS [DEFAULT]
PE#: 48632 WILLIAM KROUSE

(88-89) Appraisal

(Including calculated Items)
(88) Waterway Adequacy: 9
(89) Approach Alignment: 7
Calc Gen Appraisal: 7
Calc Deck Geometry: N
Calc Underclearance: N

Approach Information

(109) Approach Guardrail: STEEL BEAM
(110) Approach Pavement: BITUMINOUS | (111) Grade: GOOD

Culvert Information

(131) Culvert Type: 4-SIDED BOX (CONCRETE PRECAST), STRUCTUR | (127) Length: 208.0 Ft
(129) Depth of Fill: 3.0 Ft | (130) Headwalls: CONCRETE

General Information

(121) Main Member: NOT APPLICABLE (CULVERTS, TRUSSES, ARCHE | (122) Moment Plate: NO MOMENT PLATES
(169) Expansion Joint: NONE
(124) Bearing Devices: NONE
(126) Navigation: Control-N | Vert Clr: 0.0 Ft | Horiz Clear: 0.0 Ft
(193) Spec Insp: N | Freq: 0 | Date:
(188) Fracture Critical Insp: N | Freq: 24 | Date:
(138) Long Member: NOT APPLICABLE (I.E. CULVERT, BEAM, SLAB | (135) Hinges: NOT APPLICABLE (STRUCTURES WITH NO
(141) Structural Steel Memb: NONE | (139) Framing: NONE OR NOT APPLICABLE
Railing: N
Pay Wt: 0 pounds | Prime Loc: NONE (I.E. | Paint: NONE OR NOT APPLICABLE
Bridge Dedicated Name:

General Information (Continued)

(---) Hist Significance: NOT DETERMINABLE
(69) NBIS: Y
(---) Hist Builder: NONE N/A
Hist Build Year:
(69) Hist Type:
(161) Special Features (see below):
(105) Border Bridge State: Resp: %(106) SFN:

Proposed Improvements

(90) Type Work: -
(90) Length: Ft
(90) Bridge Cost ($1000s):
(90) Roadway Cost ($1000s):
(90) Total Project Cost ($1000s):
(90) Year:
(91) Future ADT (On Bridge): 177348
(92) Year of Future ADT: 2031

Programming Info

PID Number:
PID Status:
PID Date:

Original Plans Information

(142) Fabricator:
(143) Contractor: KOKOSING CONST
(144) Ohio Original Construction Project No: 000400
(---) Microfilm Reel:
(151) Standard Drawing:
Aperture Cards: Orig: N Repair: N Fabr: N
Plan Information Available: 1 PLAN INFORMATION AVAILABLE FOR LOAD RATI

(153) Repair Projects:
1) 000004 / 002

Inspection Summary

(I-8) Deck:	N
(I-32) Superstructure:	N
(I-42) Substructure:	N
(I-50) Culvert:	8
(I-54) Channel:	4
(I-60) Approaches:	8
(I-66) General Appraisal:	8
(I-66) Operational Status:	A
Inspection Date:	7/1/2015
(94) Desig Insp Freq	12 Months

(I-69) Survey Items

Railings:	MEETS ACCEPTABLE STANDARDS
Transitions:	MEETS ACCEPTABLE STANDARDS
Guardrail:	MEETS ACCEPTABLE STANDARDS
Rail Ends:	MEETS ACCEPTABLE STANDARDS
In Depth:	
Fracture Critical:	
Scour Critical	
Critical Findings:	
Insp. Update Date:	7/1/2015

Utilities

(46)	Electric:	U
	Gas:	U
	Sanitary Sewer:	U
	Telephone:	U
	TV Cable:	U
	Water:	U
	Other:	U

Special Features

(161)	Lighting:	N
	Fencing:	N
	Glare-Screen:	N
	Splash-Guard:	N
	Catwalks:	N
	Other-Feat:	U
(184)	Signs-On:	N
	Signs-Under	N
(162)	Fence-Ht	0.0
(163)	Noise Barr	N

SFNs Replacing this retired bridge: 2505673 - 2505703
SFNs That were replaced by this bridge: -
This bridge was retired and copied to:
The bridge was copied from:

INV Field Bridge Marker: FRA - 00070 - 2374 - N
INT Field Bridge Marker: - - 0000 -

(95) Insp: OHIO STATE TRANSPORTATION DEPARTMENT	2nd: NONE	3rd: NONE
(96) Maint: OHIO STATE TRANSPORTATION DEPARTMENT	2nd: NONE	3rd: NONE
(97) Routine: OHIO STATE TRANSPORTATION DEPARTMENT	2nd: NONE	3rd: NONE

PONTIS CoRe elements and Conditions States

Elem No.	CoRe Element Description	Total Quantity	Unit Meas.	Condition State Percents(*)				
				1	2	3	4	5

(*) Percentages should add to 100%

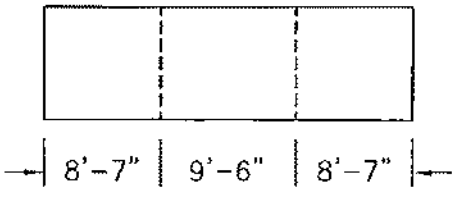
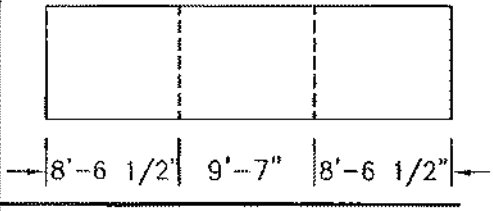
MACK INDUSTRIES, INC.

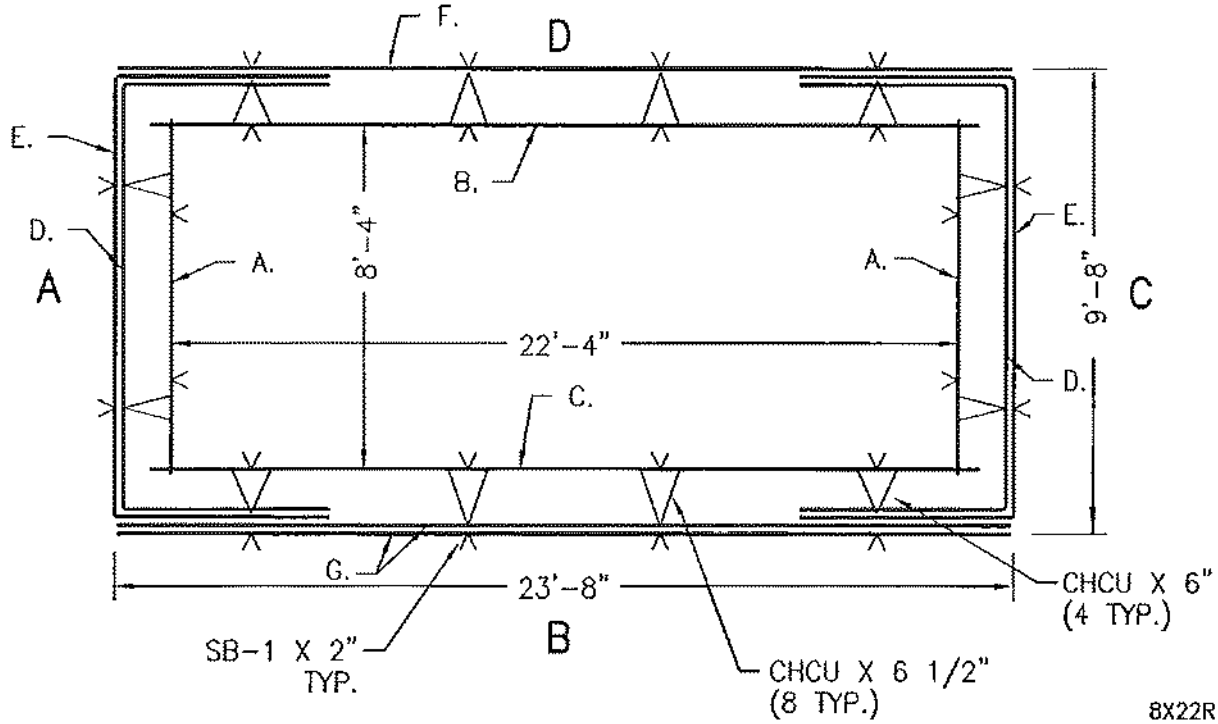
8 X 22 BOX CULVERT ASTM C-850 TABLE 2

JOB: _____ _____ SECTION

JOB NO: _____

CUST: _____ _____ REQ'D.

ITEM	QTY.	SIZE	TYPE	DESCRIPTION
A.	2	8'-6" X	2" X 8" D5/D9.6	FLAT
B.	1	22'-10" X	2" X 4" D15.5/D9.6	FLAT
C.	1	22'-10" X	2" X 8" D15.5/D9.6	FLAT
D.	2	26'-8" X	2" X 8" D11.5/D5	
E.	2	26'-8" X	2" X 8" D11.5/D5	
F.	1	23'-8" X	2" X 4" D5/D9.6	FLAT
G.	2	23'-8" X	2" X 8" D13/D5	FLAT



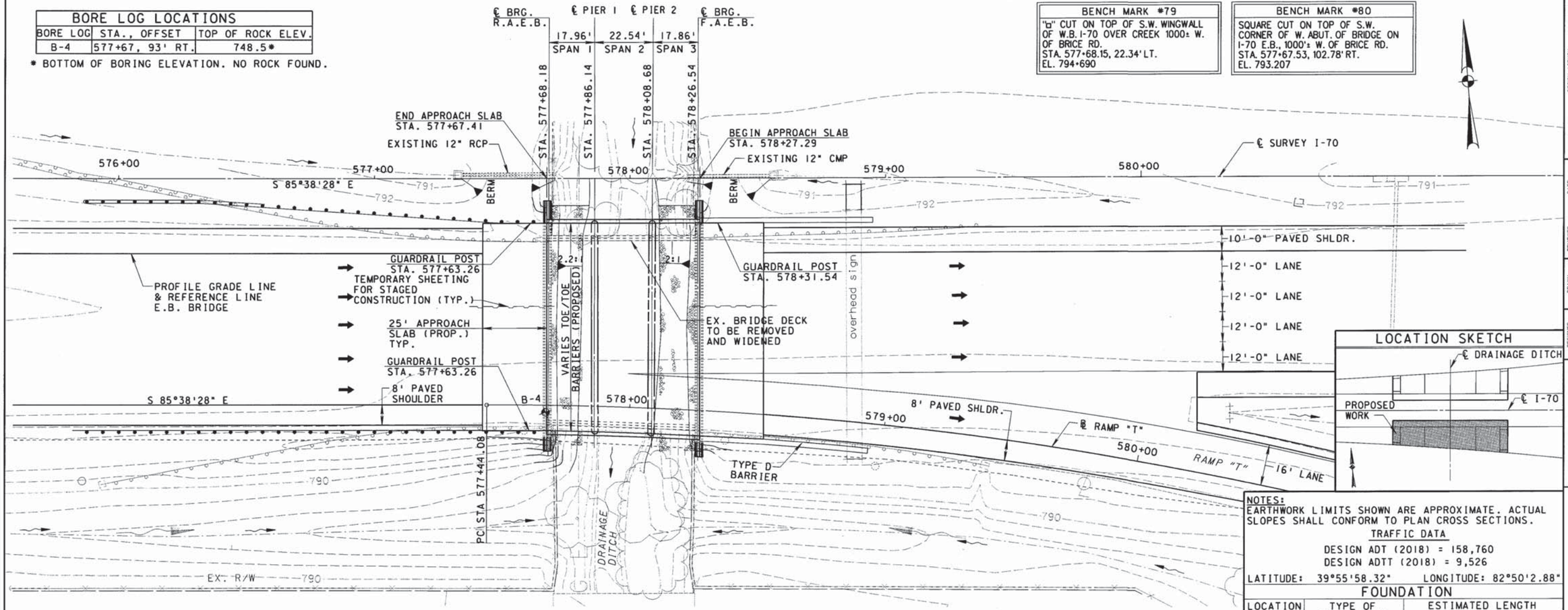
8X22R

BORE LOG LOCATIONS		
BORE LOG	STA., OFFSET	TOP OF ROCK ELEV.
B-4	577+67, 93' RT.	748.5*

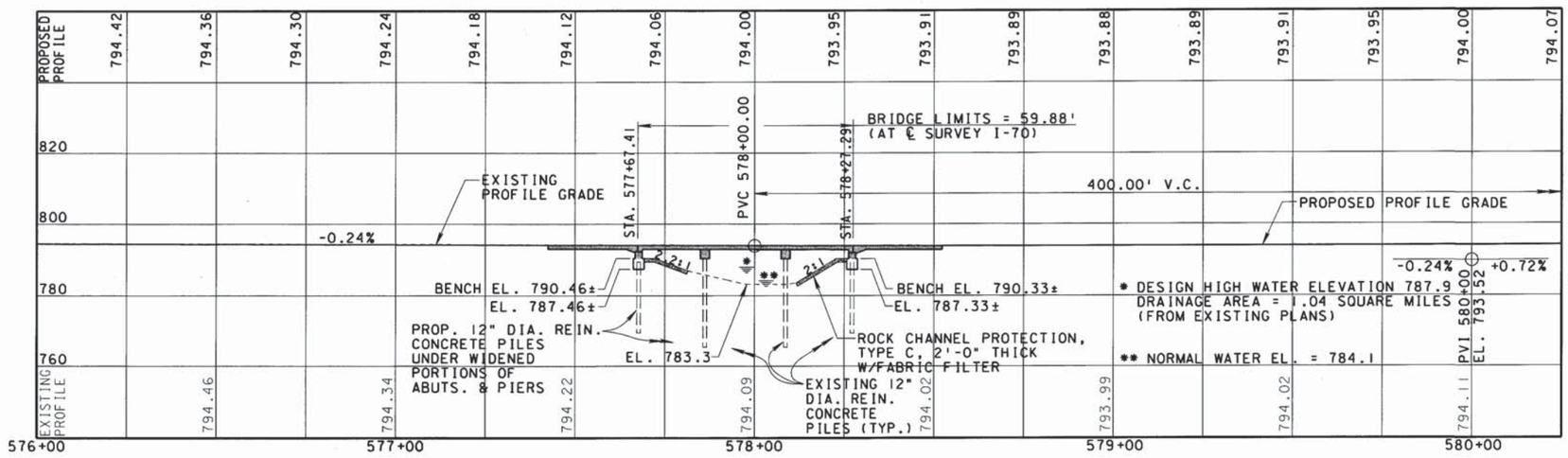
* BOTTOM OF BORING ELEVATION. NO ROCK FOUND.

BENCH MARK #79
"□" CUT ON TOP OF S.W. WINGWALL OF W.B. I-70 OVER CREEK 1000± W. OF BRICE RD. STA. 577+68.15, 22.34' LT. EL. 794.690

BENCH MARK #80
SQUARE CUT ON TOP OF S.W. CORNER OF W. ABUT. OF BRIDGE ON I-70 E.B., 1000'± W. OF BRICE RD. STA. 577+67.53, 102.78' RT. EL. 793.207



PLAN



PROFILE
(ALONG PROFILE GRADE E.B. I-70)

LOCATION SKETCH

NOTES:
EARTHWORK LIMITS SHOWN ARE APPROXIMATE. ACTUAL SLOPES SHALL CONFORM TO PLAN CROSS SECTIONS.

TRAFFIC DATA

DESIGN ADT (2018) = 158,760
DESIGN ADTT (2018) = 9,526

LATITUDE: 39°55'58.32" LONGITUDE: 82°50'2.88"

FOUNDATION

LOCATION	TYPE OF FOUNDATION	ESTIMATED LENGTH OF C.I.P. PILES
REAR ABUT.	12" C.I.P. PILES	20'
PIERS	12" C.I.P. PILES	25'
FWD. ABUT.	12" C.I.P. PILES	20'

EXISTING STRUCTURE

TYPE: CONTINUOUS REINFORCED CONCRETE SLAB WITH CAPPED PILE SUBSTRUCTURE
SPANS: 18'±, 22.5'±, 18'± c/c BEARINGS AT ℄ I-70
ROADWAY WIDTH: VARIES 72.40' TO 74.74' TOE/TOE CURB
SKEW: NONE
LOADING: CF 2000 (57)
DATE: BUILT 1966, REHAB 1979
STRUCTURE FILE NUMBER: 2505703
APPROACH SLABS: AS-I-54, (25' LONG)
WEARING SURFACE: 1" MONOLITHIC CONCRETE, 1¾" DENSE CONCRETE OVERLAY
ALIGNMENT: TANGENT
SUPERELEVATION: NONE

PROPOSED STRUCTURE

PROPOSED WORK: NEW CONTINUOUS REINFORCED CONCRETE SLAB ON WIDENED SUBSTRUCTURE
SPANS: 17.96', 22.54', 17.86' c/c ASSUMED BEARINGS AT ℄ I-70
ROADWAY WIDTH: VARIABLE
SKEW: NONE
WEARING SURFACE: 1" MONOLITHIC CONCRETE
LOADING: HS-20-44 AND ALTERNATE MILITARY
ALIGNMENT: TANGENT
APPROACH SLABS: AS-I-81, 25' LONG
SUPERELEVATION: NONE

DESIGN AGENCY
PARSONS BRINCKERHOFF OHIO INC.
655 METRO PLACE SOUTH, SUITE 390
DUBLIN, OHIO 43017

DATE 7-99
REVIEWED EBS
STRUCTURE FILE NUMBER 2505703
DRAWN CAC
REVISED
DESIGNED PJL
CHECKED JLR

FRANKLIN COUNTY
STA. 577+67.41
STA. 578+27.29

SITE PLAN
BRIDGE NO. FRA-70-2374R (E.B.)
OVER DRAINAGE DITCH

FRA-70-14.69

1 / 12

1581
1594

Tue Jul 27 08:17:33 1999 g:*cadd*7827*05811r01.prf g:*cadd*7827*05811r01.dgn

Appendix B. Hydrologic Information

82° 50' 37.5"

39° 56' 15.0"

1875000 FT

705000 FT

JOINS PANEL 0354

MAP SCALE 1 " = 500 '

0 500 1000 FEET

METERS

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0362K

FIRM

FLOOD INSURANCE RATE MAP

FRANKLIN COUNTY, OHIO AND INCORPORATED AREAS

PANEL 362 OF 465

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
BRICE, VILLAGE OF	390898	0362	K
COLUMBUS, CITY OF	390170	0362	K
FRANKLIN COUNTY	390167	0362	K
REYNOLDSBURG, CITY OF	390177	0362	K

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
39049C0362K

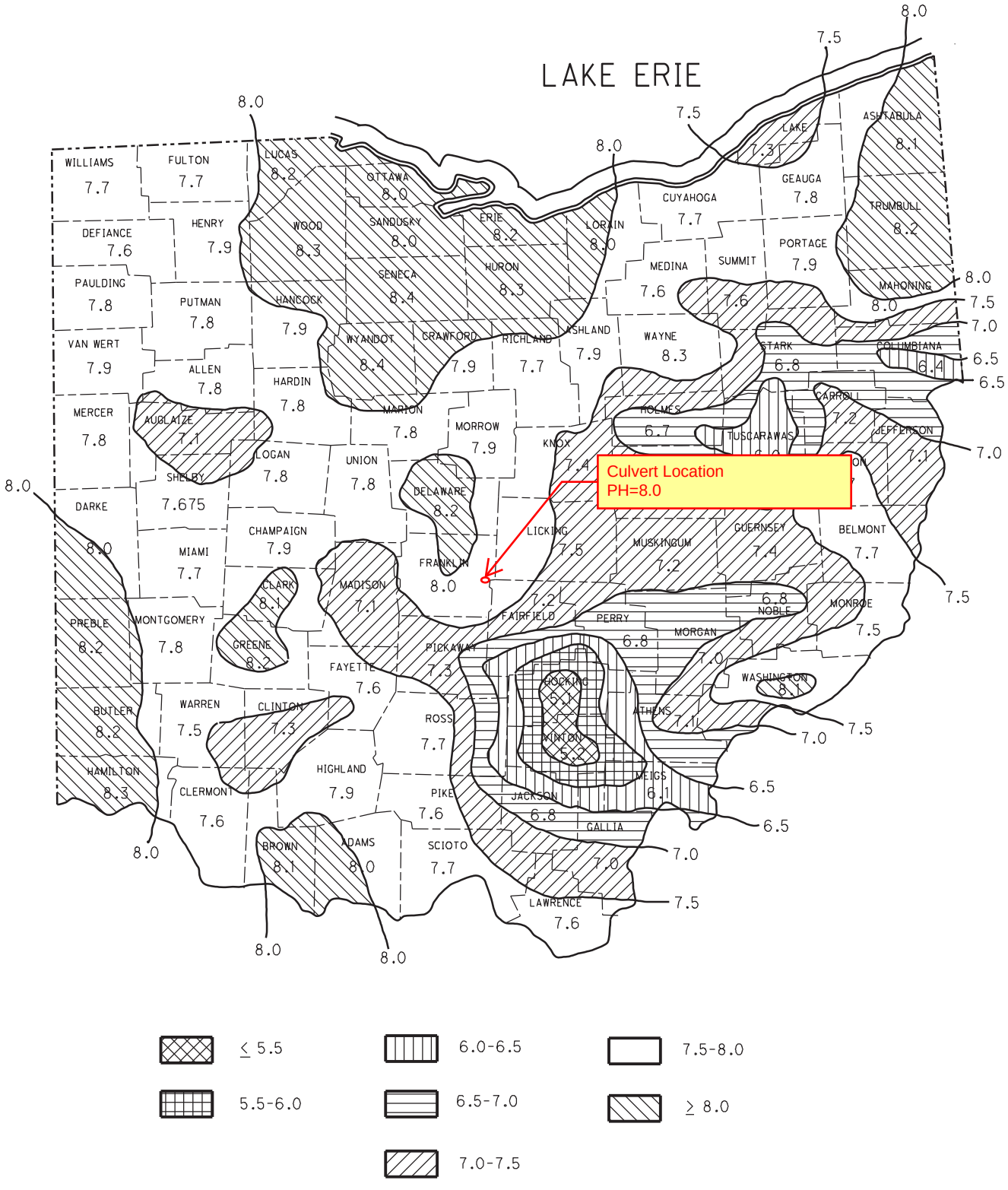
MAP REVISED
JUNE 17, 2008

Federal Emergency Management Agency

WATER pH CONTOURS BASED ON AVE. pH FOR COUNTIES

1002-2

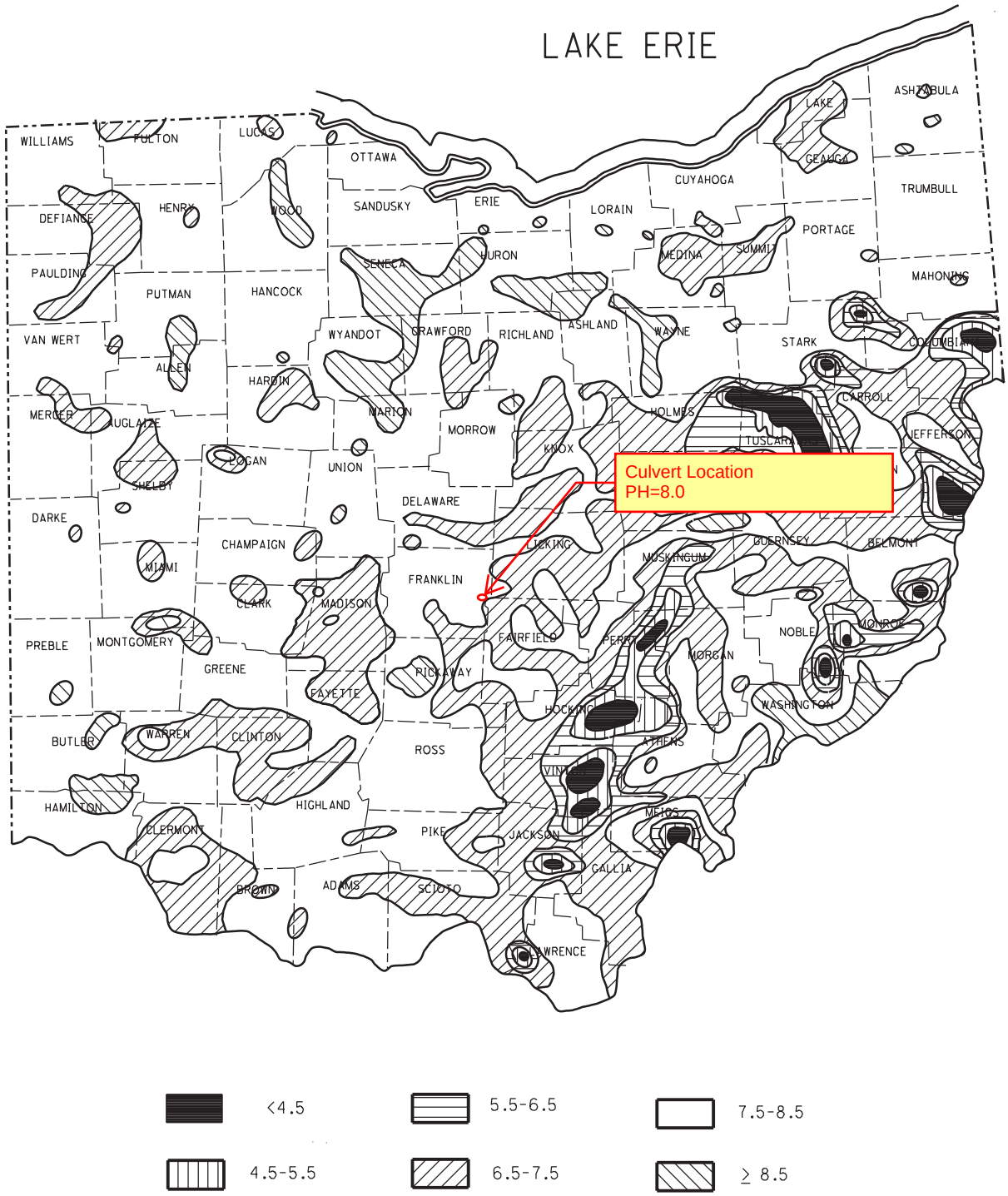
REFERENCE SECTION
1002.3.1



WATER pH CONTOURS BASED ON pH VALUES OF INDIVIDUAL CULVERTS

1002-3

REFERENCE SECTION
1002.3.1



Revised July, 1999

REQUIREMENTS FOR CONCRETE PIPE PROTECTION

1002-4

REFERENCE SECTION
1002.3.1

Concrete Pipe
706.01, 706.02, 706.04

Pipe Slope	Pipe Rise	Minimum pH to Attain Design Service Life* 50 Year	75 Year
Less than 1%	<42"	3.0	3.3
	42" - 72"	3.8	4.1
	>72"	4.2	4.5
1% to 3%	<42"	3.2	3.5
	42" - 72"	4.1	4.4
	>72"	4.6	5.0
3% to 10%	<42"	3.6	3.9
	42" - 72"	4.5	4.9
	>72"	5.0	5.4
Greater than 10%	<42"	4.0	4.5
	42" - 72"	5.0	5.5
	>72"	5.5	6.0

*Based on Equation 4 from Transportation Research Record 1008 Article "Field Performance of Concrete Pipe Culverts at Acidic Flow Sites in Ohio"

For stream flow with a pH less than the minimums listed above, epoxy coated concrete pipe, 706.03, is required

1107 Rock Channel Protection (RCP)

1107.1 General

RCP is used to control erosion and as a scour countermeasure. It is used at the outlet of culverts and storm sewers, or for lining ditches on steep grades. It is used as a scour countermeasure at wingwalls of full-height headwalls, along footings of 3-sided structures, corner cones, and under bridges.

1107.2 Culvert RCP Types

There are four types of RCP that are used in various situations. The use of the proper type at culvert and storm sewer outlets can be determined from Figure 1107-1. Type A is generally used beyond the outlet of the larger conduits having outlet velocities in excess of 12 feet per second and Type B and C for conduits having an aggregate filter where the protected slope is steeper than 3:1. A filter should always be specified to prevent soil piping through the rock. A geotextile fabric is appropriate in most cases. An aggregate filter should be used when the RCP is under water. The cost of the filter is included in the unit bid price for Item 601 Rock Channel Protection with Filter.

1107.3 Bridge RCP

Furnish RCP armor for bridges over waterways at the following locations:

A. The entire spill-through slope
B. Front side of abutments and wingwalls
C. Corner cones

Use the following table to determine the Type of RCP to use:

Channel Mean Velocity (ft/s)	RCP Type	Thickness (inch)
0-8	C	2’-0”
8-10	B	2’-6”
above 10	A	3’-0”

Special circumstances such as protection on the outside of curves or in northern regions of the state on pooled water where ice flow is a concern may require greater rock thickness.

Show on the Site Plan the locations, length, and the top of slope elevations for the RCP. Show the RCP in greater detail in the roadway section in conjunction with the channel plans. It is more economical to provide bank protection during the initial construction in order to provide sufficient embankment protection to minimize future maintenance.

Limit stream channel excavation to that portion of the channel one foot above normal water elevation in order to minimize intrusion and to preserve the natural low water channel.

1108 Agricultural Drainage

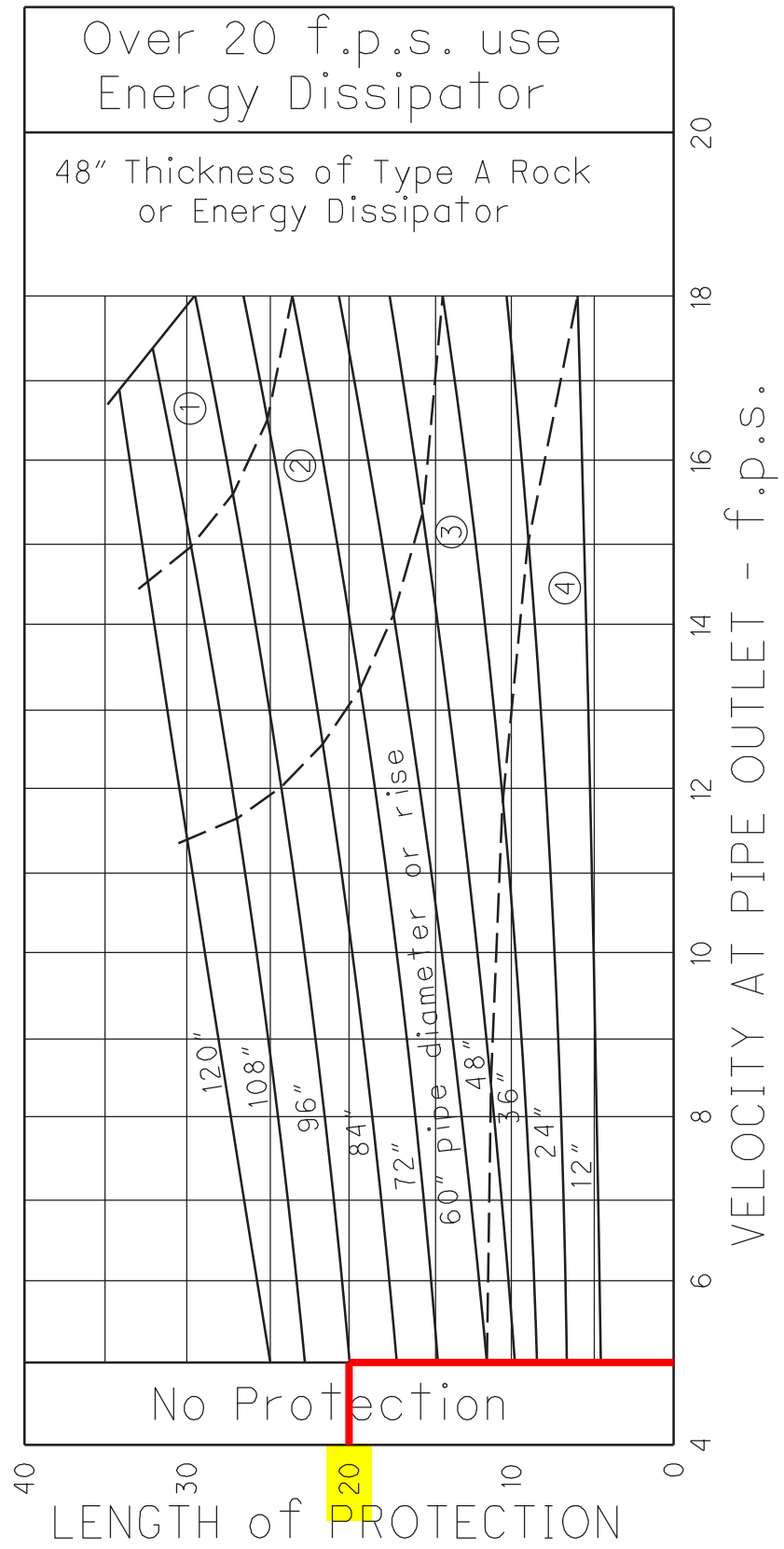
1108.1 Farm Drain Crossings

Where it is necessary to continue an existing farm drain crossing under the highway, the pipe shall be Type B Conduit, one commercial size larger than the existing farm drain within the right-of-way limits.

ROCK CHANNEL PROTECTION AT CULVERT AND STORM SEWER OUTLETS

1107-1

REFERENCE SECTION
1107.2



ROCK TYPE
A
A
B
C

LEGEND
①48" of 18" rock
②36" of 18" rock
③30" of 12" rock
④18" of 6" rock

NOTES

Rock size (6", 12", 18") indicates the square opening on which 85% of the material, by weight, will be retained.

The width of protection shall be the width of the headwall, with 4' being the minimum.

(Where a stream bed will withstand the calculated velocity without erosion, no rock channel protection will be required.)

StreamStats Version 3.0

Basin Characteristics Ungaged Site Report

Date: Wed July 6, 2016 2:05:49 PM GMT-4
Study Area: Ohio
NAD 1983 Latitude: 39.933 (39 55 59)
NAD 1983 Longitude: -82.8338 (-82 50 02)

Label	Value	Units	Definition
OHREGA	1	dimensionless	Ohio Region A Indicator
OHREGC	0	dimensionless	Ohio Region C Indicator
DRNAREA	0.7	square miles	Area that drains to a point on a stream
LAT_CENT	39.9423	decimal degrees	Latitude of Basin Centroid
CSL1085LFP	62.7	feet per mi	Change in elevation divided by length between points 10 and 85 percent of distance along the longest flow path to the basin divide, LFP from 2D grid
LONG_CENT	82.8268	decimal degrees	Longitude Basin Centroid
PRECIP	37.4	inches	Mean Annual Precipitation
STREAM_VARG	0.56	dimensionless	Streamflow variability index as defined in WRIR 02-4068, computed from regional grid
FOREST	3.33	percent	Percentage of area covered by forest
LC92STOR	0.7	percent	Percentage of water bodies and wetlands determined from the NLCD
LC11IMP	53.6	percent	Average percentage of impervious area determined from NLCD 2011 impervious dataset
LC11DEV	99.5	percent	Percentage of land-use from NLCD 2011 classes 21-24

StreamStats Version 3.0

Flow Statistics Ungaged Site Report

Date: Wed July 6, 2016 2:07:33 PM GMT-4
Study Area: Ohio
NAD 1983 Latitude: 39.933 (39 55 59)
NAD 1983 Longitude: -82.8338 (-82 50 02)
Drainage Area: 0.7 mi2

Peak Flows Basin Characteristics			
100% Peak Flow Full Model (0.7 mi2)			
Parameter	**Value**	**Regression Equation Valid Range**	
		Min	**Max**
Drainage Area (square miles)	0.7	0.01	7422
Ohio Region C Indicator 1 if in C else 0 (dimensionless)	0	0	1
Ohio Region A Indicator 1 if in A else 0 (dimensionless)	1	0	1
Stream Slope 10 and 85 Longest Flow Path (feet per mi)	62.7	1.53	674
Percent Storage from NLCD1992 (percent)	0.7	0	25.8

Low Flows Basin Characteristics			
100% Low Flow Region A 2012 5138 (0.7 mi2)			
Parameter	**Value**	**Regression Equation Valid Range**	
		Min	**Max**
Drainage Area (square miles)	0.7 (below min value 1)	1	1250
Streamflow Variability Index from Grid (dimensionless)	0.56	0.24	1.12

Warning: Some parameters are outside the suggested range. Estimates will be extrapolations with unknown errors.

Probability of Zero Flow Basin Characteristics			
100% P zero Flow 2012 5138 (0.7 mi2)			
Parameter	**Value**	**Regression Equation Valid Range**	
		Min	**Max**
Drainage Area (square miles)	0.7 (below min value 1)	1	1250
Streamflow Variability Index from Grid (dimensionless)	0.56	0.24	1.12

Warning: Some parameters are outside the suggested range. Estimates will be extrapolations with unknown errors.

Mean and Percentile Basin Characteristics			
Y coordinate (latitude) of the centroid_ in decimal degrees=39.9423			
100% Low Flow LatLE 41.2 wri02 4068 (0.7 mi2)			
Parameter	**Value**	**Regression Equation Valid Range**	
		Min	**Max**
Drainage Area (square miles)	0.7	0.12	7422
Percent Forest (percent)	3.33	0	99.1
Percent Storage from NLCD1992 (percent)	0.7	0	19
Mean Annual Precipitation (inches)	37.4	34	43.2
Streamflow Variability Index from Grid (dimensionless)	0.56	0.25	1.13
Latitude of Basin Centroid (decimal degrees)	39.9423	38.68	41.2
Longitude of Basin Centroid (decimal degrees)	82.8268	80.53	84.6

Peak Flows Statistics						
Statistic	Value	Unit	Prediction Error (percent)	Equivalent years of record	90-Percent Prediction Interval	
					Min	Max
PK2	84	ft3/s	37	2.1	41	172
PK5	151	ft3/s	35	3.3	76.5	299
PK10	201	ft3/s	34	4.4	101	399
PK25	267	ft3/s	35	5.9	131	542
PK50	316	ft3/s	37	6.8	151	660
PK100	366	ft3/s	38	7.5	170	790
PK500	486	ft3/s	42	8.6	207	1140

http://pubs.usgs.gov/sir/2006/5312/ (http://pubs.usgs.gov/sir/2006/5312/)
Koltun_ G.F._ Kula_ S.P._ and Puskas_ B.M._ 2006_ A Streamflow Statistics (StreamStats) Web Application for Ohio: U.S. Geological Survey Scientific Investigations Report 2006-5312_ 62 p.

Low Flows Statistics						
Statistic	Value	Unit	Prediction Error (percent)	Equivalent years of record	90-Percent Prediction Interval	
					Min	Max
M1D10Y	0.0093	ft3/s				
M7D10Y	0.0119	ft3/s				
M30D10Y	0.0187	ft3/s				
M90D10Y	0.0295	ft3/s				
D80	0.0623	ft3/s				

#http://pubs.usgs.gov/sir/2012/5138/#
Koltun_ G.F._ and Kula_ S.P._ 2013_ Methods for estimating selected low-flow statistics and development of annual flow-duration statistics for Ohio: U.S. Geological Survey Scientific Investigations Report 2012-5138_ 195 p.

Probability of Zero Flow Statistics						
Statistic	Value	Unit	Prediction Error (percent)	Equivalent years of record	90-Percent Prediction Interval	
					Min	Max
PROB 1DAY	0.0348	dim				
PROB 7DAY	0.0151	dim				
PROB 30DAY	0.000646	dim				

#http://pubs.usgs.gov/sir/2012/5138/#
Koltun_ G.F._ and Kula_ S.P._ 2013_ Methods for estimating selected low-flow statistics and development of annual flow-duration statistics for Ohio: U.S. Geological Survey Scientific Investigations Report 2012-5138_ 195 p.

Mean and Percentile Statistics						
Statistic	Value	Unit	Prediction Error (percent)	Equivalent years of record	90-Percent Prediction Interval	
					Min	Max
Q1	0.96	ft3/s	17			
Q2	1.18	ft3/s	12			
Q3	1.27	ft3/s	14			
Q4	1.22	ft3/s	11			
Q5	0.79	ft3/s	20			
Q6	0.53	ft3/s	27			
Q7	0.31	ft3/s	28			
Q8	0.21	ft3/s	37			
Q9	0.11	ft3/s	44			
QA	0.67	ft3/s	11			

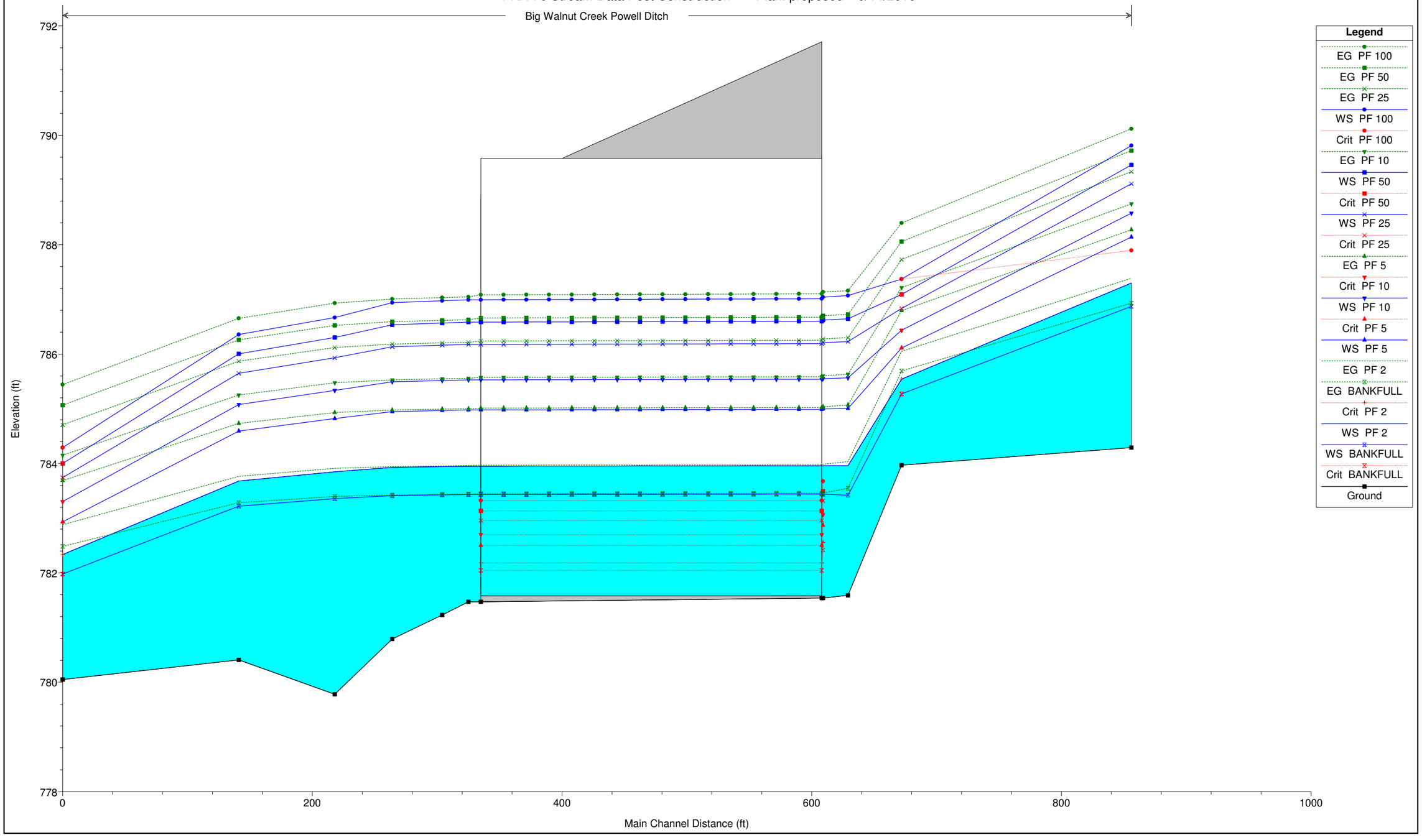
Q10	0.13	ft3/s	51			
Q11	0.31	ft3/s	38			
Q12	0.63	ft3/s	22			
QAH	0.0859	ft3/s	66			
FPS25	0.17	ft3/s	29			
FPS50	0.37	ft3/s	40			
FPS75	0.78	ft3/s	48			

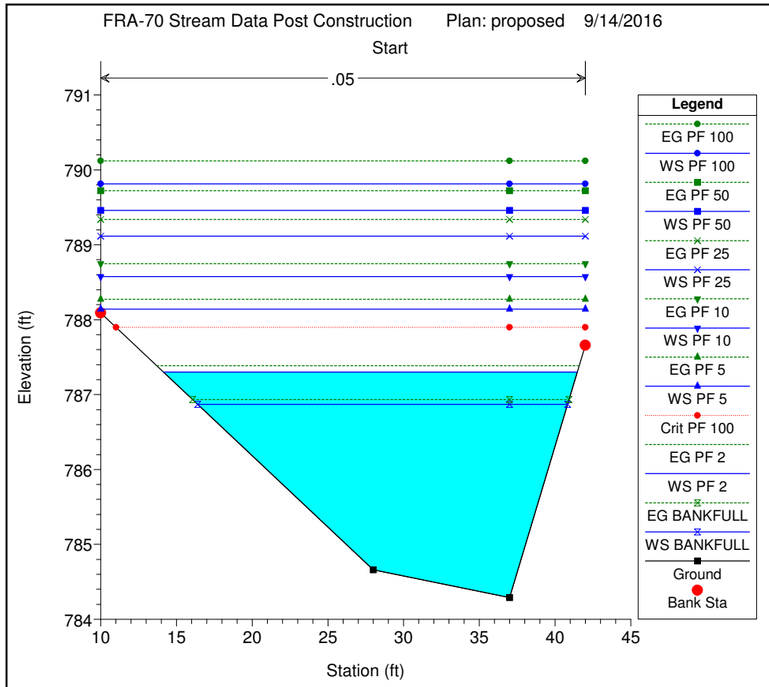
http://oh.water.usgs.gov/reports/wrir/wrir02-4068.pdf (http://oh.water.usgs.gov/reports/wrir/wrir02-4068.pdf)
Koltun_ G. F._ and Whitehead_ M. T._ 2002_ Techniques for Estimating Selected Streamflow Characteristics of Rural_ Unregulated Streams in Ohio: U. S. Geological Survey Water-Resources Investigations Report 02-4068_ 50 p

Appendix C. Existing Conditions Results

FRA-70 Stream Data Post Construction Plan: proposed 9/14/2016

Big Walnut Creek Powell Ditch

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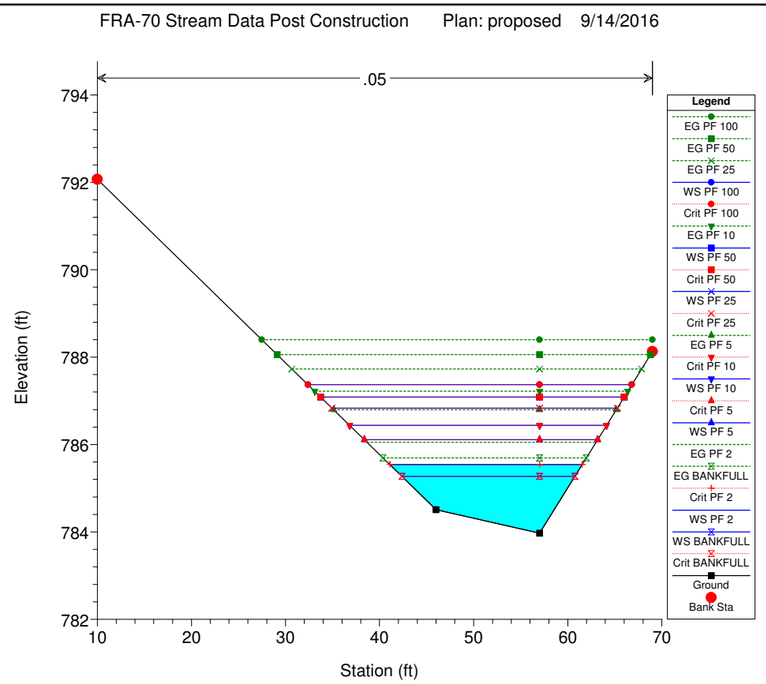
Start
.05
Elevation (ft)
Station (ft)
Legend
EG PF 100
WS PF 100
EG PF 50
WS PF 50
EG PF 25
WS PF 25
EG PF 10
WS PF 10
EG PF 5
WS PF 5
Crit PF 100
EG PF 2
WS PF 2
EG BANKFULL
WS BANKFULL
Ground
Bank Sta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.05
Elevation (ft)
Station (ft)
Legend
EG PF 100
EG PF 50
EG PF 25
WS PF 100
Crit PF 100
EG PF 10
WS PF 50
Crit PF 50
WS PF 25
Crit PF 25
EG PF 5
Crit PF 10
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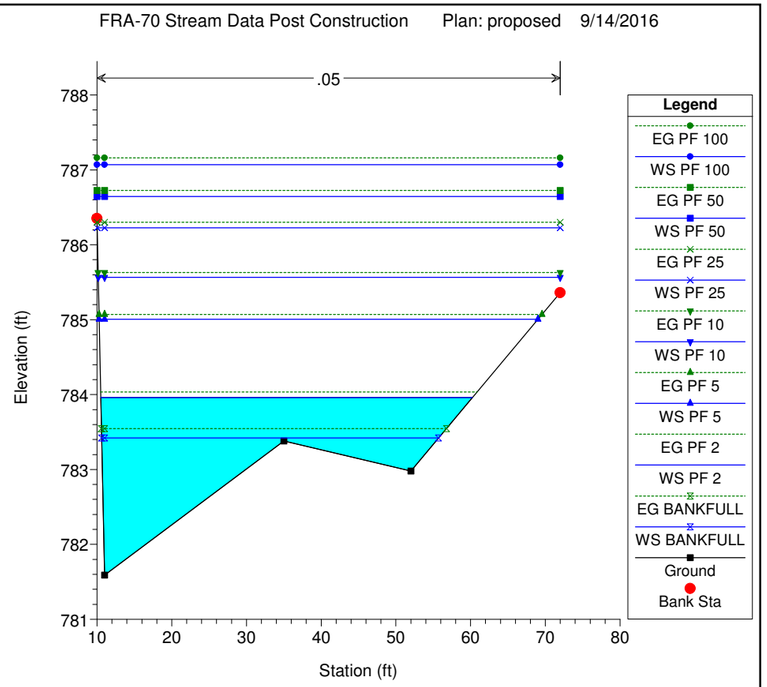
WS PF 5
EG PF 2
EG BANKFULL
Crit PF 2
WS PF 2
WS BANKFULL
Crit BANKFULL
Ground
Bank Sta


FRA-70 Stream Data Post Construction Plan: proposed 9/14/2016
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Elevation (ft)
Station (ft)
Legend
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WS PF 100
EG PF 50
WS PF 50
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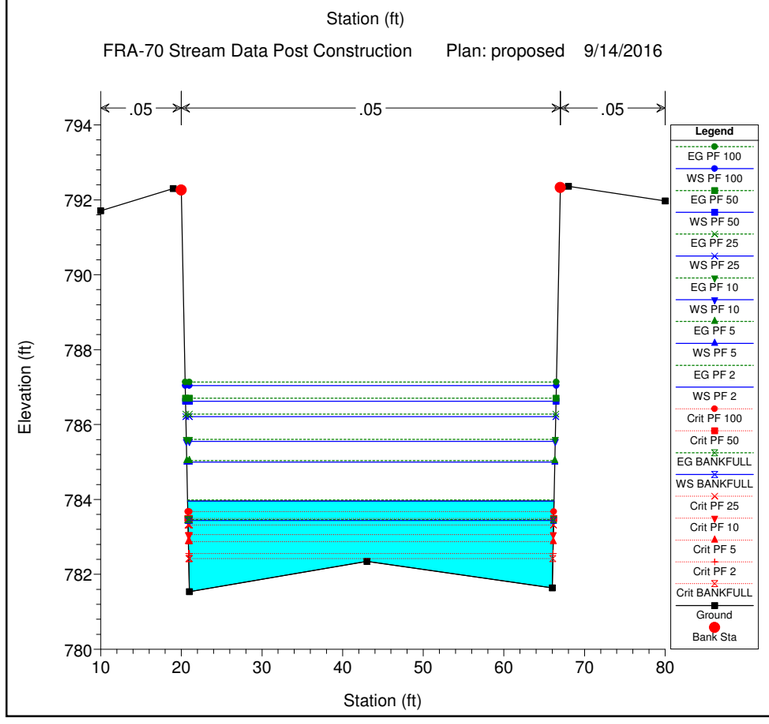
WS PF 10
EG PF 5
WS PF 5
EG PF 2
WS PF 2
EG BANKFULL
WS BANKFULL
Ground
Bank Sta


FRA-70 Stream Data Post Construction Plan: proposed 9/14/2016
FRA-70 Stream Data Post Construction Plan: proposed 9/14/2016
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Elevation (ft)
Station (ft)
Legend
EG PF 100
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EG PF 50
WS PF 50
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WS PF 25
EG PF 10
WS PF 10
EG PF 5
WS PF 5
EG PF 2
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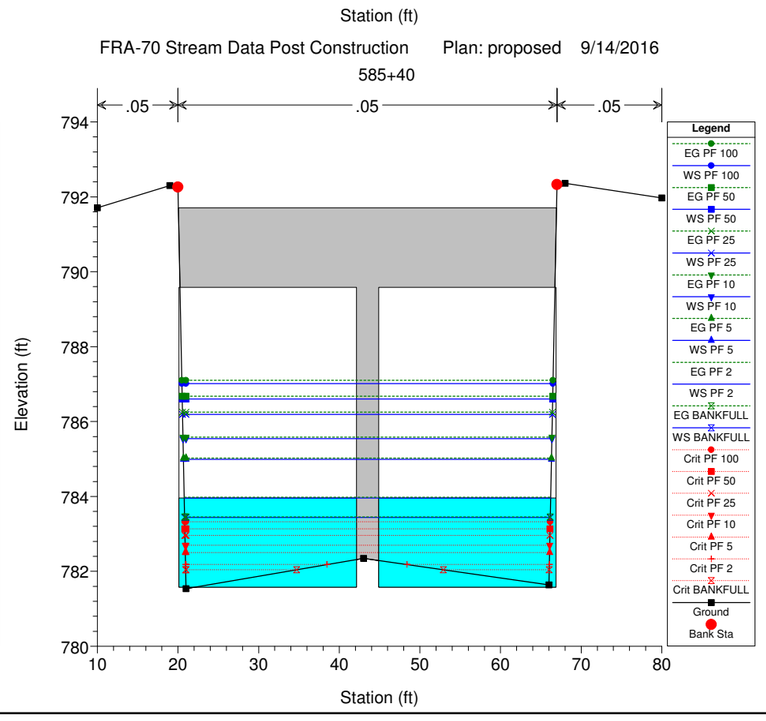
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585+40
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Elevation (ft)
Station (ft)
Legend
EG PF 100
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EG PF 50
WS PF 50
EG PF 25
WS PF 25
EG PF 10
WS PF 10
EG PF 5
WS PF 5
EG PF 2
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Crit PF 100
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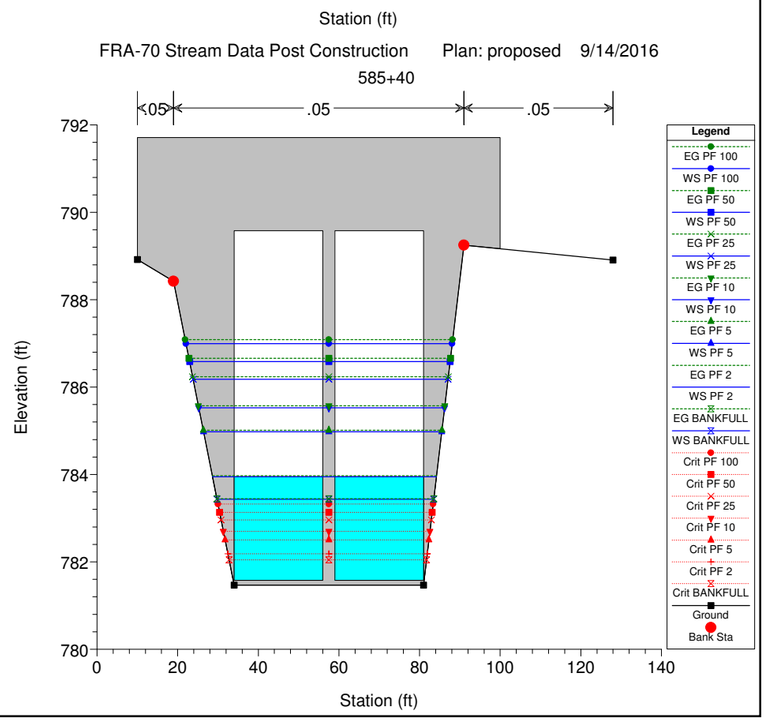
Ground
Bank Sta


FRA-70 Stream Data Post Construction Plan: proposed 9/14/2016
585+40
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Elevation (ft)
Station (ft)
Legend
EG PF 100
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WS PF 50
EG PF 25
WS PF 25
EG PF 10
WS PF 10
EG PF 5
WS PF 5
EG PF 2
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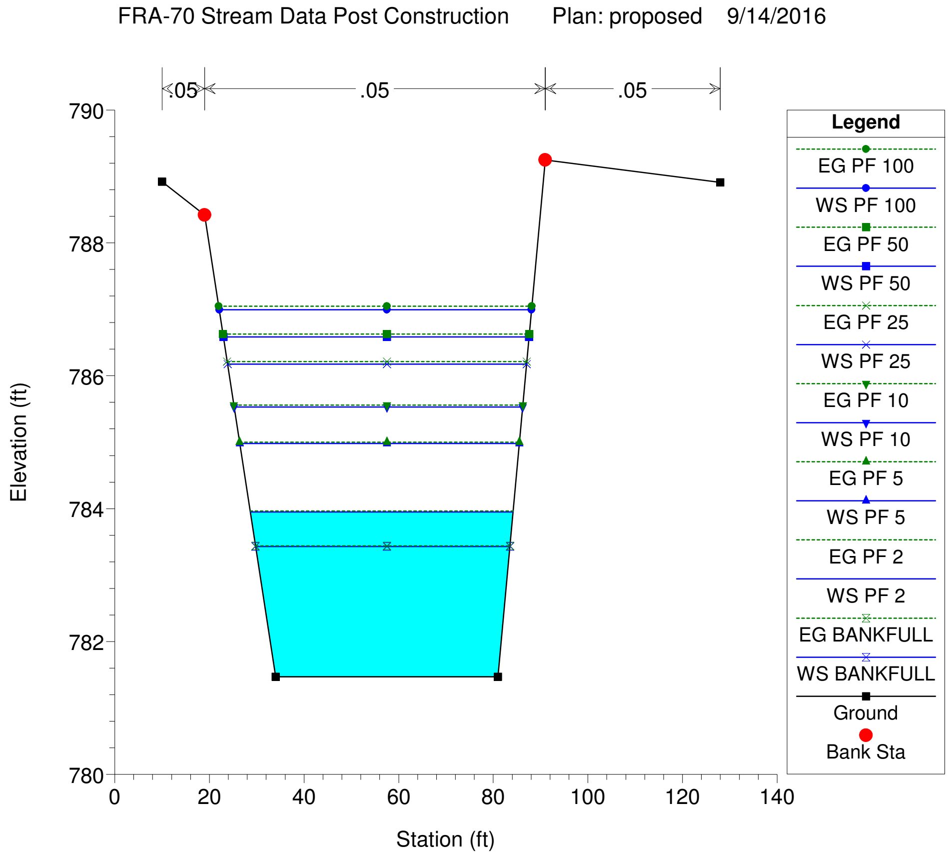
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Elevation (ft)
Station (ft)
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EG PF 50
WS PF 50
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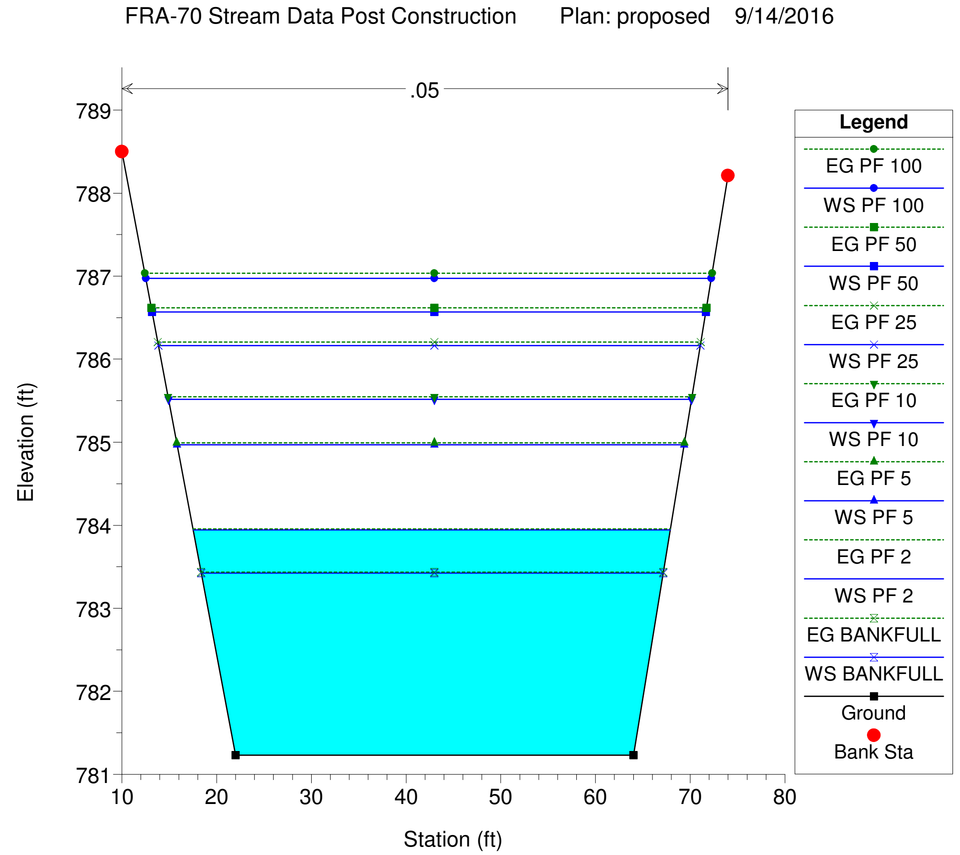
WS PF 10
EG PF 5
WS PF 5
EG PF 2
WS PF 2
EG BANKFULL
WS BANKFULL
Ground
Bank Sta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Station (ft)
Legend
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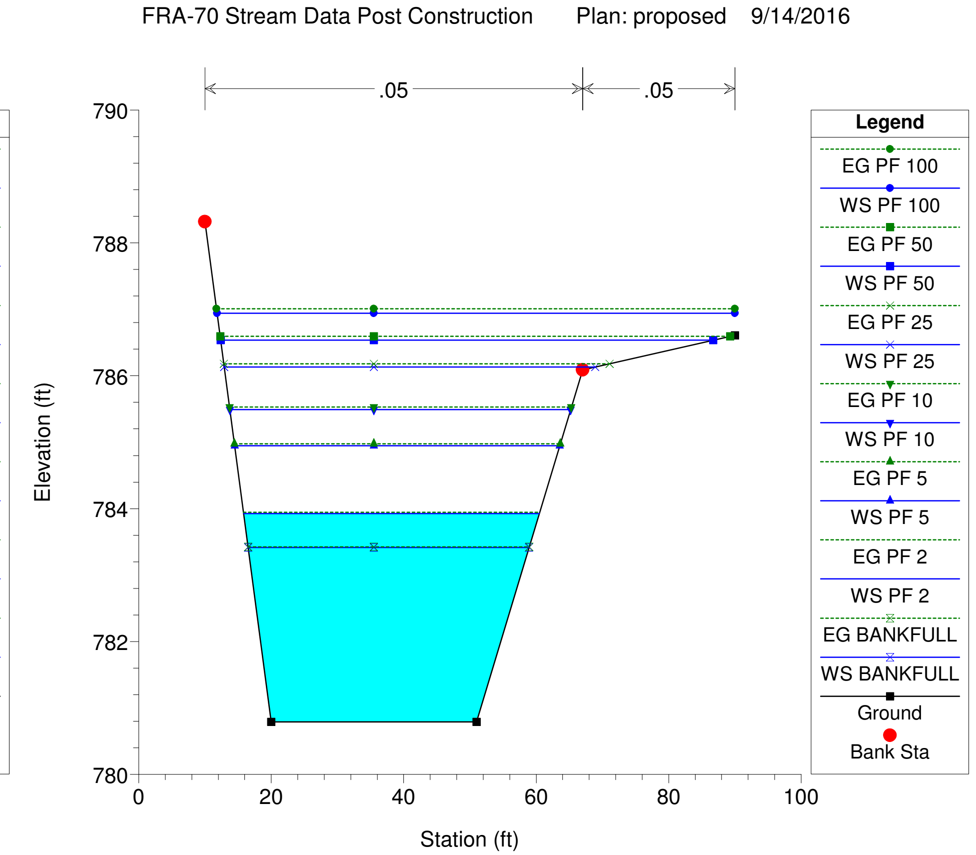
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Elevation (ft)
Station (ft)
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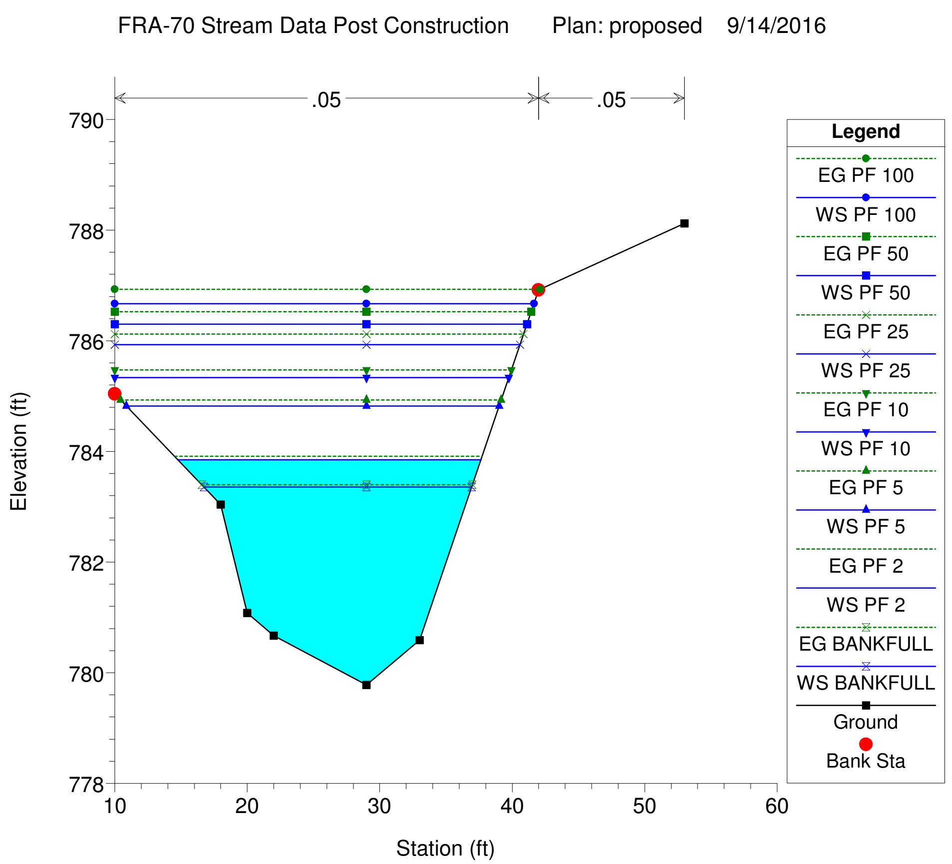
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Station (ft)
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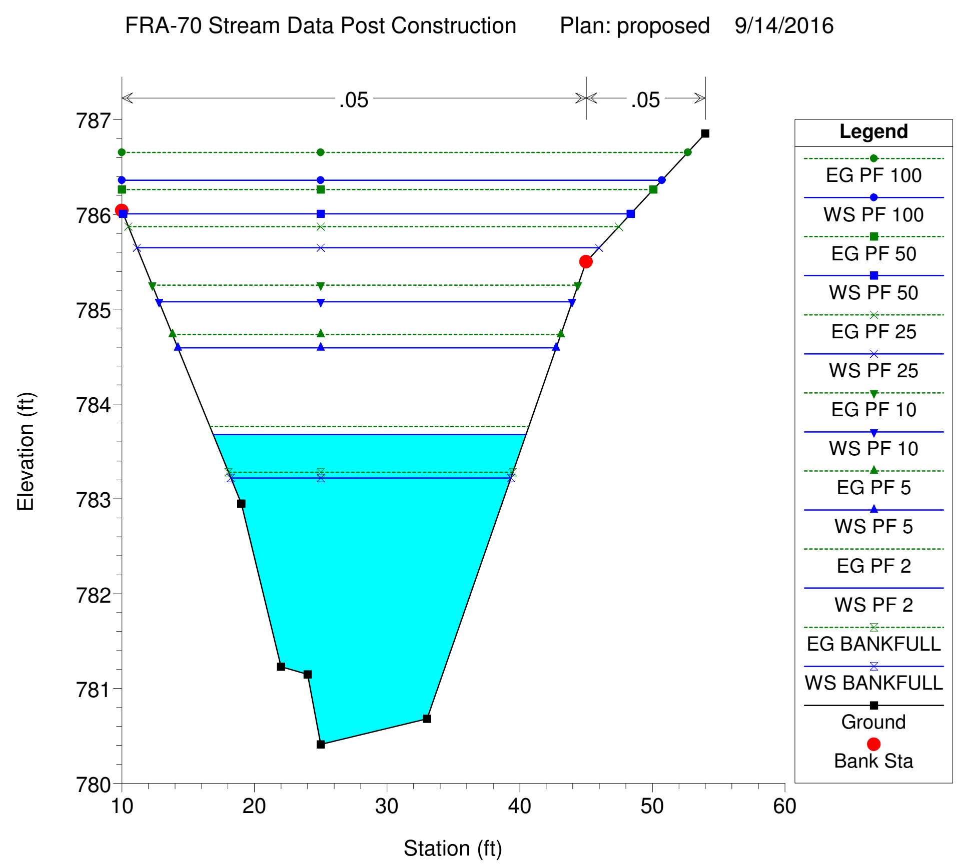
WS PF 2
EG BANKFULL
WS BANKFULL
Ground
Bank Sta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Station (ft)
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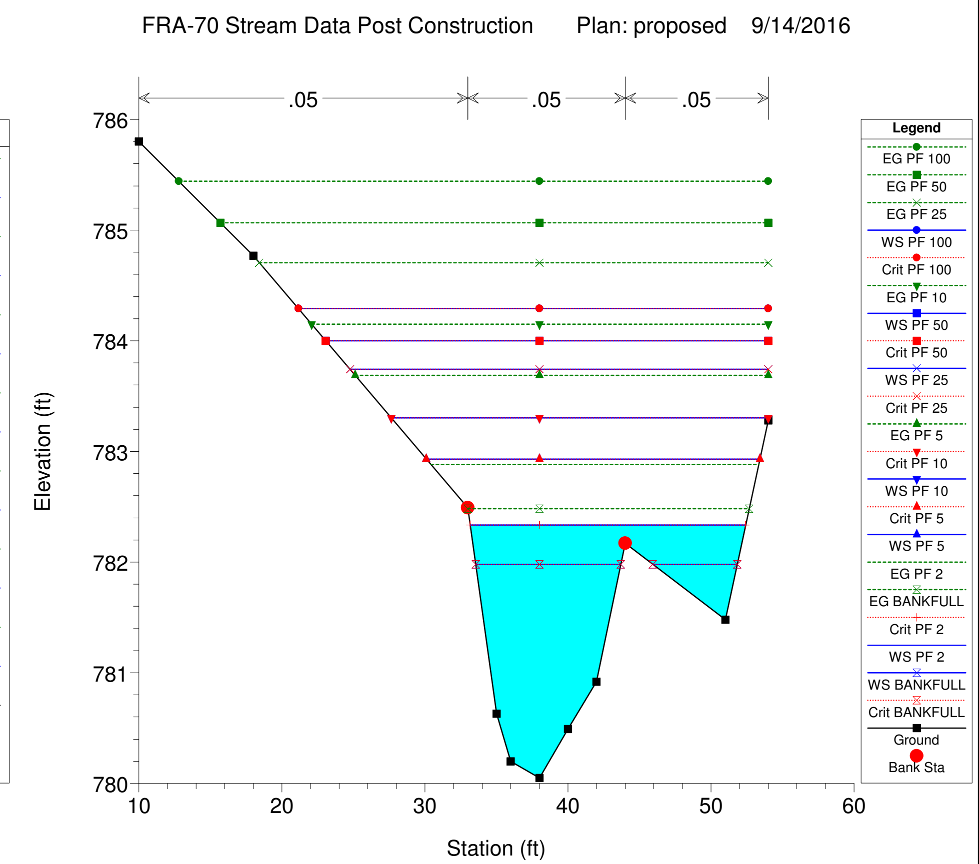
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Station (ft)
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Crit PF 100
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Crit PF 10
WS PF 10
Crit PF 5
WS PF 5
EG PF 2
EG BANKFULL
Crit PF 2
WS PF 2
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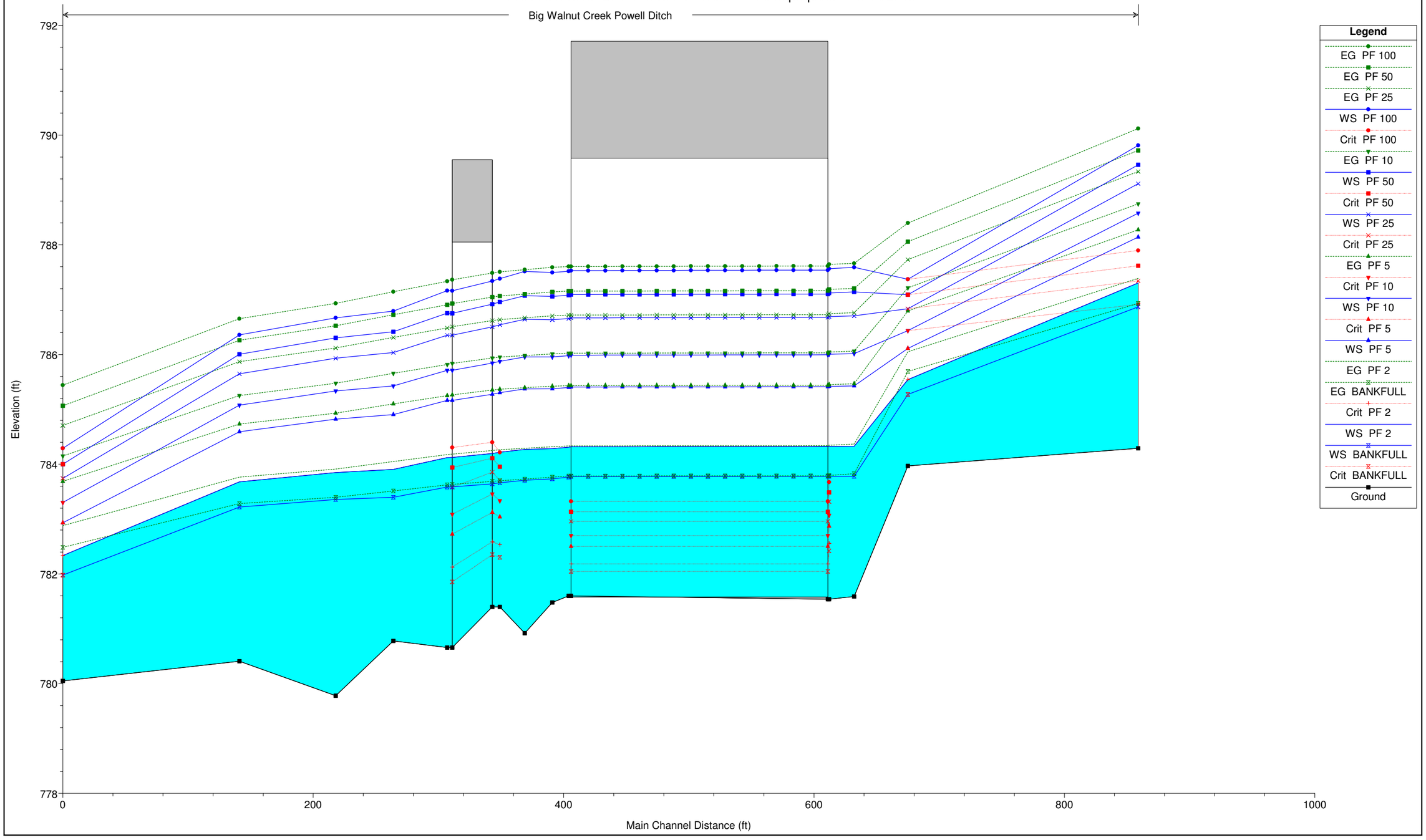
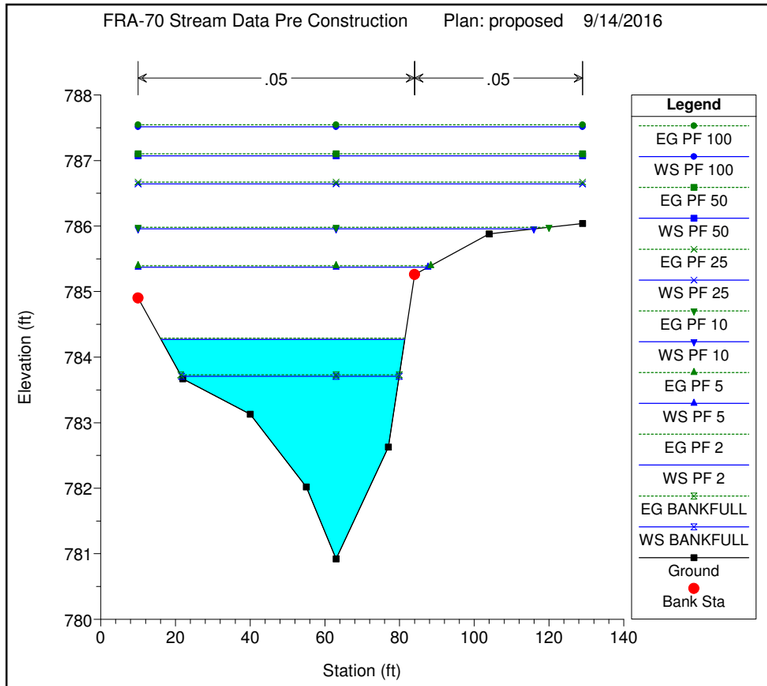
Ground
Bank Sta

Appendix D. Proposed Condition Results

FRA-70 Stream Data Pre Construction Plan: proposed 9/14/2016

Big Walnut Creek Powell Ditch




FRA-70 Stream Data Pre Construction Plan: proposed 9/14/2016
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Station (ft)
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Ground
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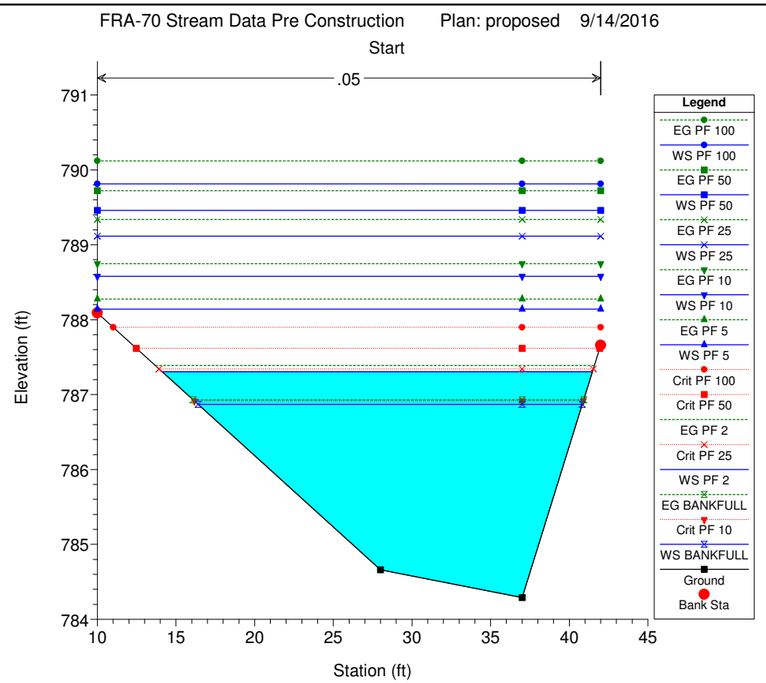
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Start
.05
Elevation (ft)
Station (ft)
Legend
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WS PF 100
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EG PF 25
WS PF 25
EG PF 10
WS PF 10
EG PF 5
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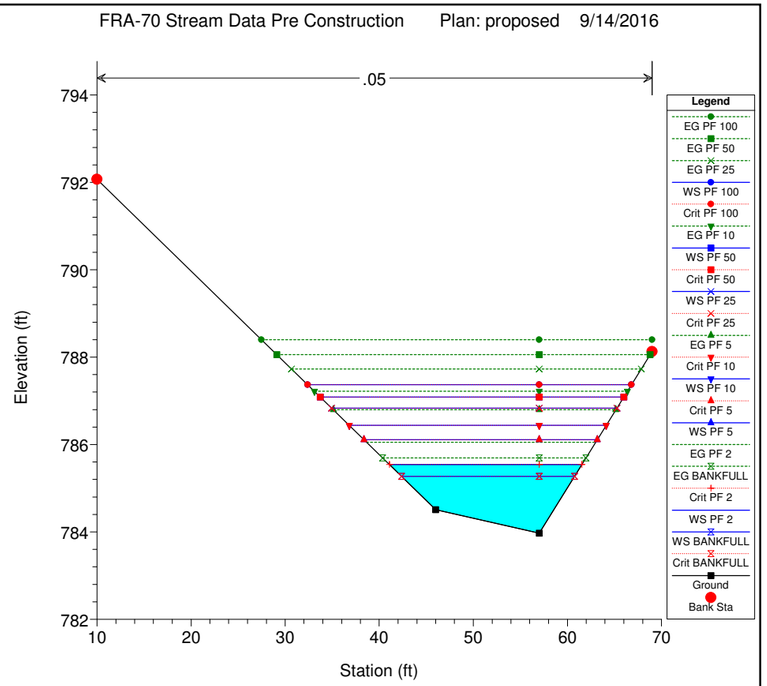
Bank Sta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Ground
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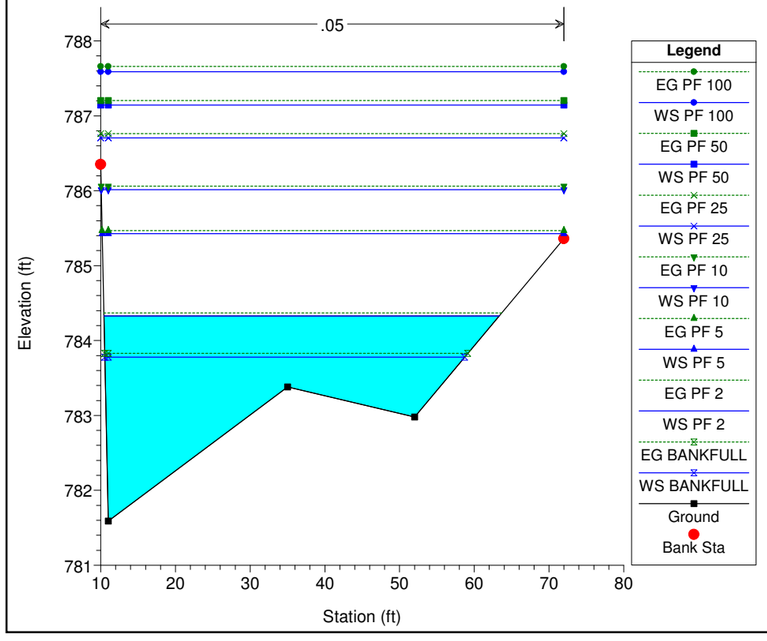
FRA-70 Stream Data Pre Construction Plan: proposed 9/14/2016
Station (ft)
FRA-70 Stream Data Pre Construction Plan: proposed 9/14/2016
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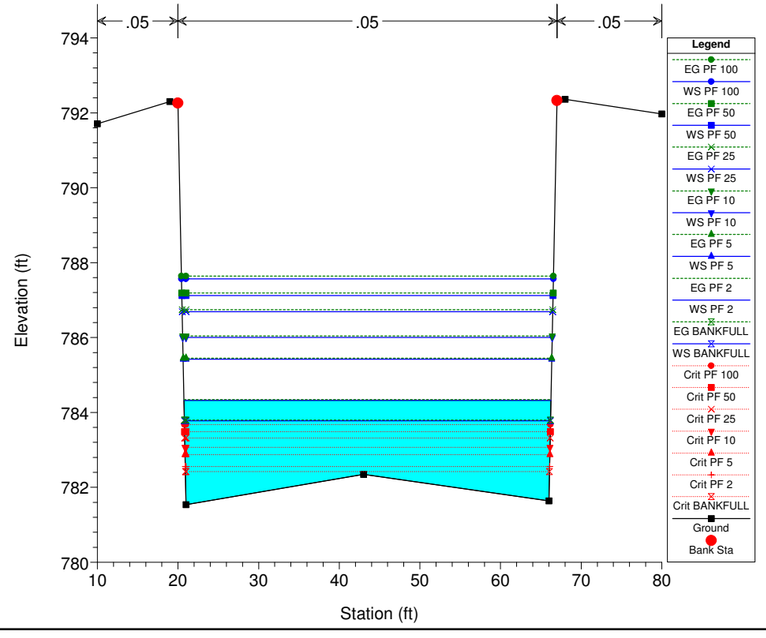
Ground
Bank Sta


FRA-70 Stream Data Pre Construction Plan: proposed 9/14/2016
Station (ft)
FRA-70 Stream Data Pre Construction Plan: proposed 9/14/2016
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Elevation (ft)
Station (ft)
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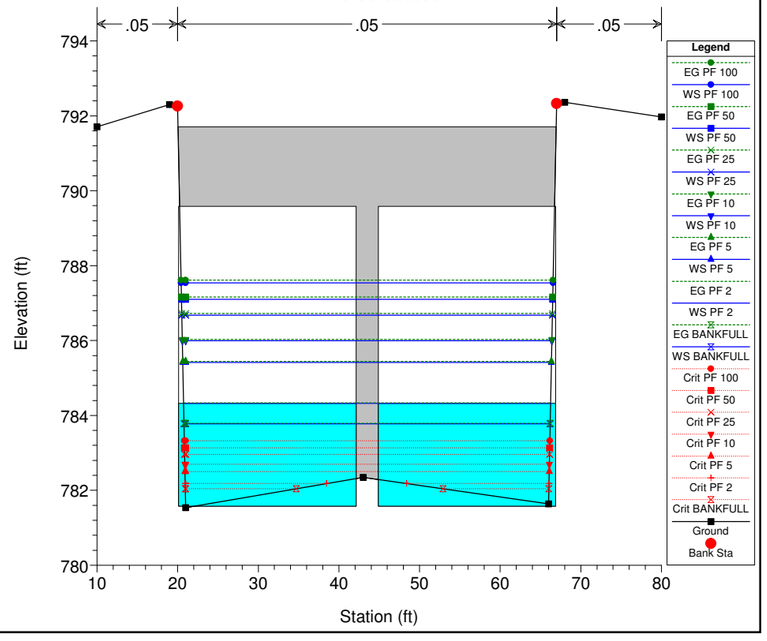
FRA-70 Stream Data Pre Construction Plan: proposed 9/14/2016
Pre Construction
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Elevation (ft)
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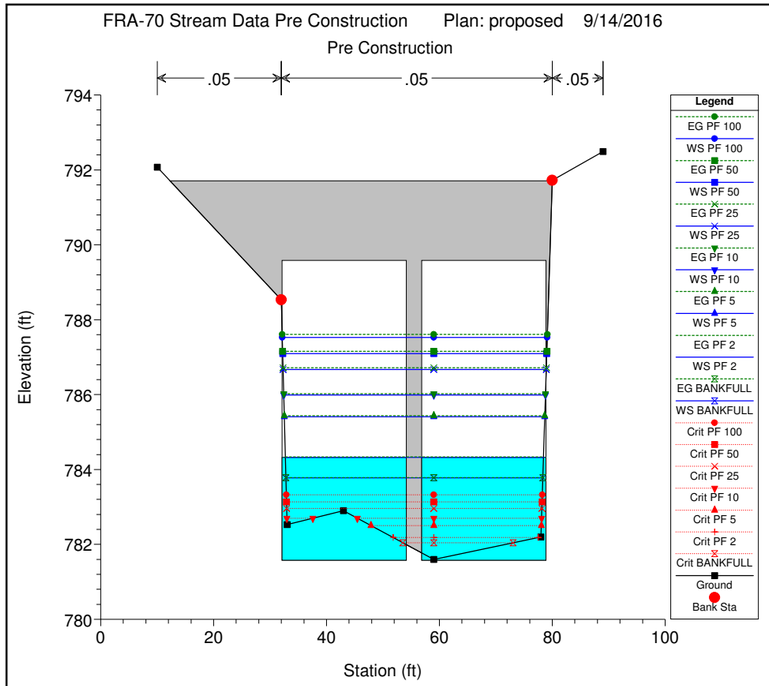
Ground
Bank Sta


FRA-70 Stream Data Pre Construction Plan: proposed 9/14/2016
Pre Construction
.05
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Elevation (ft)
Station (ft)
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WS PF 100
EG PF 50
WS PF 50
EG PF 25
WS PF 25
EG PF 10
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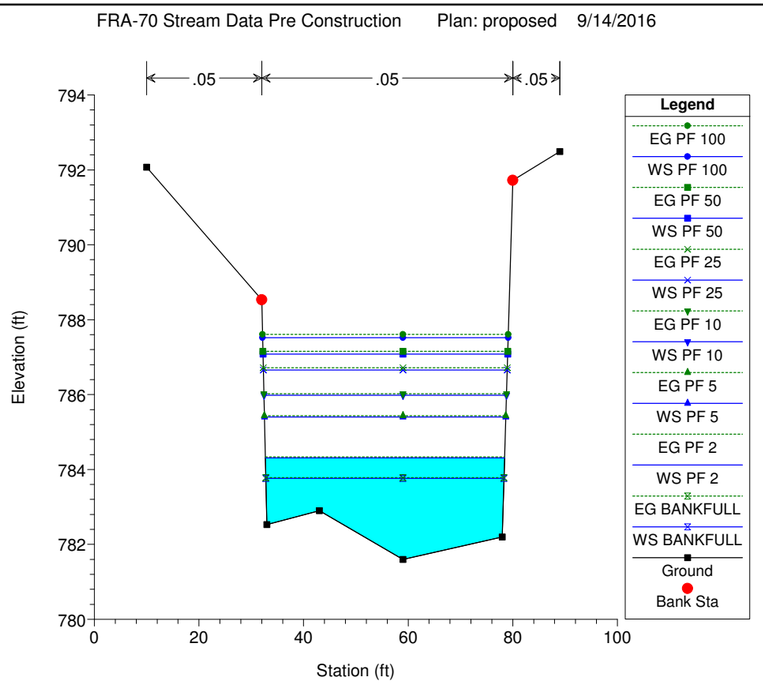
EG PF 5
WS PF 5
EG PF 2
WS PF 2
EG BANKFULL
WS BANKFULL
Crit PF 100
Crit PF 50
Crit PF 25
Crit PF 10
Crit PF 5
Crit PF 2
Crit BANKFULL
Ground
Bank Sta


FRA-70 Stream Data Pre Construction Plan: proposed 9/14/2016
.05
.05
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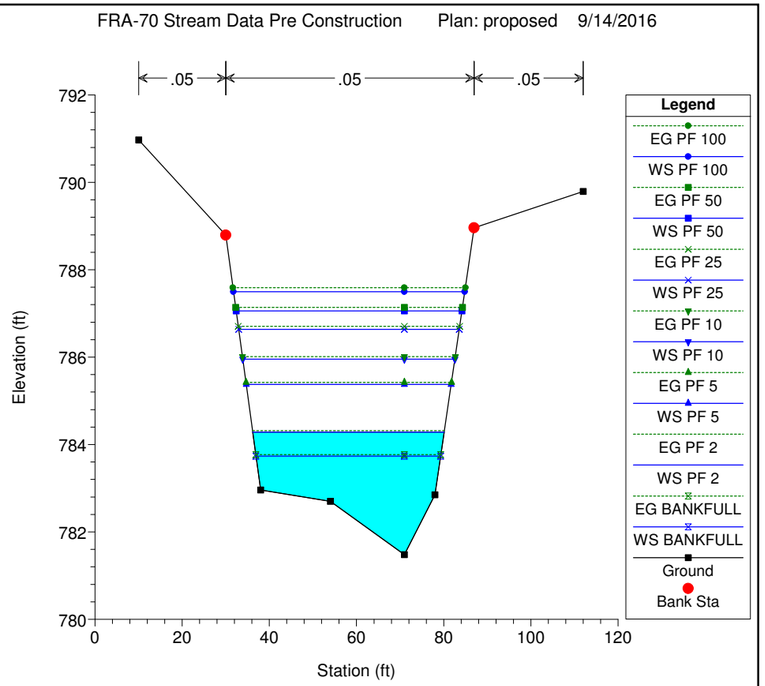
Elevation (ft)
Station (ft)
Legend
EG PF 100
WS PF 100
EG PF 50
WS PF 50
EG PF 25
WS PF 25
EG PF 10
WS PF 10
EG PF 5
WS PF 5
EG PF 2
WS PF 2
EG BANKFULL
WS BANKFULL
Ground
Bank Sta


FRA-70 Stream Data Pre Construction Plan: proposed 9/14/2016
.05
.05
.05
Elevation (ft)
Station (ft)
Legend
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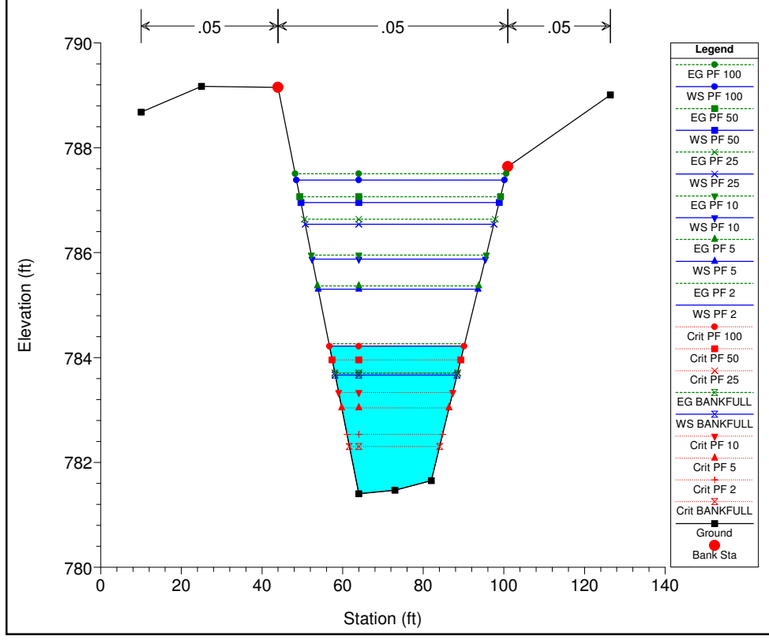
WS PF 100
EG PF 50
WS PF 50
EG PF 25
WS PF 25
EG PF 10
WS PF 10
EG PF 5
WS PF 5
EG PF 2
WS PF 2
EG BANKFULL
WS BANKFULL
Ground
Bank Sta


FRA-70 Stream Data Pre Construction Plan: proposed 9/14/2016
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Elevation (ft)
Station (ft)
Legend
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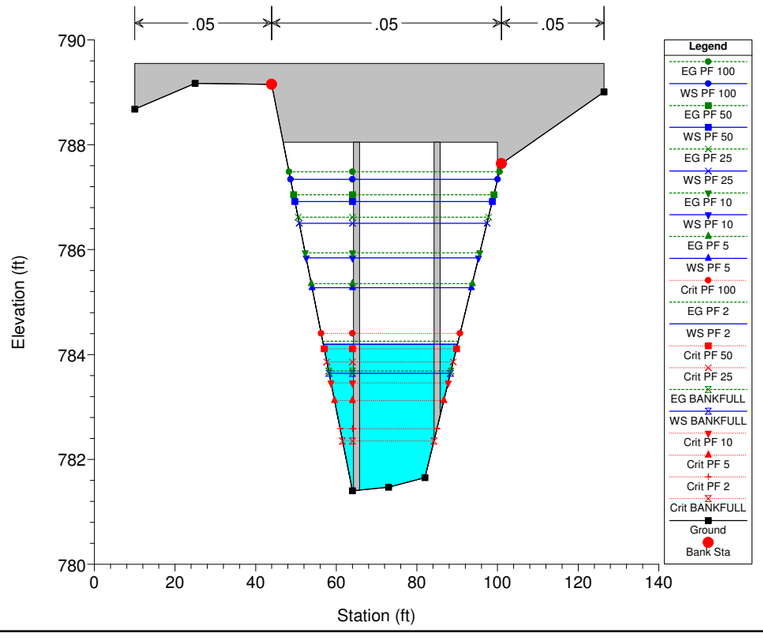
EG PF 50
WS PF 50
EG PF 25
WS PF 25
EG PF 10
WS PF 10
EG PF 5
WS PF 5
EG PF 2
WS PF 2
Crit PF 100
Crit PF 50
Crit PF 25
EG BANKFULL
WS BANKFULL
Crit PF 10
Crit PF 5
Crit PF 2
Crit BANKFULL
Ground
Bank Sta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.05
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.05
Elevation (ft)
Station (ft)
Legend
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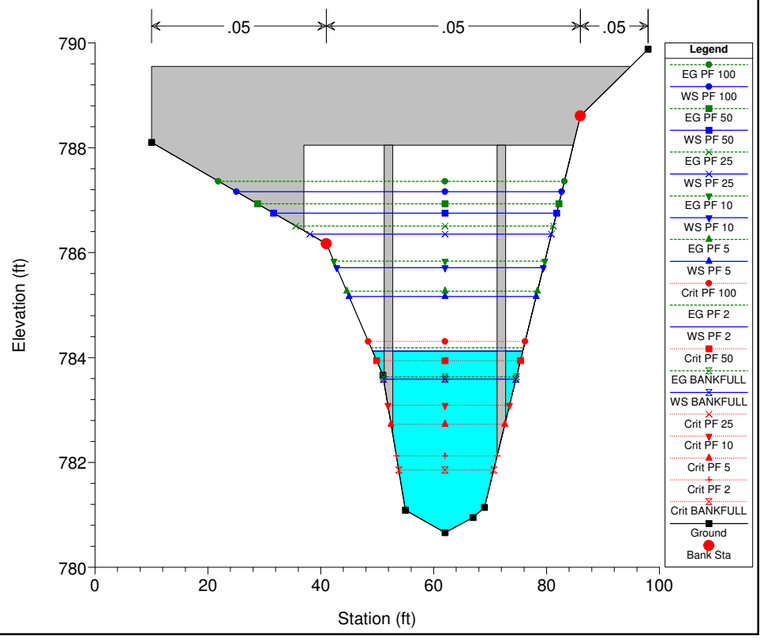
WS PF 100
EG PF 50
WS PF 50
EG PF 25
WS PF 25
EG PF 10
WS PF 10
EG PF 5
WS PF 5
Crit PF 100
EG PF 2
WS PF 2
Crit PF 50
Crit PF 25
EG BANKFULL
WS BANKFULL
Crit PF 10
Crit PF 5
Crit PF 2
Crit BANKFULL
Ground
Bank Sta


FRA-70 Stream Data Pre Construction Plan: proposed 9/14/2016
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Elevation (ft)
Station (ft)
Legend
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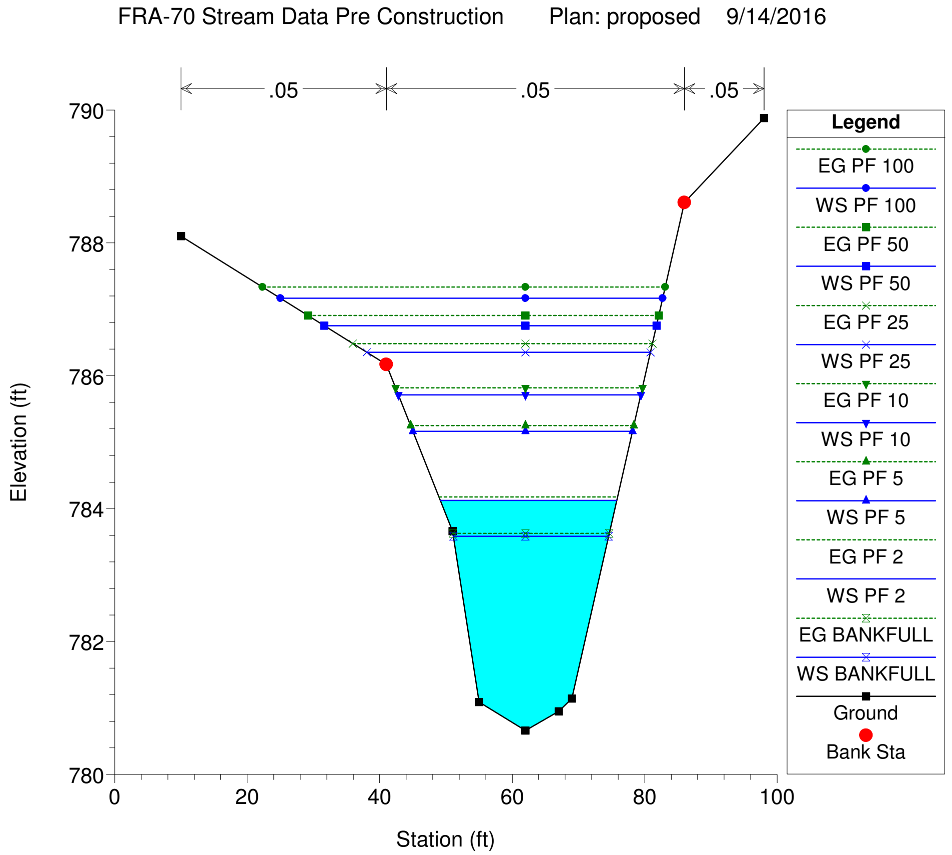
WS PF 100
EG PF 50
WS PF 50
EG PF 25
WS PF 25
EG PF 10
WS PF 10
EG PF 5
WS PF 5
Crit PF 100
EG PF 2
WS PF 2
Crit PF 50
EG BANKFULL
WS BANKFULL
Crit PF 25
Crit PF 10
Crit PF 5
Crit PF 2
Crit BANKFULL
Ground
Bank Sta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.05
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Legend
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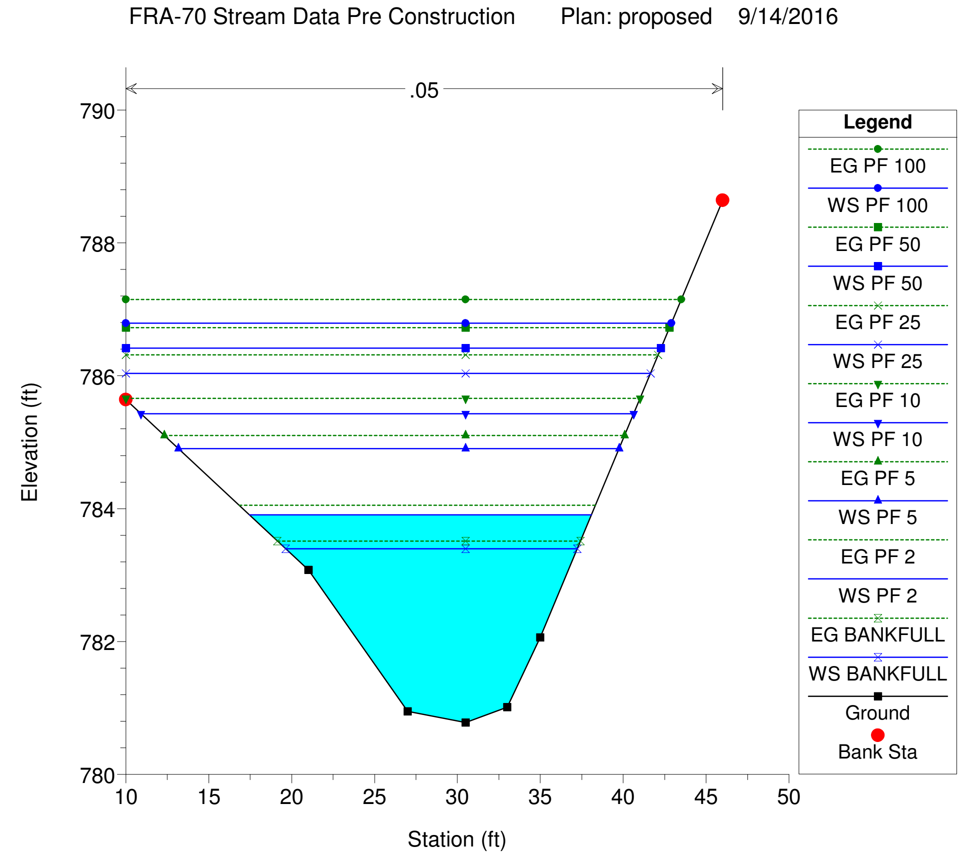
EG PF 50
WS PF 50
EG PF 25
WS PF 25
EG PF 10
WS PF 10
EG PF 5
WS PF 5
EG PF 2
WS PF 2
EG BANKFULL
WS BANKFULL
Ground
Bank Sta
Elevation (ft)
790
788
786
784
782
780
0
20
40
60
80
100
Station (ft)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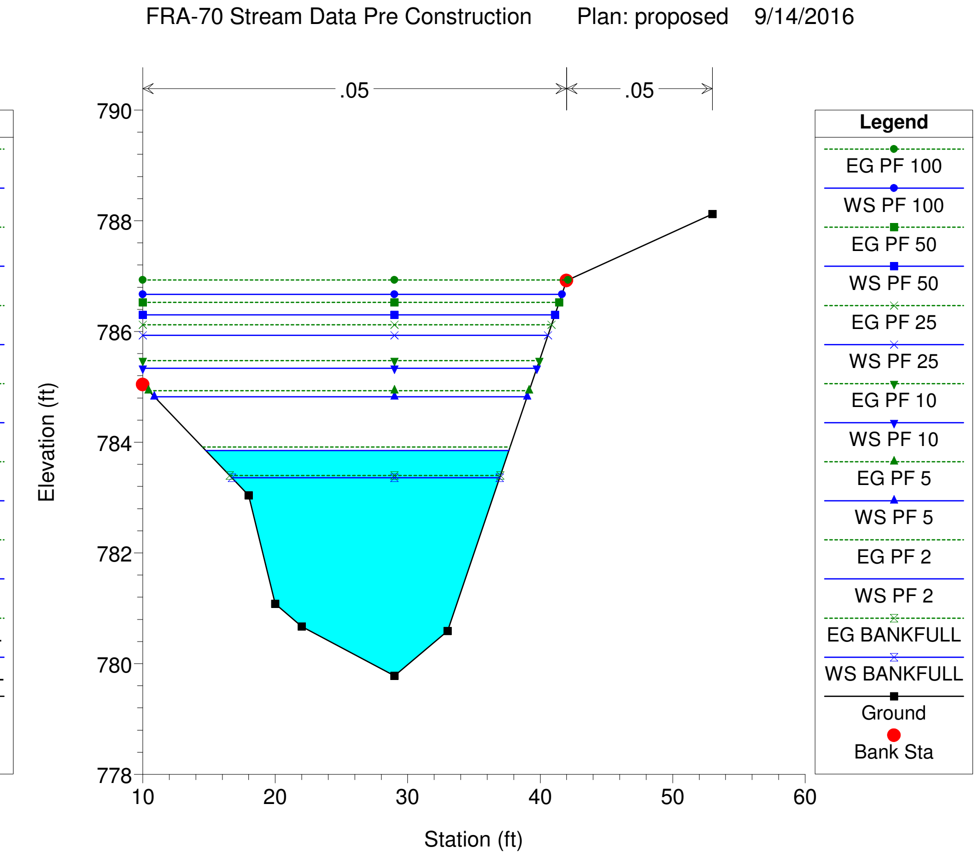
EG PF 50
WS PF 50
EG PF 25
WS PF 25
EG PF 10
WS PF 10
EG PF 5
WS PF 5
EG PF 2
WS PF 2
EG BANKFULL
WS BANKFULL
Ground
Bank Sta
Elevation (ft)
790
788
786
784
782
780
10
15
20
25
30
35
40
45
50
Station (ft)


FRA-70 Stream Data Pre Construction Plan: proposed 9/14/2016
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Legend
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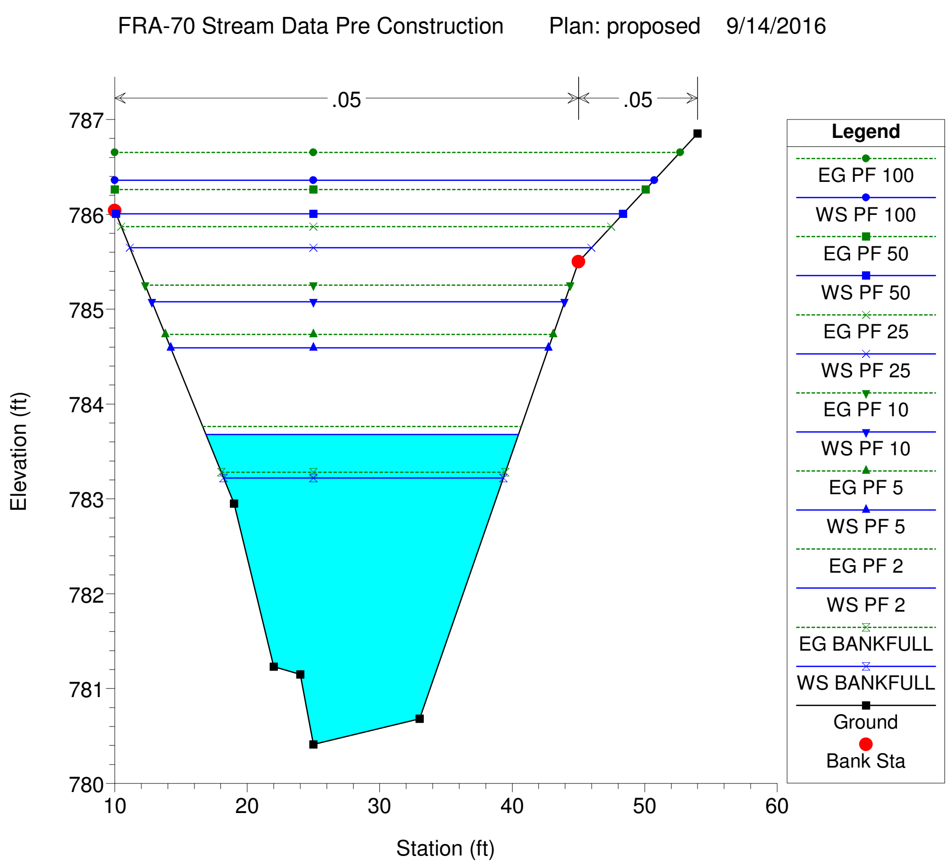
EG PF 50
WS PF 50
EG PF 25
WS PF 25
EG PF 10
WS PF 10
EG PF 5
WS PF 5
EG PF 2
WS PF 2
EG BANKFULL
WS BANKFULL
Ground
Bank Sta
Elevation (ft)
790
788
786
784
782
780
778
10
20
30
40
50
60
Station (ft)


FRA-70 Stream Data Pre Construction Plan: proposed 9/14/2016
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.05
Legend
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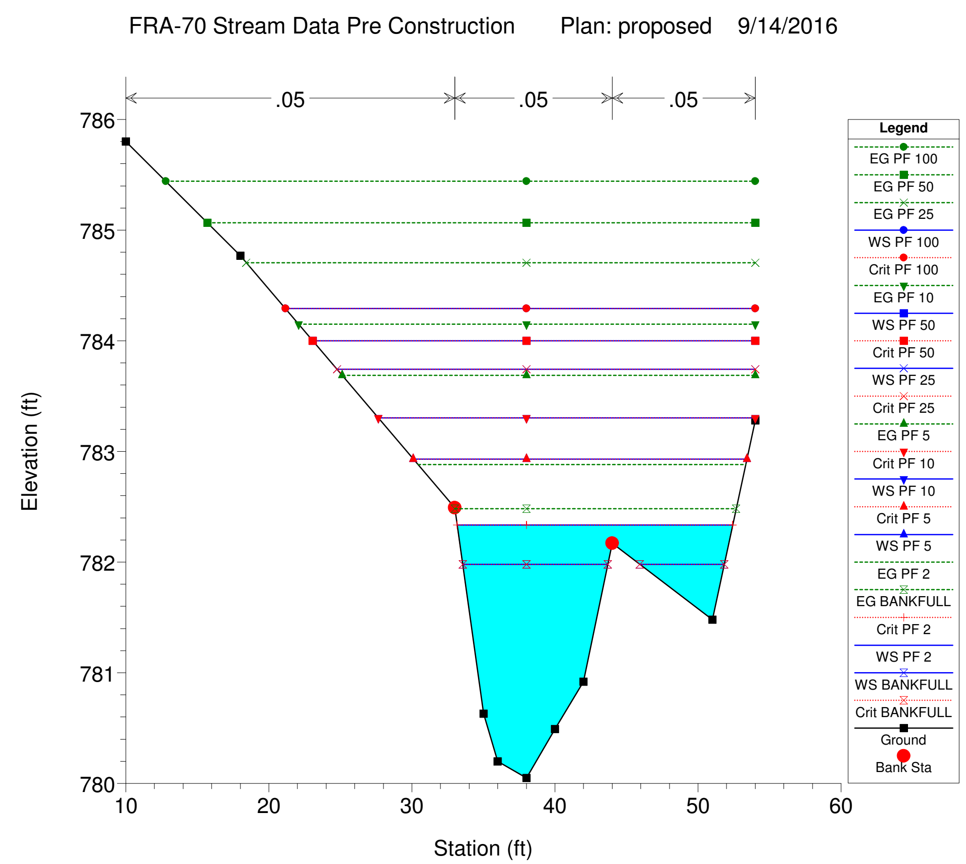
WS PF 100
EG PF 50
WS PF 50
EG PF 25
WS PF 25
EG PF 10
WS PF 10
EG PF 5
WS PF 5
EG PF 2
WS PF 2
EG BANKFULL
WS BANKFULL
Ground
Bank Sta
Elevation (ft)
787
786
785
784
783
782
781
780
10
20
30
40
50
60
Station (ft)


FRA-70 Stream Data Pre Construction Plan: proposed 9/14/2016
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.05
.05
Legend
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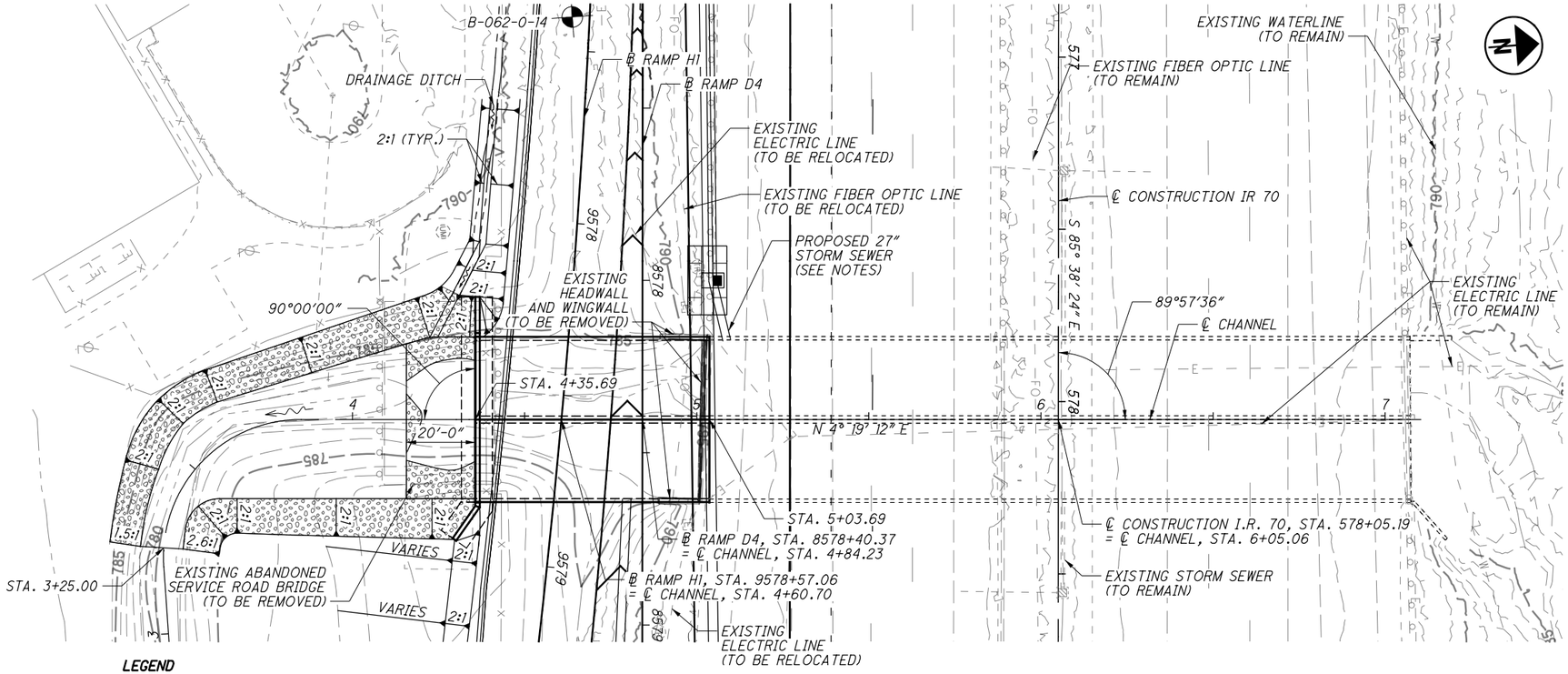
EG PF 50
EG PF 25
WS PF 100
Crit PF 100
EG PF 10
WS PF 50
Crit PF 50
WS PF 25
Crit PF 25
EG PF 5
Crit PF 10
WS PF 10
Crit PF 5
WS PF 5
EG PF 2
EG BANKFULL
Crit PF 2
WS PF 2
WS BANKFULL
Crit BANKFULL
Ground
Bank Sta
Elevation (ft)
786
785
784
783
782
781
780
10
20
30
40
50
60
Station (ft)

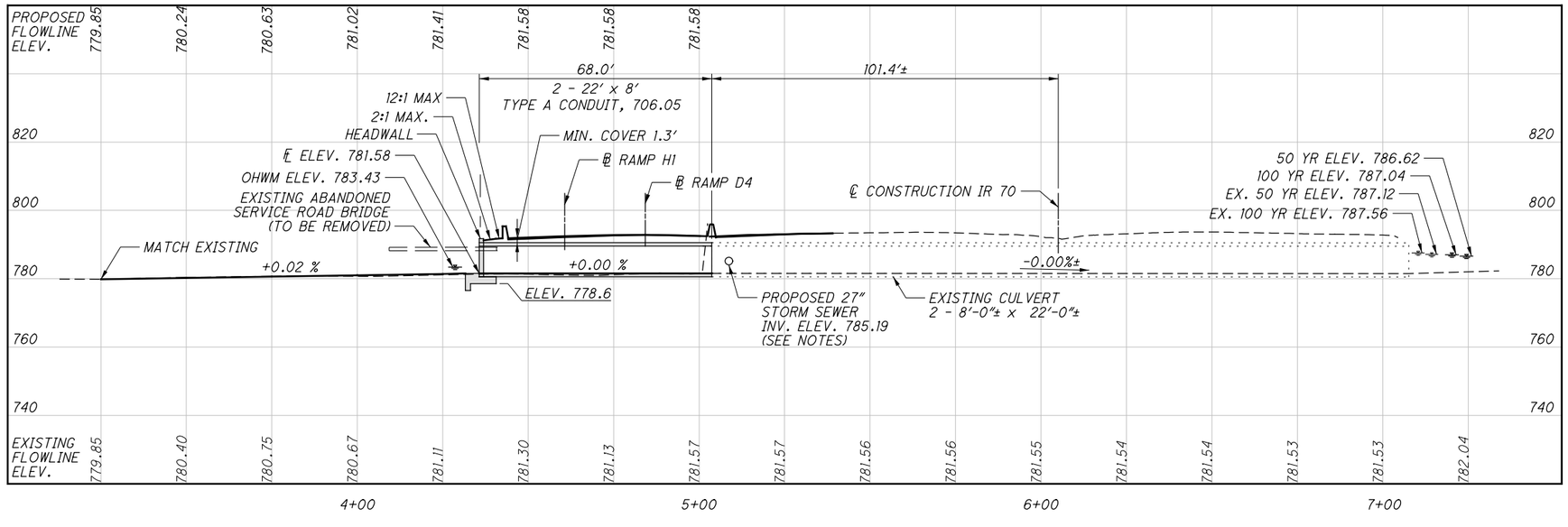
Appendix E. Stage 1 Plan Proposed Sheets



LEGEND

- LIMITS OF TYPE C ROCK CHANNEL PROTECTION

PLAN



PROFILE

BENCHMARK DATA

BM #5 STA. 562+83.78, ELEV. 789.47, OFFSET 258.15' RT.,
℄ CONSTRUCTION IR 70, CONCRETE MONUMENT
BM #8 STA. 599+83.71, ELEV. 800.43 OFFSET 146.25' LT.,
℄ CONSTRUCTION IR 70, CONCRETE MONUMENT

FOR ADDITIONAL BENCHMARK INFORMATION. SEE ROADWAY PLAN SHEET 3/635

NOTES

EARTHWORK LIMITS SHOWN ARE APPROXIMATE. ACTUAL SLOPES SHALL CONFORM TO PLAN CROSS SECTIONS.

PROPOSED 27" STORM SEWER SHALL TERMINATE THROUGH THE SIDE OF THE EXISTING BOX CULVERT

BORING LOCATIONS			
BORING	STA.	OFFSET	TOP/ROCK
B-062-0-14	4+64	116.9' LT.	N/A

EXISTING STRUCTURE
TYPE: 2 - 8'x22'± CONCRETE BOX CULVERTS
SKEW: 00°02'24"± R.F.
ALIGNMENT: TANGENT
CONDITION: GOOD

PROPOSED STRUCTURE
TYPE: 2 - 8'x22' CONCRETE BOX CULVERTS
SKEW: 00°02'24" R.F.
ALIGNMENT: TANGENT

HYDRAULIC DESIGN DATA	
DRAINAGE AREA =	488 AC.
Q_{50} =	483 CFS
Q_{100} =	574 CFS
ORDINARY HIGH WATER MARK =	783.44 FT

	EXISTING	PROPOSED
HW_{50} =	787.12 FT	786.62 FT
HW_{100} =	787.56 FT	787.04 FT
V_{50} =	2.2 FPS	1.7 FPS
V_{100} =	2.4 FPS	1.8 FPS

CONDUIT DESIGN DATA	
pH =	8.0
SERVICE LIFE =	75 YEARS
ABRASIVE SITE =	NO

DESIGN AGENCY
HDR ENGINEERING, INC.
2800 CORPORATE EXCHANGE DR.
SUITE 100
COLUMBUS, OHIO 43231
614-839-5770

DESIGNED JTW | DRAWN JTW | REVIEWED DWW | DATE 8/30/16 | CHECKED BTA | REVISED | STRUCTURE FILE NUMBER 2505681

SITE PLAN
BRIDGE NO. FRA-70-2374
IR 70, RAMP D4 AND RAMP H1 OVER DRAINAGE DITCH

FRA-70-22.61
PID No. 95639

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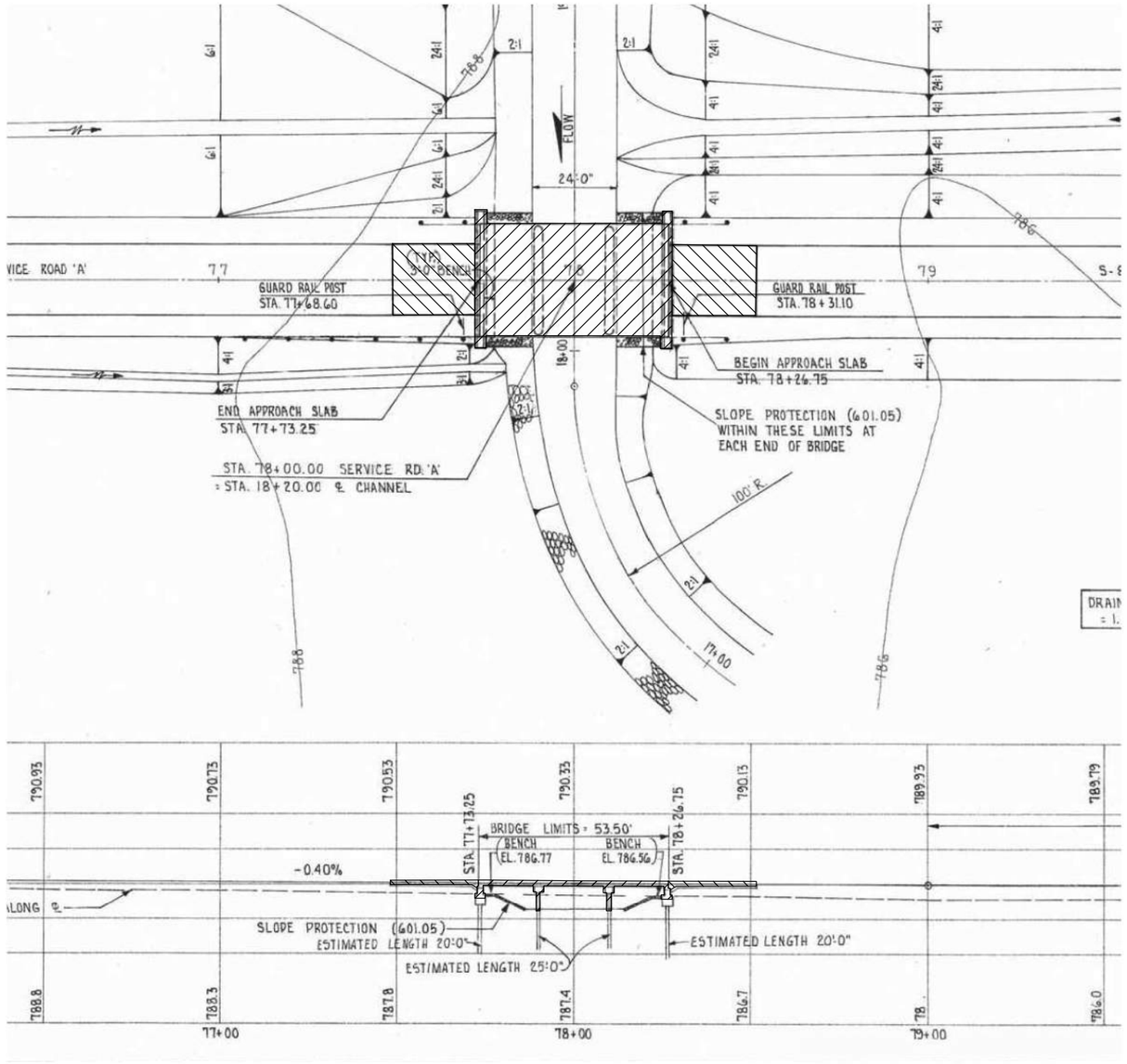
608
635



PROPOSED STRUCTURE

TYPE: CONTINUOUS REINFORCED CONCRETE SLAB WITH CAPPED PILE SUBSTRUCTURE
SPAN: 16.0'- 20.0'-16.0'
ROADWAY: 32'-0" F/F GUARD RAIL
LOAD FREQUENCY RATING: CF 130 (57)
SKEW: NONE
ALIGNMENT: TANGENT
WEARING SURFACE: 1" MONOLITHIC CONCRETE
APPROACH SLAB: 25'-0" LONG AS-1-54

DODSON, KINNEY & LINDBLOM
CONSULTING ENGINEERS
COLUMBUS, OHIO

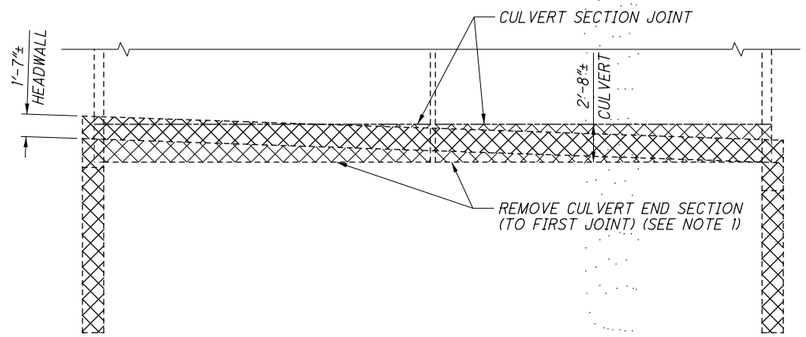
SITE PLAN

BRIDGE NO. FRA-70-2280A
PROPOSED SERVICE RD. "A" OVER
DRAINAGE DITCH

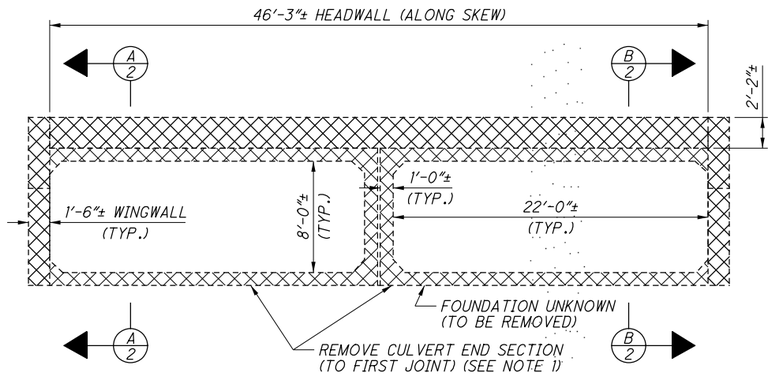
SEC. FRA-70-21.29
SCALE: 1" = 20'
PROPOSED SERVICE RD. "A"
STA. 78+00

EXISTING BRIDGE REMOVAL

(ON ABANDONED SERVICE ROAD)

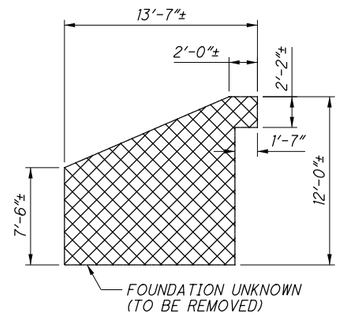


EXISTING SOUTH HEADWALL PLAN

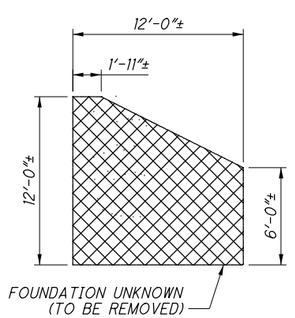


EXISTING SOUTH HEADWALL ELEVATION

(ROADWAY BARRIER NOT SHOWN)



VIEW A-A



VIEW B-B

LEGEND

- LIMITS OF AREA TO BE REMOVED PER ITEM 202 STRUCTURE REMOVED, OVER 20 FOOT SPAN
- LIMITS OF AREA TO BE REMOVED PER ITEM 202 APPROACH SLAB REMOVED
- LIMITS OF AREA TO BE REMOVED PER ITEM 202 HEADWALL REMOVED

NOTE:

1. REMOVE END CULVERT SECTION FROM BOTH BARRELS. CULVERT REMOVAL TO BE INCLUDED WITH ITEM 202 HEADWALL REMOVED, AS PER PLAN

DESIGN AGENCY
HDR ENGINEERING, INC.
2800 CORPORATE EXCHANGE DR.
SUITE 100
COLUMBUS, OHIO 43231
614-839-5770

DESIGNED	DRAWN	REVIEWED	DATE
JTW	JTW	DWW	8/30/16
CHECKED	REVISED	STRUCTURE FILE NUMBER	
BTA		2505681	

REMOVAL DETAILS
BRIDGE NO. FRA-70-2374
IR 70, RAMP D4 AND RAMP H1 OVER DRAINAGE DITCH

FRA-70-22.61
PID No. 95639

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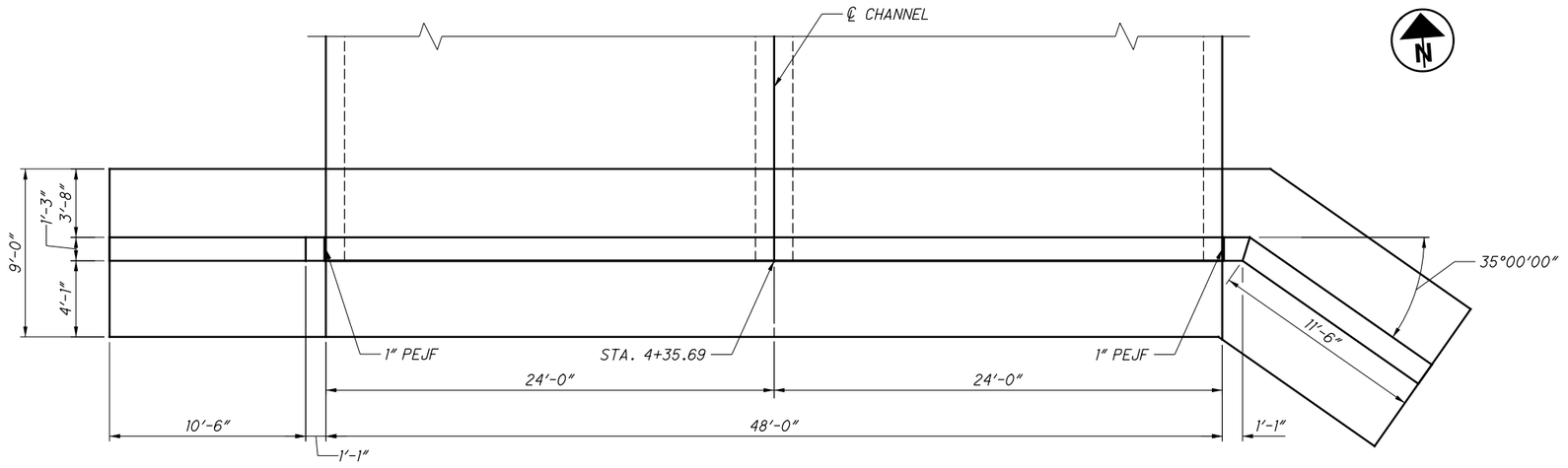
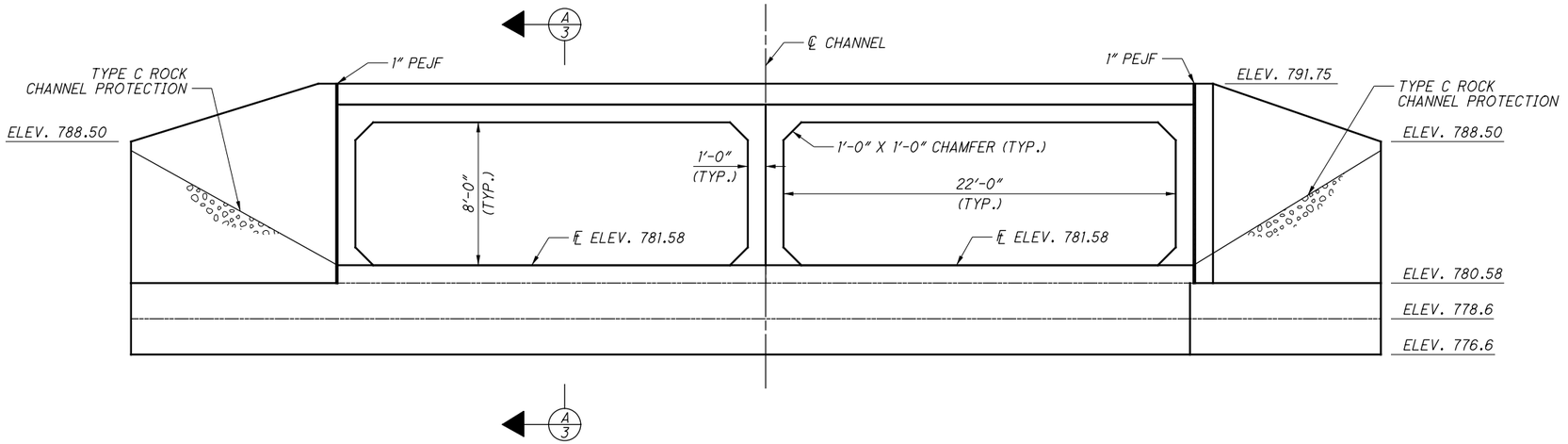
635

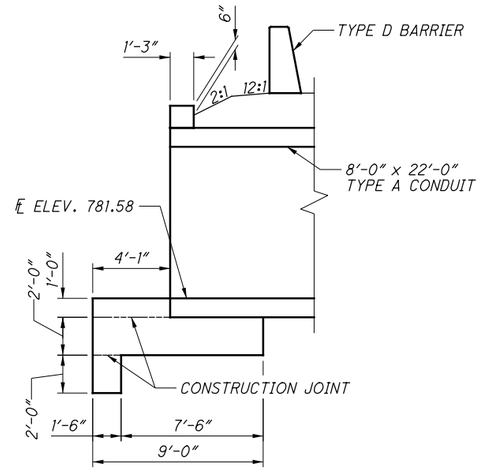


PLAN



ELEVATION

(TYPE D BARRIER NOT SHOWN)



SECTION A-A

DESIGN AGENCY
HDR ENGINEERING, INC.
2800 CORPORATE EXCHANGE DR.,
SUITE 100
COLUMBUS, OHIO 43231
614-839-5770

DESIGNED	DRAWN	REVIEWED	DATE
JTW	JTW	DWW	8/30/16
CHECKED	REVISED	STRUCTURE FILE NUMBER	
BTA		2505681	

HEADWALL DETAILS

BRIDGE NO. FRA-70-2374

IR 70, RAMP D4 AND RAMP H1 OVER DRAINAGE DITCH

FRA-70-22.61

PID No. 95639

3 / 3

610
635

Appendix J – LD-33

Form LD-33

Revised July 2011

Ohio Department of Transportation
County Engineer
Approval Form

Date Submitted to District: 8/6/2021

Date Submitted to County Engineer:

County - Route - Section: FRA-70-22.61

PID: 95639

Station	Size & Type	Culvert Invert Elevation		Existing Channel Elevation		Skew	Notes
		Inlet	Outlet	Inlet	Outlet		
IR 70 606+42.82	5'x9' box	801.13	800.53	801.13	800.53	0	extention
Ramp C1 6007+00	42"	769.18	767.70	N/A	N/A	0	new culvert
Ramp C1 6073+41	48"	783.09	781.70	783.09	781.89	25°52'52"	replace size increase