STORMWATER ANALYSIS
FOR

The Grove 2 Apartments
Salem, Oregon

February 22, 2021

Renew date: 6.30.2021

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INTRODUCTION

The Grove 2 project consists of two project sites located off Strong Road and Reed Road in Salem, Oregon. The East property is located along Reed Road, just east of The Grove Apartments. The East property is approximately 5.816 acres, with 78 units, 149 parking stalls, 1 trash unit, 2 play areas, and 1 mail center. The West property is located along Strong Road and the south side of Lindburg Road. The West property is approximately 4.294 acres, with 99 units, 179 parking stalls, 2 trash units, 1 play area, and 1 mail center. An aerial image can be seen below, with the East property outlined in GREEN and the West property outlined in BLUE:

Figure 1: Aerial image of project with properties outline in blue (West) and green (East).

The proposal includes the development of 16 apartment buildings (177 apartment units), 327 parking stalls, 2 covered mailbox, 3 trash enclosures, 3 recreation play area, and the necessary stormwater facilities.

Because this property is located within the Fairview Refinement Plan, there are some extra requirements put on the area regarding stormwater. This report will provide the stormwater analysis details to show compliance with the Fairview Refinement Plan.

SITE CONDITIONS

The East property contains 253,347 square feet (5.816 acres) and the West Property contains 187,066 square feet (4.294 acres), for a total of 440,413 square feet (10.11 acres) of vacant land. The topography of the East property slopes from the west to the east, with the slope increasing the closer the property gets to Reed Road. The average slope across the property is 2.68 percent. The existing ground cover is a mixture of grass and weeds along with several large trees. The majority of these trees are to be retained and the land around them will be undeveloped. The West property has a greater average slope of 6.9%, with the high point on the south property line and draining towards the north and the east. The existing groundcover for the West property is tall grass and weeds, which would be classified as "pasture". The property is bounded by undeveloped land on all sides. No hazardous activities are known to have taken place on this property in the past.

Preliminary soils information was obtained from the Natural Resources Conservation Service Web Soil Survey. A screen shot can be seen below:

Marion County Area, Oregon (OR643)

Marion County Area, Oregon (OR643)

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
MaA	McAlpin silty clay loam, 0 to 3 percent slopes	7.5	9.6%
NeC	Nekia silty clay loam, 7 to 12 percent slopes	4.1	5.3%
NeE	Nekia silty clay loam, 20 to 30 percent slopes	1.8	2.3%
SnB	Santiam silt loam, 3 to 6 percent slopes	31.2	39.7%
SuC	Silverton silt loam, 2 to 12 percent slopes	33.4	42.4%
SuD	Silverton silt loam, 12 to 20 percent slopes	0.6	0.8%
Totals for Area of Interest		78.8	100.0%

Figure 2: Web Soil Survey output for the site area.

The results of the NRCS Web Soil Survey indicate that there are three soil types located across the two properties: Santiam Silt Loam, Silverton silt loam, and McAlpin Silty Clay. The preliminary soil information indicates the site contains moderately well-draining soils, which is confirmed by the infiltration tests discussed below. A site with moderately well-draining soils may allow for the infiltration of stormwater. While the Fairview Refinement Plan indicates that stormwater should be infiltrated into the native soil, this is not always possible. The Fairview Refinement plan based this requirement off an infiltration rate of 3.1 inches per hour. However, infiltration tests performed on both sites showed a much lower infiltration rate for the native soil.

The Fairview Refinement Plan calls for the stormwater to be infiltrated onsite for storms up through the 20-year storm event. This requirement was based on the assumption that the soil had an infiltration rate 3.1 inches per hour. A geotechnical report has been prepared for this project. As a part of that report,

the infiltration rate was measured in 4 test pits and found to be 1.0 inches per hour in two pits and 0.7 inches per hour in the other two pits. This is considerably less than stipulated in the Fairview Refinement plan. Both sites also have considerable topography constraints, with portions of the sites having slopes of 6-10%. It is possible that water can infiltrate into the soil, but not at a rate great enough to allow for complete disposal of stormwater up to the 20-year event. The Fairview Refinement Plan Section 23A states "Private on-site detention requirements will satisfy City of Salem standards only if infiltration of the 20-year storm cannot be achieved". Based on the measured infiltration rates of the sites and the topography, infiltration of the 20-year storm cannot be achieved and this section of the Fairview Refinement Plan would apply. The stormwater design for The Grove 2 will meet the current City of Salem Design Standards of treating the new hard surface and providing detention for ½ the 2, the 10, the 25, and the 100-year storm events to the predeveloped rates.

There are several trees located throughout the property. The property owner has made considerable effect to comply with the Fairview Refinement Plan to preserve all the required trees and more. Ample open space is allotted around the remaining trees to ensure the development will not harm the vegetation. Large portions of the East site are to be fenced off during construction to prevent any disturbance of the trees, vegetation, and soil.

On the East property, leaving large areas of property undeveloped helps protect the trees. However, this limits the space available for the number stormwater facilities that would be required to meet the Refinement Plan's goal of infiltrating all the runoff for up to the 20-year storm event. The remaining buildings and infrastructure must be put closer together on the remaining land. And the remaining areas that could be used for stormwater are either uphill or in the area to be left undisturbed.

The West property has a unique shape. There are fewer trees and vegetation to preserve, but considerable slope in the larger areas with space for facilities. Given the slope and the shape, it would be difficult to provide enough flat areas to allow for large amounts of infiltration.

Upstream basins are being picked up and routed into the public system along the public streets. The runoff from these upstream properties does not drain onto the proposed property.

A National Pollution Discharge Elimination Systems (NPDES) permit and other City permits are required prior to grading for the project. No other state or federal permits are required for this project.

Groundwater was addressed as part of the Geotechnical Report prepared for this site. The following information was stated in that report:

> *Groundwater was not encountered in any of our explorations conducted at the site on September 25, 2020. We reviewed the well logs in the vicinity. Based on our review of water well logs available on the Oregon Water Resource Department website, groundwater depths near the site ranged from about 29 feet to 63 feet bgs [below ground surface]. It should be noted that groundwater levels are relative to the ground surface and due to local topography; the levels reported on the logs are considered generally indicative of local water levels and may not reflect actual groundwater levels at the site.*

The property had several agricultural buildings and fields located on it from the mid 1930s to the 1960s. In the late 1960s the property was redeveloped as a part of the Fairview Training Center and Hospital and this property was developed with dormitories. By 2010, all the buildings except for the Chapel had been demolished. A Level 1 Environmental Assessment was completed for this property. No known hazardous materials were noted in that report.

Table 1: Predevelopment Catchment Summary Table

Pre-Developed Catchment Summary							
Property	**Catchment**	**Source**	**Impervious Area (ft^2)**	**Pervious Area (ft^2)**	**Ownership**	**Curve Number**	**Tc (min)**
East	East Site	Predeveloped		219863	Private	72	52.5
West	West Site	Predeveloped		186478	Private	72	34

EXPLANATION OF DESIGN

The Fairview Refinement Plan dictates that stormwater from projects located within the refinement plan must infiltrate all stormwater generated. However, the Refinement Plan does make provisions for sites were infiltration is not adequate to dispose of that quantity of stormwater. The Fairview Refinement Plan Section 23A states "Private on-site detention requirements will satisfy City of Salem standards only if infiltration of the 20-year storm cannot be achieved".

Because of the lower infiltration rates as well as the topography, the proposal is to provide water quality as well as detention to the predeveloped conditions for the ½ the 2, the 10, the 25, and the 100 year storm events.

The properties will be split into smaller basins, each of which will drain into a specific stormwater facility via surface drainage. The West property has two subbasins, with half the property draining to a rain garden located near Lindberg Road and the other half draining to a planter box and underground detention pipe situated near Strong Road. The East property has three subbasins, each draining to a planter box sized to treat and detain the runoff.

Each facility consists of two main components: (1) the growing media and surface storage above the growing media and (2) the drain rock located beneath the growing media, on top of the native soil. Water quality will be provided as the stormwater flows through the growing media. The growing media and surface storage above the growing media must therefore be sized large enough to allow all of the water quality event to flow through the growing media, in order to meet the water quality requirements.

Water quantity is provided through detaining stormwater to allow for the stormwater to leave at the predeveloped flowrate. This detention volume is achieved through storage within the facilities as well as

the drain rock below. Each facility has two overflows. The first overflow is a rock box, used to help larger flows bypass the growing media to access more storage within the drain rock. The overflow consists of a concrete box filled with clean, open graded drain rock that extends to the top of the drain rock. Stormwater is able to be stored within the facility until it reaches the RIM elevation of the rock overflow box, at which time it spills into the rock and down into the rock gallery. The runoff is able to disperse through the drain rock into the rock gallery and infiltrate into the soil. A perforate pipe extends the length of the facility horizontally in the top of the drain rock. This is done to encourage infiltration into the native soil. When the volume of water produced exceeds the infiltration and storage capacity of the drain rock and surface storage above the growing media, the runoff will then leave through the perforate pipe. A clean out is provided at the end of the perforated collection pipe for access.

For the purposes of the final design, each facility and the area draining to it were looked at individually. All the hydrographs will be attached to the Appendix.

Table X shows the results of the proposed analysis for the ½ the 2, the 10, the 25, and the 100 year storm events. This table shows that the proposed design is able to achieve the requirement of not exceeding the predeveloped flowrate for all storm events.

Table 2: Pre and Post Allowable Flowrate Summary

Property	Facility	Peak Flowrate (cfs)							
		1/2 - 2 Year		10 Year		25 Year		100 Year	
		Pre	Post	Pre	Post	Pre	Post	Pre	Post
East	Undetained	0.02	0.00	0.40	0.17	0.56	0.23	0.95	0.37
	Multi Use Path		0.00		0.00		0.00		0.00
	PB 1		0.00		0.09		0.09		0.19
	PB 2		0.00		0.09		0.13		0.29
	PB 3		0.00		0.04		0.04		0.07
	East TOTAL		**0.00**		**0.39**		**0.49**		**0.92**
West	Undetained	0.01	0.00	0.40	0.01	0.58	0.02	0.98	0.03
	PB 1		0.00		0.18		0.25		0.46
	PB 2		0.00		0.14		0.22		0.47
	West TOTAL		**0.00**		**0.33**		**0.49**		**0.96**

STORMWATER ANALYSIS

The analysis for the stormwater was done using HydroCAD 10.00, with the Santa Barbara Unit Hydrograph and a Type 1A rainfall distribution. A design infiltration rate for the native soil is 0.70 inches per hour. The design infiltration rate through the growing media of the rain gardens is 2.0 inches per hour. The HydroCAD schematics can be seen below:

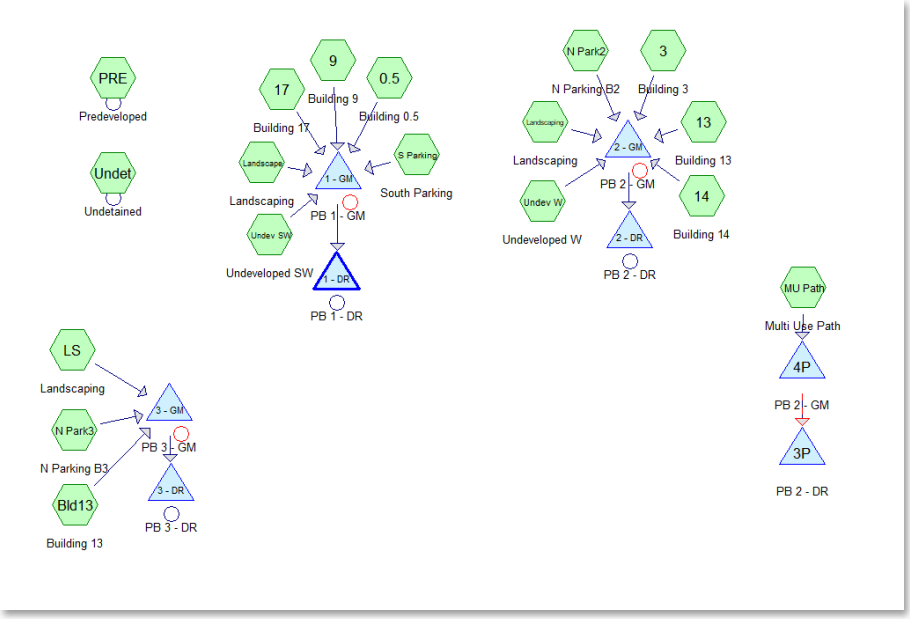


Figure 3: HydroCAD Schematic for East property.

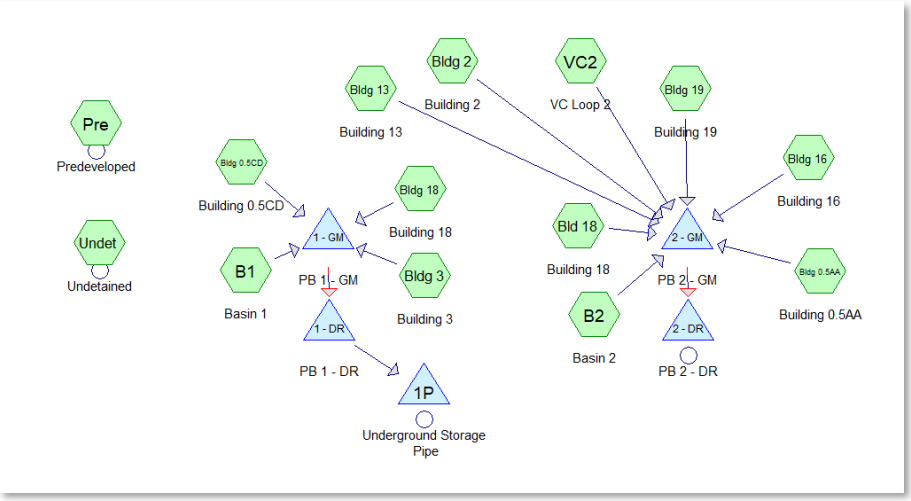


Figure 4: HydroCAD schematic for West property.

Predeveloped analyses were done to calculate the maximum allowable flowrate for each property. A time of concentration was calculated for each property. The time of concentration was calculated to be 52.5 minutes for the East property and 34 minutes for the West property. Both properties were assigned a predeveloped curve number of 72 (for City of Salem Pre-developed HSG C). The predeveloped allowable runoff for the properties for all required storm events can be found in Table X below.

Table 3: Predeveloped Flowrate for design storms

Storm Event	Predeveloped Flowrate (cfs)	
	East	West
0.5-2	0.02	0.01
10	0.4	0.4
25	0.56	0.58
100	0.95	0.98

Each facility was designed through three nodes within HydroCAD. The basin node summarizes all the stormwater generating surface directed to each facility. This includes parking lot, sidewalk, lawn, and roof area. This node is then routed to a growing media facility node. The growing media node specifies the detention volume of the facility, with the primary outlet being infiltration through the growing media at 2 inches per hour. Each facility has been designed to ensure it can infiltrate/treat the entire water quality event.

As the water quality event is exceeded, the water depth will build up to 18 inches above the growing media, at which point the stormwater will flow into the secondary outlet known as the rock box. The rock box diverts the water around the growing media and into the drain rock located below. The rock box has overall dimensions of 4 feet long by 1 foot wide. It is filled with drain rock with a void ratio of at least 30%. These dimensions give the same overall opening area equivalent to a 7-inch circular pipe, which is used in the analysis as the opening for the secondary orifice. Both outlets flow into the drain rock node.

Allowing the water to bypass the growing media allows for the rain gardens to be smaller, not using the open space for detention but rather other recreational uses. The drain rock area has a specified void ratio of 36% and a depth of 4 foot. This facility node specifies the facility volume, the void ratio in the facility, the infiltration rate into the native soil (modeled as a discarded outlet), as well as the elevation of the perforated pipe.

An emergency outlet is provided in each facility. The RIM elevation for the emergency outlet is based on the 100-year water depth in each facility, since the emergency outlet must be above that design water depth.

Special Note:

- The pervious path is analyzed with a curve number of 98, assuming it is impervious. However, the pervious concrete would actually have a curve number closer to the curve number of the native soil. Using a curve number for an impervious surface gives an overestimate for the runoff generated from the multi-use path. The hydrographs in the appendices show that the runoff is able to be completely stored in the drain rock located under the pervious concrete.

- Planter Box 1 on the West property is constrained by the property line and building setbacks. Because the planter box is not able to be expand to provide more detention, underground detention pipe is proposed to help provide the required detention to limit the flowrate leaving the property. The perforated underdrain in the planter box is routed to the 48 inch underground detention pipe. A four inch orifice is located 2.5 feet off the bottom of the detention pipe. Outflow for this planter box and water depth within Planter Box 1 is based on this design.

Basin maps can be seen in Appendix A. The separation of the basins is based on the proposed grading for the development. The post-developed facility summary table is on the following page. Each site is evaluated separately, and each is designed to provide detention to the pre-developed flowrates.

Table 4: Post-developed summary table

Property	Facility Name	Contributing Areas	Source	Impervious Area (ft^2)	Pervious Area (ft^2)	T_c (min)	Ownership	Facility Type	Area (ft^2)	CN
East	Undetained		Lawn, Landscaping		41113	5	Private	Undetained	N/A	73
	Pervious Path	Multi Use Path	Pervious Concrete Path	4624		5	Private	Pervious Concrete	4624	98
	Planter Box 1	Undeveloped SW	Undeveloped Land		46555	35.7	Private	Private Infiltration Planter Box	3008	72
		Landscaping	Lawn, Landscaping		4534	5				74
		Building 26	Roof	3520		5				98
		Building 24	Roof	5456		5				98
		Building 25	Roof	2672		5				98
		South Parking	Parking and Sidewalk	20347		5				98
	Planter Box 2	Undeveloped W	Undeveloped Land		8709	5	Private	Private Infiltration Planter Box	2482	72
		Landscaping	Lawn, Landscaping		16359	5				74
		N Parking	Parking and Sidewalk	24838		5				98
		Building 23	Roof	5360		5				98
		Building 22	Roof	5024		5				98
		Building 21	Roof	6688		5				98
	Planter Box 3	Building 20	Roof	5024		5	Private	Private Infiltration Planter Box	1436	98
		North Parking	Parking and Sidewalk	16757		5				98
		Landscaping	Lawn, Landscaping		2283	5				74
	TOTAL			**100310**	**119553**					
West	Undetained		Lawn, Landscaping		3062	5	Private	Undetained	N/A	74
	Planter Box 1	Basin 1	Planter Box, Landscaping, Parking Lot and Sidewalk	33861	28956	5	Private	Private Infiltration Planter Box	1229	87
		Building 33	Roof	2512		5				98
		Building 34	Roof	4799		5				98
		Building 35	Roof	5435		5				98
	Planter Box 2	Basin 2	Planter Box, Landscaping, Parking Lot and Sidewalk	21385	43324	5	Private	Private Infiltration Rain Garden	4519	88
		Building 30	Roof	4799		5				98
		Building 32	Roof	5024		5				98
		Building 31	Roof	6010		5				98
		VC Loop 2	Landscaping and Roadway	9515	2181	5				94
		Building 29	Roof	6917		5				98
		Building 27	Roof	6010		5				98
		Building 28	Roof	2688		5				98
	TOTAL			**108955**	**77523**					

EAST PROPERTY: PLANTER BOX 1

Plater Box 1 treats and detains about 83,084 square feet of project area, consisting of Buildings 24-26, parking lot, sidewalk, and landscaped area/lawn. This results in approximately 31,995 square feet of impervious surface as well as 51,089 square feet of lawn/landscaped area/undeveloped area. The corresponding curve numbers for these land use types are 98 for impervious surfaces, 74 for landscaping/lawn, and 72 for the portion of land fenced off as undisturbed. Because the basin areas are relatively small, a time of concentration of 5 minutes was used for the developed areas and calculated to be 35.7 minutes for the undeveloped portion of property.

The proposed planter box has a bottom area of 3000 square feet and an overall depth of 2 feet. These areas were used in the water quality facility geometry input, with a primary outlet being infiltration through the growing media at 2 inches per hour and a secondary outlet (rock box) located 1.5 feet above the bottom of the planter box.

The planter box is designed to provide treatment for the water quality event. This is shown in the hydrograph below:

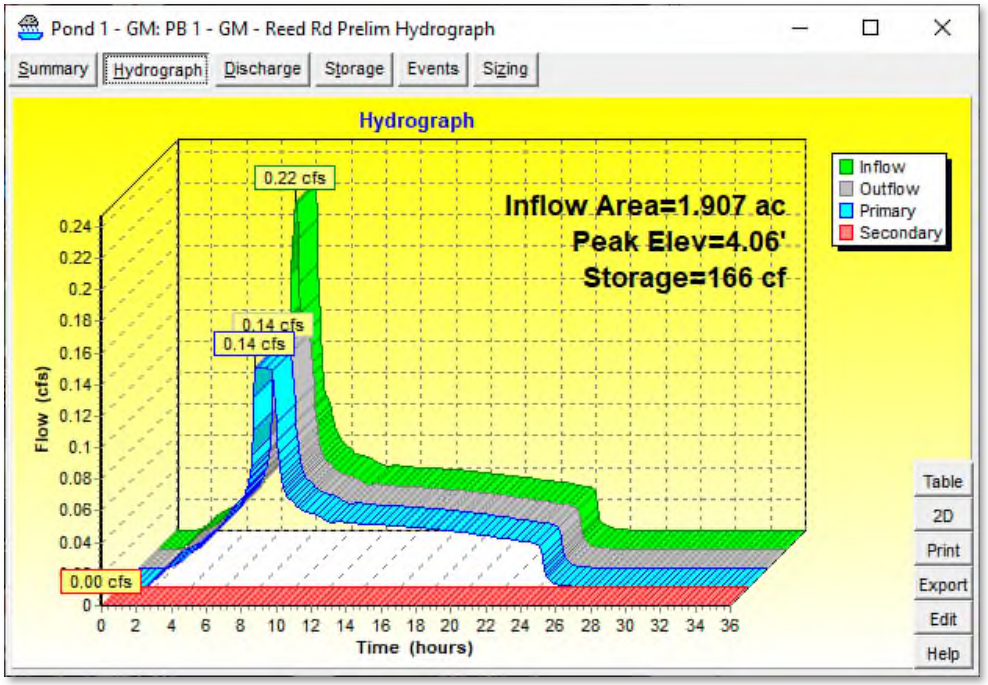


Figure 5: Rain Garden 1 - Water Quality Event through the growing media.

The hydrograph shows that all the stormwater entering the rain garden is leaving the facility through the primary outlet (BLUE line). This means that all the stormwater is infiltrating through the growing media. The hydrograph below demonstrates that the water flowing through the growing media then is stored in the drain rock until it is able to fully infiltrate into the native soil (RED line). The facility is empty by storm

hour 26. All of the runoff for the water quality event is able to infiltrate into the native soil, with no water leaving the site.

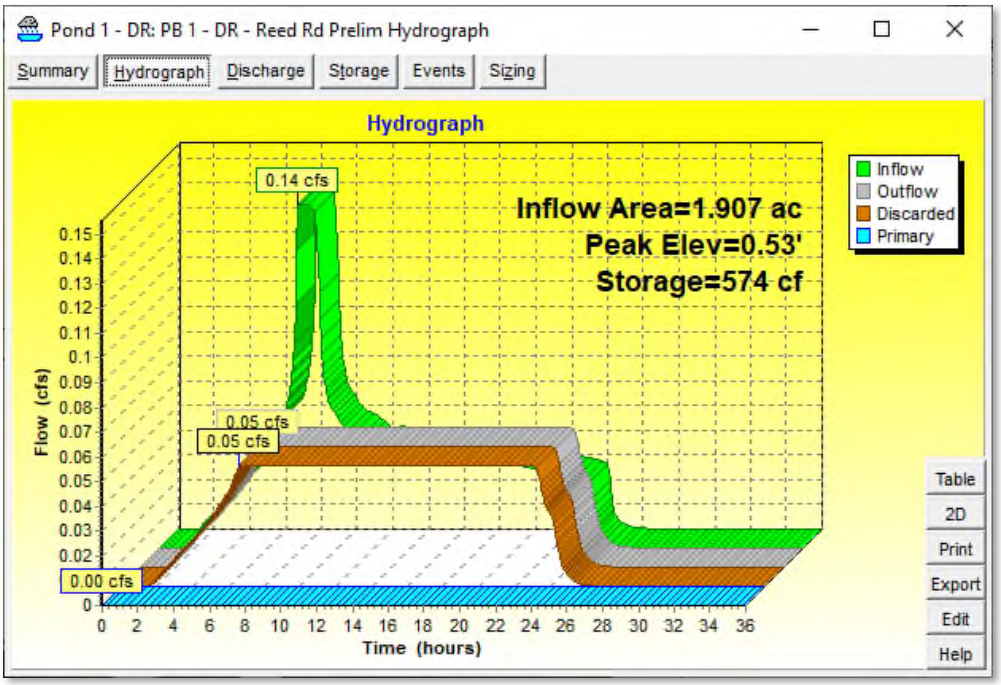
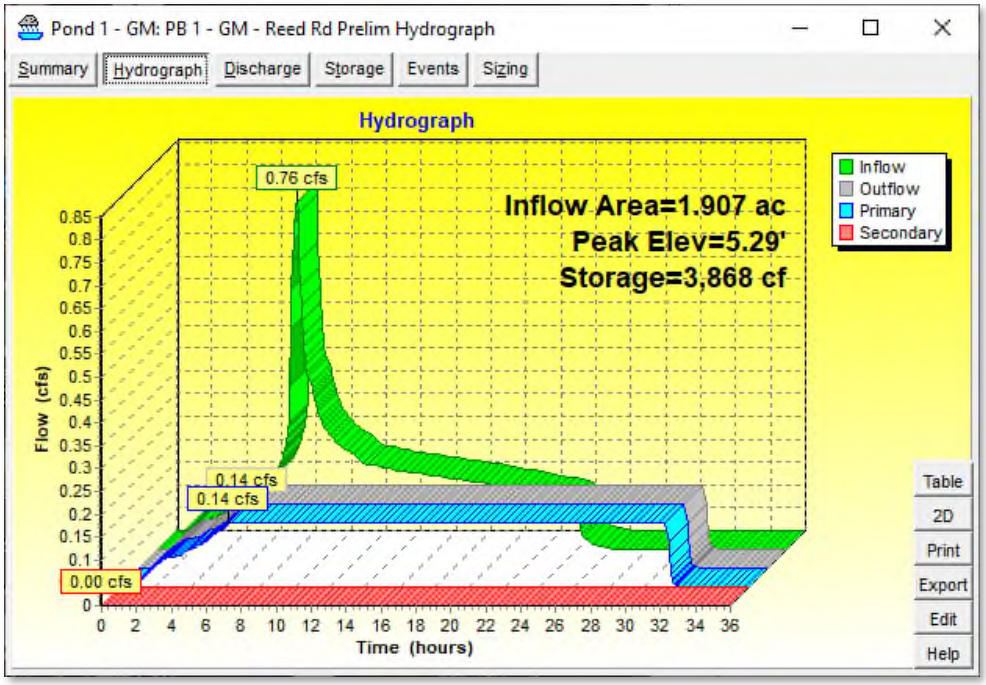


Figure 6: Rain Garden 1 - Water Quality Event in Drain Rock.

During storm events in excess of the water quality event, water will be stored within the rain garden until it reaches a depth of 18 inches. After the depth reaches 18 inches, it will flow into the rock box and be diverted past the growing media into the drain rock storage area. This larger storage area allows the larger event to be stored while it infiltrates into the native soil. The hydrographs below shows the planter box facility during the 25 year event.

The first hydrograph shows the planter box above the growing media. The stormwater is stored within the planter box while it infiltrates through the growing media. No water enters the rock box to bypass the growing media.

The second hydrograph shows the stormwater within the drain rock. At approximately storm hour 15, the runoff exceeds the ability of the native soil to infiltrate and it begins to leave through the perforated pipe at the top of the drain rock. These hydrographs demonstrate that the planter box is able to provide detention and limit the flow leaving during the 25 year storm event. Of the 0.76 cfs that comes into the planter box, only 0.09 cfs leaves.



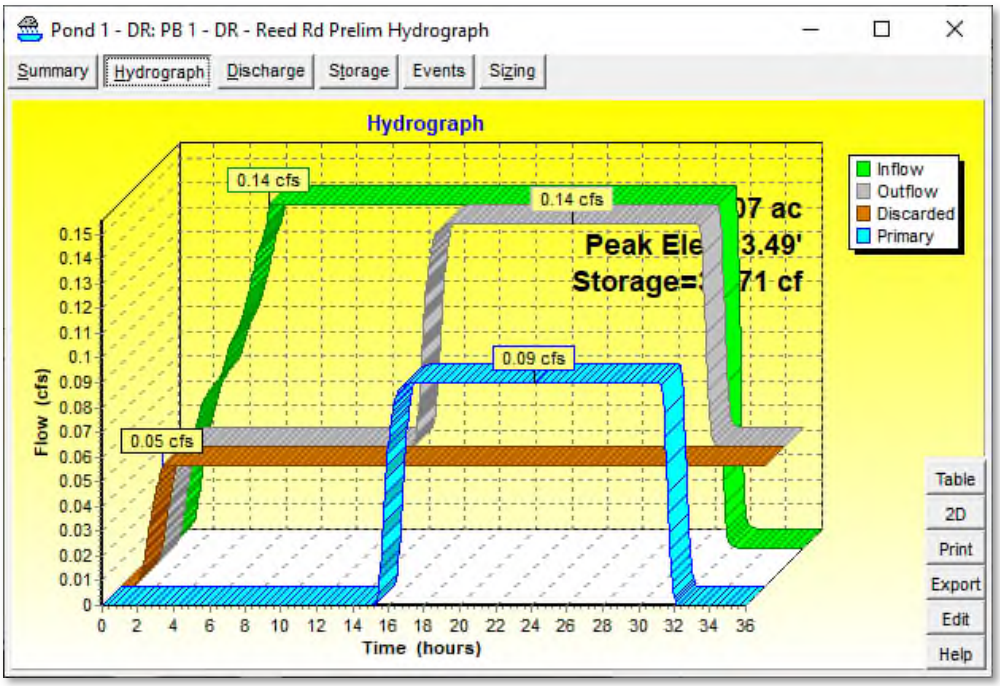


Figure 7: Rain Garden 1 - 25 year Event Rock Gallery

The 100 year storm hydrographs are shown below. First, the planter box hydrograph is shown with a water depth within the rain garden of 1.58 feet. Until storm hour 10, water is able to flow through the growing media to the drain rock below. After this, the stormwater flows through the rock box to bypass the growing media.

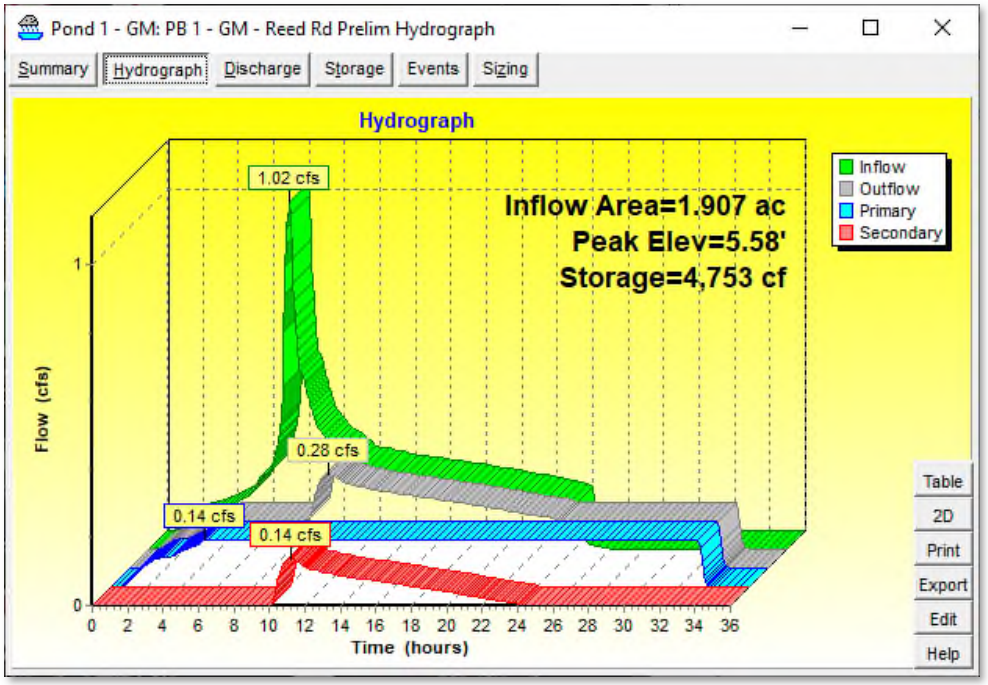


Figure 8: Planter Box 1 - 100 year Event Growing Media (blue) & Rock Box (red)

The second hydrograph shows the drain rock storage, with the 100 year event leaving through the 100 year overflow. At approximately storm hour 12, the storage in the drain rock and the infiltrate rate of the native soil are overpowered and water back up to leave through the perforate pipe. Of the 1.02 cfs coming into the planter box, only 0.19 cfs is leaving.

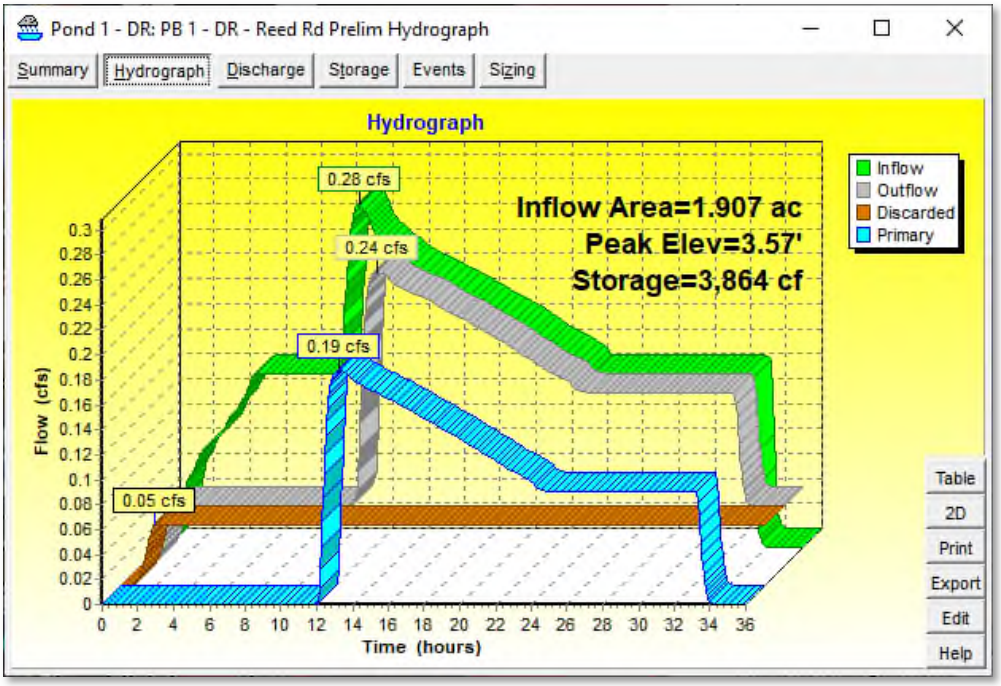


Figure 9: Rain Garden 1 - 100 year Event Rock Gallery

These hydrographs demonstrate that the facility is able to pass the 100 year event without overtopping.

SUMMARY

The remaining facilities are summarized in the following table. The table on the following page shows each facility name, the areas draining to each facility and the corresponding curve number for each basin, the surface area of the bottom of the facility, the surface area of the facility 1 foot above the growing media, the drain rock surface area, as well as the water depth within each facility for each storm event.

The hydrographs are shown attached to the report, separated by storm event. The water quality event can be found in Appendix B. The 25 year storm event hydrographs can be found in Appendix C. The 100 year storm event hydrographs can be found in Appendix D. Because the streets have a slightly different requirement than the rest of the site, the hydrographs for these areas can be seen in Appendix E.

Table 5: Stormwater Facility Summary Table

Property	Facility Name	Contributing Areas	Impervious Area (ft^2)	Pervious Area (ft^2)	CN	Top Area (ft^2)	Bottom of GM Area (ft^2)	Drain Rock Area (ft^2)	WQ Water Depth	1/2 - 2 Year Water Depth	10 Year Water Depth	25 Year Water Depth	100 Year Water Depth
East	Undetained	Undeveloped and Landscaping		41113	73								
	Pervious Path	Multi Use Path	4624		98	4624	4624	4624	Storage in the Rock				
	Planter Box 1	Undeveloped SW		46555	72	3008	3008	3008	0.06	0.03	0.78	1.28	1.58
		Landscaping		4534	74								
		Building 26	3520		98								
		Building 24	5456		98								
		Building 25	2672		98								
		South Parking	20347		98								
	Planter Box 2	Undeveloped W		8709	72	2482	2482	2482	0.15	0.09	1.52	1.56	1.65
		Landscaping		16359	74								
		N Parking	24838		98								
		Building 23	5360		98								
		Building 22	5024		98								
		Building 21	6688		98								
	Planter Box 3	Building 20	5024		98	1436	1436	1436	0.12	0.07	0.91	1.2	1.54
		North Parking	16757		98								
		Landscaping		2283	74								
	TOTAL		100310	119553									
West	Undetained	Landscaping		3062	74								
	Planter Box 1	Basin 1	33861	28956	87	1229	1229	1229	0.88	0.47	1.69	1.71	1.75
		Building 33	2512		98								
		Building 34	4799		98								
		Building 35	5435		98								
	Planter Box 2	Basin 2	21385	43324	88	4519	4519	4519	0.17	0.1	0.5	1.58	1.69
		Building 30	4799		98								
		Building 32	5024		98								
		Building 31	6010		98								
		VC Loop 2	9515	2181	94								
		Building 29	6917		98								
		Building 27	6010		98								
		Building 28	2688		98								
	TOTAL		108955	77523									

Operations & Maintenance

The proposed facility will be used to treat private stormwater and will be located on private property. Therefore, the facilities will be privately owned and maintained. The property owner will be responsible for the following maintenance activities:

- Remove/replace dead or strained vegetation with like variety.
- Irrigate during dry periods to maintain vegetation health.
- Cut grass to a height of 4 to 9 inches no less than twice a year, remove clippings.
- Weed and remove plant debris and other dead vegetation
- Remove noxious or invasive weeds when discovered.
- Should stormwater begin to pond and not infiltrate per design, filter media (i.e. topsoil or amended soil) may need to be replaced.
- Should the need arise, the filter media (i.e. the native soil located beneath the surface) can be raked or tilled to improve infiltration rates.
- Locations where ponding occurs should be noted and repaired. Ponding is defined by a location of standing water for greater than 48 hours. Holes, borrows, and excessive standing water need to be mitigated to prevent vector breeding grounds.
- Sediment and debris exceeding 4 inches in depth should be removed every 2 to 5 years or sooner, should the need arise.
- Holes, borrows, and excessive standing water need to be noted and repaired/replaced to prevent vector breeding grounds.
- Slopes need to be maintained and all inlets to the swales should be kept free of debris on a regular basis.
- Any soil erosion needs to be addressed using suitable erosion measures (i.e. jute matting and plantings).
- Grass, lawn clippings, and any other possible debris should not be discarded into the swale.
- All roadside trash will need to be removed whenever possible.
- Special Note: Herbicides, pesticides, and fertilizers should never be applied within rain gardens.

City of Salem maintenance checklist has been included in Appendix E. Each facility type has a specific maintenance checklist. The City has prepared these checklists and believe these should be used for the maintenance of the facility.

CONCLUSION

The proposed facilities and analysis have demonstrated the ability to treat the runoff generated from all new hard surface. The design as proposed will also limit the runoff leaving the properties to the predeveloped flowrate for the ½ the 2, the 10, the 25, and the 100 year storm events.

CONTACT

Please feel free to contact Natalie Janney with Multi/Tech Engineering by phone (503-363-9227) or email (NJanney@mtengineering.net) if you have any questions or concerns regarding this proposal.

APPENDIX A: PRE AND POST DEVELOPMENT BASIN MAPS, PREDEVELOPED HYDROGRAPHS, NRCS WEB SOIL SURVEY RESULTS, GEOTECHNICAL REPORT

Post-Developed Basin Map

Pre-Developed Catchment Summary							
Property	Catchment	Source	Impervious Area (ft^2)	Pervious Area (ft^2)	Ownership	Curve Number	Tc (min)
East	East Site	Predeveloped		219863	Private	72	52.5
West	West Site	Predeveloped		186478	Private	72	34

N
W E
S

NOT TO SCALE

D-E
L = 300 ft
S = (275-259)/300
=0.053 ft/ft

E-F
L = 77 ft
S = (259-249)/77
=0.1299 ft/ft

A-B
L = 300 ft
S = (249-243.05)/300
=0.0198 ft/ft

B-C
L = 159 ft
S = (243.05-236.7)/159
=0.0399 ft/ft

MULTI/TECH
ENGINEERING SERVICES, INC.
1155 13th ST. S.E. SALEM, OR. 97302
(503) 363-9227 FAX: (503) 364-1260
www.mtengineering.net office@mtengineering.net

EXISTING CONDITIONS PLAN

THE GROVE AT FAIRVIEW 2

DIMENSIONS & NOTES TAKE PRECEDENCE OVER GRAPHICAL REPRESENTATION.

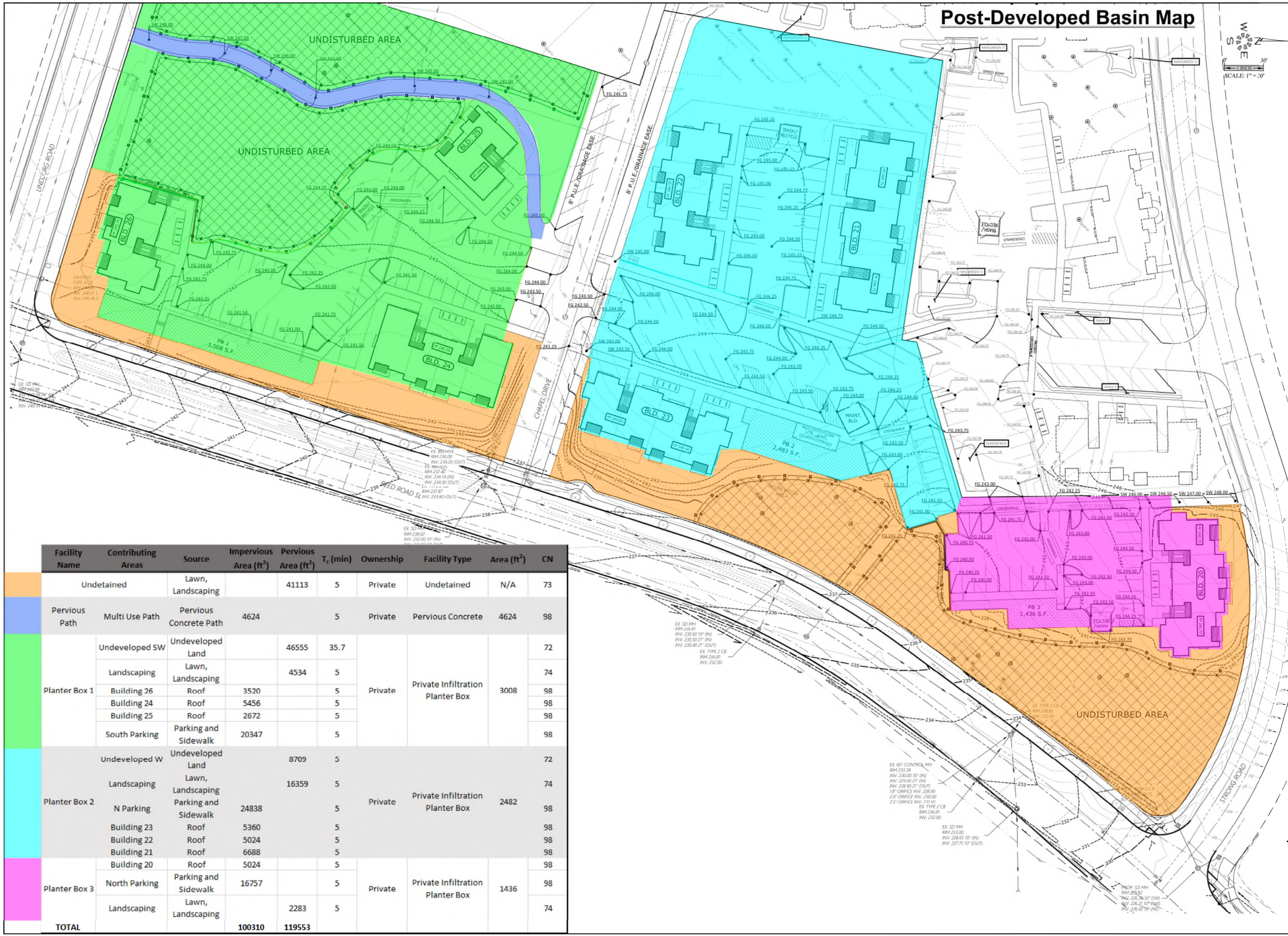
Design: M.D.G.
Drawn: C.D.S.
Checked: B.M.G.
Date: ----
Scale: AS SHOWN

REGISTERED PROFESSIONAL ENGINEER
OREGON
JULY 14, 1978
MARK D. GRENZ
EXPIRES: 06-30-2021

JOB # 7111

SDR2

Post-Developed Basin Map



	Facility Name	Contributing Areas	Source	Impervious Area (ft^2)	Pervious Area (ft^2)	T_c (min)	Ownership	Facility Type	Area (ft^2)	CN
	Undetained		Lawn, Landscaping		41113	5	Private	Undetained	N/A	73
	Pervious Path	Multi Use Path	Pervious Concrete Path	4624		5	Private	Pervious Concrete	4624	98
	Planter Box 1	Undeveloped SW	Undeveloped Land		46555	35.7	Private	Private Infiltration Planter Box	3008	72
		Landscaping	Lawn, Landscaping		4534	5				74
		Building 26	Roof	3520		5				98
		Building 24	Roof	5456		5				98
		Building 25	Roof	2672		5				98
		South Parking	Parking and Sidewalk	20347		5				98
	Planter Box 2	Undeveloped W	Undeveloped Land		8709	5	Private	Private Infiltration Planter Box	2482	72
		Landscaping	Lawn, Landscaping		16359	5				74
		N Parking	Parking and Sidewalk	24838		5				98
		Building 23	Roof	5360		5				98
		Building 22	Roof	5024		5				98
		Building 21	Roof	6688		5				98
		Building 20	Roof	5024		5				98
	Planter Box 3	North Parking	Parking and Sidewalk	16757		5	Private	Private Infiltration Planter Box	1436	98
		Landscaping	Lawn, Landscaping		2283	5				74
	TOTAL			100310	119553					

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www.mtengineering.net office@mtengineering.net

EAST

THE GROVE AT FAIRVIEW 2

DIMENSIONS & NOTES TAKE PRECEDENCE OVER GRAPHICAL REPRESENTATION.

7111p SDR14.dgn

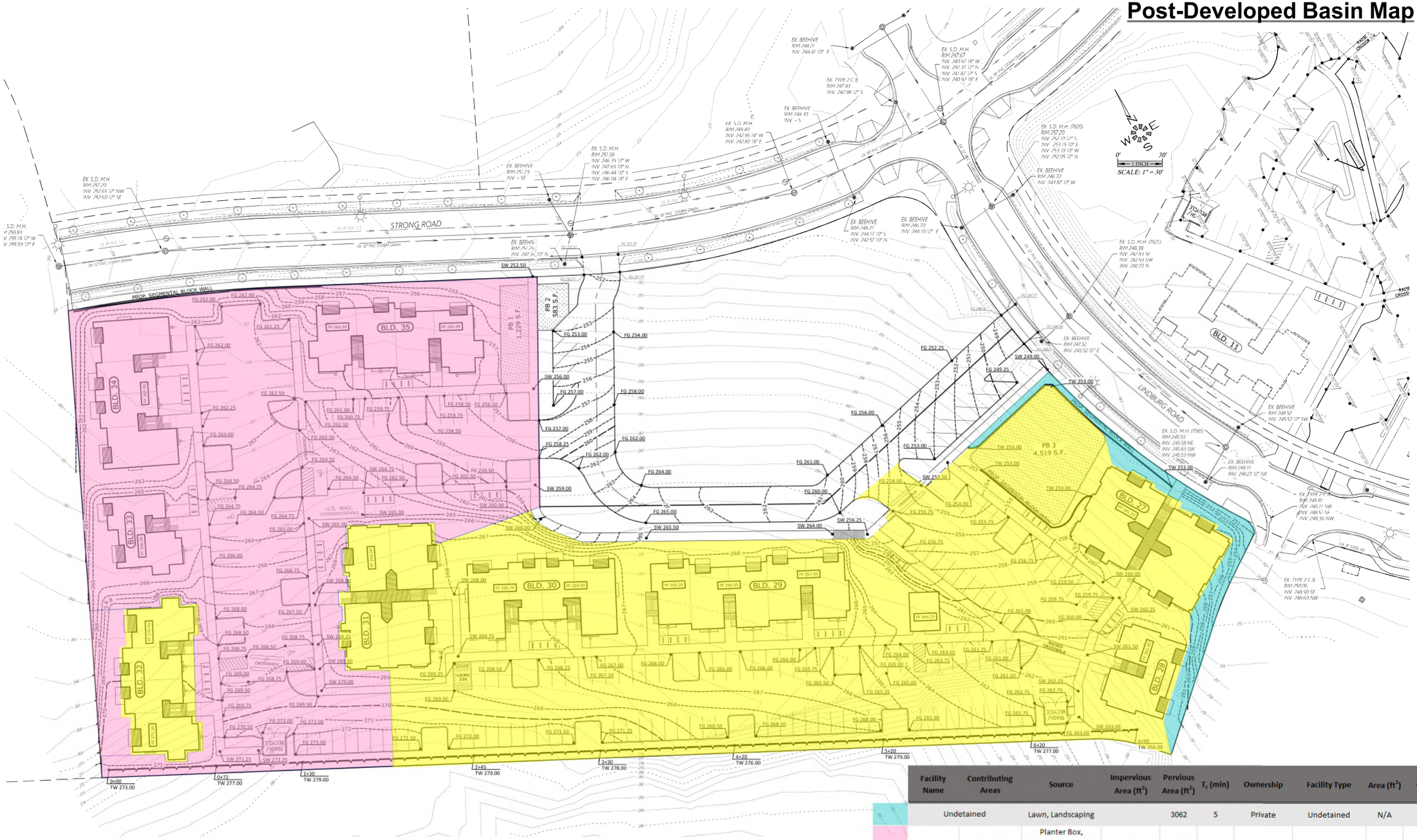
Design: M.D.G.
Drawn: C.P.S.
Checked: B.M.G.
Date: ---
Scale: AS SHOWN

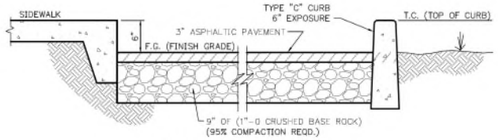
REGISTERED PROFESSIONAL ENGINEER
OREGON
JULY 14, 1978
MARK D. GRENZ
EXPIRES: 06-30-2021

JOB # 7111

SDR14

Post-Developed Basin Map





TYPICAL SIDEWALK AND PARKING SECTION

-NTS-

Facility Name	Contributing Areas	Source	Impervious Area (ft²)	Pervious Area (ft²)	T_c (min)	Ownership	Facility Type	Area (ft²)	CN
Undetained		Lawn, Landscaping		3062	5	Private	Undetained	N/A	74
Planter Box 1	Basin 1	Planter Box, Landscaping, Parking Lot and Sidewalk	33861	28956	5	Private	Private Infiltration Planter Box	1229	87
	Building 33	Roof	2512		5				98
	Building 34	Roof	4799		5				98
	Building 35	Roof	5435		5				98
Planter Box 2	Basin 2	Planter Box, Landscaping, Parking Lot and Sidewalk	21385	43324	5	Private	Private Infiltration Rain Garden	4519	88
	Building 30	Roof	4799		5				98
	Building 32	Roof	5024		5				98
	Building 31	Roof	6010		5				98
	VC Loop 2	Landscaping and Roadway	9515	2181	5				94
	Building 29	Roof	6917		5				98
	Building 27	Roof	6010		5				98
	Building 28	Roof	2688		5				98
TOTAL			108955	77523					

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www.mtengineering.net office@mtengineering.net

WEST

THE GROVE AT FAIRVIEW 2

Design: M.D.G.
Drawn: C.D.S.
Checked: B.M.G.
Date: ----
Scale: AS SHOWN

REGISTERED PROFESSIONAL ENGINEER
OREGON
JULY 14, 1978
MARK D. GRENZ
EXPIRES: 06-30-2021

JOB # 7111

SDR12

Worksheet 3: Time of Concentration (T_c) or travel time (T_t)

Project	By	Date
The Grove 2 Apartments - EAST	N. Janney	11/2020
Location	**Checked**	**Date**
Salem, Oregon		

Check one: ☑ Present ☐ Developed

Check one: ☑ T_c ☐ T_t through subarea

Notes: Space for as many as two segments per flow type can be used for each worksheet.
Include a map, schematic, or description of flow segments.

Sheet flow (Applicable to Tc only)

	Segment ID	A-B		
1.	Surface description (Table 4D-4)	Meadow/Pasture/Farm		
2.	Manning's roughness coefficient, n (Table 4D-4)	0.30		
3.	Flow length, L (total L † 300 ft) ft	300		
4.	Two-year 24-hour rainfall, P_2 in	2.2		
5.	Land slope, s ft/ft	0.0198		
6.	$T_t = \frac{0.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t hr	0.829	+	= 0.829

Shallow concentrated flow

	Segment ID	B-C		
7.	Surface description (paved or unpaved)	Minimum Tillage		
8.	Flow length, L ft	159		
9.	Watercourse slope, s ft/ft	0.0399		
10.	Average velocity, V (figure 3-1) ft/s	0.96		
11.	$T_t = \frac{L}{3600\ V}$ Compute T_t hr	0.046	+	= 0.046

Channel flow

	Segment ID			
12.	Cross sectional flow area, a ft^2			
13.	Wetted perimeter, p_w ft			
14.	Hydraulic radius, $r = \frac{a}{p_w}$ Compute r ft			
15	Channel slope, s ft/ft			
16.	Manning's roughness coefficient, n			
17.	$V = \frac{1.49\ r^{2/3}\ s^{1/2}}{n}$ Compute V ft/s			
18.	~~Flow~~ length, L ft			
19.	$T_t = \frac{L}{3600\ V}$ Compute T_t hr		+	=
20.	Watershed or subarea T_c or T_t (add T_t in steps 6, 11, and 19) Hr			

0.875 Hrs = 52.5 Minutes

Worksheet 3: Time of Concentration (T_c) or travel time (T_t)

Project	By	Date
The Grove 2 Apartments - WEST	N. Janney	11/2020
Location	**Checked**	**Date**
Salem, Oregon		

Check one: ☑ Present ☐ Developed

Check one: ☑ T_c ☐ T_t through subarea

Notes: Space for as many as two segments per flow type can be used for each worksheet.
Include a map, schematic, or description of flow segments.

Sheet flow (Applicable to Tc only)

	Segment ID	D-E	
1.	Surface description (Table 4D-4)	Meadow/Pasture/Farm	
2.	Manning's roughness coefficient, n (Table 4D-4)	0.30	
3.	Flow length, L (total L † 300 ft) ft	300	
4.	Two-year 24-hour rainfall, P_2 in	2.2	
5.	Land slope, s ft/ft	0.053	
6.	$T_t = \frac{0.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t hr	0.559	+ = 0.559

Shallow concentrated flow

	Segment ID	E-F	
7.	Surface description (paved or unpaved)	Minimum Tillage	
8.	Flow length, L ft	77	
9.	Watercourse slope, s ft/ft	0.1299	
10.	Average velocity, V (figure 3-1) ft/s	2.6	
11.	$T_t = \frac{L}{3600\ V}$ Compute T_t hr	0.008	+ = 0.008

Channel flow

	Segment ID		
12.	Cross sectional flow area, a ft^2		
13.	Wetted perimeter, p_w ft		
14.	Hydraulic radius, $r = \frac{a}{p_w}$ Compute r ft		
15	Channel slope, s ft/ft		
16.	Manning's roughness coefficient, n		
17.	$V = \frac{1.49\ r^{2/3}\ s^{1/2}}{n}$ Compute V ft/s		
18.	~~Flow~~ length, L ft		
19.	$T_t = \frac{L}{3600\ V}$ Compute T_t hr	+ =	
20.	Watershed or subarea T_c or T_t (add T_t in steps 6, 11, and 19) Hr		

0.567 Hrs = 34.04 Minutes

EAST

Predeveloped

Subcat Reach Pond Link

Routing Diagram for EAST (Reed Rd) Site Prelim Hydrograph
Prepared by Multi/Tech Engineering Services, Printed 2/17/2021

Summary for Subcatchment PRE: Predeveloped

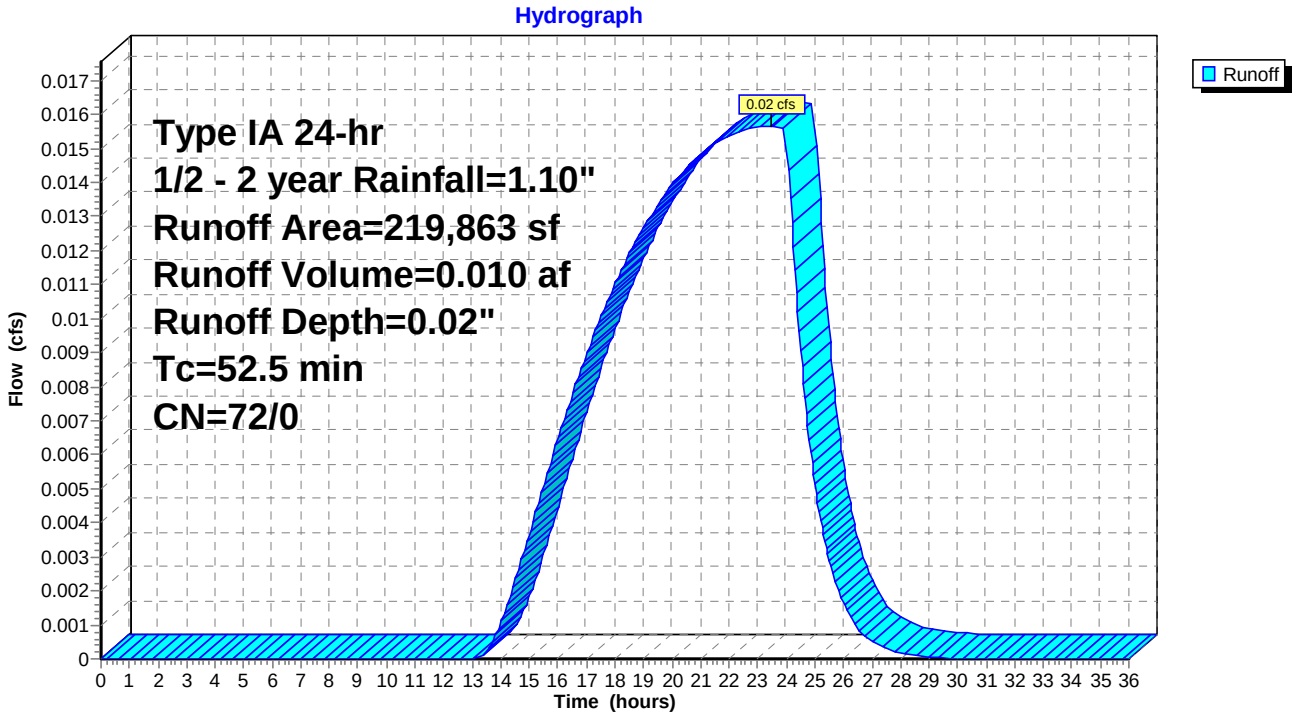
Runoff = 0.02 cfs @ 23.43 hrs, Volume= 0.010 af, Depth= 0.02"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type IA 24-hr 1/2 - 2 year Rainfall=1.10"

	Area (sf)	CN	Description
*	219,863	72	City of Salem Predeveloped, HSG C
	219,863	72	100.00% Pervious Area

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

Subcatchment PRE: Predeveloped



Summary for Subcatchment PRE: Predeveloped

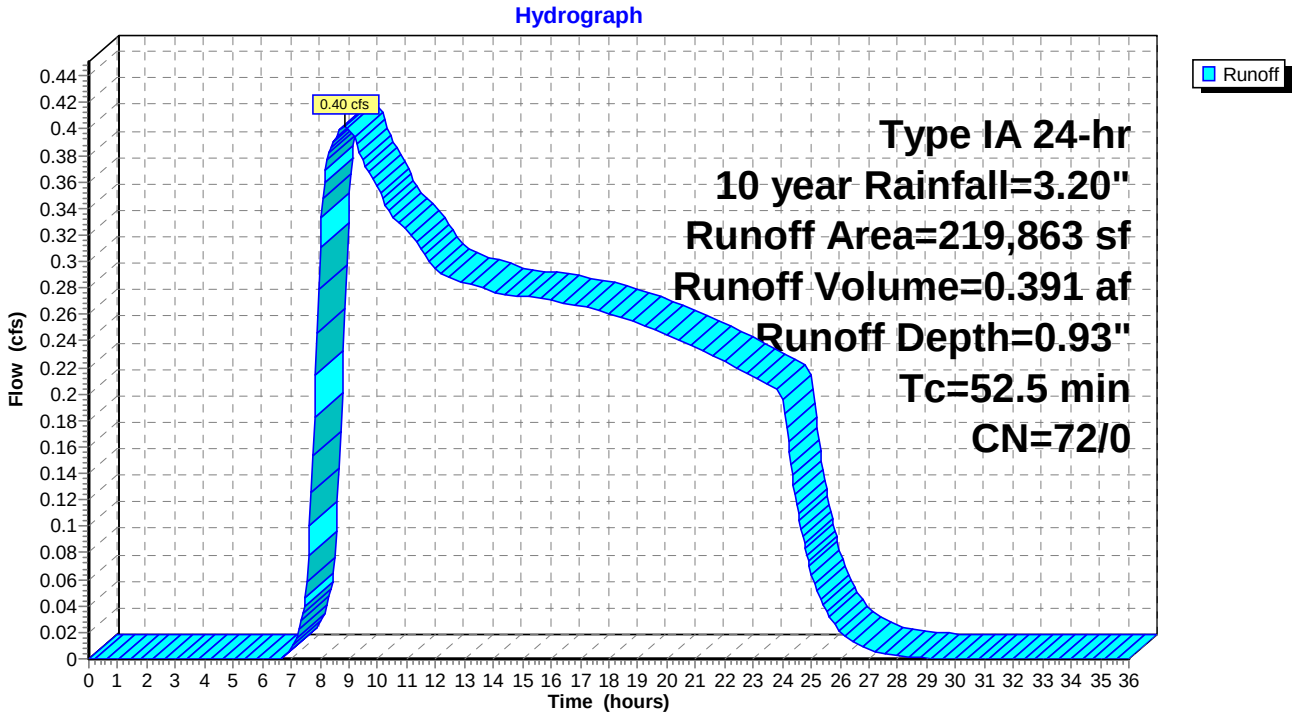
Runoff = 0.40 cfs @ 8.85 hrs, Volume= 0.391 af, Depth= 0.93"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type IA 24-hr 10 year Rainfall=3.20"

	Area (sf)	CN	Description
*	219,863	72	City of Salem Predeveloped, HSG C
	219,863	72	100.00% Pervious Area

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

Subcatchment PRE: Predeveloped



Summary for Subcatchment PRE: Predeveloped

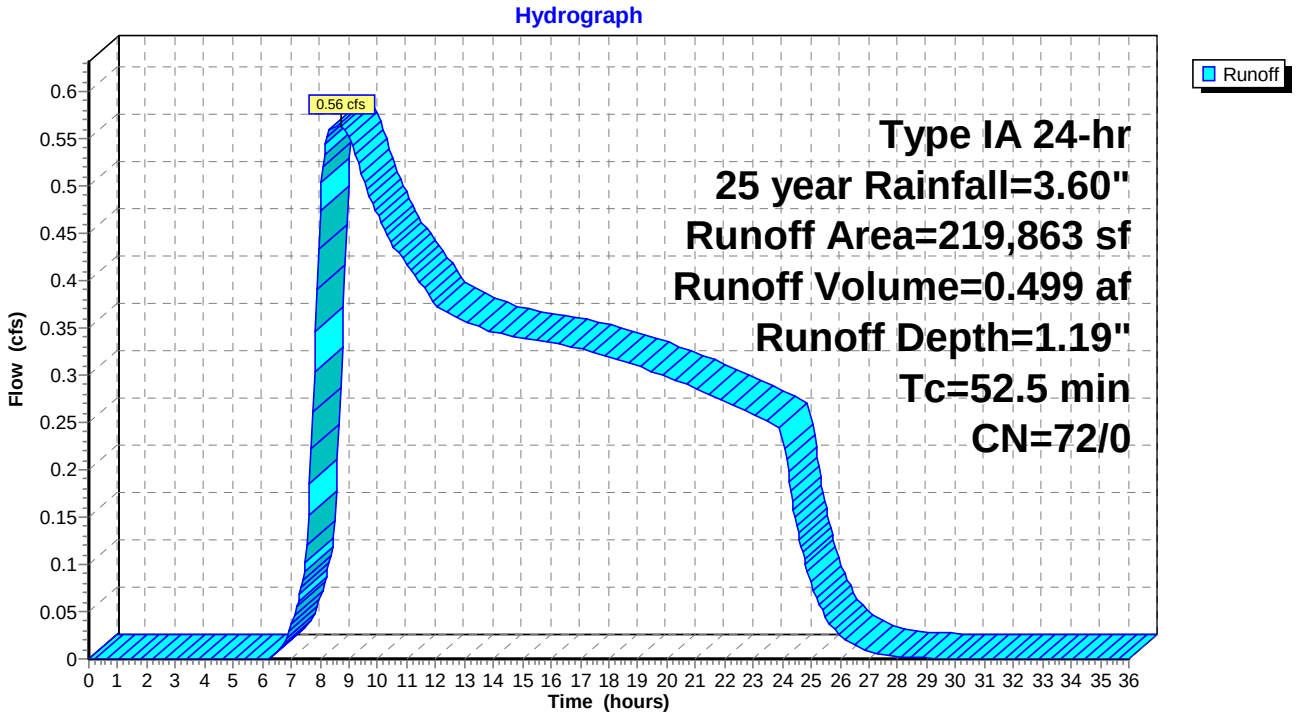
Runoff = 0.56 cfs @ 8.70 hrs, Volume= 0.499 af, Depth= 1.19"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type IA 24-hr 25 year Rainfall=3.60"

	Area (sf)	CN	Description
*	219,863	72	City of Salem Predeveloped, HSG C
	219,863	72	100.00% Pervious Area

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

Subcatchment PRE: Predeveloped



Summary for Subcatchment PRE: Predeveloped

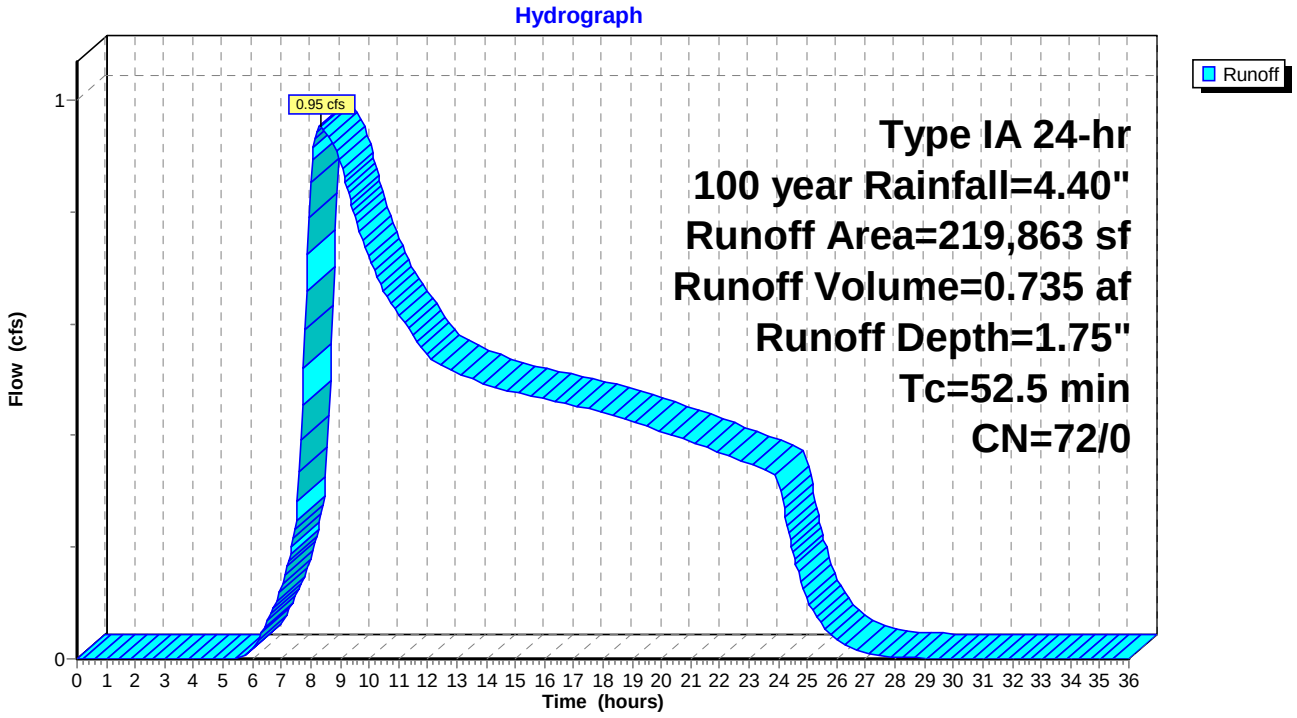
Runoff = 0.95 cfs @ 8.33 hrs, Volume= 0.735 af, Depth= 1.75"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type IA 24-hr 100 year Rainfall=4.40"

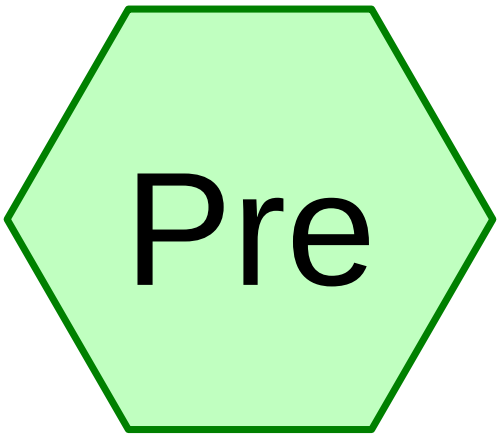
	Area (sf)	CN	Description
*	219,863	72	City of Salem Predeveloped, HSG C
	219,863	72	100.00% Pervious Area

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

Subcatchment PRE: Predeveloped



WEST



Predeveloped

Subcat Reach Pond Link

Routing Diagram for WEST (VC) Site Prelim Hydrographs
Prepared by Multi/Tech Engineering Services, Printed 2/18/2021

Summary for Subcatchment Pre: Predeveloped

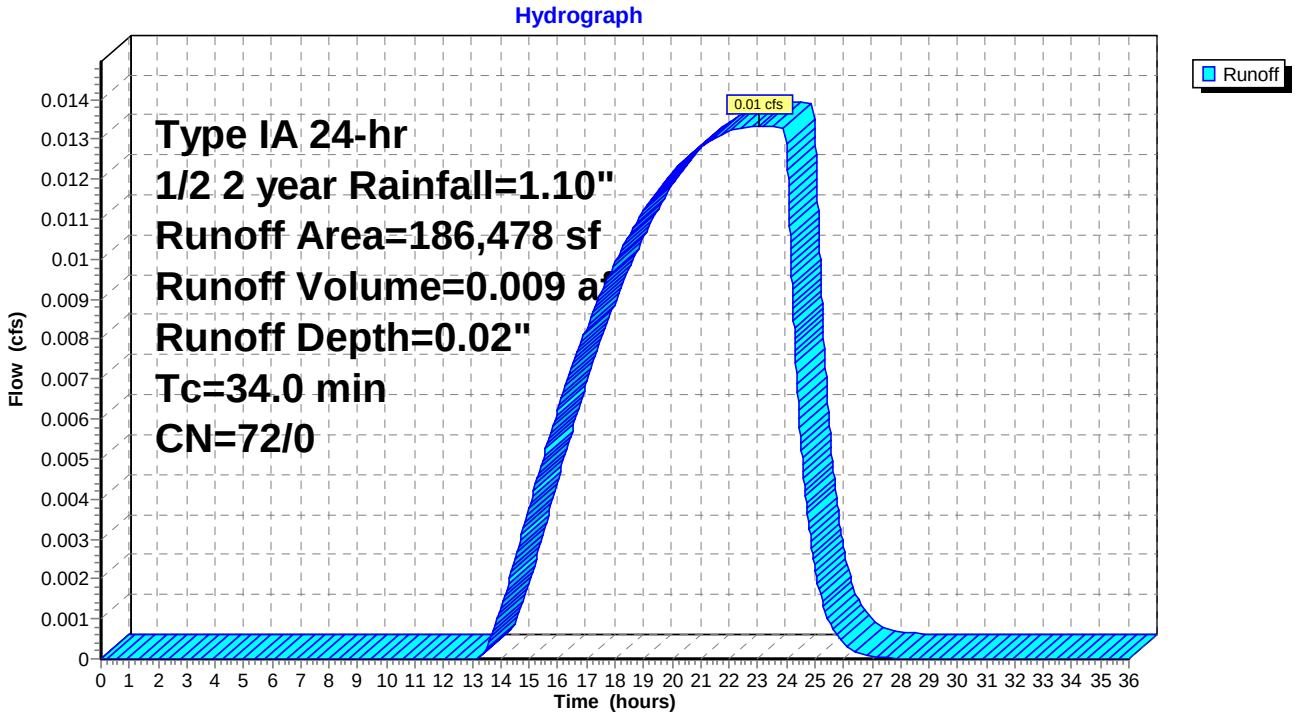
Runoff = 0.01 cfs @ 23.08 hrs, Volume= 0.009 af, Depth= 0.02"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type IA 24-hr 1/2 2 year Rainfall=1.10"

	Area (sf)	CN	Description
*	186,478	72	City of Salem Predeveloped, HSG C
	186,478	72	100.00% Pervious Area

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

Subcatchment Pre: Predeveloped



Summary for Subcatchment Pre: Predeveloped

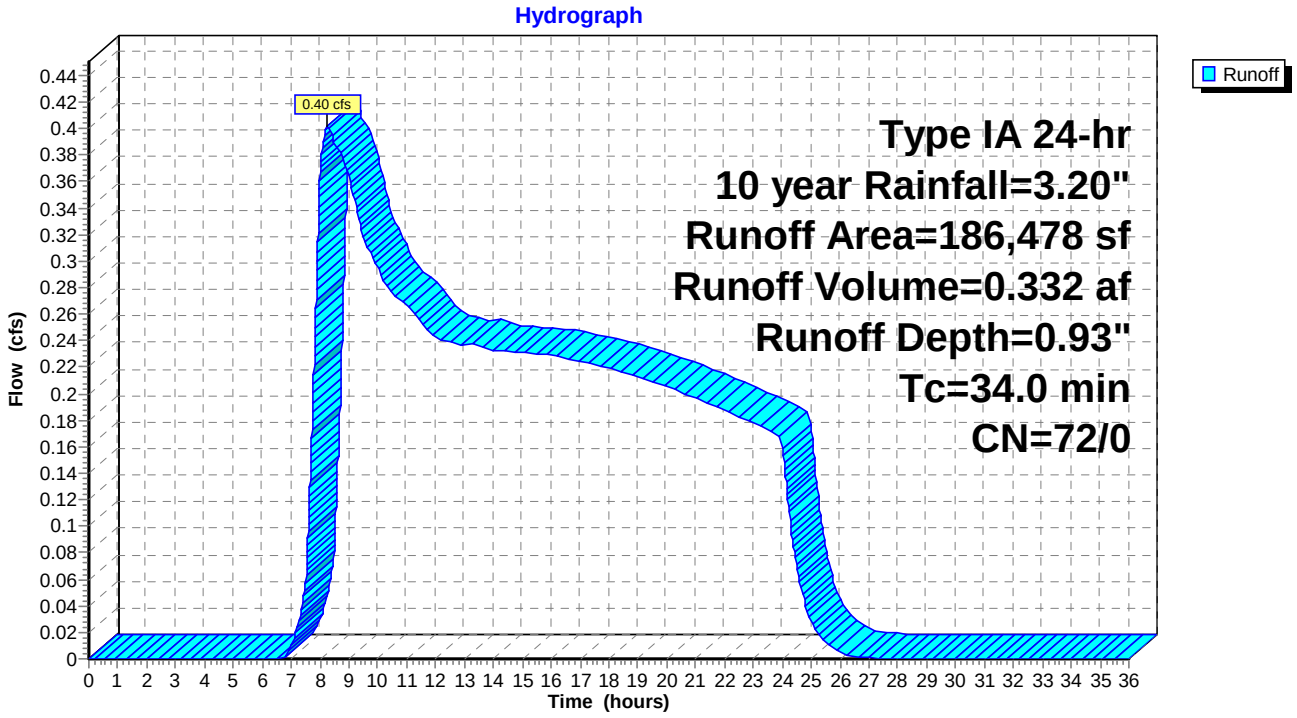
Runoff = 0.40 cfs @ 8.27 hrs, Volume= 0.332 af, Depth= 0.93"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type IA 24-hr 10 year Rainfall=3.20"

	Area (sf)	CN	Description
*	186,478	72	City of Salem Predeveloped, HSG C
	186,478	72	100.00% Pervious Area

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

Subcatchment Pre: Predeveloped



Summary for Subcatchment Pre: Predeveloped

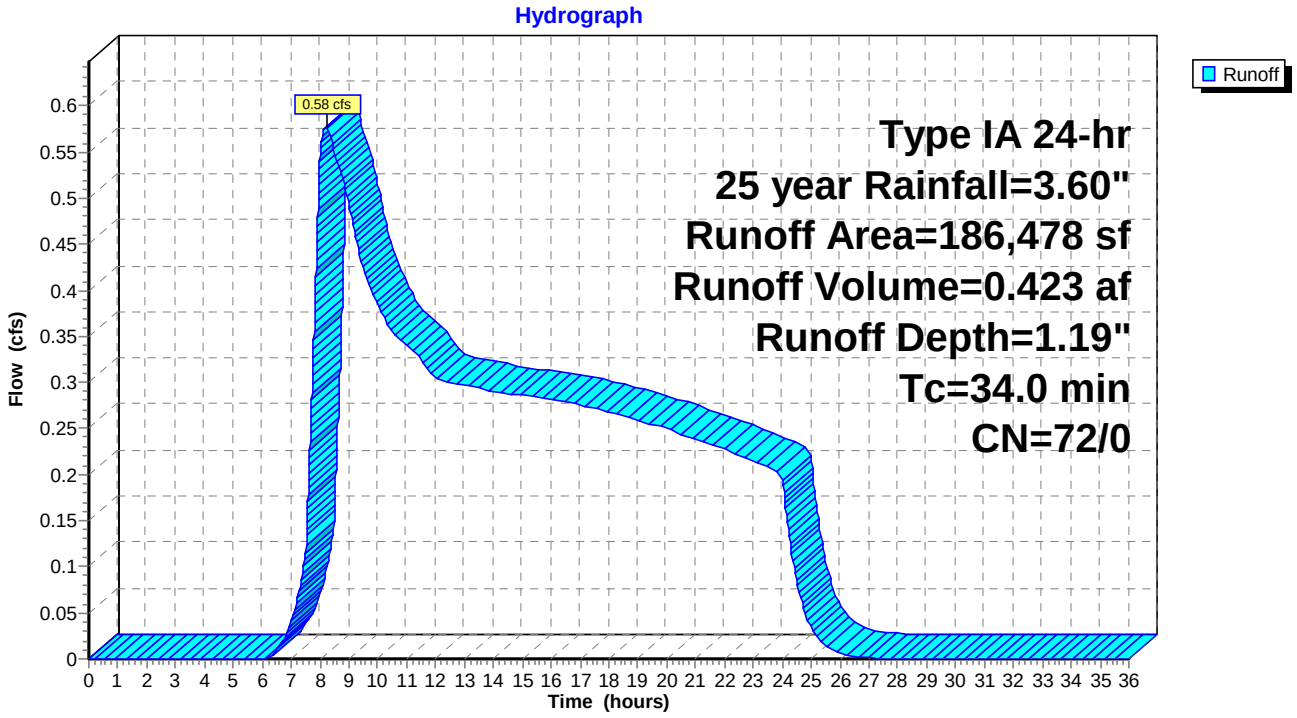
Runoff = 0.58 cfs @ 8.21 hrs, Volume= 0.423 af, Depth= 1.19"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type IA 24-hr 25 year Rainfall=3.60"

	Area (sf)	CN	Description
*	186,478	72	City of Salem Predeveloped, HSG C
	186,478	72	100.00% Pervious Area

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

Subcatchment Pre: Predeveloped



Summary for Subcatchment Pre: Predeveloped

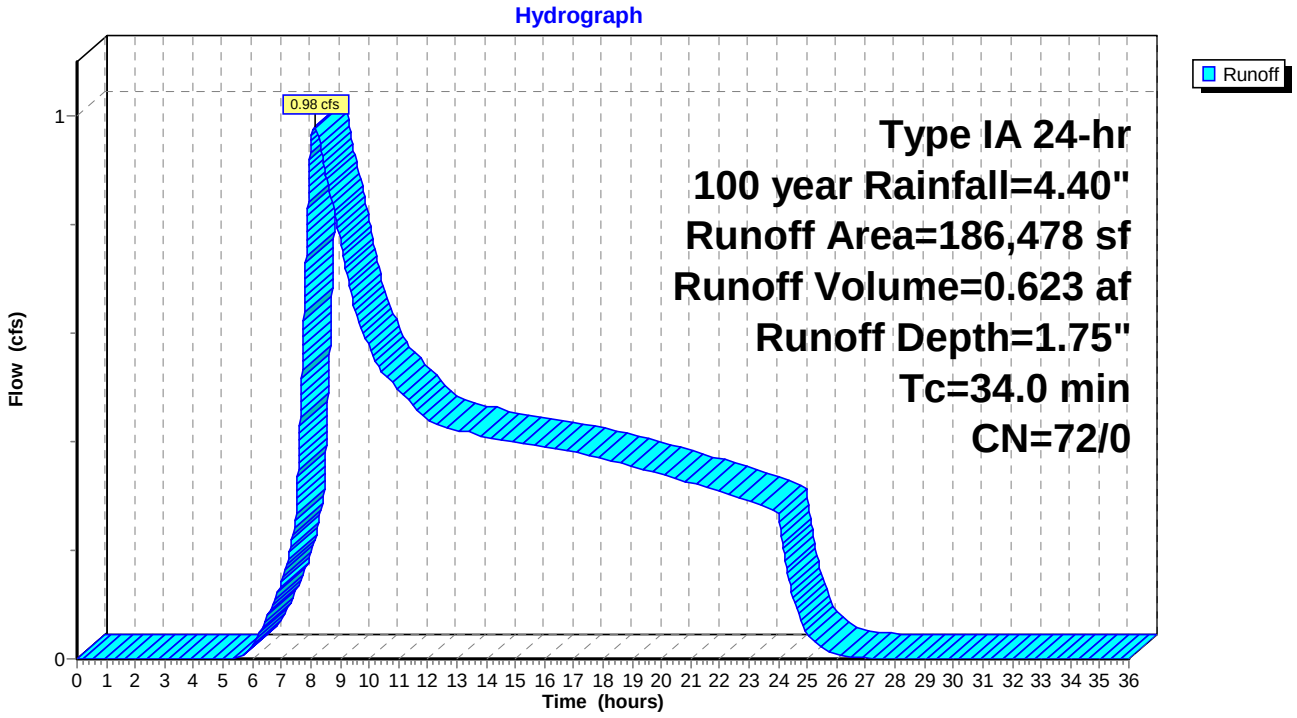
Runoff = 0.98 cfs @ 8.14 hrs, Volume= 0.623 af, Depth= 1.75"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type IA 24-hr 100 year Rainfall=4.40"

	Area (sf)	CN	Description
*	186,478	72	City of Salem Predeveloped, HSG C
	186,478	72	100.00% Pervious Area

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

Subcatchment Pre: Predeveloped



Map Scale: 1:2,330 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 30 60 120 180

Feet: 0 100 200 400 600

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

MAP LEGEND

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

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

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

Water Features
- Streams and Canals

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

Background
- Aerial Photography

MAP INFORMATION

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

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

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

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

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

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

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

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

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

Date(s) aerial images were photographed: Aug 1, 2018—Aug 31, 2018

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

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
MaA	McAlpin silty clay loam, 0 to 3 percent slopes	7.9	30.7%
SnB	Santiam silt loam, 3 to 6 percent slopes	4.3	16.7%
SuC	Silverton silt loam, 2 to 12 percent slopes	12.6	49.4%
SuD	Silverton silt loam, 12 to 20 percent slopes	0.8	3.2%
Totals for Area of Interest		**25.6**	**100.0%**

Marion County Area, Oregon

MaA—McAlpin silty clay loam, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: 24qd
Elevation: 250 to 1,000 feet
Mean annual precipitation: 40 to 60 inches
Mean annual air temperature: 52 to 54 degrees F
Frost-free period: 190 to 210 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Mcalpin and similar soils: 95 percent
Minor components: 2 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Mcalpin

Setting

Landform: Terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Mixed alluvium

Typical profile

H1 - 0 to 23 inches: silty clay loam
H2 - 23 to 65 inches: silty clay

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)
Depth to water table: About 24 to 36 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: High (about 10.5 inches)

Interpretive groups

Land capability classification (irrigated): 2e
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: C
Forage suitability group: Moderately Well Drained < 15% Slopes (G002XY004OR)
Other vegetative classification: Moderately Well Drained < 15% Slopes (G002XY004OR)
Hydric soil rating: No

Minor Components

Waldo

Percent of map unit: 2 percent
Landform: Flood plains
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Other vegetative classification: Poorly Drained (G002XY006OR)
Hydric soil rating: Yes

Data Source Information

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

Marion County Area, Oregon

SnB—Santiam silt loam, 3 to 6 percent slopes

Map Unit Setting

National map unit symbol: 24rc
Elevation: 300 to 370 feet
Mean annual precipitation: 40 to 45 inches
Mean annual air temperature: 52 to 54 degrees F
Frost-free period: 200 to 210 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Santiam and similar soils: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Santiam

Setting

Landform: Terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Silty material over basalt and gravelly alluvium

Typical profile

H1 - 0 to 13 inches: silt loam
H2 - 13 to 30 inches: silty clay loam
H3 - 30 to 60 inches: silty clay

Properties and qualities

Slope: 3 to 6 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 24 to 36 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: High (about 10.1 inches)

Interpretive groups

Land capability classification (irrigated): 2e
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: C
Forage suitability group: Moderately Well Drained < 15% Slopes (G002XY004OR)
Other vegetative classification: Moderately Well Drained < 15% Slopes (G002XY004OR)

Hydric soil rating: No

Data Source Information

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

Marion County Area, Oregon

SuC—Silverton silt loam, 2 to 12 percent slopes

Map Unit Setting

National map unit symbol: 24rh
Elevation: 230 to 300 feet
Mean annual precipitation: 40 to 45 inches
Mean annual air temperature: 52 to 54 degrees F
Frost-free period: 200 to 210 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Silverton and similar soils: 90 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Silverton

Setting

Landform: Terraces
Landform position (three-dimensional): Tread, riser
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Silty material over fine-textured material that contains gravel

Typical profile

H1 - 0 to 16 inches: silt loam
H2 - 16 to 25 inches: silty clay loam
H3 - 25 to 37 inches: gravelly silty clay
H4 - 37 to 47 inches: unweathered bedrock

Properties and qualities

Slope: 2 to 12 percent
Depth to restrictive feature: 20 to 40 inches to lithic bedrock
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Moderate (about 6.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: C
Forage suitability group: Well drained < 15% Slopes (G002XY002OR)
Other vegetative classification: Well drained < 15% Slopes (G002XY002OR)

Hydric soil rating: No

Data Source Information

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

Geotechnical Investigation

For

The Grove @ Fairview Phase 2 Apartments

Neighborly Ventures

Salem, Oregon

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Geotechnical Investigation

For

The Grove @ Fairview Phase 2

Apartment Project

Strong Road SE

Salem, Oregon

MTE Project

No. 7111

Prepared for
Mountain West Investments

Salem, Oregon

November 19, 2020

Prepared By

MULTI/TECH Engineering Services, Inc.

1155 13th Street SE

Salem, Oregon 97302

Table of Contents

INTRODUCTION

MULTI/TECH Engineering Services, Inc. (MTE) is pleased to submit the results of our Report of Geotechnical Investigation for the The Grove @ Fairview Phase 2 Apartment project site located in the Fairview Development area on two sites. One site is located along the west side of Reed Road, between Strong Road and Lindburg Road (Reed Rd Site). The other site is located on the south side of Strong Road west of the intersection of Lindburg Road with Strong Road (VC Site) both in South Salem. The site locations are shown on the attached Site Location, Figure 1. The purpose of our work was to explore subsurface conditions at the site in order to provide geotechnical engineering recommendations for the proposed development. Our scope of work included the following:

- Explore subsurface conditions at the site by excavating fifteen (15) test pits to depths of up to 10 feet below ground surface (bgs) using equipment and personnel provided by MTE and LeRud & Sons Construction.

- Classify the materials encountered in the explorations as per American Society for Testing and Materials (ASTM) Soil Classification Method D2488. A qualified member of MTE's staff observed the explorations and maintained a detailed log of each test.

- Provide recommendations for site preparation, grading and drainage, stripping depths, fill type for imported materials, compaction criteria, cut and fill slope criteria, trench excavation and backfill, use of on-site soils, and wet/dry weather earthwork.

- Provide geotechnical engineering recommendations for design and construction of shallow spread foundations, including an allowable design bearing pressure, and minimum footing depth and width requirements.

- Provide geotechnical engineering recommendations for design and construction of retaining walls, including lateral earth pressures, and backfill, compaction, and drainage requirements.

- Provide geotechnical engineering recommendations for design and construction of concrete floor slabs, including an anticipated value for subgrade modulus, and recommendations for a capillary break and vapor retarder.

- Estimate settlement of footings and floor slabs for the anticipated or provided design loading.

• Provide recommendations for subsurface drainage of foundations.

• Provide recommendations for pavement subgrade preparation.

• Provide results from Field infiltration tests performed.

• Provide recommendations for the International Building Code (IBC) Site Class, mapped maximum considered earthquake spectral response accelerations, site seismic coefficients, and Seismic Design Category.

• *Qualitatively* evaluate liquefaction potential of the soils encountered within the depths explored.

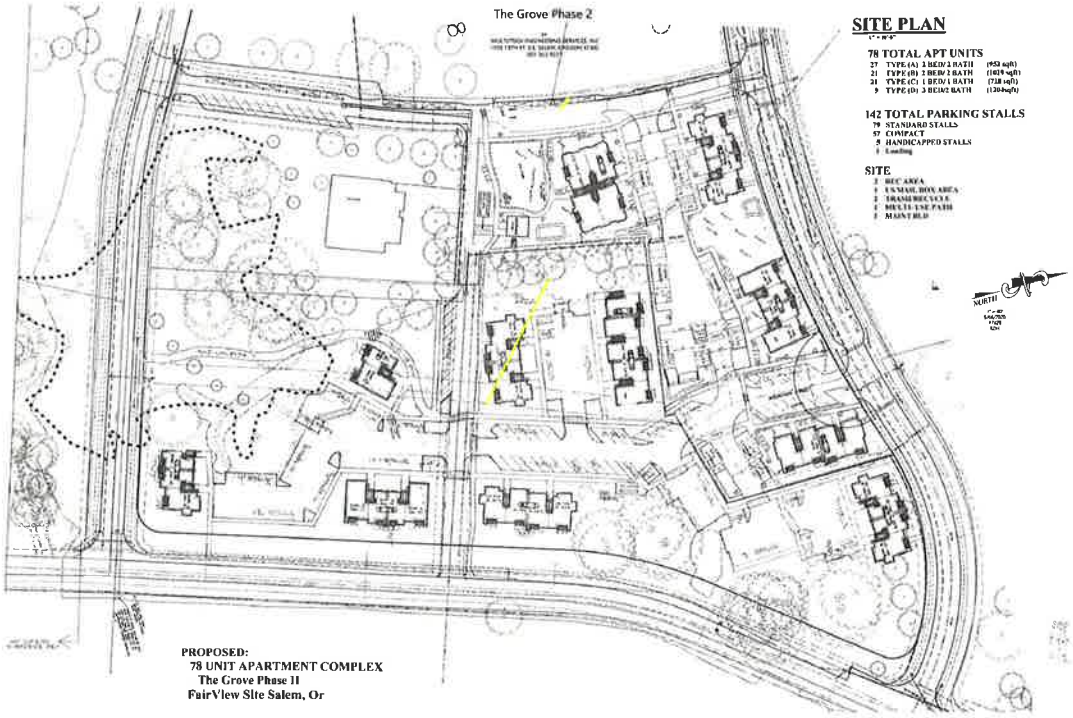
•. Provide a written report summarizing the results of our geotechnical investigation.

PROJECT INFORMATION & SITE DESCRIPTION

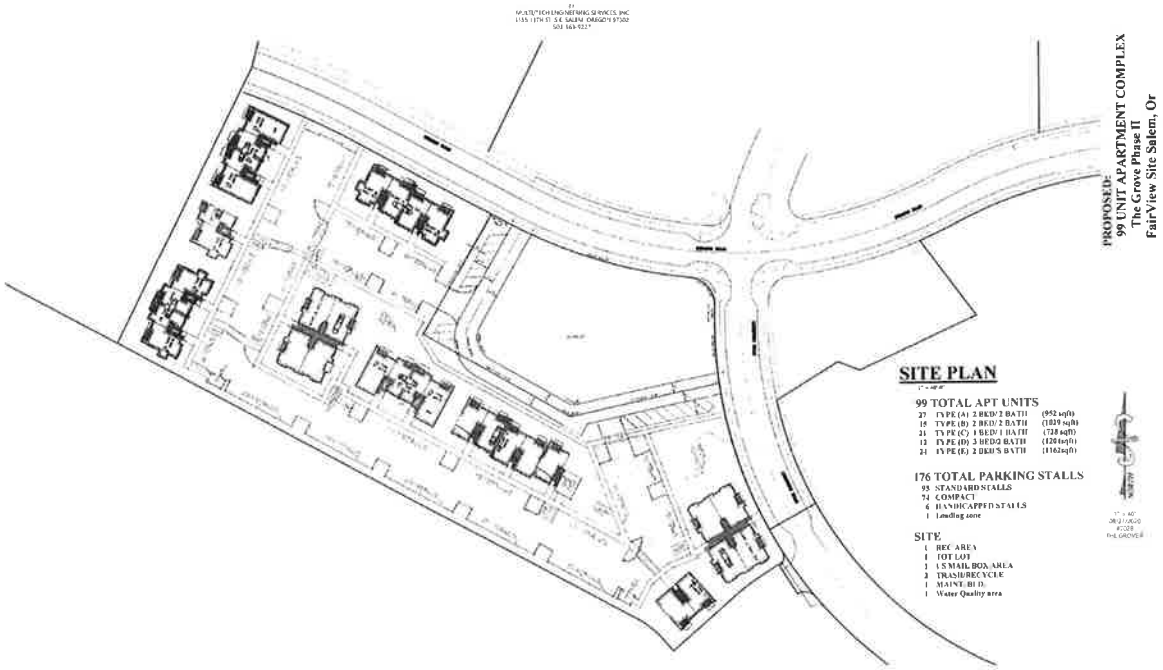
Project Information

The project will consist of the development of 177 apartment units within a total of 16 three story buildings, on two sites, adjacent to the Phase 1 project that is currently under construction. Associated with the buildings will be adjoining parking and recreation areas. The detailed construction plans and drawings have not been completed for the project at this time. Based on our knowledge of the building types, we have assumed that building loads will be typical of these types of structures, with continuous perimeter footing loads of less than 3 kips per lineal foot (klf) and interior column loads of less than 40 kips for the three-story structures. Changes in site grade are anticipated to be minimal, with cuts limited to less than 8 feet and fills limited to less than 4 feet.

Project Site



Conceptual Site Plan Reed Rd Site



Conceptual Site Plan VC Site

Site Geology

A site Geotechnical Review was completed by PBS Engineering and Environmental dated 2002 for the Fairview Training Center of which this area is a part. The Salem area geologic information has been published by Bele (1981). His information indicates the subject area is underlain by terrace deposits and basalt bedrock.

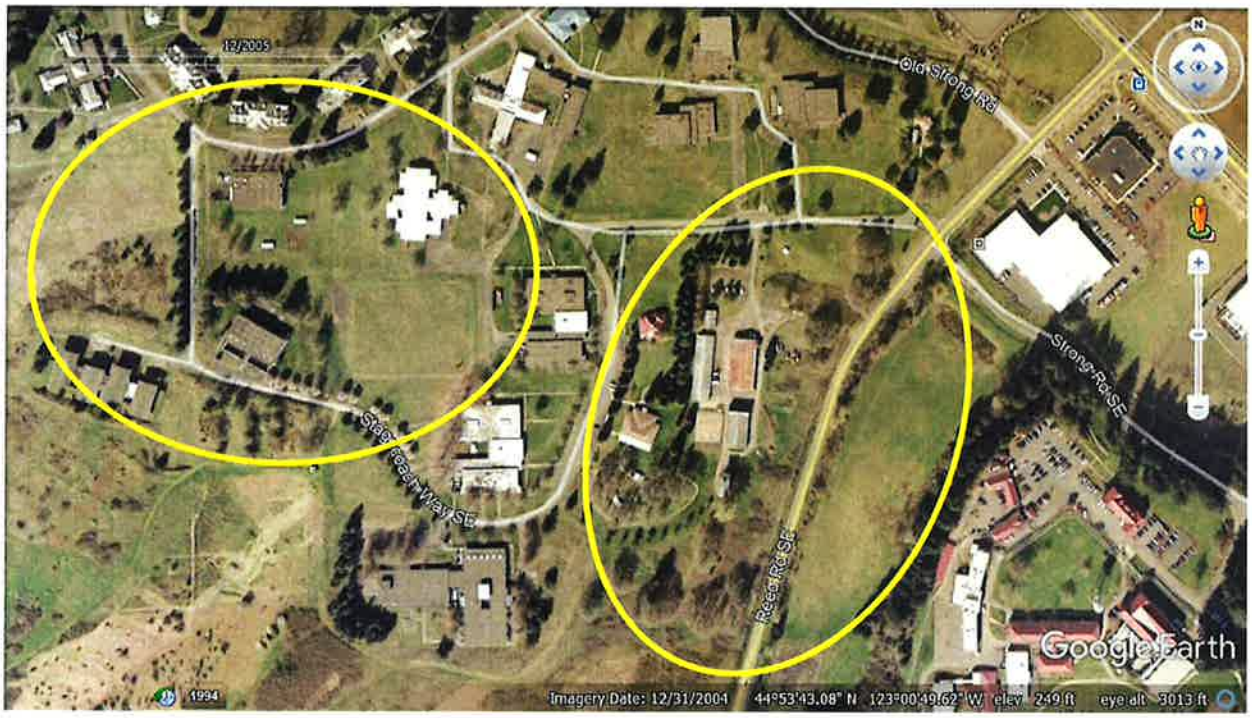
The area of this site is noted by Bela (1981) to be deposits consist of semiconsolidated sand, silt and clay. The sols may contain gravels at various locations.

Site History

The project site is a portion of the Fairview Training Center. This facility was started in 1907 by the Oregon State Legislature. As part of that facility, grading was performed for the construction of buildings and site improvements. The site improvements were initially for the development of farming activities and uses by the residents.

Buildings were developed over time, with additional structures constructed through the early 1960's.

There were three major buildings located within the limits of this project at the time the facility was closed, and care actions ended in March of 2000.



As the site areas appeared in 2005

The majority of the structures were demolished in 2009/2010.

On the Reed Rd site, there remains some old concrete storage towers, along with some concrete slabs, one is the concrete pad for a building that has been demo'd, and some asphalt pavement as well.

The area and project area in July 2010

The area and project area in July 2019

Site Surface Conditions

The Reed Road Site:

The site is bordered by New Strong Road on the north, Reed Road along the east, and Lindburg Road on the south. Passing through the site about mid-way is Chapel Drive, from Heritage to Reed Road. The site has some remnant concrete pads from old buildings that have been removed. The site has two concrete storage towers on the north side of Chapel and two on the south side of Chapel. All are proposed to be removed with this project. Present on the site are some significant trees that are to be retained as well. The concept site plan outlines the location of the trees to be retained.

The VC Site:

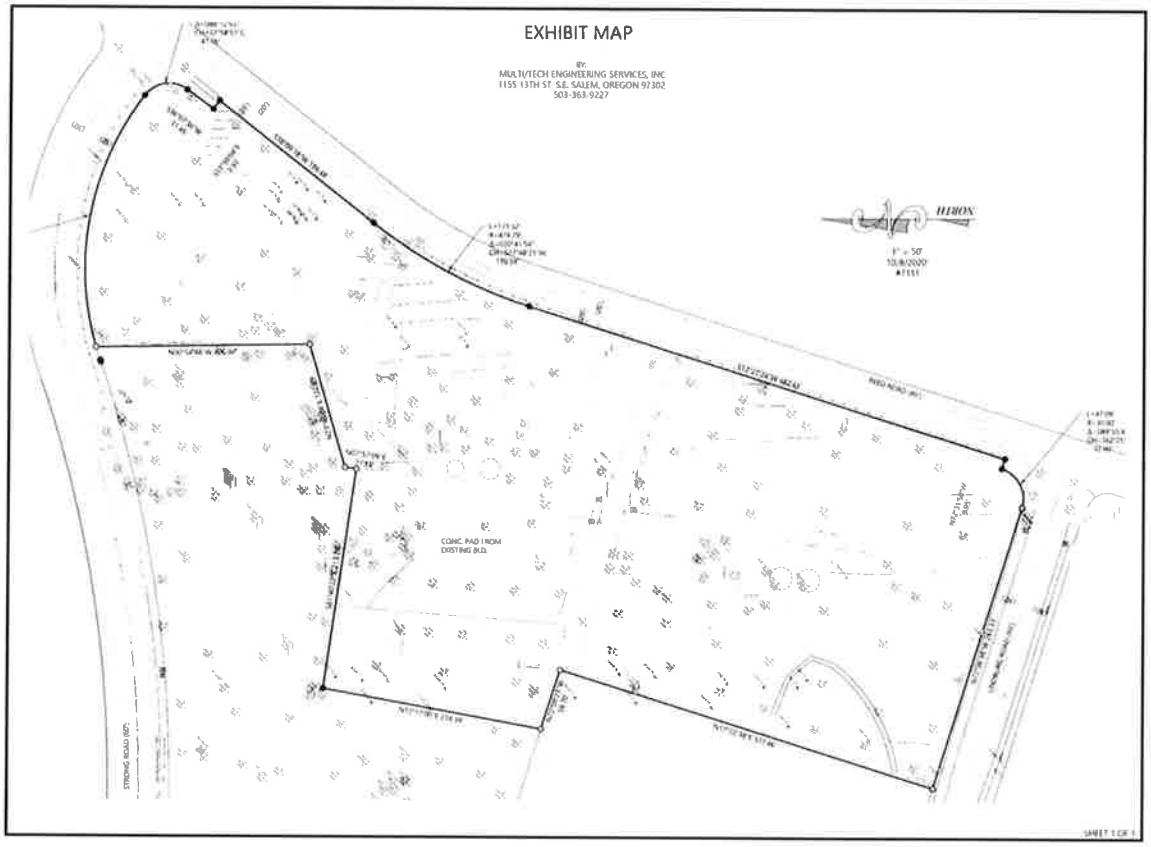
This site is bordered by New Strong Road on the north, Lindburg Road on the east, and vacant property along the south and west. There was a significant structure on the site that in the southwestern section that has been removed. We did not identify any other old issues to be addressed as to site surface conditions.

Site utilities needed for each of the sites are present in the existing roadways or stubbed to the site.

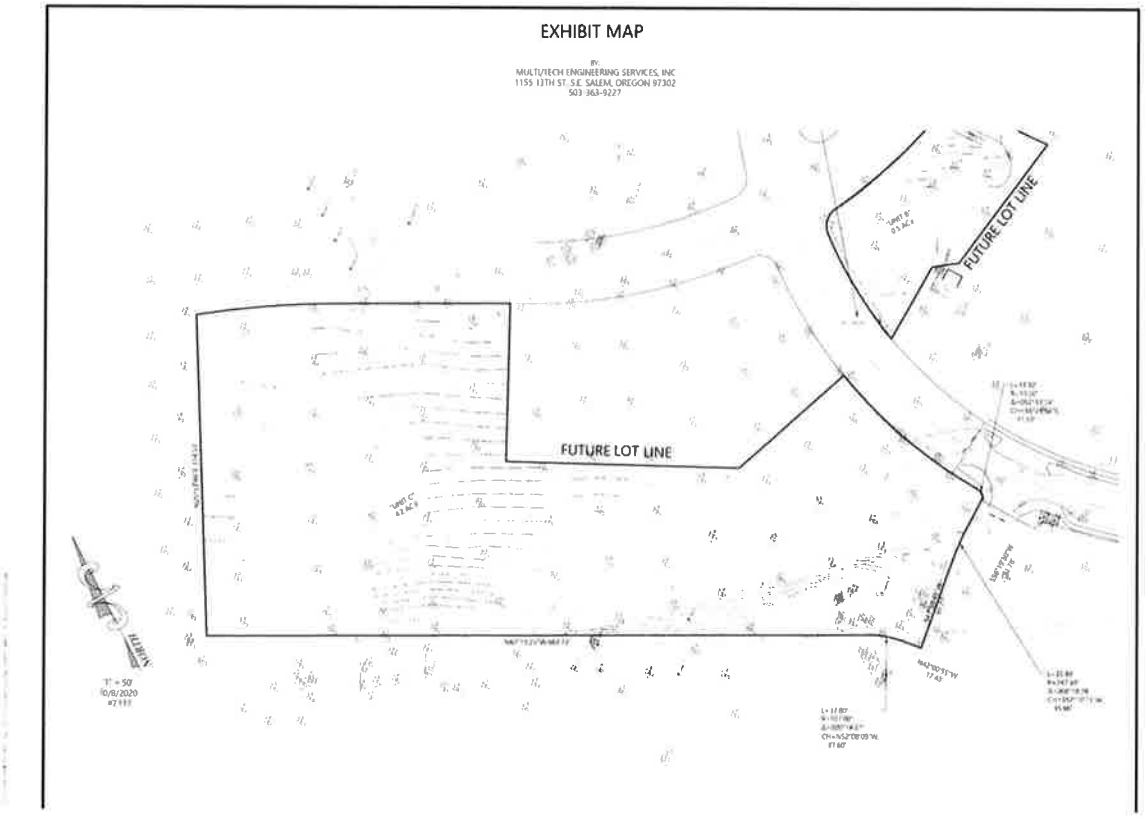
There is a Charter School located adjacent to the site at the southeast corner of Lindburg Road and Heritage Street. The balance of the area adjacent to this project is vacant.

View of the sites Surface Conditions

The Reed Road site is gently sloping, with the high ground located in the western section of the site and the low area along Reed Road. The average fall over the site is 14 feet.



The VC site is also gently sloping with more slope on it then the Reed Road site has. It has approximately 25 feet of fall across the site.



The project sites are not located within an identified "Flood Hazzard" area shown on Federal Emergency Management Agency (FEMA) maps for the area.

Site Subsurface Conditions

In preparation for this site work, we reviewed the Preliminary Geotechnical Findings for the Fairview Community that was prepared by GeoPacific Engineering, Inc in November of 2004. That report was for the total Fairview site of which our project is a small portion. They excavated approximately 18 areas on the overall site, but the copy of the report we have does not include a sample pit location map.

They noted the presents of silty clay and clay material above a layer of fractured and hard basalt material.

Our efforts included the excavation of 15 sample pits within the limits of the proposed apartment site. The excavations were to depths ranging between 3 and 10 feet in depth.

One of the goals was to determine the expected depths to the hard-fractured basalt materials. In the excavations that we completed; we did find such material in the VC site along the southern section in the eastern area. The material was very firm and difficult to dig very far into the material when found.

Field Exploration

Fifteen test pits (designated as TP-1 through TP-15) were excavated at the site on September 25th, 2020 to depths of up to 10feet bgs using a small excavator provided and operated by LeRud & Sons Construction. The approximate exploration locations are shown on the attached Test Pit Site Plans, Figure 3a and 3b. The explorations were located in the field by our surveying staff. The goal was to conduct such exploration in the area of each of the proposed building, to the extent possible.

A member of MTE's staff logged the soils observed within the explorations in general accordance with the Unified Soil Classification System (USCS). We have provided an explanation of the USCS on the attached Soil Classification Criteria and Terminology, Figure 4. Pocket penetrometer readings were taken in the upper 3 feet of the test pits in order to aid in characterizing the consistency of the soils encountered. The pocket penetrometer is a hand-held instrument that provides an approximation of the unconfined compressive strength of cohesive soils. The correlation between pocket penetrometer readings and the consistency of cohesive soils is provided on the attached Figure 4.

Logs of the test pits and hand auger borings are presented in Appendix "A" of this report.

Subsurface Materials

The following subsurface materials were encountered at the site:

We encountered a few different site soil conditions within the excavations completed. The logs of the excavations get the best information.

We did find fill material present on a couple of areas in the VC Site, primarily on the surface in the eastern area. The depths were up to 30 inches.

The Reed Road site was dominated by the presents of Silty Clay material, with Sandy Silty Clay material in the lower elevations of the excavations.

The VC site had material that was more clay in nature, the basalts in the eastern area.

As note earlier, we did encounter very firm weathered basalt in the south east portion of the VC Site.

As noted, we did find fill material and evidence of prior grading activities on this site, consistent with the history of the area.

We did NOT find bed rock or fractured basalt in any of the excavations.

Ground Water

Ground water was not encountered in any of our explorations conducted at the site on September 25th, 2020. We reviewed the well logs in the vicinity. Based on our review of water well logs available on the Oregon Water Resources Department website, ground water depths near the site ranged from about 29

feet to 63 feet bgs. It should be noted that ground water levels are relative to the ground surface and due to local topography; the levels reported on the logs are considered generally indicative of local water levels and may not reflect actual ground water levels at the site.

CONCLUSIONS

Based on the results of our field explorations and analyses, it is our opinion that the site can be developed as described in the Project Information section of this report, provided the following recommendations are incorporated into design and construction:

That the areas of the proposed improvements be stripped of the shallow top soil and organic layer. Based on the site information this would be between 6 and 18 inches.

The eastern section of the VC Site has fill material present that was placed during recent grading activities in the area. This would need to be removed prior to any site improvements.

With the knowledge of the old building on the sites, it is critical that each building pad be reviewed during the excavation work to make sure that some unidentified materials are present.

The following paragraphs present specific geotechnical recommendations for design and construction of the development.

RECOMMENDATIONS

Site Preparation

Stripping & Over-Excavation

Surface vegetation and organic topsoil from the site. The fill material noted above that has been found on the site can remain. We recommend that after the removal of the organic layer that this material be

scarified and compacted back in place. This would be true for all portions of the site at are to be improved.

Table 1. Anticipated Site Stripping & Over-Excavation

Depth Requirements

Stripped surface vegetation and organic topsoil should be transported off-site for disposal or stockpiled for later use in landscaped areas. Should any of the fill material be removed, it should be stockpiled and used for site structural or nonstructural fills with the application of moisture as needed when placed. A geotechnical representative from MTE should provide recommendations for actual stripping depths based on observations during site stripping.

Material	Site Location	Approximate Thickness
Surface Vegetation & Silt Topsoil (OL)	Site Development Areas & 5-Foot Margins	6 to 18 inches*
Topsoil (OL) [where present]	to be confirmed in the field during construction.	

**Actual depths will need to be determined in the field during over-excavation.*

Subgrade Preparation

After site stripping and over-excavation as recommended above and prior to excavation of footings or placement of new structural fill, a representative from MTE should probe and/or observe a proof-roll of the exposed subgrade soils in order to identify areas of excessive yielding. If areas of soft soil or excessive yielding are identified, the affected material should be over-excavated to firm, stable subgrade, and replaced with compacted materials as recommended for structural fill. Areas that appear too soft and wet to support proof rolling equipment should be prepared in general accordance with the recommendations for wet weather construction given below.

Erosion Control

Silt fences, hay bales, buffer zones of natural growth, sedimentation ponds, and granular haul roads should be used as required to reduce sediment transport during construction to acceptable levels. Measures to reduce erosion should be implemented in general accordance with State of Oregon Administrative Rules 340-41-006 and 340-41-455 and the City of Salem regulations regarding erosion control.

Wet Weather Considerations

The on-site native silt loam (CL) to silty clay loam (CL) **are highly** susceptible to disturbance during wet weather. Trafficability of these soils may be difficult, and significant damage to subgrade soils could occur if earthwork is undertaken without proper precautions at times when the exposed soils are more than a few percentage points above optimum moisture content.

For construction that will occur during the wet season, the site preparation activities may need to be accomplished using track-mounted equipment, loading removed material into trucks supported on granular haul roads, or other methods to limit soil disturbance. A qualified geotechnical engineer should evaluate the subgrade during excavation by probing rather than proof-rolling. Soils that have been disturbed during site preparation activities, or soft or loose areas identified during probing, should be over excavated to firm, stable subgrade, and replaced with structural fill.

Main Access and haul roads subjected to repeated heavy construction traffic will require a minimum of 12 inches of imported granular material. Additional granular material and/or geo-grid reinforcement may be recommended based on site conditions and/or loading at the time of construction. Ten inches of imported granular material should be sufficient for light staging areas. A minimum of 2 to 4 inches of imported granular material is recommended to protect footing subgrades from foot traffic and inclement weather. The imported granular material should consist of crushed rock that is well graded between course and fine, contains no organic matter, debris, or particles larger than 1 inch, and has less than 5 percent material by weight passing the U.S. Standard No. 200 Sieve. For footing areas, particles should be limited to less than 1-1/2 inches in diameter. The imported granular material should be placed in one lift over the prepared, undisturbed subgrade, and compacted using a smooth-drum, non-vibratory roller.

It may be necessary to install a geotextile separation / filter fabric as a barrier between the subgrade and imported fill in areas of repeated construction traffic. The geotextile fabric, if used, should have a minimum Mullen burst strength of 250 pounds per square inch for puncture resistance, and an apparent opening size (AOS) between the U.S. Standard No. 70 and No. 100 Sieves.

Structural Fill

On-Site Materials

Use of the on-site, fill (CL) and native soils as structural fill may be difficult in wet weather because these soils are sensitive to small changes in moisture content and are difficult, if not impossible, to adequately compact during wet weather. The on-site soils should be free of organic matter, debris, and particles larger than 1/2 inches if used as structural fill. When used as structural fill, the on-site soils should be

placed in lifts with a maximum thickness of about 8 inches, and compacted to not less than 92 percent of the materials maximum dry density, as determined in general accordance with ASTM D 1557 (Modified Proctor).

If the on-site soils cannot be properly moisture-conditioned and/or processed, we recommend using imported granular material for structural fill.

Imported Granular Structural Fill

Imported granular structural fill should consist of angular pit or quarry run rock, crushed gravel that is well-graded between coarse and fine particle sizes. The granular material should contain no organic matter, debris, or particles larger than 1/2 inches, and have less 5 percent material passing the U.S. Standard No. 200 Sieve. The percentage of fines car increased to 12 percent of the material passing the U.S. Standard No. 200 Sieve if placed during dry weather, and provided the fill material is moisture-conditioned, as necessary proper compaction. Granular fill material should be placed in lifts with a maximum thickness about 12 inches and compacted to not less than 95 percent of the materials m density, as determined in general accordance with ASTM D 1557 (Modified Proctor).

Shallow Foundations

We recommend that spread footings be founded on the native, medium stiff to very stiff, (CL) to sandy silt (CL), or on structural fill that is properly placed and compacted during construction or the native, medium stiff to stiff, silt (CL) to sandy silt material. If otherwise unsuitable soils are encountered, they should be over-excavated as recommended by the MTE geotechnical engineer. The resulting over-excavation should be brought grade with granular structural fill. All granular pads for footings should be constructed minimum of 6 inches wider on each side of the footing for every vertical foot of over-excavation.

Footing Construction

We recommend the following footing design and construction criteria for this site:

Table 2. Footing Embedment and Sizing

Footing Type	Minimum Embedment	Minimum Width for 1- to 2-Story Residential Structures	Minimum Width for 3-Story Residential Structures

Individual Spread (Column) Footings	12 inches*	24 inches	24 inches
Continuous Wall Footings	12 inches*	15 inches	18 inches

**Measured below lowest, adjacent, permanent site grade. Shallower depths may be allowed based on detailed site inspections at the time the foundation system preparation is being completed.*

Excavations near footings should not extend within a 1 H: 1V (horizontal vertical) plane projected out and down from the outside bottom edge of the footings

Bearing Pressure and Settlement:

Footings founded as recommended should be proportioned for a maximum allowable soil bearing pressure of 1.500 to 2,000 psf. This bearing pressure is a net bearing pressure and applies to the total of dead and long-term live loads and may be increased by 1.13 when considering seismic or wind loads. For the recommended design bearing pressure total settlement of footings is anticipated to be less than 1-inch, differential settlements between adjacent columns and/or bearing walls should not exceed 1/2-inch.

Lateral Capacity

We recommend using a passive earth pressure of 300 pounds per cubic foot (pcf) for design for footings confined by the native, medium stiff to very stiff silt (CL) to sandy silt (CL) or structural fill that is properly placed and compacted during construction. The recommended earth pressure was computed using a factor of safety of 1.5 which is appropriate due to the amount of movement required to develop full passive resistance

In order to develop the above capacity, the following should be understood: (1) concrete must be poured neat in excavations or the foundations must be backfilled with compacted structural fill, (2) the adjacent grade must be level, and (3) the static ground water level must remain below the base of the footings throughout the year. Adjacent floor slabs, pavements, or the upper 12-inch-depth of adjacent, unpaved areas should not be considered when calculating passive resistance.

An ultimate coefficient of friction equal to 0.30 may be used when calculating resistance to sliding for footings founded on the native, medium stiff to very stiff, silt (CL) to sandy silt (CL), or on structural fill that is properly placed and compacted on this material during construction. An ultimate coefficient of

friction equal to 0.45 may be used when calculating resistance to sliding for footings founded on a minimum of 4 inches of granular structural fill that is properly placed and compacted during construction.

Drainage

Based on the site soils found, we do not recommend placing foundation drains at the base elevations of the footings on the outside of the footings. Foundation drains is installed, should consist of a 3-inch-diameter, perforated, flexible, PVC drainpipe wrapped with a geotextile filter fabric. The drains should be backfilled with a minimum of 2 cubic feet per foot of open graded drain rock, which should be encased in a geotextile fabric in order to provide separation from the surrounding silt soils. MTE should be contacted to observe the drain prior to backfilling.

Retaining Walls

Retaining wall footings should be designed and constructed in general accordance with the recommendations contained in the Shallow Foundations section of this report. For retaining walls founded as recommended, the following design parameters should be used by the project structural engineer during external stability analyses:

Table 3. Retaining Wall Design Parameters

Retaining Wall Condition	Backfill Condition	Equivalent Fluid Pressure / Static Soil Lateral Load	Seismic! Dynamic Lateral Load*
Not Restrained from Rotation	Level	35 pcf	(8 pcf)*H*H
Restrained from Rotation	Level	60 pcf	(14 pcf)*H*H

**Acting at a point 0.6H above the base of the wall, where H is equal to the exposed wall height in feet.*

Backfilling

Retaining walls should be backfilled to a level condition with imported granular material compacted to a minimum of 92 percent of material's maximum dry density, as determined in general accordance with ASTM D 1557 (Modified Proctor). When placing fill behind walls, care must be taken to minimize undue

lateral loads on the walls by keeping heavy compaction equipment at least 3 feet from the back of the walls. Light mechanical or hand tamping equipment should be used for compaction of backfill materials within 3 feet of the back of the walls.

Drainage

MTE recommends placing drains behind the walls at their base. Wall drains should consist of a 4-inch-diameter, perforated, flexible, PVC drainpipe wrapped with a geotextile filter fabric, the drains should be backfilled with a minimum of 2 cubic foot per foot of open graded drain rock, which should be encased in a geotextile filter fabric in order to provide separation from the surrounding soils. MTE should be contacted to observe the drains prior to backfilling.

Limitations

The above design recommendations are based on the assumptions that: (1) the walls consist of conventional cantilevered retaining walls, (2) the walls are less than 10 feet in height, (3) the backfill is level, drained and consists of imported granular material, (4) no surcharges are imposed behind the walls, and (5) the grade in front of the wall is level. Re-evaluation of our recommendations will be required if the retaining wall design criteria for the project vary from these assumptions.

Floor Slabs

General

Satisfactory subgrade support for floor slabs constructed on grade (if used), supporting up to 150 psf area loading, can be obtained from the native, medium stiff to very stiff silt loam (CL), or on structural fill that is properly placed and compacted on these materials during construction. The native, medium stiff to very stiff silt loam materials were encountered at depths ranging from about 8 inches to 16 inches bgs in our explorations. If soft or otherwise unsuitable soils are encountered, they should be over-excavated as recommended by the MTE geotechnical engineer. The resulting over-excavation should be brought back to grade with granular structural fill.

A minimum 6-inch-thick layer of crushed rock base, compacted to not less than 95 percent of the materials maximum dry density, as determined in general accordance with ASTM D 1557, should be placed over the prepared subgrade to provide a more uniform surface for placing concrete and supporting the slab. Base rock material placed directly below the slab should be 3/4-inch maximum or less. The surface of the base rock should be choked with sand just prior to concrete placement. Choking the base rock surface reduces the lateral restraint on the bottom of the concrete during curing. For floor slabs constructed as recommended, a subgrade modulus of 150 pounds per cubic inch can be used for the design of the floor slab. Floor slabs constructed as recommended will likely settle less than 1/4-inch. We

recommend that slabs be jointed around columns and walls to permit slabs and foundations to settle differentially.

Subgrade Moisture Considerations

Due to the presence of on-site, fine-grained, materials near the surface of the site, liquid moisture and moisture vapor should be expected at the subgrade surface. A capillary break, consisting of at least 6 inches of crushed rock base having less than 5 percent of the material passing the U.S. Standard No. 200 Sieve, typically provides protection against liquid moisture. Where moisture vapor emission through the slab must be minimized, e.g. impervious floor coverings, storage of moisture sensitive materials directly on the slab surface, etc., a vapor retarding membrane or vapor barrier below the slab should be considered. Factors such as cost, special considerations for construction, floor coverings, and end use suggest that the decision regarding a vapor retarding membrane or vapor barrier be made by the architect and owner.

If a vapor retarder or vapor barrier is placed below the slab, its location should be based on current American Concrete Institute (ACI) guidelines, ACI 302 Guide for Concrete Floor and Slab Construction. In some cases, this indicates placement of concrete directly on the vapor retarder or barrier. Please note that the placement of concrete directly on impervious membranes increases the risk of plastic shrinkage cracking and slab curling in the concrete. Construction practices to reduce or eliminate such risk, as, described in ACI 302 should be employed during concrete placement.

Utility Trenches

Utility Trench Excavation

Trench cuts should stand near vertical to depths of approximately 4 feet in the native material, provided no ground water seepage is observed in the sidewalls. If seepage is encountered that undermines the stability of the trench, or caving of the sidewalls is observed during excavation, the sidewalls should be flattened or shored.

Trench dewatering may be required to maintain dry working conditions if the invert elevations of the proposed utilities are below the ground water level. Pumping from sumps located within the trench will likely be effective in removing water resulting from seepage. If ground water is present at the base of utility excavations, we recommend placing trench stabilization material at the base of the excavations. Trench stabilization material should consist of 1-foot of well- graded gravel, crushed gravel, or crushed rock with a maximum particle size of 4 inches, and less than 5 percent material passing the U.S. Standard No. 4 Sieve. The material should be free of organic matter and other deleterious material and should be placed in one lift and compacted until well-keyed.

While we have described certain approaches to the trench excavation, it is the contractor's responsibility to select the excavation and dewatering methods, to monitor the trench excavations for safety, and to provide any shoring required to protect personnel and adjacent improvements. All trench excavations should be in accordance with applicable OSHA and state regulations.

Trench Backfill Material

Trench backfill for the utility pipe base and pipe zone should consist of well-graded granular material containing no organic matter or debris, have a maximum particle size of 3/4-inch, and have less than 8 percent material passing the U.S. Standard No. 200 Sieve.

Backfill for the pipe base and within the pipe zone should be placed in maximum 12-inch-thick lifts, and compacted to not less than 90 percent of the materials maximum dry density, as determined in general accordance with ASTM D 1557, or as recommended by the pipe manufacturer. Backfill above the pipe zone should be placed in maximum 12-inch-thick lifts and compacted to not less than 92 percent of the material's maximum dry density, as determined in general accordance with ASTM D 1557. Trench backfill located within 3 feet of finished subgrade elevation should be placed in maximum 12-inch-thick lifts, and compacted to not less than 95 percent of the materials maximum dry density, as determined in general accordance with ASTM D 1557.

Asphalt Pavements

Satisfactory subgrade support for asphalt pavements constructed on grade can be obtained from the native medium stiff to very stiff silt loam, or on structural fill that is properly placed and compacted on these materials during construction. The native medium stiff to very stiff materials were encountered at depths ranging from about 8 inches to 16 inches bgs in our explorations. If soft or otherwise unsuitable soils are encountered, they should be over-excavated as recommended by the MTE geotechnical engineer. The resulting over-excavation should be brought back to grade with granular structural fill.

The flexible pavement design for the project was determined on the basis of the expected and anticipated traffic volumes and loading conditions relative to the expected subgrade soil strength ("R" value) characteristics. Based on a laboratory subgrade "R" value of 26 (Resilient Modulus = 5,252) and utilizing the asphalt Institute Flexible Pavement Design Procedures we recommend a pavement section for this project is 3 inches of A.C. Pavement on a minimum of 9 inches of compacted crushed base rock. In areas within the project sites that will be subject to heavy truck traffic, such as fire trucks or garbage trucks, the section should be increased to 3 inches of A.C. on 12 inches of compacted crushed base rock.

Infiltration Testing and Analysis

While on site, we conducted four (4) field infiltration tests as required by the City of Salem for site drainage analysis. The infiltration tests were performed in Test Pits 2, 5, 6, & 10 as shown on the site in Figure 3a and 3b at a depth of approximately 5 feet. The soils in the lower level of each of the test pits were the silty clay materials noted in the Test Pit Logs.

The field infiltration testing was performed in general conformance with the EPA Falling Head Method and/or the City of Salem Design Standards. Specifically, water was discharged into the test holes and allowed to penetrate the exposed subgrade soils at depth within the excavations. The water level was adjusted over a two (2) hour period and allowed to achieve a saturated subgrade soil condition. At the end of the saturation period, water was added to the test holes and the time and rate at which the water level dropped was monitored and recorded. The water level changes were monitored until a consistent infiltration rate was observed and repeated.

Based on the results of this testing, we have found that the silty clay material in Test Pits 2 & 5 possess an ultimate infiltration rate of about 1.0 inches per hour (in/hr). This should provide a reasonable infiltration rate for the disposal of storm water from the site.

Within Test Pits 6 & 10 the material had higher clay content and exhibited a slower infiltration rate, with a rate of 0.70 inches per hour.

Additional Drainage Considerations

We recommend that subsurface drains be connected to the nearest storm drain or other suitable discharge point. We also recommend that paved surfaces and ground near or adjacent to the residential structures be sloped to drain away from the structures. Surface water from pavement surfaces and open spaces should be collected and routed to a suitable discharge point. Surface water should not be routed to foundation or wall drains.

Permanent Slopes

Permanent slopes should not exceed 2H:1V (horizontal: vertical).

Seismic Design

Design Criteria

Based on the results of our subsurface explorations and analyses, the following design criteria has been developed using ASCE 7-10 Standards

Table 4. Design Criteria

Coefficient	Value	
Site Class	D	Table 1613.5.2
S_S	0.914	USGS US Seismic Design Maps
S_1	0.431	USGS US Seismic Design Maps
S_{MS}	1.037	Equation 16-37
S_{M1}	0.677	Equation 1 USGS US Seismic Design Maps 6-38
S_{DS}	0.691	USGS US Seismic Design Maps
S_{D1}	0.451	USGS US Seismic Design Maps
Category*	II	Table 1604.5
Seismic Design Category	D	Tables 1613.5.6(1), and 1613.5.6(2)

**If this is not correct, please inform us if warranted in writing so that changes to our recommendations can be made.*

Liquefaction

In general liquefaction occurs when deposits of loose saturated soils generally sands and sand-silt mixtures are subjected to strong earthquake shaking. If these deposits cannot drain rapidly, there will be an increase in the pore water pressure. With increasing oscillation, the pore water pressure can increase to the value of the overburden pressure. The shear strength of a cohesionless soil is directly proportional to the effective stress, which is equal to the difference between the overburden pressure and the pore water pressure. When the pore water pressure increases to the value of the overburden pressure, the shear strength of the soil reduces to zero and the soil deposit turns into a liquefied state.

The following parameters are generally used to designate non-liquefiable, fine-grained soils:

- Fines content (percent passing the U.S. Standard No. 200 Sieve) greater than 80 percent
- Clay content (particle size less than 0.005 mm) exceeding 20 percent
- Liquid limit greater than 35 percent
- Water content less than 90 percent of the liquid limit

Based on the fine-grained nature of the native, medium stiff to very stiff, silt (CL) to sandy silt (CL), and lack of ground water with the depths explored, these soils are considered to be non- liquefiable.

Additional Seismic

Slope Instability

Due to the relatively flat surface topography, the pre- construction risk of slope instability due to seismic forces is considered negligible. Provided newly constructed slopes in excess of 5 feet on existing gradients of 20% or greater, if any, incorporate appropriate keying and benching and do not exceed 2 horizontal to 1 vertical gradients, the risk of seismic slope instability is considered negligible.

Surface Rapture

Although the site is situated in a region of the country known for seismic activity, no known faults exist on or immediately adjacent to the site. Additionally, no large bodies of water exist within 500 feet of the site. Accordingly, the risk of surface rapture due to faulting and lateral spread is considered negligible.

OBSERVATIONS OF CONSTRUCTION

Satisfactory earthwork and pavement performance depends to a large degree on the quality of construction. Sufficient observation of the contractor's activities is a key part of determining that the work is completed in accordance with the construction drawings and specifications. Subsurface conditions observed during construction should be compared with those encountered during subsurface explorations, and recognition of changed conditions often requires experience. We recommend that qualified personnel visit the site with sufficient frequency to detect whether subsurface conditions change significantly from those observed to date and anticipated in this report.

We recommend that site stripping, rough grading, foundation, floor slab, and pavement subgrades, and placement of engineered fill are observed by the project geotechnical engineer or their representative. Because observation is typically performed on an on-call basis, we recommend that the earthwork contractor be held contractually responsible for scheduling observation. The schedule of Construction Observations is set out in Table 5.

LIMITATIONS

We have prepared this report for use by the owner/developer and other members of the design and construction team for the proposed development. The opinions and recommendations contained within this report are not intended to be, nor should they be construed, as a warranty of subsurface conditions, but are forwarded to assist in the planning and design process.

We have made observations based on our explorations that indicate the soil conditions at only those specific locations and only to the depths penetrated. These observations do not necessarily reflect soil types, strata thickness, or water level variations that may exist between explorations. If subsurface conditions vary from those encountered in our site exploration, MTE should be alerted to the change in conditions so that we may provide additional geotechnical recommendations if necessary. Observation by experienced geotechnical personnel should be considered an integral part of the construction process. The owner/developer is responsible for insuring that the project designers and contractors implement our recommendations. When the design has been finalized, we recommend that the design and specifications be reviewed by our firm to see that our recommendations have been interpreted and implemented as intended. If design changes are made, we request that we be retained to review our conclusions and recommendations and to provide a clarifications, modifications, or verification.

The scope of our services does not include services related to construction safety precautions, and our recommendations are not intended to direct the contractor's methods, techniques, sequences, or procedures, except as specifically described in our report for consideration in design.

Within the limitations of scope, schedule, and budget, our services have been executed in accordance with the generally accepted practices in this area at the time this report was prepared. No warranty or other conditions expressed or implied should be understood.

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Table 5

Schedule of Construction Observations

Item	Appropriate Point to Contact MTE	Report Reference
Site Stripping, Grubbing & Over-Excacation	During the Construction Activity and prior to Placement of Materials	Refer to the Site Preperation Section of the Geotech Report for Recommended Depths of Stripping
Subgrade Preperation for Foundation, Retaining Walls, pavement, and Floor Slabs	During the Construction Activity and prior to Placement of Structural Fills or Base Rock	See Recommendations Section of Geotech Report
Placement of Fills	Prior to the start of filling and during the preperation of the fill areas	Refer to the Site Prepertion Section of the Geotech Report
Placement & Compaction of Utility Trench Backfill	During the installation of the Backfill	Refer to Utility Trenches section of the Geotech Report for Testing and Compaction percentages
Pavement Base Rock	Prior to the Placement and During the Placement of the Material	Refer to the Pavement Section of the Geotech Report for Recommendations of Rock and Pavment Depths
Pavement Asphalt	Prior to the start of Paving	Refer to the Pavement Section of the Geotech Report for Recommendations of Rock and Pavment Depths
Retaining Wall Backfilling	Prior to the start of the Backfilling and and during Placement	Refer to the Retaining Wall section of the Geotech Report for Discussion of Wall Construction and Drainage
Final Site Grading	Prior to the Start of the final Grading	Check to make sure that Proper Site Grading is considered to remove Site drainage

Figure 1 – Site Arial

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Figure 2 – Arial Vicinity Map

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Figure 3a - Test Pits

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503-363-9227

Reed Road Site

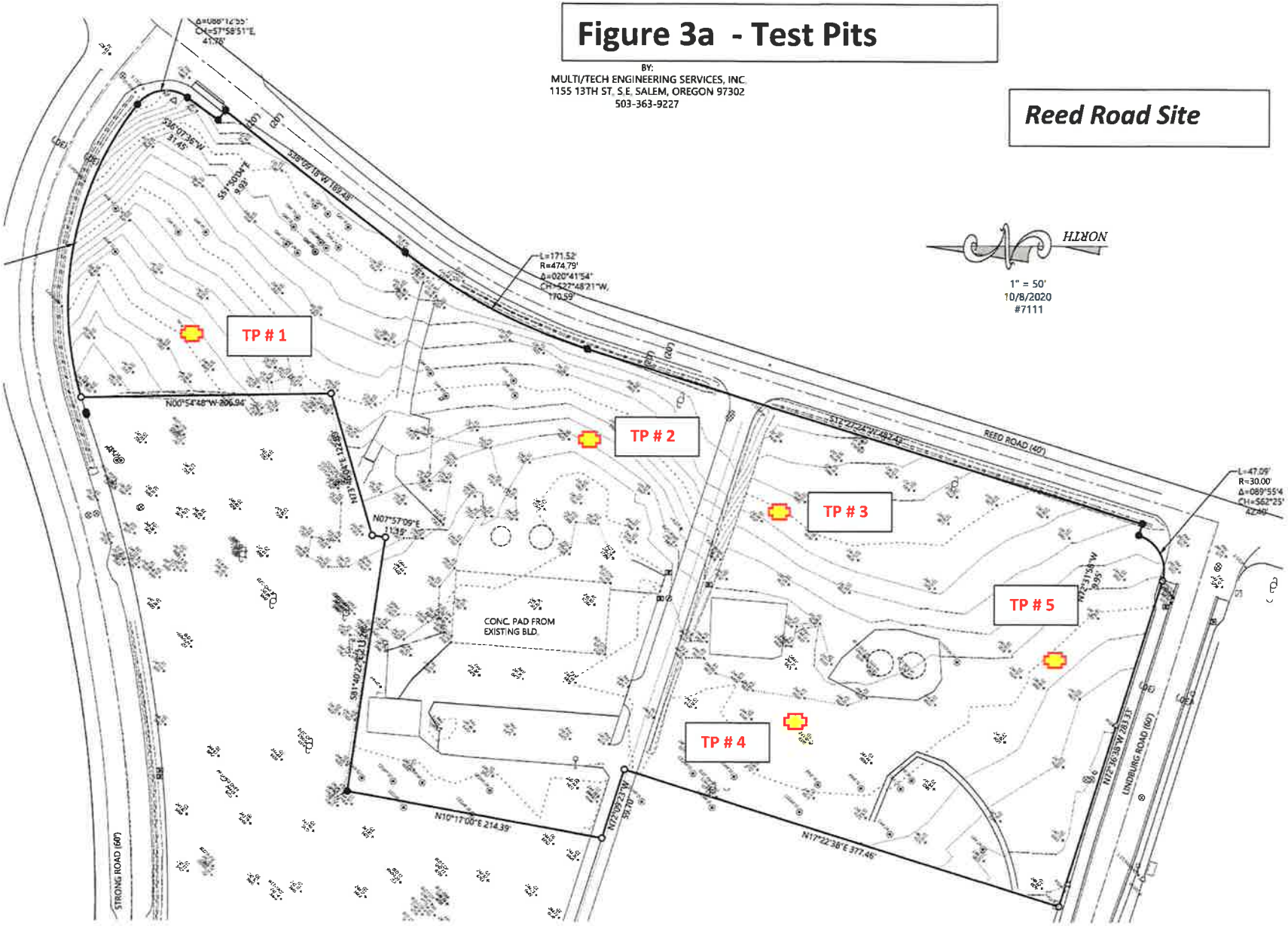

Figure 3b - Test Pits

VC Site

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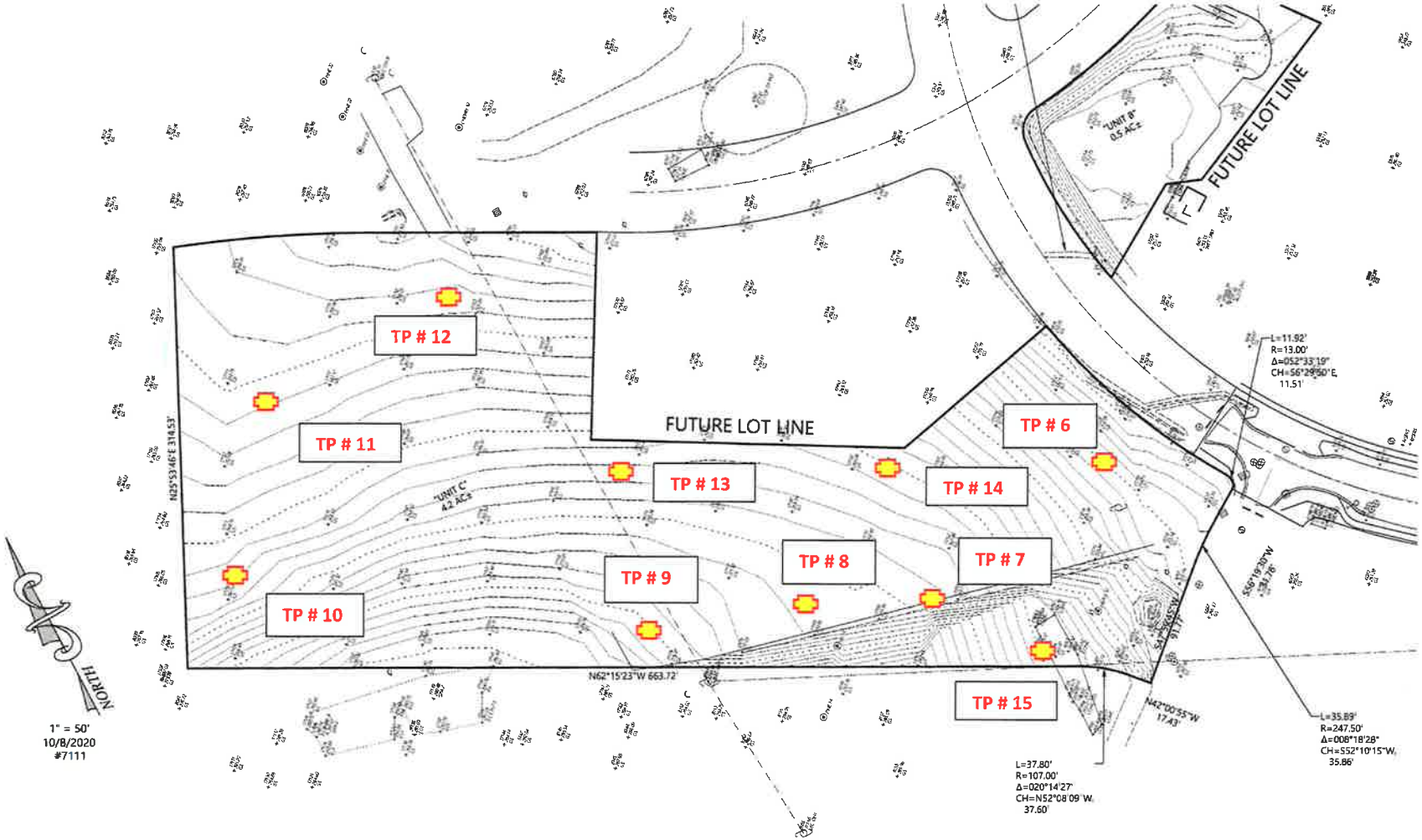
503-363-9227



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UNIFIED SOIL CLASSIFICATION SYSTEM

UNIFIED SOIL CLASSIFICATION AND SYMBOL CHART

COARSE-GRAINED SOILS (more than 50% of material is larger than No. 200 sieve size.)			
GRAVELS More than 50% of coarse fraction larger than No. 4 sieve size	Clean Gravels (Less than 5% fines)	GW	Well-graded gravels, gravel-sand mixtures, little or no fines
		GP	Poorly-graded gravels, gravel-sand mixtures, little or no fines
	Gravels with fines (More than 12% fines)	GM	Silty gravels, gravel-sand-silt mixtures
		GC	Clayey gravels, gravel-sand-clay mixtures
SANDS 50% or more of coarse fraction smaller than No. 4 sieve size	Clean Sands (Less than 5% fines)	SW	Well-graded sands, gravelly sands, little or no fines
		SP	Poorly graded sands, gravelly sands, little or no fines
	Sands with fines (More than 12% fines)	SM	Silty sands, sand-silt mixtures
		SC	Clayey sands, sand-clay mixtures
FINE-GRAINED SOILS (50% or more of material is smaller than No. 200 sieve size.)			
SILTS AND CLAYS Liquid limit less than 50%		ML	Inorganic silts and very fine sands, rock flour, silty of clayey fine sands or clayey silts with slight plasticity
		CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays
		OL	Organic silts and organic silty clays of low plasticity
SILTS AND CLAYS Liquid limit 50% or greater		MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts
		CH	Inorganic clays of high plasticity, fat clays
		OH	Organic clays of medium to high plasticity, organic silts
HIGHLY ORGANIC SOILS		PT	Peat and other highly organic soils

LABORATORY CLASSIFICATION CRITERIA

GW	$C_u = \frac{D_{60}}{D_{10}}$ greater than 4; $C_c = \frac{D_{30}}{D_{10} \times D_{60}}$ between 1 and 3	
GP	Not meeting all gradation requirements for GW	
GM	Atterberg limits below "A" line or P.I. less than 4	Above "A" line with P.I. between 4 and 7 are borderline cases requiring use of dual symbols
GC	Atterberg limits above "A" line with P.I. greater than 7	
SW	$C_u = \frac{D_{60}}{D_{10}}$ greater than 4; $C_c = \frac{D_{30}}{D_{10} \times D_{60}}$ between 1 and 3	
SP	Not meeting all gradation requirements for GW	
SM	Atterberg limits below "A" line or P.I. less than 4	Limits plotting in shaded zone with P.I. between 4 and 7 are borderline cases requiring use of dual symbols.
SC	Atterberg limits above "A" line with P.I. greater than 7	

Determine percentages of sand and gravel from grain-size curve. Depending on percentage of fines (fraction smaller than No. 200 sieve size), coarse-grained soils are classified as follows:

Less than 5 percent	GW, GP, SW, SP
More than 12 percent	GM, GC, SM, SC
5 to 12 percent	Borderline cases requiring dual symbols

PLASTICITY CHART

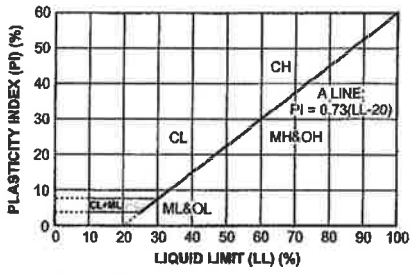

FIGURE 4 *Unified Soil Classification System*

EXHIBIT MAP

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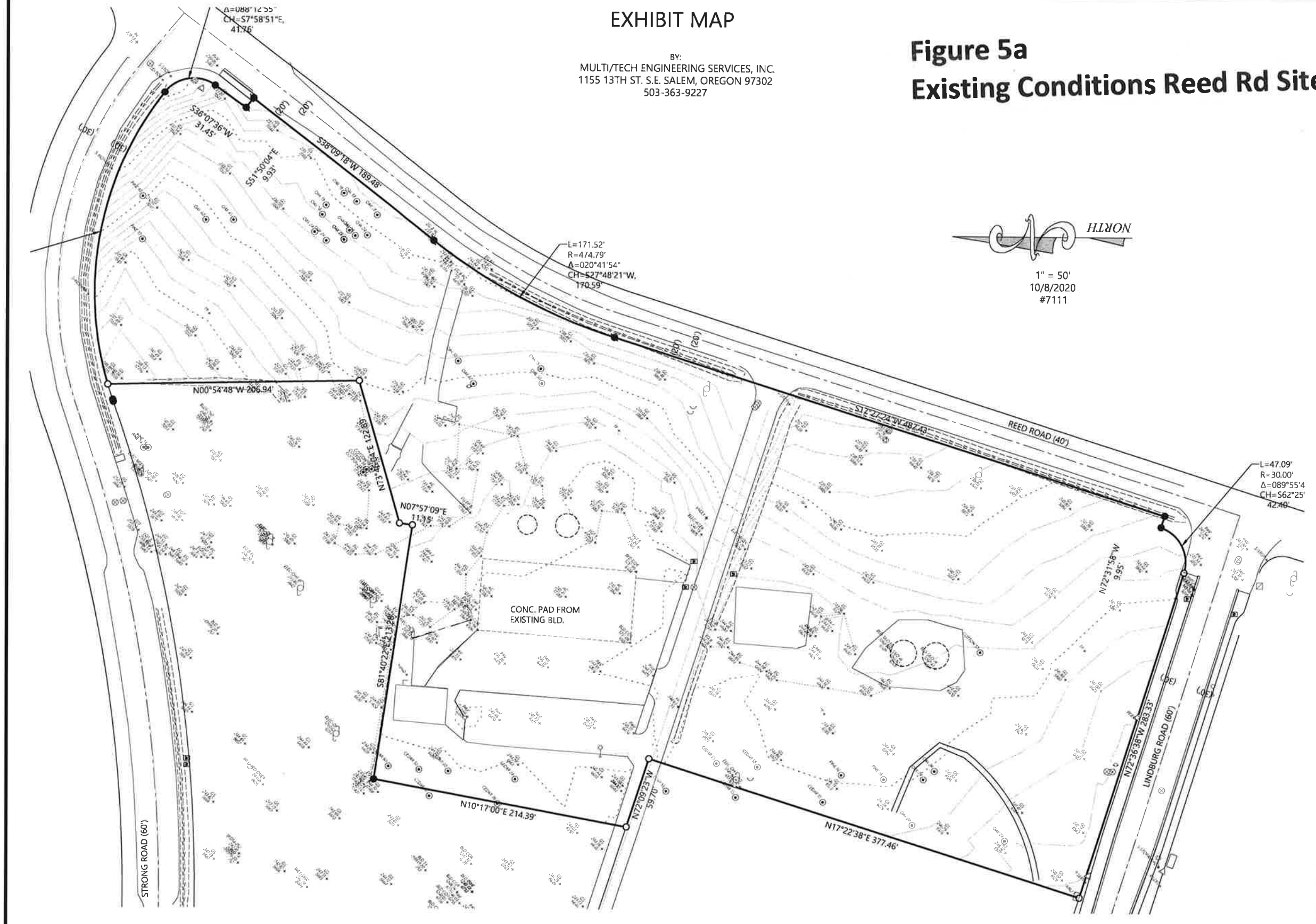
Figure 5a
Existing Conditions Reed Rd Site

NORTH

1" = 50'
10/8/2020
#7111



SHEET 1 OF 1

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EXHIBIT MAP

BY:
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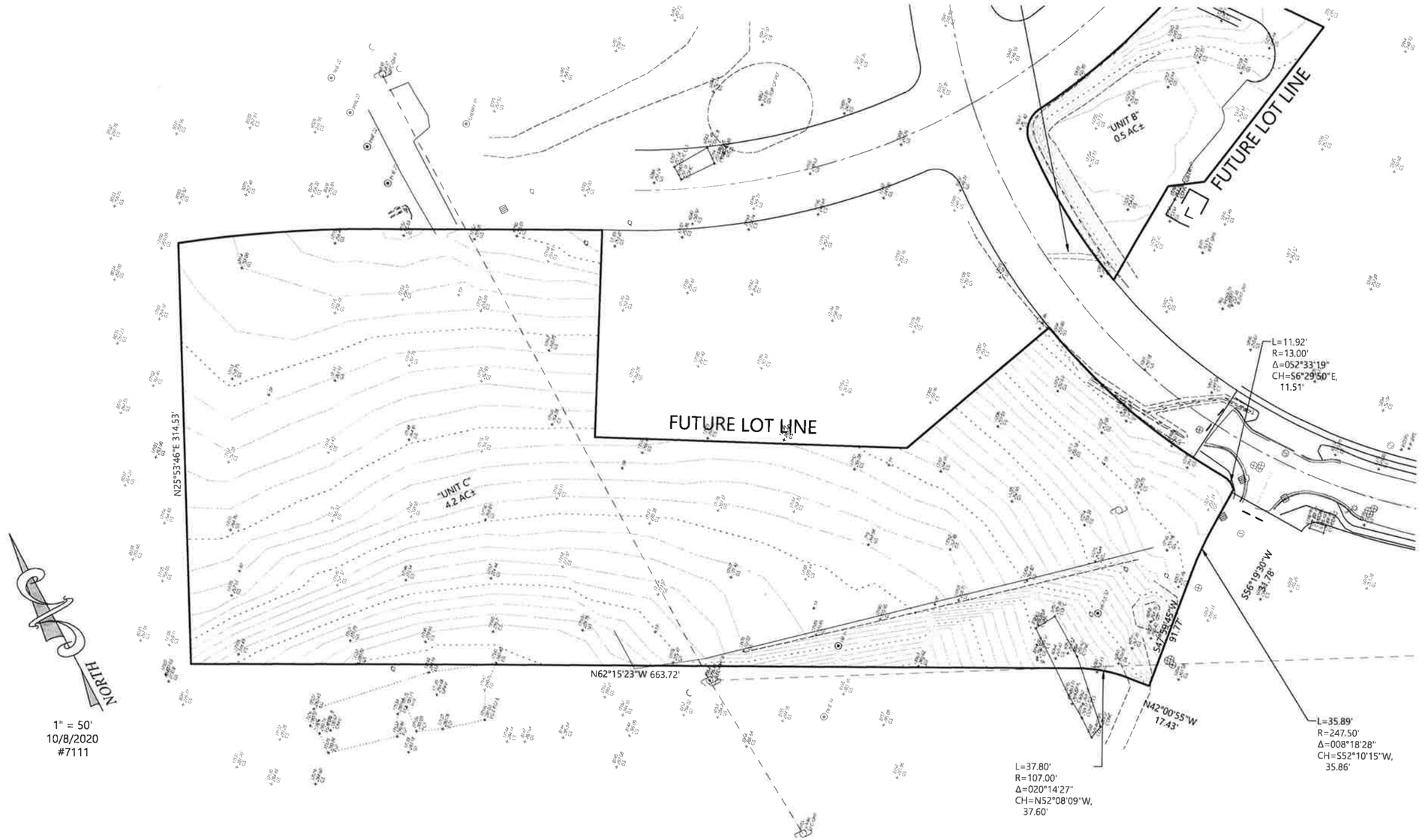
Figure 5b
Existing Conditions VC Site



1" = 50'
10/8/2020
#7111

Figure 6a
Reed Rd Site Plan

The Grove Phase 2

BY:
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503-363-9227

SITE PLAN

1" = 40'-0"

78 TOTAL APT UNITS

27	TYPE (A) 2 BED/ 2 BATH	(952 sqft)
21	TYPE (B) 2 BED/ 2 BATH	(1029 sqft)
21	TYPE (C) 1 BED/ 1 BATH	(728 sqft)
9	TYPE (D) 3 BED/2 BATH	(1204sqft)

142 TOTAL PARKING STALLS

79	STANDARD STALLS
57	COMPACT
5	HANDICAPPED STALLS
1	Loading

SITE

2	REC AREA
1	US MAIL BOX AREA
2	TRASH/RECYCLE
1	MULTI- USE PATH
1	MAINT BLD

NORTH

1" = 40'
5/04/2020
#7028
RDH

MULTI-USE PATH

MOUNTAIN STREET

. NOT SURVEYED
OR REFERENCE ONLY

PROPOSED:
78 UNIT APARTMENT COMPLEX
The Grove Phase II
FairView Site Salem, Or

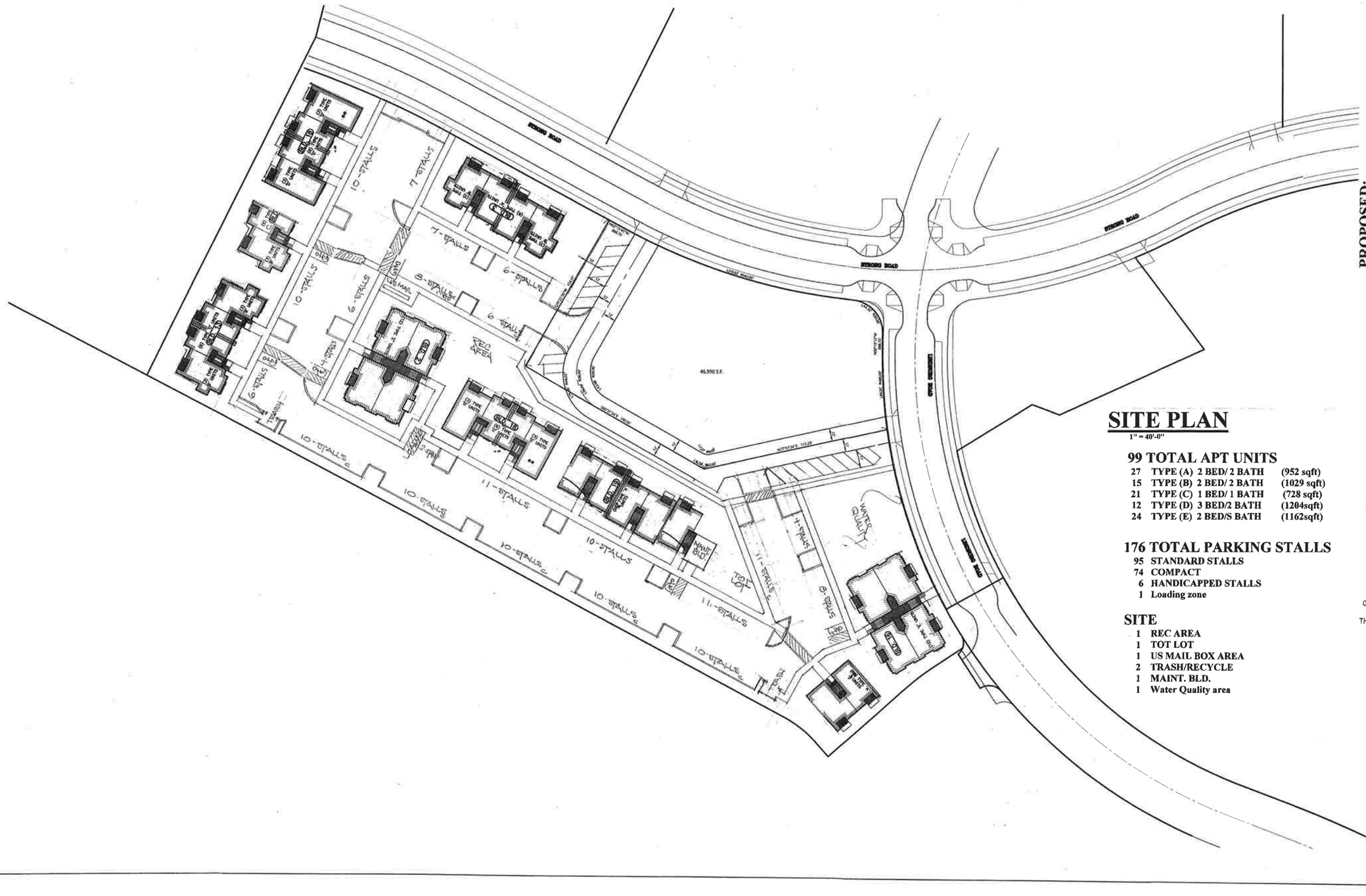
11-17-20
11-16-20
10-13-20
REVISED

EXHIBIT MAP

BY:
MULTI/TECH ENGINEERING SERVICES, INC.
1155 13TH ST. S.E. SALEM, OREGON 97302
503-363-9227

Figure 6b
VC Site Plan

PROPOSED:
99 UNIT APARTMENT COMPLEX
The Grove Phase II
FairView Site Salem, Or



SITE PLAN

1" = 40'-0"

99 TOTAL APT UNITS

27	TYPE (A) 2 BED/ 2 BATH	(952 sqft)
15	TYPE (B) 2 BED/ 2 BATH	(1029 sqft)
21	TYPE (C) 1 BED/ 1 BATH	(728 sqft)
12	TYPE (D) 3 BED/2 BATH	(1204sqft)
24	TYPE (E) 2 BED/S BATH	(1162sqft)

176 TOTAL PARKING STALLS

95	STANDARD STALLS
74	COMPACT
6	HANDICAPPED STALLS
1	Loading zone

SITE

1	REC AREA
1	TOT LOT
1	US MAIL BOX AREA
2	TRASH/RECYCLE
1	MAINT. BLD.
1	Water Quality area

NORTH

1" = 40'
08/27/2020
#7028
THE GROVE 2

REVISED 10-8-20

Appendix "A"

MULTI/TECH

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Site Test Pit Log **Pit No. 1**

Depth Feet	Sample	Moisiture Content	Soil Class	Discription
0				
1				Organic Layer , top soil
2				Silty Clay Loam, damp Dark Brown Medium Stiff
3				
4				Light Brown Silty Clay, slightly sandy, Stiff, Dry
5				Terminated Excavationwork at 48 inches No ground water encountered at the time of the excavation
6				
7				
8				
9				
10				

MULTI / TECH
ENGINEERING SERVICES, INC.

Site Test Pit Log **Pit No. 2**

Depth Feet	Sample	Moisiture Content	Soil Class	Discription
0				
1				Organic Layer , top soil
2				Silty Clay Loam, damp Dark Brown Medium Stiff
3				
4				
5				Light Brown Silty Clay, Stiff, Dry
6				light Brown in Color Sandy Silty Clay material, moist, stiff
7				Terminated Excavationwork at 72 inches No ground water encountered at the time of the excavation
8				
9				
10				

MULTI / TECH

ENGINEERING SERVICES, INC.

Site Test Pit Log **Pit No. 3**

Depth Feet	Sample	Moisiture Content	Soil Class	Discription
0				
1				Organic Layer , top soil
2				Silty Clay Loam, damp Dark Brown Medium Stiff
3				Silty Clay Loam, damp Dark Brown Stiff
4				
5				Light Brown Silty Clay, Stiff, Dry
6				
7				light Brown in Color Sandy Silty Clay material, moist, stiff There appears to be more clay present at the bottom of the excavation
8				
9				Terminated Excavationwork at 84 inches No ground water encountered at the time of the excavation
10				

MULTI/TECH
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Site Test Pit Log **Pit No. 4**

Depth Feet	Sample	Moisiture Content	Soil Class	Discription
0				Organic material, root zone
13"				Noted Top Soil and fill material in this range
32"				Silty Clay Loam, damp Gray/Brown
				Light Brown Silty Clay, Stiff, Dry
78"				Material Sandy Silt Clay in bottom of excavation, medium stiff
				Terminated Excavationwork at 78 inches No ground water encountered at the time of the excavation

MULTI/TECH
ENGINEERING SERVICES, INC.

Site Test Pit Log **Pit No. 5**

Depth Feet	Sample	Moisiture Content	Soil Class	Discription
0				Organic material, root zone
1				Noted Top Soil, Dark Brown, soft
2				
3	32"			Silty Clay Loam, damp Gray/Brown
4				
5				Light Brown Silty Clay, Stiff, Dry
6				
7				Material Sandy Silt Clay in bottom of excavation, medium stiff
8				
9				Terminated Excavationwork at 80 inches No ground water encountered at the time of the excavation
10				

MULTI/TECH
ENGINEERING SERVICES, INC.

Site Test Pit Log **Pit No. 6**

Depth Feet	Sample	Moisiture Content	Soil Class	Discription
0				
1				
2				Organic fill material present
3				Organic material, root zone
4				
5				Light Brown Silty Clay, Stiff, Dry
6				
7				
8				
9				Terminated Excavationwork at 96 inches No ground water encountered at the time of the excavation
10				

MULTI/TECH
ENGINEERING SERVICES, INC.

Site Test Pit Log **Pit No. 7**

Depth Feet	Sample	Moisiture Content	Soil Class	Discription
0				
1				Organic material, root zone
2				Fractured Basalt Material, very hard
3				
4				Terminated Excavationwork at 24 inches No ground water encountered at the time of the excavation
5				
6				
7				
8				
9				
10				

MULTI/TECH
ENGINEERING SERVICES, INC.

Site Test Pit Log **Pit No. 8**

Depth Feet	Sample	Moisiture Content	Soil Class	Discription
0				
1				A fractured rock surface material
14"				
2				
3				
4				A Red Clay material, very firm
5				
6				Weathered Basalt material, fractured
7				Terminated Excavationwork at 72 inches No ground water encountered at the time of the excavation
8				
9				
10				

MULTI / TECH
ENGINEERING SERVICES, INC.

Site Test Pit Log **Pit No. 9**

Depth Feet	Sample	Moisiture Content	Soil Class	Discription
0				
1				Top Soil material
2				
3				
4				Sandy Silt Material
5				
6				Red Clay material very firm
7				
8				Terminated Excavationwork at 84 inches No ground water encountered at the time of the excavation
9				
10				

MULTI/TECH
ENGINEERING SERVICES, INC.

Site Test Pit Log **Pit No. 10**

Depth Feet	Sample	Moisiture Content	Soil Class	Discription
0				
1				Top soil - fill material
2				
3				
4				
5				
6				Red Clay material very firm
7				
8				Very Firm Clay material
9				
10				Terminated Excavationwork at 108 inches No ground water encountered at the time of the excavation

MULTI/TECH
ENGINEERING SERVICES, INC.

Site Test Pit Log **Pit No. 11**

Depth Feet	Sample	Moisiture Content	Soil Class	Discription
0				Organic material, root zone
8"				
1				Noted Top Soil, Dark Brown, soft
20"				
2				
3				
4				
5				Light Brown Silty Clay, Stiff, Dry
6				
7				
8				
9				Terminated Excavationwork at 80 inches No ground water encountered at the time of the excavation
10				

MULTI/TECH
ENGINEERING SERVICES, INC.

Site Test Pit Log **Pit No. 12**

Depth Feet	Sample	Moisiture Content	Soil Class	Discription
0				
1 (9")				Organic Layer , top soil
2				
3				
4				Light Brown Silty Clay material, Stiff
5				
6				light Brown in Color Clay material
7				
8				Terminated Excavationwork at 84 inches No ground water encountered at the time of the excavation
9				
10				

MULTI / TECH
ENGINEERING SERVICES, INC.

Site Test Pit Log **Pit No. 13**

Depth Feet	Sample	Moisiture Content	Soil Class	Discription
0				
1				
2 (14")				Top soil - fill material
3				
4				
5				
6				Cilty Clay - light Brown - Stiff
7				
8				Terminated Excavationwork at 72 inches No ground water encountered at the time of the excavation
9				
10				

MULTI / TECH
ENGINEERING SERVICES, INC.

Site Test Pit Log **Pit No. 14**

Depth Feet	Sample	Moisiture Content	Soil Class	Discription
0				
1				Top soil - fill material
2				
3				
4				
5				
6				Cilty Clay - light Brown - Stiff
7				
8				Terminated Excavationwork at 72 inches No ground water encountered at the time of the excavation
9				
10				

MULTI / TECH
ENGINEERING SERVICES, INC.

Site Test Pit Log **Pit No. 15**

Depth Feet	Sample	Moisiture Content	Soil Class	Discription
0				
1				Top soil - fill material
2				
3				Silty Clay - very Stiff - Light Brown
4				
5				
6				Espect to find fractured basalt at some point
7				
8				Terminated Excavationwork at 72 inches No ground water encountered at the time of the excavation
9				
10				

MULTI / TECH
ENGINEERING SERVICES, INC.

The Grove at Fairview - Phase 2 Reed Road Site

Infiltration Test

Test No.1 (Excavation Pit No. 2)

September 25th, 2020

Site Soils are a Silty Clay Loam

Time *(min)*	Time Difference *(min)*	Water Level *(feet)*	Infiltration *(feet)*	Infiltration *(inches)*	Infiltration Rate *In/Min*	Infiltration Rate *In/hr*	Cumilative Infiltration *(inches)*
0		1.25					
	4		0.02	0.24	0.06	3.6	0.24
4		1.27					
	4		0.02	0.24	0.06	3.6	0.48
8		1.29					
	4		0.01	0.12	0.03	1.8	0.6
12		1.3					
	4		0.01	0.12	0.03	1.8	0.72
16		1.31					
	4		0.03	0.36	0.09	5.4	1.08
20		1.34					
	10		0.02	0.24	0.024	1.44	1.32
30		1.36					
	10		0.01	0.12	0.012	0.72	1.44
40		1.37					
	10		0.02	0.24	0.024	1.44	1.68
50		1.39					
	10		0.01	0.12	0.012	0.72	1.8
60		1.4					
	10						
70							
	10		0	0	0	0	0
80							
	10		0	0	0	0	0
90							
	10		0	0	0	0	0
100							
	20		0	0	0	0	0
120							

Average Rate 1.8

Design Rate 1 *in/hr*

24 Hour Design Rate ***24 in***

MULTI / TECH
ENGINEERING SERVICES, INC.

The Grove at Fairview - Phase 2 Reed Road Site

Infiltration Test

Test No.2 (Excavation Pit No. 5)

September 25th, 2020

Site Soils are a Silty Clay Loam

Time *(min)*	Time Difference *(min)*	Water Level *(feet)*	Infiltration *(feet)*	Infiltration *(inches)*	Infiltration Rate *In/Min*	Infiltration Rate *In/hr*	Cumilative Infiltration *(inches)*
0		1.4					
	4		0.03	0.36	0.09	5.4	0.36
4		1.43					
	4		0.02	0.24	0.06	3.6	0.6
8		1.45					
	4		0.01	0.12	0.03	1.8	0.72
12		1.46					
	4		0.01	0.12	0.03	1.8	0.84
16		1.47					
	4		0.01	0.12	0.03	1.8	0.96
20		1.48					
	10		0.02	0.24	0.024	1.44	1.2
30		1.5					
	10		0.01	0.12	0.012	0.72	1.32
40		1.51					
	10		0.01	0.12	0.012	0.72	1.44
50		1.52					
	10		0.01	0.12	0.012	0.72	1.56
60		1.53					
	10						
70							
	10		0	0	0	0	0
80							
	10		0	0	0	0	0
90							
	10		0	0	0	0	0
100							
	20		0	0	0	0	0
120							

Average Rate 1.56

Design Rate 1 *in/hr*

24 Hour Design Rate ***24 in***

MULTI / TECH
ENGINEERING SERVICES, INC.

The Grove at Fairview - Phase 2 Reed Road Site

Infiltration Test

Test No.3 (Excavation Pit No. 6)

September 25th, 2020

Site Soils are a firm Clay

Time *(min)*	Time Difference *(min)*	Water Level *(feet)*	Infiltration *(feet)*	Infiltration *(inches)*	Infiltration Rate *In/Min*	Infiltration Rate *In/hr*	Cumilative Infiltration *(inches)*
0		1.6					
	4		0.01	0.12	0.03	1.8	0.12
4		1.61					
	4		0.01	0.12	0.03	1.8	0.24
8		1.62					
	4		0.01	0.12	0.03	1.8	0.36
12		1.63					
	4		0.005	0.06	0.015	0.9	0.42
16		1.635					
	4		0.005	0.06	0.015	0.9	0.48
20		1.64					
	10		0.02	0.24	0.024	1.44	0.72
30		1.66					
	10		0.01	0.12	0.012	0.72	0.84
40		1.67					
	10		0.01	0.12	0.012	0.72	0.96
50		1.68					
	10		0	0	0	0	0.96
60		1.68					
	10						
70							
	10		0	0	0	0	0
80							
	10		0	0	0	0	0
90							
	10		0	0	0	0	0
100							
	20		0	0	0	0	0
120							

Average Rate 0.96

Design Rate 0.7 *in/hr*

24 Hour Design Rate ***16.8 in***

MULTI / TECH
ENGINEERING SERVICES, INC.

The Grove at Fairview - Phase 2 Reed Road Site

Infiltration Test

Test No.4 (Excavation Pit No. 10)

September 25th, 2020

Site Soils are a firm Clay

Time *(min)*	Time Difference *(min)*	Water Level *(feet)*	Infiltration *(feet)*	Infiltration *(inches)*	Infiltration Rate *In/Min*	Infiltration Rate *In/hr*	Cumilative Infiltration *(inches)*
0		1.5					
	4		0.01	0.12	0.03	1.8	0.12
4		1.51					
	4		0	0	0	0	0.12
8		1.51					
	4		0.01	0.12	0.03	1.8	0.24
12		1.52					
	4		0	0	0	0	0.24
16		1.52					
	4		0.01	0.12	0.03	1.8	0.36
20		1.53					
	10		0.01	0.12	0.012	0.72	0.48
30		1.54					
	10		0.01	0.12	0.012	0.72	0.6
40		1.55					
	10		0	0	0	0	0.6
50		1.55					
	10		0.01	0.12	0.012	0.72	0.72
60		1.56					
	10						
70							
	10		0	0	0	0	0
80							
	10		0	0	0	0	0
90							
	10		0	0	0	0	0
100							
	20		0	0	0	0	0
120							

Average Rate 0.72

Design Rate 0.7 *in/hr*

24 Hour Design Rate ***16.8 in***

Appendix "B"

GeoPacific Engineering, Inc.

Real-World Geotechnical Solutions
Investigation • Design • Construction Support

November 22, 2004

Project No. 04-9026

J.T. Smith Companies
4386 SW Macadam Ave. Suite 102
Portland, Oregon 97201
Fax: 503-657-3625

Attention: Joe Schiewe

RE: PRELIMINARY GEOTECHNICAL FINDINGS
FAIRVIEW COMMUNITY
SALEM, OREGON

This report presents our preliminary geotechnical findings, interpretations, and conclusions based on 18 exploratory test pits that were excavated at select locations on the above-referenced property. Logs of the test pits are presented in Appendix A. Their approximate locations are shown on a topographic map of the site with a contour interval of 10 feet. Preliminary streets and lots are also shown but the design may be further refined. The purpose of this preliminary report is to present subsurface information and our preliminary geotechnical interpretations assessing potentially adverse site conditions and to assist in site development, project planning, and preliminary budgeting.

SITE DESCRIPTION AND PROPOSED DEVELOPMENT

The Fairview facility opened about 1890 but reached its maximum operation potential between about 1970 and 1990. Since that time the facility operations have declined to the point that most of the 80-some buildings are closed and only maintenance and security personnel remain in charge of the property. A small group of school children still hold classes at the facility. In addition, local, state, and federal law enforcement agencies hold periodic training exercises at the facility.

The area to be developed is lies south and west of this old Fairview facility. The site area is bounded by Pringle Road on the west, Battle Creek Road on the south, and Reed Road on the east, as shown on Figure 1. The site topography is characterized by a series of elevated knobs and broad, rounded ridges, which are separated by incised valleys that drain slightly east of north. Slopes average between 10 and 15 percent grade with local maximum grades approaching about 25 percent. Native vegetation in the portion of the site that has not been cleared consists primarily of oak and Douglas fir. Oak appear to prefer areas where rock is at or near the ground surface, such as in the northwest portion of the site. Most of the southeastern portion of the development area was cleared years ago and utilized as a fruit orchard of cherry, apple, plum, and pear trees. These trees have become moss-covered and overgrown by blackberry vines to the point that much of the area is virtually impenetrable on foot without the aid of equipment.

The currently proposed plan for development includes about 1,000 lots for single-family homes, 136 townhomes, and a number of lots for smaller homes or condominimums. Associated improvements include about 24,000 lineal feet of new streets. Plans for site grading are still in their preliminary stages. Retaining walls may be added after refining of the grading plan. Storm water facilities and open space tracts are also in the planning stages.

SITE EXPLORATIONS

On November 15 and 16, 2004, GeoPacific explored subsurface conditions on the site by excavating eighteen exploratory test pits to depths ranging between 6.0 and 19.5 feet with a Link-Belt 3400 trackhoe from C&M Construction, Inc. at the locations shown on Figure 1. The test pit locations were very roughly located in the field by GeoPacific on the basis of topography, estimated distances from such features as power lines and previous test pits. Lines of test pits were aligned with distant fixed objects, such as a water tower and tall trees. After completion of logging and backfilling, the test pits were marked with a numbered stake and red flagging for later identification by WRG surveyors who will provide locations and elevations for subsequent subsurface mapping by GeoPacific, such as contours on top of weathered rock and hard rock.

SUBSURFACE CONDITIONS

The observed subsurface conditions and soil types are summarized below.

Topsoil – Based on observations at 18 test pit locations, topsoil thickness ranged between about 8 and 12 inches. It typically consisted of dark brown to red-brown clayey silt with abundant roots but generally without a significant quantity of fine organic debris, except in the bottoms of incised drainages.

Colluvial Soil – The soil horizon directly below topsoil at most test pit locations consisted of brown to red-brown clayey silt that was typically medium stiff to stiff. This transported soil generally ranged in thickness between 1.5 and 2 feet with local variations of up to about 3 feet.

Residual Soil – Residual soil in the site region generally refers to the end product of volcanic rock weathering whereby hard, fresh lava rock is weathered in-place without lateral movement or transport to become soil. This soil unit was typically very stiff and varied in thickness between a foot and less to about 3.5 feet. In test pit TP-10 an unusual thickness of colluvial/residual soil was encountered between depths of 2.5 to 13 feet. Residual soil typically provides good foundation bearing for structures.

Rock – Basalt rock was encountered in all exploratory test pits; however, it was largely absent, deep, and highly weathered in test pit TP-10. The depths of rock weathering and fracturing vary widely over relatively short horizontal distances. The test pit logs indicate progressive changes in rock characteristics with depth below the residual soil horizon. Typically, the top of rock is soft and readily excavated. It is usually highly weathered, light to dark brown with closely spaced, black stained, fractures yielding gravel-size angular rock fragments. With depth, the fractures often become more widely spaced, yielding cobble-size rock fragments. With additional depth, the basalt may become gray in color and be excavated with some difficulty (medium hard), followed by a sudden change to very hard rock with few fractures. At this point the test pit is terminated. At some locations, see TP-7, the rock may be gray and hard but will remain highly fractured. Under these conditions, the trackhoe can continue to excavate to its depth limit.

Soil Moisture and Groundwater

Soil moisture was encountered in the near surface soil horizons (Topsoil, Colluvial, and Residual); however, these soils throughout the site have an abundance of clay and characteristically low permeability. No groundwater seepage in these soils was observer or anticipated. Test pit TP-15 encountered some slow seepage of groundwater in the form of wet fracture surfaces in highly fractured basalt rock between depths of 13 to 16 feet. No significant accumulation of groundwater was observed at the bottom of the test pit.

PRELIMINARY CONCLUSIONS AND RECOMMENDATIONS

Rock

Our brief test pit exploration of the site clearly indicated the entire site to be underlain by basalt rock. The depth of weathering of this rock appears to be related to elevation and drainage. The average depth to hard rock at 18 test pit locations, including TP-10, is 13.75 feet. The average depth to top of excavatable rock is 5.36 feet. The extent and relatively shallow depth of rock at the site represents a serious consideration with regard to site grading and sanitary sewer trenching.

Topsoil Stripping

At most of the test pit locations, we recorded a topsoil thickness of 1 foot. Much of the organic debris in the topsoil horizon appeared to consist primarily of tree and berry roots. We believe that much of this debris can be mechanically removed and the total topsoil thickness to be removed can be reduced by 50% or more.

Site Grading

Site grading below an average depth of about 5.5 feet will be cutting into in-situ weathered, but generally soft, excavatable rock. Deeper cuts below 14 feet have a good chance of encountering very hard rock.
Overall grading requirements for the site should be reviewed with respect to reducing grading cuts where possible.

Infiltration Potential

While no infiltration testing has been performed at the site to date. Based on our field experience, it appears likely that infiltration testing in the near-surface clayey soil will yield very low infiltration rates. It may be that highly fractured basalt rock from about 6 to 12 feet will provide higher infiltrations rates than on-site soils. Infiltration testing in fractured rock sections is recommended. Stormwater disposal in trenches cut into weathered rock or in drywells with a sand filtering system should be considered an alternative. On-site clayey soils should be avoided for in-ground disposal of strorm water.

On-site Rock For Construction

With the abundance of rock on the site, the possibility of enlarging the existing on-site quarry along Reed Road and setting up a site rock crusher should be considered and could reduce aggregate import costs.

UNCERTAINTY AND LIMITATIONS

We have prepared this report for the developer and engineers, for use on this project only. This report should be provided in its entirety to prospective contractors for bidding and estimating purposes; however, the conclusions and interpretations presented in this report should not be construed as a warranty of the subsurface conditions. Inconsistent conditions can occur between explorations that may not be detected by a geotechnical study. If, during future site operations, subsurface conditions are encountered which vary appreciably from those described herein, GeoPacific should be notified for review of the recommendations of this report, and revision of such if necessary.

We recommend that GeoPacific be retained to prepare a final investigation report and to review the plans and specifications and verify that our recommendations have been interpreted and implemented as intended. Sufficient geotechnical monitoring, testing and consultation should be provided during construction to confirm that the conditions encountered are consistent with those indicated by explorations.

Within the limitations of scope, schedule and budget, GeoPacific attempted to execute these services in accordance with generally accepted professional principles and practices in the fields of geotechnical engineering and engineering geology at the time the report was prepared. No warranty, express or implied, is made. The scope of our work did not include environmental assessments or evaluations regarding the presence or absence of wetlands or hazardous or toxic substances in the soil, surface water, or groundwater at this site.

Sincerely,

GEOPACIFIC ENGINEERING, INC.

James E. Pyne R.G.
Senior Geologist

James D. Imbrie, P.E., C.E.G.
Principal Geotechnical Engineer

Attachments:

Figure 1 – Site and Exploration Plan
Appendix A - Logs of Test Pits

cc: Richard D. Boyle – WRG Design

Fairview Community – 04-9026

APPENDIX A

GeoPacific Engineering, Inc.
7312 SW Durham Road
Portland, Oregon 97224
Tel: (503) 598-8445 Fax: (503) 598-8705

TEST PIT LOG

Project: Fairview Village Salem, Oregon.	Project No. 04-9026	Test Pit No. **TP- 1**

Depth (ft)	Pocket Penetrometer (tons/ft²)	Sample Type	In-Situ Dry Density (lb/ft³)	Moisture Content (%)	Water Bearing Zone	Material Description
1						Red-brown clayey silt with abundant roots, soft, moist (Topsoil - ML).
2						Red-brown clayey silt, medium stiff, moist (Colluvial Soil - ML).
3						Light brown clayey silt with abundant fragments of completely weathered basalt, very stiff, moist (Residual Soil - ML).
4						
5						Gray to brown highly weathered and fractured basalt rock with black mineralization on fracture surfaces, soft, readily excavated.
6						
7						
8						Weathered and fractured basalt rock similar to above
9						
10						
11						
12						Rock changes to gray, medium hard, then hard at 13' depth.
13						
14						Test pit completed at 13 feet, No groundwater encountered.
15						
16						
17						

LEGEND

Bag Sample | Bucket Sample | Shelby Tube Sample | Seepage | Water Bearing Zone | Water Level at Abandonment

Date Excavated: 11/15-16/04
Logged By: J. Pyne
Surface Elevation:

GeoPacific Engineering, Inc.
7312 SW Durham Road
Portland, Oregon 97224
Tel: (503) 598-8445 Fax: (503) 598-8705

TEST PIT LOG

Project: Fairview Village Salem, Oregon.	Project No. 04-9026	Test Pit No. **TP- 2**

Depth (ft)	Pocket Penetrometer (tons/ft²)	Sample Type	In-Situ Dry Density (lb/ft³)	Moisture Content (%)	Water Bearing Zone	Material Description
0						Dark red-brown clayey silt, abundant roots, soft, moist (Topsoil - ML).
1						
						Dark red-brown clayey silt, medium stiff, moist (Colluvial Soil - ML).
2						
3						Light brown clayey silt with inclusions of highly to completely weathered rock Residual Soil - ML).
4						
						Rust brown highly weathered and fractured basalt rock, black mineral staining on fracture surfaces, soft rock, readily excavated.
5						
6						
7						
8						
9						
						Gray basalt, hard.
10						Test pit terminated at 9.5 feet, No groundwater encountered.
11						
12						
13						
14						
15						
16						
17						

LEGEND

Bag Sample

Bucket Sample


Shelby Tube Sample


Seepage


Water Bearing Zone


Water Level at Abandonment

Date Excavated: 11/15-16/04
Logged By: J. Pyne
Surface Elevation:

GeoPacific Engineering, Inc.
7312 SW Durham Road
Portland, Oregon 97224
Tel: (503) 598-8445 Fax: (503) 598-8705

TEST PIT LOG

Project: Fairview Village Salem, Oregon.	Project No. 04-9026	Test Pit No. **TP- 3**

Depth (ft)	Pocket Penetrometer (tons/ft²)	Sample Type	In-Situ Dry Density (lb/ft³)	Moisture Content (%)	Water Bearing Zone	Material Description
						Dark red-brown clayey silt, abundant roots, soft, moist (Topsoil - ML).
1						
						Red-brown clayey silt, medium stiff, moist (Colluvial Soil - ML).
2						
3						Red-brown clayey silt, very stiff, moist with occasional weathered fragments of basalt (Residual Soil - ML).
4						
5						Tan to dark brown highly weathered and fractures basalt, black mineral stains on fracture surfaces, soft rock, readily excavated, very stiff, damp.
6						
7						
8						Red-brown basalt, highly weathered and fractured basalt
9						Light to dark brown and gray basalt, weathered, highly fractured basalt
10						
11						
12						
13						
14						Sudden change to hard gray basalt at 15 feet.
15						
16						Test pit terminated at 15 feet, No groundwater encountered.
17						

LEGEND

Bag Sample

Bucket Sample


Shelby Tube Sample


Seepage


Water Bearing Zone


Water Level at Abandonment

Date Excavated: 11/15-16/04
Logged By: J. Pyne
Surface Elevation:

GeoPacific Engineering, Inc.
7312 SW Durham Road
Portland, Oregon 97224
Tel: (503) 598-8445 Fax: (503) 598-8705

TEST PIT LOG

Project: Fairview Village Salem, Oregon.	Project No. 04-9026	Test Pit No. **TP- 4**

Depth (ft)	Pocket Penetrometer (tons/ft²)	Sample Type	In-Situ Dry Density (lb/ft³)	Moisture Content (%)	Water Bearing Zone	Material Description
0						Red-brown clayey silt, abundant roots, soft, moist (Topsoil - ML).
1						Dark red-brown clayey silt, medium stiff to stiff, moist (Colluvial Soil - ML).
2						
3						Light brown clayey silt with abundant gravel-size fragments of highly weathered basalt, stiff, moist (Residual Soil - ML).
4						
5						Brown weathered and fractured basalt, soft, readily excavated, black mineral stains on fracture surfaces.
6						
7						Change to red, brown, and black highly weathered and fractured basalt below 6 feet depth
8						
9						
10						
11						
12						
13						Gray, medium hard and fractured rock below 13 feet.
14						Sudden change to hard gray rock at 15 feet.
15						Test pit terminated at 15 feet depth, No groundwater encountered.
16						
17						

LEGEND

Bag Sample

Bucket Sample


Shelby Tube Sample


Seepage


Water Bearing Zone


Water Level at Abandonment

Date Excavated: 11/15-16/04
Logged By: J. Pyne
Surface Elevation:

GeoPacific Engineering, Inc.
7312 SW Durham Road
Portland, Oregon 97224
Tel: (503) 598-8445 Fax: (503) 598-8705

TEST PIT LOG

Project: Fairview Village Salem, Oregon.	Project No. 04-9026	Test Pit No. **TP- 5**

Depth (ft)	Pocket Penetrometer (tons/ft²)	Sample Type	In-Situ Dry Density (lb/ft³)	Moisture Content (%)	Water Bearing Zone	Material Description
						Dark red-brown clayey silt, abundant roots, moist, soft (Topsoil - ML).
1						
						Red-brown clayey silt, medium stiff to stiff, moist (Colluvial Soil - ML).
2						
3						
						Light brown clayey silt with abundant fragments of highly to completely weathered basalt rock (Residual Soil - ML/GM).
4						
5						
						Light to dark brown basalt, weathered, highly fractured with black mineral stains on fracture surfaces, soft rock, readily excavated.
6						
7						
8						
9						
10						
						Change to brownish-gray basalt, medium hard, fractured
11						
12						
						Sudden change to hard, gray basalt at 14 feet.
13						
14						
						Test pit terminated at 14 feet, No groundwater encountered.
15						
16						
17						

LEGEND

Bag Sample

Bucket Sample


Shelby Tube Sample


Seepage


Water Bearing Zone


Water Level at Abandonment

Date Excavated: 11/15-16/04
Logged By: J. Pyne
Surface Elevation:

GeoPacific Engineering, Inc.
7312 SW Durham Road
Portland, Oregon 97224
Tel: (503) 598-8445 Fax: (503) 598-8705

TEST PIT LOG

Project: Fairview Village Salem, Oregon.	Project No. 04-9026	Test Pit No. **TP- 6**

Depth (ft)	Pocket Penetrometer (tons/ft²)	Sample Type	In-Situ Dry Density (lb/ft³)	Moisture Content (%)	Water Bearing Zone	Material Description
1						Red-brown clayey silt, abundant roots, soft, moist (Topsoil - ML).
2						Red-brown clayey silt, medium stiff to stiff, moist (Colluvial Soil - ML).
3						
4						Light brown clayey silt with some highly to completely weathered basalt fragments, very stiff, moist (Residual Soil - ML).
5						Brown highly weathered basalt with black mineral staining on fracture surfaces, soft rock, readily excavated.
6						
7						Sudden change to hard gray basalt at 8 feet depth.
8						
9						Test pit terminated at 8 feet, No groundwater encountered.
10						
11						
12						
13						
14						
15						
16						
17						

LEGEND

Bag Sample

Bucket Sample


Shelby Tube Sample


Seepage


Water Bearing Zone


Water Level at Abandonment

Date Excavated: 11/15-16/04
Logged By: J. Pyne
Surface Elevation:

GeoPacific Engineering, Inc.
7312 SW Durham Road
Portland, Oregon 97224
Tel: (503) 598-8445 Fax: (503) 598-8705

TEST PIT LOG

Project: Fairview Village Salem, Oregon.	Project No. 04-9026	Test Pit No. **TP- 7**

Depth (ft)	Pocket Penetrometer (tons/ft²)	Sample Type	In-Situ Dry Density (lb/ft³)	Moisture Content (%)	Water Bearing Zone	Material Description
						Brown clayey silt, abundant roots, soft, moist (Topsoil - ML).
1						Brown clayey silt, medium stiff to stiff, moist, occasional inclusion of weathered basalt (Colluvial Soil - ML).
2						
3						Light brown silt with abundant fragments of highly to completely weathered basalt and black mineral staining (Residual Soil - ML/ GM).
4						
5						Gray basalt, medium hard, weathered and closely fractured, yielding coarse gravel-size rock fragments, slow excavating progress.
6						
7						
8						
9						Gray medium hard basalt similar to above but with wider fracture spacing yielding abundant cobble-size rock fragments.
10						
11						
12						
13						Dark gray hard and highly fractured rock, slow excavating progress.
14						
15						
16						
17						Test pit terminated at 19 feet on top of hard rock with few fractures; No groundwater encountered.

LEGEND

Bag Sample

Bucket Sample


Shelby Tube Sample


Seepage


Water Bearing Zone


Water Level at Abandonment

Date Excavated: 11/15-16/04
Logged By: J. Pyne
Surface Elevation:

GeoPacific Engineering, Inc.
7312 SW Durham Road
Portland, Oregon 97224
Tel: (503) 598-8445 Fax: (503) 598-8705

TEST PIT LOG

Project: Fairview Village Salem, Oregon.	Project No. 04-9026	Test Pit No. **TP- 8**

Depth (ft)	Pocket Penetrometer (tons/ft²)	Sample Type	In-Situ Dry Density (lb/ft³)	Moisture Content (%)	Water Bearing Zone	Material Description
						Brown clayey silt with abundant roots, soft, moist (Topsoil - ML).
1						Dark brown clayey silt, medium stiff to stiff, moist (Colluvial Soil - ML).
2						
3						Light brown silt with some clay, occasional inclusion of weathered basalt (Residual Soil - ML).
4						
5						
6						Gray basalt, medium hard, highly fractured.
7						
8						
9						
10						Dark gray highly fractured basalt, breaks into gravel- to cobble-size rock fragments
11						
12						
13						
14						
15						Basalt becomes less fractured below 15 feet.
16						
17						Test pit terminated at 16.5 feet, No groundwater encountered.

LEGEND

Bag Sample | Bucket Sample | Shelby Tube Sample | Seepage | Water Bearing Zone | Water Level at Abandonment

Date Excavated: 11/15-16/04
Logged By: J. Pyne
Surface Elevation:

GeoPacific Engineering, Inc.
7312 SW Durham Road
Portland, Oregon 97224
Tel: (503) 598-8445 Fax: (503) 598-8705

TEST PIT LOG

Project: Fairview Village Salem, Oregon.	Project No. 04-9026	Test Pit No. **TP-9**

Depth (ft)	Pocket Penetrometer (tons/ft²)	Sample Type	In-Situ Dry Density (lb/ft³)	Moisture Content (%)	Water Bearing Zone	Material Description
1						Red-brown clayey silt, numerous roots, soft, moist (Topsoil - ML).
2						Dark red-brown clayey silt, medium stiff to stiff, moist (Colluvial Soil - ML).
3						
4						Dark red-brown clayey silt with inclusions of weathered basalt, very stiff, moist (Residual Soil - ML).
5						Light brown clayey silt with inclusions of highly to completely weathered basalt with black mineral staining, very stiff, moist.
6						Brown and black basalt, soft, highly weathered, black stained fractures; easily excavated with trackhoe.
7						
8						
9						Gray medium hard basalt changing to hard basalt at 10 feet depth.
10						Test pit terminated at 10 feet depth, No groundwater encountered.
11						
12						
13						
14						
15						
16						
17						

LEGEND

Bag Sample

Bucket Sample


Shelby Tube Sample


Seepage


Water Bearing Zone


Water Level at Abandonment

Date Excavated: 11/15-16/04
Logged By: J. Pyne
Surface Elevation:

GeoPacific Engineering, Inc.
7312 SW Durham Road
Portland, Oregon 97224
Tel: (503) 598-8445 Fax: (503) 598-8705

TEST PIT LOG

Project: Fairview Village
Salem, Oregon.

Project No. 04-9026

Test Pit No. **TP-10**

Depth (ft)	Pocket Penetrometer (tons/ft²)	Sample Type	In-Situ Dry Density (lb/ft³)	Moisture Content (%)	Water Bearing Zone	Material Description
0						Brown clayey silt with abundant roots, moist, soft (Topsoil - ML).
1						Brown clayey silt, medium stiff, moist (Colluvial Soil - ML).
2						
3						Dark red-brown clayey silt with numerous black fragments of completely weathered basalt rock, stiff, moist (Residual/Colluvial Soil - ML).
4						Note: due to the unusual thickness of this soil unit, there is considerable question as to its origin; additional exploration of the area may be required.
5						
6						
7						
8						
9						
10						
11						
12						
13						Change to light tan color at 13 feet depth; Soil is light tan to rust-brown, angular to rounded siltstone fragments in a matrix of light gray soft clay, soft, moist but no seepage of groundwater.
14						
15						
16						Some zones of highly weathered brown & black basalt apparently interbedded with siltstone. Test pit terminated at 19.5 feet (depth limit of trackhoe); NO groundwater encountered.
17						

LEGEND

Bag Sample

Bucket Sample


Shelby Tube Sample


Seepage


Water Bearing Zone


Water Level at Abandonment

Date Excavated: 11/15-16/04
Logged By: J. Pyne
Surface Elevation:

GeoPacific Engineering Inc.
7312 SW Durham Road
Portland, Oregon 97224
Tel: (503) 598-8445 Fax: (503) 598-8705

TEST PIT LOG

Project: Fairview Village Salem, Oregon.	Project No. 04-9026	Test Pit No. **TP-11**

Depth (ft)	Pocket Penetrometer (tons/ft²)	Sample Type	In-Situ Dry Density (lb/ft³)	Moisture Content (%)	Water Bearing Zone	Material Description
						Dark brown clayey silt, abundant grass roots, soft, moist (Topsoil - ML).
1						Numerous subangular gravel- to boulder-size fragments of medium basalt in a matrix of light brown clayey silt. (Surface exposures of weathered rock in vicinity of large oak tree on southern tip of topographic ridge).
2						
3						Brown to gray basalt rock, weathered, medium hard, fractured.
4						Gray basalt below 4 feet, hard, fractured; very hard below 6 feet depth.
5						
6						Test pit terminated at 6 feet, No groundwater encountered.
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						

LEGEND

Bag Sample | Bucket Sample | Shelby Tube Sample | Seepage | Water Bearing Zone | Water Level at Abandonment

Date Excavated: 11/15-16/04
Logged By: J. Pyne
Surface Elevation:

GeoPacific Engineering Inc.
7312 SW Durham Road
Portland, Oregon 97224
Tel: (503) 598-8445 Fax: (503) 598-8705

TEST PIT LOG

Project: Fairview Village
Salem, Oregon.

Project No. 04-9026

Test Pit No. **TP-12**

Depth (ft)	Pocket Penetrometer (tons/ft²)	Sample Type	In-Situ Dry Density (lb/ft³)	Moisture Content (%)	Water Bearing Zone	Material Description
1						Light brown clayey silt, some roots, soft, moist (Topsoil - ML).
2						Light brown clayey silt, medium stiff to stiff; occasional weathered fragments of basalt below 3 feet depth (Colluvial Soil - ML).
3						
4						
5						
6						Gray basalt, hard, fractured, excavated to 7 feet depth with difficulty.
7						
8						Test pit terminated at 7 feet, No groundwater encountered.
9						
10						
11						
12						
13						
14						
15						
16						
17						

LEGEND

Bag Sample

Bucket Sample


Shelby Tube Sample


Seepage


Water Bearing Zone


Water Level at Abandonment

Date Excavated: 11/15-16/04
Logged By: J. Pyne
Surface Elevation:

GeoPacific Engineering, Inc.
7312 SW Durham Road
Portland, Oregon 97224
Tel: (503) 598-8445 Fax: (503) 598-8705

TEST PIT LOG

Project: Fairview Village
Salem, Oregon.

Project No. 04-9026

Test Pit No. **TP-13**

Depth (ft)	Pocket Penetrometer (tons/ft²)	Sample Type	In-Situ Dry Density (lb/ft³)	Moisture Content (%)	Water Bearing Zone	Material Description
1						Light brown clayey silt, abundant roots, soft, moist (Topsoil - ML).
2						Light brown clayey silt with some isolated fragments of weathered basalt, stiff moist (Colluvial Soil - ML).
3						
4						
5						Dark red-brown clayey silt with some gray fragments of weathered basalt, stiff, moist (Residual Soil - ML).
6						
7						Changes to very stiff residual soil below 7 feet depth, abundant highly to completely weathered basalt fragments with black mineral staining.
8						
9						
10						Light rust-brown and black highly weathered basalt with occasional inclusions of light gray medium hard basalt; fracture surfaces have black mineral staining.
11						
12						Brown to black highly weathered and fractured basalt with ledges of hard, gray basalt.
13						
14						Hard gray basalt at 15 feet depth.
15						Test pit terminated at 15 feet, No groundwater encountered.
16						
17						

LEGEND

Bag Sample

Bucket Sample


Shelby Tube Sample


Seepage


Water Bearing Zone


Water Level at Abandonment

Date Excavated: 11/15-16/04
Logged By: J. Pyne
Surface Elevation:

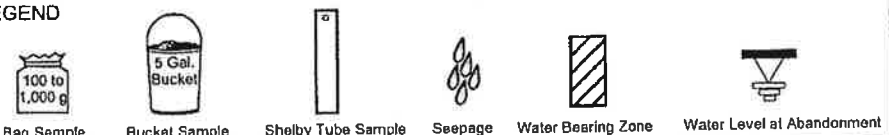
GeoPacific Engineering, Inc.
7312 SW Durham Road
Portland, Oregon 97224
Tel: (503) 598-8445 Fax: (503) 598-8705

TEST PIT LOG

Project: Fairview Village Salem, Oregon.	Project No. 04-9026	Test Pit No. **TP-14**

Depth (ft)	Pocket Penetrometer (tons/ft²)	Sample Type	In-Situ Dry Density (lb/ft³)	Moisture Content (%)	Water Bearing Zone	Material Description
						Brown clayey silt, abundant roots, soft, moist (Topsoil - ML).
1						
						Light brown clayey silt with a basal zone of weathered basalt fragments in light gray silt (Colluvial Soil - ML).
2						
3						
						Red-brown clayey silt with some inclusions of weathered basalt, stiff, moist (Residual Soil - ML).
4						
5						
						Sudden change at 6.5 feet to very hard gray basalt rock.
6						
7						Test pit terminated at 6.5 feet, No groundwater encountered.
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						

LEGEND



Bag Sample | Bucket Sample | Shelby Tube Sample | Seepage | Water Bearing Zone | Water Level at Abandonment

Date Excavated: 11/15-16/04
Logged By: J. Pyne
Surface Elevation:

GeoPacific Engineering, Inc.
7312 SW Durham Road
Portland, Oregon 97224
Tel: (503) 598-8445 Fax: (503) 598-8705

TEST PIT LOG

Project: Fairview Village Salem, Oregon.	Project No. 04-9026	Test Pit No. **TP-15**

Depth (ft)	Pocket Penetrometer (tons/ft²)	Sample Type	In-Situ Dry Density (lb/ft³)	Moisture Content (%)	Water Bearing Zone	Material Description
						Brown clayey silt, abundant roots, soft, moist (Topsoil - ML).
1						
2						Light brown clayey silt with occasional weathered fragment of basalt, medium stiff, moist (Colluvial Soil - ML).
3						
4						Red-brown clayey silt, very stiff, moist (Residual Soil - ML).
5						
6						Rust-brown clayey silt with abundant brown to black fragments of highly weathered basalt, very stiff, damp (very soft weathered rock- ML).
7						
8						Brown basalt, weathered and highly fractured, black mineral stains on fracture surfaces, soft, readily excavated
9						
10						
11						
12						
13						Some slow seepage of groundwater, wet on fracture surfaces.
14						Basalt, medium hard, highly fractured, breaks into gravel-size fragments, wet from slow seepage of groundwater
15						Basalt changes to hard gray rock at 16 feet depth, no groundwater seepage
16						Test pit terminated at 16 feet.
17						

LEGEND

Bag Sample

Bucket Sample


Shelby Tube Sample


Seepage


Water Bearing Zone


Water Level at Abandonment

Date Excavated: 11/15-16/04
Logged By: J. Pyne
Surface Elevation:

GeoPacific Engineering, Inc.
7312 SW Durham Road
Portland, Oregon 97224
Tel: (503) 598-8445 Fax: (503) 598-8705

TEST PIT LOG

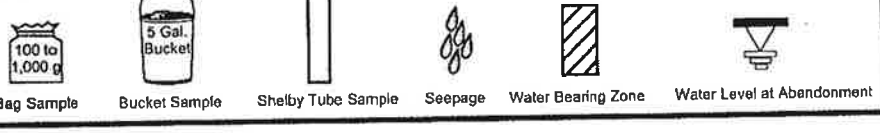
Project: Fairview Village
Salem, Oregon.

Project No. 04-9026

Test Pit No. **TP-16**

Depth (ft)	Pocket Penetrometer (tons/ft²)	Sample Type	In-Situ Dry Density (lb/ft³)	Moisture Content (%)	Water Bearing Zone	Material Description
0						Dark brown clayey silt, abundant grass and blackberry roots, moist, soft (Topsoil - ML).
1						Dark brown clayey silt with some weathered fragments of basalt, moist, medium stiff (Colluvial Soil - ML).
2						
3						Light brown clayey silt with numerous inclusions of brown highly weathered and fractures basalt, stiff, damp (Residual Soil - ML).
4						
5						
6						Brown weathered and fractured basalt, fracture faces have black mineral staining, soft, readily broken to fine to coarse, angular gravel-size fragments.
7						
8						
9						Basalt suddenly changes to hard, gray rock at 10 feet depth.
10						
11						Test pit terminated at 10 feet, No groundwater encountered.
12						
13						
14						
15						
16						
17						

LEGEND



Bag Sample | Bucket Sample | Shelby Tube Sample | Seepage | Water Bearing Zone | Water Level at Abandonment

Date Excavated: 11/15-16/04
Logged By: J. Pyne
Surface Elevation:

GeoPacific Engineering, Inc.
7312 SW Durham Road
Portland, Oregon 97224
Tel: (503) 598-8445 Fax: (503) 598-8705

TEST PIT LOG

Project: Fairview Village Salem, Oregon.	Project No. 04-9026	Test Pit No. **TP-17**

Depth (ft)	Pocket Penetrometer (tons/ft²)	Sample Type	In-Situ Dry Density (lb/ft³)	Moisture Content (%)	Water Bearing Zone	Material Description
1						Dark brown clayey silt with abundant grass roots, moist, soft (Topsoil - ML)
2						Dark brown clayey silt with occasional weathered fragment of basalt, medium stiff, moist (Colluvial Soil - ML).
3						
4						Light rust-brown clayey silt with inclusions of weathered basalt, very stiff (Residual Soil - ML).
5						
6						Brown in-situ weathered basalt, black stains on fractures faces, soft , easily excavated, breaks to fine to coarse gravel-size, angular fragments
7						
8						
9						
10						
11						Basalt becomes medium hard, highly fractured
12						
13						
14						
15						Trackhoe bucket scraping on hard in-situ basalt at 16 feet depth.
16						Test pit terminated at 16 feet,
17						No groundwater encountered.

LEGEND

Bag Sample

Bucket Sample


Shelby Tube Sample


Seepage


Water Bearing Zone


Water Level at Abandonment

Date Excavated: 11/15-16/04
Logged By: J. Pyne
Surface Elevation:

GeoPacific Engineering Inc.
7312 SW Durham Road
Portland, Oregon 97224
Tel: (503) 598-8445 Fax: (503) 598-8705

TEST PIT LOG

Project: Fairview Village
Salem, Oregon.

Project No. 04-9026

Test Pit No. **TP-18**

Depth (ft)	Pocket Penetrometer (tons/ft²)	Sample Type	In-Situ Dry Density (lb/ft³)	Moisture Content (%)	Water Bearing Zone	Material Description
1						Dark brown clayey silt with abundant grass roots, soft, moist (Topsoil - ML).
2						Dark brown clayey silt, medium stiff, occasional fragment of highly weathered basalt (Colluvial Soil - ML).
3						Light brown clayey silt with abundant fragments of weathered basalt (Residual Soil - ML)
4						Top of in-situ weathered basalt, brown with black mineral staining on fracture surfaces, highly fractured, soft, easily excavated, breaks to fine to coarse gravel-size, angular fragments
5						
6						
7						
8						
9						
10						
11						Basalt changes to medium hard below 11', still highly fractured; sudden change to hard rock at 12 feet depth.
12						Test pit terminated at 12 feet, No groundwater encountered.
13						
14						
15						
16						
17						

LEGEND

Bag Sample

Bucket Sample


Shelby Tube Sample


Seepage


Water Bearing Zone


Water Level at Abandonment

Date Excavated: 11/15-16/04
Logged By: J. Pyne
Surface Elevation:

Appendix "C"

PBS

Geotechnical Site Review

Fairview Training Center
2250 Strong Road, S.E.
Salem, Oregon

Prepared for:
Opsis Architecture
Portland, Oregon

October 2002
Project # 17107.000

4412 SW Corbett
Portland, OR 97239
503.248.1939 MAIN
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888.248.1939 TOLLFREE

ENGINEERING AND ENVIRONMENTAL
www.pbsenv.com

GEOTECHNICAL SITE REVIEW

Fairview Training Center
2250 Strong Road, S.E.
Salem, Oregon

Prepared for:
Opsis Architecture
Portland, Oregon

Prepared by:
PBS Engineering and Environmental
4412 SW Corbett Avenue
Portland, OR 97239
(503) 248-1939

PBS Project No: 17107.000

October 2002

TABLE OF CONTENTS

1.0 INTRODUCTION

PBS Engineering and Environmental (PBS) was requested to complete a geotechnical engineering review of the Fairview Training Center (Fairview) site, located at 2250 Strong Road, S.E., Salem, Oregon, to form an opinion of subsurface soil conditions that may have an impact on proposed redevelopment of the site currently being considered. Our review was limited to research of readily accessible published geologic documents for the site and surrounding vicinity, and completion of cursory site observations on September 25, 2002. No subsurface investigation or sampling was completed to confirm our findings. Our work was done in general accordance with our proposal dated September 18, 2002, submitted to Opsis Architecture (Client) c/o Don Forbes.

The review was completed by Daniel Trisler, PE, Senior Geotechnical Engineer with PBS. Mr. Trisler's resume is attached to this document. The following summary provides our current understanding of geologic/geotechnical conditions associated with the site as well as a discussion of potential foundation issues associated with redevelopment of the site.

2.0 REGIONAL GEOLOGY

The Fairview property is situated in southern Salem in the central Willamette Valley. The valley is a structural low between the Coast Range mountains to the west and the Cascade Range mountains to the east. The region is typically underlain by sedimentary rocks of the Eocene and Oligocene period. Overlying the sedimentary bedrock is the Miocene-aged Columbia River Basalt Group. The basalt weathers to laterite (red clay), which can reach thicknesses of nearly 200 feet in the hills. Quaternary soil deposits overlie the bedrock materials in the valley floor. These soils typically consist of unconsolidated to semi-consolidated interbedded deposits of gravel, sand, silt, clay, and organic material.

3.0 SITE GEOLOGY

Geologic information regarding the Salem area has been published by Bela (1981). His mapping indicates the subject site is underlain by terrace deposits and basalt bedrock. The relevant portion of his map is included in Figure A - Local Geologic Map.

The lower, northwest corner of the property (Area A) and the area to the northeast of the property is shown by Bela (1981) to be underlain by *lower terrace deposits of alluvial bottomlands* (map symbol "Qtlb"). These soils are described as consisting of "somewhat stratified very fine sands, silty sandy clays, silty clays, and silty clay loams." He also indicates these soils may be "soft, organic and compressible...with low shear strength." Soils similar to these materials are also likely to be found within the natural drainage swales found within the upper portions of the site.

The northeast and eastern portions of the site (part of Area B and Area C) are mapped as being underlain by *higher terrace deposits* (Qth). Bela (1981) indicates these deposits consist of semiconsolidated sand, silt and clay. The soils are also noted to contain gravels at various locations.

The upper portions of the site (part of Area B and Areas D and E) are mapped as being underlain by the Columbia River Basalt Group (Tcr). The basalt is noted to weather to "reddish-brown silty clay loam and gravelly silty clay loams." These weathered soils are generally called laterite. The laterite is considered to have a low to moderate plasticity index (Williams, 1972). Unweathered basalt is typically gray to black, fine-grained basalt. Unweathered basalt bedrock was observed in the quarry pit at the southeast corner of the property.

4.0 SEISMIC HAZARDS

Seismic hazard mapping of the Salem area and the Willamette Valley was completed by Wang and Leonard (1996) and Yeats, et al (1996), respectively.

The mapping by Yeats, et al (1996) notes that traces of several earthquake faults are located within about 2¼ miles of the subject site. While there is no conclusive evidence that these nearby fault traces are active, they have been assigned a low probability of activity by Geomatrix (1995). The nearest known active fault is the Mt. Angel Fault, located approximately 12 miles northeast of the property. No fault traces are mapped as passing through, or trending towards, the subject site. A portion of the Yeats, et al (1996) map has been reproduced in Figure B - Geologic and Tectonic Map. Several traces of the potentially active faults are shown on this portion of the map.

As part of their work, Wang and Leonard (1996) produced four earthquake hazard maps, which covered the Salem area. The maps included: a Relative Earthquake Hazard Map, a Landslide Susceptibility Map, a Liquefaction Susceptibility Map, and an Amplification Susceptibility Map. The relevant portions of these maps have been reproduced in Figures C through F, respectively.

The *Landslide Susceptibility Map* (Figure D) indicates that the lower portion of the site (Areas B, C, and part of D) is an area of *high susceptibility to landsliding in areas with existing landslides.* The area indicated as an "existing landslide" is located within the area mostly mapped by Bela (1981) as being underlain by high terrace deposits (Qth). The rest of the site is mapped by Wang and Leonard (1996) as areas with gentle to moderate slopes underlain by relatively shallow bedrock, with a relatively low potential for earthquake-induced landslide. During our site visit on September 25, 2002, we did not observe any obvious signs of active or recent large-scale landsliding. Topographic features indicate subdued slopes with no obvious recent scarps or grabens. It appears as though the large-scale landslide indicated by the map may be an ancient landslide that could have occurred thousands of years ago, and is essentially stable at this point in time. Discussions with Salem's Lead Development Services Engineer (Ron Derrick) indicate that City mapping considers the area to have a relatively low slope stability hazard potential.

The *Liquefaction Susceptibility Map* (Figure E) indicates that only the lowest portions of the site, along Strong Road, are underlain by potentially liquefiable materials. The mapping indicates that as much as 12 feet of potentially liquefiable soil may be present in the northernmost corner of the site. The potentially liquefiable soils are generally limited to areas underlain by lower terrace deposits (Qtlb).

The *Amplification Susceptibility Map* (Figure F) indicates that most of the site is within areas with the potential for maximum amplification of earthquake ground shaking of less than 1.4 times the peak bedrock acceleration. In areas with competent bedrock at or near the ground surface, little or no amplification should occur.

The *Relative Earthquake Hazard Map* (Figure C) is a composite map, which combines the relative hazards due to the potential for landsliding, liquefaction, and amplification. The lower portion of the subject site (Areas B, C, and part of A and D) is generally mapped as having an intermediate to high earthquake hazard. The high hazard ranking is a result of the mapping of the existing landslide in the lower portion of the site. The upper portions of the site (Areas D and E) are mapped as having the lowest to an intermediate hazard.

5.0 MISCELLANEOUS

During PBS' recent site visit (September 25, 2002) several miscellaneous geotechnically-relevant features were noted at the site:

(1) Three developed drainage swales/creeks are present at the site. These include Pringle Creek passing through Area A, and the two unnamed broad drainage swales in the upper, southwest portion of the property. Soft, wet soils were observed in all of these drainage areas. It is likely that development within or directly below the swales will be restricted for other reasons, however, should any development occur in *or directly below* these areas, then consideration will be required for the presence of the soft, weak materials.

(2) A large stockpile of concrete and asphalt debris was placed adjacent to the top of the roadway leading to the residences in Area E. It is estimated that 3,000 to 5,000 cubic yards of debris may be present in this area. The debris will need to be removed from that area, although it could potentially by recycled for use as roadbase or backfill material.

(3) Several areas of existing fill are present around the existing buildings. The fills are generally judged to be less than 6 feet thick. There is the potential that the fills are poorly compacted and may not be suitable for future building support. Most of the fill was observed near the crest of the slope at the southern end of Area A and along the outer edge of the roadway leading to the upper, western residences. Additionally some fill was present in the pigpen area in the southeast corner of the site. However, we note that the placement of thick fills around the property does not appear to have been a widespread practice.

(4) Significant metal debris was present in the quarry site in the southeast corner of the site.

On June 14, 2001, a representative from PBS spoke with John Cooper, Director of the State Office of Developmental Disability Services, about the subject site. Mr. Cooper reported that three buildings at the site had been demolished in the past. Two of the buildings had basements, and the demolition debris was backfilled into the basements. It will be necessary to determine the location of these buildings and to remove the demolition debris. (Reference: PBS Phase One Environmental Site Assessment)

6.0 SUMMARY

Based upon our site reconnaissance and review of local geologic and earthquake hazards maps, it is apparent the Fairview property is underlain by variable soil and bedrock deposits. The vast majority of the site is underlain by basalt bedrock that would generally be considered to be an acceptable and stable building material. However, the lower terrace deposits (Qtlb) in the lower portions of the property are potentially prone to settlement, earthquake-induced liquefaction, and amplification of earthquake ground shaking. The higher terrace deposits (Qth) mapped in the northeast and eastern portions of the site should be considered transitional materials, which may be susceptible to some, though not all, of the conditions, which may affect the lower terrace deposits. Additionally, some softer soils are likely to be present within and below the existing drainage swales/creeks at the site.

The northern and eastern portions of Area A are underlain by the greatest extent of poor quality materials. It is likely that special mitigation measures may be required to stabilize these soils in order to allow new development at the site. Such measures might include: stone columns, piles, mat foundations, subsurface drainage improvements, soil grouting, etc. Some seismically sensitive soils may also exist in the eastern corner of the site (northeast corner of Area D). However, other areas of the property are unlikely to require extensive seismic mitigation efforts due to subsurface conditions.

The lower, northeast half of the site is mapped by Wang and Leonard (1996) as consisting of a large existing landslide. However, this area is gently sloping with no signs of active or recent slide movements. Based upon the regional topography, it is possible the mapped area is an ancient landslide, which may have occurred thousands of years ago, when undercutting of the bedrock at the toe of the slope could have resulted from a meander of Mill Creek. (This is an on-going condition/problem on the west side of the hills, along the Willamette River.) This feature will need to be carefully investigated as part of a full-scale geotechnical investigation, however, it is our opinion there is a low probability the possible landslide feature will have a significant impact on re-development of the lower portion of the site.

The proposed developed will need to account for the presence of soft soils in lower portions of the site, and in or near the drainage swales, and for the potential presence of moderately plastic soils throughout the site. These conditions may result in the use of wider- or deeper-than-normal footings to reduce bearing pressures and improve resistance to seasonal soil shifting. In an extreme case of soft soil, the use of pin piles may be appropriate. Alternatively, conventional earthwork practices, such as removal and replacement of soft soils, can be employed.

There are also several items of relatively small consequence (e.g. old fills, debris piles, etc.) exist around the site; however, they are easily addressed via conventional methods during the development of the site.

7.0 REFERENCES

Bela, J.L., 1981, *Geology of the Rickreall, Salem West, Monmouth, and Sidney 7½' Quadrangles, Marion, Polk, and Linn Counties Oregon*, GMS-18, State of Oregon, Department of Geology and Mineral Industries

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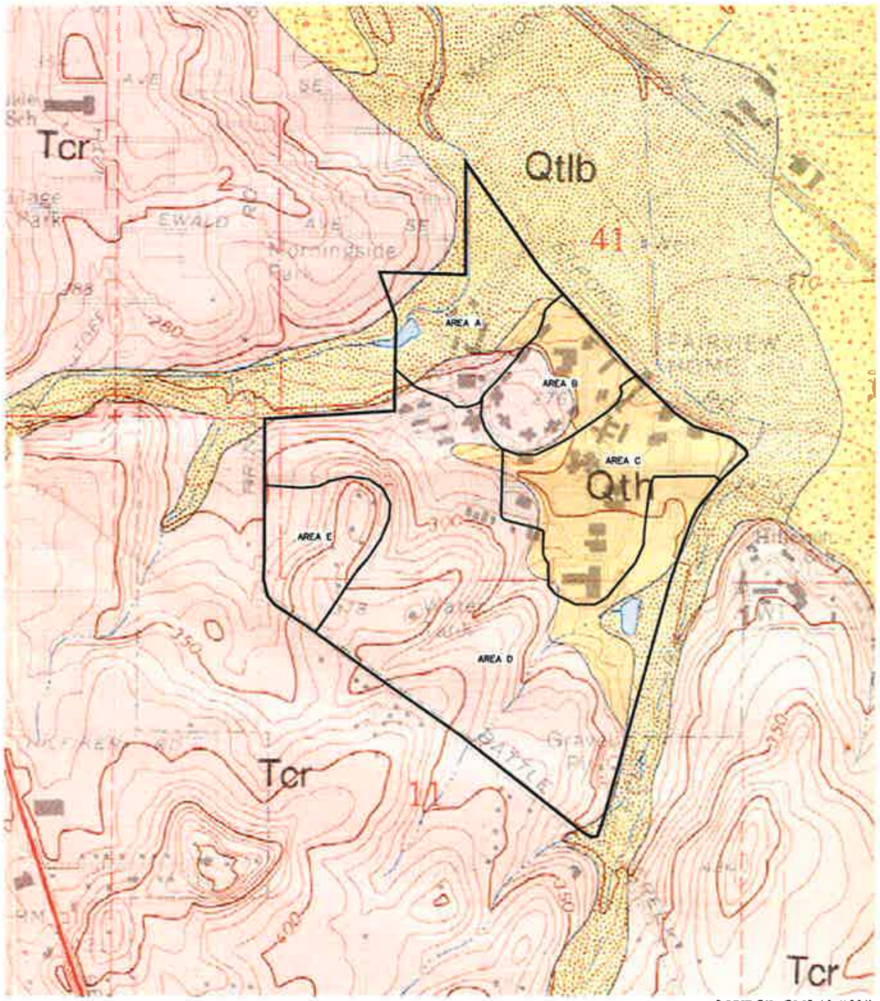
Yeats, R.S., E.P. Graven, K.S. Werner, C. Goldfinger, and T. Popowski, 1996, *Earthquake Hazards in the Pacific Northwest of the United States*, OFR 91-441-P, U.S. Department of the Interior, Geological Survey, 47 p.

Sincerely,
PBS Engineering and Environmental

Daniel J. Trisler, PE — Date
Senior Geotechnical Engineer

Guy M. Neal, PE — Date
Principal Engineer

FIGURES



SOURCE: GMS-18 (1981)

0' 500' 1,000' 2,000'

SCALE: 1" = 1,000'

LEGEND

Qtlb

Qtm

Qlg

Qth

Tcr

PBS
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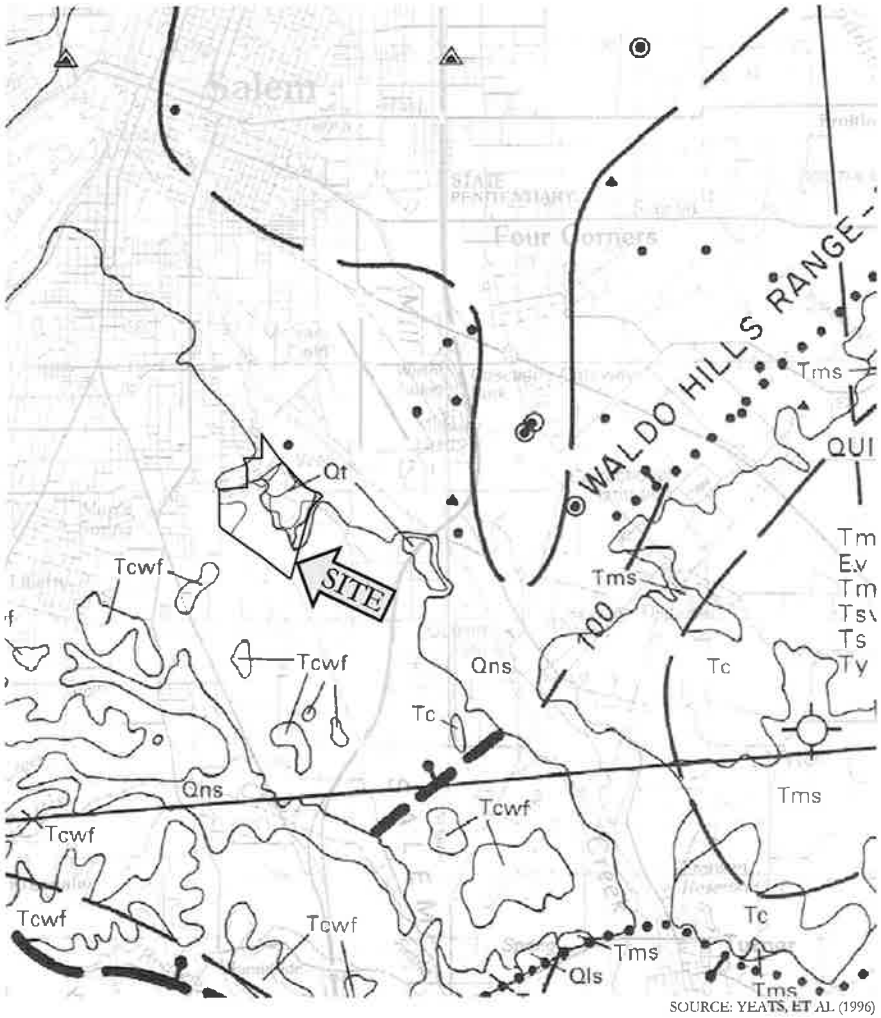
LOCAL GEOLOGIC MAP
FAIRVIEW TRAINING CENTER
SALEM, OREGON

LOCAL GEOLOGIC MAP

SEPTEMBER 2002

17107.000

FIGURE A



SOURCE: YEATS, ET AL. (1996)

0' 2,500' 5,000' 10,000'

SCALE: 1" = 5,000'

LEGEND

Qns	Nonmarine sedimentary deposits (Holocene and Pleistocene)
Qt	High terrace gravels (Pleistocene)
Tc	Columbia River Basalt Group (Miocene), undivided
Tcwf	Wanapum Basalt Frenchman Springs Member

Fault. Dashed where inferred; queried where uncertain; barbs are hall on downthrown side. On cross sections, arrows show direction of relative movement: T, movement toward viewer; A, movement away from viewer.

Concealed fault—Dots projected where location is unconstrained; bar and ball on downthrown side; queried where uncertain.

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GEOLOGIC AND TECTONIC MAP
FAIRVIEW TRAINING CENTER
SALEM, OREGON

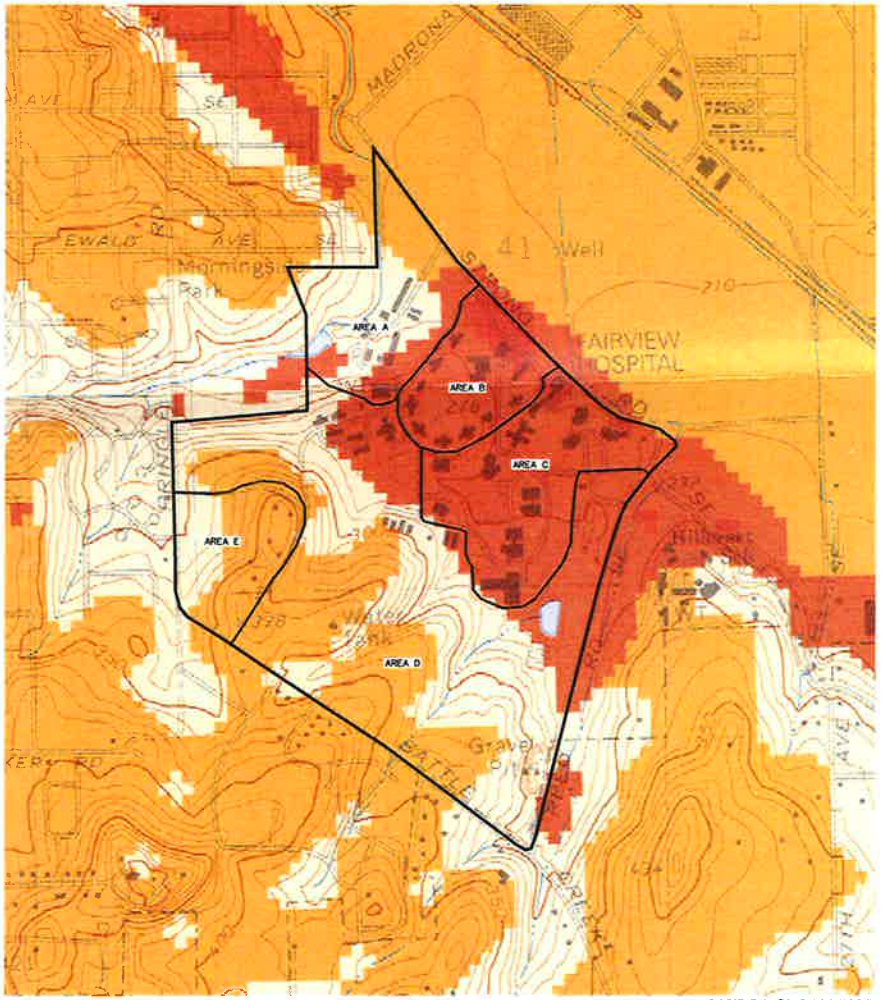
GEOLOGIC AND TECTONIC MAP

SEPTEMBER 2002

17107.000

B
FIGURE

9/26/02 16:02 D:\17107.000_apwtmpb.dwg



SOURCE: GMS-105 (1996)

0' 500' 1,000' 2,000'

SCALE: 1" = 1,000'

LEGEND

Zone A	Highest hazard
Zone B	Intermediate to high hazard
Zone C	Low to intermediate hazard
Zone D	Lowest hazard

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RELATIVE EARTHQUAKE HAZARD MAP
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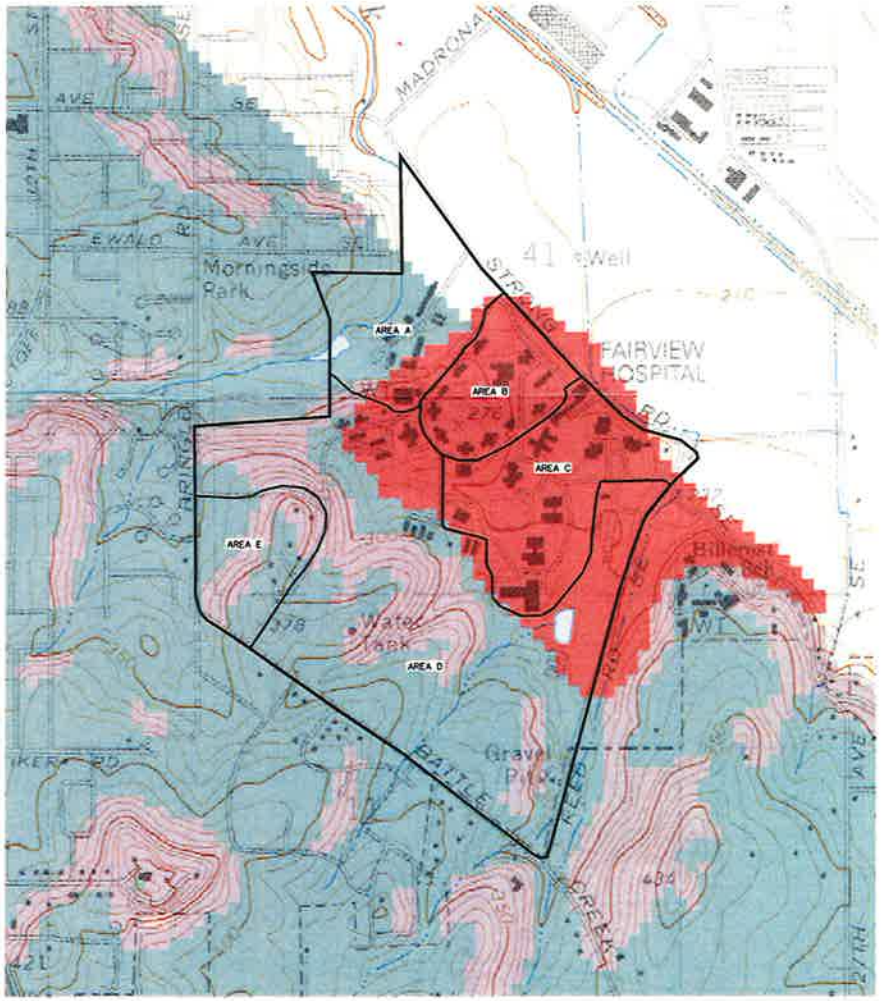
RELATIVE EARTHQUAKE HAZARD MAP

SEPTEMBER 2002

17107.000 | C FIGURE



SOURCE: GMS-105 (1996)

0' 500' 1,000' 2,000'

SCALE: 1" = 1,000'

LEGEND

Category 5	High susceptibility to landsliding in areas with existing landslides
Category 4	>22 degrees of slope angle
Category 3	≥14-22 degrees of slope angle
Category 2	≥6-14 degrees of slope angle
Category 1	<6 degrees of slope angle in hills
Category 0	<6 degrees of slope angle in valley

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LANDSLIDE SUSCEPTIBILITY MAP
FAIRVIEW TRAINING CENTER
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LANDSLIDE
SUSCEPTIBILITY MAP

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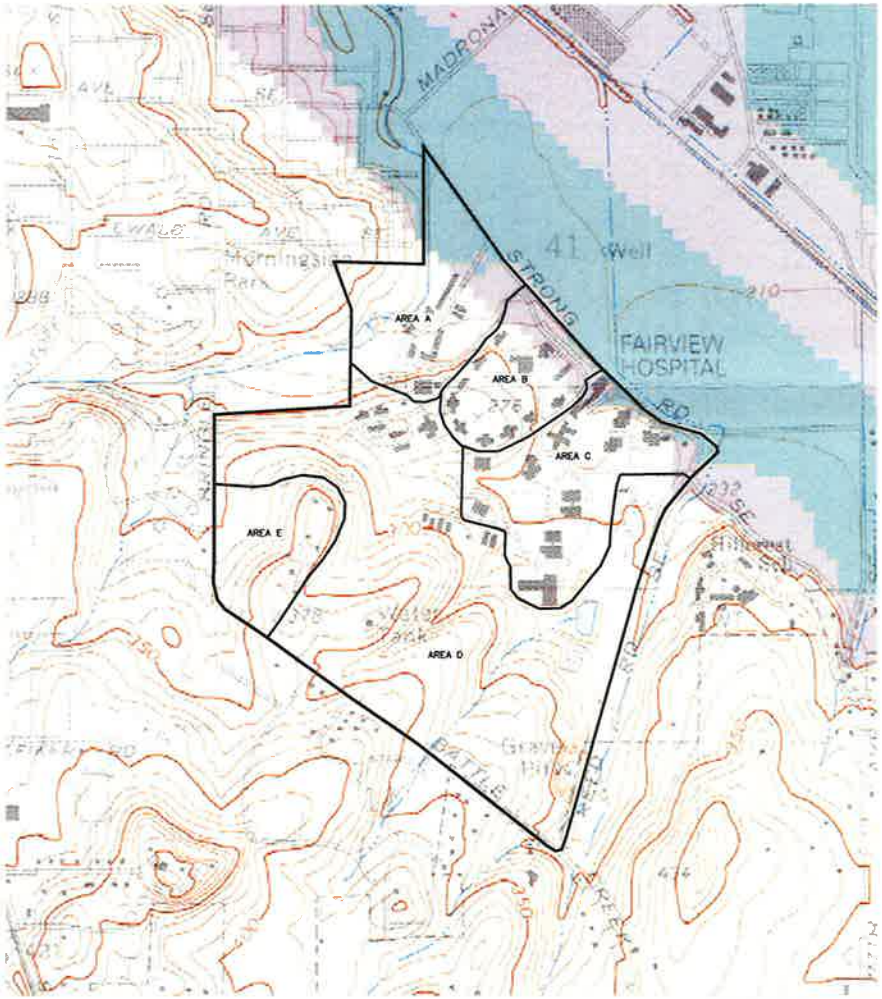
17107.000

D
FIGURE



SOURCE: GMS-105 (1996)

0' 500' 1,000' 2,000'

SCALE: 1" = 1,000'

LEGEND

Category 2		≥6-12 feet estimated thickness of liquefiable material
Category 1		<6 feet estimated thickness of liquefiable material
Category 0		No susceptibility, with possible exceptions in small, localized areas

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LIQUEFACTION SUSCEPTIBILITY MAP
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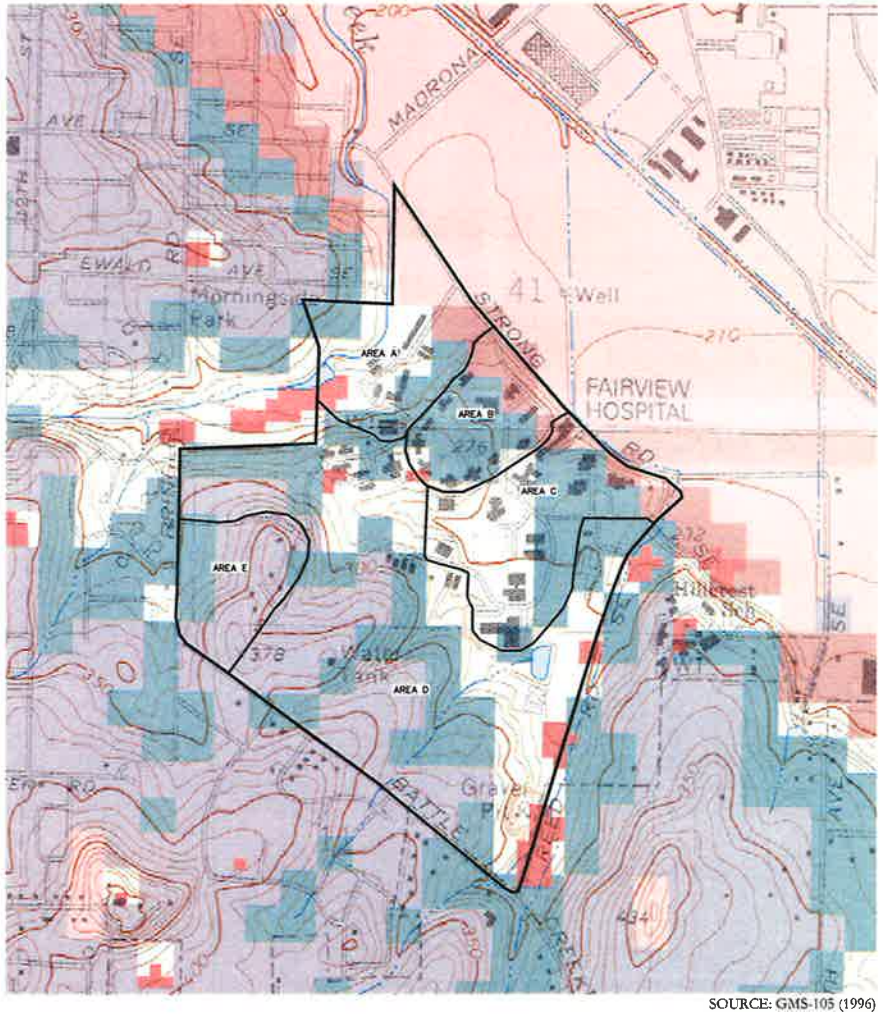
LIQUEFACTION SUSCEPTIBILITY MAP

SEPTEMBER 2002

17107.000

E

FIGURE



SOURCE: GMS-105 (1996)

0' 500' 1,000' 2,000'

SCALE: 1" = 1,000'

LEGEND

Category 5	Possible high susceptibility to amplification in areas of abrupt topographic changes
Category 4	>1.6 amplification factor for peak rock accelerations
Category 3	≥1.4-1.6 amplification factor for peak rock accelerations
Category 2	≥1.2-1.4 amplification factor for peak rock accelerations
Category 1	>1.2 amplification factor for peak rock accelerations
Category 0	No susceptibility (stable bedrock at or near the surface), with possible exceptions in small, localized areas

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AMPLIFICATION SUSCEPTIBILITY MAP
FAIRVIEW TRAINING CENTER
SALEM, OREGON

AMPLIFICATION SUSCEPTIBILITY MAP

SEPTEMBER 2002

17107.000

F
FIGURE

APPENDIX A

PBS Resumes

PBS

Key Personnel

DANIEL J. TRISLER, P.E.

SENIOR GEOTECHNICAL ENGINEER

Education Cornell University, M.Eng., Geotechnical Engineering, 1993.
Cornell University, B.S., Civil Engineering, 1992.

Accreditations Registered Professional Engineer, Oregon, PE#69386
Registered Civil Engineer, Washington, PE#38279
Registered Civil Engineer, California, PE#54676

Memberships American Society of Civil Engineers (ASCE)

Daniel Trisler is a professional geotechnical engineer with experience on hundreds of projects in the Western US, including municipal wastewater, drinking water, transportation, steep slopes and stormwater management. He also has experience in land development (subdivision & mixed use), deep foundations, and seismic evaluations in high risk geographic locations. He has also overseen assessments of a number of municipal, commercial, and industrial projects along with insurance and litigation projects.

Mr. Trisler has extensive experience with "problem" soils, such as: liquefiable sands, unstable slopes, and weak alluvial deposits. He has conducted numerous site investigations, forensic studies of distressed structures, investigations for landslide repairs/stabilization, and drainage evaluations. Mr. Trisler has significant experience managing and overseeing project engineers and geologists on various-sized projects, performing field investigations, conducting construction monitoring and testing services, and preparation of reports.

Career Highlights

- Geotechnical Engineer, Geotechnical consulting for a wastewater treatment plant upgrade project for the City of Garibaldi, Oregon
- Geotechnical Enginee, Manzanita Water District; New Pile-Supported Well Pump House, Geotechncal Investigation, Manzanita, Oregon
- Geotechnical Engineer, Geotechnical engineering work related to the building of a new city water reservoir, Oakland, Oregon
- Geotechnical Engineer, Lebanon School District, Additions to Two School Buildings, Geotechnical Investigations and Seismic Hazard Studies
- Geotechnical Engineer, Walker Middle School, Salem, Oregon, New Gymnasium and School Additions with Auger-Cast Piles, Construction Monitoring
- Geotechnical Engineer, Jackson County Fire Districts #3 and #5, Two New Fire Stations with Liquefaction Mitigation, Geotechnical Investigations and Seismic Hazard Studies
- Project Engineer/Manager, Hundreds of Residential and Mixed-Use Developments, California, Oregon, and Washington, Geotechnical Investigations and Construction Monitoring
- Project Engineer, Numerous Distressed Buildings, California and Oregon, Forensic Investigations for Insurance Companies, Private Owners, and Law Firms
- Project Engineer, Numerous Projects, California, Oregon, and Washington, Design of Segmental CMU and Stone Gravity Retaining Walls
- Project Engineer/Manager, Crossings Condominiums, New Structure with Underground Parking and Dewatering System, Mountain View, California, Geotechnical Investigation and Monitoring
- Geotechnical Engineer, Desert Glade and Harvest Meadows Subdivisions, 26- and 76-Lot Subdivisions, Richland, Washington, Geotechnical Investigations
- Geotechnical Engineer, Mud Mountain Dam Maintenance and Storage Buildings, Enumclaw, Washington, Geotechnical Investigations and Construction Monitoring
- Project Engineer, Additions to and Remodel of San Mateo County Library, Redwood City, California, Geotechnical Investigation and Construction Monitoring

PBS

Key Personnel

GUY M. NEAL, P.E.

PRINCIPAL / ENVIRONMENTAL AND CIVIL ENGINEER

Education B.S., Construction Engineering Technology, Montana State University, 1986

Accreditation
Professional Environmental Engineer (Oregon)
Professional Civil Engineer (Oregon, Washington)
OSHA 40-hour (Oregon) & 80- hour (Washington) Hazardous Waste Training
OSHA 24-hour Emergency Response Team Training

Memberships
American Society of Civil Engineers (ASCE)
Air and Waste Management Association (AWMA)
Oregon Air National Guard – Restoration Advisory Board, Co-Chair
Clean Water Services – Clean Water Advisory Council, Representing District #2

Mr. Neal is the principal in charge of PBS' engineering division, which provides geotechnical, civil, environmental, and ACAD/GIS services to our clients. He oversees the civil and environmental engineering design for site development (utilities, road improvements, foundations), underground storage tank installations, treatment system design, hazardous waste management unit design, and other projects involving civil, geotechnical and environmental expertise. Mr. Neal is a civil and environmental engineer specializing in the control and treatment of storm water for new construction and retrofits of existing facilities. He has project experience for jurisdictions throughout western Oregon and Washington. His designs have included innovative approaches to detaining and treating storm water from new developments and from process areas at manufacturing facilities. He also has experience in utility design, underground storage tank systems, wastewater treatment design, and road improvements.

Representative Projects

- Department of Corrections -Various Sites. Engineer for design of several projects for DOC at existing facilities. Projects included vehicle washing facility, UST upgrades, sewer replacement, and fuel island upgrades. Project bidding, contract management, and construction inspections were provided.
- Pipeline Remediation – Precision Castparts. Project Environmental/Civil Engineer for the design of wastewater conveyance system used during the decontamination of 6,000 feet of a trunkline combined sewer system that was contaminated with Thorium oxides.
- Holden Creek Relocation Project, Tillamook, Oregon. Project Manager for planned upgrades to an operational lumber mill located in Tillamook, Oregon. Planning included upgrades to site utilities and movement of an existing creek to eliminate impacts by the facility.
- Tualatin Valley Fire & Rescue (TVF&R) Multiple Fire Stations, Washington County, Oregon. Design Engineer responsible for site development of a new fire stations located in Washington County, Oregon. Responsible for geotechnical, grading/roads, utilities, erosion control, and construction inspections during development of each site.
- City of Bend, Public Service Buildings, Bend, Oregon. Principal Engineer during geotechnical and civil design and construction observations during development of four public service buildings for the City of Bend.
- Fair Oaks Drive Project – City of Corvallis. Principal Engineer in charge of site development design for a new street located in Corvallis, Oregon. Work included wetland mitigation, new street design, bridge, grading, sewer pump station and water supply piping.
- U.S. Postal Service, Tukwila (WA) Distribution Center. Principal Engineer in charge of storm water retrofit design of an existing storm water drainage system. Work included pump station design, oil/water separators, erosion control, pond redesign, and piping layout.
- Dammasch – Sewer Treatment Plant Demolition. Principal Engineer for the design and contract oversight for demolition of the former State of Oregon hospital's sewer treatment plant located in Wilsonville, Oregon. Coordinated hazardous material studies, geotechnical review, agency permitting, and developed design and contract documents for project.

Appendix "D"

Coordinates: 44.8978981°N 123.0137063°W

Fairview Training Center

The **Fairview Training Center** was a state-run facility for people with developmental disabilities in Salem, Oregon, United States. Fairview was established in 1907 as the State Institution for the Feeble-Minded. The hospital opened on December 1, 1908 with 39 patients transferred from the Oregon State Hospital for the Insane.[3] Before its closure in 2000, Fairview was administered by the Oregon Department of Human Services (DHS).[4] DHS continued to operate the Eastern Oregon Training Center in Pendleton[5][6] until October 2009.

Fairview Training Center

State of Oregon

LeBreton Cottage at Fairview, built in 1908

Geography	
Location	Salem, Oregon, United States
Coordinates	44.8978981°N 123.0137063°W[1]
Organization	
Care system	Public
Hospital type	Psychiatric hospital
History	
Founded	1907[2]
Closed	March 01, 2000[2]
Links	
Lists	Hospitals in Oregon
Other links	Oregon State Hospital

Contents

History

Early history

In 1907, the **Oregon State Institution for the Feeble-Minded** was created by the Oregon State Legislature.[2] It was established as a quasi-educational institution charged with educating the "feeble-minded" (today known as people with intellectual disability and various other developmental and learning disabilities) and caring for the "idiotic and epileptic."[2] The facility was overseen by a Board of Trustees consisting of the Governor, Secretary of State and State Treasurer.[2] Construction had progressed enough by 1908 that the first patients were transferred from the Oregon State Insane Asylum (now the Oregon State Hospital).[2] They resided on a 670-acre (270 ha) compound consisting of an administration building (LeBreton Cottage),[7] a dormitory, a laundry and boiler house.[2] By 1913, two more cottages where constructed and the Board of Trustees was replaced by the Oregon State Board of Control.[2]

In 1917, a commitment law was passed that was to standardize admissions to the institution by insuring that valuable space was used for the "feeble-minded" and not for the "insane".[2] It also imposed an age limit on admissions to people five years of age and older.[2] The age limit was removed in 1921.[2]

The institution had a working farm that provided both food and training for its residents.[2] By 1920, most of the land to be used for farming had been cleared.[2] 400 acres (160 ha) were planted in crops and 45 acres (18 ha) in orchards.[2] The farm also raised hogs, chickens, and dairy and beef cattle.[2]

In 1923, the legislature established the Oregon Board of Eugenics, and Fairview's superintendent served as an ex-officio board member.[2] The eugenics legislation provided for the "sterilization of all feeble-minded, insane, epileptics, habitual criminals, moral degenerates, and sexual perverts who are a menace to society."[2] Sterilizations required either the person's consent or a court order.[2] By 1929, 300 residents had been sterilized.[2]

Two types of parole for residents were established in 1931: home parole and industrial parole.[2] Requirements for parole included a surety bond filed by the parolee's guardian or overseer, who had to have a net worth of at least $1000 and have lived in the state for at least six months, the parolee had to be sterilized, and the home or workplace had to be inspected.[2] Two-thirds of residents who had been sterilized were paroled, which freed up beds for new patients.[2]

In 1933 the facility was renamed **Oregon Fairview Home**.[2]

Changes in care and additions to the facility continued through the 1940s-1960s, and improvements were made to the medical care and nutrition of the residents.[2]

In 1965, Oregon Fairview Home was renamed **Fairview Hospital and Training Center**.[2]

In the late 1960s, the orchard, raising of beef, and general farm activities were eliminated.[2] The raising of hogs was eliminated in 1975 and poultry processing ended in 1977.[2] These activities had formerly provided all the ham, bacon, sausage, eggs, broiler chickens, and pork chops used by Fairview.[2]

In 1969, the Board of Control was dissolved and the Mental Health Division placed under the newly created Executive Department of the state government.[2]

In 1979, the facility changed its name from Fairview Hospital and Training Center to Fairview Training Center.[2]

Modern history

Fairview was closed on March 1, 2000.[2]

A group known as Sustainable Fairview Associates purchased 275 acres (111 ha) of the former Fairview grounds in 2002.[8] The land included several historic buildings.[9]

In 2004, Sustainable Fairview Associates sold 32 acres (13 ha) of their holdings to Sustainable Development Inc. for building Pringle Creek Community, a sustainable housing development.[9][10]

Pierce Cottage, one of several buildings remaining on the former Fairview site, was gutted by a fire of suspicious origin in January 2010.[11][12] The building had previously been slated for demolition and recycling.[13] Two men were charged with arson in connection with the fire the next month. All remaining cottages were demolished in 2016.[14]

Superintendents

H.E. Bickers 1908-1912 Frank E. Smith, M.D. 1913-1914 J.H. Thompson, M.D. 1914-1915 J.N. Smith, M.D. 1915-1929 R.D. Byrd 1930-1938 Horace G. Miller M.D. 1939-1944 Ray M. Waltz, M.D. 1944-1946 Irvin B. Hill, M.D. 1946-1959 Jim Pomeroy, M.D. 1960-1970 Larry W. Talkington, Ph.D. 1970-1976 Jerry E. McGee, Ed.D. 1977-1987 Linda K. Gustafson, Ph.D. 1989-1991 Rosemary C. Hennessy 1991-1995 Charles Farnham 1995-1997 Jon E. Cooper M.B.A. 1997-2000

Cottages

The cottages on the grounds housed both staff and patients. Some of the structures were named after Oregon governors, including:

- Benson Cottage - Frank W. Benson
- Chamberlain Cottage - George Earle Chamberlain
- Lane Cottage - Joseph Lane
- Martin Cottage - Charles Martin
- Meier Cottage - Julius Meier
- Pierce Cottage - Walter M. Pierce (*image (https://www.flickr.com/photos/9681449@N05/2177526396/in/set-72157600659175511/)*) Destroyed by fire January 27, 2010[11]
- Smith Cottage - Elmo Smith
- Snell Cottage - Earl Snell
- Withycombe Cottage - James Withycombe

Fairview in the media

- ***Where's Molly?*** is a 2007 documentary about Molly Daly who was institutionalized at the Fairview Hospital and Training Center in the 1950s[15]
- *Population: 2* is a post-apocalyptic film that features Fairview heavily as a location and contains the last footage of the center taken before its dismantling began in 2011

See also

- List of institutions for the mentally disabled

References

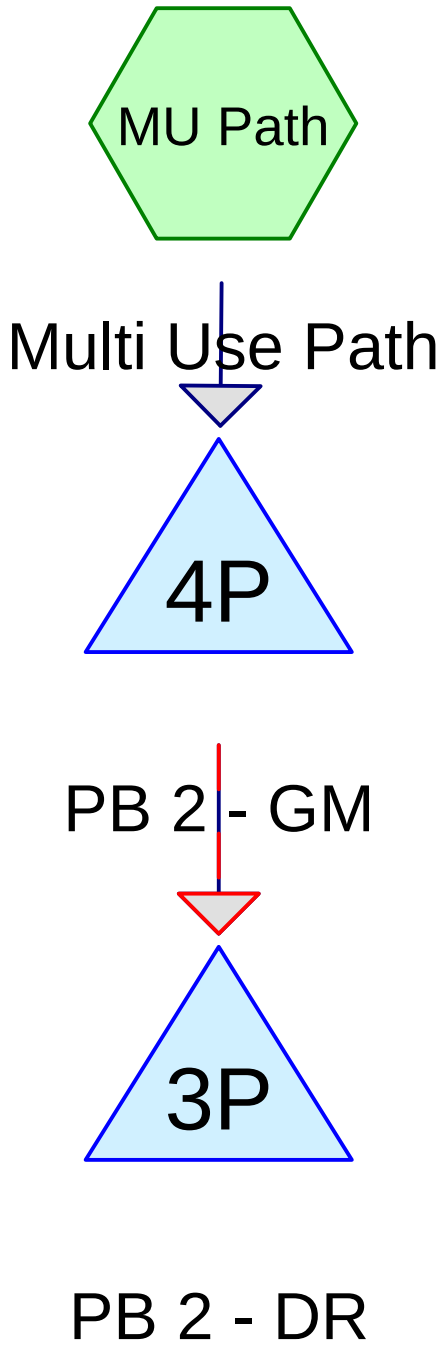
1. "Fairview Training Center" (https://geonames.usgs.gov/apex/f?p=gnispq:3:::NO::P3_FID:1120576). *Geographic Names Information System*. United States Geological Survey. November 28, 1980. Retrieved 2010-01-30.
2. "Fairview Training Center: Agency History" (https://web.archive.org/web/20120131193928/http://bluebook.state.or.us/state/executive. *Oregon Blue Book*. Oregon Secretary of State. 1994. Archived from the original (http://bluebook.state.or.us/state/executive/Mental_Health/fairview.htm) on 2012-01-31. Retrieved 2018-01-11.
3. Salem Online History (http://www.salemhistory.net/places/fairview_training_center.htm)
4. House Bill 3599, (http://www.leg.state.or.us/03reg/measures/hb3500.dir/hb3599.intro.html) Seventy-second Oregon Legislative Assembly (2003)
5. "Supports for Adults" (http://www.oregon.gov/DHS/dd/adults/residential.shtml). Oregon Department of Human Services: Developmental Disabilities Division. Retrieved January 26, 2009.
6. "Chapter 427 — Persons With Mental Retardation; Persons With Developmental Disabilities" (http://www.leg.state.or.us/ors/427.html). *Oregon Revised Statutes*. 2007. Retrieved January 26, 2009.
7. Oregon Historic Photograph Collections (http://photos.salemhistory.net/cdm4/item_viewer.php?CISOROOT=/orarc&CISOPTR=290&CISOBOX=1&REC=1)
8. "Planners May Hand Off Fairview" (http://www.pringlecreekcommunity.com/news/8_20_05.htm). *Statesman Journal*. pringlecreekcommunity.com. August 20, 2005. Retrieved 2010-01-28.
9. "Fairview Plan would Pay Dividends for City" (http://www.pringlecreek.com/news/2_16_04.htm). *Statesman Journal*. pringlecreekcommunity.com. February 16, 2004. Retrieved 2010-01-28.
10. "Pringle Creek Community" (http://www.pringlecreekcommunity.com/news/8_22_05.htm). *Statesman Journal*. pringlecreekcommunity.com. August 22, 2005. Retrieved 2010-01-28.
11. "3-alarm Old Fairview Center fire in Salem" (http://www.kgw.com/news/2-alarm-blaze-at-abandoned-state-hospital-in-Salem-82845467.html). KGW. Retrieved 2010-01-28.
12. Guerrero-Huston, Thelma; Michael Rose (January 29, 2010). "Fire raises suspicions" (http://www.statesmanjournal.com/article/20100129/NEWS/1290326/Fairview-fire-raises-suspicions). *Statesman Journal*. Retrieved 2010-01-29.
13. Guerrero-Huston, Thelma; Michael Rose (January 29, 2010). "Structure that burned, one of 50 at site, was to be demolished anyway" (http://www.statesmanjournal.com/article/20100129/NEWS/1290327). *Statesman Journal*. Retrieved 26 February 2010.
14. Russell, Michael (February 18, 2010). "Keizer men arrested in fire at Fairview Training Center in Salem" (http://www.oregonlive.com/news/index.ssf/2010/02/keizer_men_arrested_in_fire_at.html) *The Oregonian*. Retrieved 19 February 2010.
15. "Review: "Where's Molly?"" (http://blog.oregonlive.com/madaboutmovies/2007/03/review_wheres_molly.html). OregonLive.com. March 9, 2007. Retrieved January 26, 2009.

External links

- Historic images of Fairview (http://photos.salemhistory.net/cdm4/results.php?CISOOP1=all&CISOBOX1=&CISOFIELD1=CISOSEARCHALL&CISOOP2=exact&CISOBOX2=Fairview%20Training%20Center&CISOFIELD2=CISOSEARCHALL&CISOOP3=any&CIS from Salem Public Library.
- Images of abandoned structures at Fairview (http://boundless.uoregon.edu/cdm4/results.php?CISOOP1=exact&CISOFIELD1=CISOSEARCHALL&CISOROOT=/archpnw&CISOBOX1=Fairview+Training+Center++Salem%2C+Oregon+) from the University of Oregon digital archives
- *Where's Molly* (http://wheresmolly.net) official website
- "In Our Care" a 1959 film about Fairview (http://blog.oregonlive.com/oregonianextra/2007/11/video_fairview.html) from *The Oregonian*
- "Away from the Public Gaze": A History of the Fairview Training Center and the Institutionalization of People with Developmental Disabilities in Oregon (http://www.institutionwatch.ca/cms-filesystem-action?file=research/fairview_report.pdf) from The Teaching Research Institute at Western Oregon University
- Photo essay of closed Fairview site (https://www.flickr.com/photos/9681449@N05/sets/72157600659175511/) from Flickr

APPENDIX B: WATER QUALITY HYDROGRAPHS

EAST



Subcat Reach Pond Link

Routing Diagram for EAST (Reed Rd) Site Prelim Hydrograph
Prepared by Multi/Tech Engineering Services, Printed 2/17/2021

Summary for Subcatchment MU Path: Multi Use Path

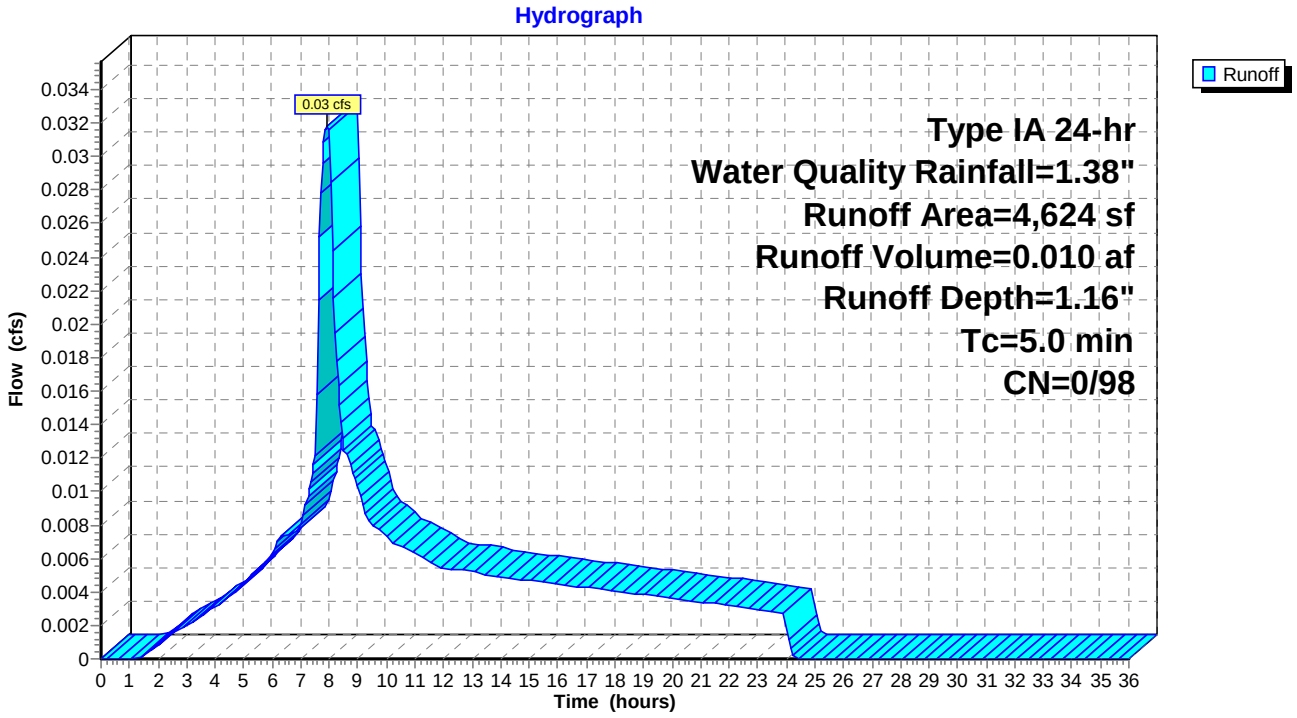
Runoff = 0.03 cfs @ 7.91 hrs, Volume= 0.010 af, Depth= 1.16"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type IA 24-hr Water Quality Rainfall=1.38"

Area (sf)	CN	Description
4,624	98	Unconnected pavement, HSG C
4,624	98	100.00% Impervious Area

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

Subcatchment MU Path: Multi Use Path



Summary for Pond 4P: PB 2 - GM

Inflow Area = 0.106 ac,100.00% Impervious, Inflow Depth = 1.16" for Water Quality event
Inflow = 0.03 cfs @ 7.91 hrs, Volume= 0.010 af
Outflow = 0.03 cfs @ 7.91 hrs, Volume= 0.010 af, Atten= 0%, Lag= 0.0 min
Primary = 0.03 cfs @ 7.91 hrs, Volume= 0.010 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 4.00' @ 7.91 hrs Surf.Area= 4,624 sf Storage= 0 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 0.0 min (697.3 - 697.3)

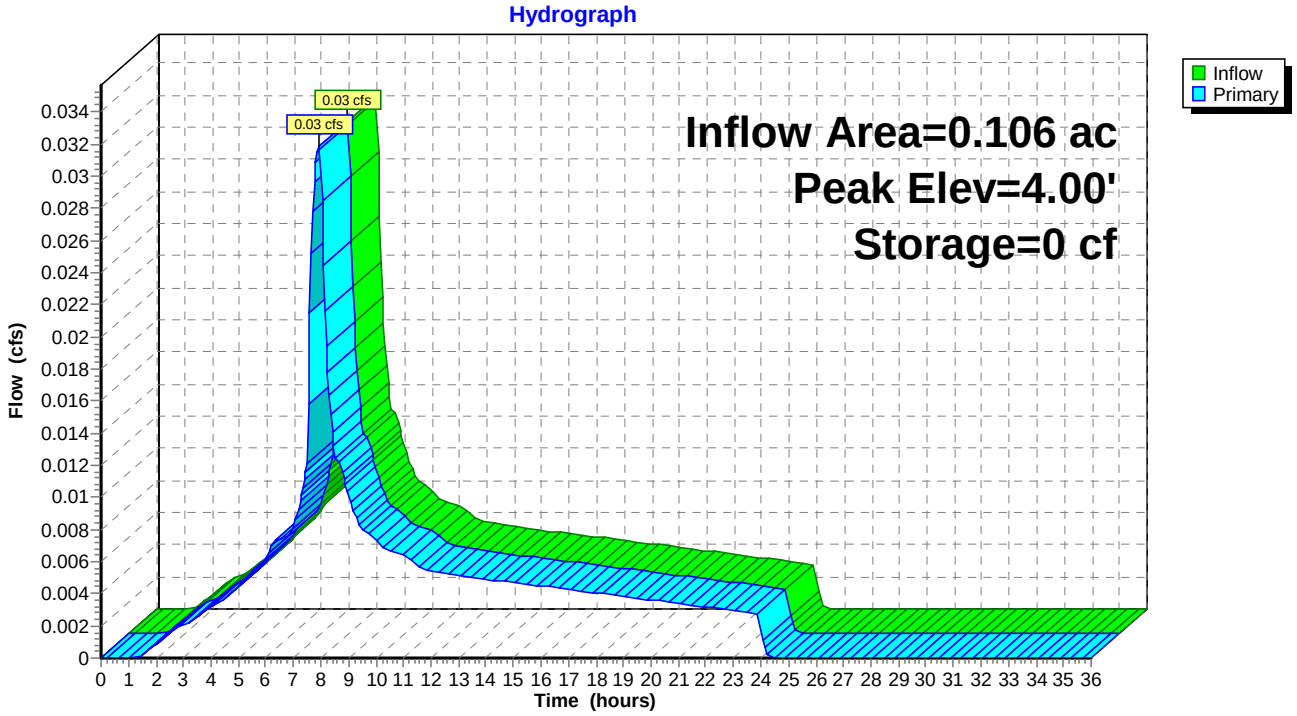
Volume	Invert	Avail.Storage	Storage Description
#1	4.00'	0 cf	**Growing Media (Prismatic)** Listed below (Recalc) 1,526 cf Overall x 0.0% Voids

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
4.00	4,624	0	0
4.33	4,624	1,526	1,526

Device	Routing	Invert	Outlet Devices
#1	Primary	4.00'	**100.000 in/hr Exfiltration over Surface area**

Primary OutFlow Max=10.70 cfs @ 7.91 hrs HW=4.00' (Free Discharge)
1=Exfiltration (Exfiltration Controls 10.70 cfs)

Pond 4P: PB 2 - GM



Summary for Pond 3P: PB 2 - DR

Inflow Area = 0.106 ac,100.00% Impervious, Inflow Depth = 1.16" for Water Quality event
Inflow = 0.03 cfs @ 7.91 hrs, Volume= 0.010 af
Outflow = 0.03 cfs @ 8.02 hrs, Volume= 0.010 af, Atten= 6%, Lag= 6.8 min
Discarded = 0.03 cfs @ 8.02 hrs, Volume= 0.010 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 0.01' @ 8.02 hrs Surf.Area= 4,624 sf Storage= 16 cf

Plug-Flow detention time= 8.6 min calculated for 0.010 af (100% of inflow)
Center-of-Mass det. time= 8.6 min (705.9 - 697.3)

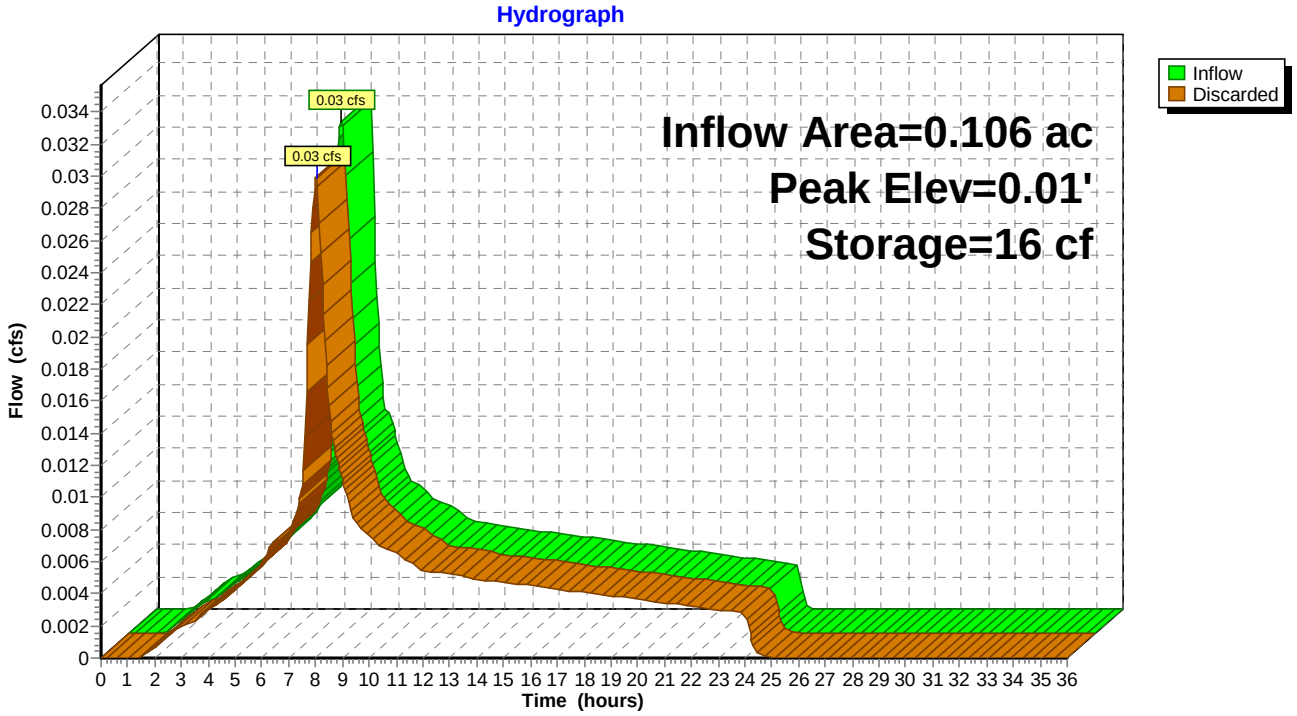
Volume	Invert	Avail.Storage	Storage Description
#1	0.00'	1,665 cf	**Drain Rock (Prismatic)** Listed below (Recalc) 4,624 cf Overall x 36.0% Voids

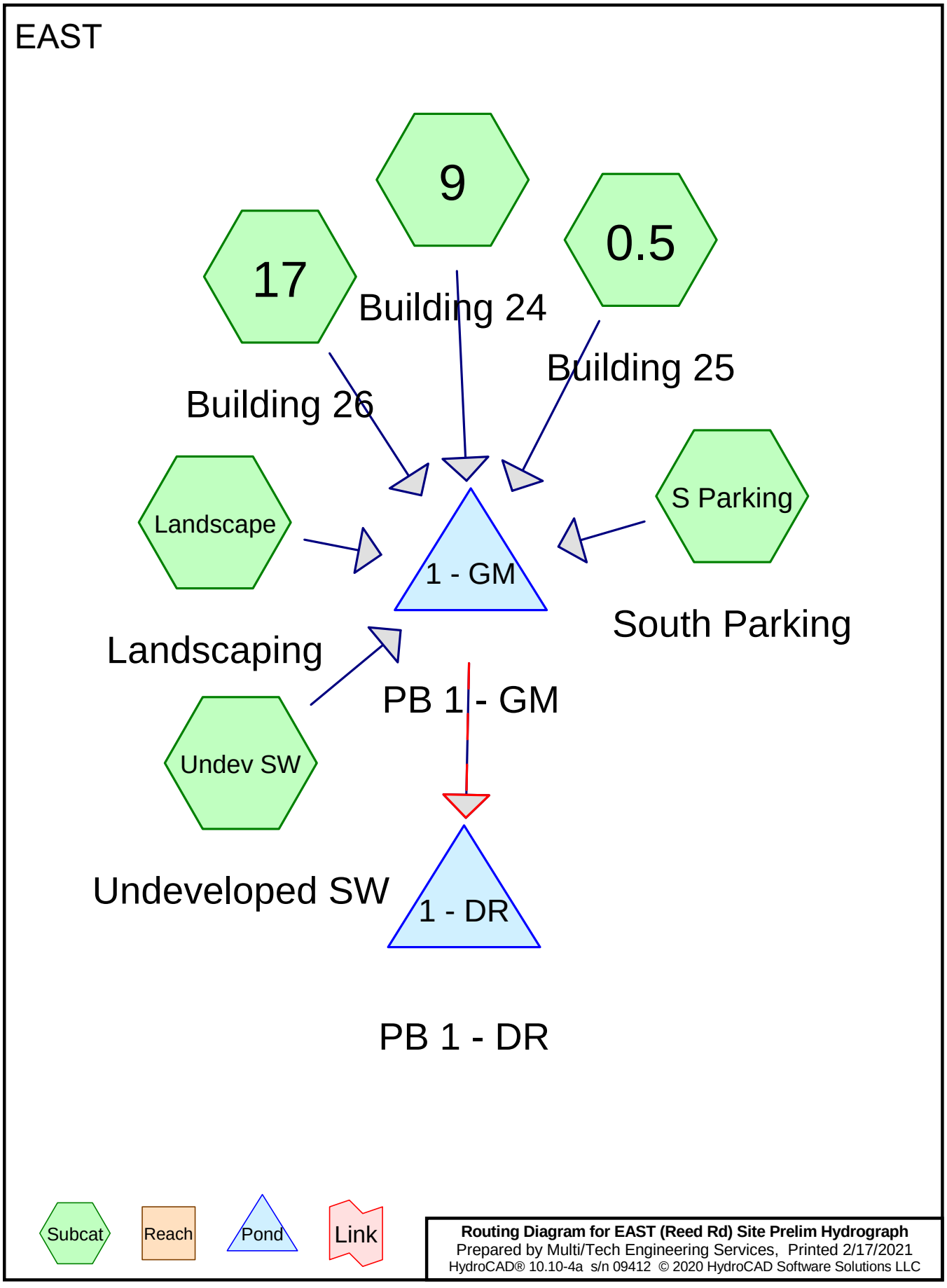
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
0.00	4,624	0	0
1.00	4,624	4,624	4,624

Device	Routing	Invert	Outlet Devices
#1	Discarded	0.00'	**0.300 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.03 cfs @ 8.02 hrs HW=0.01' (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 0.03 cfs)

Pond 3P: PB 2 - DR





Routing Diagram for EAST (Reed Rd) Site Prelim Hydrograph
Prepared by Multi/Tech Engineering Services, Printed 2/17/2021

Summary for Subcatchment 0.5: Building 25

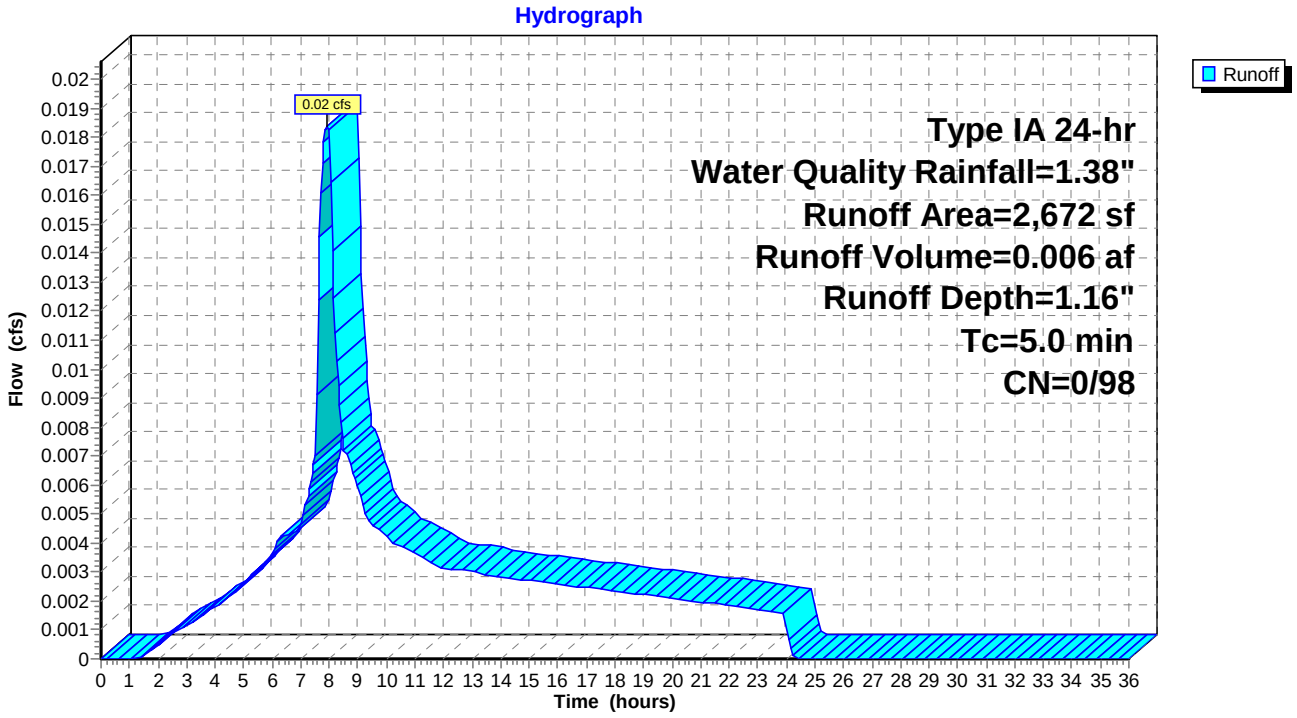
Runoff = 0.02 cfs @ 7.91 hrs, Volume= 0.006 af, Depth= 1.16"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type IA 24-hr Water Quality Rainfall=1.38"

Area (sf)	CN	Description
2,672	98	Roofs, HSG C
2,672	98	100.00% Impervious Area

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

Subcatchment 0.5: Building 25



Summary for Subcatchment 9: Building 24

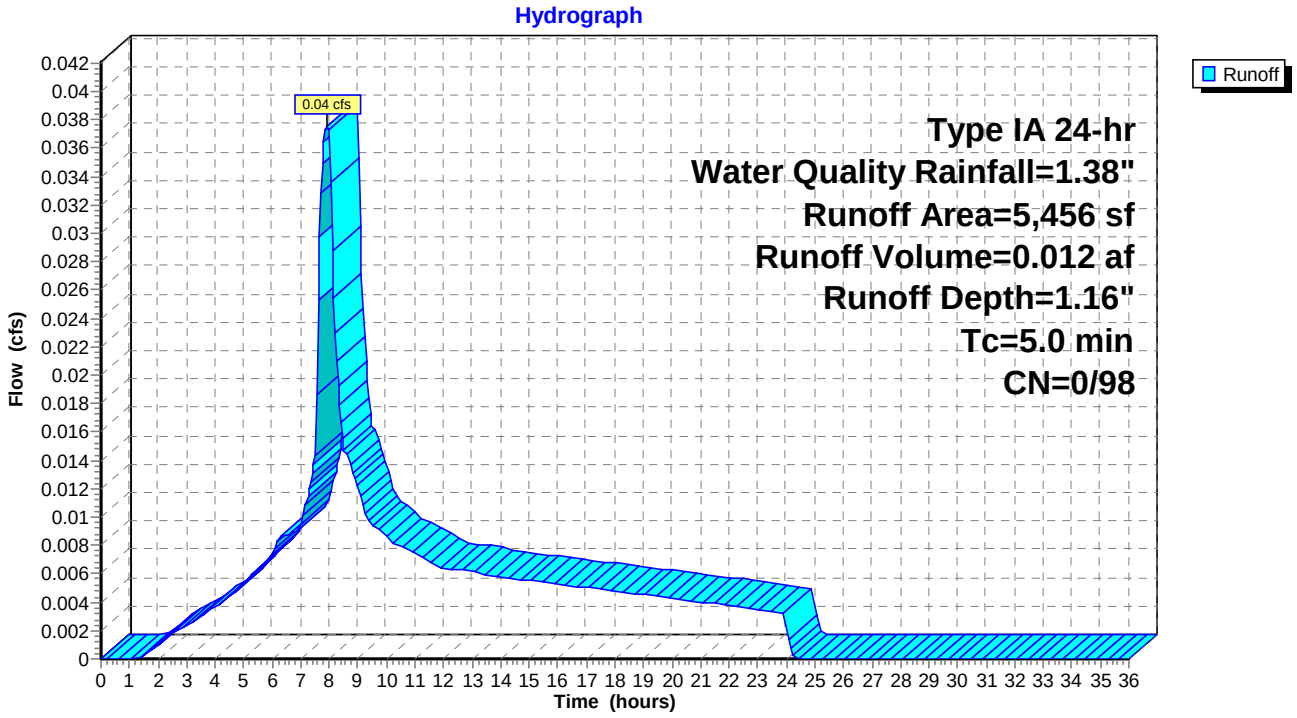
Runoff = 0.04 cfs @ 7.91 hrs, Volume= 0.012 af, Depth= 1.16"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type IA 24-hr Water Quality Rainfall=1.38"

Area (sf)	CN	Description
5,456	98	Roofs, HSG C
5,456	98	100.00% Impervious Area

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

Subcatchment 9: Building 24



Summary for Subcatchment 17: Building 26

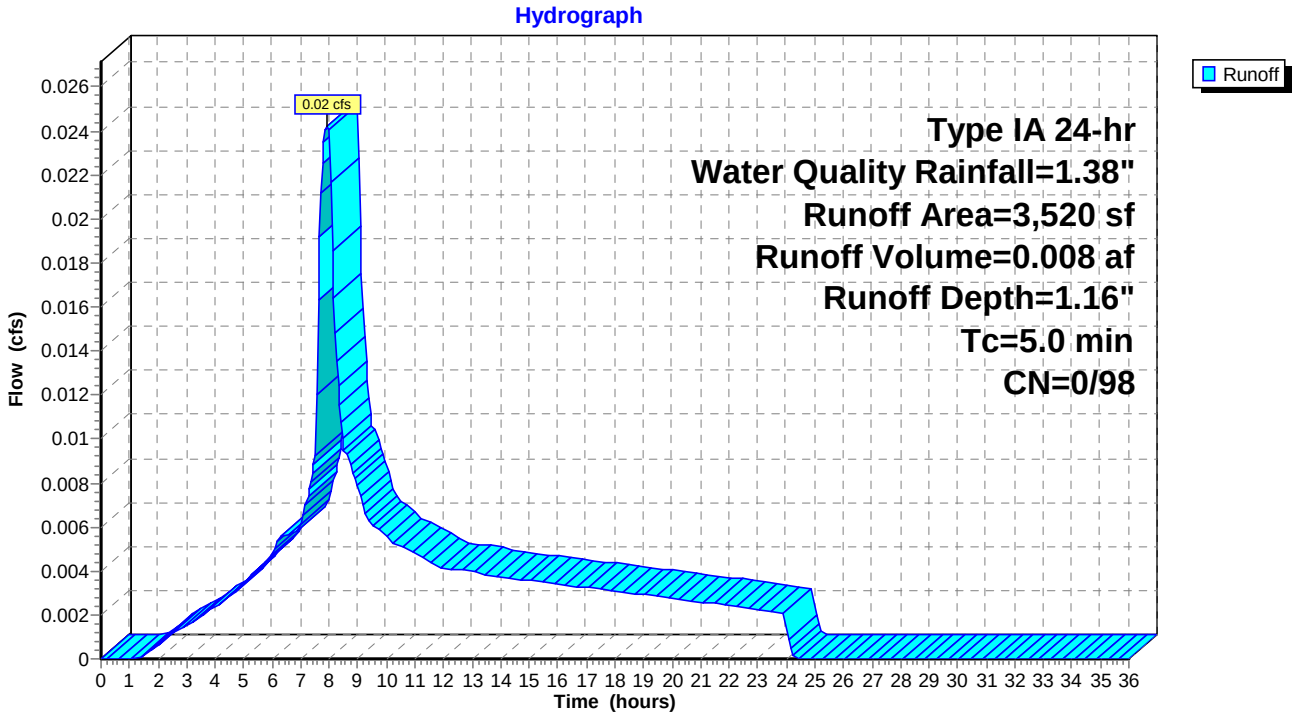
Runoff = 0.02 cfs @ 7.91 hrs, Volume= 0.008 af, Depth= 1.16"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type IA 24-hr Water Quality Rainfall=1.38"

Area (sf)	CN	Description
3,520	98	Roofs, HSG C
3,520	98	100.00% Impervious Area

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

Subcatchment 17: Building 26



Summary for Subcatchment Landscape: Landscaping

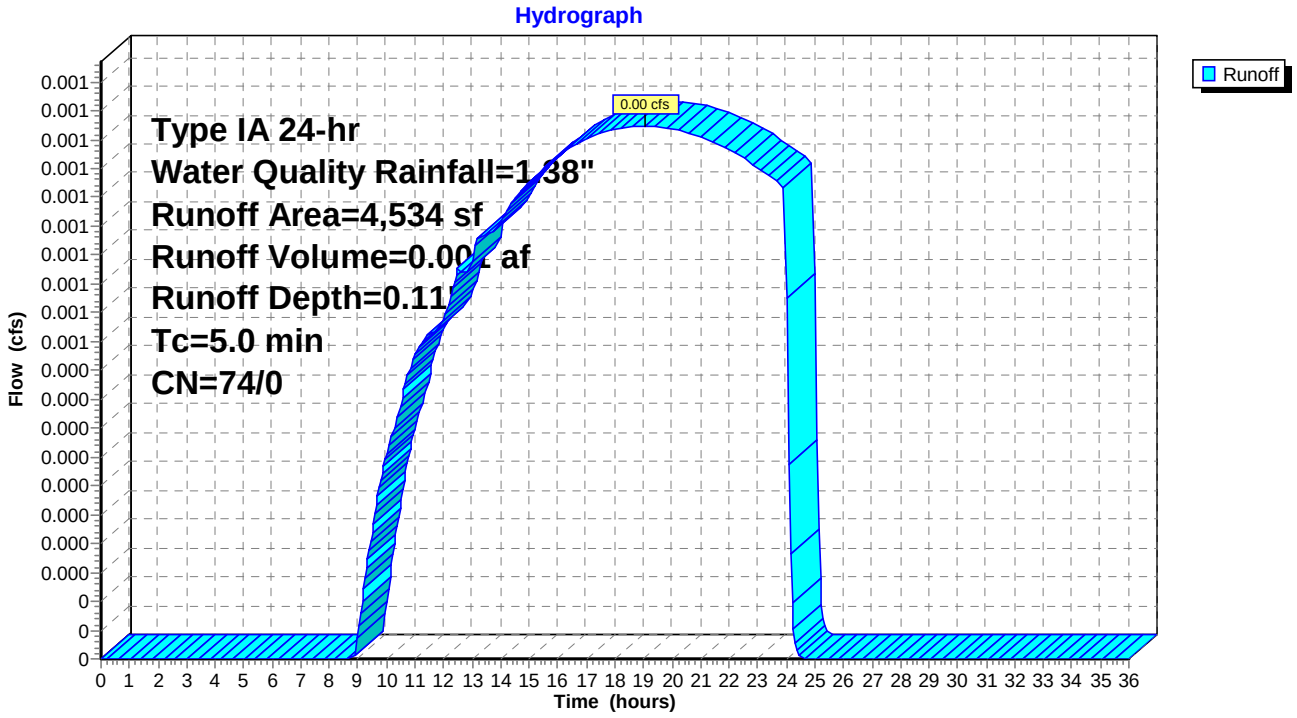
Runoff = 0.00 cfs @ 19.03 hrs, Volume= 0.001 af, Depth= 0.11"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type IA 24-hr Water Quality Rainfall=1.38"

Area (sf)	CN	Description
4,534	74	>75% Grass cover, Good, HSG C
4,534	74	100.00% Pervious Area

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

Subcatchment Landscape: Landscaping



Summary for Subcatchment S Parking: South Parking

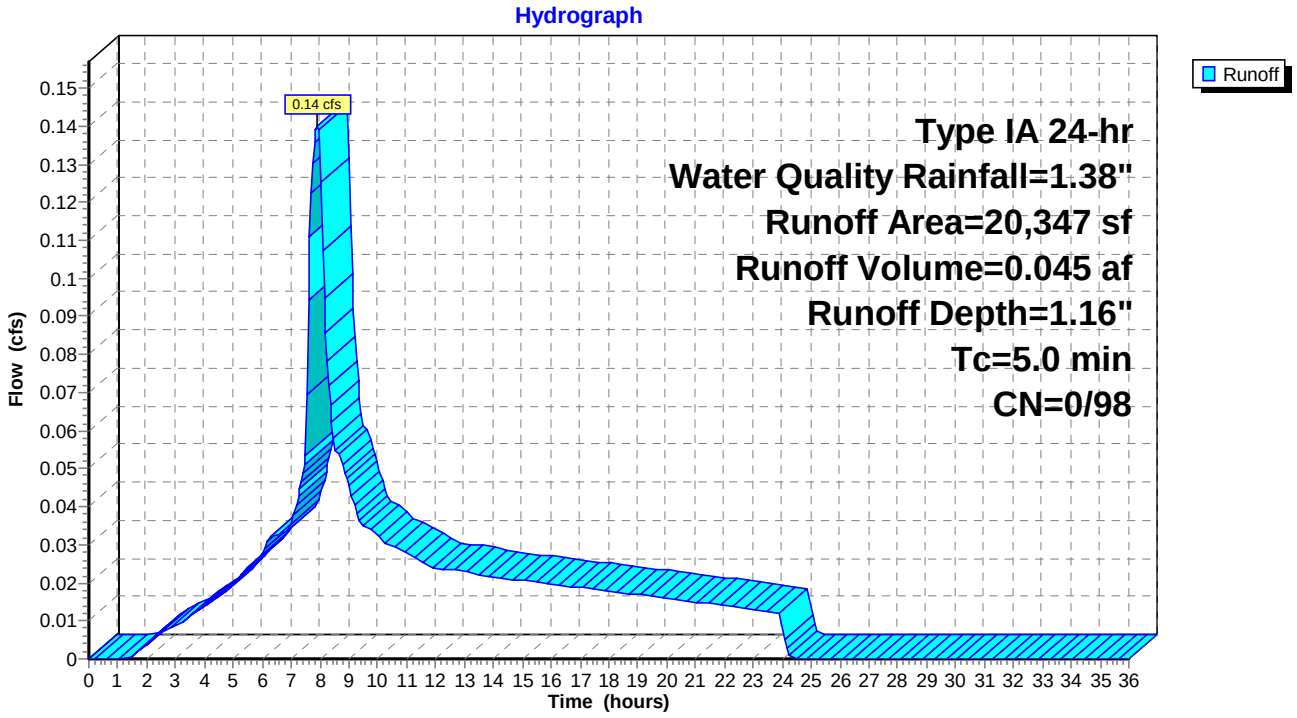
Runoff = 0.14 cfs @ 7.91 hrs, Volume= 0.045 af, Depth= 1.16"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type IA 24-hr Water Quality Rainfall=1.38"

Area (sf)	CN	Description
20,347	98	Paved parking, HSG C
20,347	98	100.00% Impervious Area

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

Subcatchment S Parking: South Parking



Summary for Subcatchment Undev SW: Undeveloped SW

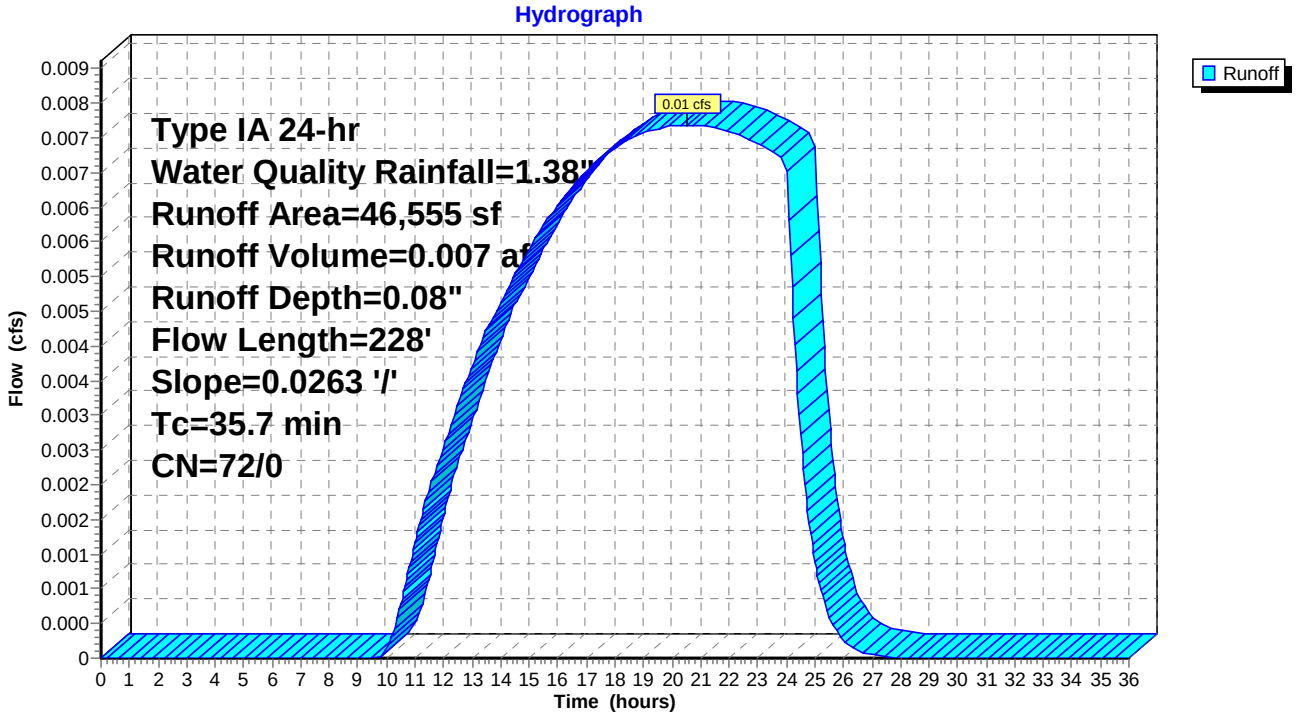
Runoff = 0.01 cfs @ 20.53 hrs, Volume= 0.007 af, Depth= 0.08"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type IA 24-hr Water Quality Rainfall=1.38"

	Area (sf)	CN	Description
*	46,555	72	City of Salem Predeveloped, HSG C
	46,555	72	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
35.7	228	0.0263	0.11		**Sheet Flow,** n= 0.300 P2= 2.20"

Subcatchment Undev SW: Undeveloped SW



Summary for Pond 1 - GM: PB 1 - GM

Inflow Area = 1.907 ac, 38.51% Impervious, Inflow Depth = 0.50" for Water Quality event
Inflow = 0.22 cfs @ 7.91 hrs, Volume= 0.079 af
Outflow = 0.14 cfs @ 7.70 hrs, Volume= 0.079 af, Atten= 37%, Lag= 0.0 min
Primary = 0.14 cfs @ 7.70 hrs, Volume= 0.079 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 4.06' @ 8.18 hrs Surf.Area= 3,008 sf Storage= 166 cf

Plug-Flow detention time= 8.4 min calculated for 0.079 af (100% of inflow)
Center-of-Mass det. time= 8.4 min (748.0 - 739.5)

Volume	Invert	Avail.Storage	Storage Description
#1	4.00'	6,016 cf	**Growing Media (Prismatic)** Listed below (Recalc)

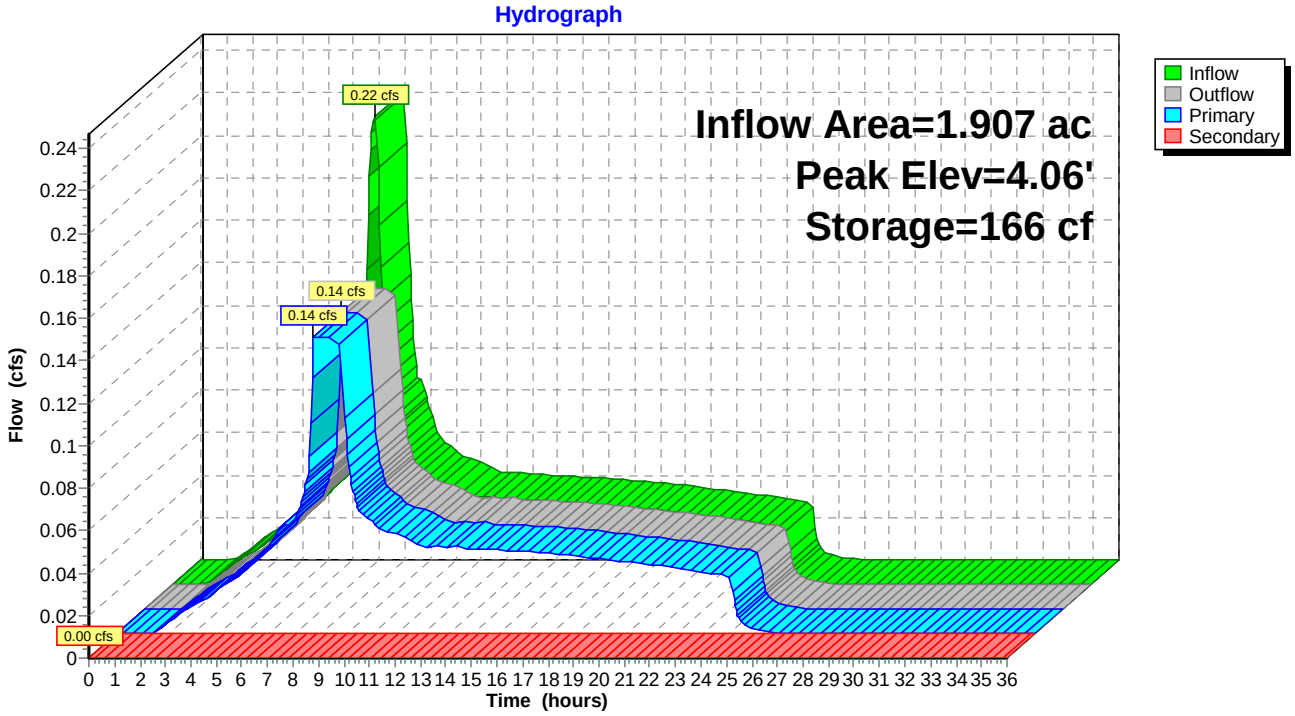
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
4.00	3,008	0	0
6.00	3,008	6,016	6,016

Device	Routing	Invert	Outlet Devices
#1	Primary	4.00'	**2.000 in/hr Exfiltration over Surface area**
#2	Secondary	5.50'	**7.0" Horiz. Rock Box** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.14 cfs @ 7.70 hrs HW=4.02' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.14 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=4.00' (Free Discharge)
↑—**2=Rock Box** (Controls 0.00 cfs)

Pond 1 - GM: PB 1 - GM



Summary for Pond 1 - DR: PB 1 - DR

Inflow Area = 1.907 ac, 38.51% Impervious, Inflow Depth = 0.50" for Water Quality event
Inflow = 0.14 cfs @ 7.70 hrs, Volume= 0.079 af
Outflow = 0.05 cfs @ 6.60 hrs, Volume= 0.079 af, Atten= 65%, Lag= 0.0 min
Discarded = 0.05 cfs @ 6.60 hrs, Volume= 0.079 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 0.53' @ 10.37 hrs Surf.Area= 3,008 sf Storage= 572 cf

Plug-Flow detention time= 106.4 min calculated for 0.079 af (100% of inflow)
Center-of-Mass det. time= 106.4 min (854.4 - 748.0)

Volume	Invert	Avail.Storage	Storage Description
#1	0.00'	4,332 cf	**Drain Rock (Prismatic)** Listed below (Recalc) 12,032 cf Overall x 36.0% Voids

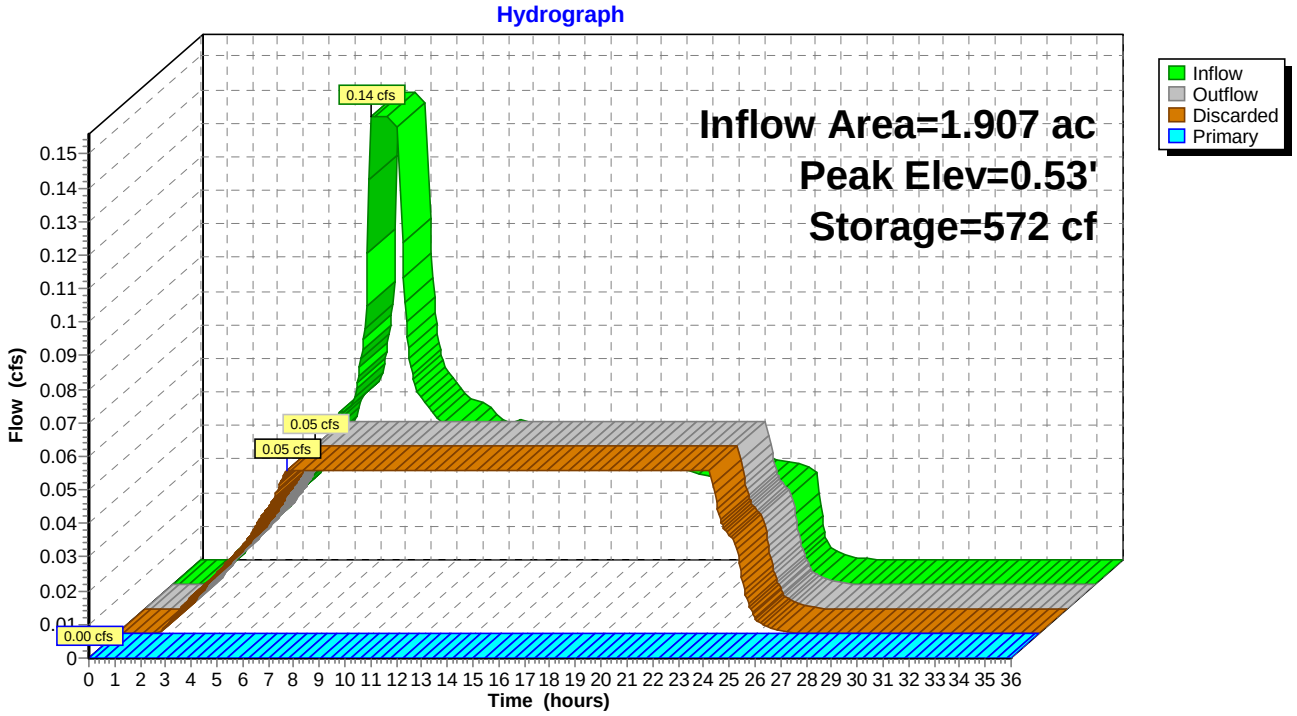
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
0.00	3,008	0	0
4.00	3,008	12,032	12,032

Device	Routing	Invert	Outlet Devices
#1	Discarded	0.00'	**0.700 in/hr Exfiltration over Surface area**
#2	Primary	3.33'	**8.0" Vert. Underdrain** C= 0.600 Limited to weir flow at low heads

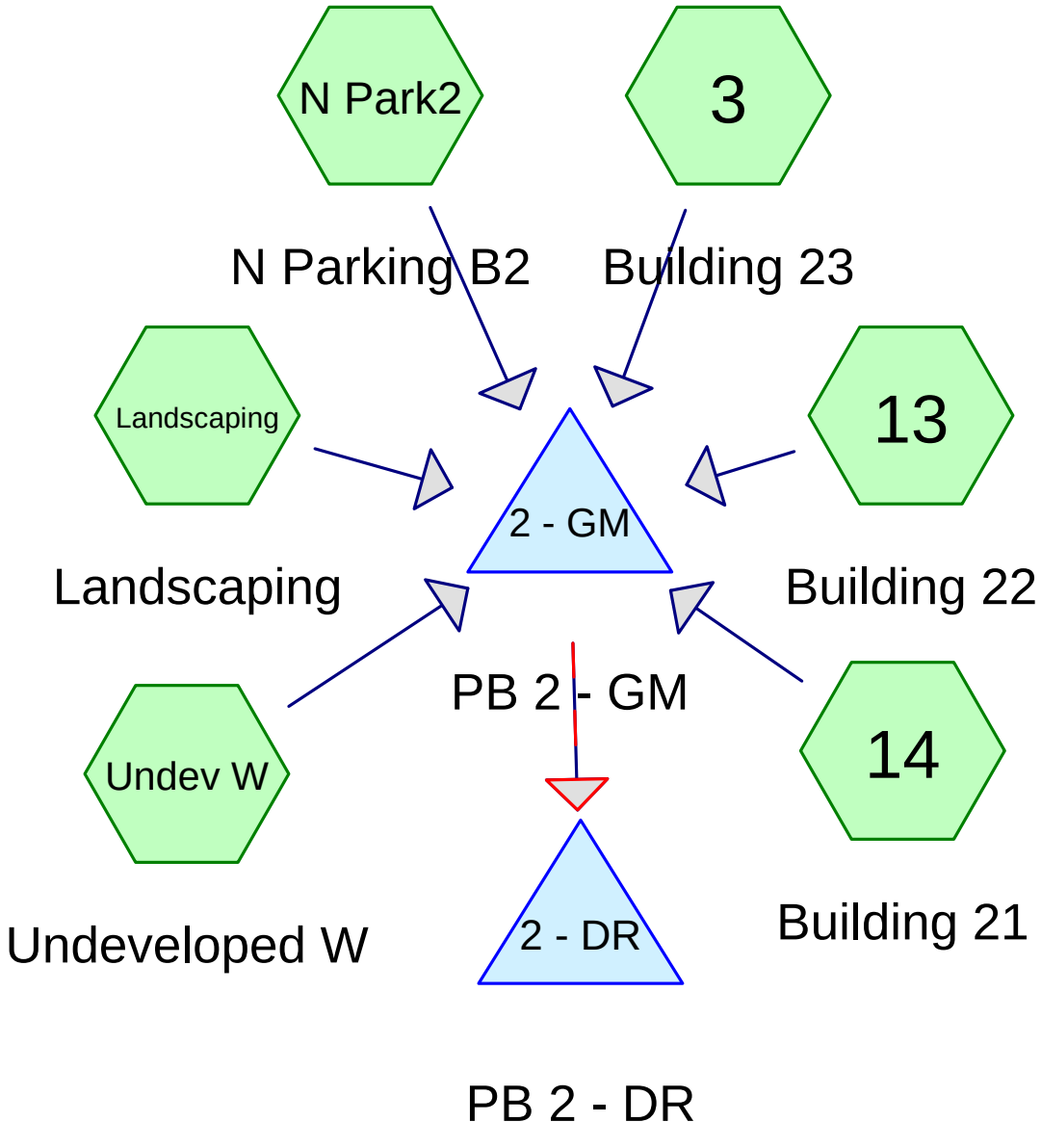
Discarded OutFlow Max=0.05 cfs @ 6.60 hrs HW=0.04' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.05 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=0.00' (Free Discharge)
↑—**2=Underdrain** (Controls 0.00 cfs)

Pond 1 - DR: PB 1 - DR



EAST



Subcat Reach Pond Link

Routing Diagram for EAST (Reed Rd) Site Prelim Hydrograph
Prepared by Multi/Tech Engineering Services, Printed 2/17/2021

Summary for Subcatchment 3: Building 23

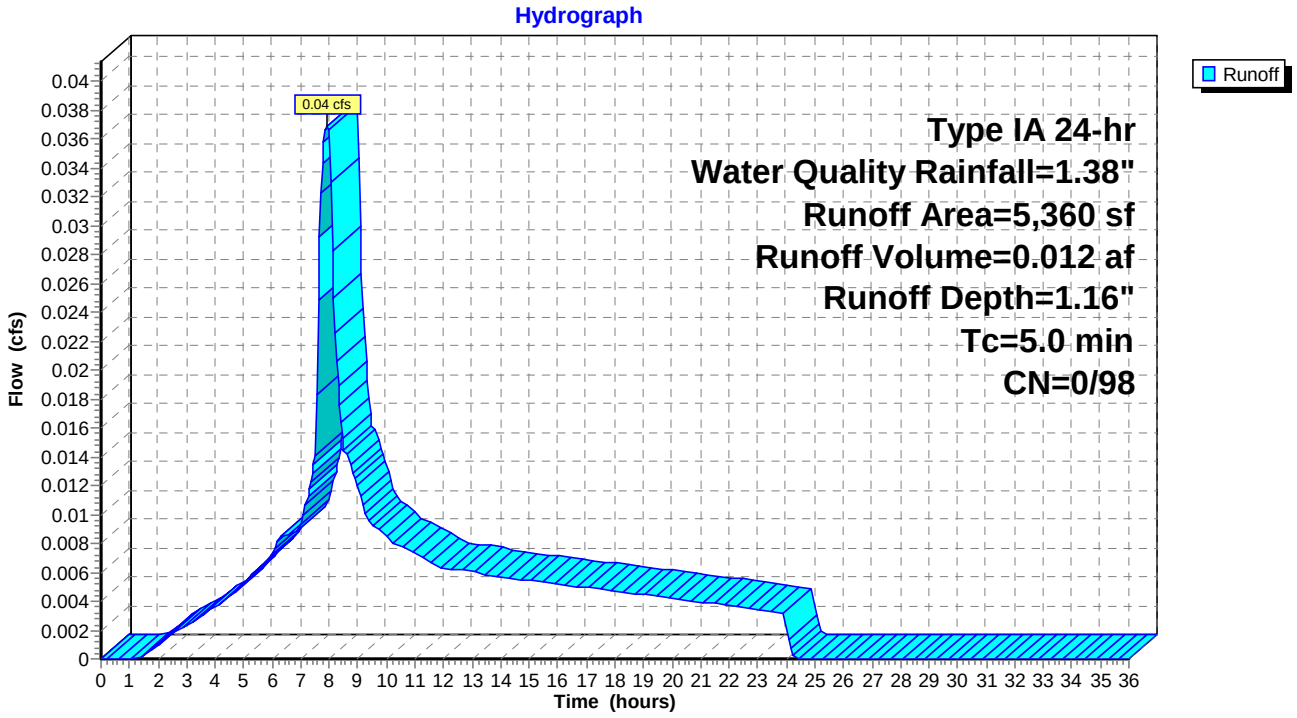
Runoff = 0.04 cfs @ 7.91 hrs, Volume= 0.012 af, Depth= 1.16"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type IA 24-hr Water Quality Rainfall=1.38"

Area (sf)	CN	Description
5,360	98	Roofs, HSG C
5,360	98	100.00% Impervious Area

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

Subcatchment 3: Building 23



Summary for Subcatchment 13: Building 22

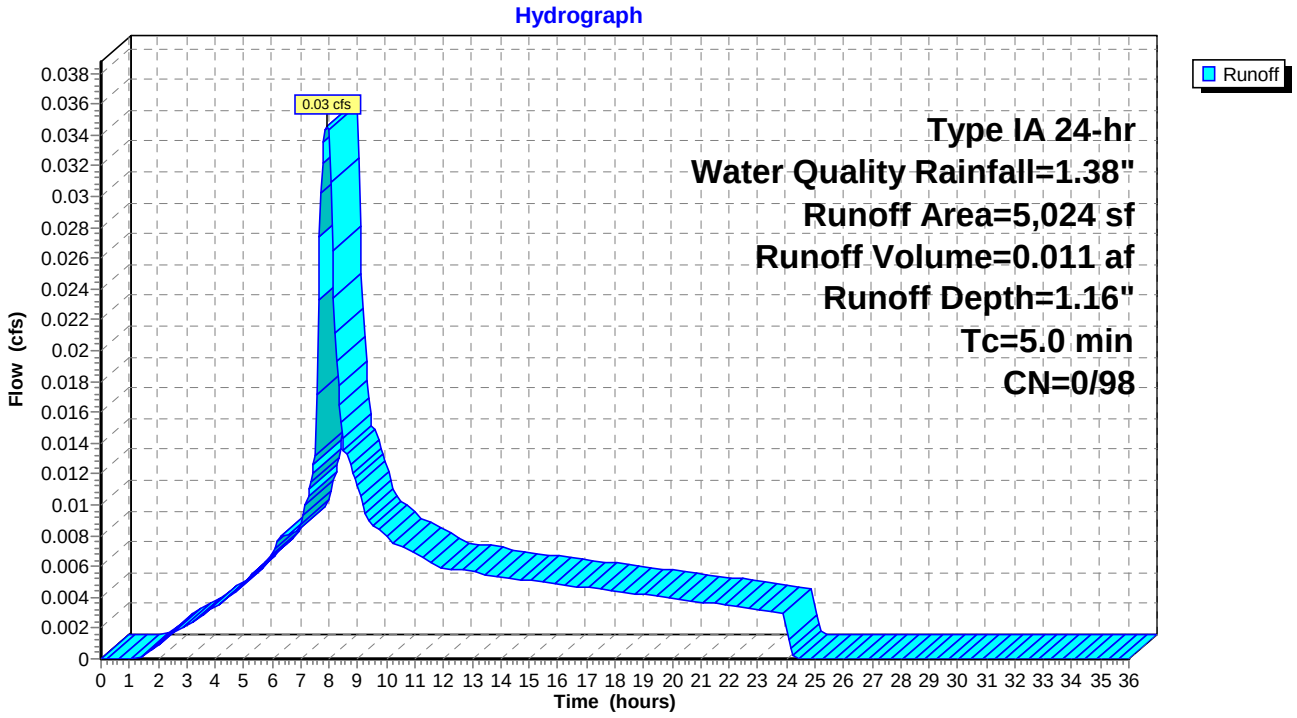
Runoff = 0.03 cfs @ 7.91 hrs, Volume= 0.011 af, Depth= 1.16"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type IA 24-hr Water Quality Rainfall=1.38"

Area (sf)	CN	Description
5,024	98	Roofs, HSG C
5,024	98	100.00% Impervious Area

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

Subcatchment 13: Building 22



Summary for Subcatchment 14: Building 21

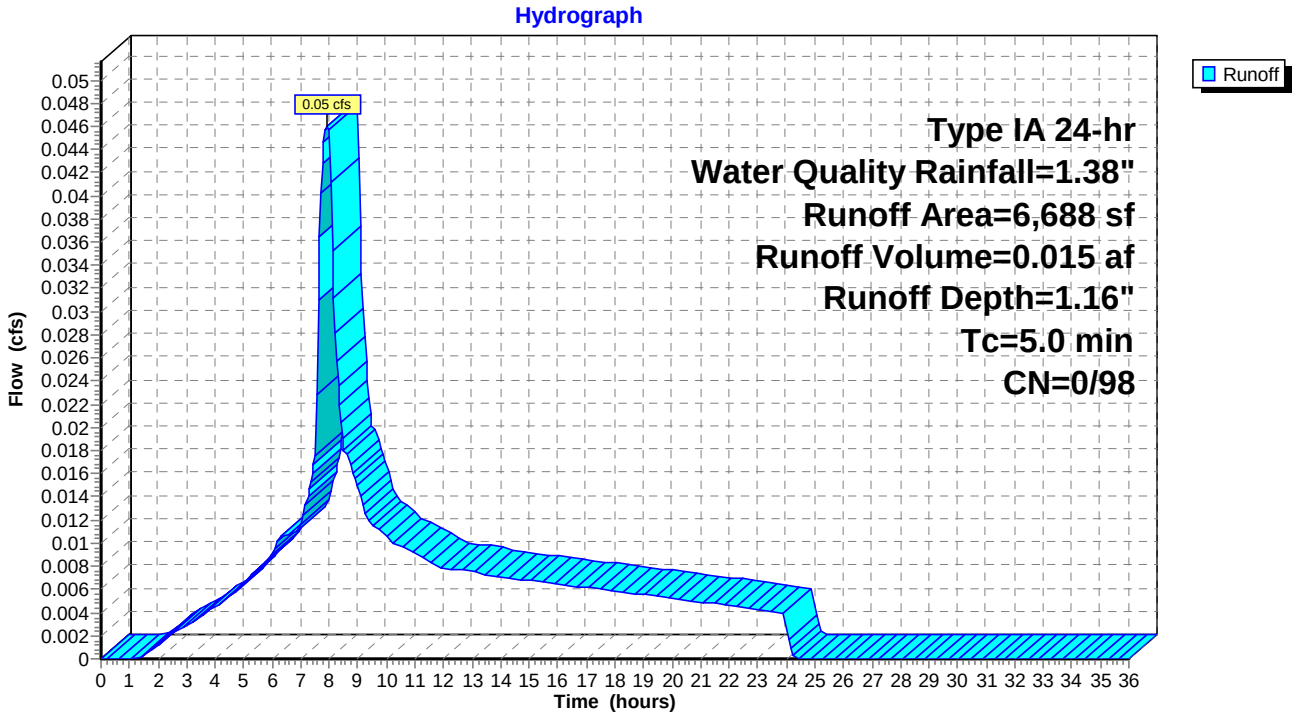
Runoff = 0.05 cfs @ 7.91 hrs, Volume= 0.015 af, Depth= 1.16"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type IA 24-hr Water Quality Rainfall=1.38"

Area (sf)	CN	Description
6,688	98	Roofs, HSG C
6,688	98	100.00% Impervious Area

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

Subcatchment 14: Building 21



Summary for Subcatchment Landscaping: Landscaping

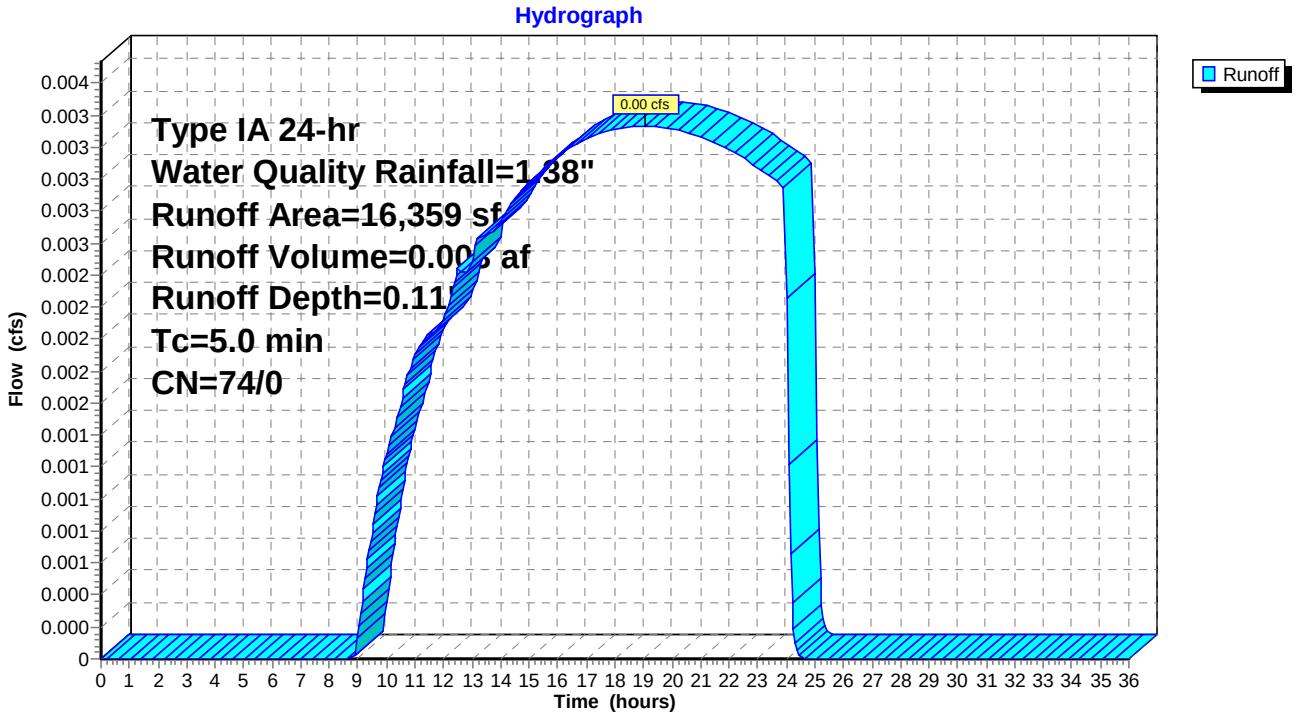
Runoff = 0.00 cfs @ 19.03 hrs, Volume= 0.003 af, Depth= 0.11"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type IA 24-hr Water Quality Rainfall=1.38"

Area (sf)	CN	Description
16,359	74	>75% Grass cover, Good, HSG C
16,359	74	100.00% Pervious Area

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

Subcatchment Landscaping: Landscaping



Summary for Subcatchment N Park2: N Parking B2

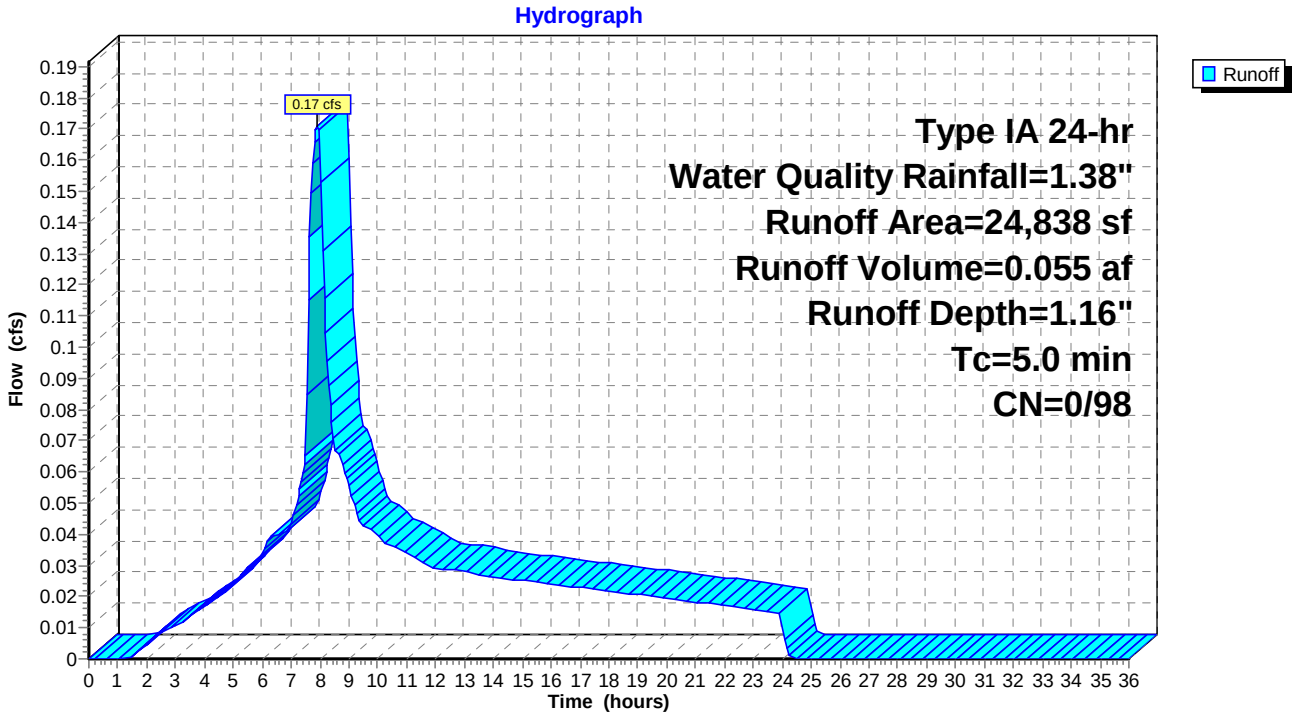
Runoff = 0.17 cfs @ 7.91 hrs, Volume= 0.055 af, Depth= 1.16"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type IA 24-hr Water Quality Rainfall=1.38"

Area (sf)	CN	Description
24,838	98	Unconnected pavement, HSG C
24,838	98	100.00% Impervious Area

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

Subcatchment N Park2: N Parking B2



Summary for Subcatchment Undev W: Undeveloped W

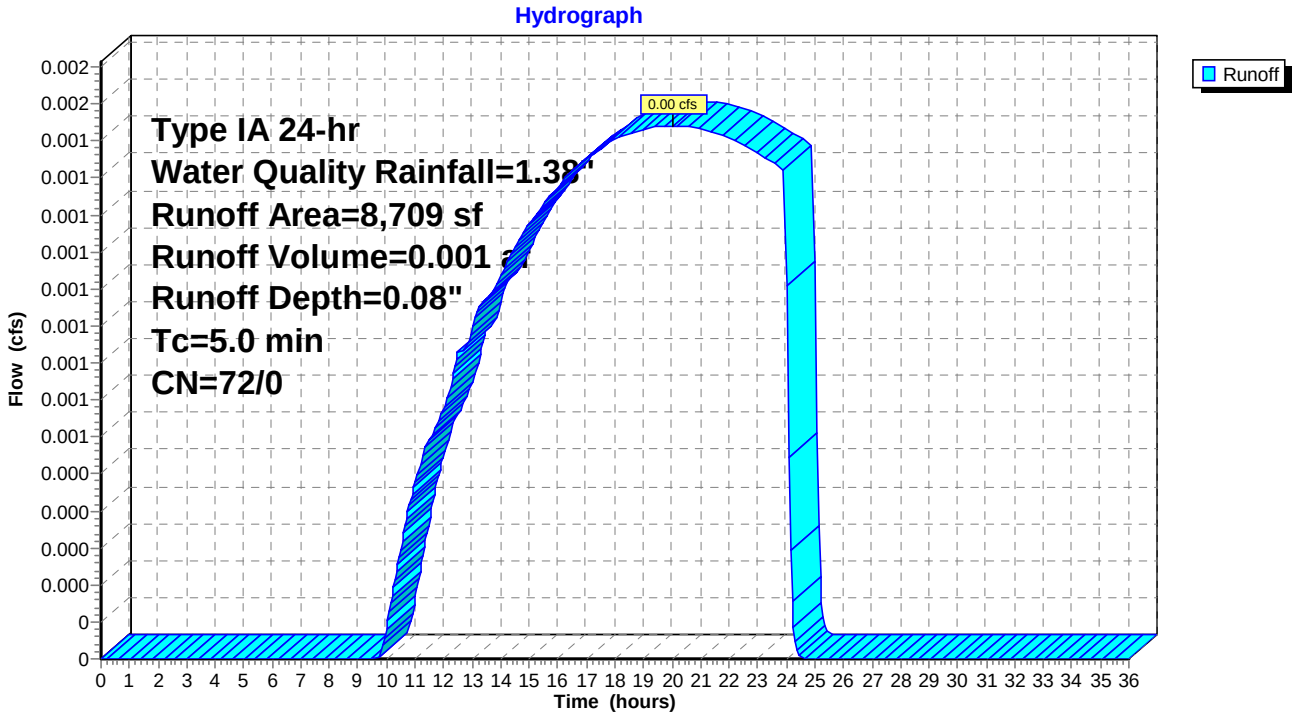
Runoff = 0.00 cfs @ 20.00 hrs, Volume= 0.001 af, Depth= 0.08"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type IA 24-hr Water Quality Rainfall=1.38"

	Area (sf)	CN	Description
*	8,709	72	City of Salem Undeveloped, HSG C
	8,709	72	100.00% Pervious Area

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

Subcatchment Undev W: Undeveloped W



Summary for Pond 2 - GM: PB 2 - GM

Inflow Area = 1.538 ac, 62.57% Impervious, Inflow Depth = 0.76" for Water Quality event
Inflow = 0.29 cfs @ 7.91 hrs, Volume= 0.098 af
Outflow = 0.11 cfs @ 7.60 hrs, Volume= 0.098 af, Atten= 60%, Lag= 0.0 min
Primary = 0.11 cfs @ 7.60 hrs, Volume= 0.098 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 4.15' @ 8.49 hrs Surf.Area= 2,482 sf Storage= 382 cf

Plug-Flow detention time= 16.9 min calculated for 0.098 af (100% of inflow)
Center-of-Mass det. time= 16.9 min (731.8 - 714.9)

Volume	Invert	Avail.Storage	Storage Description
#1	4.00'	4,964 cf	**Growing Media (Prismatic)** Listed below (Recalc)

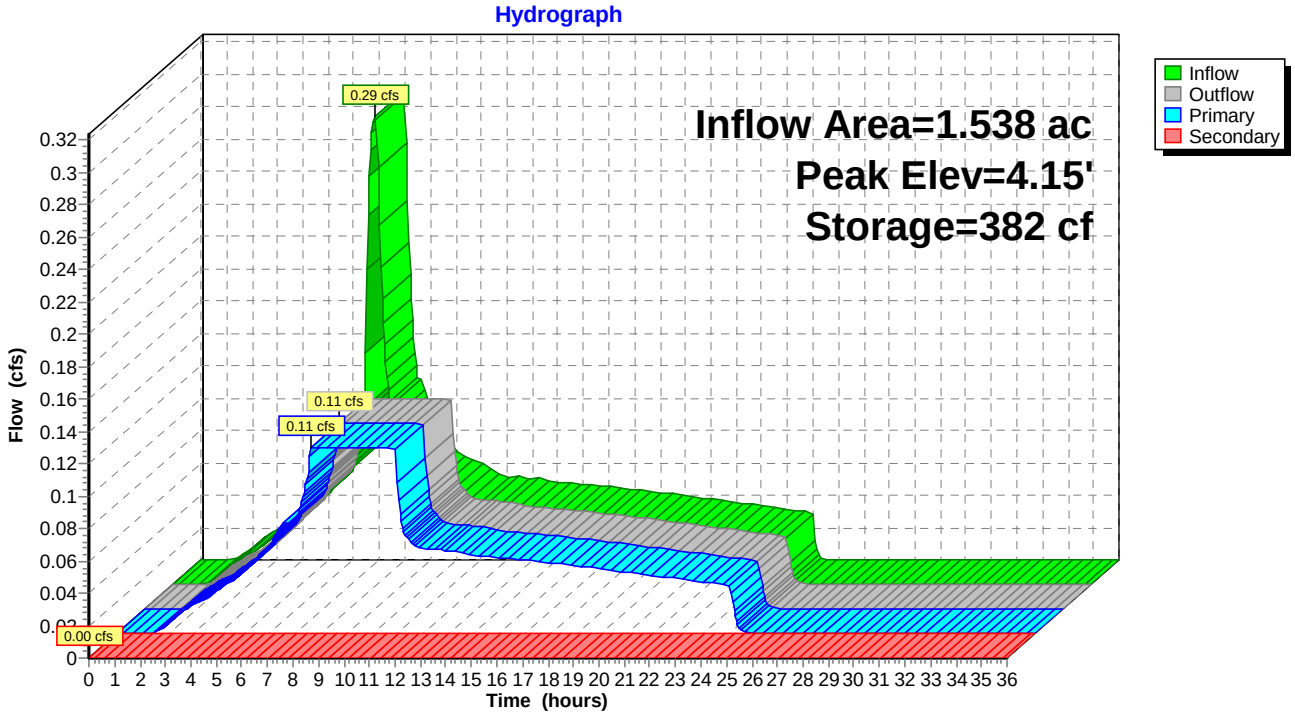
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
4.00	2,482	0	0
6.00	2,482	4,964	4,964

Device	Routing	Invert	Outlet Devices
#1	Primary	4.00'	**2.000 in/hr Exfiltration over Surface area**
#2	Secondary	5.50'	**7.0" Horiz. Rock Box** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.11 cfs @ 7.60 hrs HW=4.02' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.11 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=4.00' (Free Discharge)
↑—**2=Rock Box** (Controls 0.00 cfs)

Pond 2 - GM: PB 2 - GM



Summary for Pond 2 - DR: PB 2 - DR

Inflow Area = 1.538 ac, 62.57% Impervious, Inflow Depth = 0.76" for Water Quality event
Inflow = 0.11 cfs @ 7.60 hrs, Volume= 0.098 af
Outflow = 0.04 cfs @ 5.35 hrs, Volume= 0.098 af, Atten= 65%, Lag= 0.0 min
Discarded = 0.04 cfs @ 5.35 hrs, Volume= 0.098 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 1.54' @ 18.78 hrs Surf.Area= 2,482 sf Storage= 1,377 cf

Plug-Flow detention time= 362.5 min calculated for 0.098 af (100% of inflow)
Center-of-Mass det. time= 362.5 min (1,094.3 - 731.8)

Volume	Invert	Avail.Storage	Storage Description
#1	0.00'	3,574 cf	**Drain Rock (Prismatic)** Listed below (Recalc) 9,928 cf Overall x 36.0% Voids

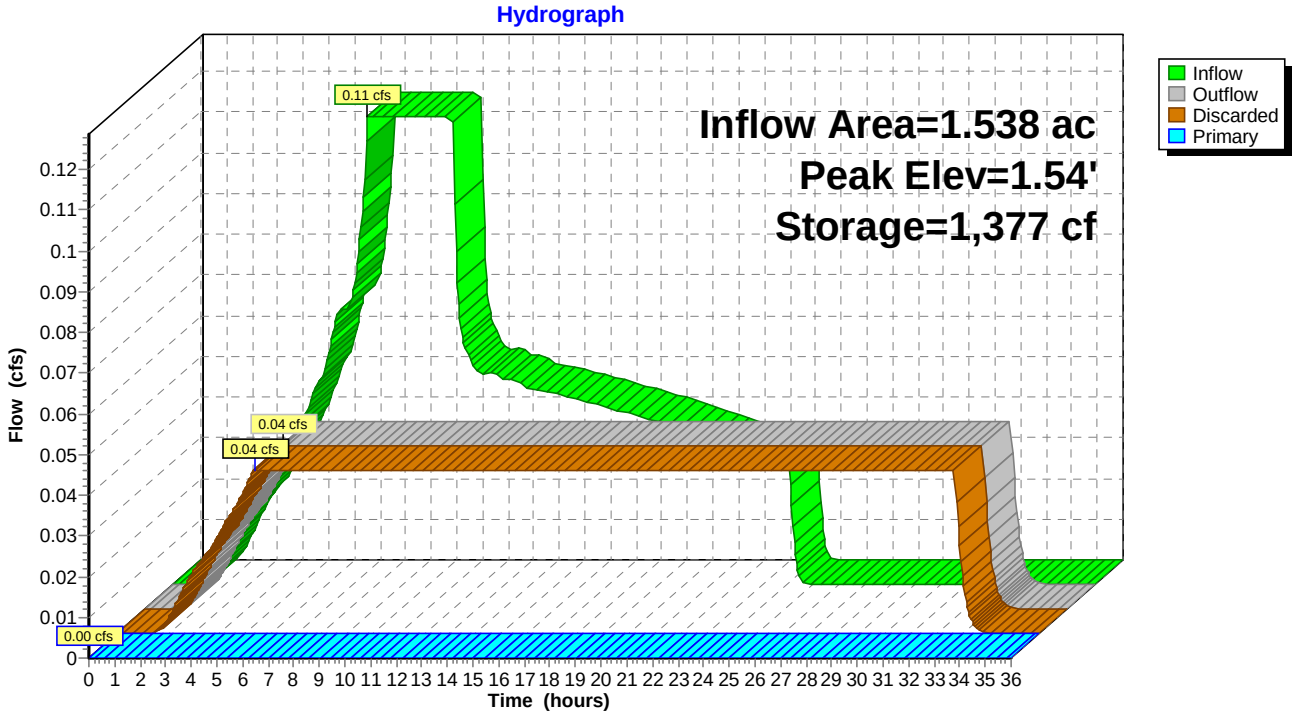
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
0.00	2,482	0	0
4.00	2,482	9,928	9,928

Device	Routing	Invert	Outlet Devices
#1	Discarded	0.00'	**0.700 in/hr Exfiltration over Surface area**
#2	Primary	3.33'	**8.0" Vert. Underdrain** C= 0.600 Limited to weir flow at low heads

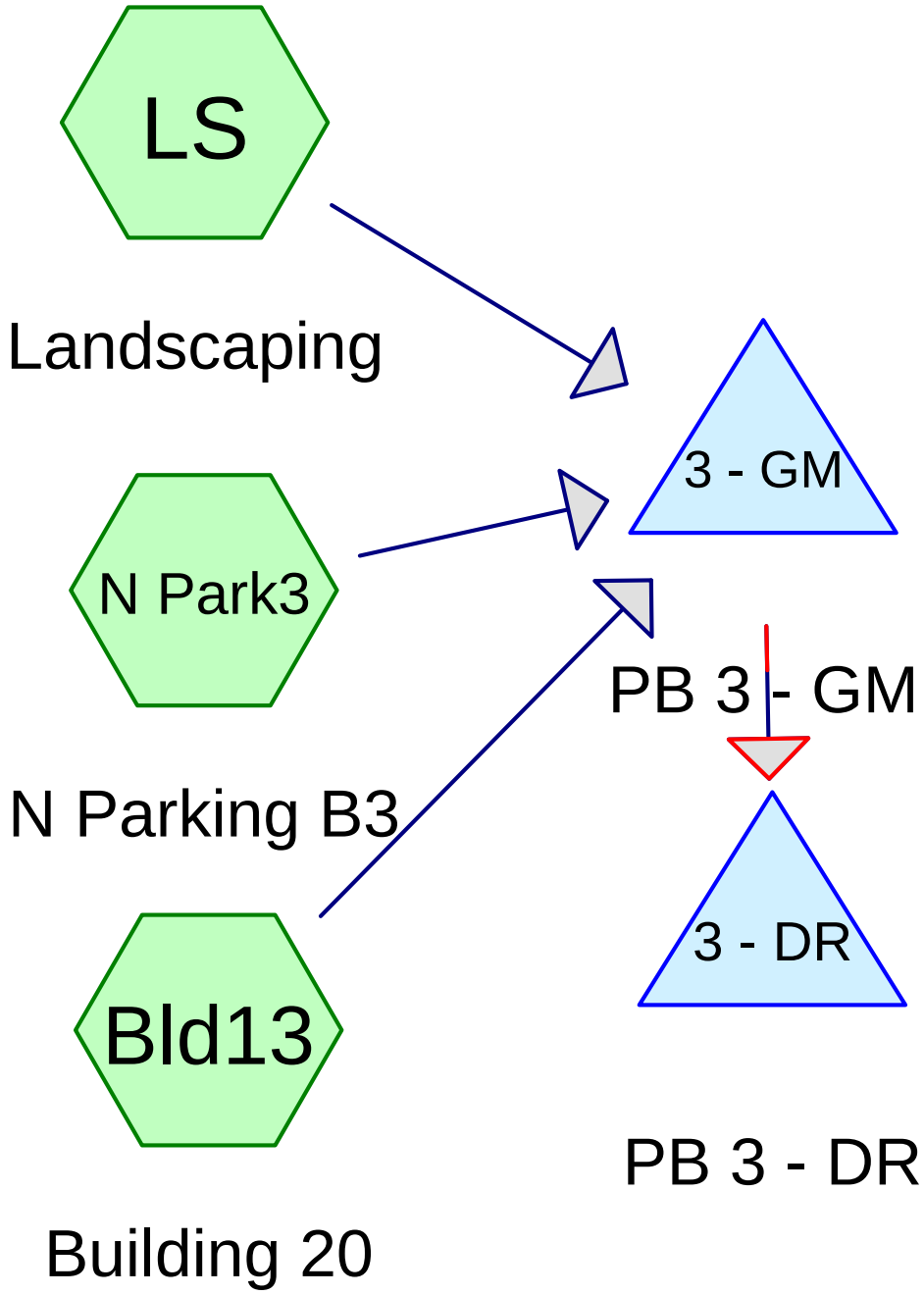
Discarded OutFlow Max=0.04 cfs @ 5.35 hrs HW=0.04' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.04 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=0.00' (Free Discharge)
↑—**2=Underdrain** (Controls 0.00 cfs)

Pond 2 - DR: PB 2 - DR



EAST



Subcat Reach Pond Link

Routing Diagram for EAST (Reed Rd) Site Prelim Hydrograph
Prepared by Multi/Tech Engineering Services, Printed 2/17/2021

Summary for Subcatchment Bld13: Building 20

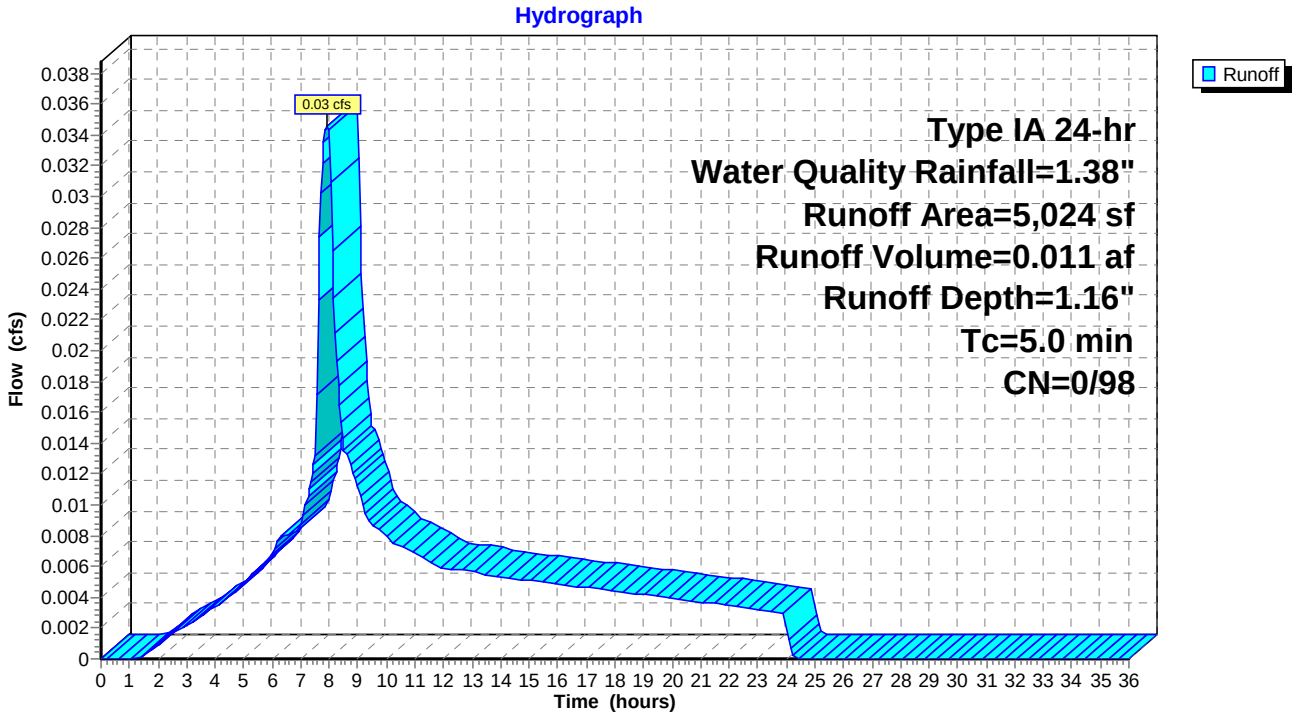
Runoff = 0.03 cfs @ 7.91 hrs, Volume= 0.011 af, Depth= 1.16"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type IA 24-hr Water Quality Rainfall=1.38"

Area (sf)	CN	Description
5,024	98	Roofs, HSG C
5,024	98	100.00% Impervious Area

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

Subcatchment Bld13: Building 20



Summary for Subcatchment LS: Landscaping

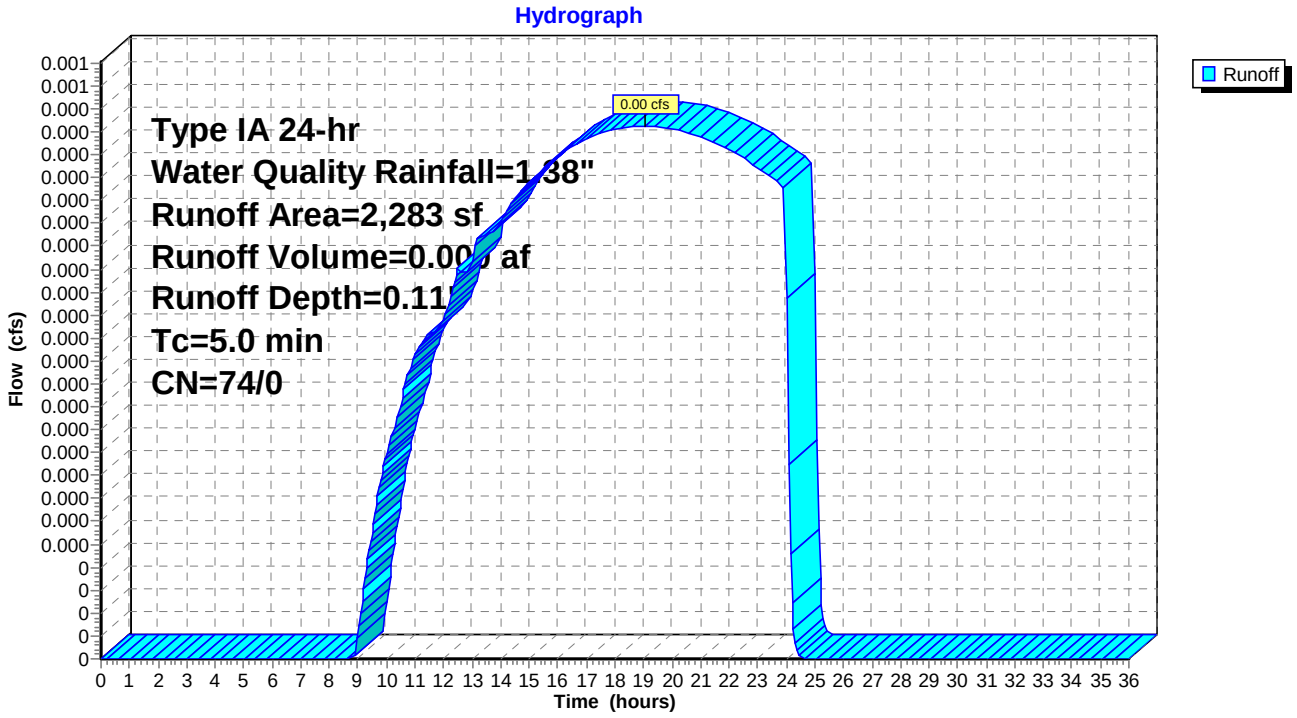
Runoff = 0.00 cfs @ 19.03 hrs, Volume= 0.000 af, Depth= 0.11"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type IA 24-hr Water Quality Rainfall=1.38"

Area (sf)	CN	Description
2,283	74	>75% Grass cover, Good, HSG C
2,283	74	100.00% Pervious Area

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

Subcatchment LS: Landscaping



Summary for Subcatchment N Park3: N Parking B3

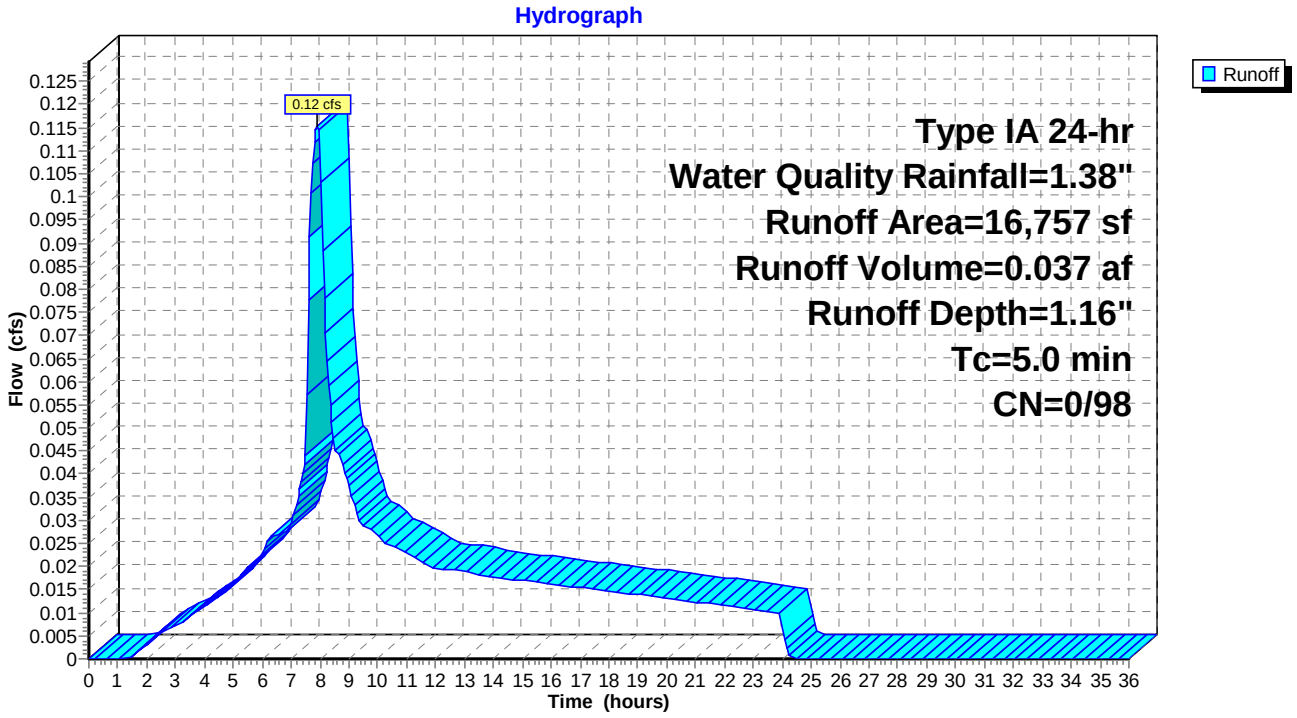
Runoff = 0.12 cfs @ 7.91 hrs, Volume= 0.037 af, Depth= 1.16"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type IA 24-hr Water Quality Rainfall=1.38"

Area (sf)	CN	Description
16,757	98	Paved parking, HSG C
16,757	98	100.00% Impervious Area

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

Subcatchment N Park3: N Parking B3



Summary for Pond 3 - GM: PB 3 - GM

Inflow Area = 0.552 ac, 90.51% Impervious, Inflow Depth = 1.06" for Water Quality event
Inflow = 0.15 cfs @ 7.91 hrs, Volume= 0.049 af
Outflow = 0.07 cfs @ 7.60 hrs, Volume= 0.049 af, Atten= 56%, Lag= 0.0 min
Primary = 0.07 cfs @ 7.60 hrs, Volume= 0.049 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 4.12' @ 8.40 hrs Surf.Area= 1,436 sf Storage= 177 cf

Plug-Flow detention time= 13.9 min calculated for 0.049 af (100% of inflow)
Center-of-Mass det. time= 14.0 min (714.7 - 700.7)

Volume	Invert	Avail.Storage	Storage Description
#1	4.00'	2,872 cf	**Growing Media (Prismatic)** Listed below (Recalc)

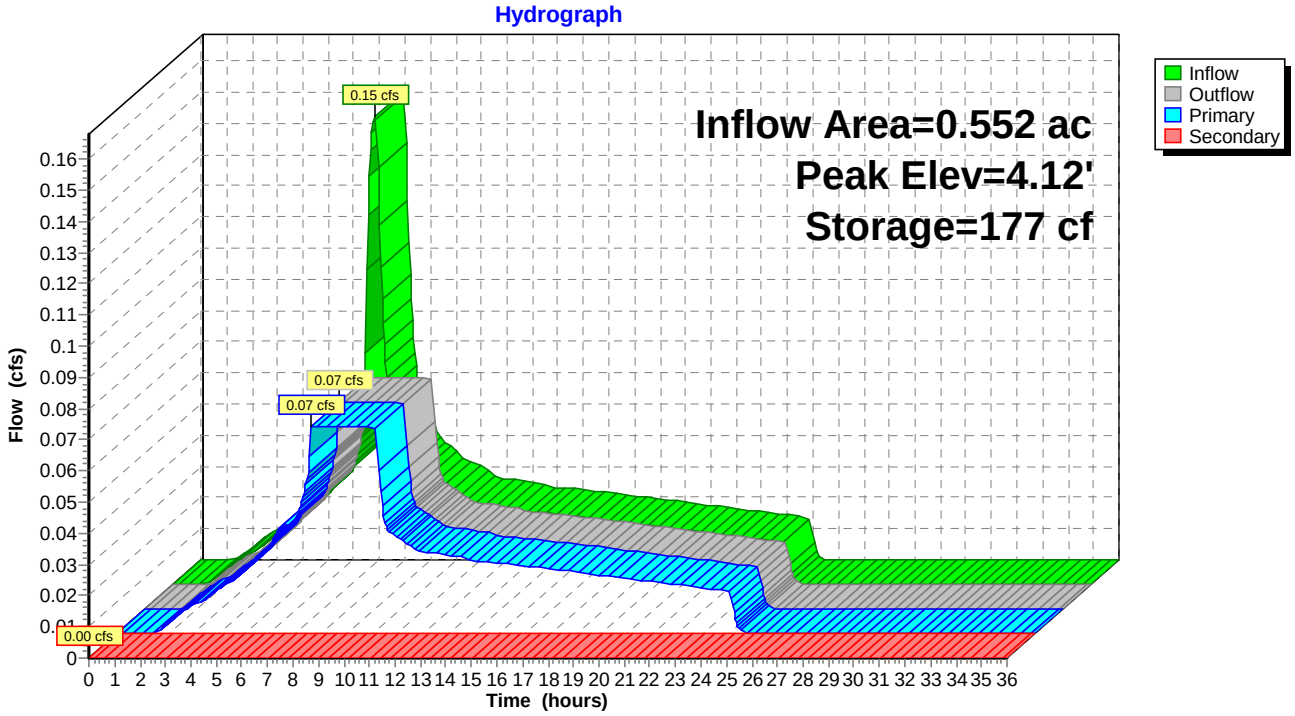
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
4.00	1,436	0	0
6.00	1,436	2,872	2,872

Device	Routing	Invert	Outlet Devices
#1	Primary	4.00'	**2.000 in/hr Exfiltration over Surface area**
#2	Secondary	5.50'	**7.0" Horiz. Rock Box** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.07 cfs @ 7.60 hrs HW=4.02' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.07 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=4.00' (Free Discharge)
└**2=Rock Box** (Controls 0.00 cfs)

Pond 3 - GM: PB 3 - GM



Summary for Pond 3 - DR: PB 3 - DR

Inflow Area = 0.552 ac, 90.51% Impervious, Inflow Depth = 1.06" for Water Quality event
Inflow = 0.07 cfs @ 7.60 hrs, Volume= 0.049 af
Outflow = 0.02 cfs @ 5.60 hrs, Volume= 0.049 af, Atten= 65%, Lag= 0.0 min
Discarded = 0.02 cfs @ 5.60 hrs, Volume= 0.049 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 1.14' @ 14.02 hrs Surf.Area= 1,436 sf Storage= 588 cf

Plug-Flow detention time= 269.7 min calculated for 0.049 af (100% of inflow)
Center-of-Mass det. time= 269.8 min (984.4 - 714.7)

Volume	Invert	Avail.Storage	Storage Description
#1	0.00'	2,068 cf	**Drain Rock (Prismatic)** Listed below (Recalc) 5,744 cf Overall x 36.0% Voids

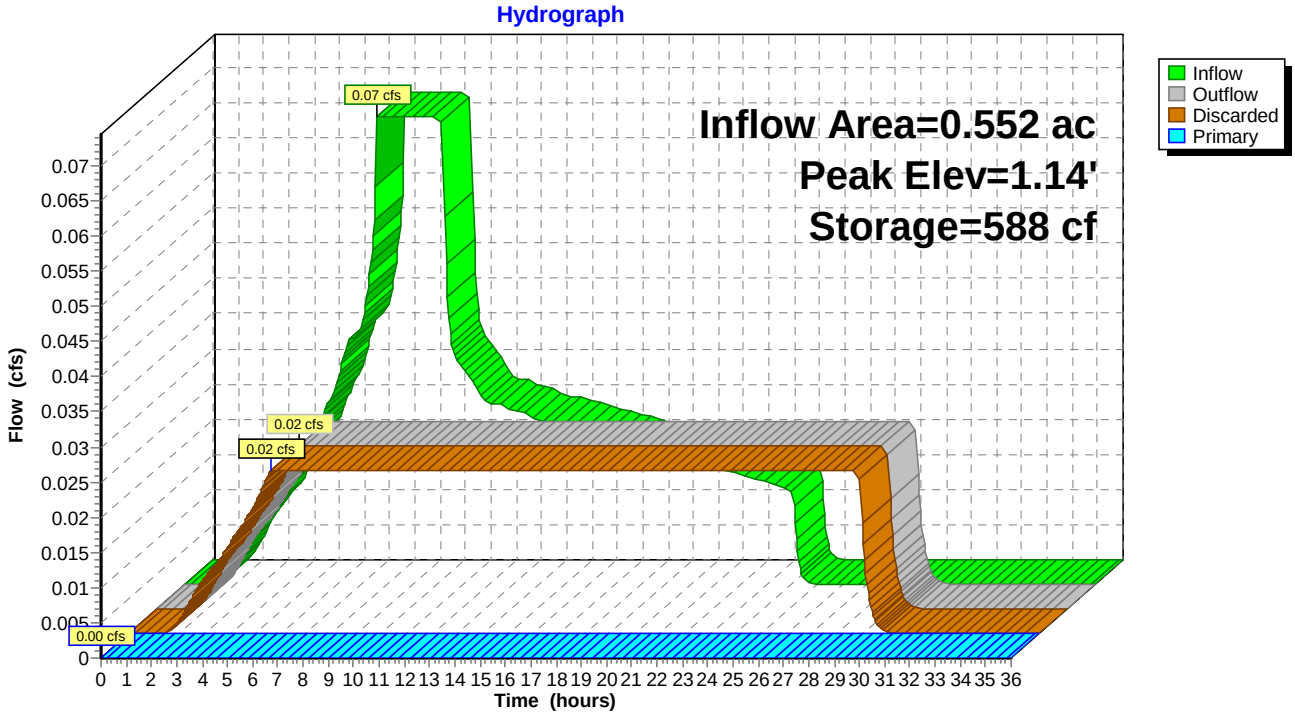
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
0.00	1,436	0	0
4.00	1,436	5,744	5,744

Device	Routing	Invert	Outlet Devices
#1	Discarded	0.00'	**0.700 in/hr Exfiltration over Surface area**
#2	Primary	3.33'	**8.0" Vert. Underdrain** C= 0.600 Limited to weir flow at low heads

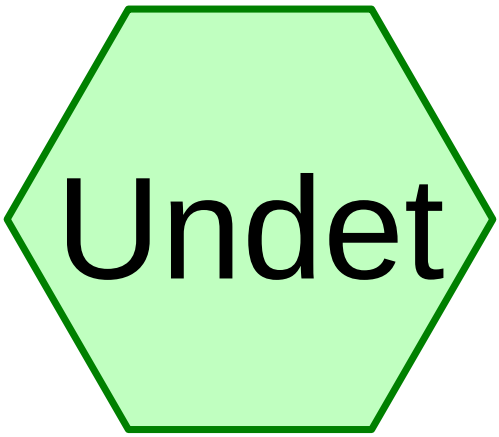
Discarded OutFlow Max=0.02 cfs @ 5.60 hrs HW=0.04' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.02 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=0.00' (Free Discharge)
↑—**2=Underdrain** (Controls 0.00 cfs)

Pond 3 - DR: PB 3 - DR



EAST



Undetained

Subcat Reach Pond Link

Routing Diagram for EAST (Reed Rd) Site Prelim Hydrograph
Prepared by Multi/Tech Engineering Services, Printed 2/17/2021

Summary for Subcatchment Undet: Undetained

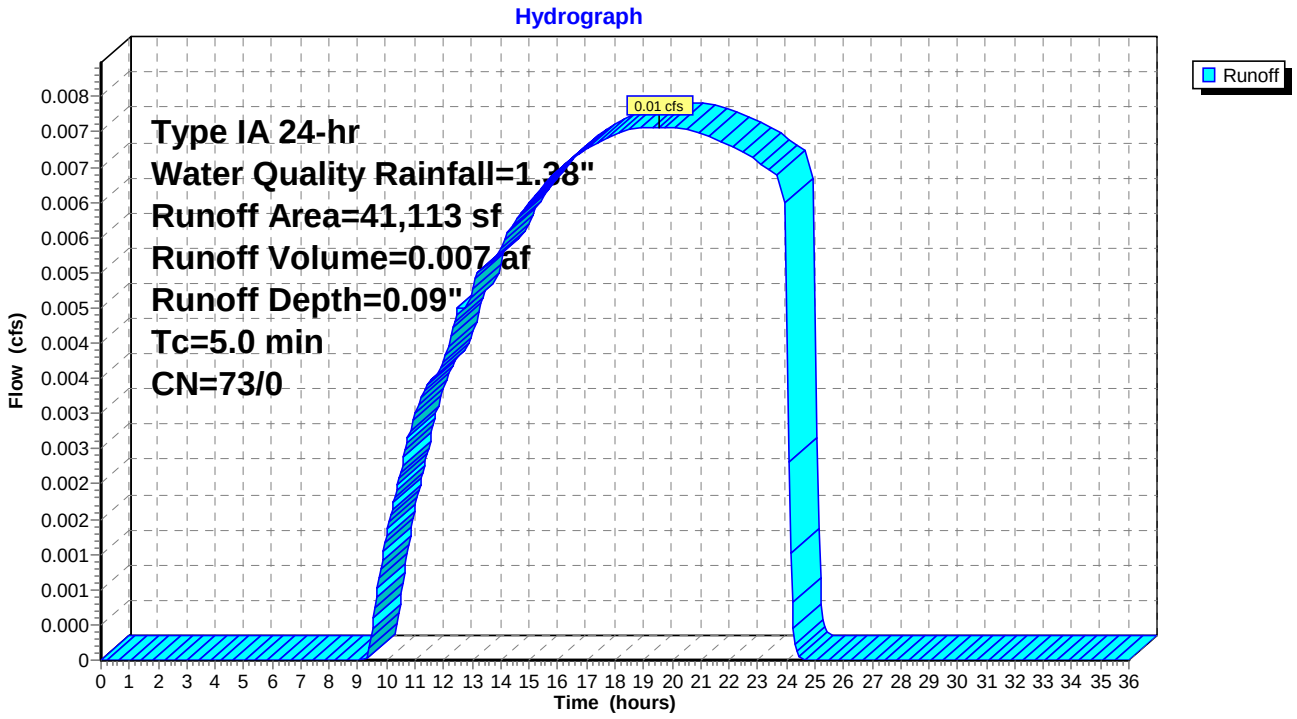
Runoff = 0.01 cfs @ 19.51 hrs, Volume= 0.007 af, Depth= 0.09"

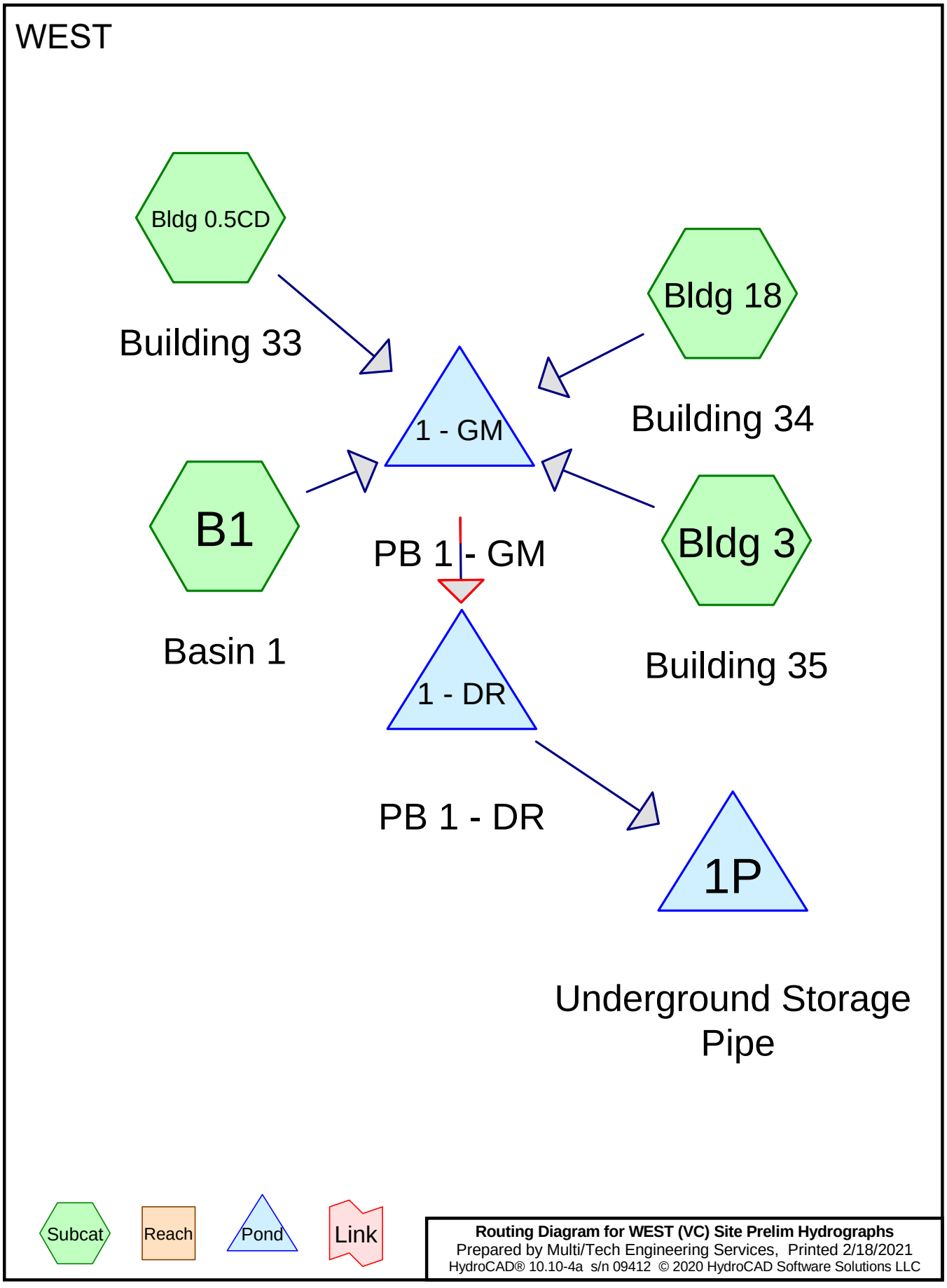
Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type IA 24-hr Water Quality Rainfall=1.38"

	Area (sf)	CN	Description
	3,680	74	>75% Grass cover, Good, HSG C
	3,296	74	>75% Grass cover, Good, HSG C
	7,604	74	>75% Grass cover, Good, HSG C
	1,317	74	>75% Grass cover, Good, HSG C
*	25,216	72	City of Salem Predeveloped, HSG C
	41,113	73	Weighted Average
	41,113	73	100.00% Pervious Area

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

Subcatchment Undet: Undetained




WEST
Bldg 0.5CD
Building 33
Bldg 18
Building 34
1 - GM
B1
Basin 1
PB 1 - GM
Bldg 3
Building 35
1 - DR
PB 1 - DR
1P
Underground Storage Pipe
Subcat
Reach
Pond
Link
Routing Diagram for WEST (VC) Site Prelim Hydrographs
Prepared by Multi/Tech Engineering Services, Printed 2/18/2021
HydroCAD® 10.10-4a s/n 09412 © 2020 HydroCAD Software Solutions LLC

Summary for Subcatchment B1: Basin 1

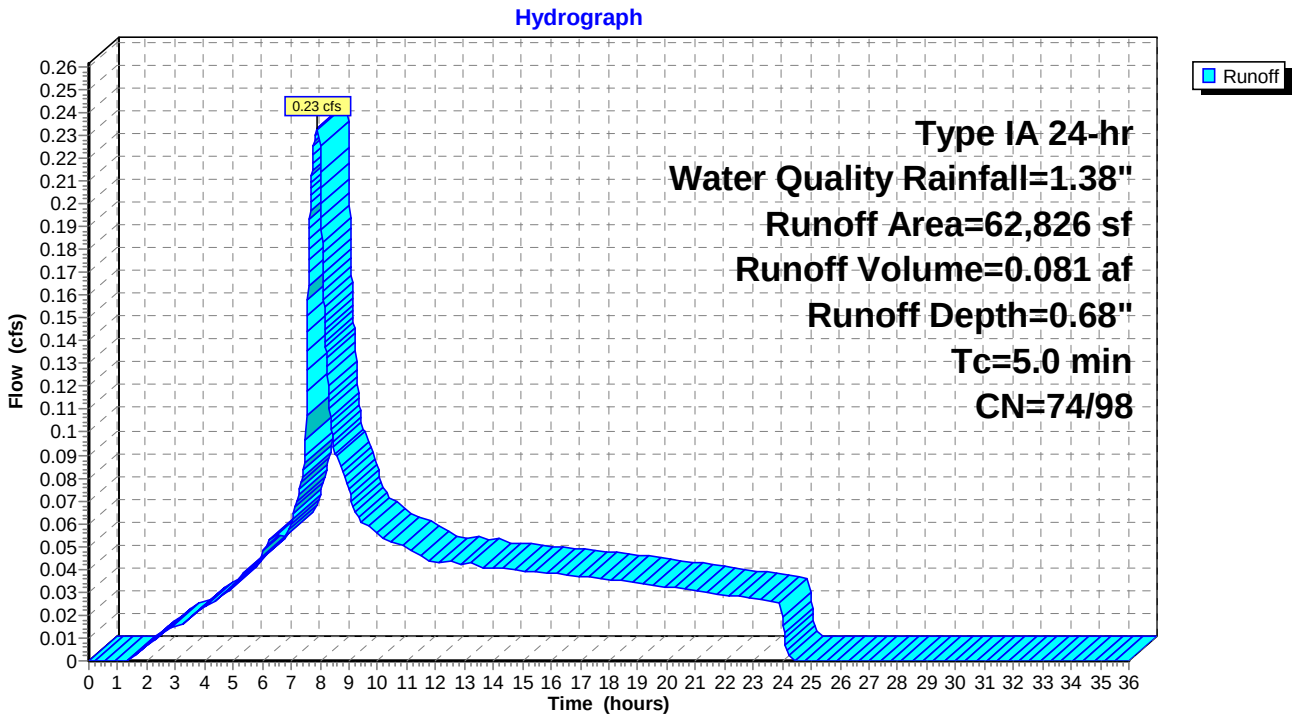
Runoff = 0.23 cfs @ 7.89 hrs, Volume= 0.081 af, Depth= 0.68"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type IA 24-hr Water Quality Rainfall=1.38"

	Area (sf)	CN	Description
	33,861	98	Paved parking, HSG C
	27,754	74	>75% Grass cover, Good, HSG C
*	1,211	72	Planter Box
	62,826	87	Weighted Average
	28,965	74	46.10% Pervious Area
	33,861	98	53.90% Impervious Area

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

Subcatchment B1: Basin 1



Summary for Subcatchment Bldg 0.5CD: Building 33

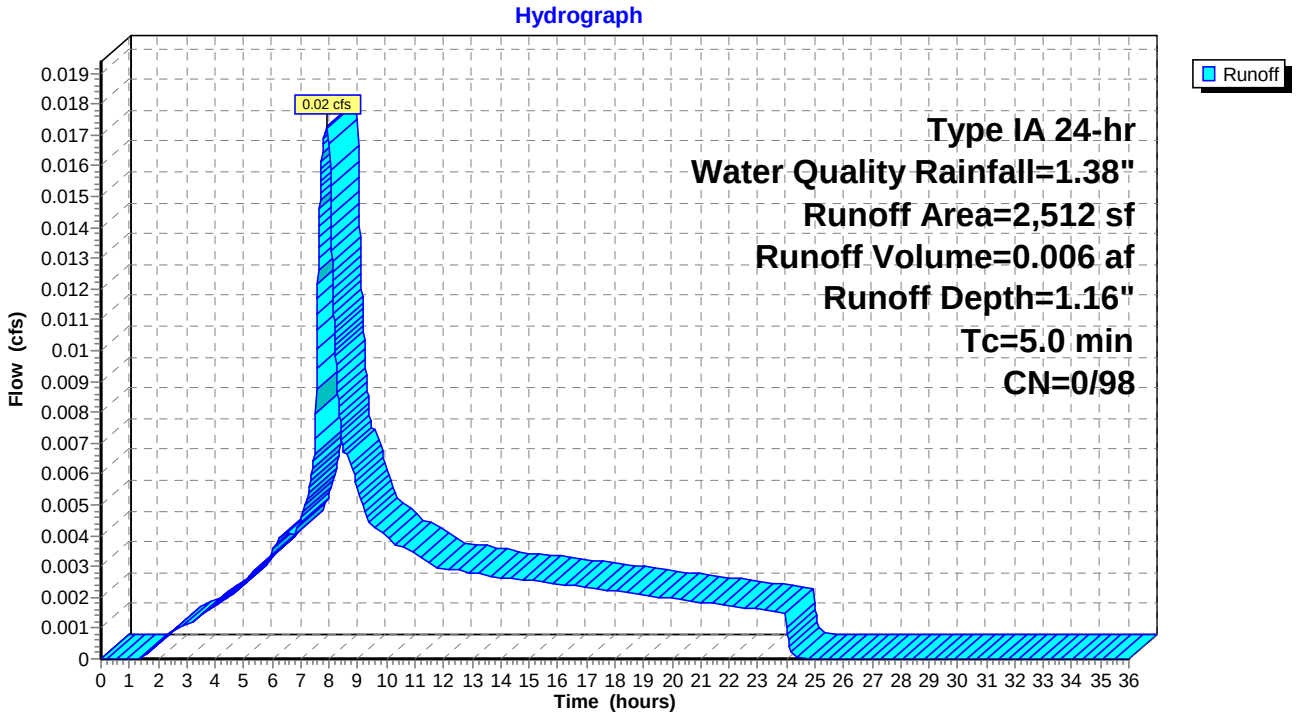
Runoff = 0.02 cfs @ 7.89 hrs, Volume= 0.006 af, Depth= 1.16"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type IA 24-hr Water Quality Rainfall=1.38"

Area (sf)	CN	Description
2,512	98	Roofs, HSG C
2,512	98	100.00% Impervious Area

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

Subcatchment Bldg 0.5CD: Building 33



Summary for Subcatchment Bldg 18: Building 34

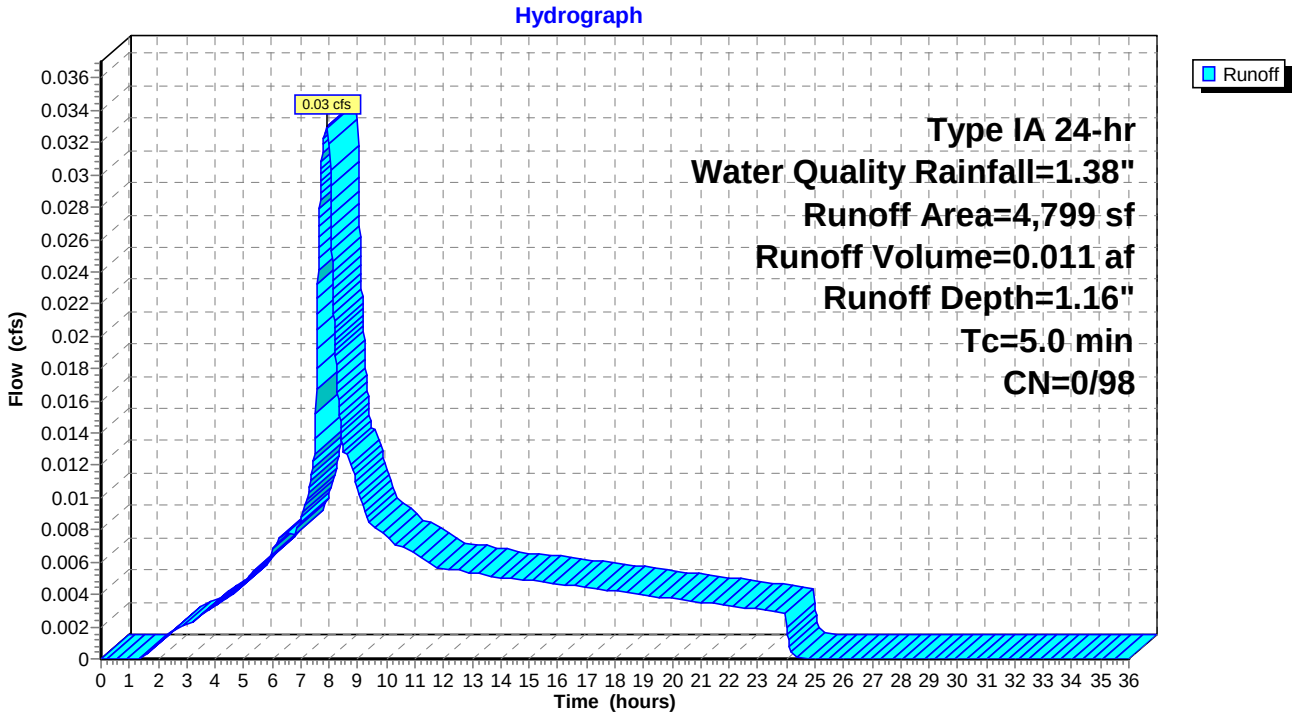
Runoff = 0.03 cfs @ 7.89 hrs, Volume= 0.011 af, Depth= 1.16"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type IA 24-hr Water Quality Rainfall=1.38"

Area (sf)	CN	Description
4,799	98	Roofs, HSG C
4,799	98	100.00% Impervious Area

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

Subcatchment Bldg 18: Building 34



Summary for Subcatchment Bldg 3: Building 35

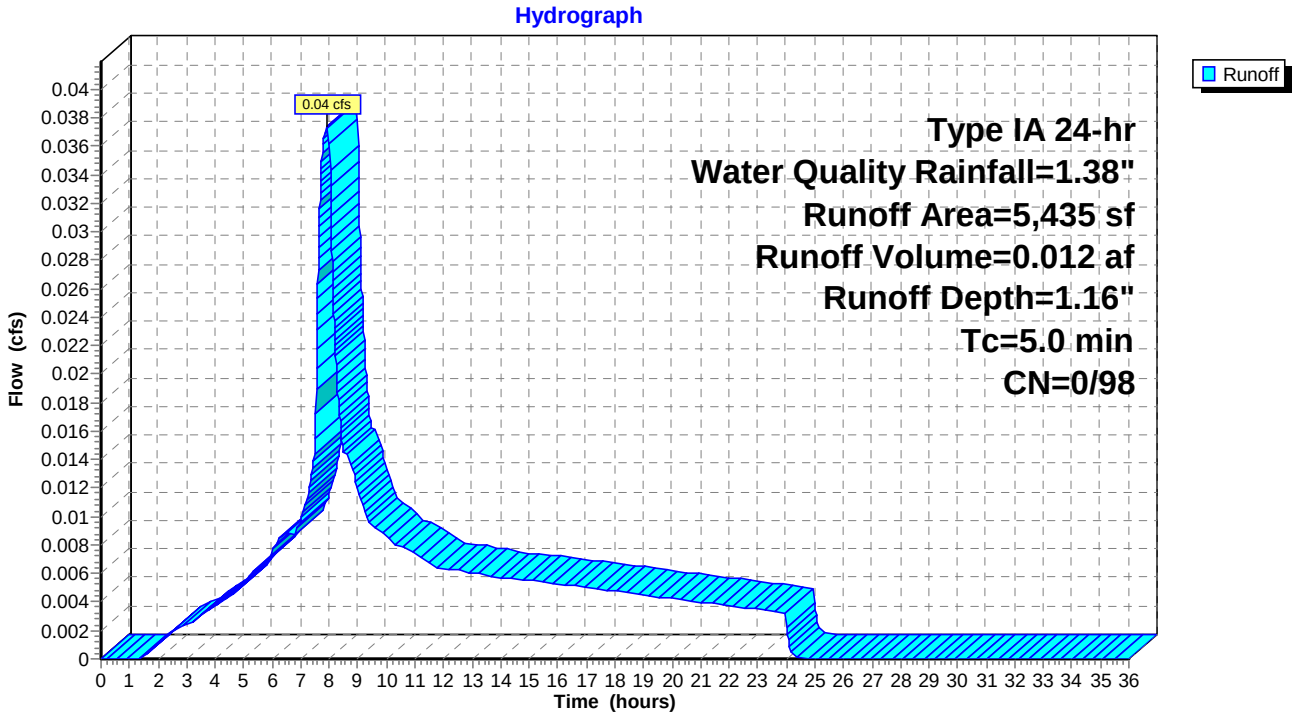
Runoff = 0.04 cfs @ 7.89 hrs, Volume= 0.012 af, Depth= 1.16"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type IA 24-hr Water Quality Rainfall=1.38"

Area (sf)	CN	Description
5,435	98	Roofs, HSG C
5,435	98	100.00% Impervious Area

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

Subcatchment Bldg 3: Building 35



Summary for Pond 1 - GM: PB 1 - GM

Inflow Area = 1.735 ac, 61.67% Impervious, Inflow Depth = 0.76" for Water Quality event
Inflow = 0.32 cfs @ 7.89 hrs, Volume= 0.110 af
Outflow = 0.06 cfs @ 5.80 hrs, Volume= 0.110 af, Atten= 82%, Lag= 0.0 min
Primary = 0.06 cfs @ 5.80 hrs, Volume= 0.110 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 4.88' @ 12.68 hrs Surf.Area= 1,229 sf Storage= 1,077 cf

Plug-Flow detention time= 205.5 min calculated for 0.110 af (100% of inflow)
Center-of-Mass det. time= 205.5 min (920.9 - 715.5)

Volume	Invert	Avail.Storage	Storage Description
#1	4.00'	2,458 cf	**Planter Box Storage (Prismatic)** Listed below (Recalc)

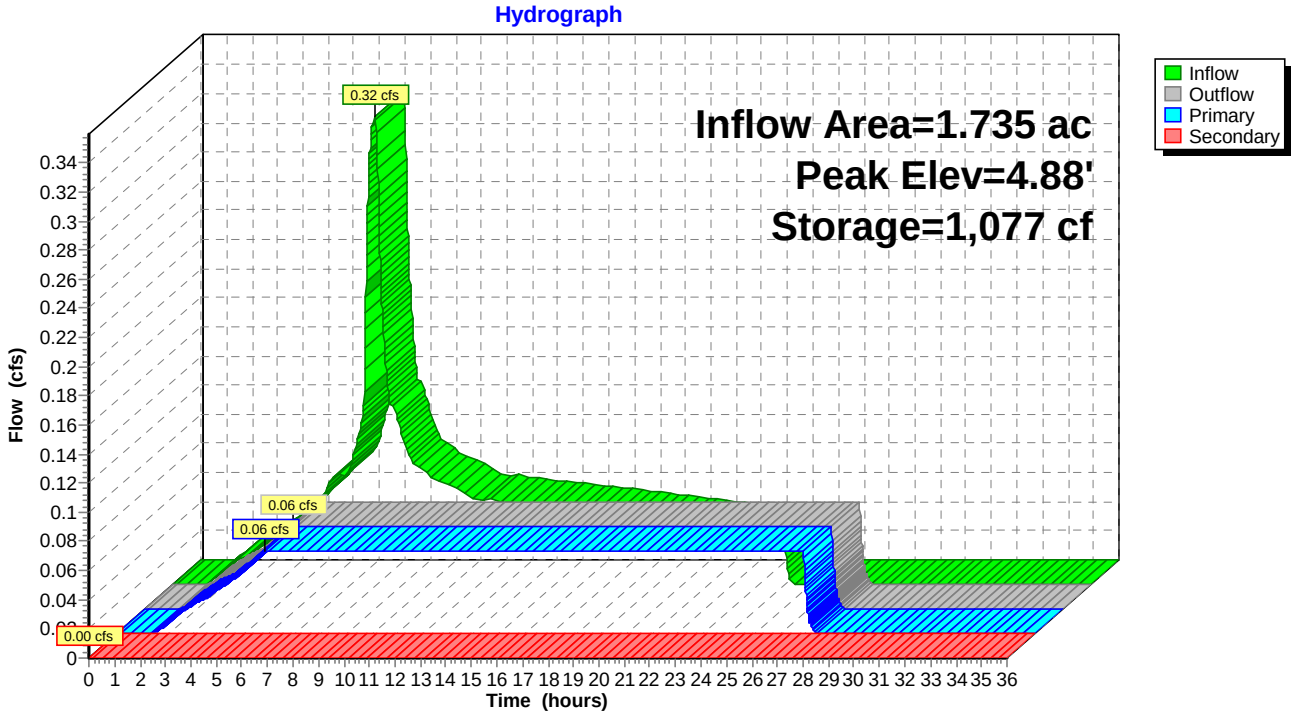
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
4.00	1,229	0	0
6.00	1,229	2,458	2,458

Device	Routing	Invert	Outlet Devices
#1	Primary	4.00'	**2.000 in/hr Flow through Growing Media over Surface area**
#2	Secondary	5.50'	**12.0" Horiz. Rock Box** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.06 cfs @ 5.80 hrs HW=4.02' (Free Discharge)
↑—**1=Flow through Growing Media** (Exfiltration Controls 0.06 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=4.00' (Free Discharge)
↑—**2=Rock Box** (Controls 0.00 cfs)

Pond 1 - GM: PB 1 - GM



Summary for Pond 1 - DR: PB 1 - DR

Inflow Area = 1.735 ac, 61.67% Impervious, Inflow Depth = 0.76" for Water Quality event
Inflow = 0.06 cfs @ 5.80 hrs, Volume= 0.110 af
Outflow = 0.06 cfs @ 18.81 hrs, Volume= 0.093 af, Atten= 0%, Lag= 780.6 min
Discarded = 0.02 cfs @ 3.29 hrs, Volume= 0.055 af
Primary = 0.04 cfs @ 18.81 hrs, Volume= 0.038 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 3.09' @ 18.81 hrs Surf.Area= 1,229 sf Storage= 1,367 cf

Plug-Flow detention time= 378.1 min calculated for 0.093 af (85% of inflow)
Center-of-Mass det. time= 273.2 min (1,194.1 - 920.9)

Volume	Invert	Avail.Storage	Storage Description
#1	0.00'	1,770 cf	**Drain Rock Storage (Prismatic)** Listed below (Recalc) 4,916 cf Overall x 36.0% Voids

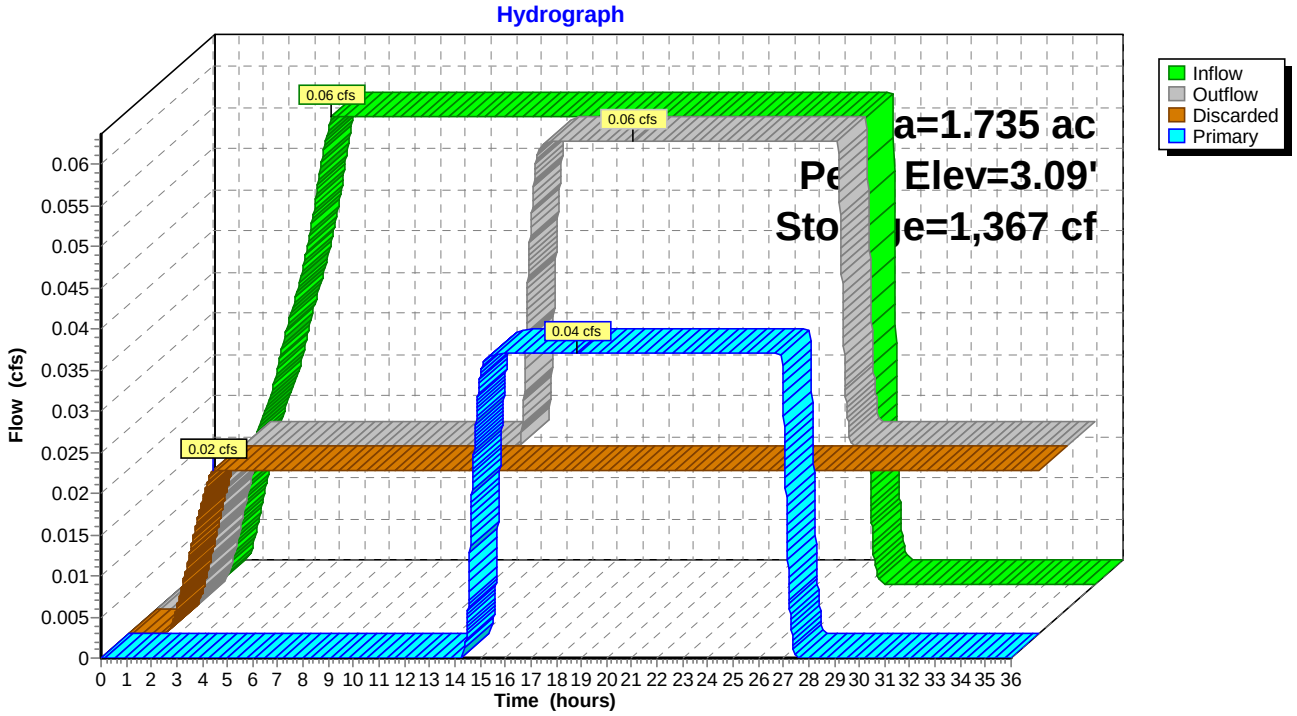
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
0.00	1,229	0	0
4.00	1,229	4,916	4,916

Device	Routing	Invert	Outlet Devices
#1	Discarded	0.00'	**0.700 in/hr Native Infiltration over Surface area**
#2	Primary	3.00'	**12.0" Vert. Underdrain** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.02 cfs @ 3.29 hrs HW=0.04' (Free Discharge)
↑—**1=Native Infiltration** (Exfiltration Controls 0.02 cfs)

Primary OutFlow Max=0.04 cfs @ 18.81 hrs HW=3.09' (Free Discharge)
↑—**2=Underdrain** (Orifice Controls 0.04 cfs @ 1.02 fps)

Pond 1 - DR: PB 1 - DR



Summary for Pond 1P: Underground Storage Pipe

Inflow Area = 1.735 ac, 61.67% Impervious, Inflow Depth = 0.26" for Water Quality event
Inflow = 0.04 cfs @ 18.81 hrs, Volume= 0.038 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 1.81' @ 27.46 hrs Surf.Area= 0.027 ac Storage= 0.038 af

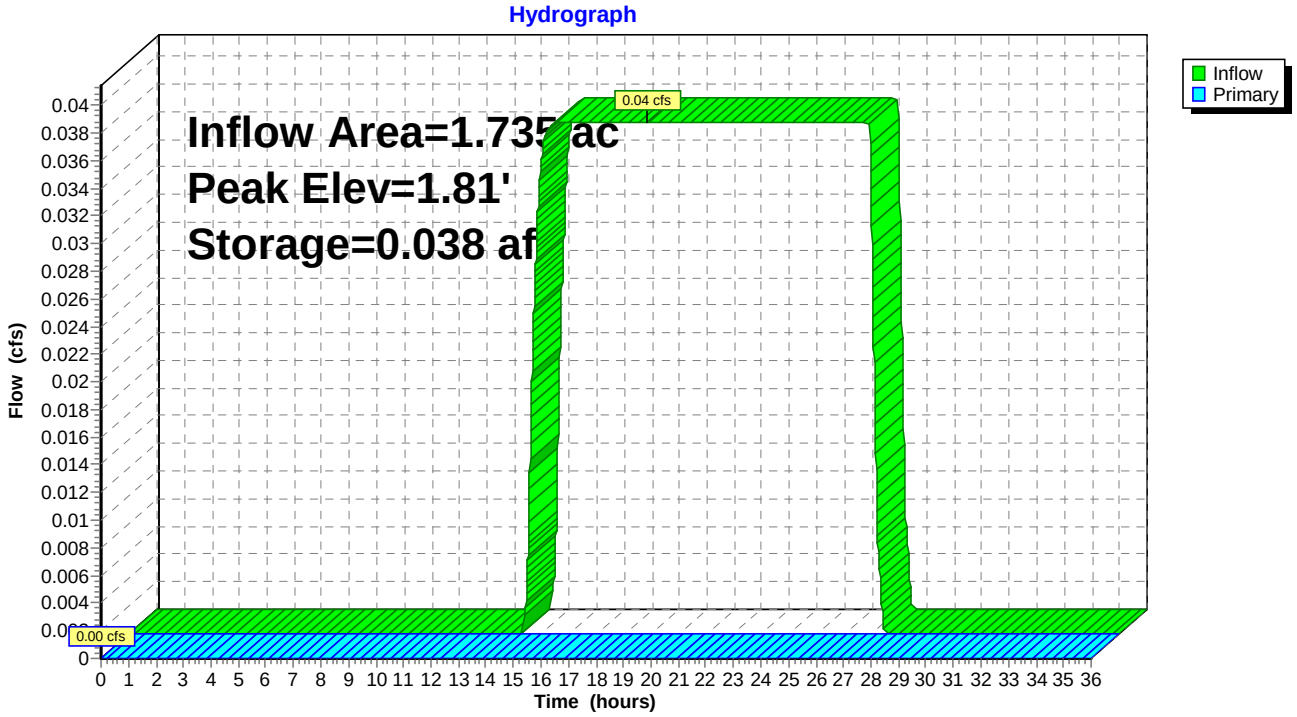
Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= (not calculated: no outflow)

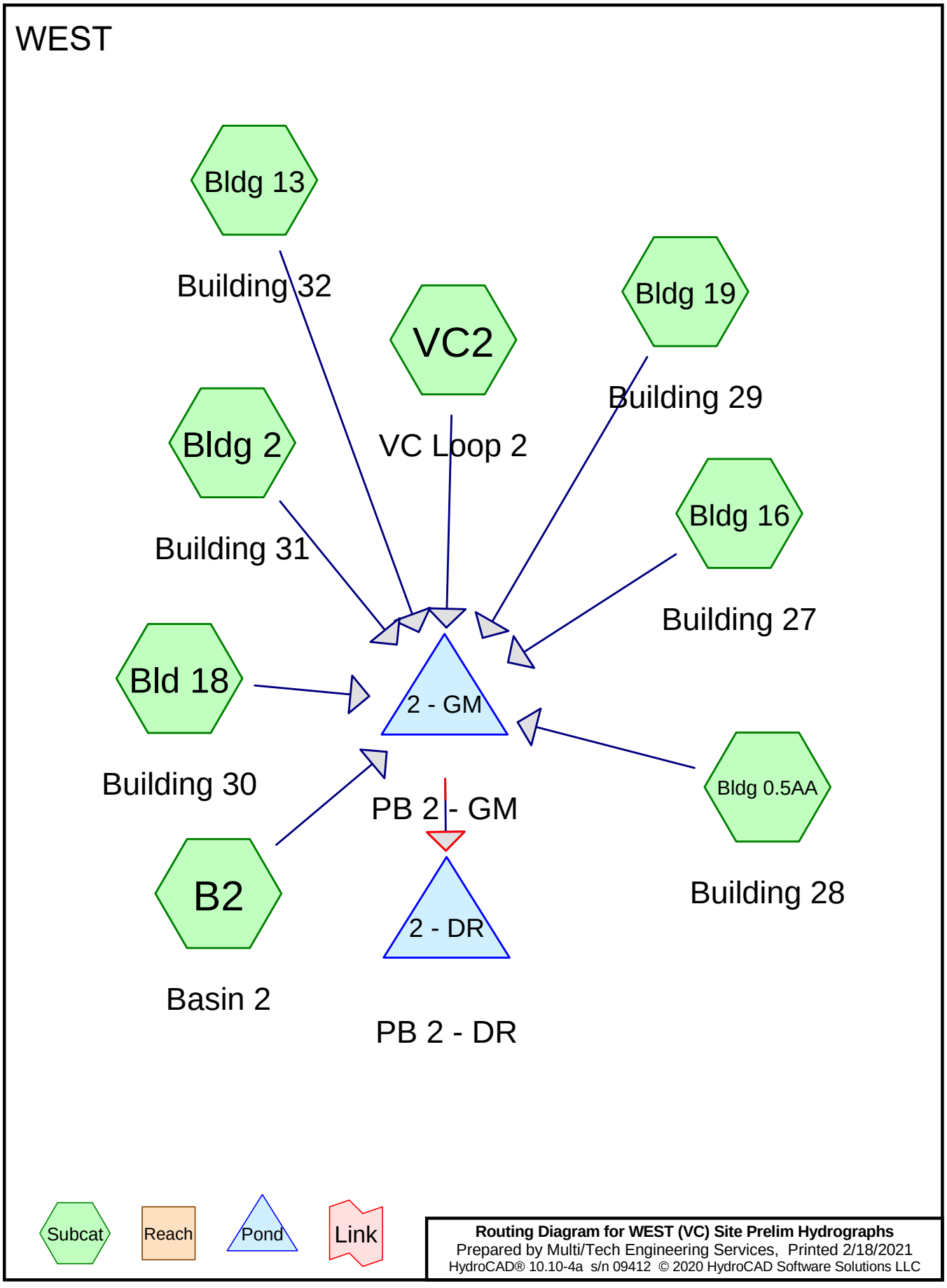
Volume	Invert	Avail.Storage	Storage Description
#1	0.00'	0.087 af	**48.0" Round Pipe Storage** L= 300.0'

Device	Routing	Invert	Outlet Devices
#1	Primary	2.50'	**4.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=0.00' (Free Discharge)
1=Orifice/Grate (Controls 0.00 cfs)

Pond 1P: Underground Storage Pipe




WEST
Bldg 13
Building 32
VC2
VC Loop 2
Bldg 19
Building 29
Bldg 2
Building 31
Bldg 16
Building 27
Bld 18
Building 30
2 - GM
Bldg 0.5AA
Building 28
PB 2 - GM
B2
Basin 2
2 - DR
PB 2 - DR
Subcat
Reach
Pond
Link
Routing Diagram for WEST (VC) Site Prelim Hydrographs
Prepared by Multi/Tech Engineering Services, Printed 2/18/2021
HydroCAD® 10.10-4a s/n 09412 © 2020 HydroCAD Software Solutions LLC

Summary for Subcatchment B2: Basin 2

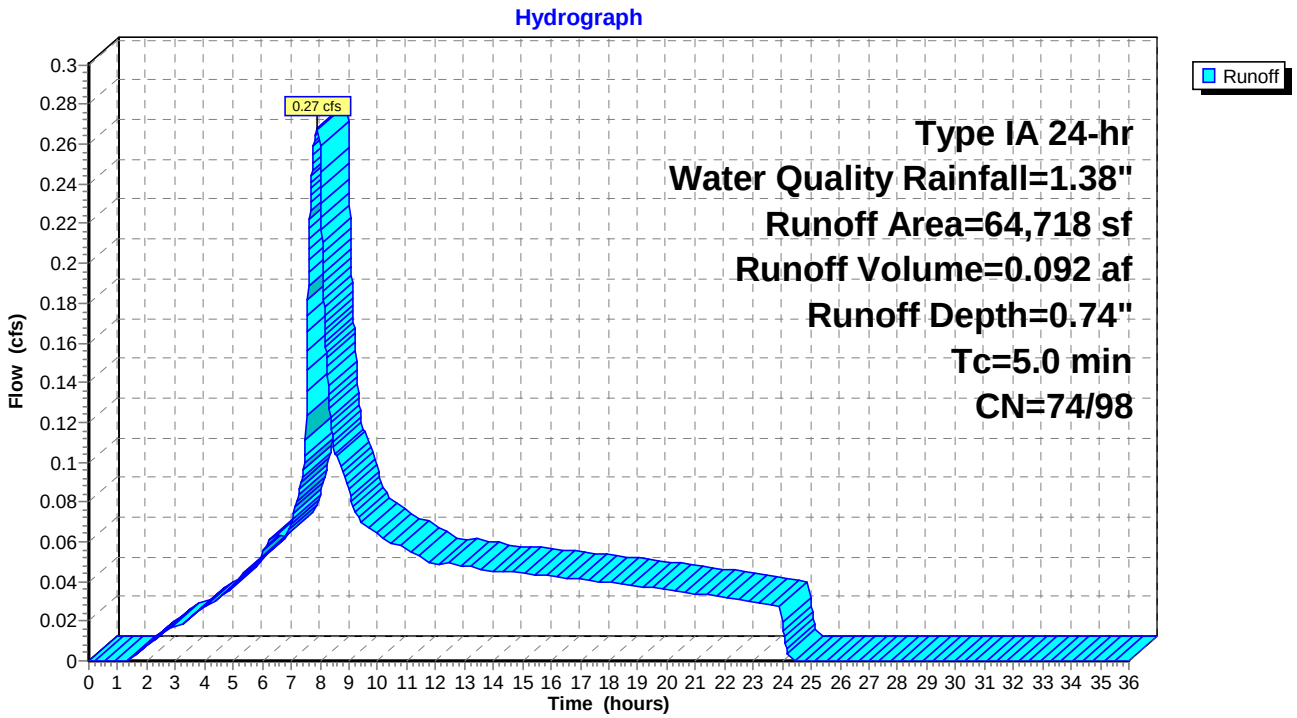
Runoff = 0.27 cfs @ 7.89 hrs, Volume= 0.092 af, Depth= 0.74"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type IA 24-hr Water Quality Rainfall=1.38"

	Area (sf)	CN	Description
	21,385	74	>75% Grass cover, Good, HSG C
	38,965	98	Paved parking, HSG C
*	4,368	72	Planter Box
	64,718	88	Weighted Average
	25,753	74	39.79% Pervious Area
	38,965	98	60.21% Impervious Area

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

Subcatchment B2: Basin 2



Summary for Subcatchment Bld 18: Building 30

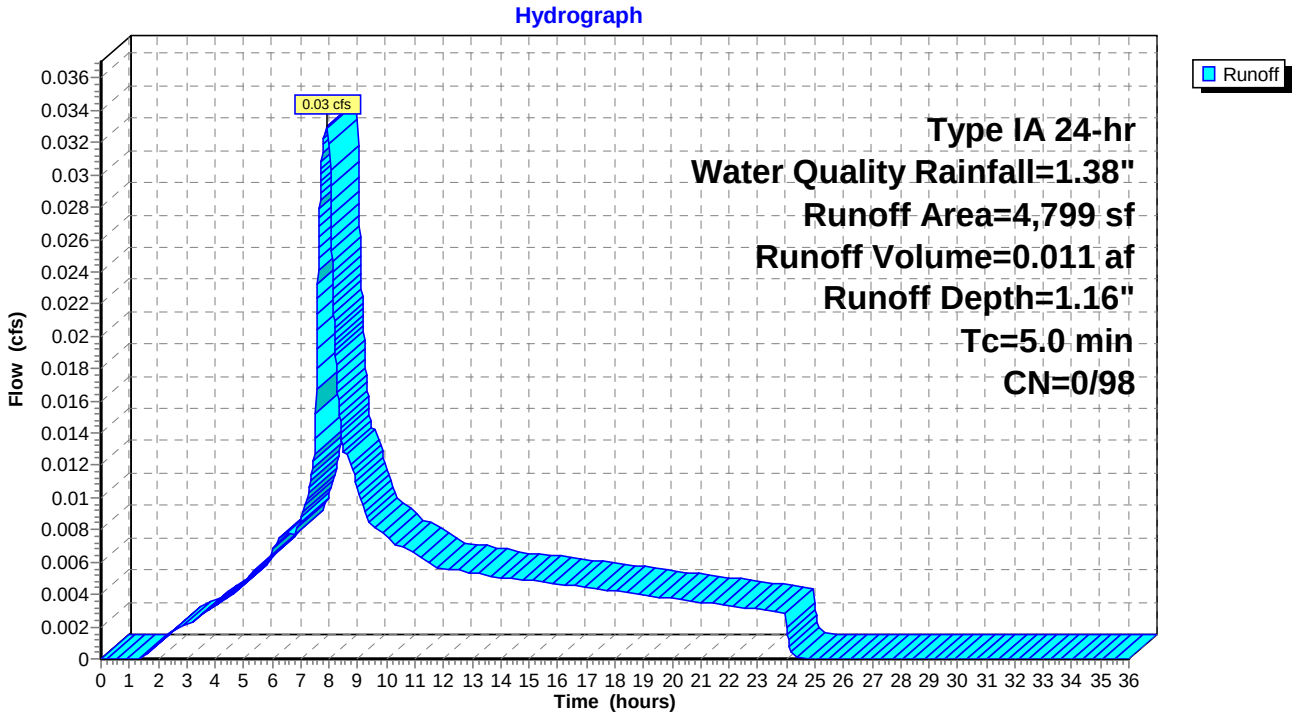
Runoff = 0.03 cfs @ 7.89 hrs, Volume= 0.011 af, Depth= 1.16"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type IA 24-hr Water Quality Rainfall=1.38"

Area (sf)	CN	Description
4,799	98	Roofs, HSG C
4,799	98	100.00% Impervious Area

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

Subcatchment Bld 18: Building 30



Summary for Subcatchment Bldg 0.5AA: Building 28

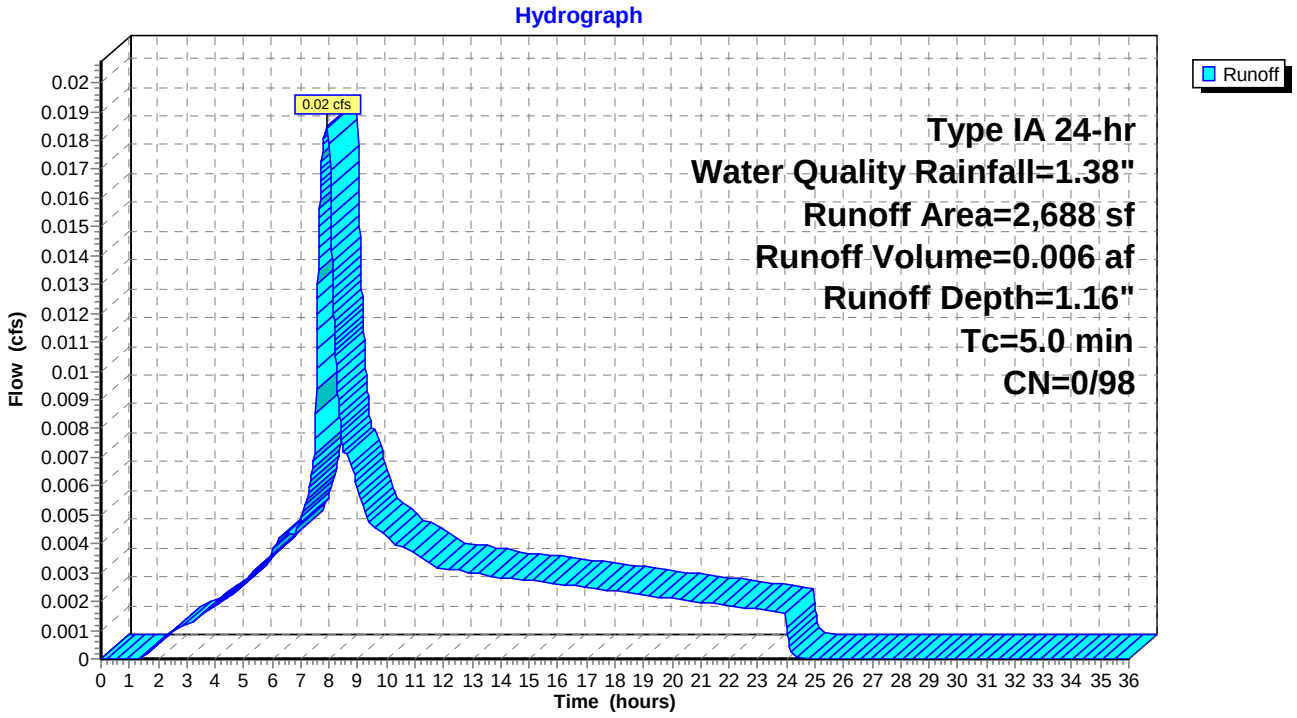
Runoff = 0.02 cfs @ 7.89 hrs, Volume= 0.006 af, Depth= 1.16"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type IA 24-hr Water Quality Rainfall=1.38"

Area (sf)	CN	Description
2,688	98	Roofs, HSG C
2,688	98	100.00% Impervious Area

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

Subcatchment Bldg 0.5AA: Building 28



Summary for Subcatchment Bldg 13: Building 32

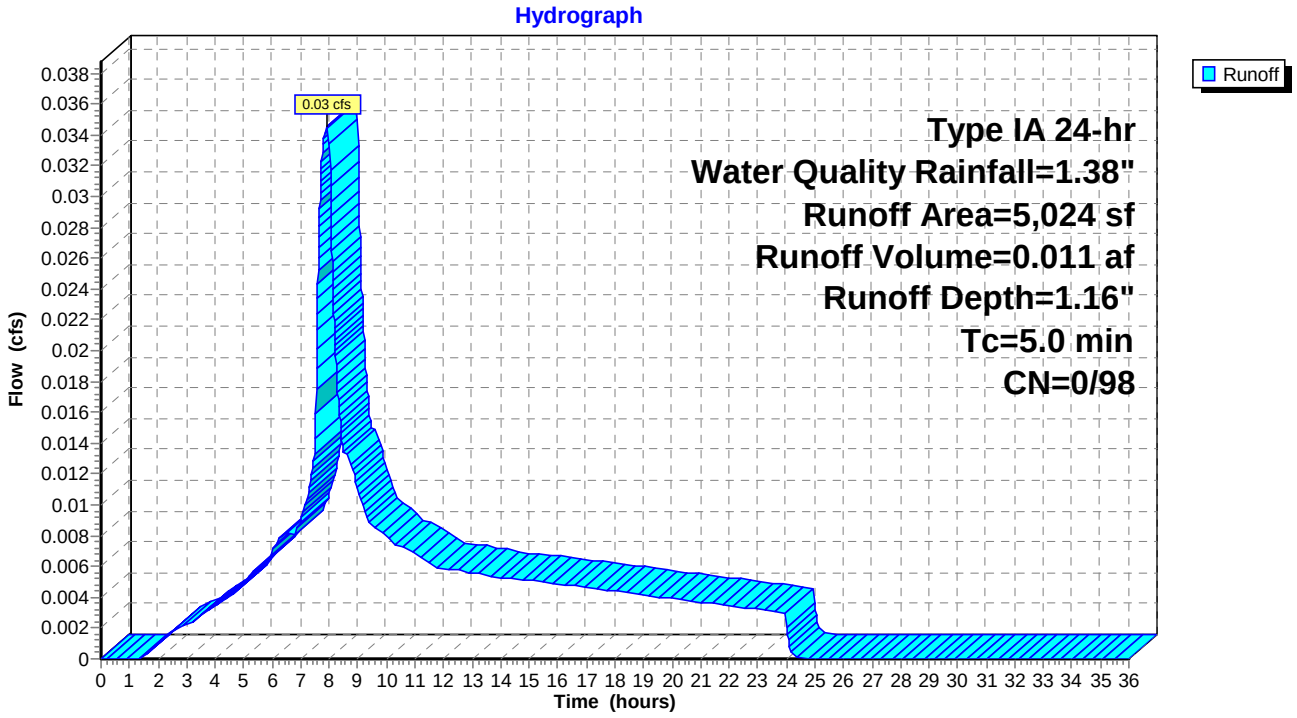
Runoff = 0.03 cfs @ 7.89 hrs, Volume= 0.011 af, Depth= 1.16"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type IA 24-hr Water Quality Rainfall=1.38"

Area (sf)	CN	Description
5,024	98	Roofs, HSG C
5,024	98	100.00% Impervious Area

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

Subcatchment Bldg 13: Building 32



Summary for Subcatchment Bldg 16: Building 27

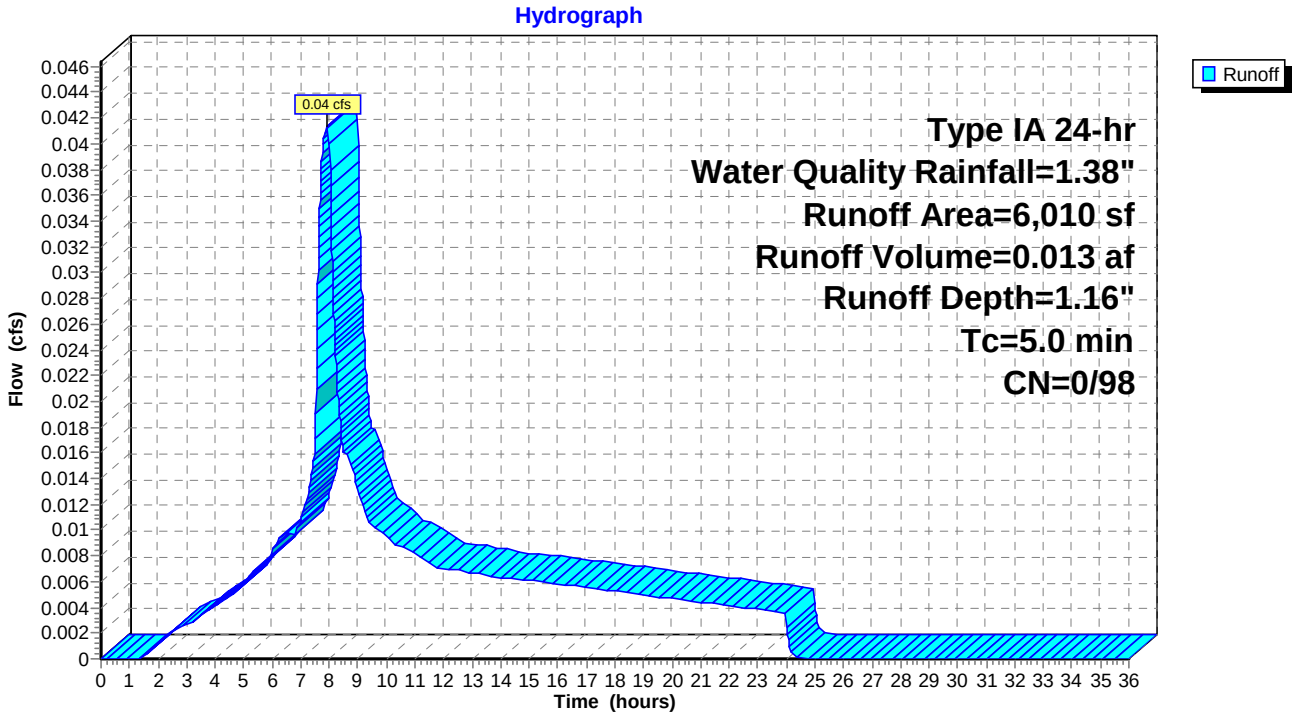
Runoff = 0.04 cfs @ 7.89 hrs, Volume= 0.013 af, Depth= 1.16"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type IA 24-hr Water Quality Rainfall=1.38"

Area (sf)	CN	Description
6,010	98	Roofs, HSG C
6,010	98	100.00% Impervious Area

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

Subcatchment Bldg 16: Building 27



Summary for Subcatchment Bldg 19: Building 29

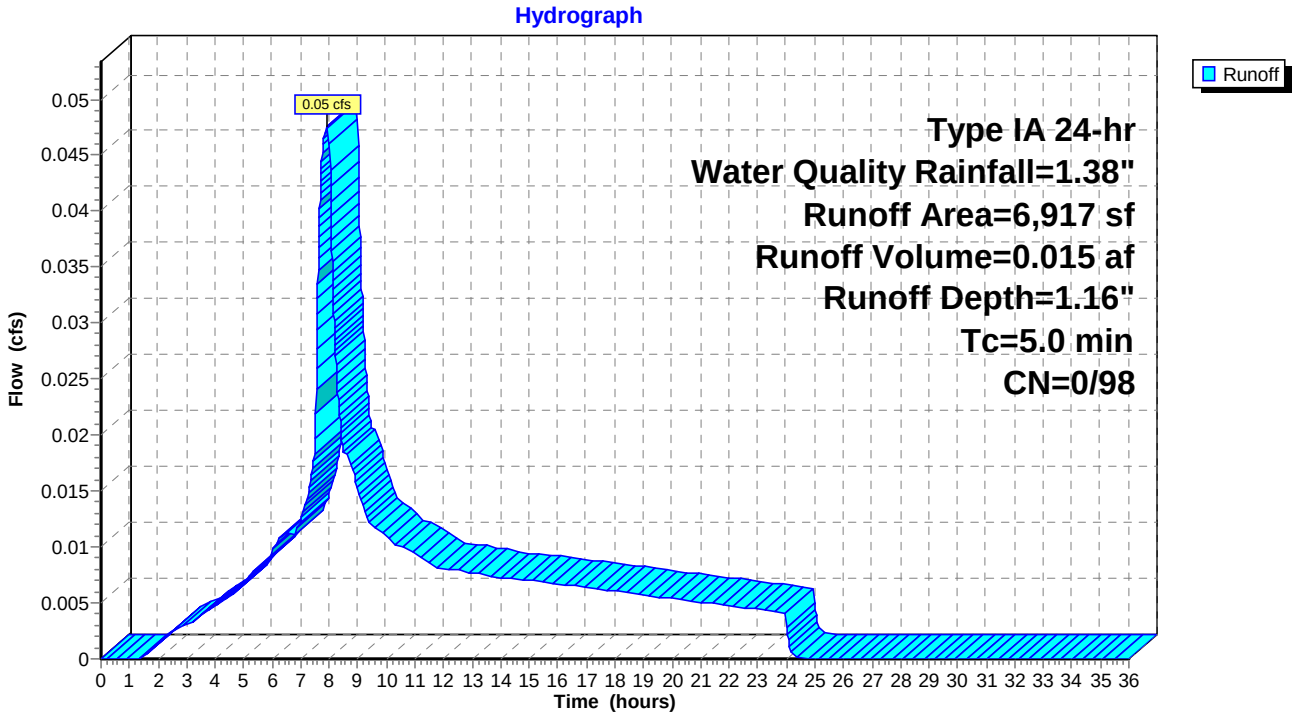
Runoff = 0.05 cfs @ 7.89 hrs, Volume= 0.015 af, Depth= 1.16"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type IA 24-hr Water Quality Rainfall=1.38"

Area (sf)	CN	Description
6,917	98	Roofs, HSG C
6,917	98	100.00% Impervious Area

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

Subcatchment Bldg 19: Building 29



Summary for Subcatchment Bldg 2: Building 31

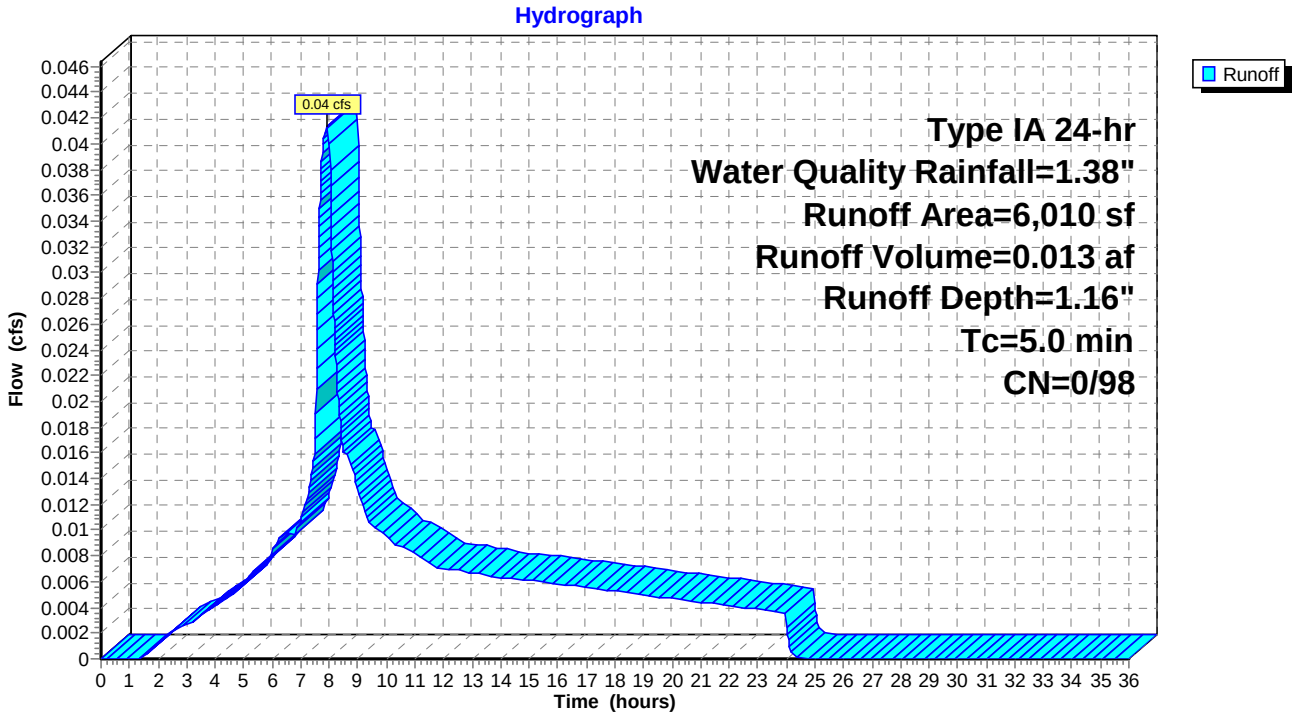
Runoff = 0.04 cfs @ 7.89 hrs, Volume= 0.013 af, Depth= 1.16"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type IA 24-hr Water Quality Rainfall=1.38"

Area (sf)	CN	Description
6,010	98	Roofs, HSG C
6,010	98	100.00% Impervious Area

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

Subcatchment Bldg 2: Building 31



Summary for Subcatchment VC2: VC Loop 2

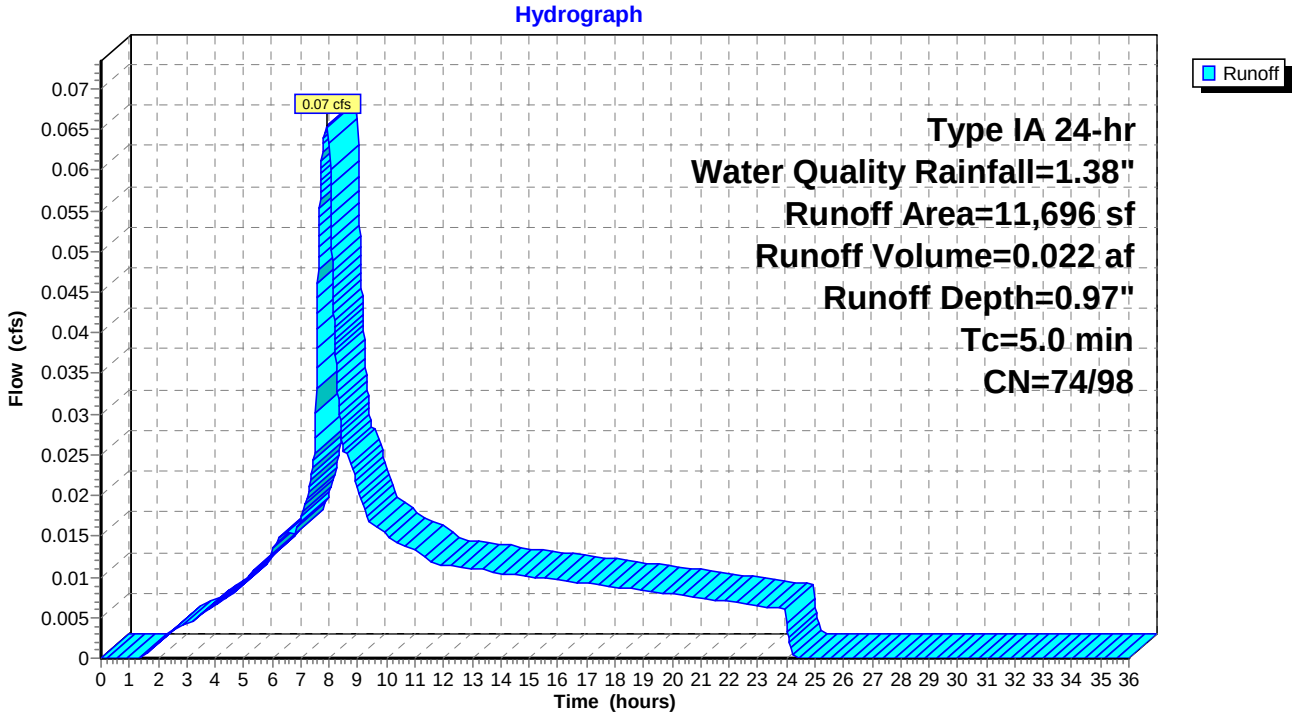
Runoff = 0.07 cfs @ 7.89 hrs, Volume= 0.022 af, Depth= 0.97"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type IA 24-hr Water Quality Rainfall=1.38"

Area (sf)	CN	Description
2,181	74	>75% Grass cover, Good, HSG C
9,515	98	Paved parking, HSG C
11,696	94	Weighted Average
2,181	74	18.65% Pervious Area
9,515	98	81.35% Impervious Area

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

Subcatchment VC2: VC Loop 2



Summary for Pond 2 - GM: PB 2 - GM

Inflow Area = 2.476 ac, 74.10% Impervious, Inflow Depth = 0.89" for Water Quality event
Inflow = 0.55 cfs @ 7.89 hrs, Volume= 0.184 af
Outflow = 0.21 cfs @ 7.54 hrs, Volume= 0.184 af, Atten= 62%, Lag= 0.0 min
Primary = 0.21 cfs @ 7.54 hrs, Volume= 0.184 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 4.17' @ 8.67 hrs Surf.Area= 4,519 sf Storage= 764 cf

Plug-Flow detention time= 18.9 min calculated for 0.183 af (100% of inflow)
Center-of-Mass det. time= 18.9 min (726.1 - 707.2)

Volume	Invert	Avail.Storage	Storage Description
#1	4.00'	9,038 cf	**Planter Box Storage (Prismatic)** Listed below (Recalc)

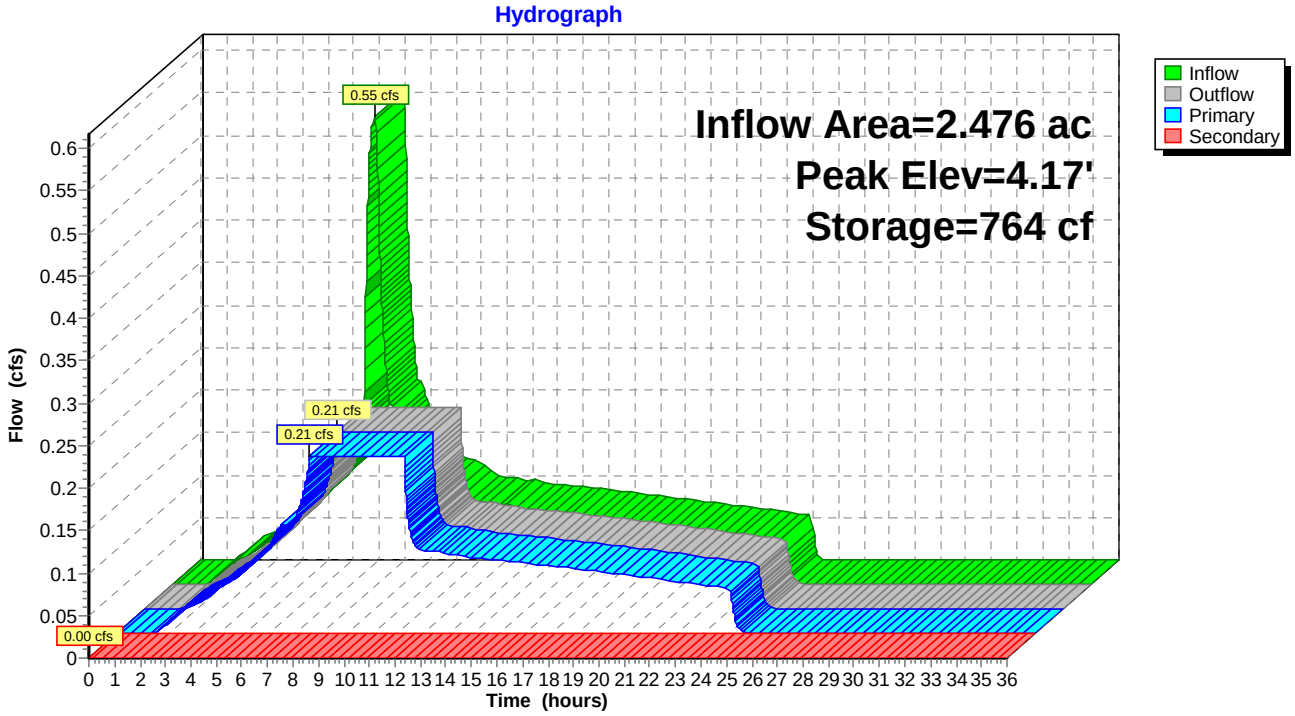
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
4.00	4,519	0	0
5.00	4,519	4,519	4,519
6.00	4,519	4,519	9,038

Device	Routing	Invert	Outlet Devices
#1	Primary	4.00'	**2.000 in/hr Flow through Growing Media over Surface area**
#2	Secondary	5.50'	**8.0" Horiz. Rock Box** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.21 cfs @ 7.54 hrs HW=4.02' (Free Discharge)
1=Flow through Growing Media (Exfiltration Controls 0.21 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=4.00' (Free Discharge)
2=Rock Box (Controls 0.00 cfs)

Pond 2 - GM: PB 2 - GM



Summary for Pond 2 - DR: PB 2 - DR

Inflow Area = 2.476 ac, 74.10% Impervious, Inflow Depth = 0.89" for Water Quality event
Inflow = 0.21 cfs @ 7.54 hrs, Volume= 0.184 af
Outflow = 0.07 cfs @ 5.18 hrs, Volume= 0.184 af, Atten= 65%, Lag= 0.0 min
Discarded = 0.07 cfs @ 5.18 hrs, Volume= 0.184 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 1.67' @ 18.78 hrs Surf.Area= 4,519 sf Storage= 2,718 cf

Plug-Flow detention time= 387.9 min calculated for 0.183 af (100% of inflow)
Center-of-Mass det. time= 388.0 min (1,114.1 - 726.1)

Volume	Invert	Avail.Storage	Storage Description
#1	0.00'	6,507 cf	**Drain Rock Storage (Prismatic)** Listed below (Recalc) 18,076 cf Overall x 36.0% Voids

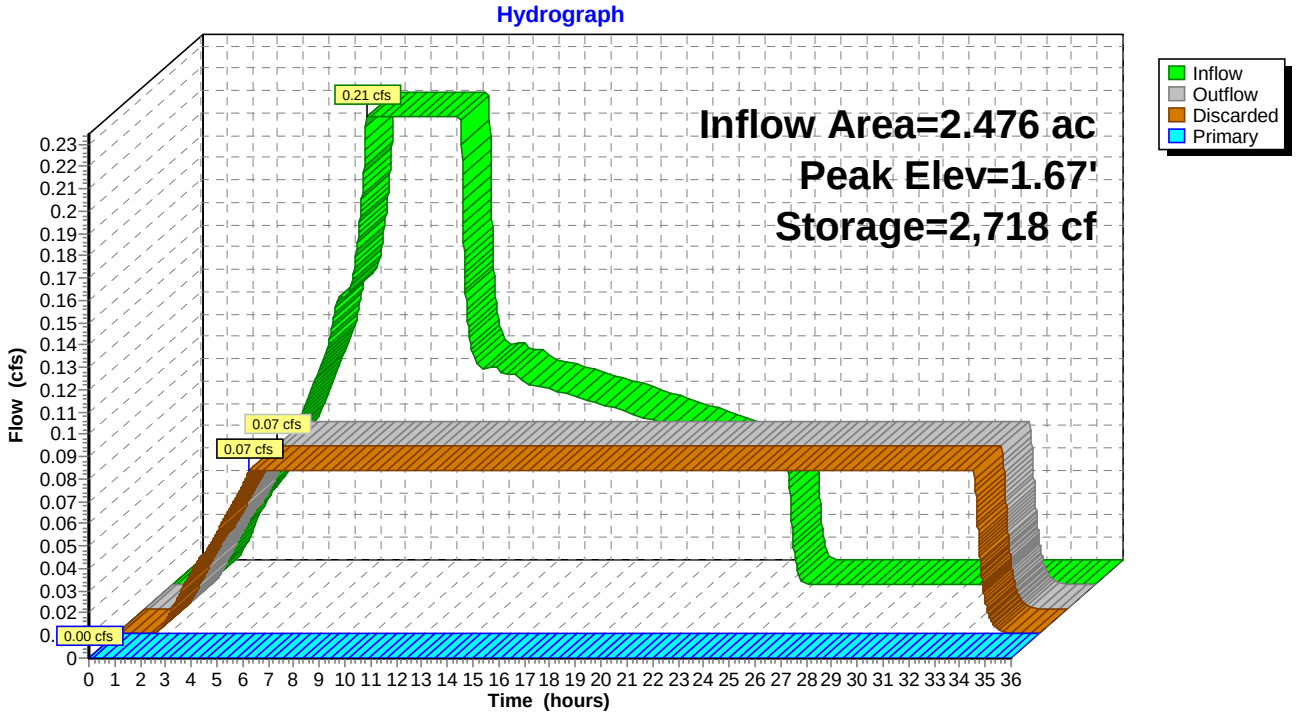
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
0.00	4,519	0	0
4.00	4,519	18,076	18,076

Device	Routing	Invert	Outlet Devices
#1	Discarded	0.00'	**0.700 in/hr Native Infiltration over Surface area**
#2	Primary	3.33'	**8.0" Vert. Underdrain** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.07 cfs @ 5.18 hrs HW=0.04' (Free Discharge)
↑—**1=Native Infiltration** (Exfiltration Controls 0.07 cfs)

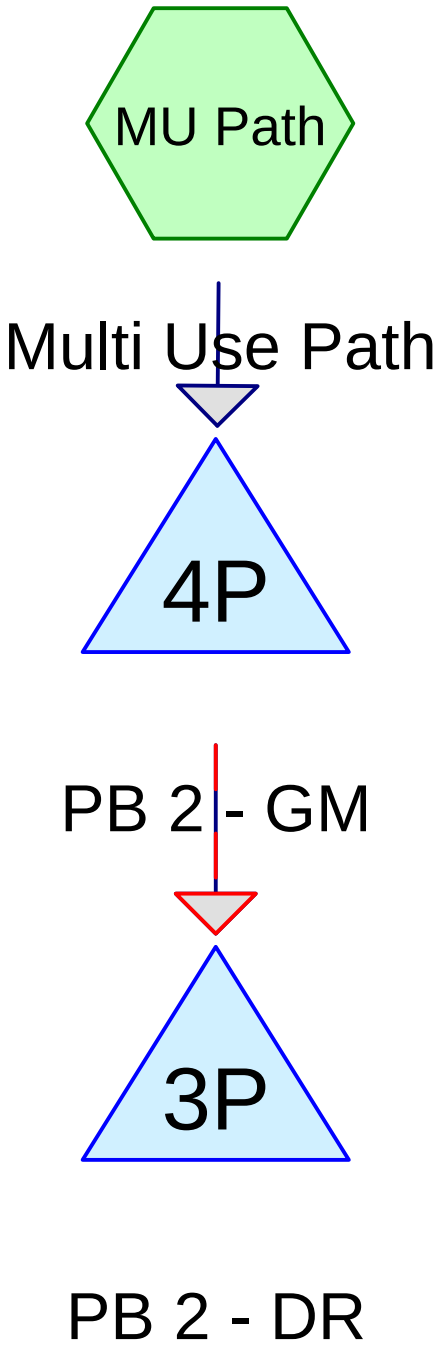
Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=0.00' (Free Discharge)
↑—**2=Underdrain** (Controls 0.00 cfs)

Pond 2 - DR: PB 2 - DR



APPENDIX C: ½ - 2 YEAR HYDROGRAPHS

EAST



Subcat Reach Pond Link

Routing Diagram for EAST (Reed Rd) Site Prelim Hydrograph
Prepared by Multi/Tech Engineering Services, Printed 2/17/2021

Summary for Subcatchment MU Path: Multi Use Path

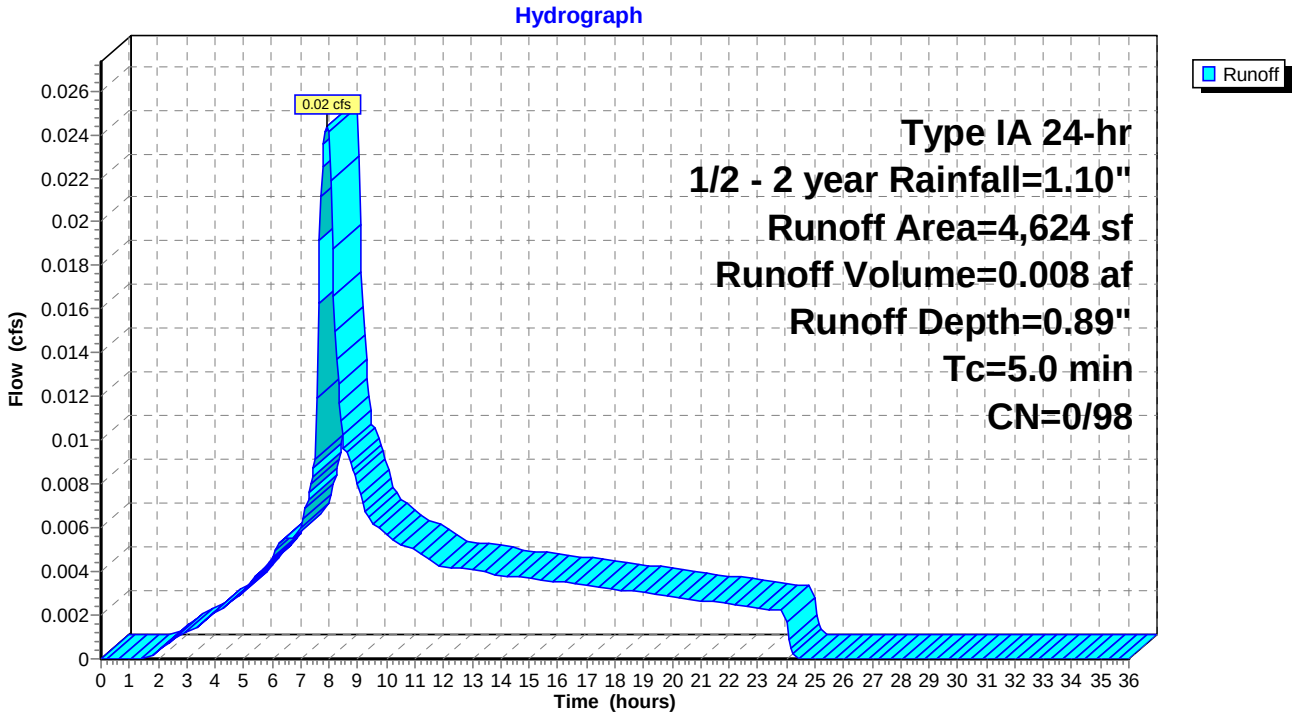
Runoff = 0.02 cfs @ 7.92 hrs, Volume= 0.008 af, Depth= 0.89"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type IA 24-hr 1/2 - 2 year Rainfall=1.10"

Area (sf)	CN	Description
4,624	98	Unconnected pavement, HSG C
4,624	98	100.00% Impervious Area

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

Subcatchment MU Path: Multi Use Path



Summary for Pond 4P: PB 2 - GM

Inflow Area = 0.106 ac,100.00% Impervious, Inflow Depth = 0.89" for 1/2 - 2 year event
Inflow = 0.02 cfs @ 7.92 hrs, Volume= 0.008 af
Outflow = 0.02 cfs @ 7.92 hrs, Volume= 0.008 af, Atten= 0%, Lag= 0.0 min
Primary = 0.02 cfs @ 7.92 hrs, Volume= 0.008 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 4.00' @ 7.92 hrs Surf.Area= 4,624 sf Storage= 0 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 0.0 min (708.6 - 708.6)

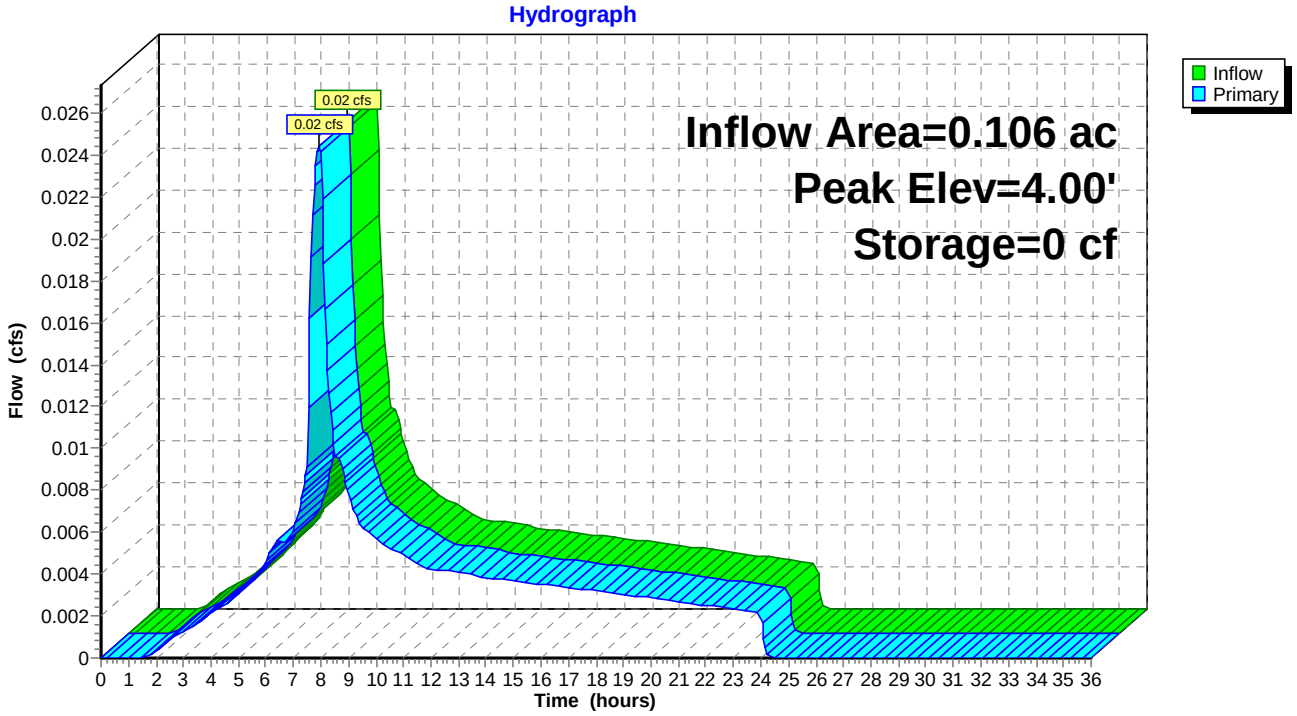
Volume	Invert	Avail.Storage	Storage Description
#1	4.00'	0 cf	**Growing Media (Prismatic)** Listed below (Recalc) 1,526 cf Overall x 0.0% Voids

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
4.00	4,624	0	0
4.33	4,624	1,526	1,526

Device	Routing	Invert	Outlet Devices
#1	Primary	4.00'	**100.000 in/hr Exfiltration over Surface area**

Primary OutFlow Max=10.70 cfs @ 7.92 hrs HW=4.00' (Free Discharge)
1=Exfiltration (Exfiltration Controls 10.70 cfs)

Pond 4P: PB 2 - GM



Summary for Pond 3P: PB 2 - DR

Inflow Area = 0.106 ac,100.00% Impervious, Inflow Depth = 0.89" for 1/2 - 2 year event
Inflow = 0.02 cfs @ 7.92 hrs, Volume= 0.008 af
Outflow = 0.02 cfs @ 8.03 hrs, Volume= 0.008 af, Atten= 6%, Lag= 6.6 min
Discarded = 0.02 cfs @ 8.03 hrs, Volume= 0.008 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 0.01' @ 8.03 hrs Surf.Area= 4,624 sf Storage= 12 cf

Plug-Flow detention time= 8.6 min calculated for 0.008 af (100% of inflow)
Center-of-Mass det. time= 8.6 min (717.3 - 708.6)

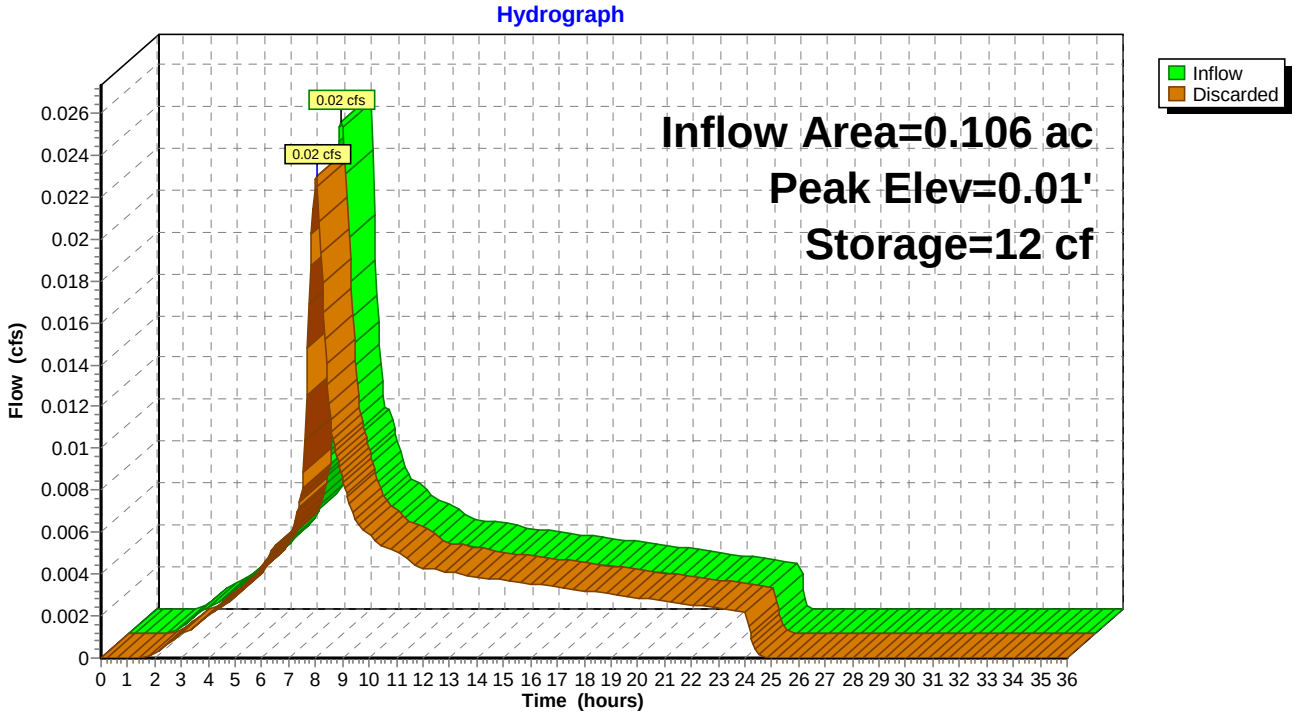
Volume	Invert	Avail.Storage	Storage Description
#1	0.00'	1,665 cf	**Drain Rock (Prismatic)** Listed below (Recalc) 4,624 cf Overall x 36.0% Voids

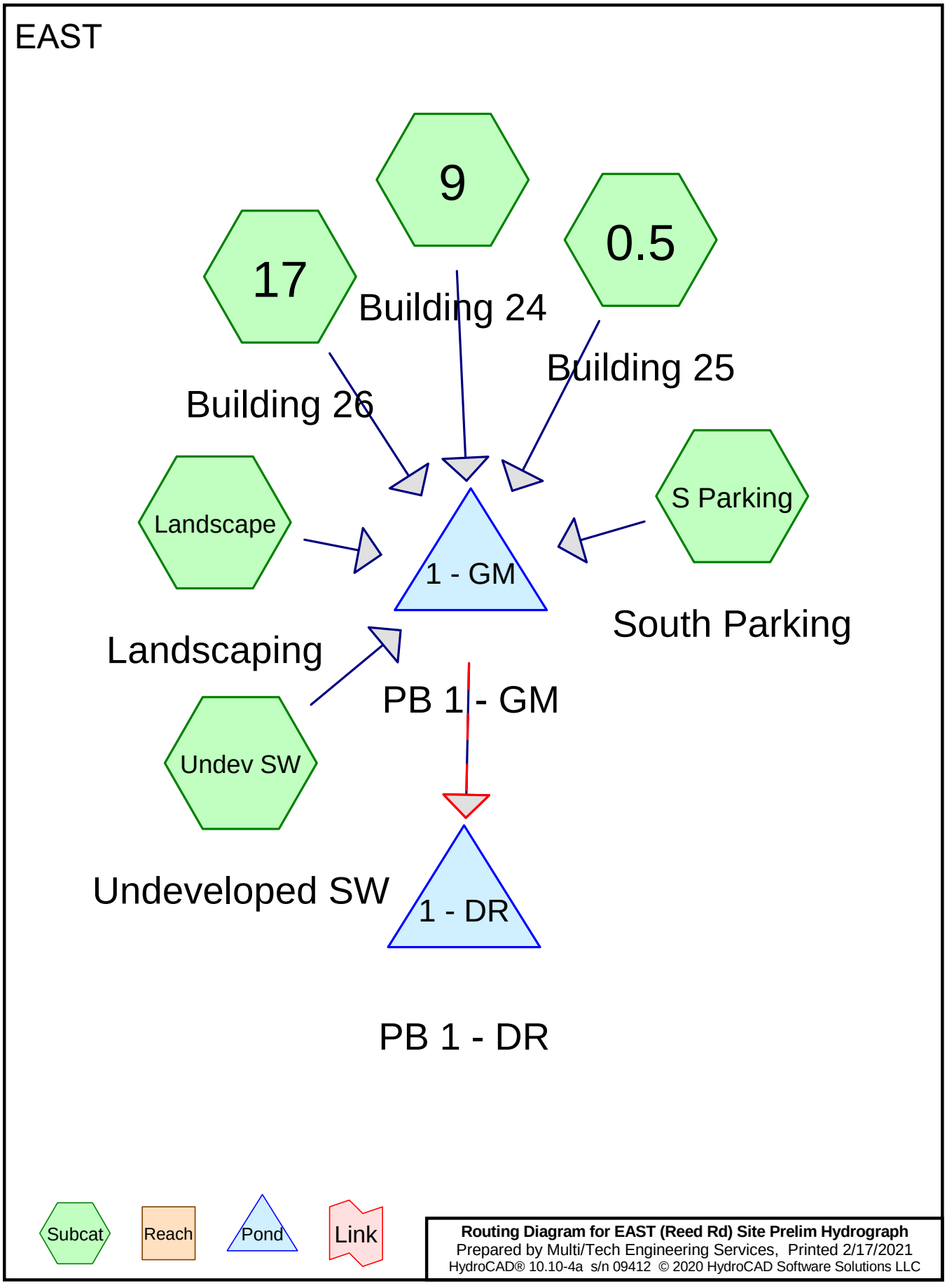
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
0.00	4,624	0	0
1.00	4,624	4,624	4,624

Device	Routing	Invert	Outlet Devices
#1	Discarded	0.00'	**0.300 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.03 cfs @ 8.03 hrs HW=0.01' (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 0.03 cfs)

Pond 3P: PB 2 - DR





Routing Diagram for EAST (Reed Rd) Site Prelim Hydrograph
Prepared by Multi/Tech Engineering Services, Printed 2/17/2021

Summary for Subcatchment 0.5: Building 25

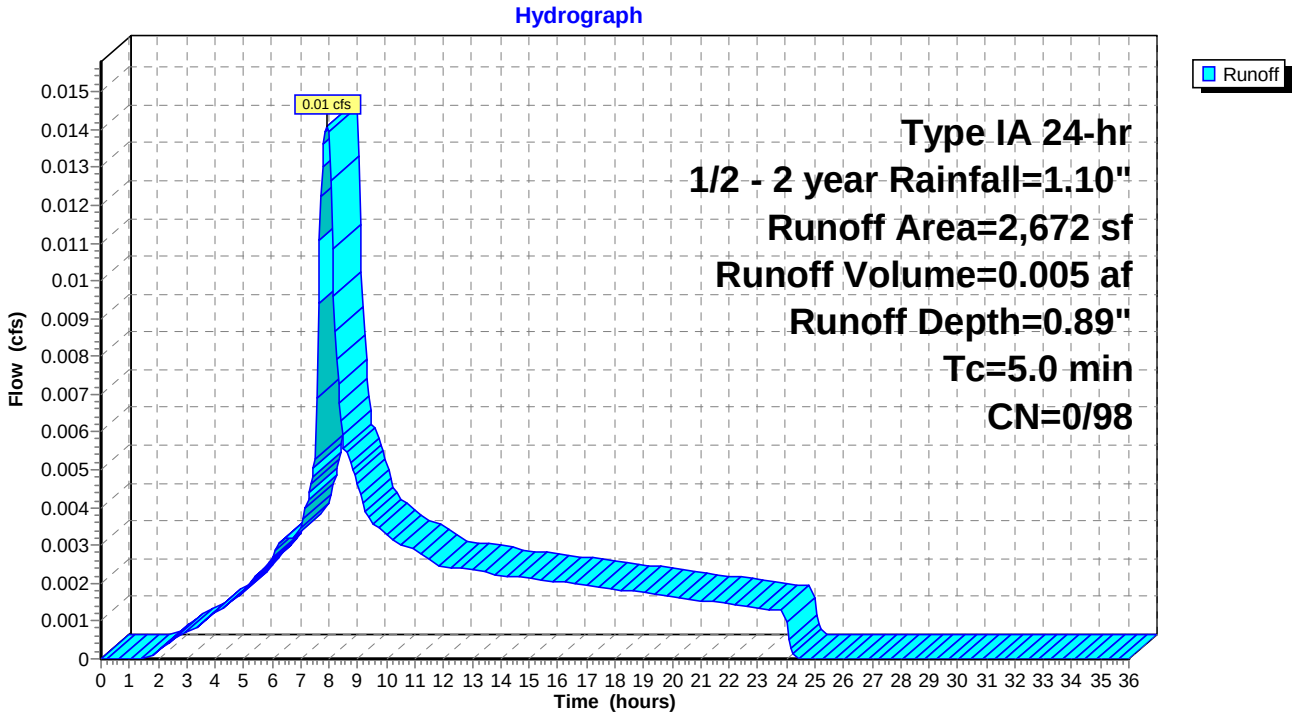
Runoff = 0.01 cfs @ 7.92 hrs, Volume= 0.005 af, Depth= 0.89"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type IA 24-hr 1/2 - 2 year Rainfall=1.10"

Area (sf)	CN	Description
2,672	98	Roofs, HSG C
2,672	98	100.00% Impervious Area

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

Subcatchment 0.5: Building 25



Summary for Subcatchment 9: Building 24

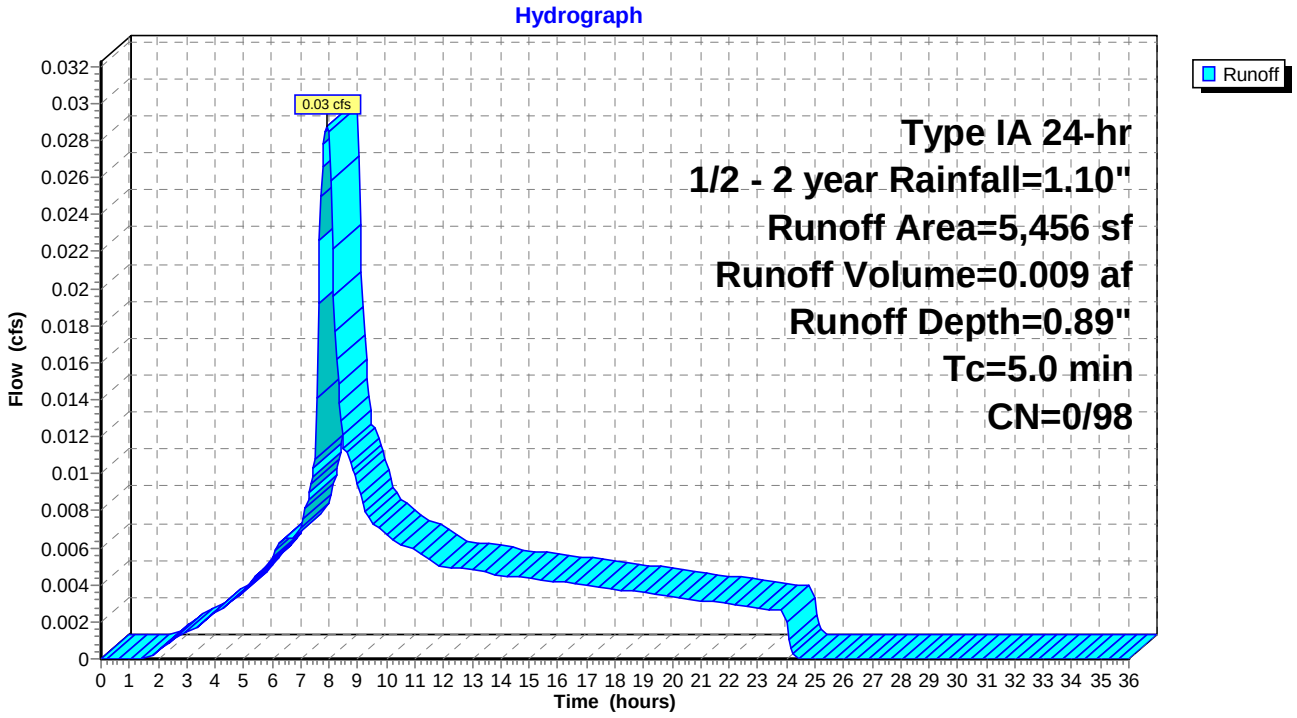
Runoff = 0.03 cfs @ 7.92 hrs, Volume= 0.009 af, Depth= 0.89"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type IA 24-hr 1/2 - 2 year Rainfall=1.10"

Area (sf)	CN	Description
5,456	98	Roofs, HSG C
5,456	98	100.00% Impervious Area

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

Subcatchment 9: Building 24



Summary for Subcatchment 17: Building 26

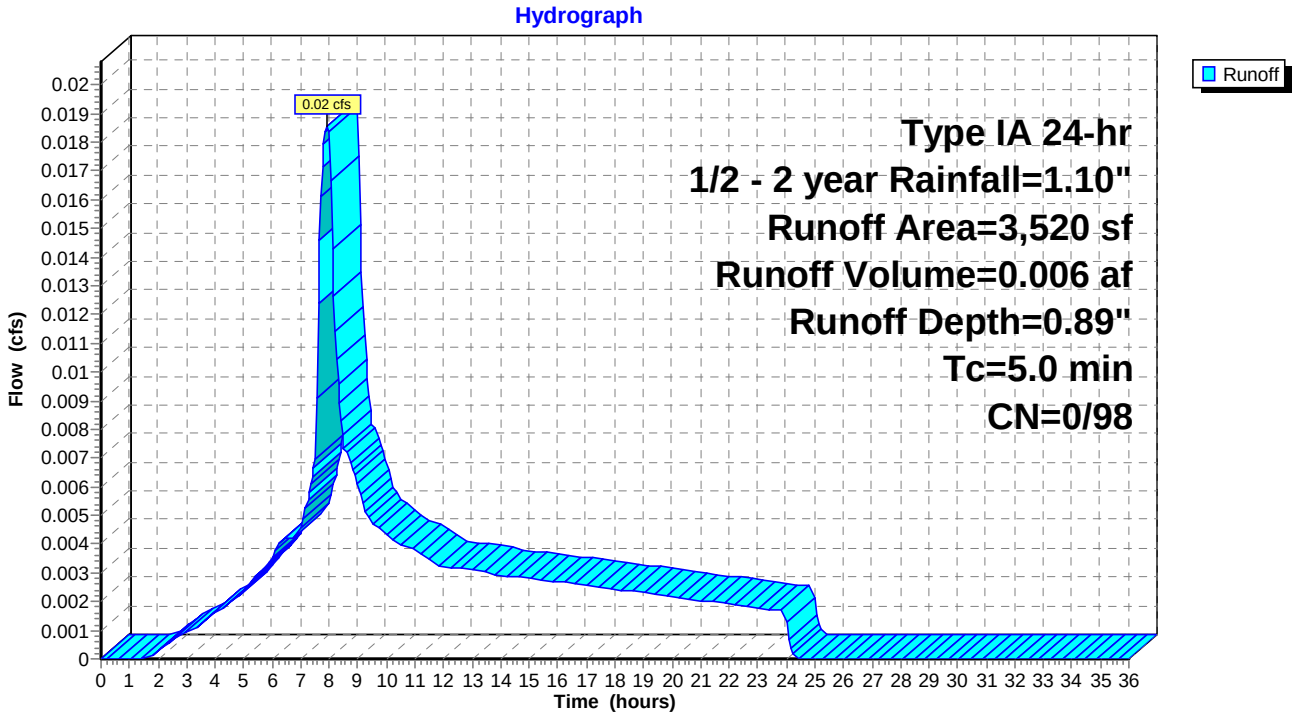
Runoff = 0.02 cfs @ 7.92 hrs, Volume= 0.006 af, Depth= 0.89"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type IA 24-hr 1/2 - 2 year Rainfall=1.10"

Area (sf)	CN	Description
3,520	98	Roofs, HSG C
3,520	98	100.00% Impervious Area

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

Subcatchment 17: Building 26



Summary for Subcatchment Landscape: Landscaping

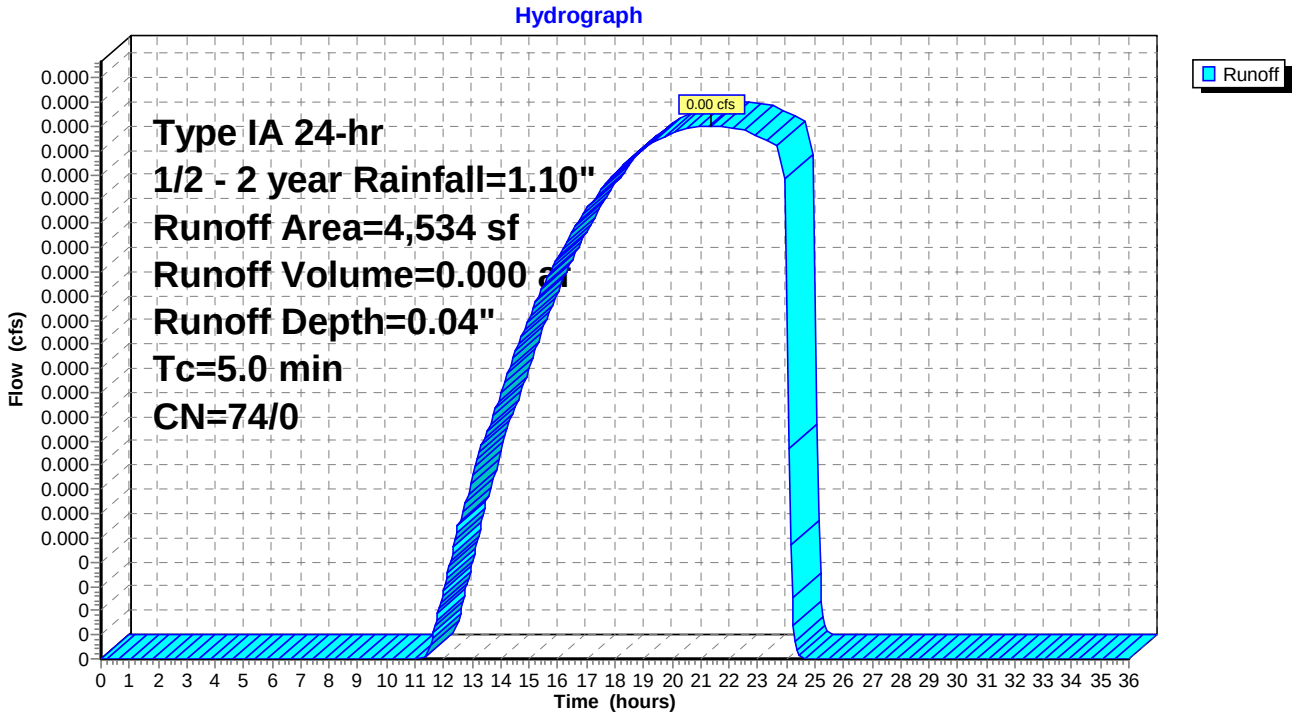
Runoff = 0.00 cfs @ 21.35 hrs, Volume= 0.000 af, Depth= 0.04"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type IA 24-hr 1/2 - 2 year Rainfall=1.10"

Area (sf)	CN	Description
4,534	74	>75% Grass cover, Good, HSG C
4,534	74	100.00% Pervious Area

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

Subcatchment Landscape: Landscaping



Summary for Subcatchment S Parking: South Parking

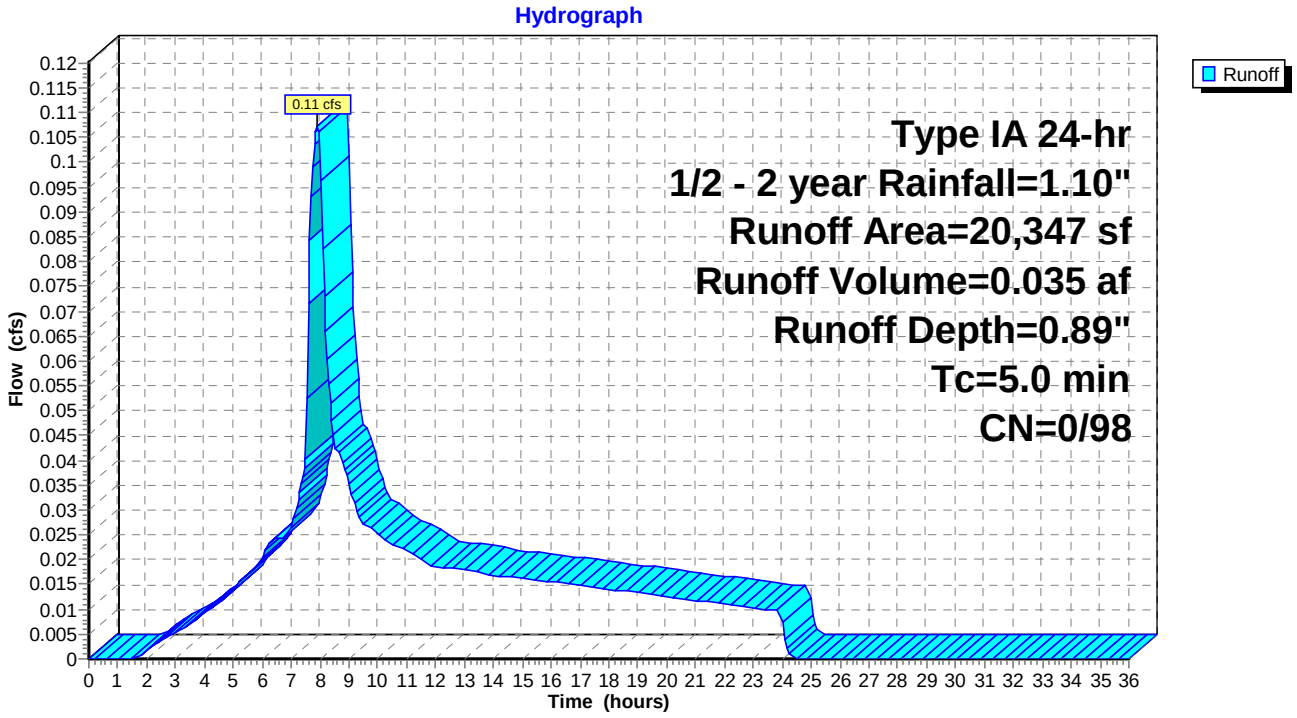
Runoff = 0.11 cfs @ 7.92 hrs, Volume= 0.035 af, Depth= 0.89"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type IA 24-hr 1/2 - 2 year Rainfall=1.10"

Area (sf)	CN	Description
20,347	98	Paved parking, HSG C
20,347	98	100.00% Impervious Area

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

Subcatchment S Parking: South Parking



Summary for Subcatchment Undev SW: Undeveloped SW

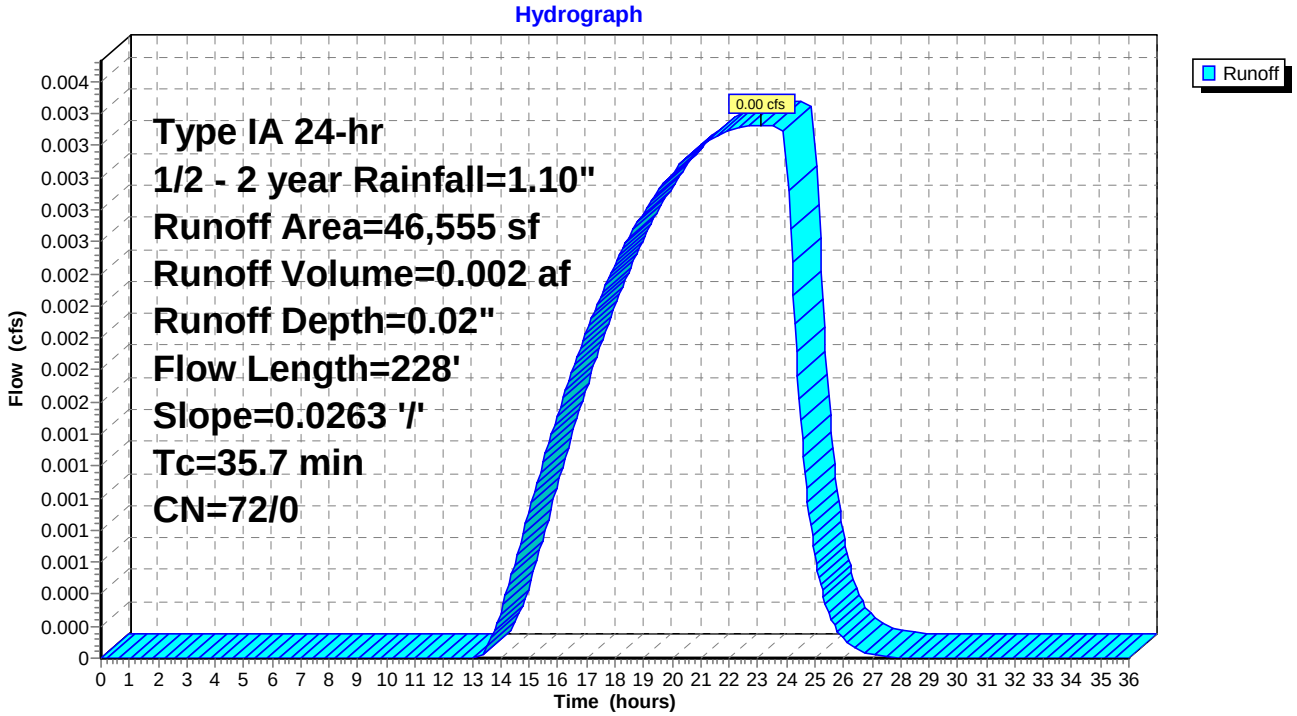
Runoff = 0.00 cfs @ 23.13 hrs, Volume= 0.002 af, Depth= 0.02"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type IA 24-hr 1/2 - 2 year Rainfall=1.10"

	Area (sf)	CN	Description
*	46,555	72	City of Salem Predeveloped, HSG C
	46,555	72	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
35.7	228	0.0263	0.11		**Sheet Flow,** n= 0.300 P2= 2.20"

Subcatchment Undev SW: Undeveloped SW



Summary for Pond 1 - GM: PB 1 - GM

Inflow Area = 1.907 ac, 38.51% Impervious, Inflow Depth = 0.36" for 1/2 - 2 year event
Inflow = 0.17 cfs @ 7.92 hrs, Volume= 0.057 af
Outflow = 0.14 cfs @ 7.85 hrs, Volume= 0.057 af, Atten= 18%, Lag= 0.0 min
Primary = 0.14 cfs @ 7.85 hrs, Volume= 0.057 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 4.03' @ 8.08 hrs Surf.Area= 3,008 sf Storage= 83 cf

Plug-Flow detention time= 7.4 min calculated for 0.057 af (100% of inflow)
Center-of-Mass det. time= 7.4 min (738.4 - 731.0)

Volume	Invert	Avail.Storage	Storage Description
#1	4.00'	6,016 cf	**Growing Media (Prismatic)** Listed below (Recalc)

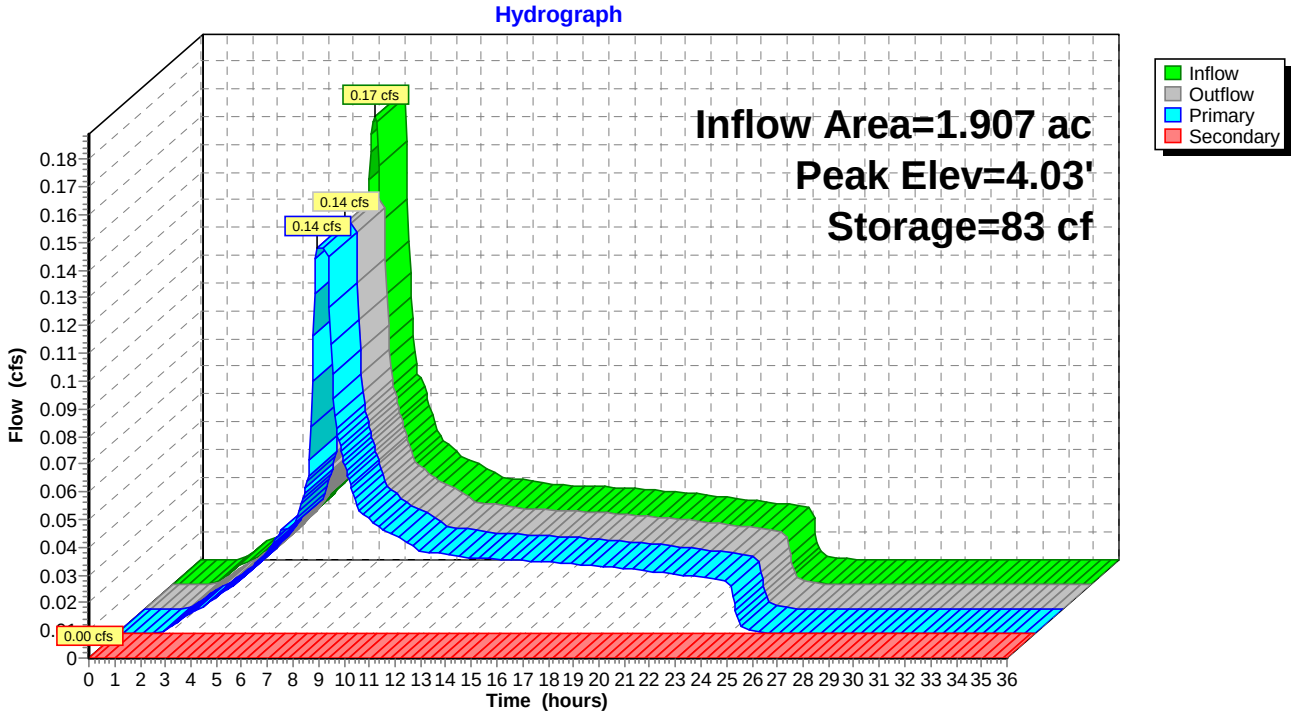
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
4.00	3,008	0	0
6.00	3,008	6,016	6,016

Device	Routing	Invert	Outlet Devices
#1	Primary	4.00'	**2.000 in/hr Exfiltration over Surface area**
#2	Secondary	5.50'	**7.0" Horiz. Rock Box** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.14 cfs @ 7.85 hrs HW=4.02' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.14 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=4.00' (Free Discharge)
└**2=Rock Box** (Controls 0.00 cfs)

Pond 1 - GM: PB 1 - GM



Summary for Pond 1 - DR: PB 1 - DR

Inflow Area = 1.907 ac, 38.51% Impervious, Inflow Depth = 0.36" for 1/2 - 2 year event
Inflow = 0.14 cfs @ 7.85 hrs, Volume= 0.057 af
Outflow = 0.05 cfs @ 7.55 hrs, Volume= 0.057 af, Atten= 65%, Lag= 0.0 min
Discarded = 0.05 cfs @ 7.55 hrs, Volume= 0.057 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 0.31' @ 9.32 hrs Surf.Area= 3,008 sf Storage= 336 cf

Plug-Flow detention time= 44.6 min calculated for 0.057 af (100% of inflow)
Center-of-Mass det. time= 44.6 min (783.0 - 738.4)

Volume	Invert	Avail.Storage	Storage Description
#1	0.00'	4,332 cf	**Drain Rock (Prismatic)** Listed below (Recalc) 12,032 cf Overall x 36.0% Voids

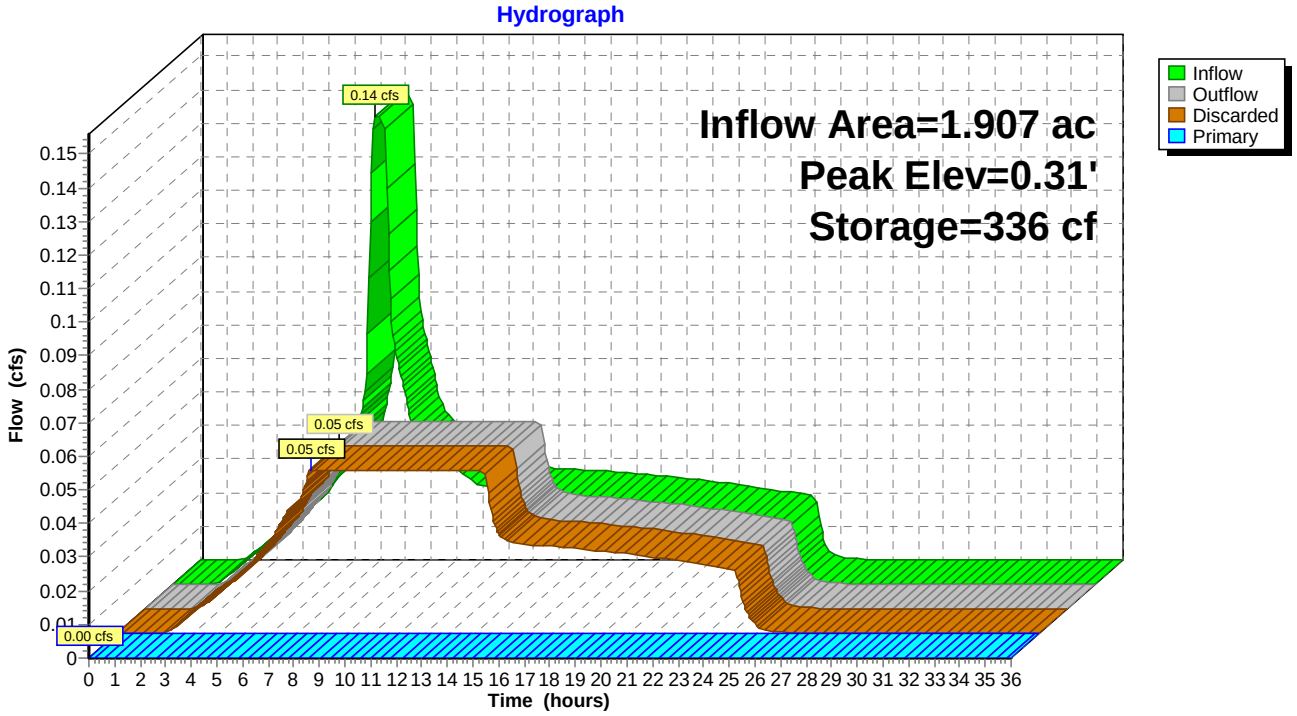
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
0.00	3,008	0	0
4.00	3,008	12,032	12,032

Device	Routing	Invert	Outlet Devices
#1	Discarded	0.00'	**0.700 in/hr Exfiltration over Surface area**
#2	Primary	3.33'	**8.0" Vert. Underdrain** C= 0.600 Limited to weir flow at low heads

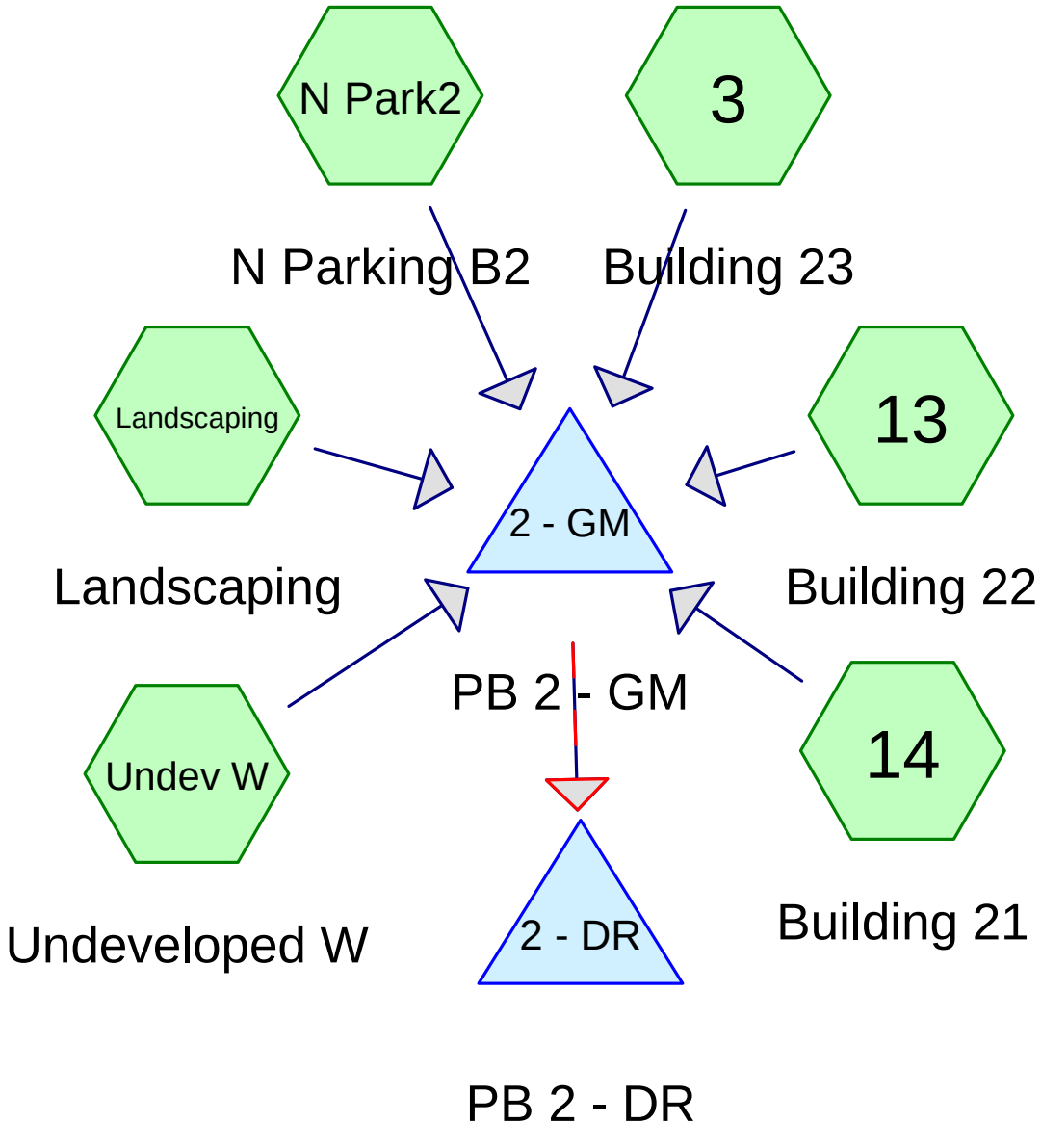
Discarded OutFlow Max=0.05 cfs @ 7.55 hrs HW=0.04' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.05 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=0.00' (Free Discharge)
↑—**2=Underdrain** (Controls 0.00 cfs)

Pond 1 - DR: PB 1 - DR



EAST



Subcat Reach Pond Link

Routing Diagram for EAST (Reed Rd) Site Prelim Hydrograph
Prepared by Multi/Tech Engineering Services, Printed 2/17/2021

Summary for Subcatchment 3: Building 23

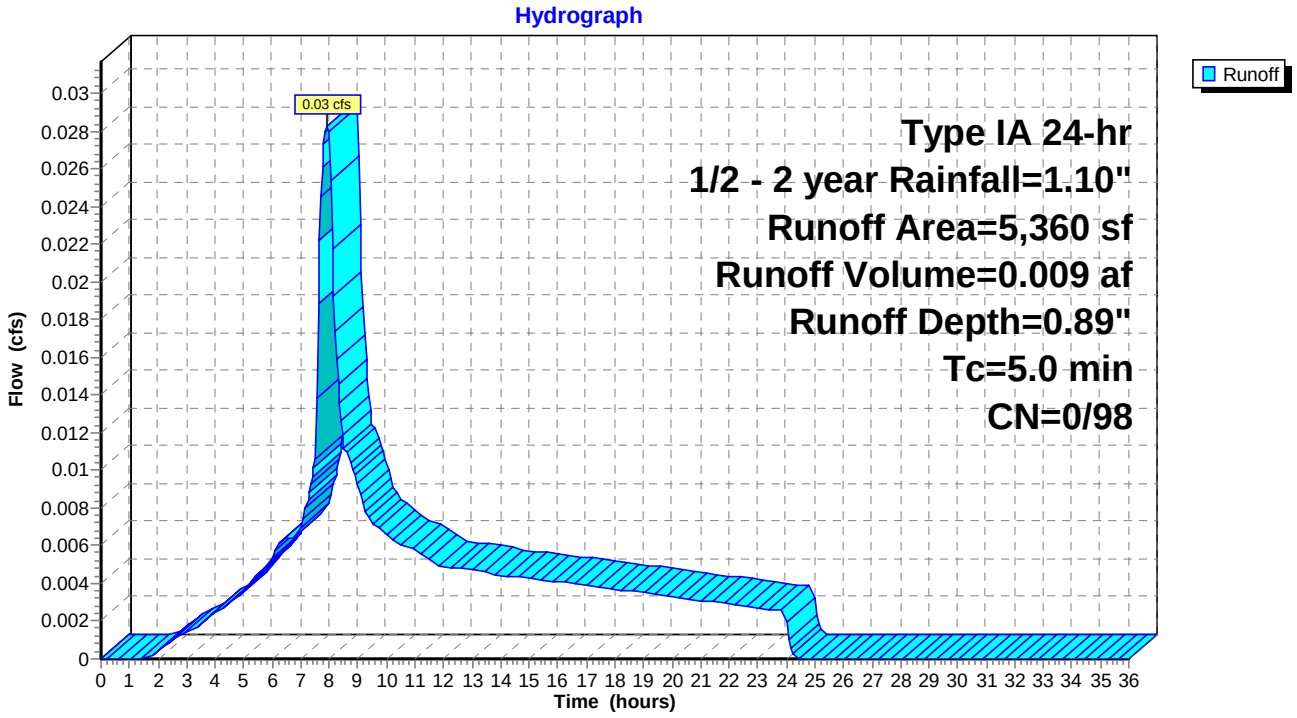
Runoff = 0.03 cfs @ 7.92 hrs, Volume= 0.009 af, Depth= 0.89"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type IA 24-hr 1/2 - 2 year Rainfall=1.10"

Area (sf)	CN	Description
5,360	98	Roofs, HSG C
5,360	98	100.00% Impervious Area

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

Subcatchment 3: Building 23



Summary for Subcatchment 13: Building 22

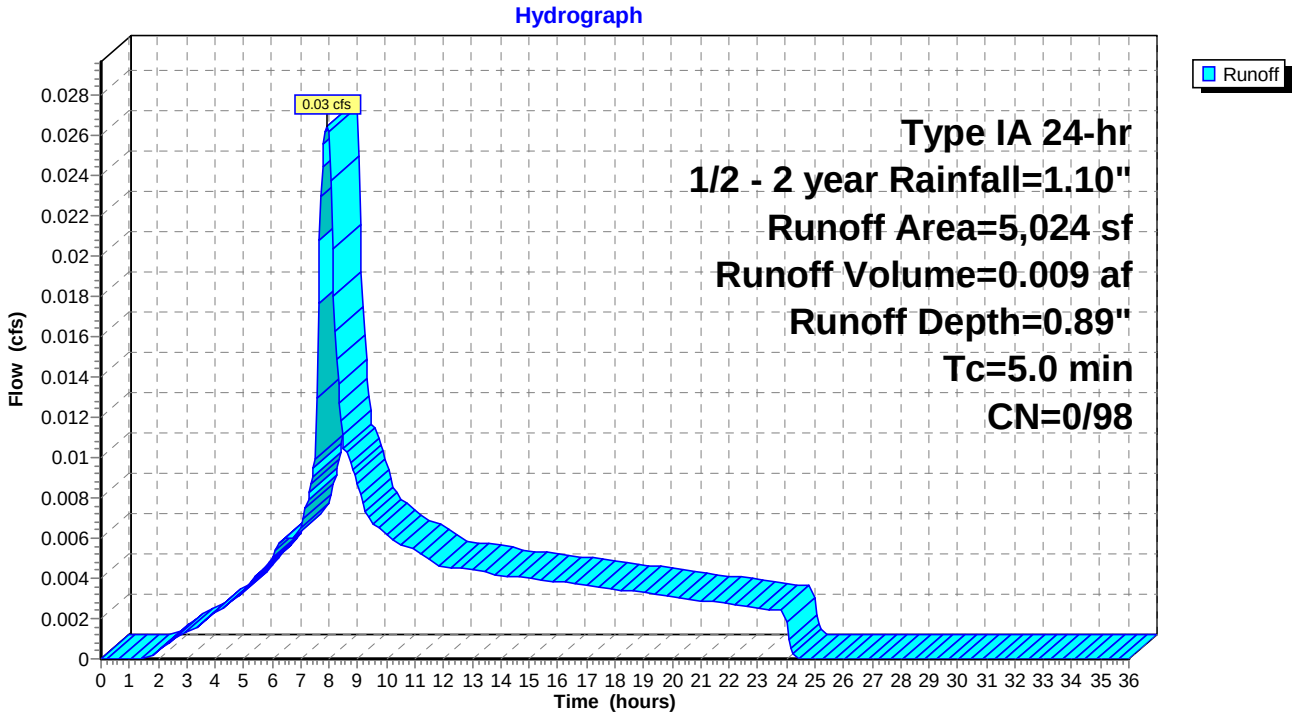
Runoff = 0.03 cfs @ 7.92 hrs, Volume= 0.009 af, Depth= 0.89"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type IA 24-hr 1/2 - 2 year Rainfall=1.10"

Area (sf)	CN	Description
5,024	98	Roofs, HSG C
5,024	98	100.00% Impervious Area

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

Subcatchment 13: Building 22



Summary for Subcatchment 14: Building 21

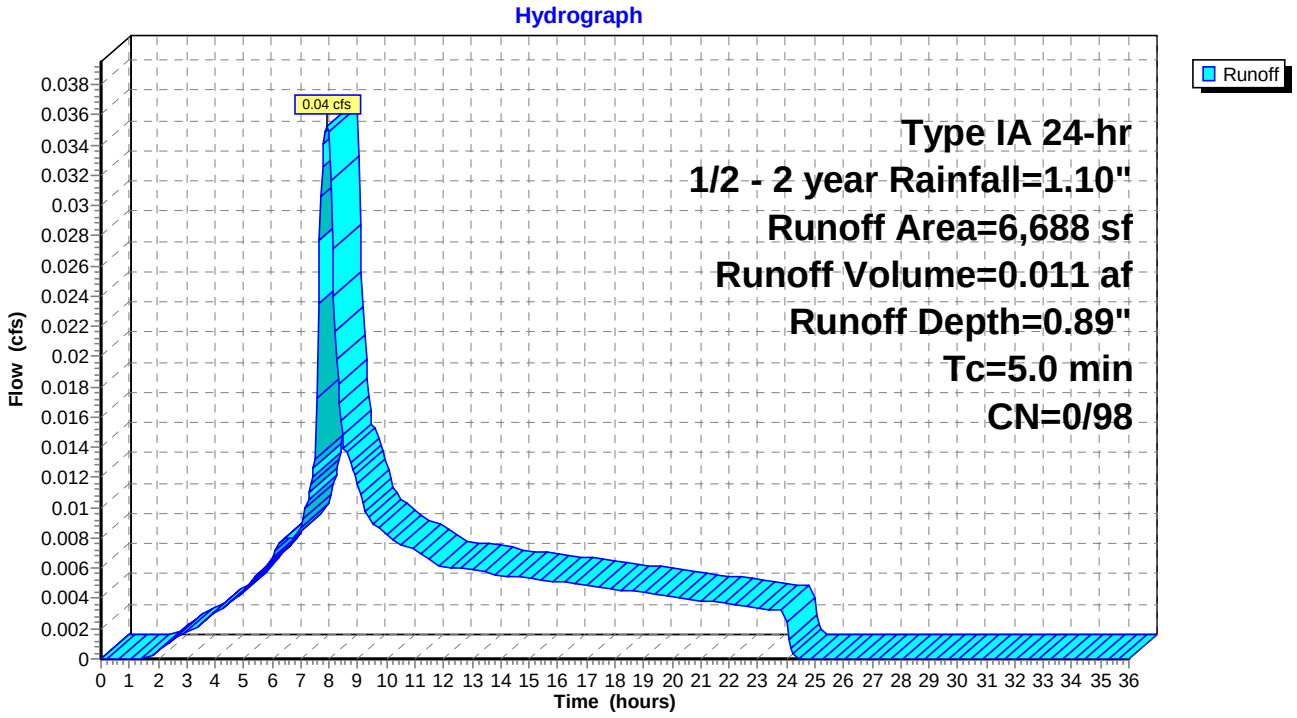
Runoff = 0.04 cfs @ 7.92 hrs, Volume= 0.011 af, Depth= 0.89"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type IA 24-hr 1/2 - 2 year Rainfall=1.10"

Area (sf)	CN	Description
6,688	98	Roofs, HSG C
6,688	98	100.00% Impervious Area

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

Subcatchment 14: Building 21



Summary for Subcatchment Landscaping: Landscaping

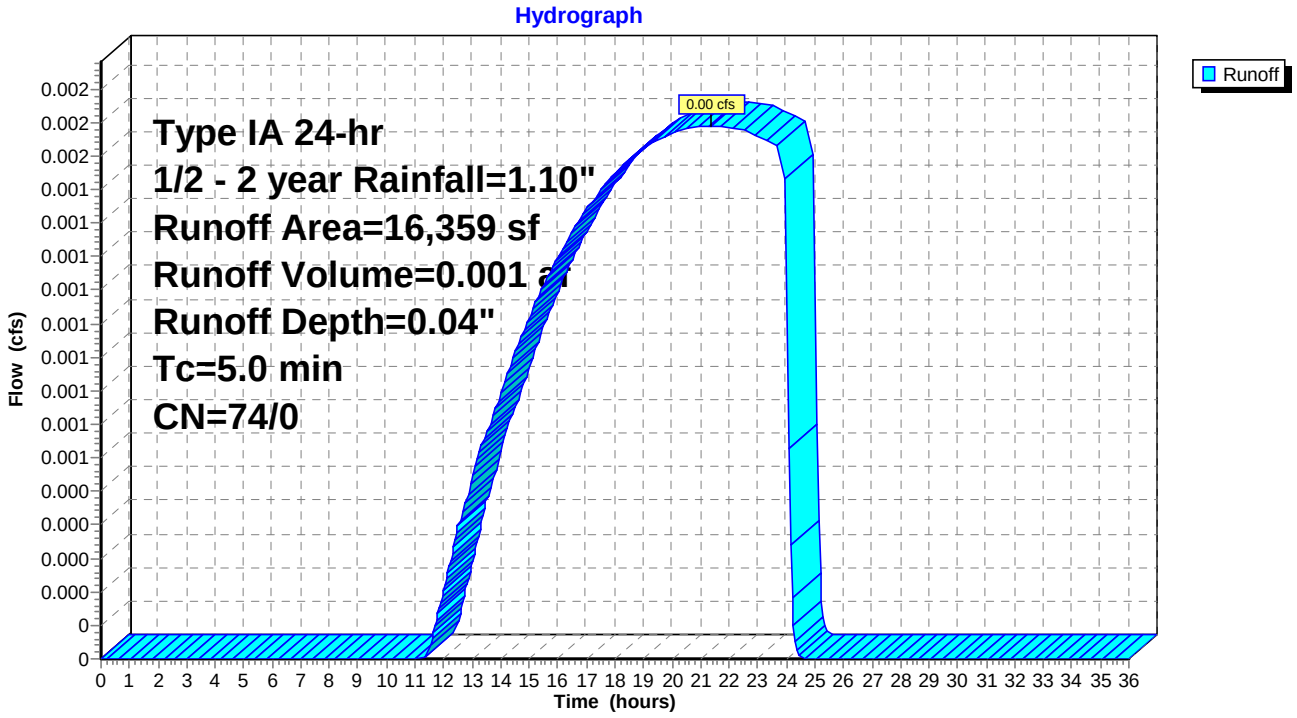
Runoff = 0.00 cfs @ 21.35 hrs, Volume= 0.001 af, Depth= 0.04"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type IA 24-hr 1/2 - 2 year Rainfall=1.10"

Area (sf)	CN	Description
16,359	74	>75% Grass cover, Good, HSG C
16,359	74	100.00% Pervious Area

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

Subcatchment Landscaping: Landscaping



Summary for Subcatchment N Park2: N Parking B2

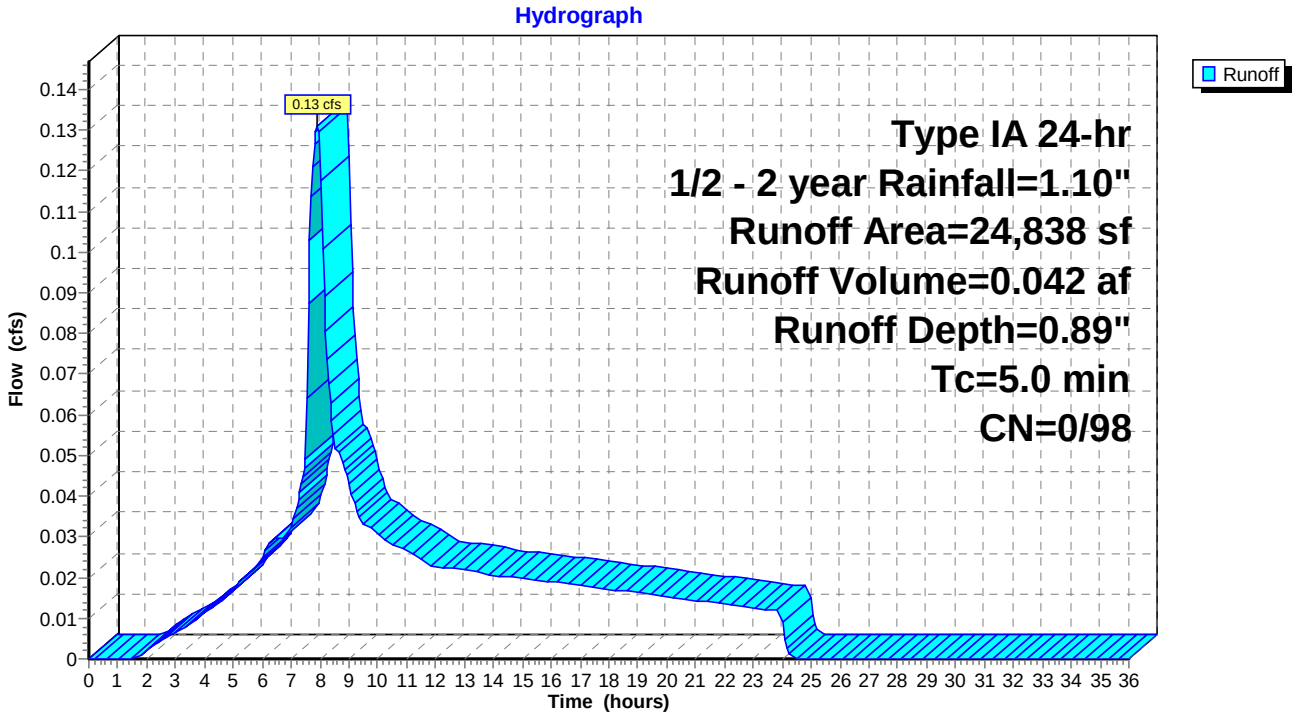
Runoff = 0.13 cfs @ 7.92 hrs, Volume= 0.042 af, Depth= 0.89"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type IA 24-hr 1/2 - 2 year Rainfall=1.10"

Area (sf)	CN	Description
24,838	98	Unconnected pavement, HSG C
24,838	98	100.00% Impervious Area

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

Subcatchment N Park2: N Parking B2



Summary for Subcatchment Undev W: Undeveloped W

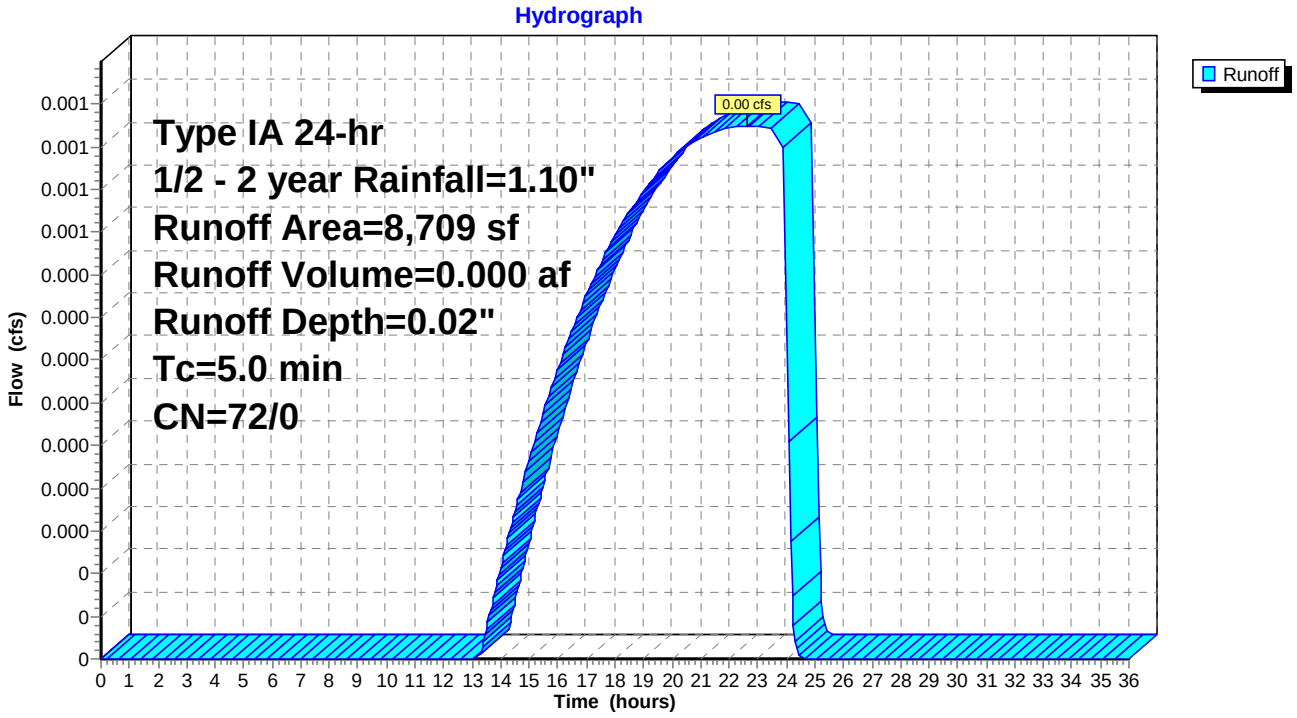
Runoff = 0.00 cfs @ 22.60 hrs, Volume= 0.000 af, Depth= 0.02"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type IA 24-hr 1/2 - 2 year Rainfall=1.10"

	Area (sf)	CN	Description
*	8,709	72	City of Salem Undeveloped, HSG C
	8,709	72	100.00% Pervious Area

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

Subcatchment Undev W: Undeveloped W



Summary for Pond 2 - GM: PB 2 - GM

Inflow Area = 1.538 ac, 62.57% Impervious, Inflow Depth = 0.57" for 1/2 - 2 year event
Inflow = 0.22 cfs @ 7.92 hrs, Volume= 0.073 af
Outflow = 0.11 cfs @ 7.65 hrs, Volume= 0.073 af, Atten= 48%, Lag= 0.0 min
Primary = 0.11 cfs @ 7.65 hrs, Volume= 0.073 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 4.09' @ 8.30 hrs Surf.Area= 2,482 sf Storage= 217 cf

Plug-Flow detention time= 10.8 min calculated for 0.073 af (100% of inflow)
Center-of-Mass det. time= 10.8 min (729.6 - 718.8)

Volume	Invert	Avail.Storage	Storage Description
#1	4.00'	4,964 cf	**Growing Media (Prismatic)** Listed below (Recalc)

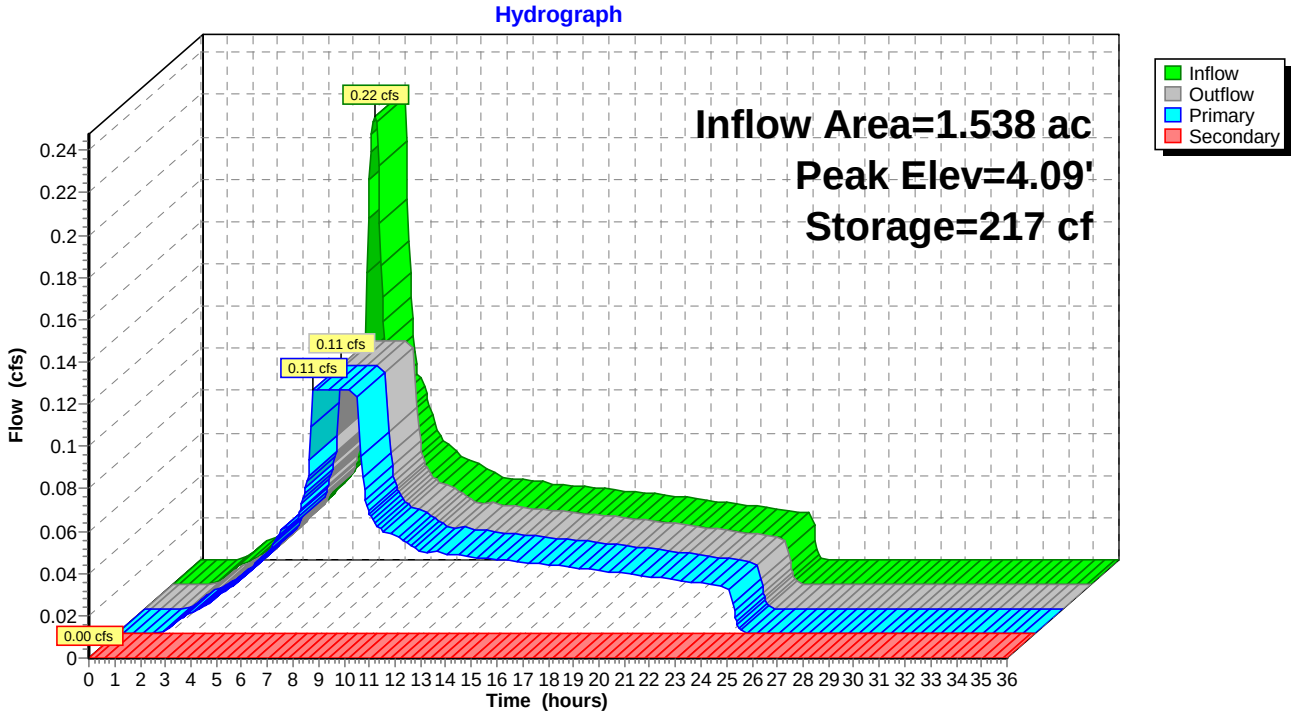
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
4.00	2,482	0	0
6.00	2,482	4,964	4,964

Device	Routing	Invert	Outlet Devices
#1	Primary	4.00'	**2.000 in/hr Exfiltration over Surface area**
#2	Secondary	5.50'	**7.0" Horiz. Rock Box** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.11 cfs @ 7.65 hrs HW=4.02' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.11 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=4.00' (Free Discharge)
└**2=Rock Box** (Controls 0.00 cfs)

Pond 2 - GM: PB 2 - GM



Summary for Pond 2 - DR: PB 2 - DR

Inflow Area = 1.538 ac, 62.57% Impervious, Inflow Depth = 0.57" for 1/2 - 2 year event
Inflow = 0.11 cfs @ 7.65 hrs, Volume= 0.073 af
Outflow = 0.04 cfs @ 6.25 hrs, Volume= 0.073 af, Atten= 65%, Lag= 0.0 min
Discarded = 0.04 cfs @ 6.25 hrs, Volume= 0.073 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 0.80' @ 11.71 hrs Surf.Area= 2,482 sf Storage= 718 cf

Plug-Flow detention time= 185.9 min calculated for 0.073 af (100% of inflow)
Center-of-Mass det. time= 185.8 min (915.4 - 729.6)

Volume	Invert	Avail.Storage	Storage Description
#1	0.00'	3,574 cf	**Drain Rock (Prismatic)** Listed below (Recalc) 9,928 cf Overall x 36.0% Voids

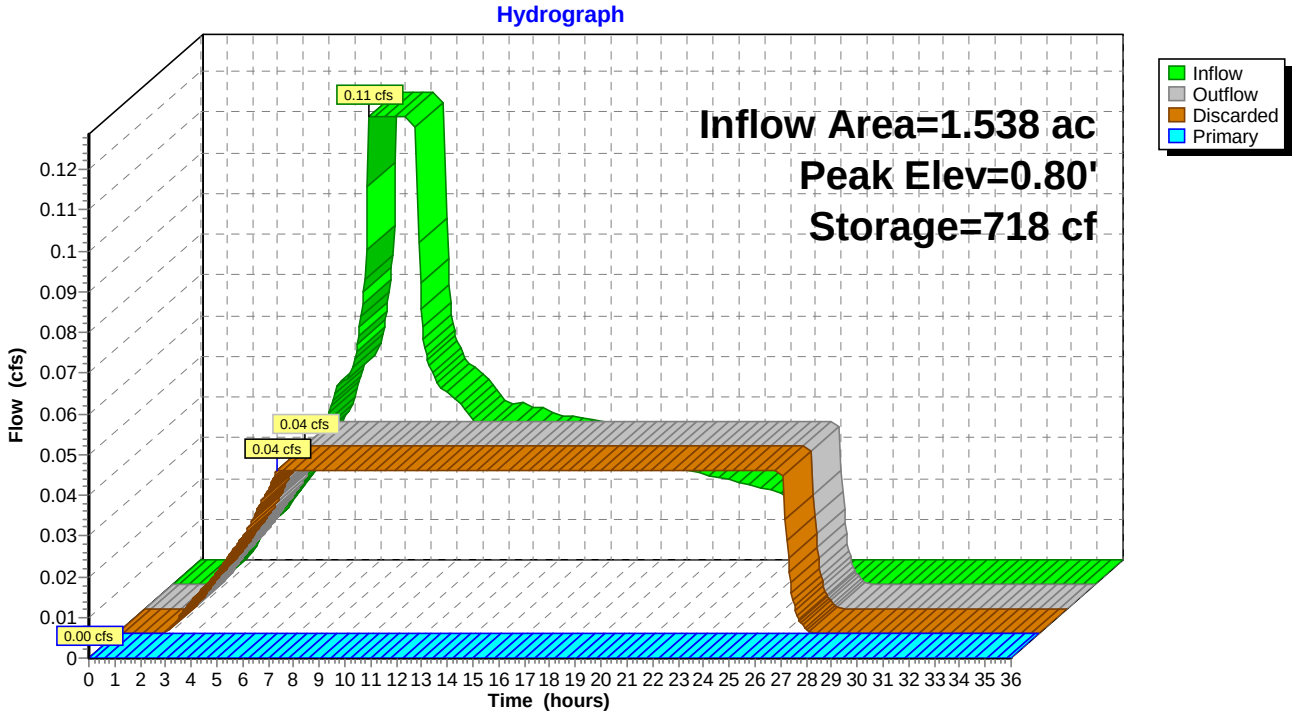
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
0.00	2,482	0	0
4.00	2,482	9,928	9,928

Device	Routing	Invert	Outlet Devices
#1	Discarded	0.00'	**0.700 in/hr Exfiltration over Surface area**
#2	Primary	3.33'	**8.0" Vert. Underdrain** C= 0.600 Limited to weir flow at low heads

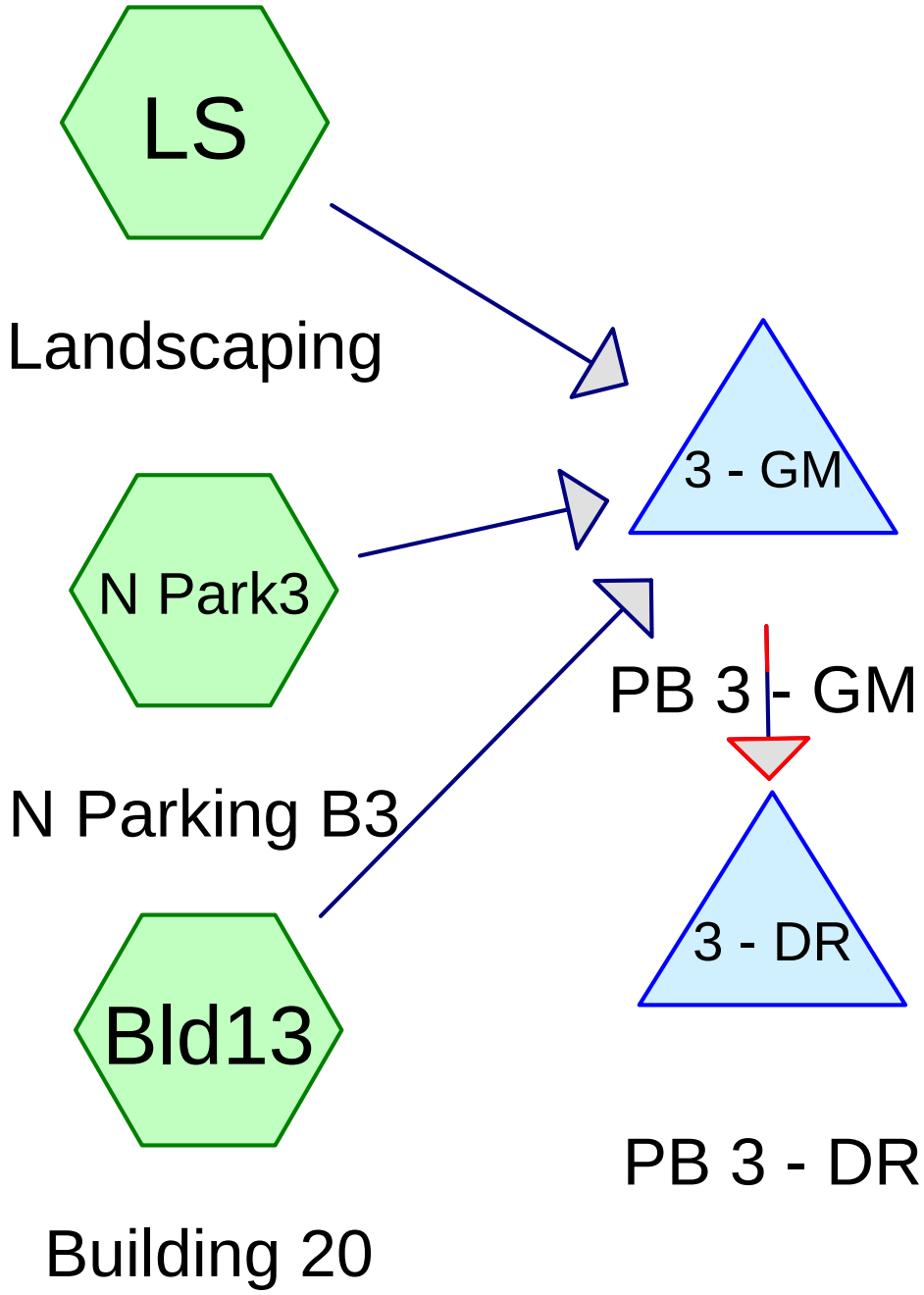
Discarded OutFlow Max=0.04 cfs @ 6.25 hrs HW=0.04' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.04 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=0.00' (Free Discharge)
↑—**2=Underdrain** (Controls 0.00 cfs)

Pond 2 - DR: PB 2 - DR



EAST



Subcat Reach Pond Link

Routing Diagram for EAST (Reed Rd) Site Prelim Hydrograph
Prepared by Multi/Tech Engineering Services, Printed 2/17/2021

Summary for Subcatchment Bld13: Building 20

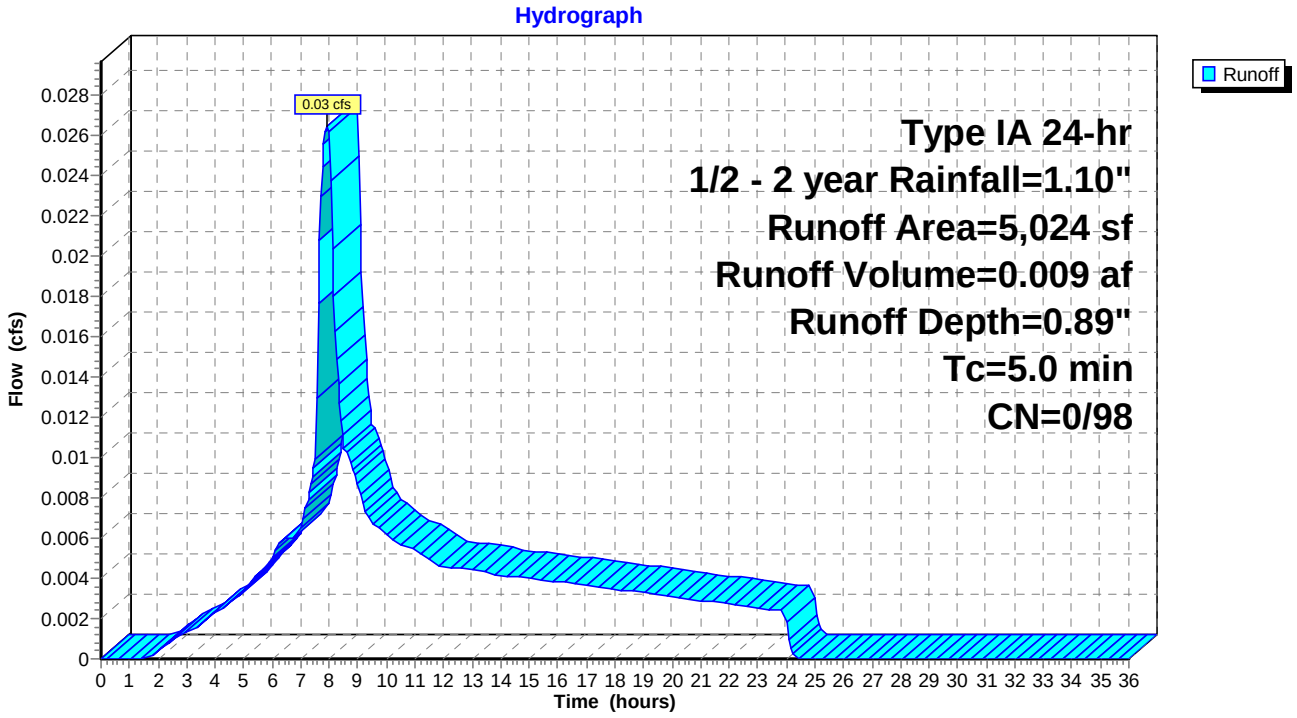
Runoff = 0.03 cfs @ 7.92 hrs, Volume= 0.009 af, Depth= 0.89"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type IA 24-hr 1/2 - 2 year Rainfall=1.10"

Area (sf)	CN	Description
5,024	98	Roofs, HSG C
5,024	98	100.00% Impervious Area

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

Subcatchment Bld13: Building 20



Summary for Subcatchment LS: Landscaping

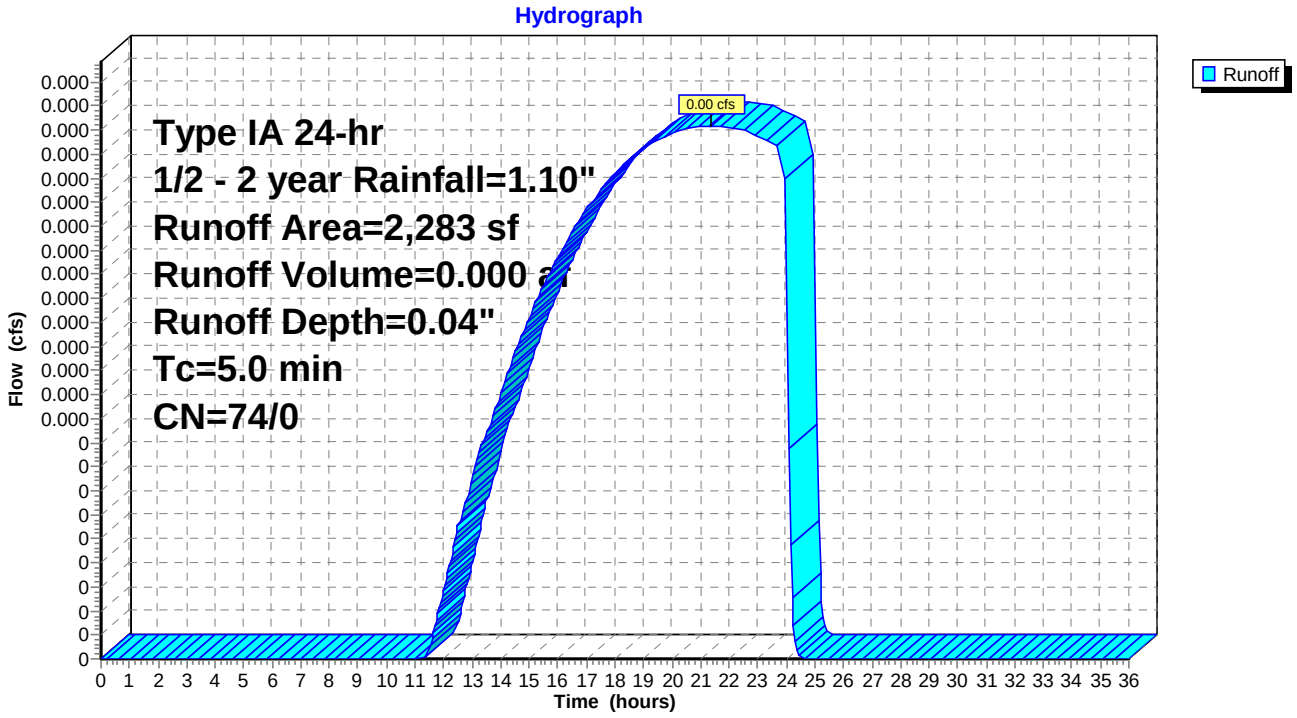
Runoff = 0.00 cfs @ 21.35 hrs, Volume= 0.000 af, Depth= 0.04"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type IA 24-hr 1/2 - 2 year Rainfall=1.10"

Area (sf)	CN	Description
2,283	74	>75% Grass cover, Good, HSG C
2,283	74	100.00% Pervious Area

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

Subcatchment LS: Landscaping



Summary for Subcatchment N Park3: N Parking B3

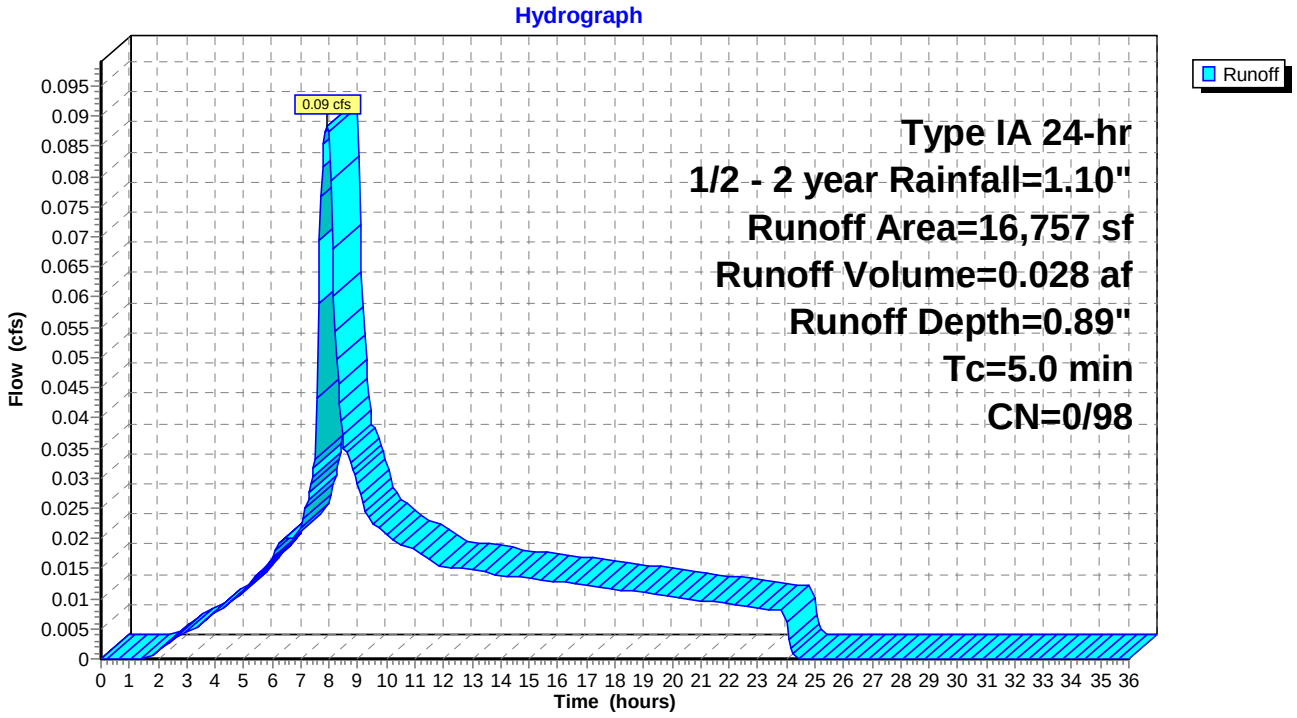
Runoff = 0.09 cfs @ 7.92 hrs, Volume= 0.028 af, Depth= 0.89"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type IA 24-hr 1/2 - 2 year Rainfall=1.10"

Area (sf)	CN	Description
16,757	98	Paved parking, HSG C
16,757	98	100.00% Impervious Area

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

Subcatchment N Park3: N Parking B3



Summary for Pond 3 - GM: PB 3 - GM

Inflow Area = 0.552 ac, 90.51% Impervious, Inflow Depth = 0.81" for 1/2 - 2 year event
Inflow = 0.11 cfs @ 7.92 hrs, Volume= 0.037 af
Outflow = 0.07 cfs @ 7.70 hrs, Volume= 0.037 af, Atten= 42%, Lag= 0.0 min
Primary = 0.07 cfs @ 7.70 hrs, Volume= 0.037 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 4.07' @ 8.23 hrs Surf.Area= 1,436 sf Storage= 98 cf

Plug-Flow detention time= 9.6 min calculated for 0.037 af (100% of inflow)
Center-of-Mass det. time= 9.4 min (720.1 - 710.7)

Volume	Invert	Avail.Storage	Storage Description
#1	4.00'	2,872 cf	**Growing Media (Prismatic)** Listed below (Recalc)

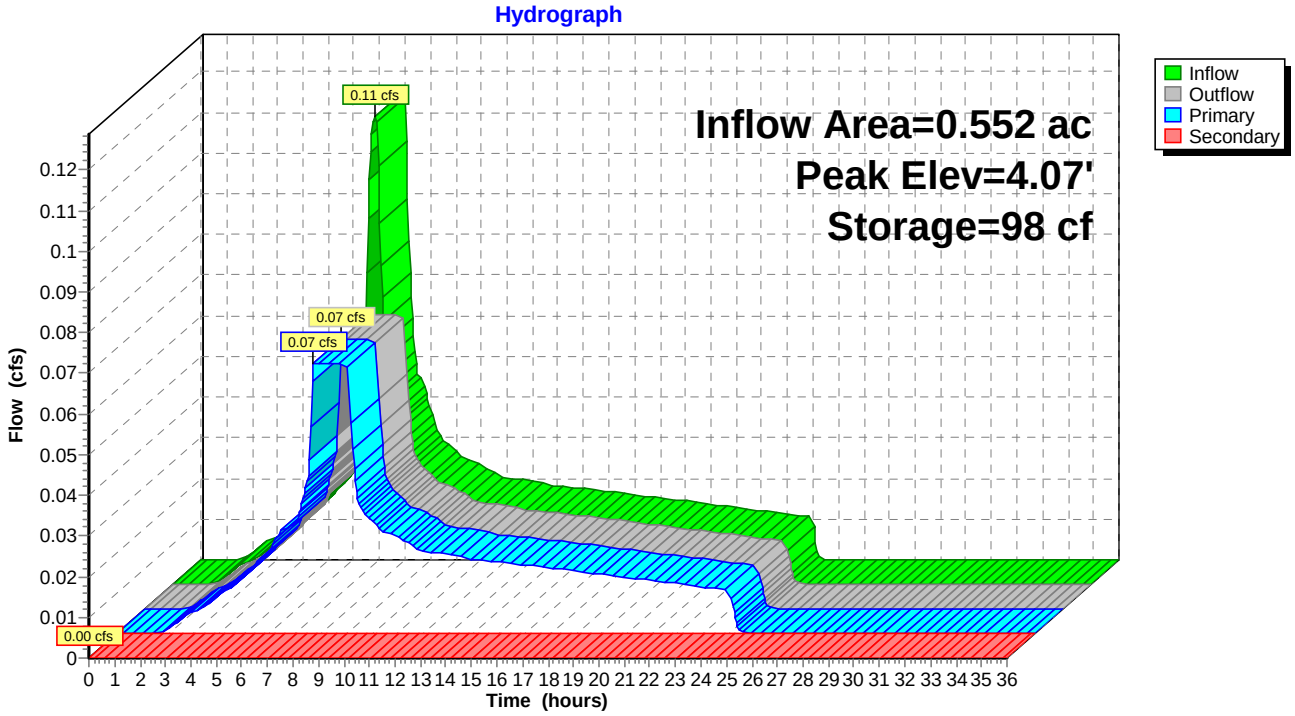
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
4.00	1,436	0	0
6.00	1,436	2,872	2,872

Device	Routing	Invert	Outlet Devices
#1	Primary	4.00'	**2.000 in/hr Exfiltration over Surface area**
#2	Secondary	5.50'	**7.0" Horiz. Rock Box** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.07 cfs @ 7.70 hrs HW=4.02' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.07 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=4.00' (Free Discharge)
└**2=Rock Box** (Controls 0.00 cfs)

Pond 3 - GM: PB 3 - GM



Summary for Pond 3 - DR: PB 3 - DR

Inflow Area = 0.552 ac, 90.51% Impervious, Inflow Depth = 0.81" for 1/2 - 2 year event
Inflow = 0.07 cfs @ 7.70 hrs, Volume= 0.037 af
Outflow = 0.02 cfs @ 6.50 hrs, Volume= 0.037 af, Atten= 65%, Lag= 0.0 min
Discarded = 0.02 cfs @ 6.50 hrs, Volume= 0.037 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 0.64' @ 11.16 hrs Surf.Area= 1,436 sf Storage= 329 cf

Plug-Flow detention time= 129.9 min calculated for 0.037 af (100% of inflow)
Center-of-Mass det. time= 129.8 min (849.9 - 720.1)

Volume	Invert	Avail.Storage	Storage Description
#1	0.00'	2,068 cf	**Drain Rock (Prismatic)** Listed below (Recalc) 5,744 cf Overall x 36.0% Voids

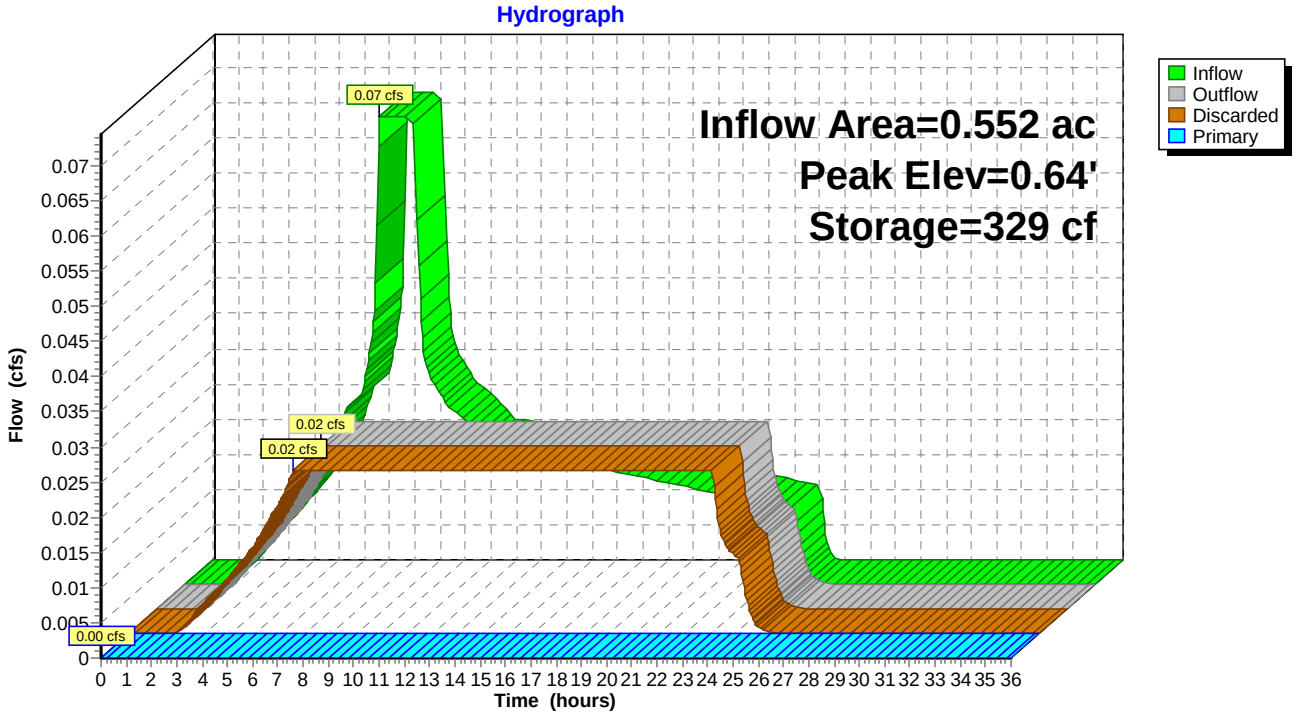
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
0.00	1,436	0	0
4.00	1,436	5,744	5,744

Device	Routing	Invert	Outlet Devices
#1	Discarded	0.00'	**0.700 in/hr Exfiltration over Surface area**
#2	Primary	3.33'	**8.0" Vert. Underdrain** C= 0.600 Limited to weir flow at low heads

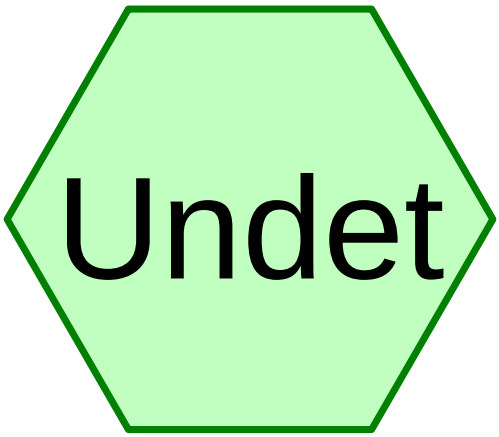
Discarded OutFlow Max=0.02 cfs @ 6.50 hrs HW=0.04' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.02 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=0.00' (Free Discharge)
↑—**2=Underdrain** (Controls 0.00 cfs)

Pond 3 - DR: PB 3 - DR



EAST



Undetained

Subcat Reach Pond Link

Routing Diagram for EAST (Reed Rd) Site Prelim Hydrograph
Prepared by Multi/Tech Engineering Services, Printed 2/17/2021

Summary for Subcatchment Undet: Undetained

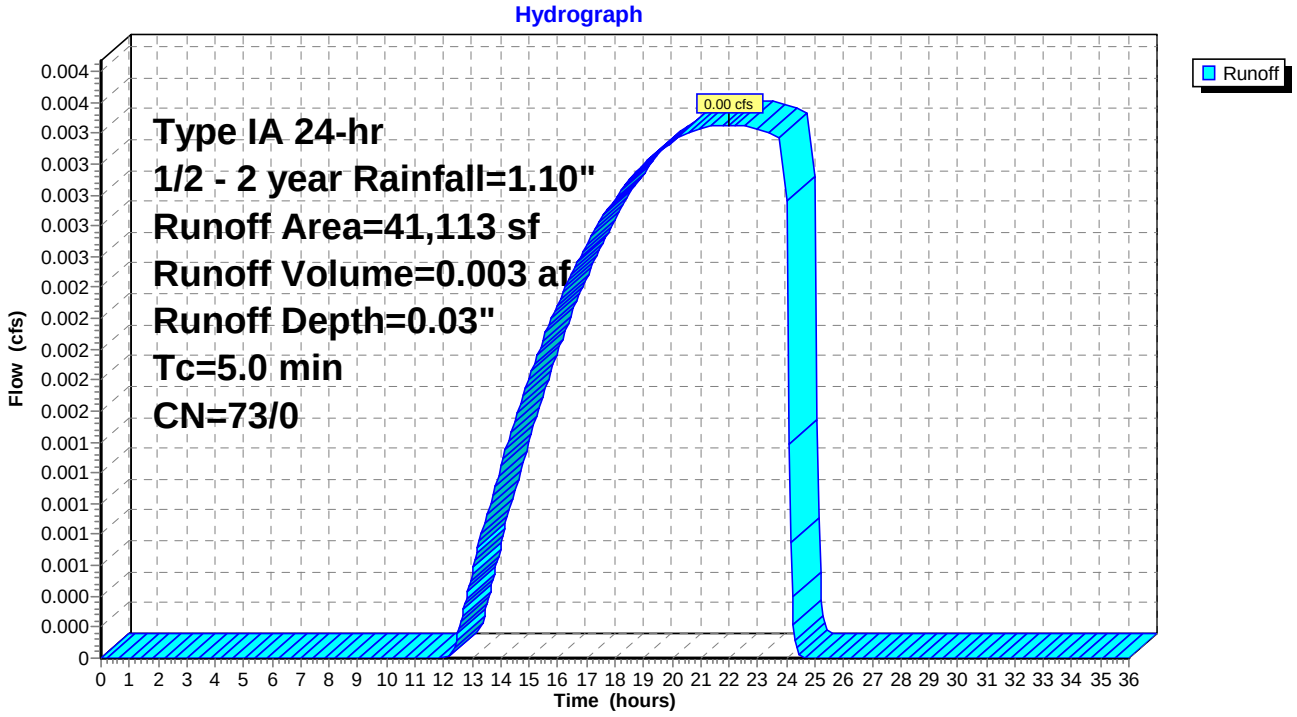
Runoff = 0.00 cfs @ 21.96 hrs, Volume= 0.003 af, Depth= 0.03"

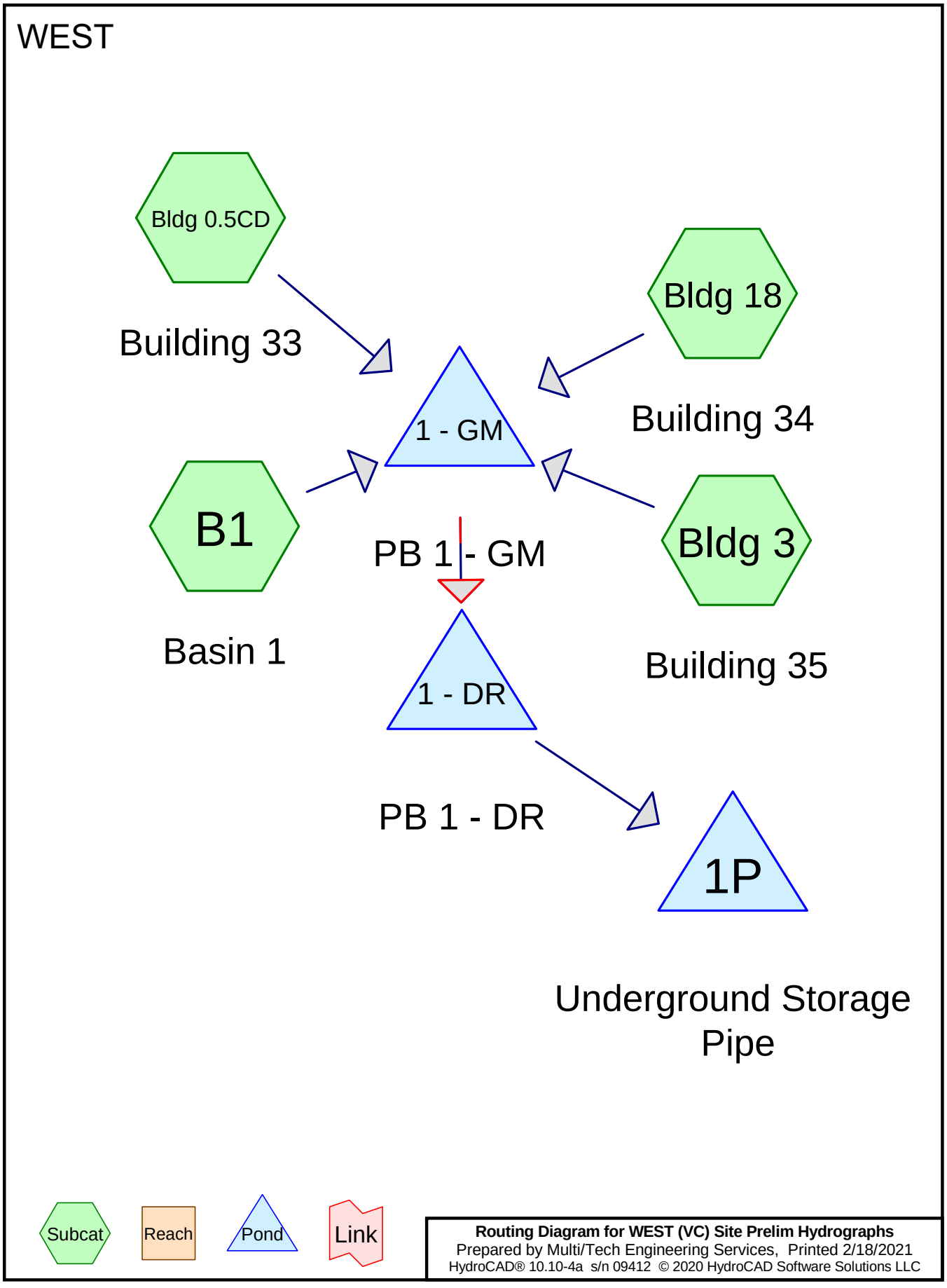
Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type IA 24-hr 1/2 - 2 year Rainfall=1.10"

	Area (sf)	CN	Description
	3,680	74	>75% Grass cover, Good, HSG C
	3,296	74	>75% Grass cover, Good, HSG C
	7,604	74	>75% Grass cover, Good, HSG C
	1,317	74	>75% Grass cover, Good, HSG C
*	25,216	72	City of Salem Predeveloped, HSG C
	41,113	73	Weighted Average
	41,113	73	100.00% Pervious Area

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

Subcatchment Undet: Undetained




WEST
Bldg 0.5CD
Building 33
Bldg 18
Building 34
1 - GM
B1
Basin 1
PB 1 - GM
Bldg 3
Building 35
1 - DR
PB 1 - DR
1P
Underground Storage Pipe
Subcat
Reach
Pond
Link
Routing Diagram for WEST (VC) Site Prelim Hydrographs
Prepared by Multi/Tech Engineering Services, Printed 2/18/2021
HydroCAD® 10.10-4a s/n 09412 © 2020 HydroCAD Software Solutions LLC

Summary for Subcatchment B1: Basin 1

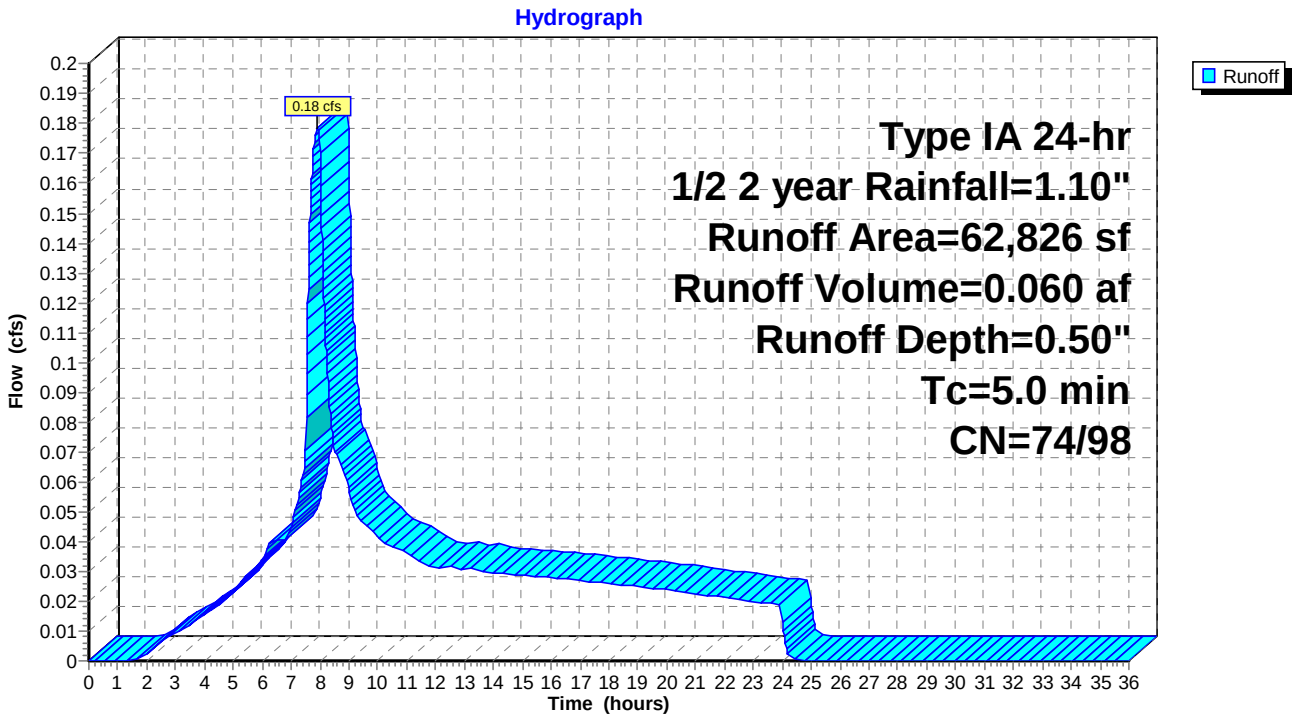
Runoff = 0.18 cfs @ 7.90 hrs, Volume= 0.060 af, Depth= 0.50"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type IA 24-hr 1/2 2 year Rainfall=1.10"

	Area (sf)	CN	Description
	33,861	98	Paved parking, HSG C
	27,754	74	>75% Grass cover, Good, HSG C
*	1,211	72	Planter Box
	62,826	87	Weighted Average
	28,965	74	46.10% Pervious Area
	33,861	98	53.90% Impervious Area

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

Subcatchment B1: Basin 1



Summary for Subcatchment Bldg 0.5CD: Building 33

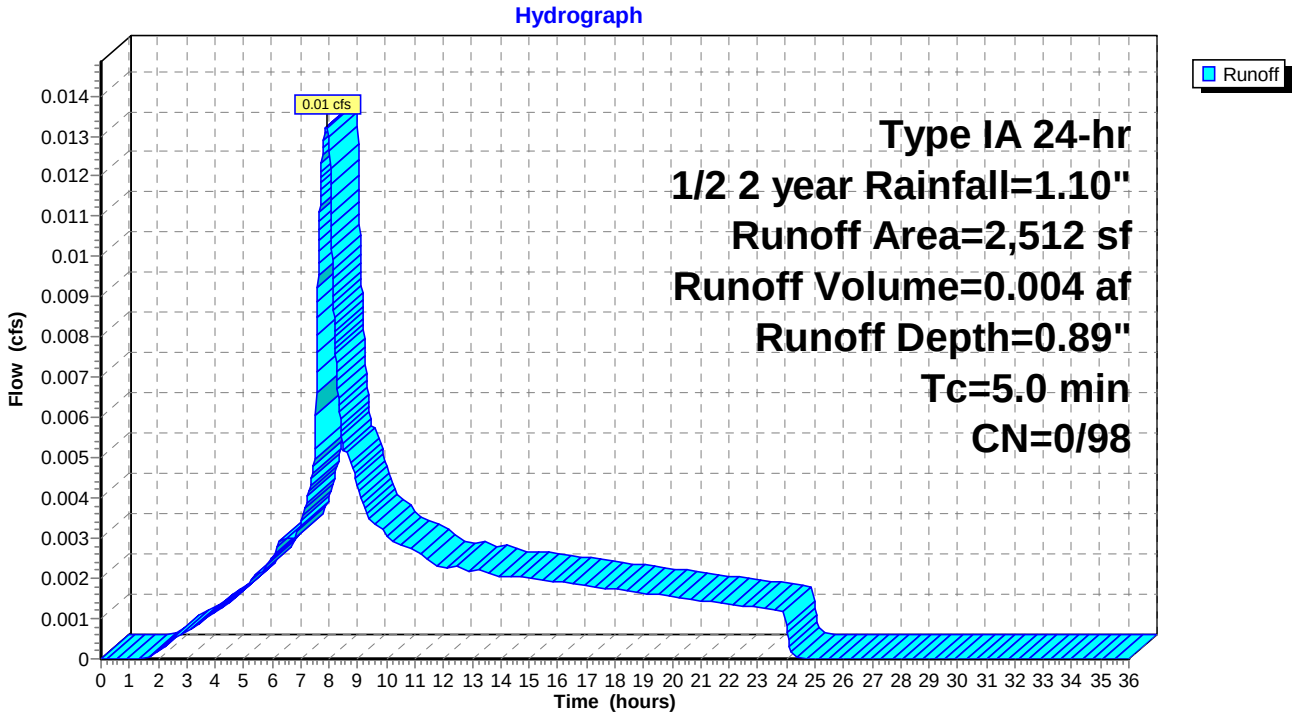
Runoff = 0.01 cfs @ 7.90 hrs, Volume= 0.004 af, Depth= 0.89"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type IA 24-hr 1/2 2 year Rainfall=1.10"

Area (sf)	CN	Description
2,512	98	Roofs, HSG C
2,512	98	100.00% Impervious Area

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

Subcatchment Bldg 0.5CD: Building 33



Summary for Subcatchment Bldg 18: Building 34

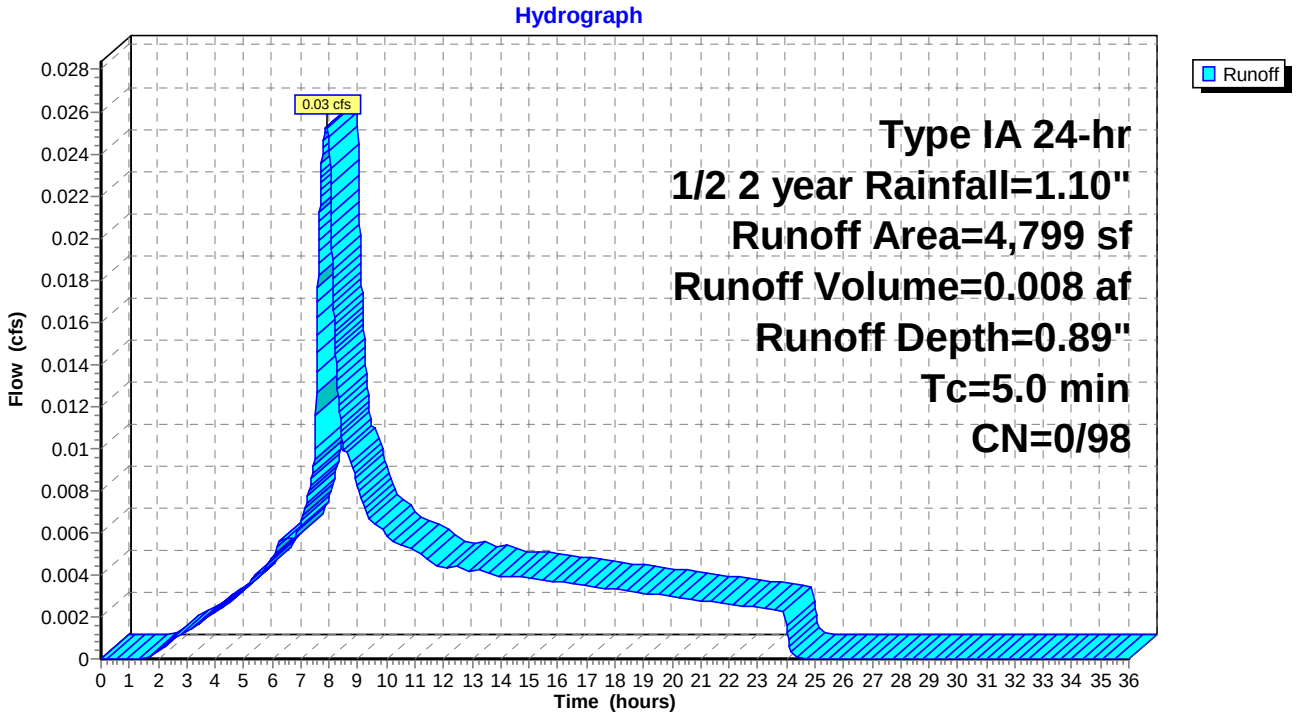
Runoff = 0.03 cfs @ 7.90 hrs, Volume= 0.008 af, Depth= 0.89"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type IA 24-hr 1/2 2 year Rainfall=1.10"

Area (sf)	CN	Description
4,799	98	Roofs, HSG C
4,799	98	100.00% Impervious Area

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

Subcatchment Bldg 18: Building 34



Summary for Subcatchment Bldg 3: Building 35

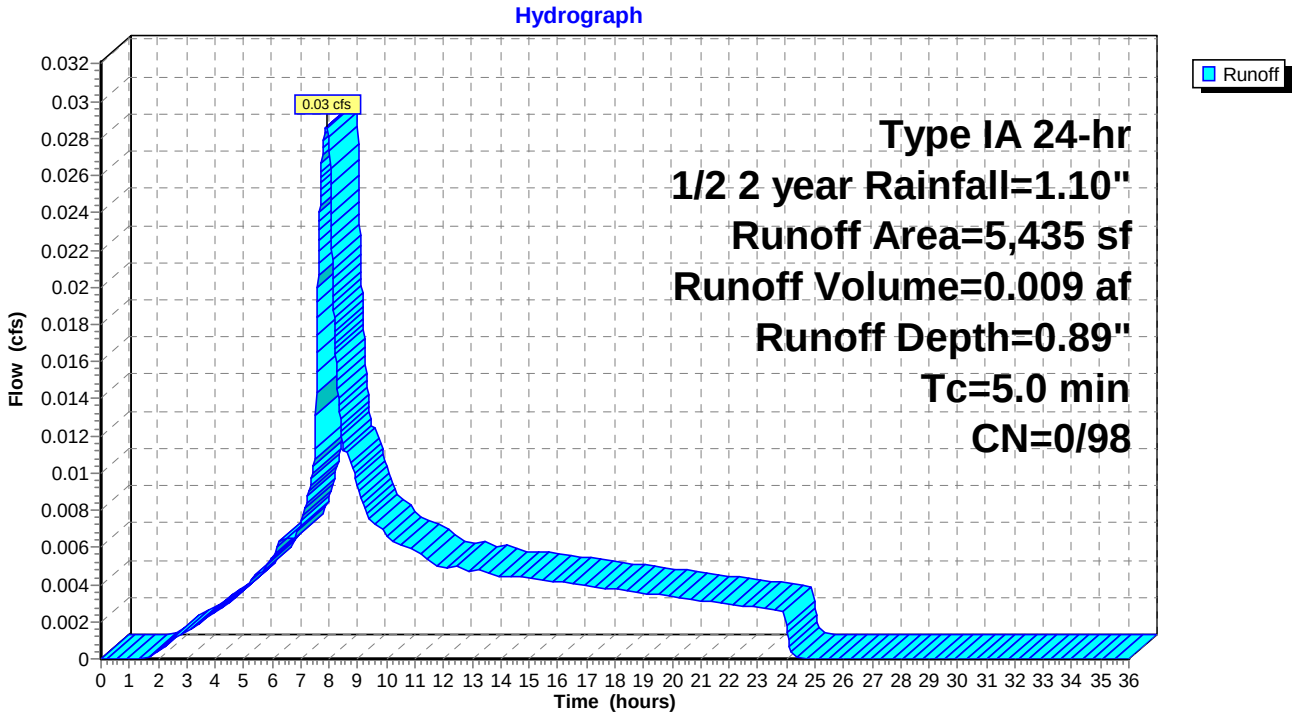
Runoff = 0.03 cfs @ 7.90 hrs, Volume= 0.009 af, Depth= 0.89"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type IA 24-hr 1/2 2 year Rainfall=1.10"

Area (sf)	CN	Description
5,435	98	Roofs, HSG C
5,435	98	100.00% Impervious Area

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

Subcatchment Bldg 3: Building 35



Summary for Pond 1 - GM: PB 1 - GM

Inflow Area = 1.735 ac, 61.67% Impervious, Inflow Depth = 0.56" for 1/2 2 year event
Inflow = 0.25 cfs @ 7.90 hrs, Volume= 0.081 af
Outflow = 0.06 cfs @ 6.91 hrs, Volume= 0.081 af, Atten= 77%, Lag= 0.0 min
Primary = 0.06 cfs @ 6.91 hrs, Volume= 0.081 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 4.47' @ 10.04 hrs Surf.Area= 1,229 sf Storage= 583 cf

Plug-Flow detention time= 78.3 min calculated for 0.081 af (100% of inflow)
Center-of-Mass det. time= 78.3 min (797.6 - 719.3)

Volume	Invert	Avail.Storage	Storage Description
#1	4.00'	2,458 cf	**Planter Box Storage (Prismatic)** Listed below (Recalc)

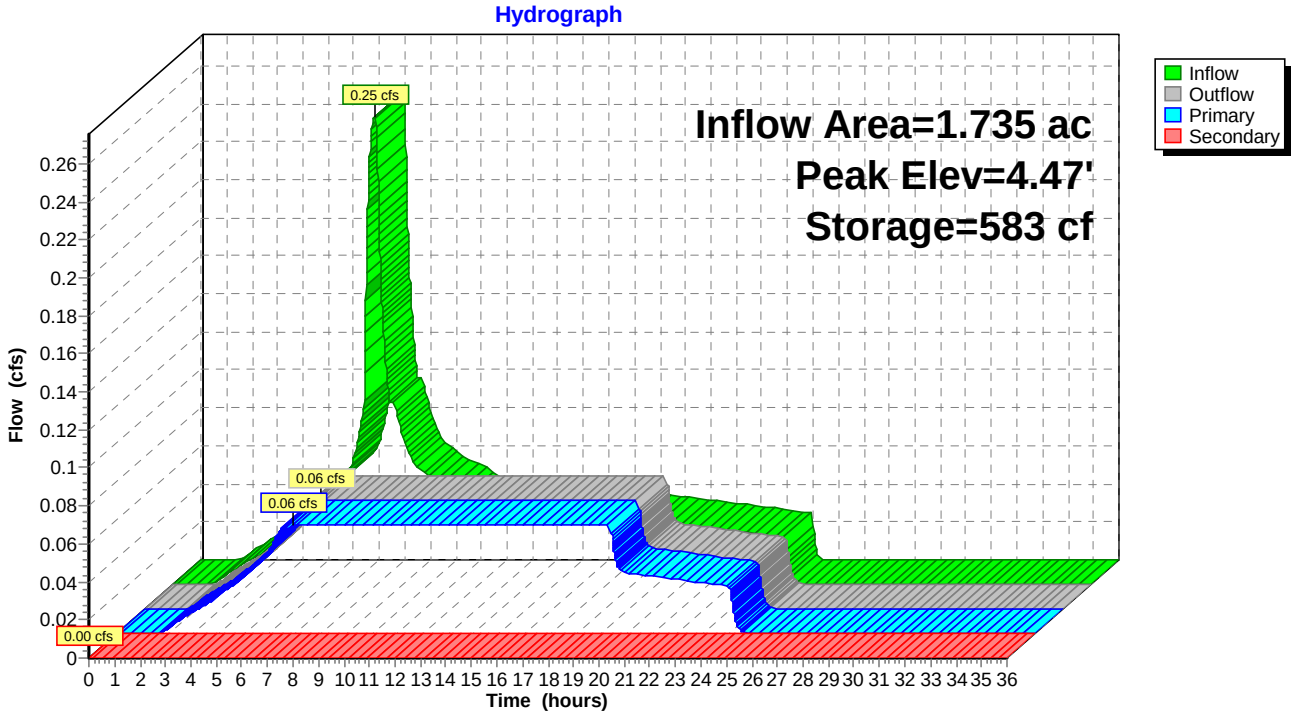
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
4.00	1,229	0	0
6.00	1,229	2,458	2,458

Device	Routing	Invert	Outlet Devices
#1	Primary	4.00'	**2.000 in/hr Flow through Growing Media over Surface area**
#2	Secondary	5.50'	**12.0" Horiz. Rock Box** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.06 cfs @ 6.91 hrs HW=4.02' (Free Discharge)
↑—**1=Flow through Growing Media** (Exfiltration Controls 0.06 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=4.00' (Free Discharge)
↑—**2=Rock Box** (Controls 0.00 cfs)

Pond 1 - GM: PB 1 - GM



Summary for Pond 1 - DR: PB 1 - DR

Inflow Area = 1.735 ac, 61.67% Impervious, Inflow Depth = 0.56" for 1/2 2 year event
Inflow = 0.06 cfs @ 6.91 hrs, Volume= 0.081 af
Outflow = 0.06 cfs @ 19.38 hrs, Volume= 0.070 af, Atten= 0%, Lag= 748.2 min
Discarded = 0.02 cfs @ 4.20 hrs, Volume= 0.054 af
Primary = 0.04 cfs @ 19.38 hrs, Volume= 0.016 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 3.09' @ 19.38 hrs Surf.Area= 1,229 sf Storage= 1,367 cf

Plug-Flow detention time= 441.8 min calculated for 0.070 af (86% of inflow)
Center-of-Mass det. time= 360.1 min (1,157.7 - 797.6)

Volume	Invert	Avail.Storage	Storage Description
#1	0.00'	1,770 cf	**Drain Rock Storage (Prismatic)** Listed below (Recalc) 4,916 cf Overall x 36.0% Voids

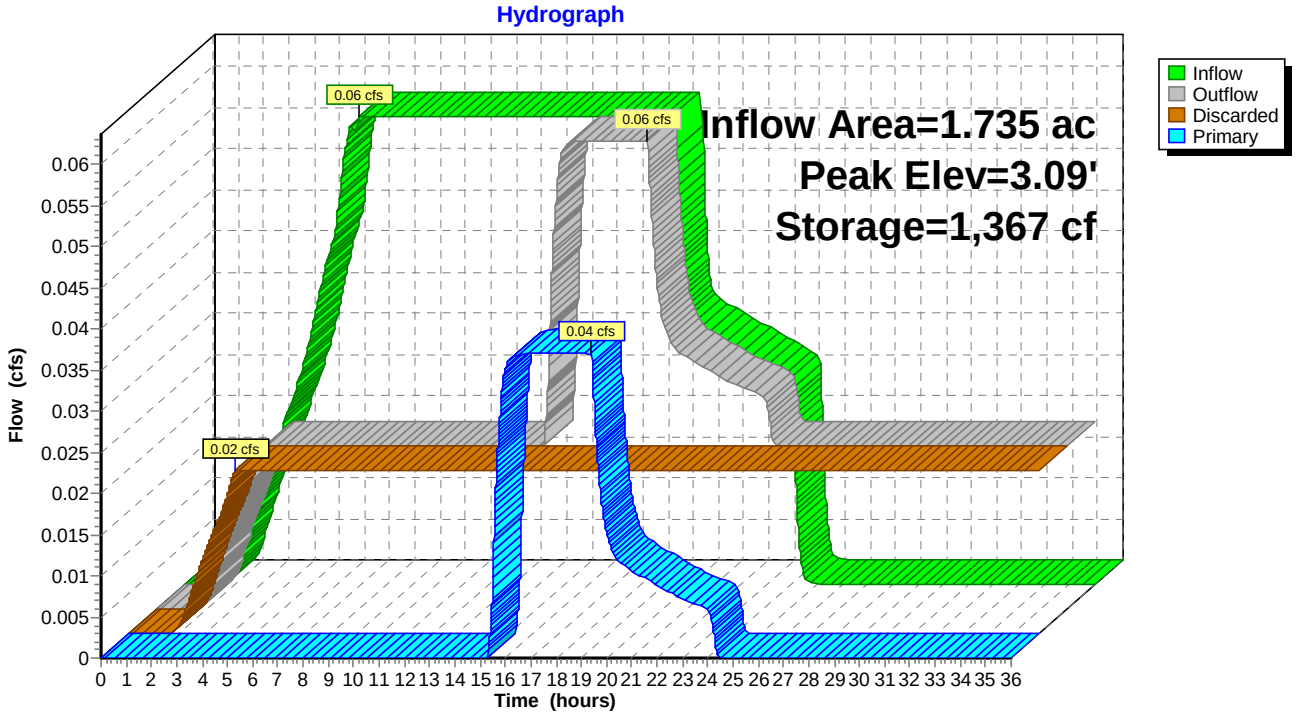
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
0.00	1,229	0	0
4.00	1,229	4,916	4,916

Device	Routing	Invert	Outlet Devices
#1	Discarded	0.00'	**0.700 in/hr Native Infiltration over Surface area**
#2	Primary	3.00'	**12.0" Vert. Underdrain** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.02 cfs @ 4.20 hrs HW=0.04' (Free Discharge)
↑—**1=Native Infiltration** (Exfiltration Controls 0.02 cfs)

Primary OutFlow Max=0.04 cfs @ 19.38 hrs HW=3.09' (Free Discharge)
↑—**2=Underdrain** (Orifice Controls 0.04 cfs @ 1.02 fps)

Pond 1 - DR: PB 1 - DR



Summary for Pond 1P: Underground Storage Pipe

Inflow Area = 1.735 ac, 61.67% Impervious, Inflow Depth = 0.11" for 1/2 2 year event
Inflow = 0.04 cfs @ 19.38 hrs, Volume= 0.016 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 0.95' @ 24.38 hrs Surf.Area= 0.023 ac Storage= 0.016 af

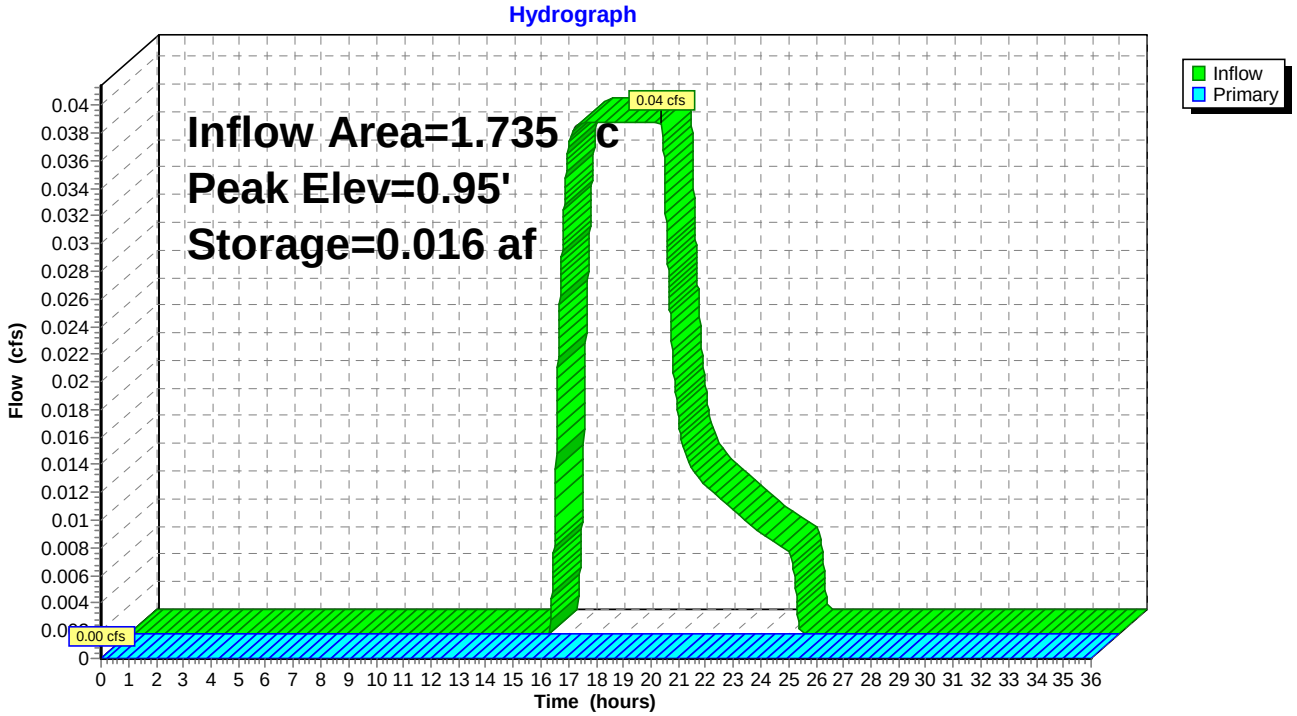
Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= (not calculated: no outflow)

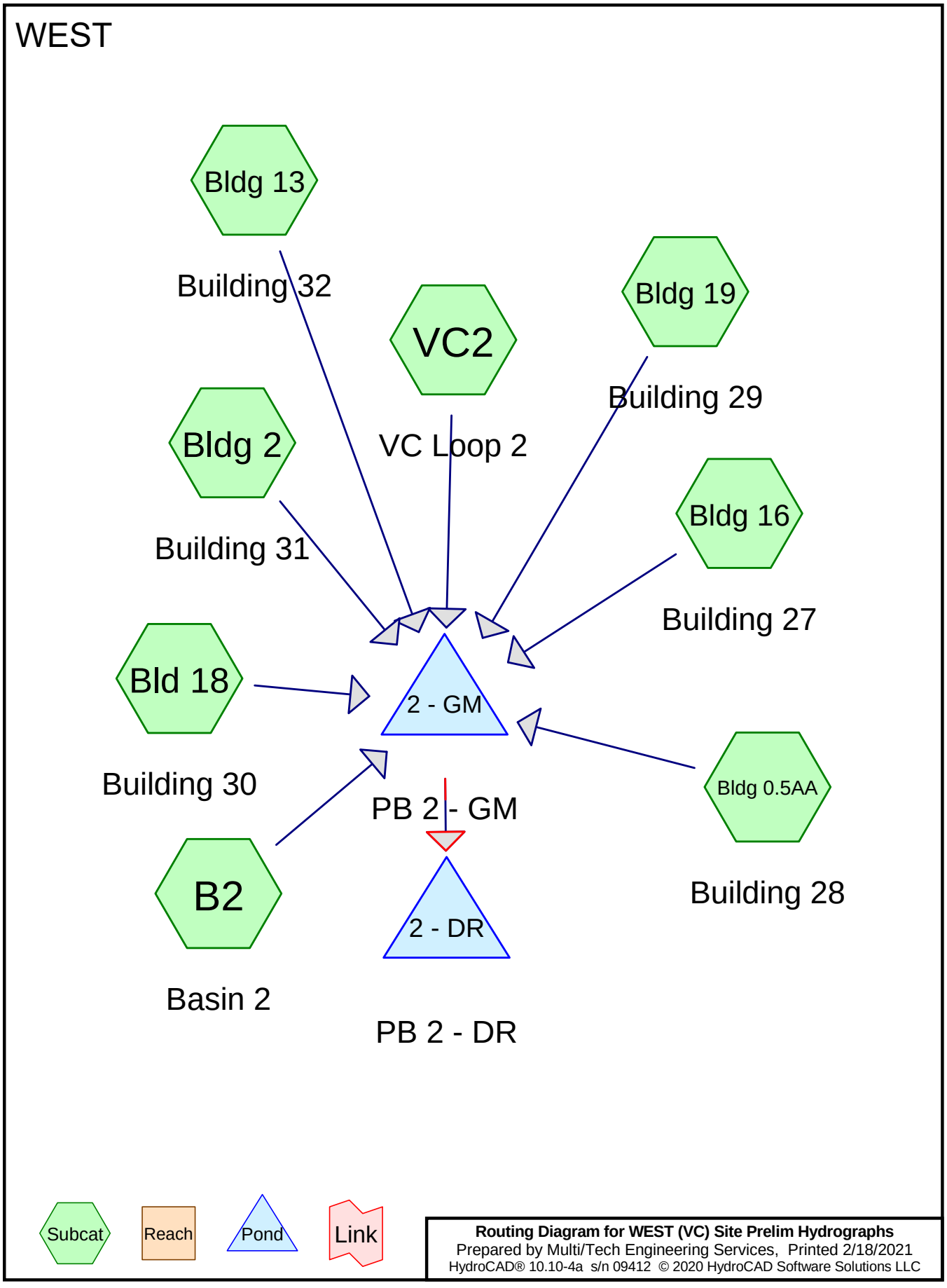
Volume	Invert	Avail.Storage	Storage Description
#1	0.00'	0.087 af	**48.0" Round Pipe Storage** L= 300.0'

Device	Routing	Invert	Outlet Devices
#1	Primary	2.50'	**4.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=0.00' (Free Discharge)
1=Orifice/Grate (Controls 0.00 cfs)

Pond 1P: Underground Storage Pipe




WEST
Bldg 13
Building 32
VC2
VC Loop 2
Bldg 19
Building 29
Bldg 2
Building 31
Bldg 16
Building 27
Bld 18
Building 30
2 - GM
Bldg 0.5AA
Building 28
PB 2 - GM
B2
Basin 2
2 - DR
PB 2 - DR
Subcat
Reach
Pond
Link
Routing Diagram for WEST (VC) Site Prelim Hydrographs
Prepared by Multi/Tech Engineering Services, Printed 2/18/2021
HydroCAD® 10.10-4a s/n 09412 © 2020 HydroCAD Software Solutions LLC

Summary for Subcatchment B2: Basin 2

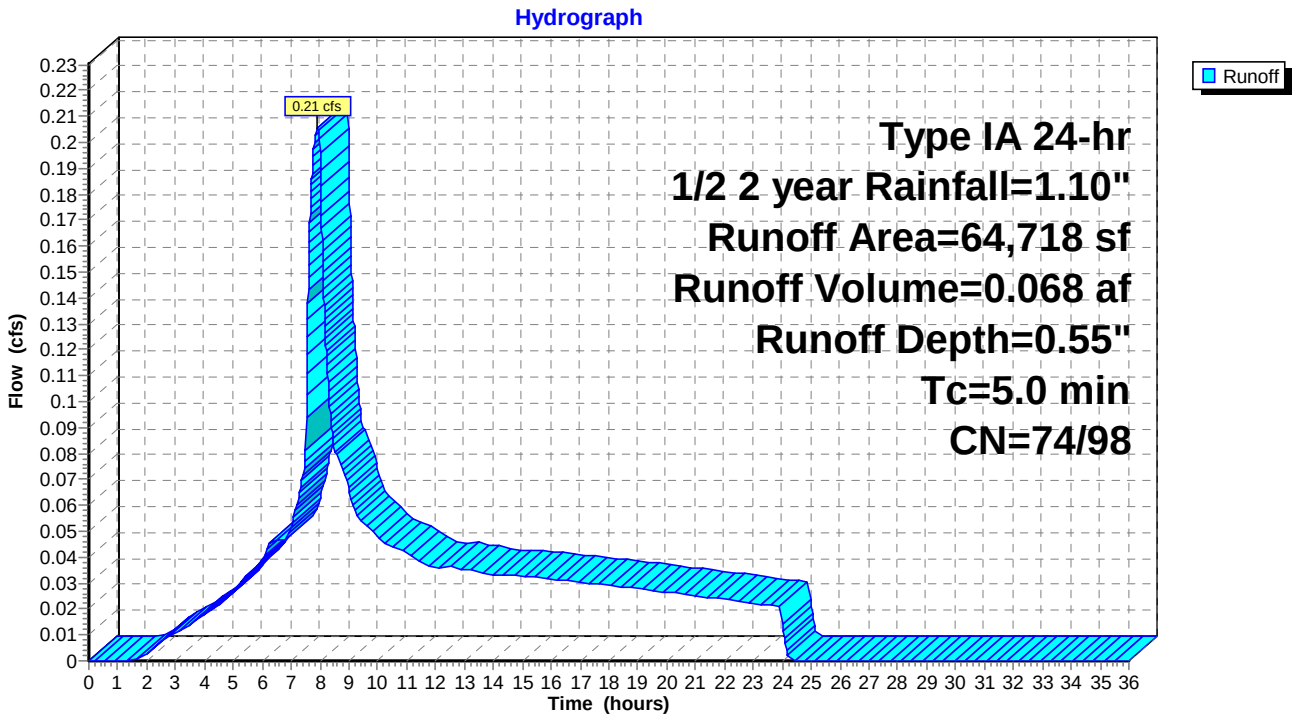
Runoff = 0.21 cfs @ 7.90 hrs, Volume= 0.068 af, Depth= 0.55"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type IA 24-hr 1/2 2 year Rainfall=1.10"

	Area (sf)	CN	Description
	21,385	74	>75% Grass cover, Good, HSG C
	38,965	98	Paved parking, HSG C
*	4,368	72	Planter Box
	64,718	88	Weighted Average
	25,753	74	39.79% Pervious Area
	38,965	98	60.21% Impervious Area

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

Subcatchment B2: Basin 2



Summary for Subcatchment Bld 18: Building 30

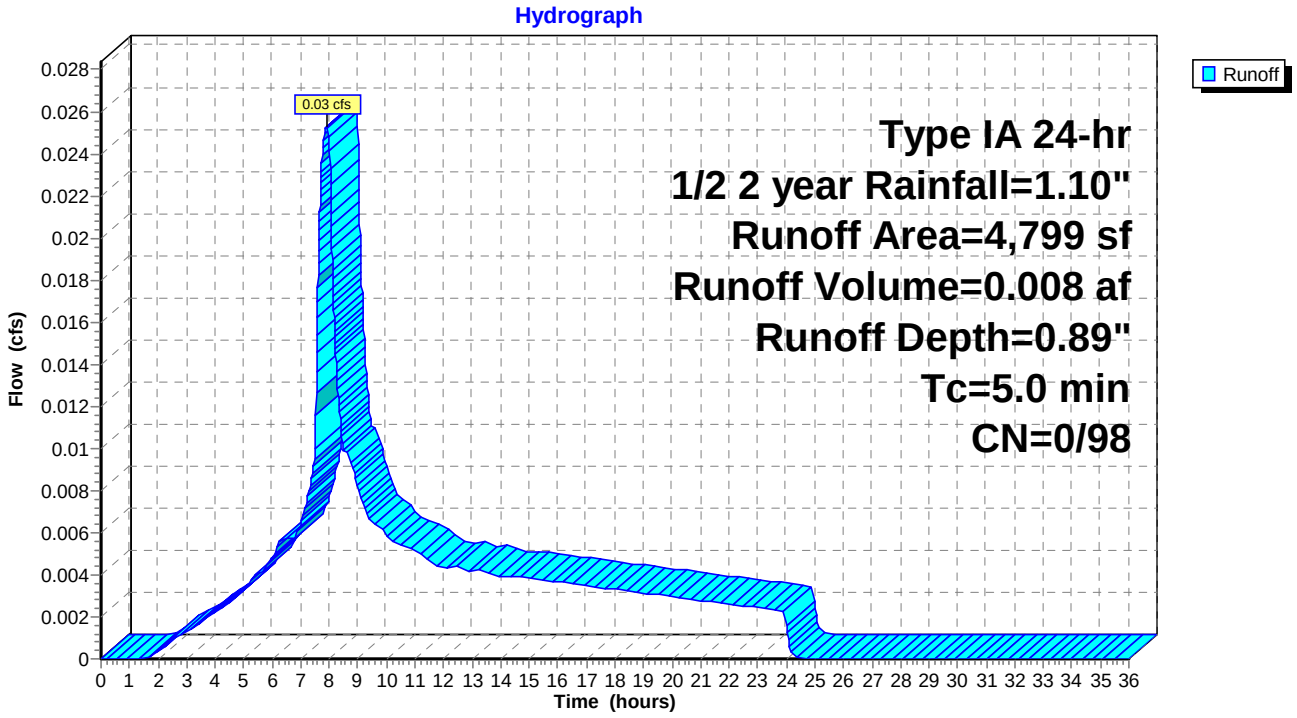
Runoff = 0.03 cfs @ 7.90 hrs, Volume= 0.008 af, Depth= 0.89"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type IA 24-hr 1/2 2 year Rainfall=1.10"

Area (sf)	CN	Description
4,799	98	Roofs, HSG C
4,799	98	100.00% Impervious Area

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

Subcatchment Bld 18: Building 30



Summary for Subcatchment Bldg 0.5AA: Building 28

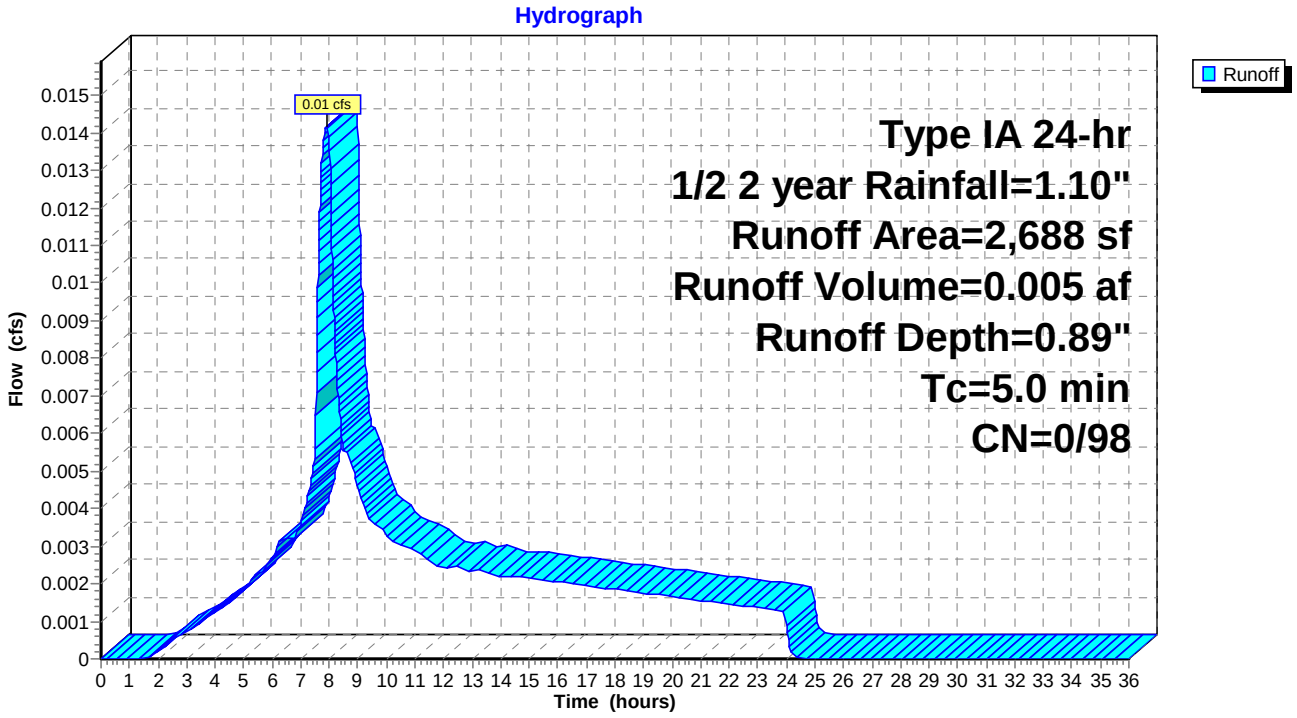
Runoff = 0.01 cfs @ 7.90 hrs, Volume= 0.005 af, Depth= 0.89"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type IA 24-hr 1/2 2 year Rainfall=1.10"

Area (sf)	CN	Description
2,688	98	Roofs, HSG C
2,688	98	100.00% Impervious Area

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

Subcatchment Bldg 0.5AA: Building 28



Summary for Subcatchment Bldg 13: Building 32

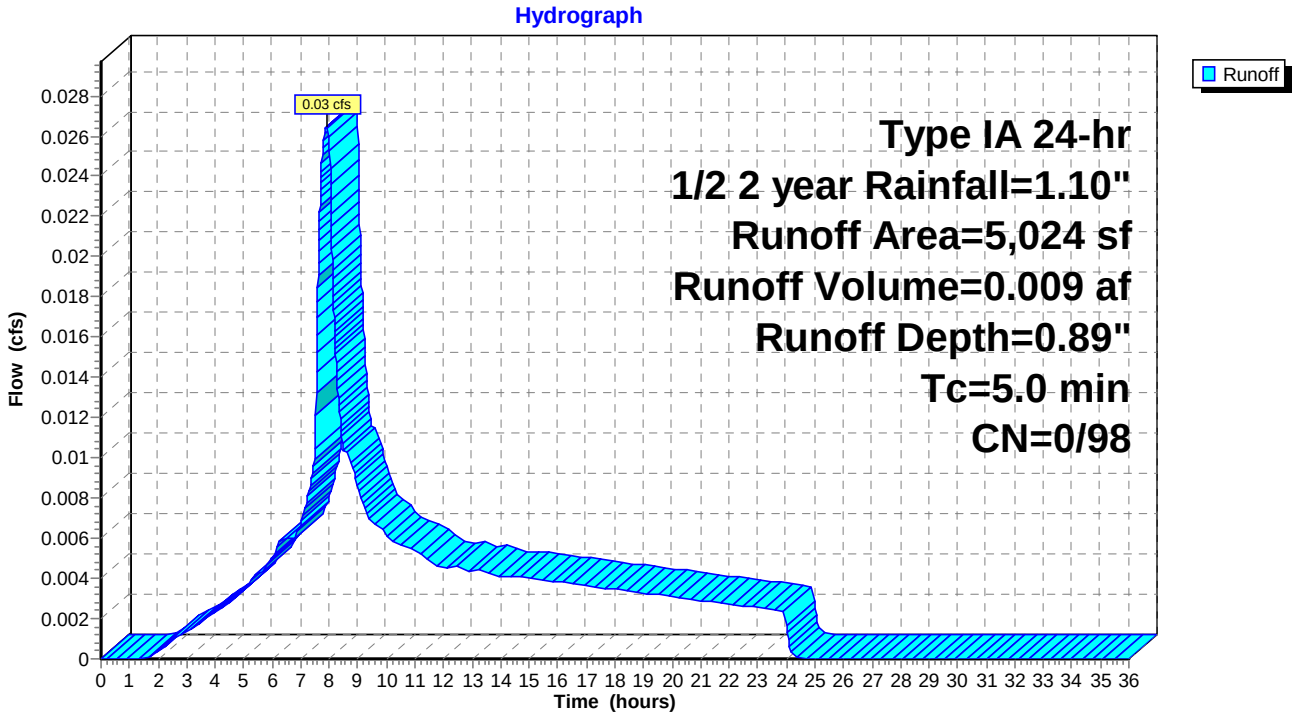
Runoff = 0.03 cfs @ 7.90 hrs, Volume= 0.009 af, Depth= 0.89"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type IA 24-hr 1/2 2 year Rainfall=1.10"

Area (sf)	CN	Description
5,024	98	Roofs, HSG C
5,024	98	100.00% Impervious Area

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

Subcatchment Bldg 13: Building 32



Summary for Subcatchment Bldg 16: Building 27

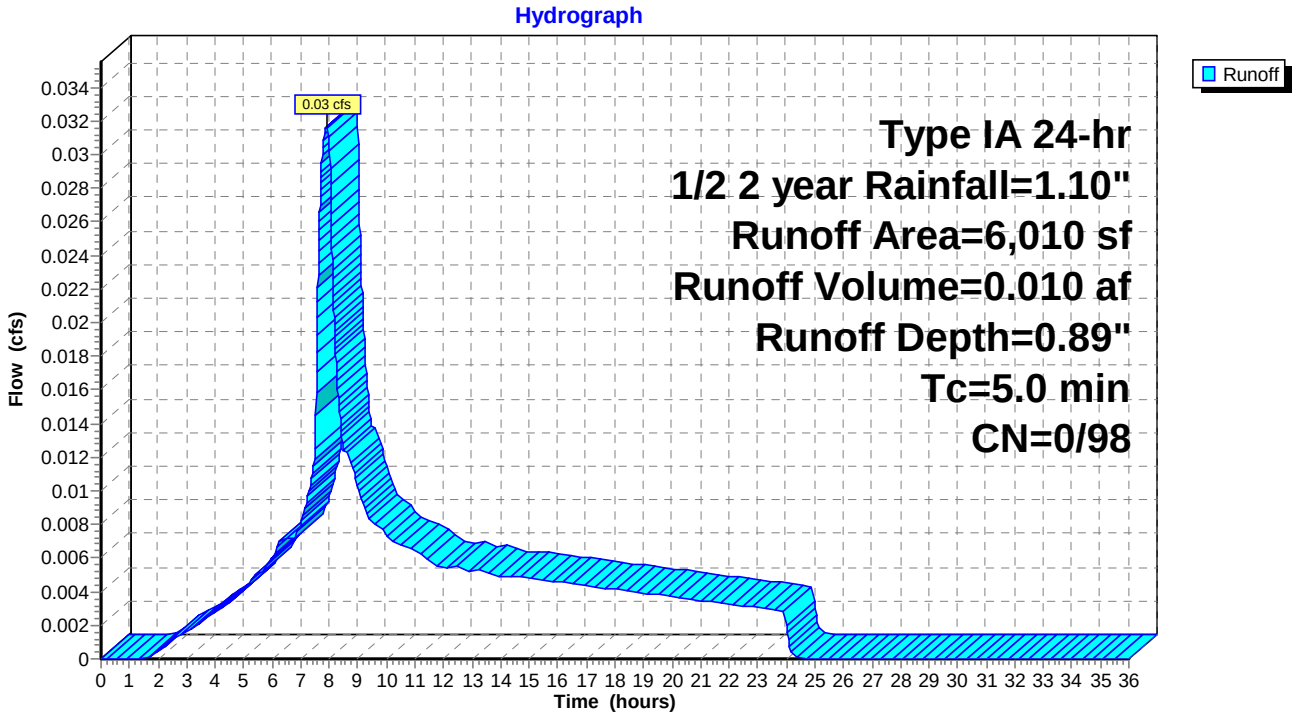
Runoff = 0.03 cfs @ 7.90 hrs, Volume= 0.010 af, Depth= 0.89"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type IA 24-hr 1/2 2 year Rainfall=1.10"

Area (sf)	CN	Description
6,010	98	Roofs, HSG C
6,010	98	100.00% Impervious Area

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

Subcatchment Bldg 16: Building 27



Summary for Subcatchment Bldg 19: Building 29

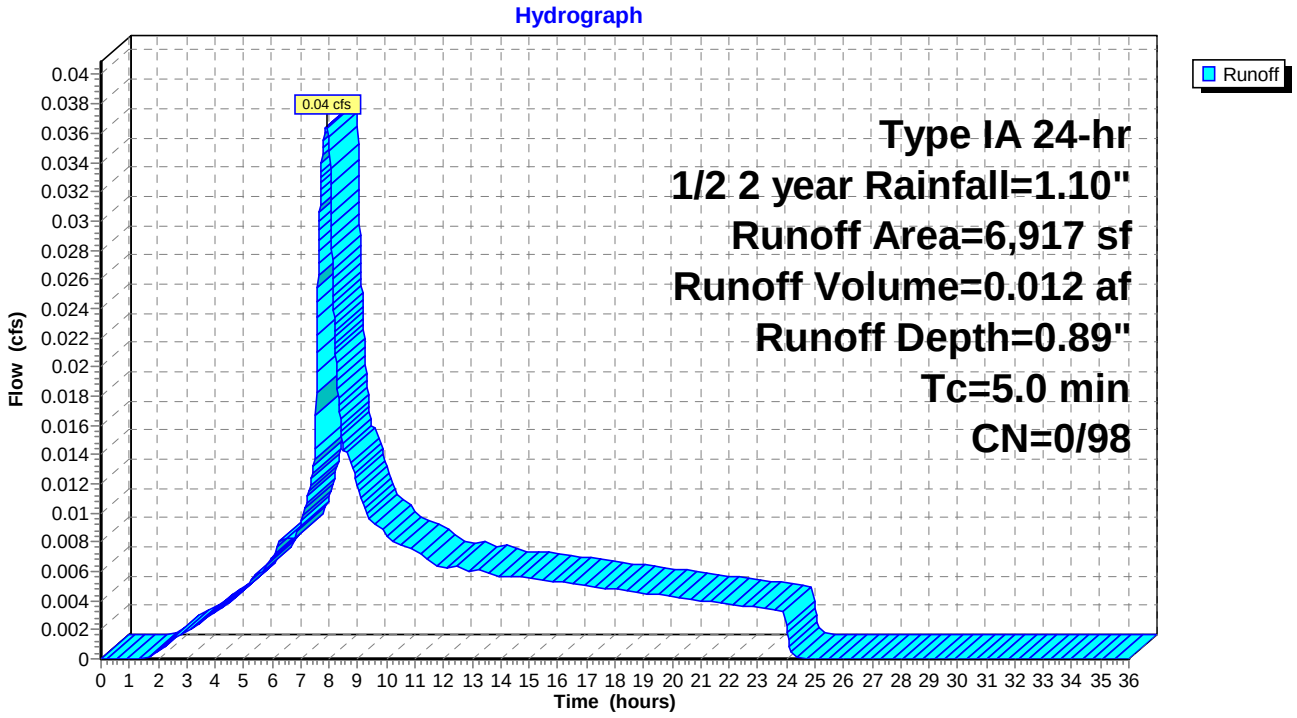
Runoff = 0.04 cfs @ 7.90 hrs, Volume= 0.012 af, Depth= 0.89"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type IA 24-hr 1/2 2 year Rainfall=1.10"

Area (sf)	CN	Description
6,917	98	Roofs, HSG C
6,917	98	100.00% Impervious Area

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

Subcatchment Bldg 19: Building 29



Summary for Subcatchment Bldg 2: Building 31

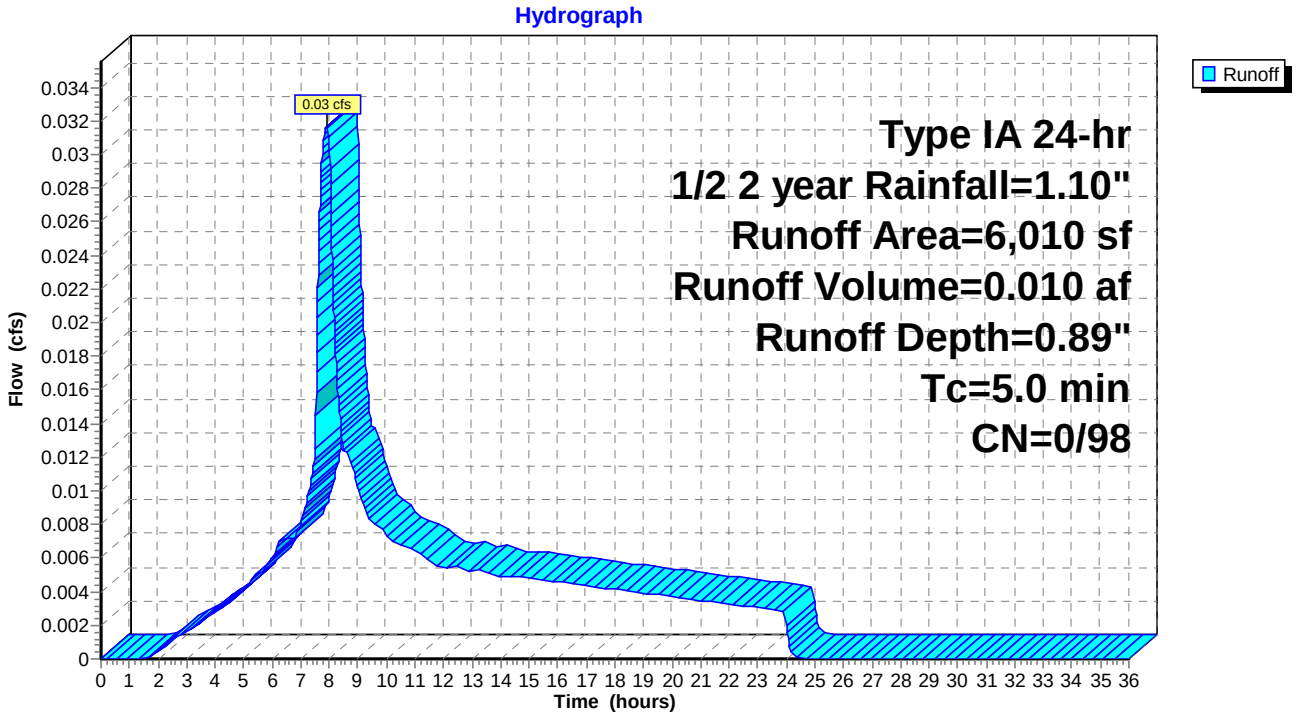
Runoff = 0.03 cfs @ 7.90 hrs, Volume= 0.010 af, Depth= 0.89"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type IA 24-hr 1/2 2 year Rainfall=1.10"

Area (sf)	CN	Description
6,010	98	Roofs, HSG C
6,010	98	100.00% Impervious Area

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

Subcatchment Bldg 2: Building 31



Summary for Subcatchment VC2: VC Loop 2

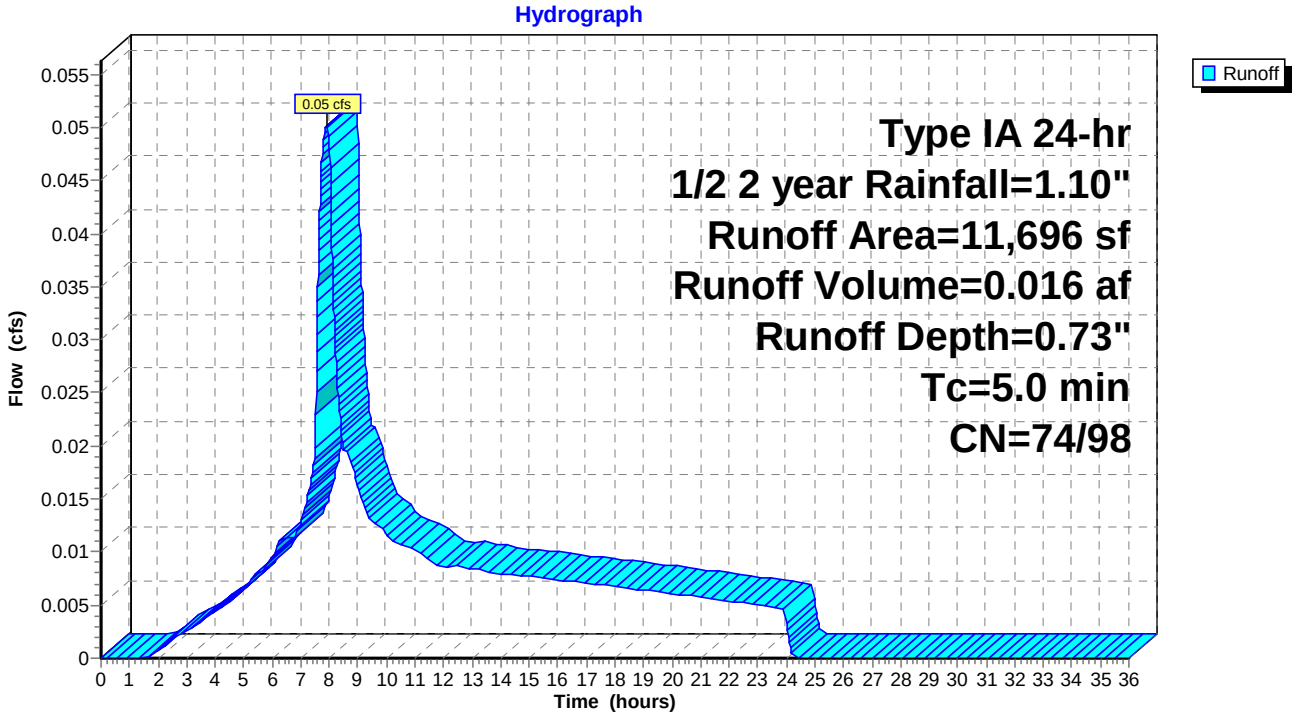
Runoff = 0.05 cfs @ 7.90 hrs, Volume= 0.016 af, Depth= 0.73"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type IA 24-hr 1/2 2 year Rainfall=1.10"

Area (sf)	CN	Description
2,181	74	>75% Grass cover, Good, HSG C
9,515	98	Paved parking, HSG C
11,696	94	Weighted Average
2,181	74	18.65% Pervious Area
9,515	98	81.35% Impervious Area

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

Subcatchment VC2: VC Loop 2



Summary for Pond 2 - GM: PB 2 - GM

Inflow Area = 2.476 ac, 74.10% Impervious, Inflow Depth = 0.67" for 1/2 2 year event
Inflow = 0.42 cfs @ 7.90 hrs, Volume= 0.138 af
Outflow = 0.21 cfs @ 7.61 hrs, Volume= 0.138 af, Atten= 50%, Lag= 0.0 min
Primary = 0.21 cfs @ 7.61 hrs, Volume= 0.138 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 4.10' @ 8.31 hrs Surf.Area= 4,519 sf Storage= 439 cf

Plug-Flow detention time= 11.6 min calculated for 0.138 af (100% of inflow)
Center-of-Mass det. time= 11.6 min (725.8 - 714.2)

Volume	Invert	Avail.Storage	Storage Description
#1	4.00'	9,038 cf	**Planter Box Storage (Prismatic)** Listed below (Recalc)

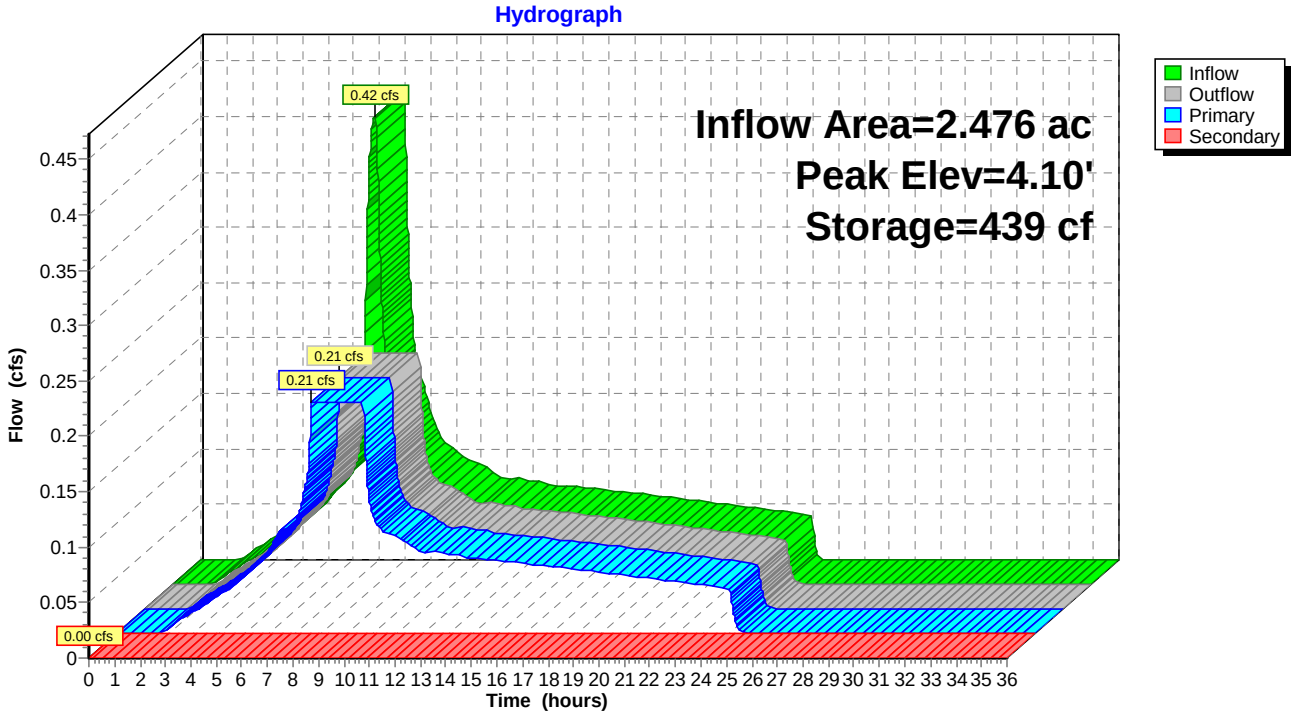
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
4.00	4,519	0	0
5.00	4,519	4,519	4,519
6.00	4,519	4,519	9,038

Device	Routing	Invert	Outlet Devices
#1	Primary	4.00'	**2.000 in/hr Flow through Growing Media over Surface area**
#2	Secondary	5.50'	**8.0" Horiz. Rock Box** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.21 cfs @ 7.61 hrs HW=4.02' (Free Discharge)
↑—**1=Flow through Growing Media** (Exfiltration Controls 0.21 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=4.00' (Free Discharge)
↑—**2=Rock Box** (Controls 0.00 cfs)

Pond 2 - GM: PB 2 - GM



Summary for Pond 2 - DR: PB 2 - DR

Inflow Area = 2.476 ac, 74.10% Impervious, Inflow Depth = 0.67" for 1/2 2 year event
Inflow = 0.21 cfs @ 7.61 hrs, Volume= 0.138 af
Outflow = 0.07 cfs @ 6.13 hrs, Volume= 0.138 af, Atten= 65%, Lag= 0.0 min
Discarded = 0.07 cfs @ 6.13 hrs, Volume= 0.138 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 0.89' @ 12.67 hrs Surf.Area= 4,519 sf Storage= 1,440 cf

Plug-Flow detention time= 209.5 min calculated for 0.138 af (100% of inflow)
Center-of-Mass det. time= 209.4 min (935.2 - 725.8)

Volume	Invert	Avail.Storage	Storage Description
#1	0.00'	6,507 cf	**Drain Rock Storage (Prismatic)** Listed below (Recalc) 18,076 cf Overall x 36.0% Voids

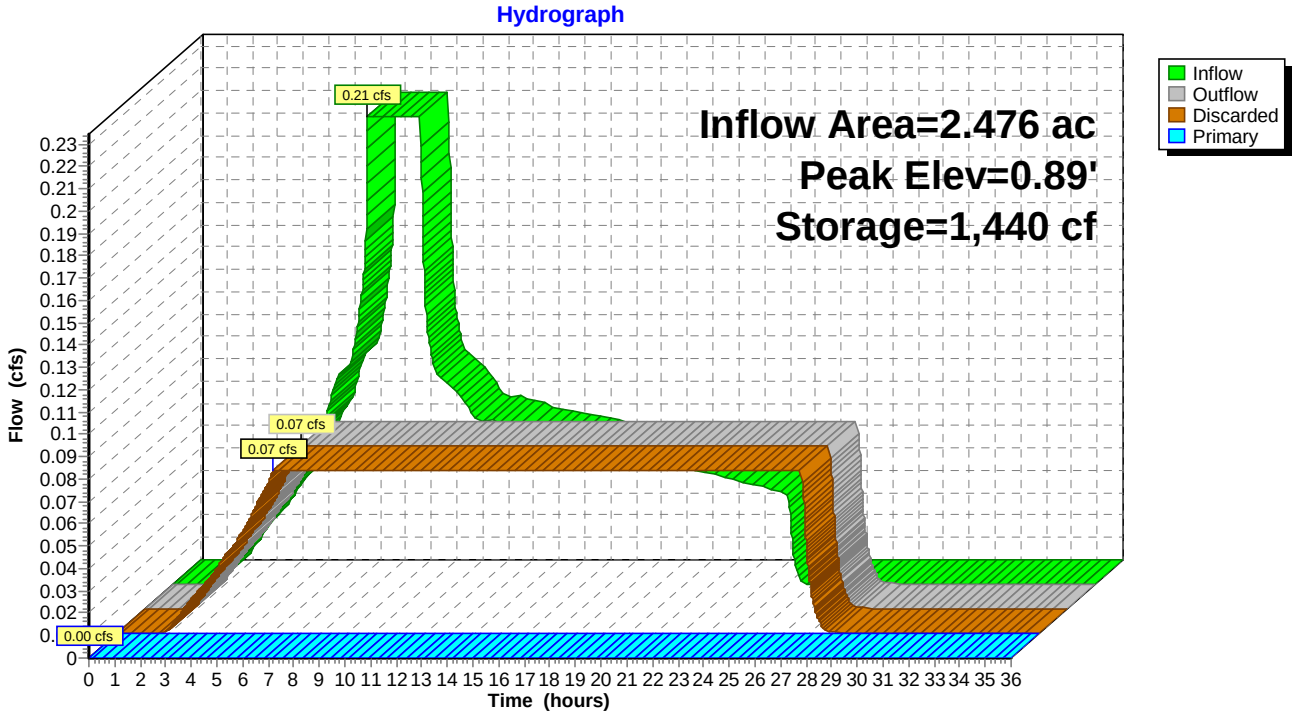
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
0.00	4,519	0	0
4.00	4,519	18,076	18,076

Device	Routing	Invert	Outlet Devices
#1	Discarded	0.00'	**0.700 in/hr Native Infiltration over Surface area**
#2	Primary	3.33'	**8.0" Vert. Underdrain** C= 0.600 Limited to weir flow at low heads

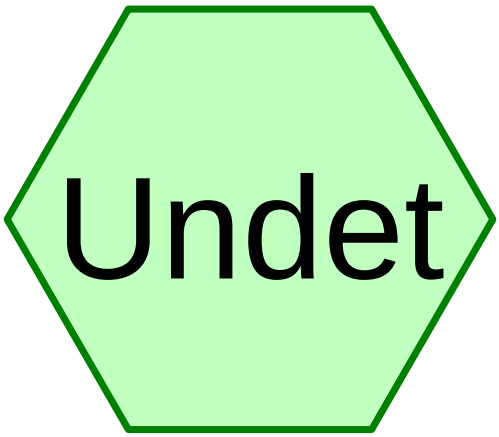
Discarded OutFlow Max=0.07 cfs @ 6.13 hrs HW=0.04' (Free Discharge)
↑—**1=Native Infiltration** (Exfiltration Controls 0.07 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=0.00' (Free Discharge)
↑—**2=Underdrain** (Controls 0.00 cfs)

Pond 2 - DR: PB 2 - DR



WEST



Undetained

Subcat Reach Pond Link

Routing Diagram for WEST (VC) Site Prelim Hydrographs
Prepared by Multi/Tech Engineering Services, Printed 2/18/2021

Summary for Subcatchment Undet: Undetained

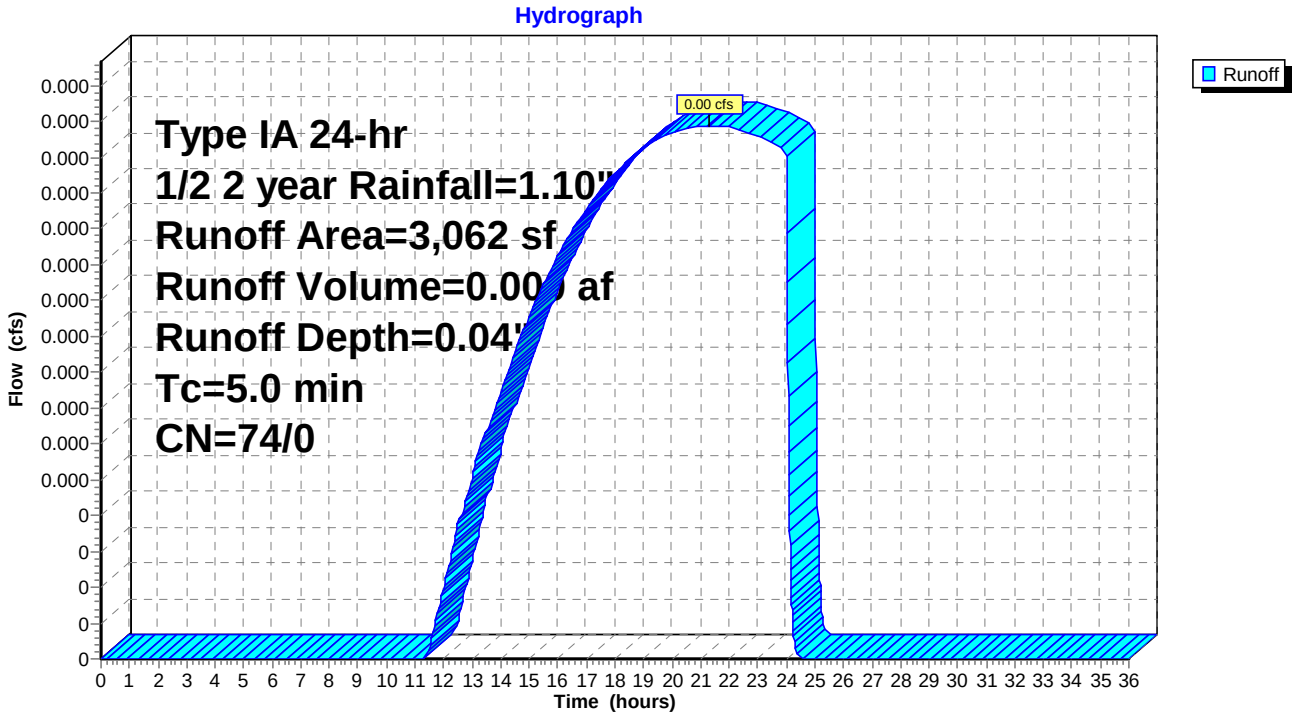
Runoff = 0.00 cfs @ 21.33 hrs, Volume= 0.000 af, Depth= 0.04"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type IA 24-hr 1/2 2 year Rainfall=1.10"

Area (sf)	CN	Description
3,062	74	>75% Grass cover, Good, HSG C
3,062	74	100.00% Pervious Area

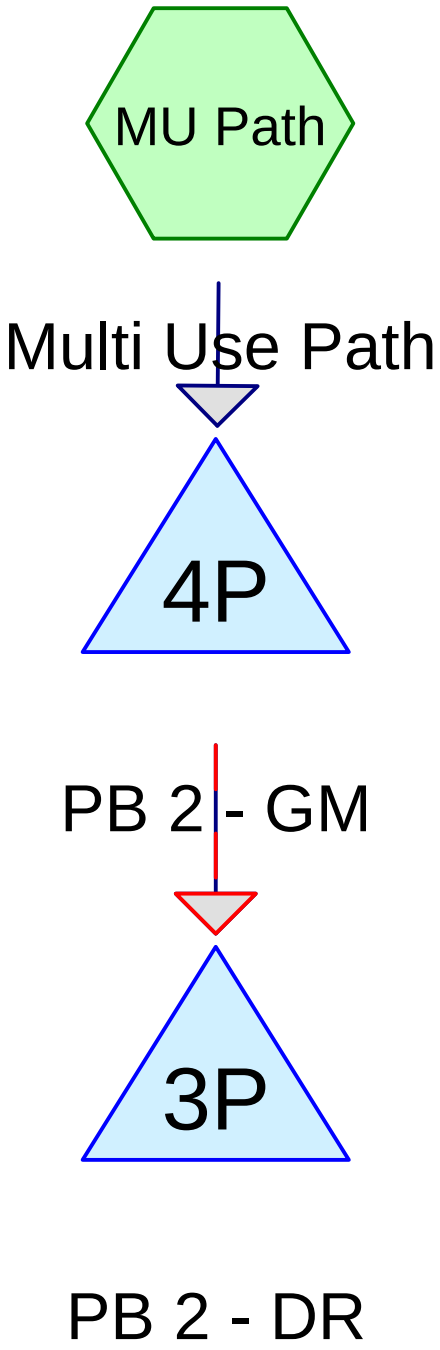
Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment Undet: Undetained



APPENDIX D: 10 YEAR HYDROGRAPHS

EAST



Subcat Reach Pond Link

Routing Diagram for EAST (Reed Rd) Site Prelim Hydrograph
Prepared by Multi/Tech Engineering Services, Printed 2/17/2021

Summary for Subcatchment MU Path: Multi Use Path

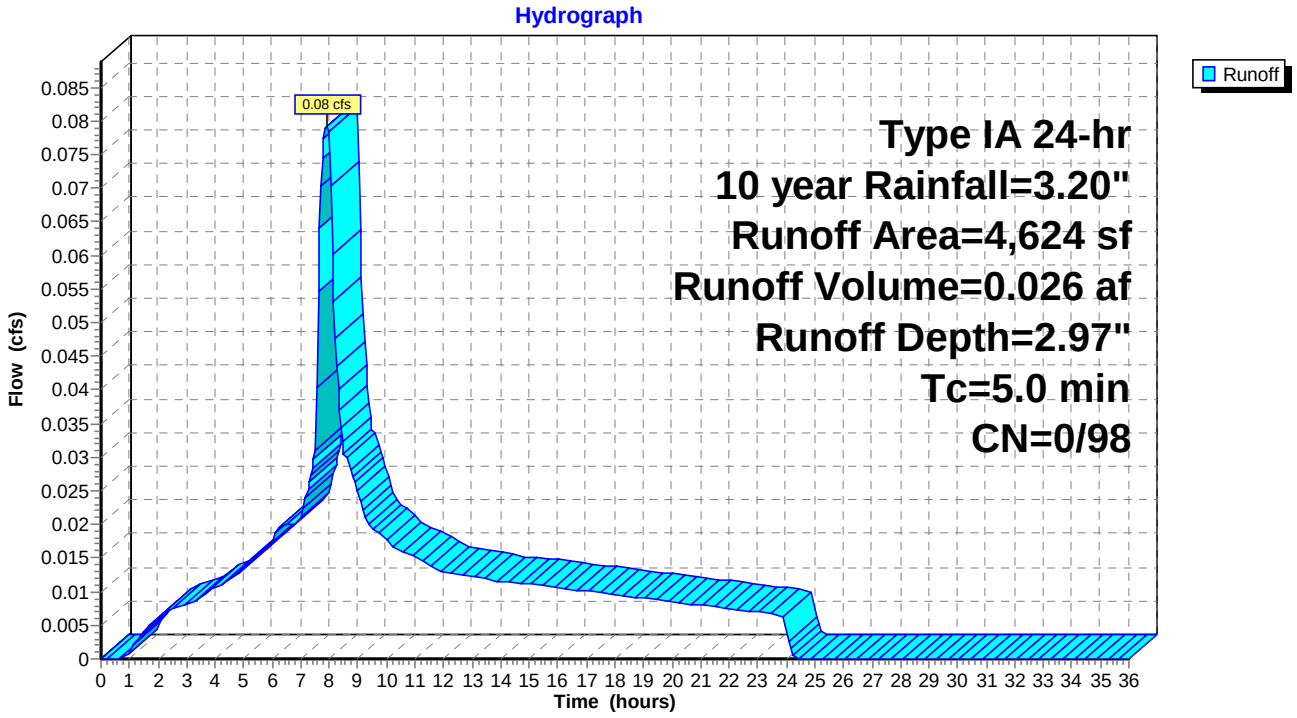
Runoff = 0.08 cfs @ 7.90 hrs, Volume= 0.026 af, Depth= 2.97"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type IA 24-hr 10 year Rainfall=3.20"

Area (sf)	CN	Description
4,624	98	Unconnected pavement, HSG C
4,624	98	100.00% Impervious Area

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

Subcatchment MU Path: Multi Use Path



Summary for Pond 4P: PB 2 - GM

Inflow Area = 0.106 ac,100.00% Impervious, Inflow Depth = 2.97" for 10 year event
Inflow = 0.08 cfs @ 7.90 hrs, Volume= 0.026 af
Outflow = 0.08 cfs @ 7.90 hrs, Volume= 0.026 af, Atten= 0%, Lag= 0.0 min
Primary = 0.08 cfs @ 7.90 hrs, Volume= 0.026 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 4.00' @ 7.90 hrs Surf.Area= 4,624 sf Storage= 0 cf

Plug-Flow detention time= 0.0 min calculated for 0.026 af (100% of inflow)
Center-of-Mass det. time= 0.0 min (666.4 - 666.4)

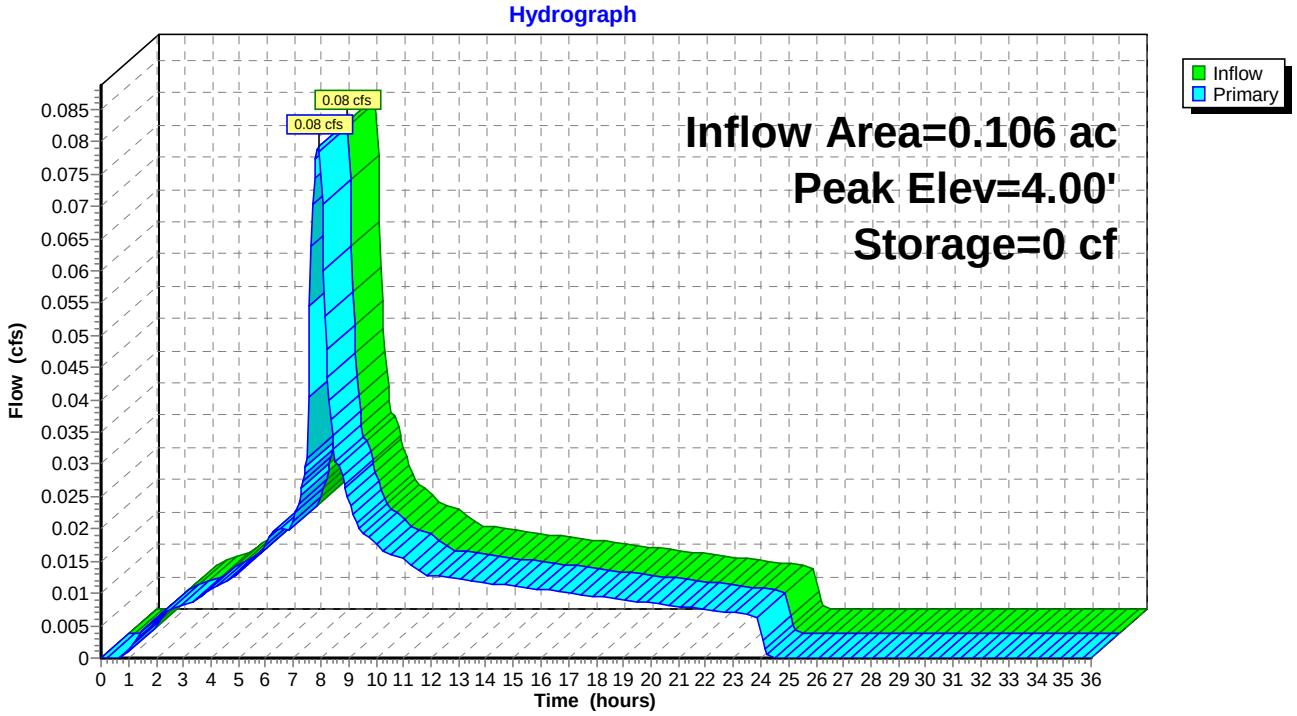
Volume	Invert	Avail.Storage	Storage Description
#1	4.00'	0 cf	**Growing Media (Prismatic)** Listed below (Recalc) 1,526 cf Overall x 0.0% Voids

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
4.00	4,624	0	0
4.33	4,624	1,526	1,526

Device	Routing	Invert	Outlet Devices
#1	Primary	4.00'	**100.000 in/hr Exfiltration over Surface area**

Primary OutFlow Max=10.70 cfs @ 7.90 hrs HW=4.00' (Free Discharge)
1=Exfiltration (Exfiltration Controls 10.70 cfs)

Pond 4P: PB 2 - GM



Summary for Pond 3P: PB 2 - DR

Inflow Area = 0.106 ac,100.00% Impervious, Inflow Depth = 2.97" for 10 year event
Inflow = 0.08 cfs @ 7.90 hrs, Volume= 0.026 af
Outflow = 0.03 cfs @ 7.60 hrs, Volume= 0.026 af, Atten= 59%, Lag= 0.0 min
Discarded = 0.03 cfs @ 7.60 hrs, Volume= 0.026 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 0.06' @ 8.46 hrs Surf.Area= 4,624 sf Storage= 106 cf

Plug-Flow detention time= 17.7 min calculated for 0.026 af (100% of inflow)
Center-of-Mass det. time= 17.6 min (684.0 - 666.4)

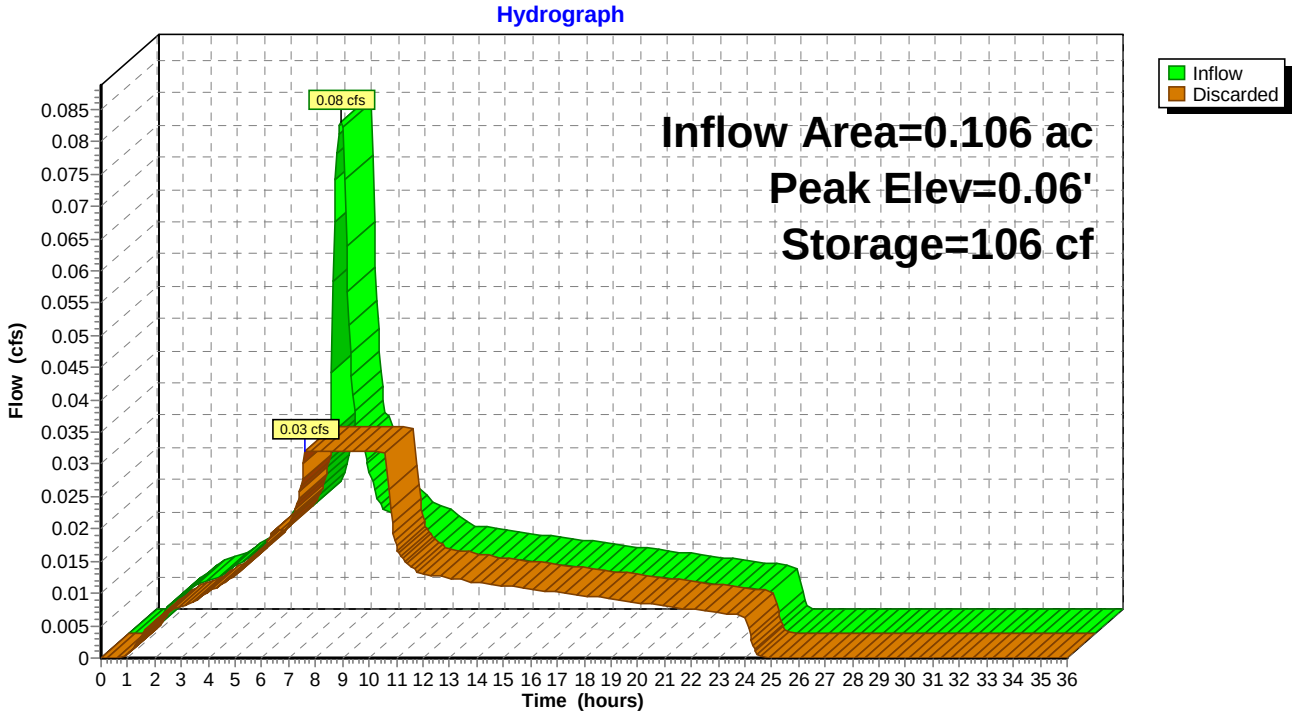
Volume	Invert	Avail.Storage	Storage Description
#1	0.00'	1,665 cf	**Drain Rock (Prismatic)** Listed below (Recalc) 4,624 cf Overall x 36.0% Voids

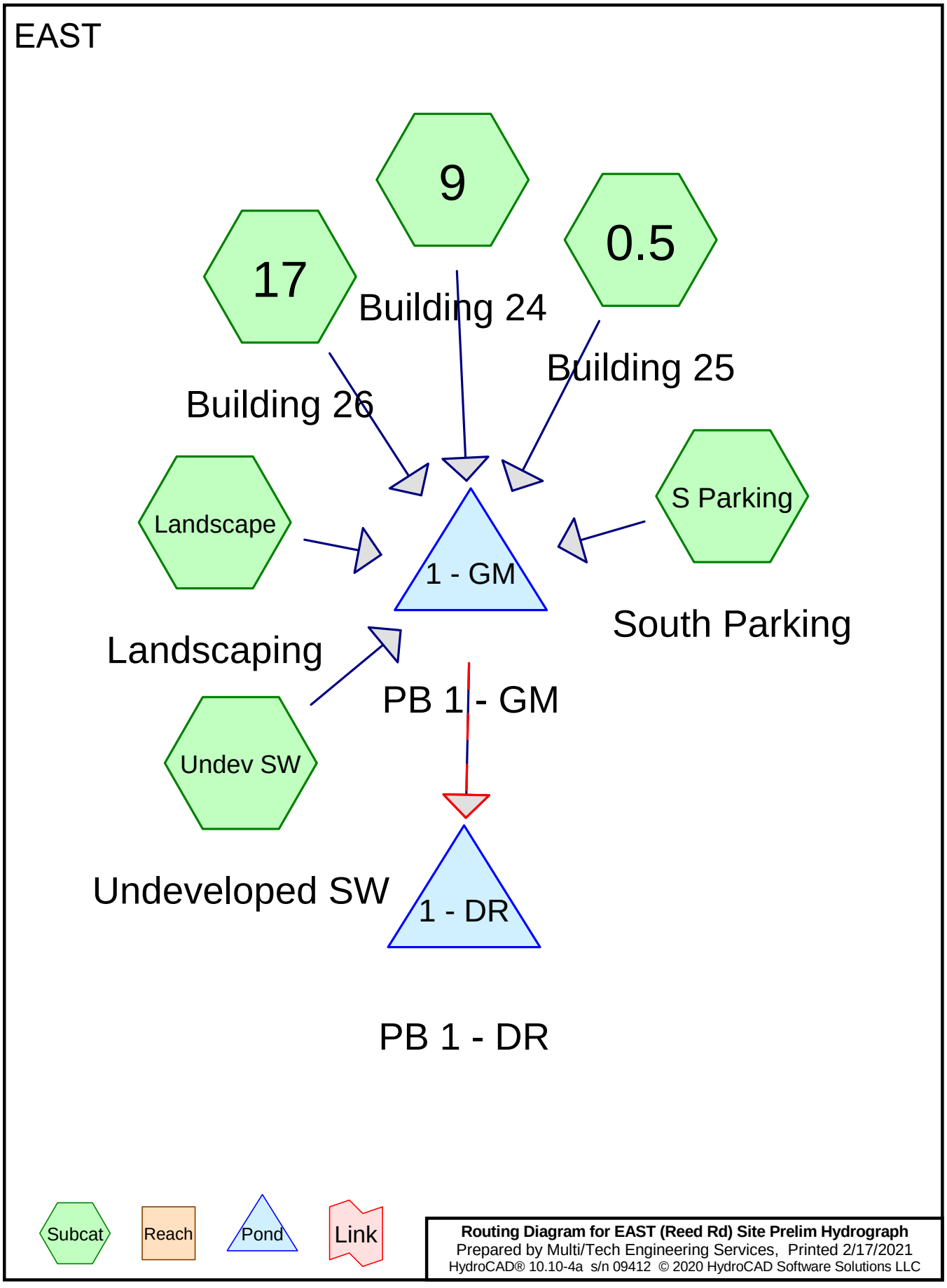
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
0.00	4,624	0	0
1.00	4,624	4,624	4,624

Device	Routing	Invert	Outlet Devices
#1	Discarded	0.00'	**0.300 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.03 cfs @ 7.60 hrs HW=0.01' (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 0.03 cfs)

Pond 3P: PB 2 - DR





Routing Diagram for EAST (Reed Rd) Site Prelim Hydrograph
Prepared by Multi/Tech Engineering Services, Printed 2/17/2021

Summary for Subcatchment 0.5: Building 25

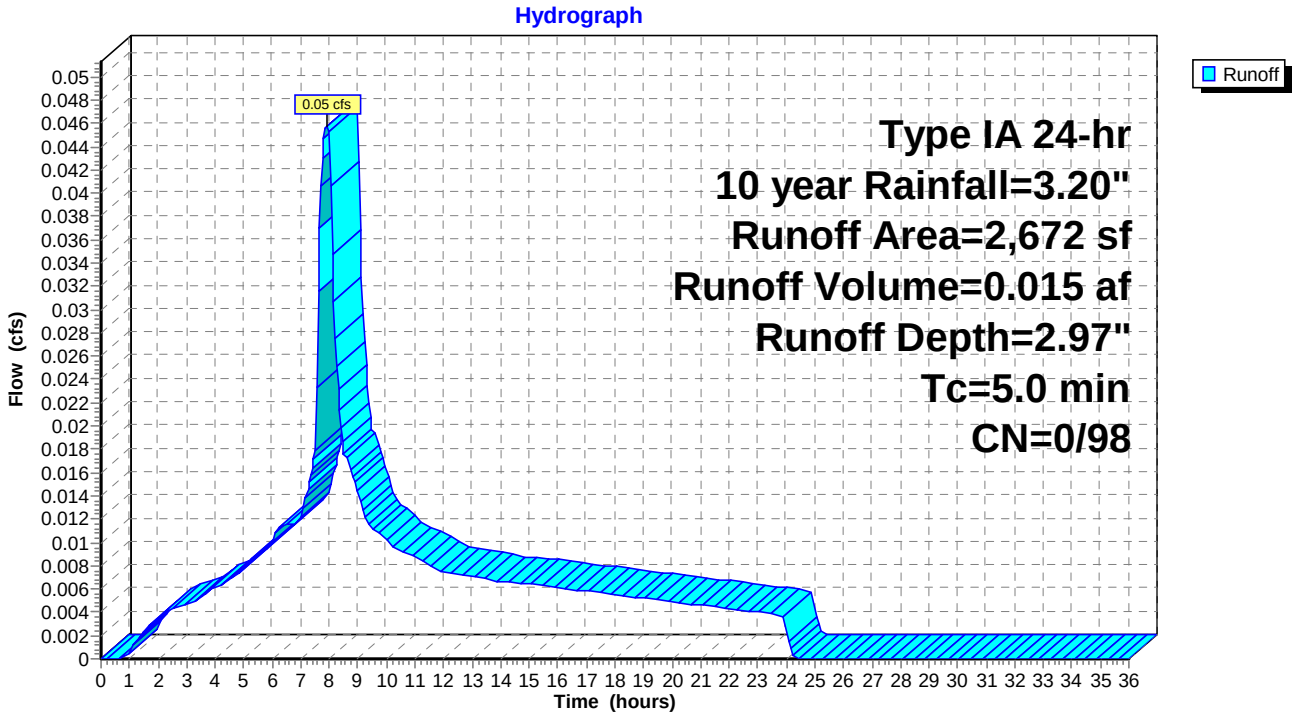
Runoff = 0.05 cfs @ 7.90 hrs, Volume= 0.015 af, Depth= 2.97"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type IA 24-hr 10 year Rainfall=3.20"

Area (sf)	CN	Description
2,672	98	Roofs, HSG C
2,672	98	100.00% Impervious Area

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

Subcatchment 0.5: Building 25



Summary for Subcatchment 9: Building 24

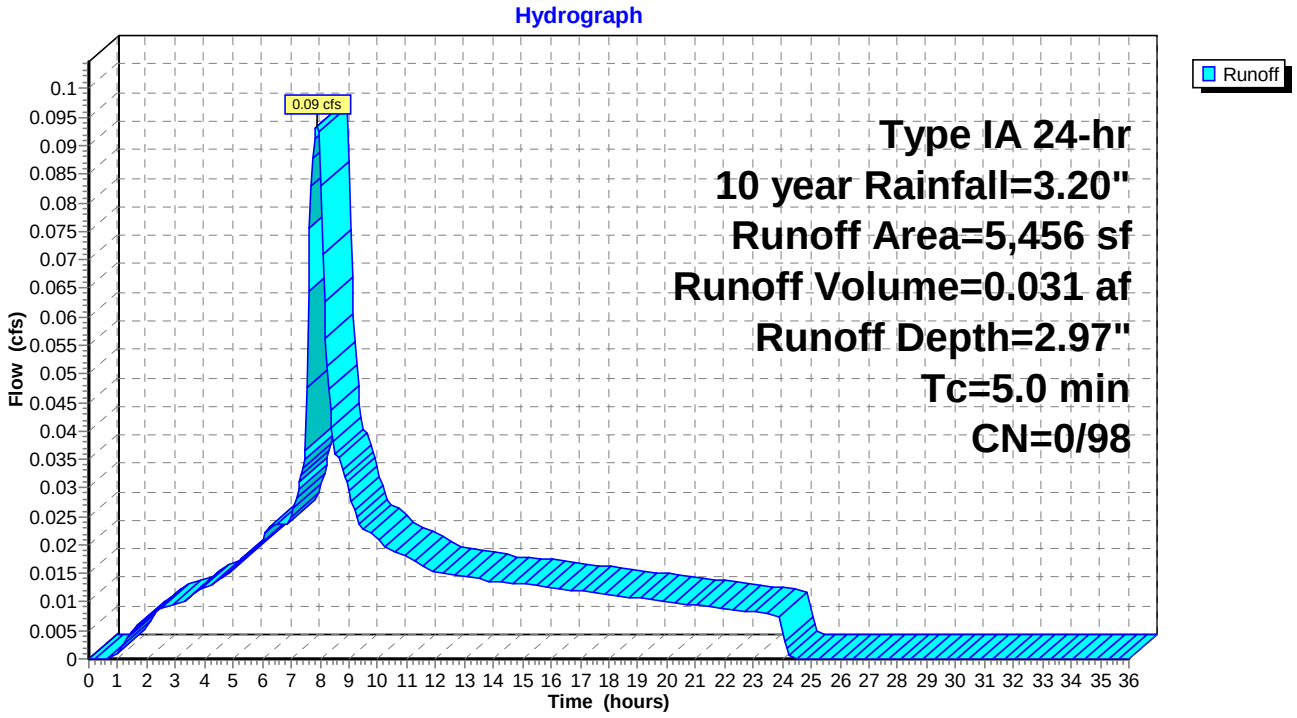
Runoff = 0.09 cfs @ 7.90 hrs, Volume= 0.031 af, Depth= 2.97"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type IA 24-hr 10 year Rainfall=3.20"

Area (sf)	CN	Description
5,456	98	Roofs, HSG C
5,456	98	100.00% Impervious Area

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

Subcatchment 9: Building 24



Summary for Subcatchment 17: Building 26

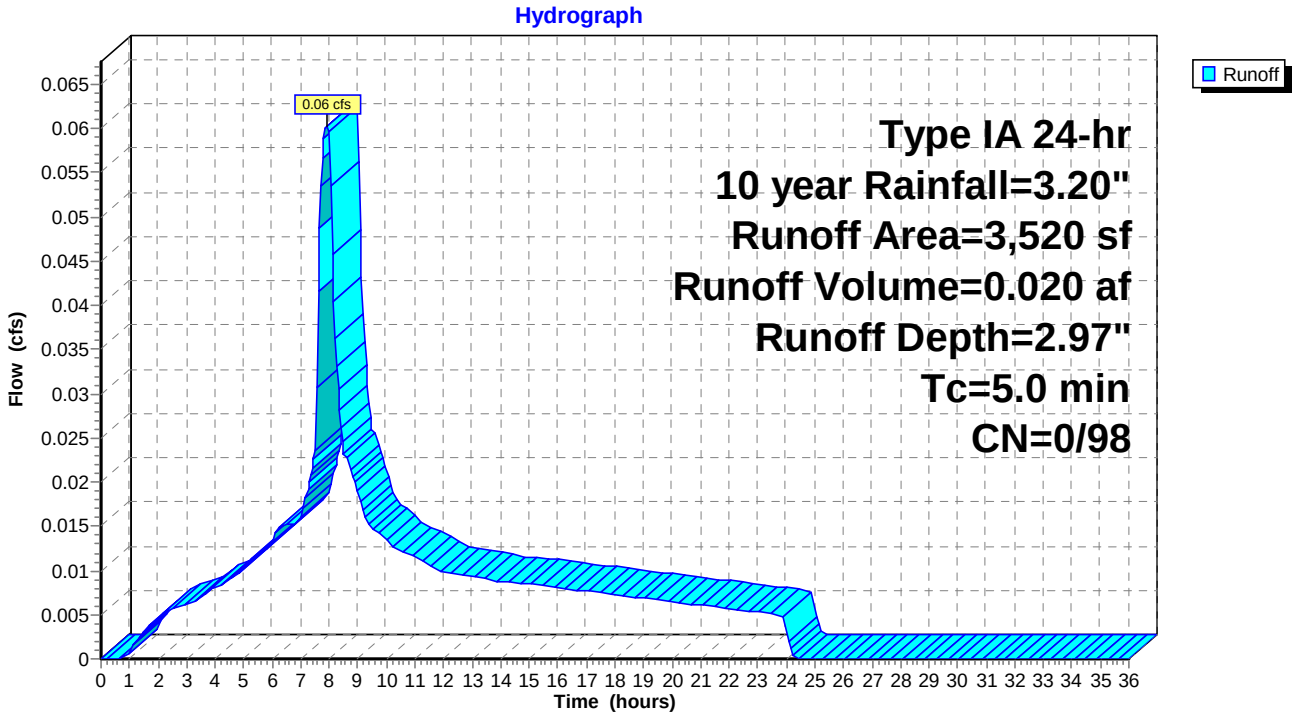
Runoff = 0.06 cfs @ 7.90 hrs, Volume= 0.020 af, Depth= 2.97"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type IA 24-hr 10 year Rainfall=3.20"

Area (sf)	CN	Description
3,520	98	Roofs, HSG C
3,520	98	100.00% Impervious Area

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

Subcatchment 17: Building 26



Summary for Subcatchment Landscape: Landscaping

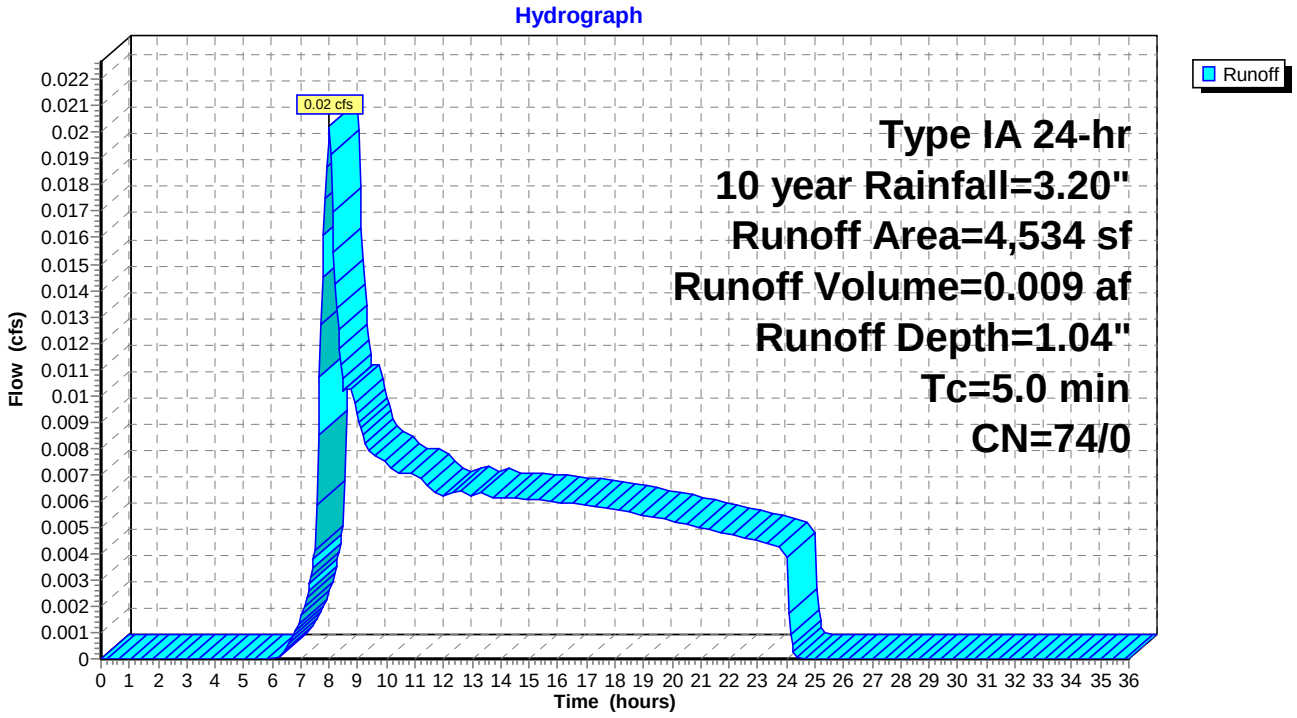
Runoff = 0.02 cfs @ 7.99 hrs, Volume= 0.009 af, Depth= 1.04"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type IA 24-hr 10 year Rainfall=3.20"

Area (sf)	CN	Description
4,534	74	>75% Grass cover, Good, HSG C
4,534	74	100.00% Pervious Area

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

Subcatchment Landscape: Landscaping



Summary for Subcatchment S Parking: South Parking

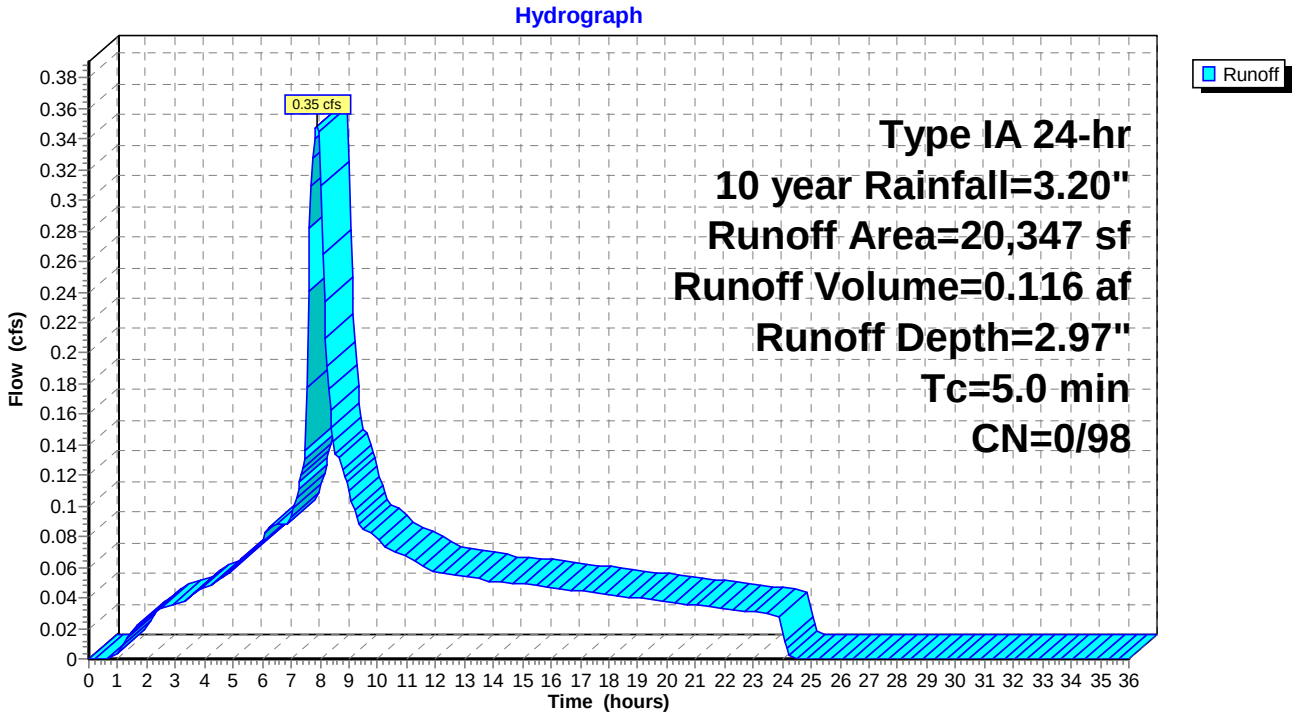
Runoff = 0.35 cfs @ 7.90 hrs, Volume= 0.116 af, Depth= 2.97"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type IA 24-hr 10 year Rainfall=3.20"

Area (sf)	CN	Description
20,347	98	Paved parking, HSG C
20,347	98	100.00% Impervious Area

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

Subcatchment S Parking: South Parking



Summary for Subcatchment Undev SW: Undeveloped SW

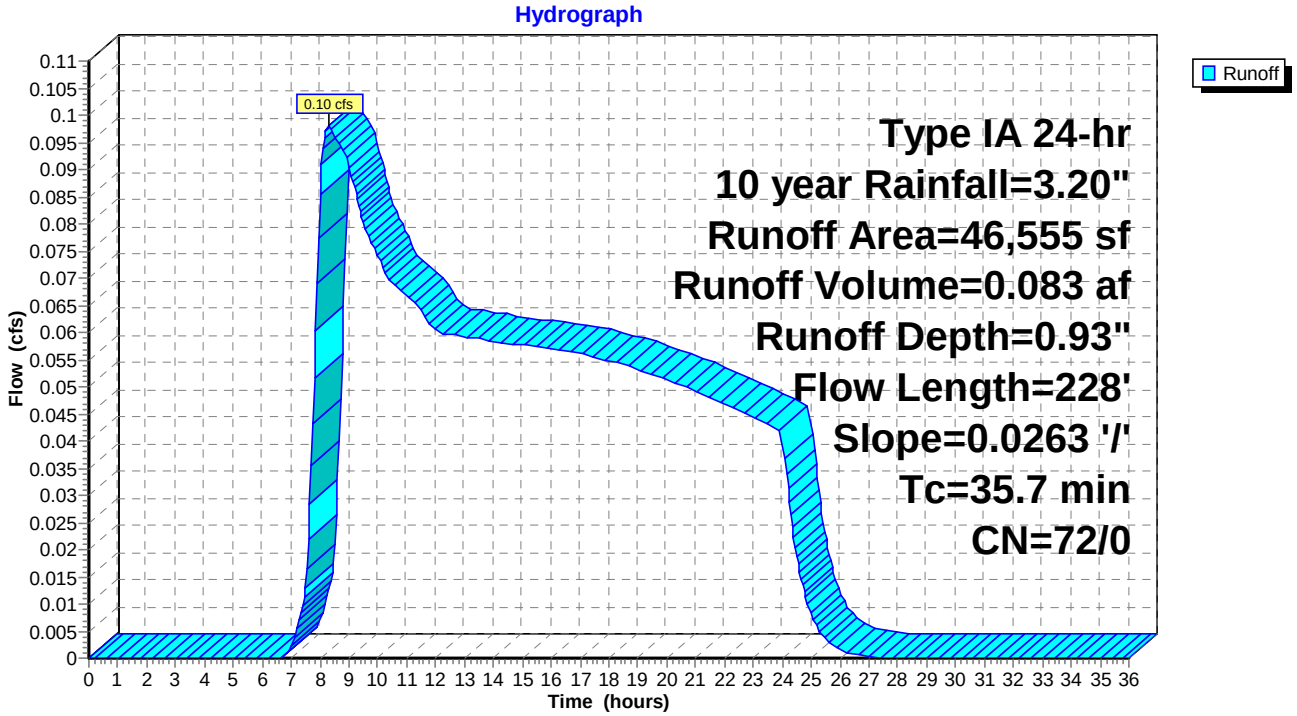
Runoff = 0.10 cfs @ 8.31 hrs, Volume= 0.083 af, Depth= 0.93"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type IA 24-hr 10 year Rainfall=3.20"

	Area (sf)	CN	Description
*	46,555	72	City of Salem Predeveloped, HSG C
	46,555	72	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
35.7	228	0.0263	0.11		**Sheet Flow,** n= 0.300 P2= 2.20"

Subcatchment Undev SW: Undeveloped SW



Summary for Pond 1 - GM: PB 1 - GM

Inflow Area = 1.907 ac, 38.51% Impervious, Inflow Depth = 1.72" for 10 year event
Inflow = 0.64 cfs @ 7.96 hrs, Volume= 0.273 af
Outflow = 0.14 cfs @ 6.50 hrs, Volume= 0.273 af, Atten= 78%, Lag= 0.0 min
Primary = 0.14 cfs @ 6.50 hrs, Volume= 0.273 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 4.78' @ 15.35 hrs Surf.Area= 3,008 sf Storage= 2,354 cf

Plug-Flow detention time= 187.3 min calculated for 0.273 af (100% of inflow)
Center-of-Mass det. time= 187.4 min (934.0 - 746.6)

Volume	Invert	Avail.Storage	Storage Description
#1	4.00'	6,016 cf	**Growing Media (Prismatic)** Listed below (Recalc)

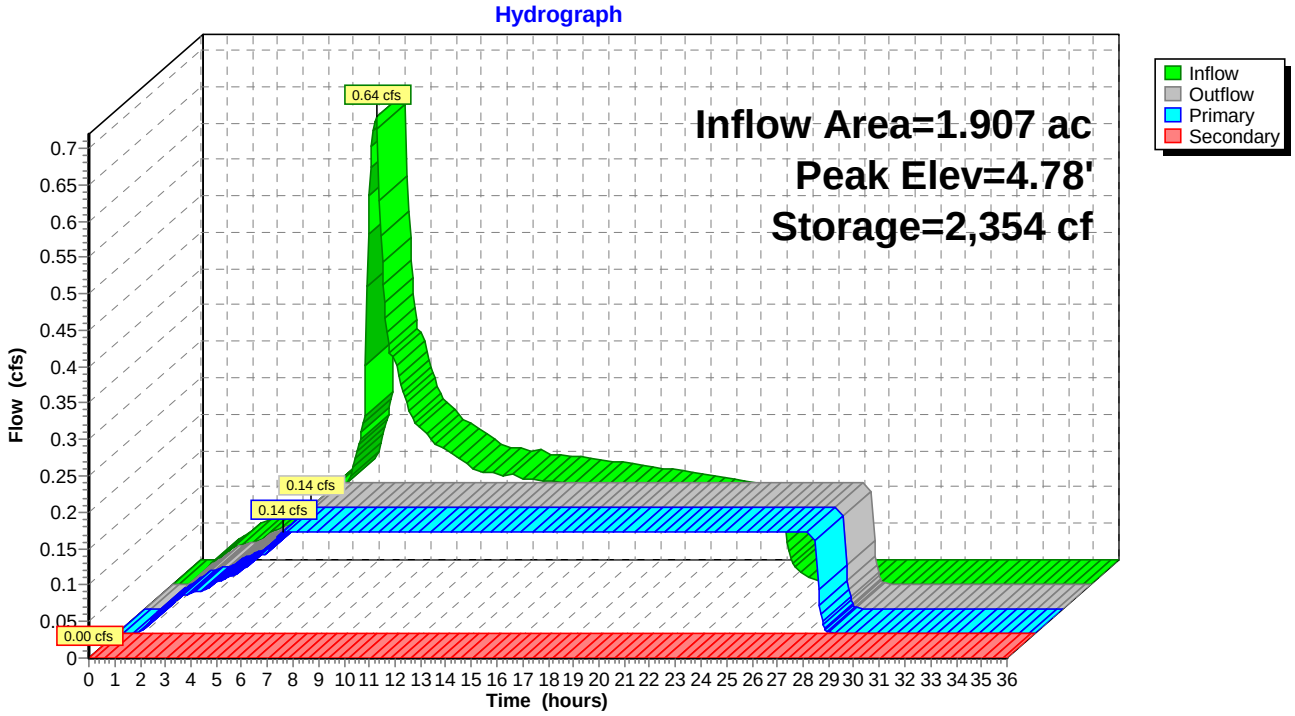
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
4.00	3,008	0	0
6.00	3,008	6,016	6,016

Device	Routing	Invert	Outlet Devices
#1	Primary	4.00'	**2.000 in/hr Exfiltration over Surface area**
#2	Secondary	5.50'	**7.0" Horiz. Rock Box** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.14 cfs @ 6.50 hrs HW=4.02' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.14 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=4.00' (Free Discharge)
└**2=Rock Box** (Controls 0.00 cfs)

Pond 1 - GM: PB 1 - GM



Summary for Pond 1 - DR: PB 1 - DR

Inflow Area = 1.907 ac, 38.51% Impervious, Inflow Depth = 1.72" for 10 year event
Inflow = 0.14 cfs @ 6.50 hrs, Volume= 0.273 af
Outflow = 0.14 cfs @ 24.80 hrs, Volume= 0.222 af, Atten= 0%, Lag= 1,098.0 min
Discarded = 0.05 cfs @ 2.75 hrs, Volume= 0.138 af
Primary = 0.09 cfs @ 24.80 hrs, Volume= 0.084 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 3.49' @ 24.80 hrs Surf.Area= 3,008 sf Storage= 3,781 cf

Plug-Flow detention time= 406.8 min calculated for 0.222 af (81% of inflow)
Center-of-Mass det. time= 271.9 min (1,205.9 - 934.0)

Volume	Invert	Avail.Storage	Storage Description
#1	0.00'	4,332 cf	**Drain Rock (Prismatic)** Listed below (Recalc) 12,032 cf Overall x 36.0% Voids

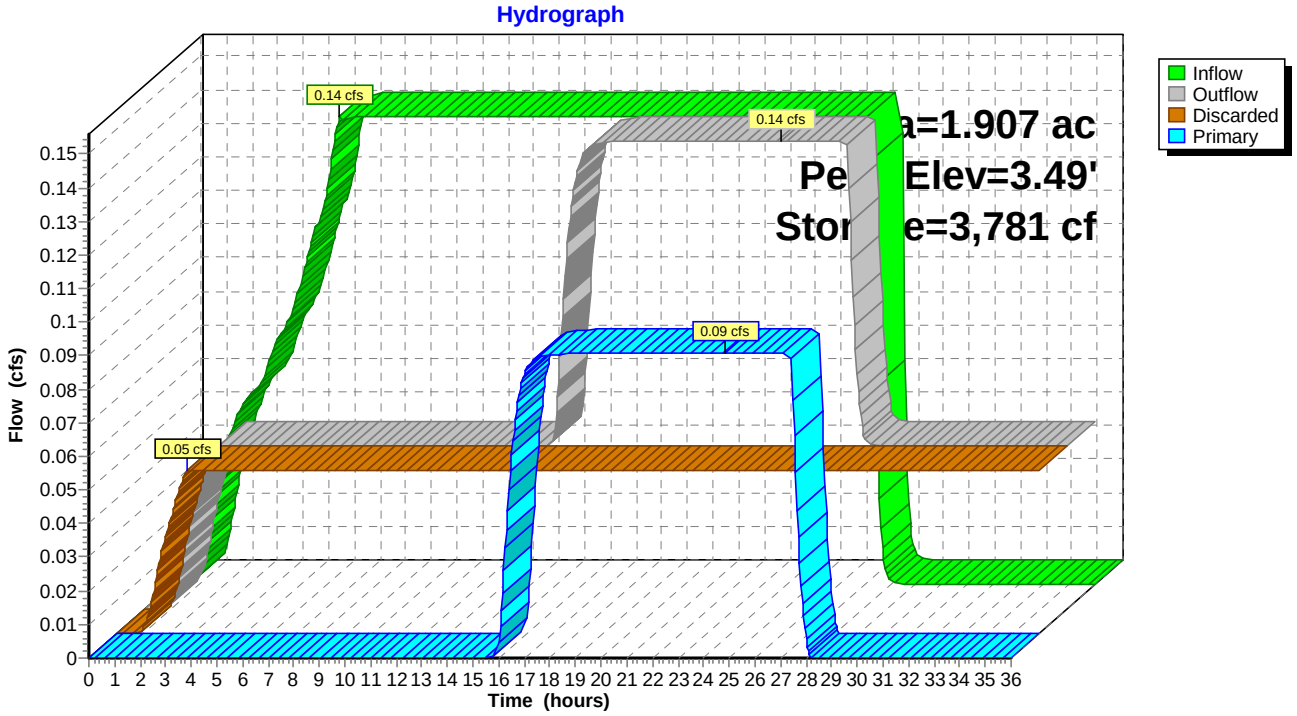
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
0.00	3,008	0	0
4.00	3,008	12,032	12,032

Device	Routing	Invert	Outlet Devices
#1	Discarded	0.00'	**0.700 in/hr Exfiltration over Surface area**
#2	Primary	3.33'	**8.0" Vert. Underdrain** C= 0.600 Limited to weir flow at low heads

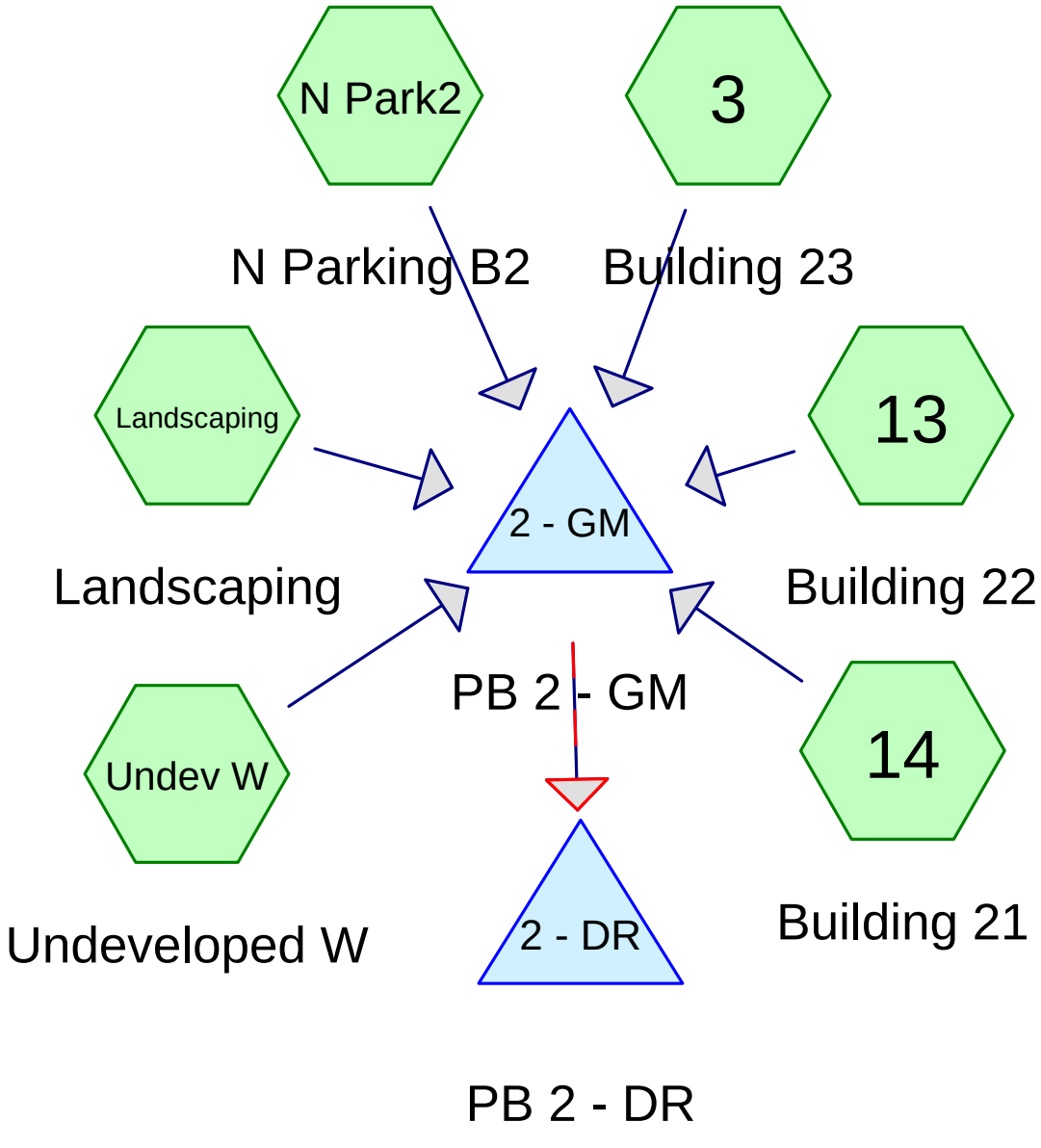
Discarded OutFlow Max=0.05 cfs @ 2.75 hrs HW=0.04' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.05 cfs)

Primary OutFlow Max=0.09 cfs @ 24.80 hrs HW=3.49' (Free Discharge)
↑—**2=Underdrain** (Orifice Controls 0.09 cfs @ 1.37 fps)

Pond 1 - DR: PB 1 - DR



EAST



Subcat Reach Pond Link

Routing Diagram for EAST (Reed Rd) Site Prelim Hydrograph
Prepared by Multi/Tech Engineering Services, Printed 2/17/2021

Summary for Subcatchment 3: Building 23

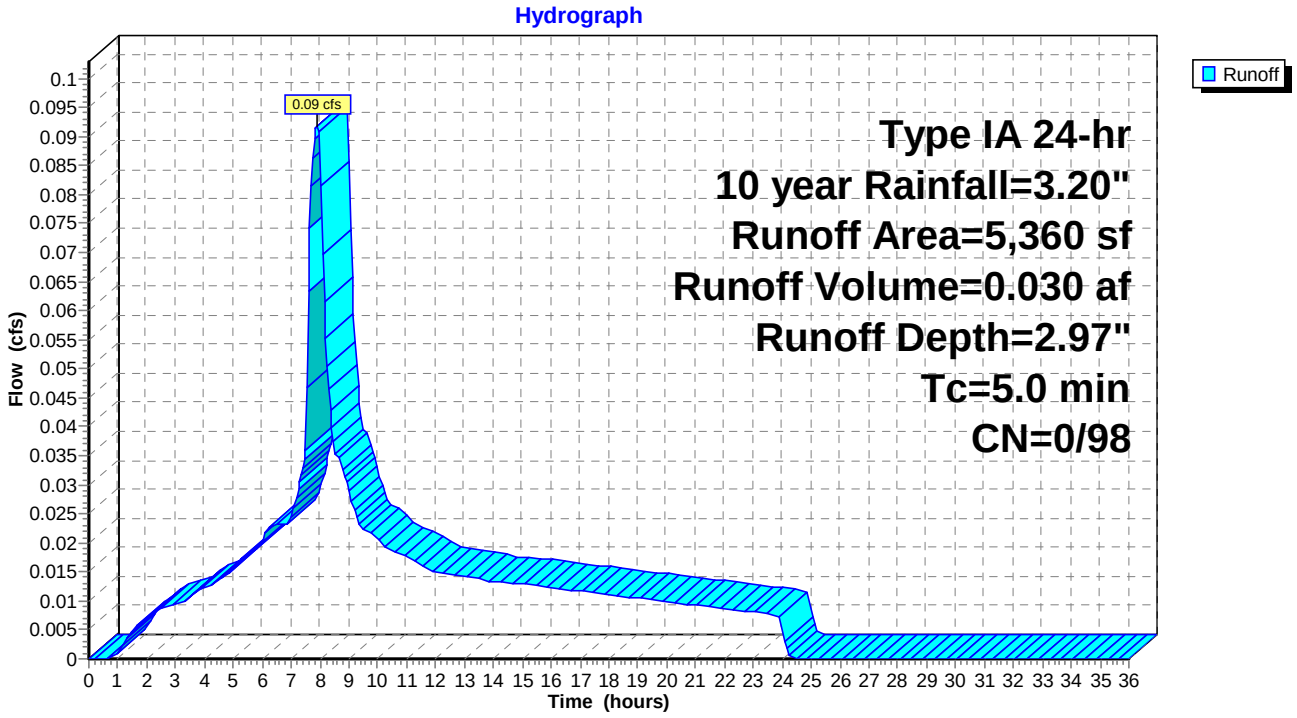
Runoff = 0.09 cfs @ 7.90 hrs, Volume= 0.030 af, Depth= 2.97"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type IA 24-hr 10 year Rainfall=3.20"

Area (sf)	CN	Description
5,360	98	Roofs, HSG C
5,360	98	100.00% Impervious Area

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

Subcatchment 3: Building 23



Summary for Subcatchment 13: Building 22

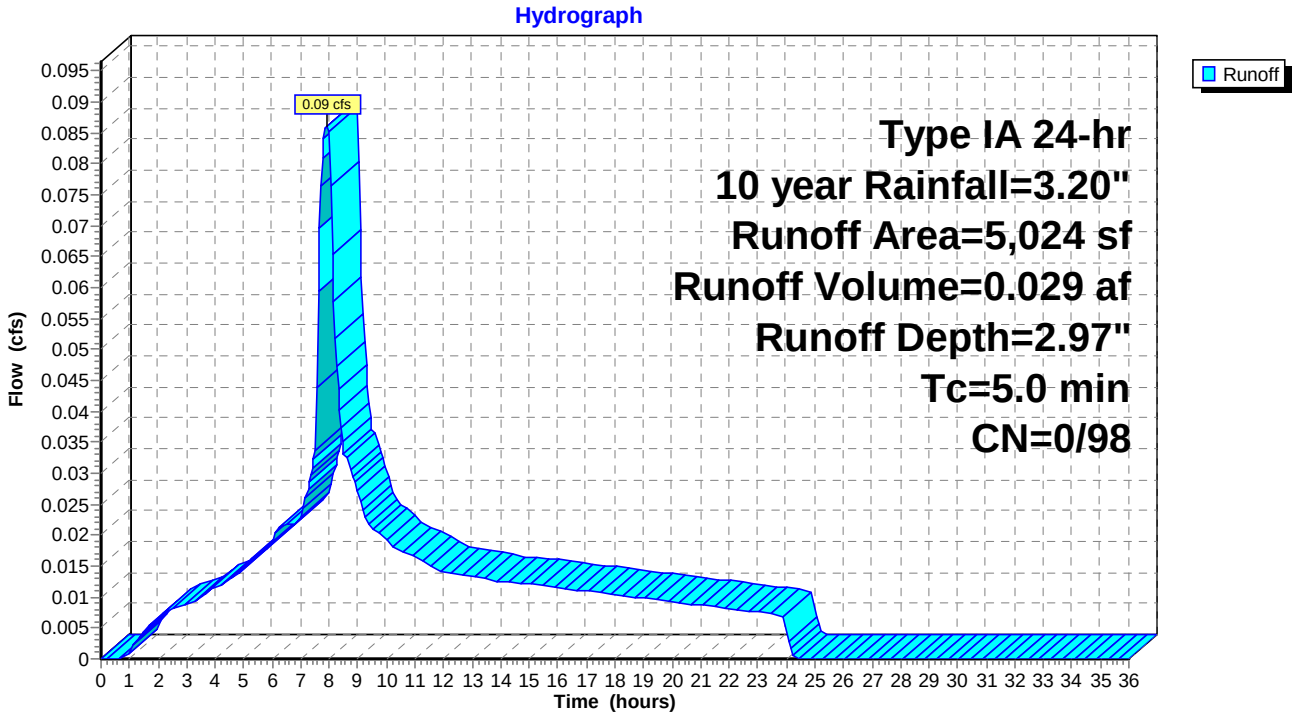
Runoff = 0.09 cfs @ 7.90 hrs, Volume= 0.029 af, Depth= 2.97"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type IA 24-hr 10 year Rainfall=3.20"

Area (sf)	CN	Description
5,024	98	Roofs, HSG C
5,024	98	100.00% Impervious Area

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

Subcatchment 13: Building 22



Summary for Subcatchment 14: Building 21

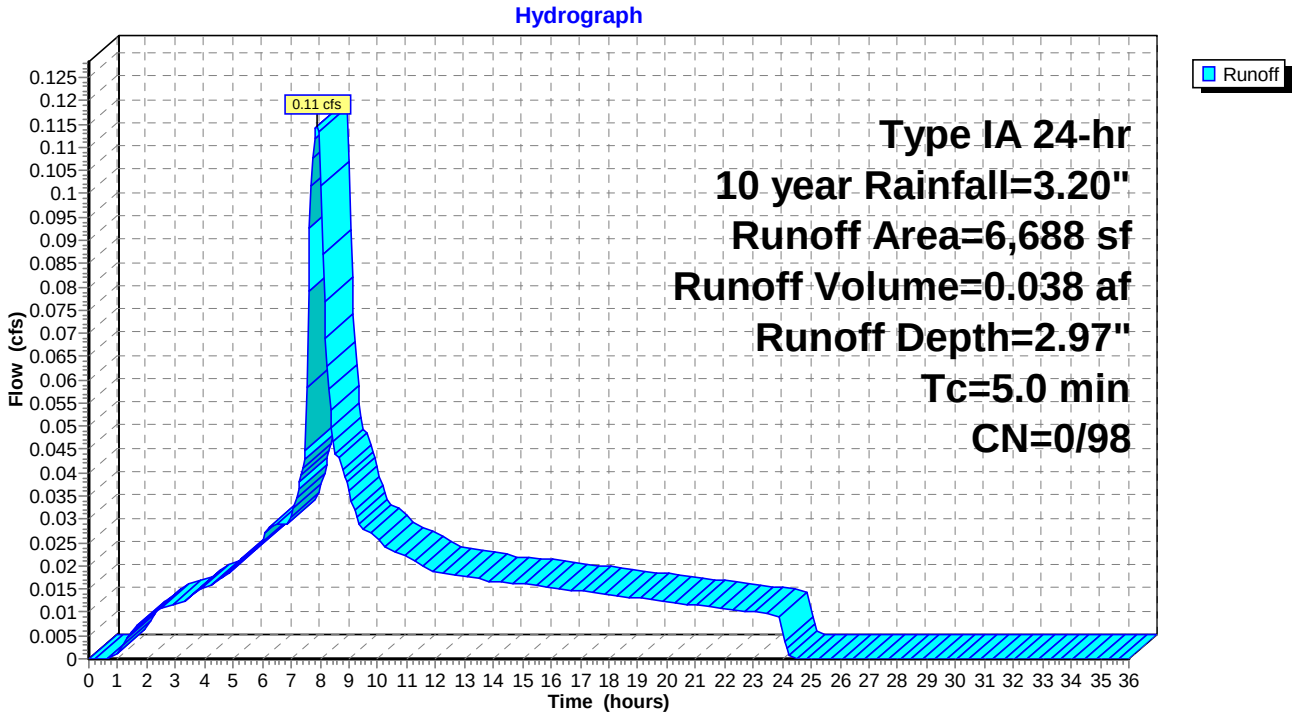
Runoff = 0.11 cfs @ 7.90 hrs, Volume= 0.038 af, Depth= 2.97"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type IA 24-hr 10 year Rainfall=3.20"

Area (sf)	CN	Description
6,688	98	Roofs, HSG C
6,688	98	100.00% Impervious Area

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

Subcatchment 14: Building 21



Summary for Subcatchment Landscaping: Landscaping

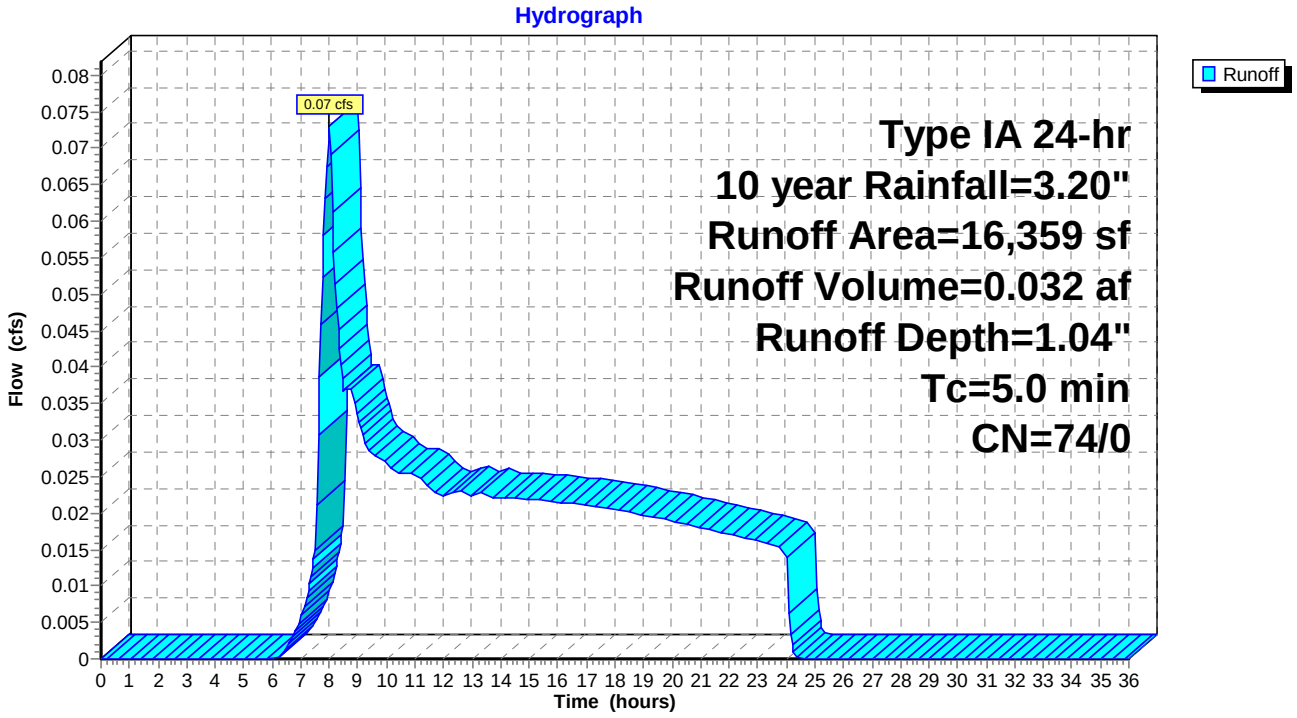
Runoff = 0.07 cfs @ 7.99 hrs, Volume= 0.032 af, Depth= 1.04"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type IA 24-hr 10 year Rainfall=3.20"

Area (sf)	CN	Description
16,359	74	>75% Grass cover, Good, HSG C
16,359	74	100.00% Pervious Area

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

Subcatchment Landscaping: Landscaping



Summary for Subcatchment N Park2: N Parking B2

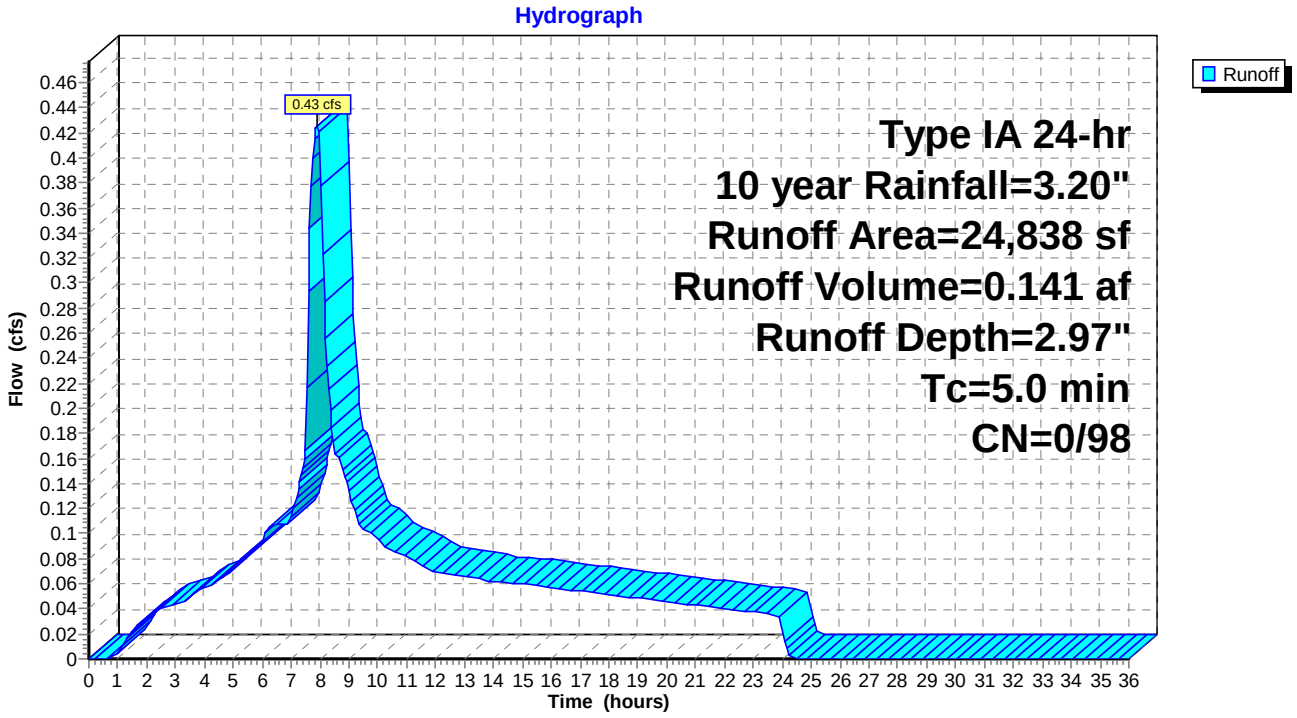
Runoff = 0.43 cfs @ 7.90 hrs, Volume= 0.141 af, Depth= 2.97"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type IA 24-hr 10 year Rainfall=3.20"

Area (sf)	CN	Description
24,838	98	Unconnected pavement, HSG C
24,838	98	100.00% Impervious Area

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

Subcatchment N Park2: N Parking B2



Summary for Subcatchment Undev W: Undeveloped W

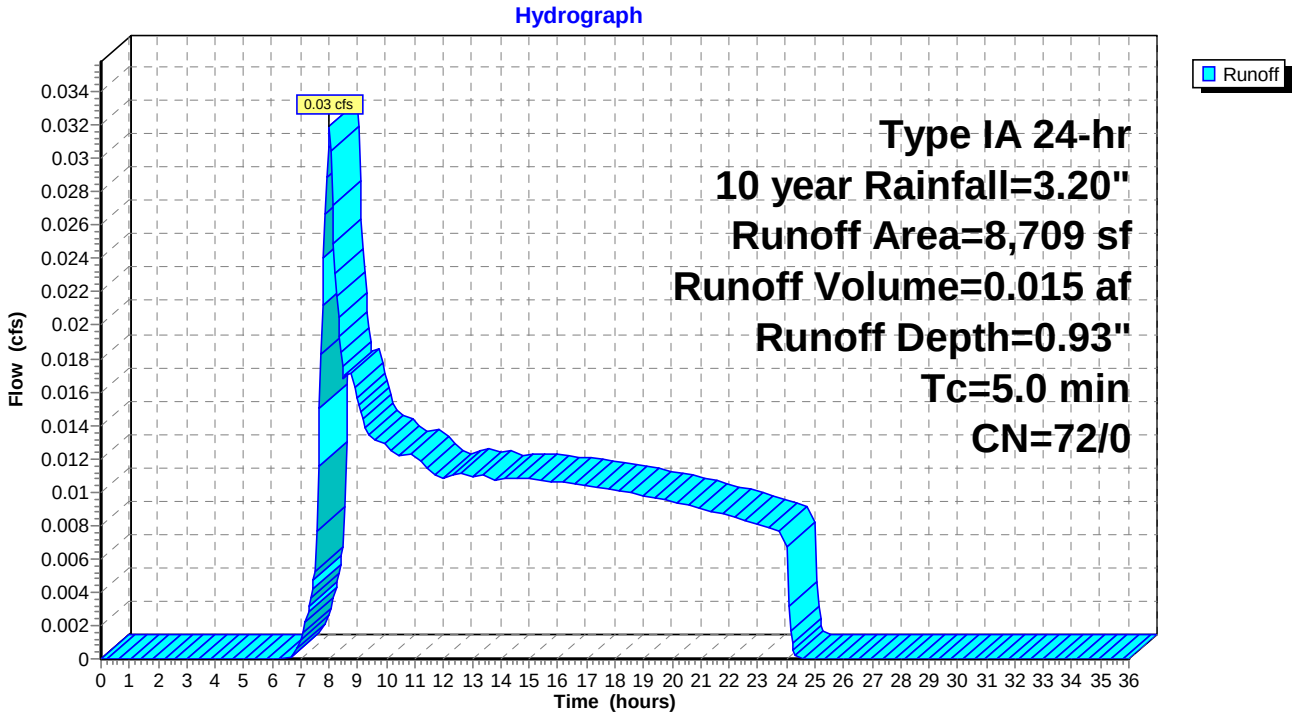
Runoff = 0.03 cfs @ 8.00 hrs, Volume= 0.015 af, Depth= 0.93"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type IA 24-hr 10 year Rainfall=3.20"

	Area (sf)	CN	Description
*	8,709	72	City of Salem Undeveloped, HSG C
	8,709	72	100.00% Pervious Area

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

Subcatchment Undev W: Undeveloped W



Summary for Pond 2 - GM: PB 2 - GM

Inflow Area = 1.538 ac, 62.57% Impervious, Inflow Depth = 2.23" for 10 year event
Inflow = 0.82 cfs @ 7.93 hrs, Volume= 0.286 af
Outflow = 0.13 cfs @ 15.85 hrs, Volume= 0.286 af, Atten= 84%, Lag= 475.5 min
Primary = 0.11 cfs @ 4.95 hrs, Volume= 0.282 af
Secondary = 0.01 cfs @ 15.85 hrs, Volume= 0.004 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 5.52' @ 15.85 hrs Surf.Area= 2,482 sf Storage= 3,764 cf

Plug-Flow detention time= 342.8 min calculated for 0.286 af (100% of inflow)
Center-of-Mass det. time= 342.8 min (1,043.2 - 700.4)

Volume	Invert	Avail.Storage	Storage Description
#1	4.00'	4,964 cf	**Growing Media (Prismatic)** Listed below (Recalc)

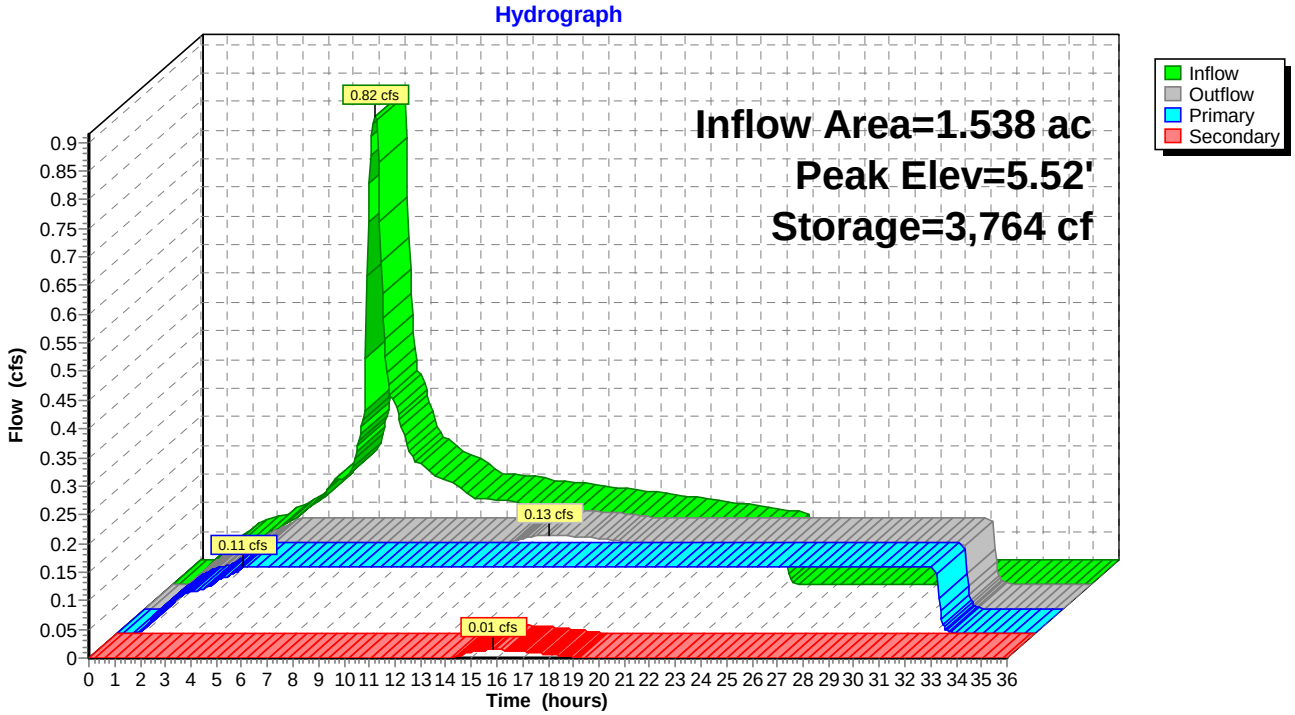
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
4.00	2,482	0	0
6.00	2,482	4,964	4,964

Device	Routing	Invert	Outlet Devices
#1	Primary	4.00'	**2.000 in/hr Exfiltration over Surface area**
#2	Secondary	5.50'	**7.0" Horiz. Rock Box** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.11 cfs @ 4.95 hrs HW=4.02' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.11 cfs)

Secondary OutFlow Max=0.01 cfs @ 15.85 hrs HW=5.52' (Free Discharge)
↑—**2=Rock Box** (Weir Controls 0.01 cfs @ 0.42 fps)

Pond 2 - GM: PB 2 - GM



Summary for Pond 2 - DR: PB 2 - DR

Inflow Area = 1.538 ac, 62.57% Impervious, Inflow Depth = 2.23" for 10 year event
Inflow = 0.13 cfs @ 15.85 hrs, Volume= 0.286 af
Outflow = 0.13 cfs @ 16.16 hrs, Volume= 0.228 af, Atten= 0%, Lag= 18.8 min
Discarded = 0.04 cfs @ 2.00 hrs, Volume= 0.115 af
Primary = 0.09 cfs @ 16.16 hrs, Volume= 0.113 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 3.49' @ 16.16 hrs Surf.Area= 2,482 sf Storage= 3,118 cf

Plug-Flow detention time= 399.8 min calculated for 0.228 af (80% of inflow)
Center-of-Mass det. time= 218.8 min (1,262.0 - 1,043.2)

Volume	Invert	Avail.Storage	Storage Description
#1	0.00'	3,574 cf	**Drain Rock (Prismatic)** Listed below (Recalc) 9,928 cf Overall x 36.0% Voids

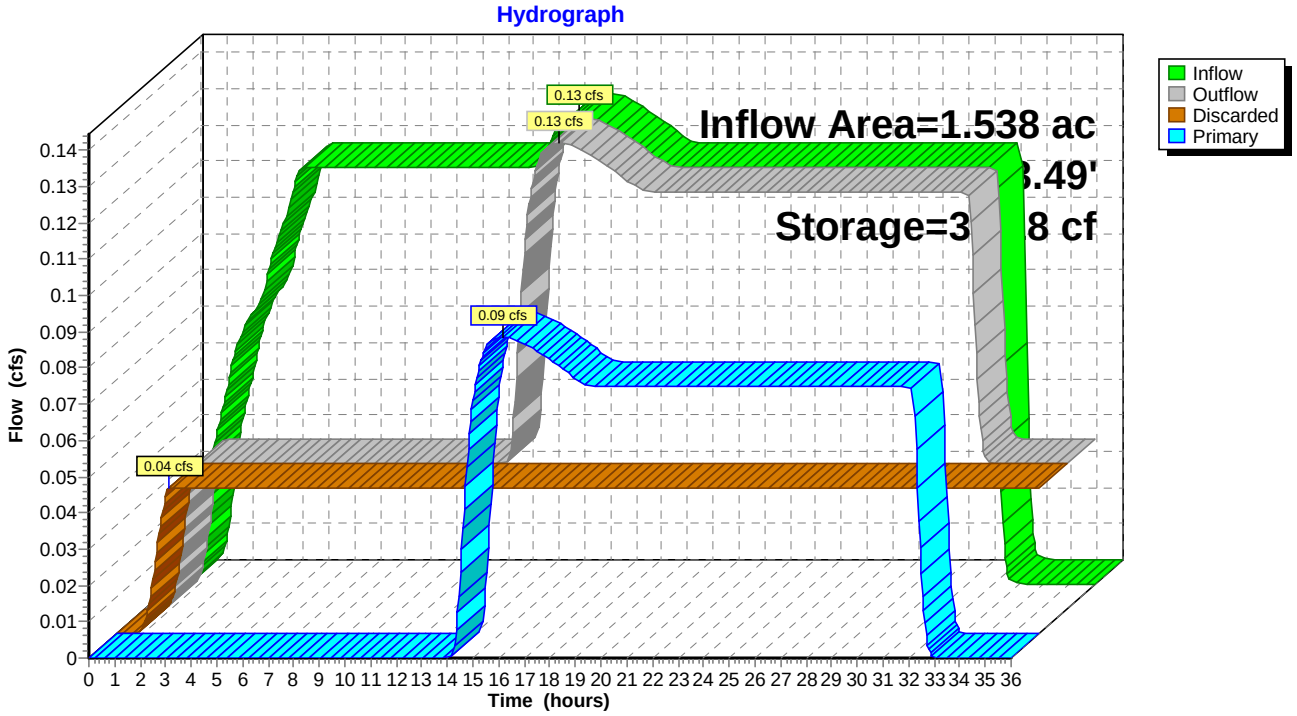
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
0.00	2,482	0	0
4.00	2,482	9,928	9,928

Device	Routing	Invert	Outlet Devices
#1	Discarded	0.00'	**0.700 in/hr Exfiltration over Surface area**
#2	Primary	3.33'	**8.0" Vert. Underdrain** C= 0.600 Limited to weir flow at low heads

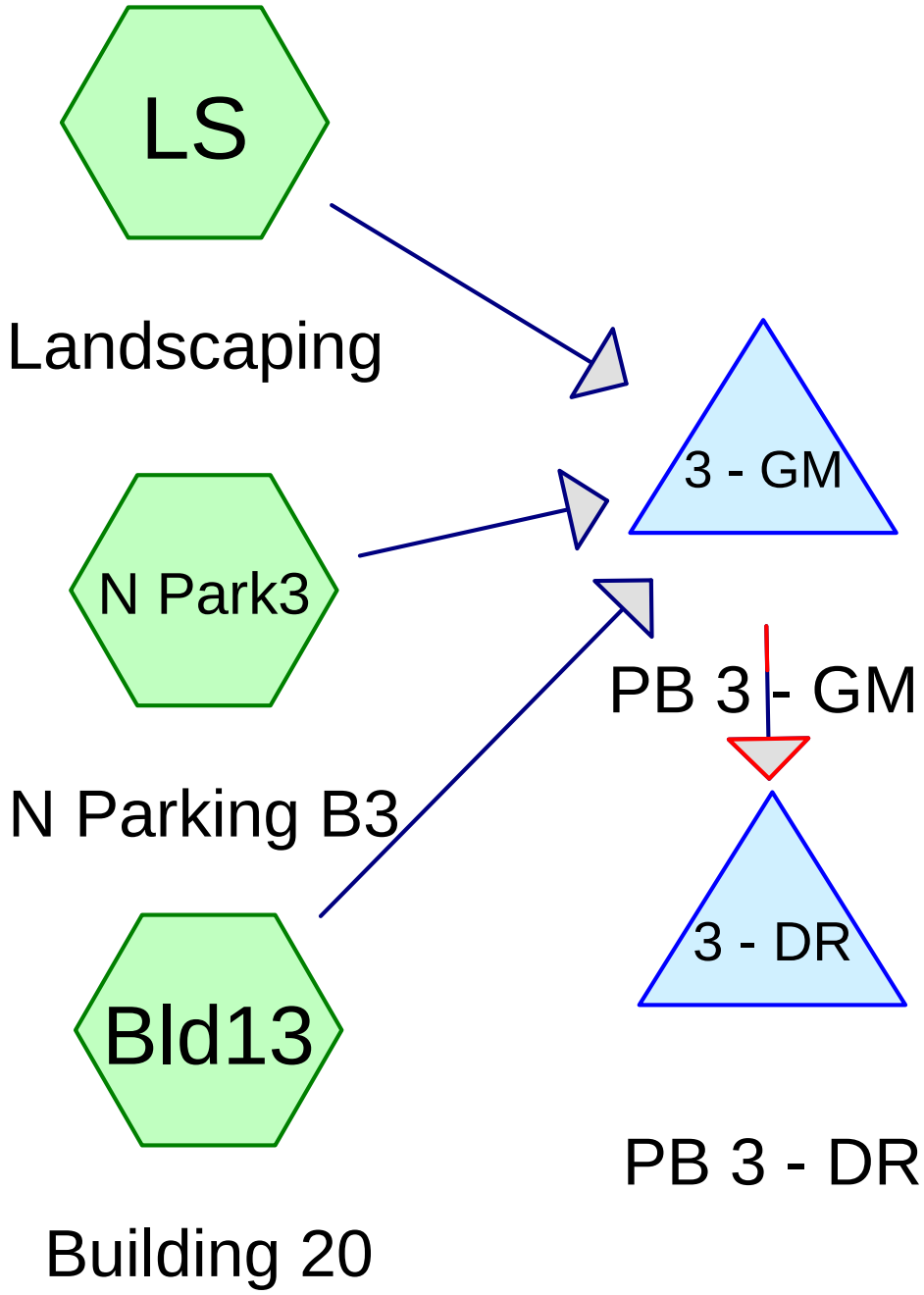
Discarded OutFlow Max=0.04 cfs @ 2.00 hrs HW=0.04' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.04 cfs)

Primary OutFlow Max=0.09 cfs @ 16.16 hrs HW=3.49' (Free Discharge)
↑—**2=Underdrain** (Orifice Controls 0.09 cfs @ 1.36 fps)

Pond 2 - DR: PB 2 - DR



EAST



Subcat Reach Pond Link

Routing Diagram for EAST (Reed Rd) Site Prelim Hydrograph
Prepared by Multi/Tech Engineering Services, Printed 2/17/2021

Summary for Subcatchment Bld13: Building 20

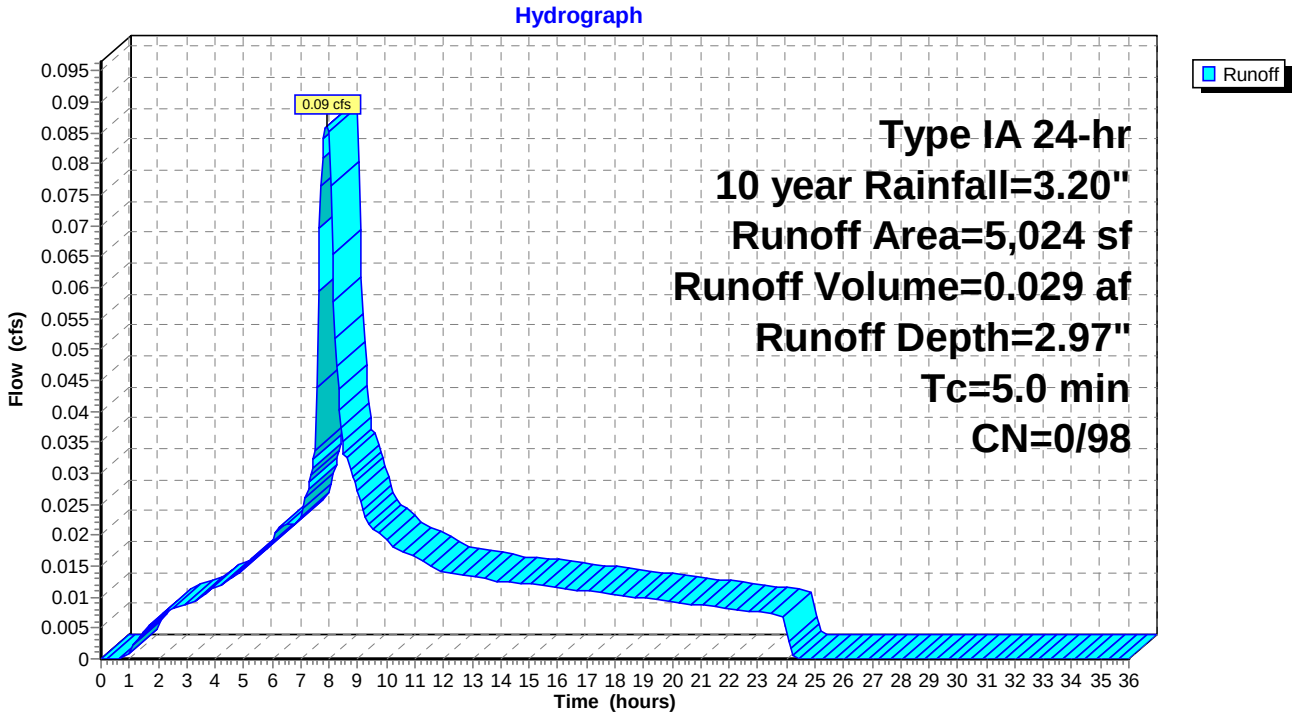
Runoff = 0.09 cfs @ 7.90 hrs, Volume= 0.029 af, Depth= 2.97"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type IA 24-hr 10 year Rainfall=3.20"

Area (sf)	CN	Description
5,024	98	Roofs, HSG C
5,024	98	100.00% Impervious Area

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

Subcatchment Bld13: Building 20



Summary for Subcatchment LS: Landscaping

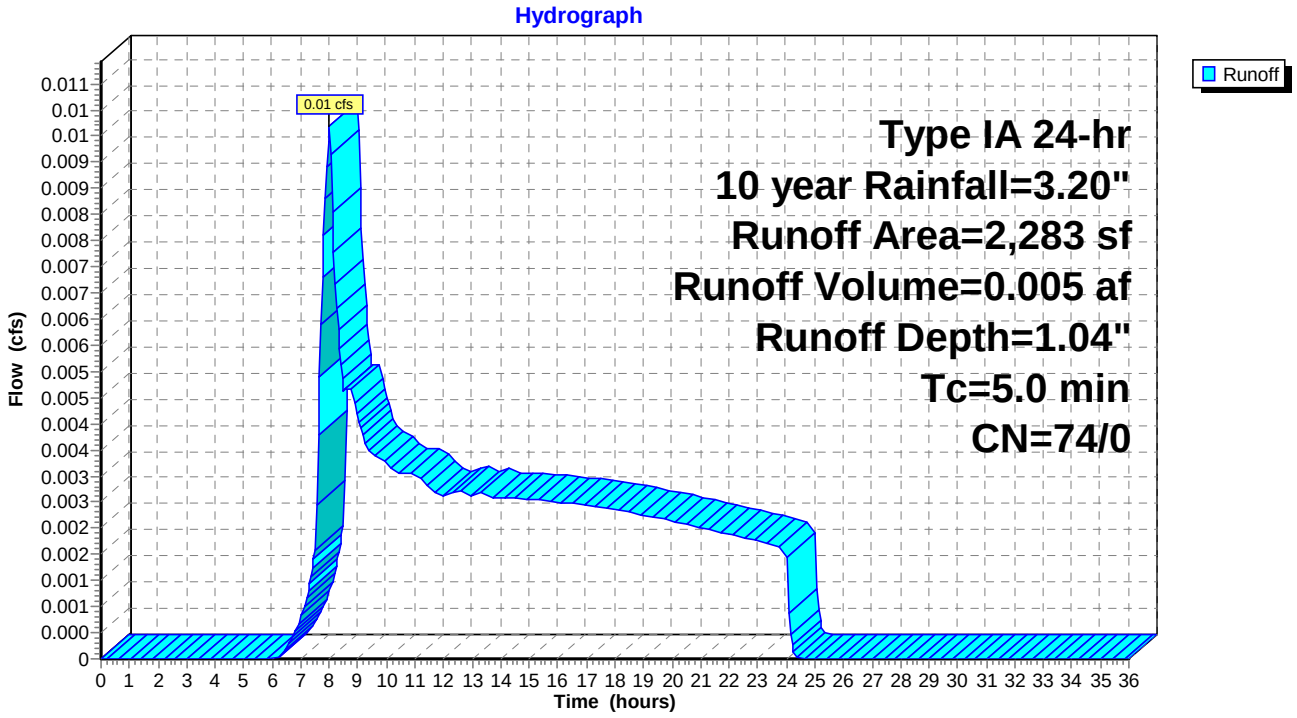
Runoff = 0.01 cfs @ 7.99 hrs, Volume= 0.005 af, Depth= 1.04"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type IA 24-hr 10 year Rainfall=3.20"

Area (sf)	CN	Description
2,283	74	>75% Grass cover, Good, HSG C
2,283	74	100.00% Pervious Area

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

Subcatchment LS: Landscaping



Summary for Subcatchment N Park3: N Parking B3

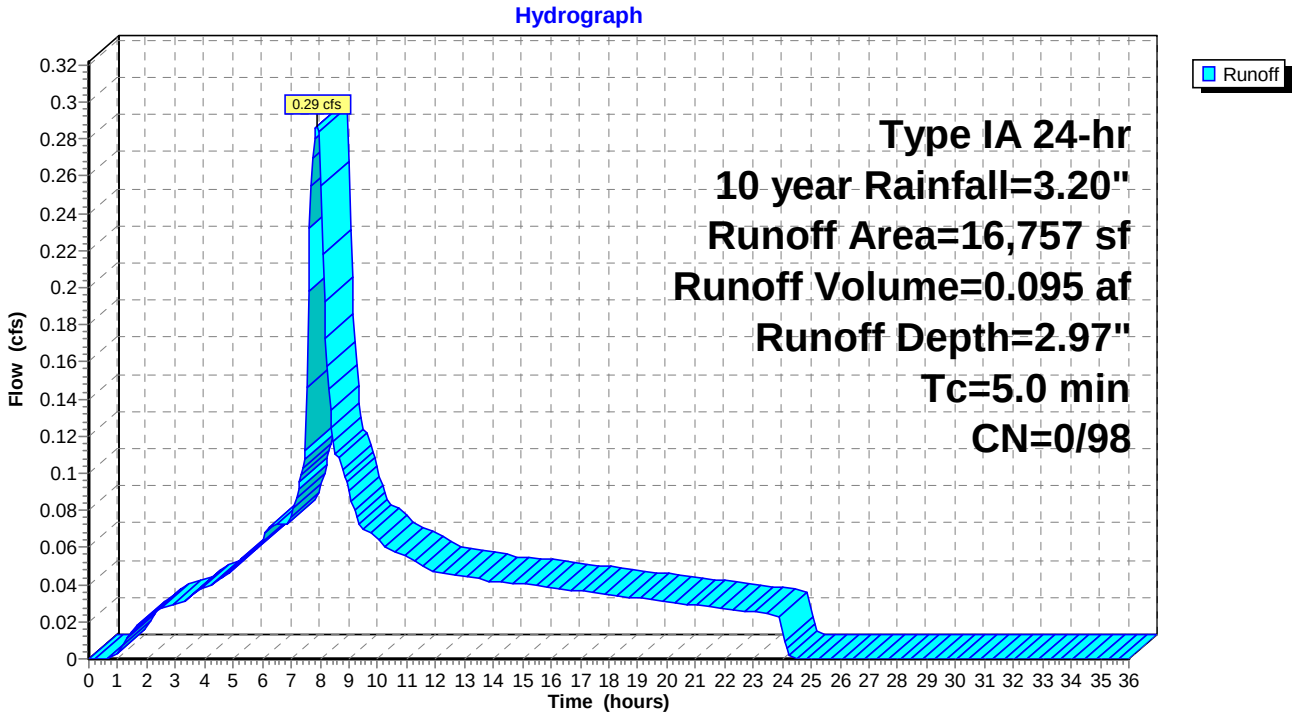
Runoff = 0.29 cfs @ 7.90 hrs, Volume= 0.095 af, Depth= 2.97"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type IA 24-hr 10 year Rainfall=3.20"

Area (sf)	CN	Description
16,757	98	Paved parking, HSG C
16,757	98	100.00% Impervious Area

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

Subcatchment N Park3: N Parking B3



Summary for Pond 3 - GM: PB 3 - GM

Inflow Area = 0.552 ac, 90.51% Impervious, Inflow Depth = 2.78" for 10 year event
Inflow = 0.38 cfs @ 7.90 hrs, Volume= 0.128 af
Outflow = 0.07 cfs @ 5.30 hrs, Volume= 0.128 af, Atten= 83%, Lag= 0.0 min
Primary = 0.07 cfs @ 5.30 hrs, Volume= 0.128 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 4.91' @ 11.61 hrs Surf.Area= 1,436 sf Storage= 1,304 cf

Plug-Flow detention time= 193.2 min calculated for 0.128 af (100% of inflow)
Center-of-Mass det. time= 193.0 min (866.4 - 673.4)

Volume	Invert	Avail.Storage	Storage Description
#1	4.00'	2,872 cf	**Growing Media (Prismatic)** Listed below (Recalc)

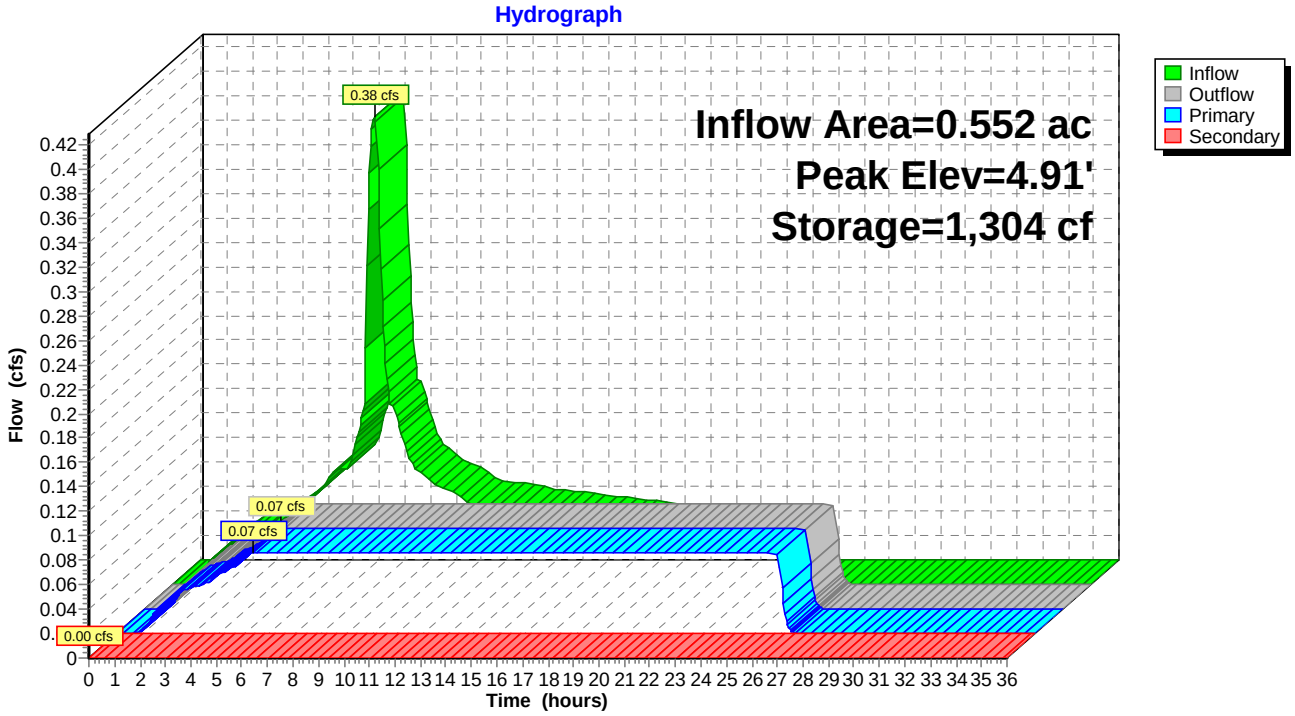
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
4.00	1,436	0	0
6.00	1,436	2,872	2,872

Device	Routing	Invert	Outlet Devices
#1	Primary	4.00'	**2.000 in/hr Exfiltration over Surface area**
#2	Secondary	5.50'	**7.0" Horiz. Rock Box** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.07 cfs @ 5.30 hrs HW=4.02' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.07 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=4.00' (Free Discharge)
└**2=Rock Box** (Controls 0.00 cfs)

Pond 3 - GM: PB 3 - GM



Summary for Pond 3 - DR: PB 3 - DR

Inflow Area = 0.552 ac, 90.51% Impervious, Inflow Depth = 2.78" for 10 year event
Inflow = 0.07 cfs @ 5.30 hrs, Volume= 0.128 af
Outflow = 0.07 cfs @ 20.25 hrs, Volume= 0.107 af, Atten= 0%, Lag= 897.0 min
Discarded = 0.02 cfs @ 2.10 hrs, Volume= 0.066 af
Primary = 0.04 cfs @ 20.25 hrs, Volume= 0.040 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 3.44' @ 20.20 hrs Surf.Area= 1,436 sf Storage= 1,779 cf

Plug-Flow detention time= 419.5 min calculated for 0.107 af (83% of inflow)
Center-of-Mass det. time= 301.7 min (1,168.2 - 866.4)

Volume	Invert	Avail.Storage	Storage Description
#1	0.00'	2,068 cf	**Drain Rock (Prismatic)** Listed below (Recalc) 5,744 cf Overall x 36.0% Voids

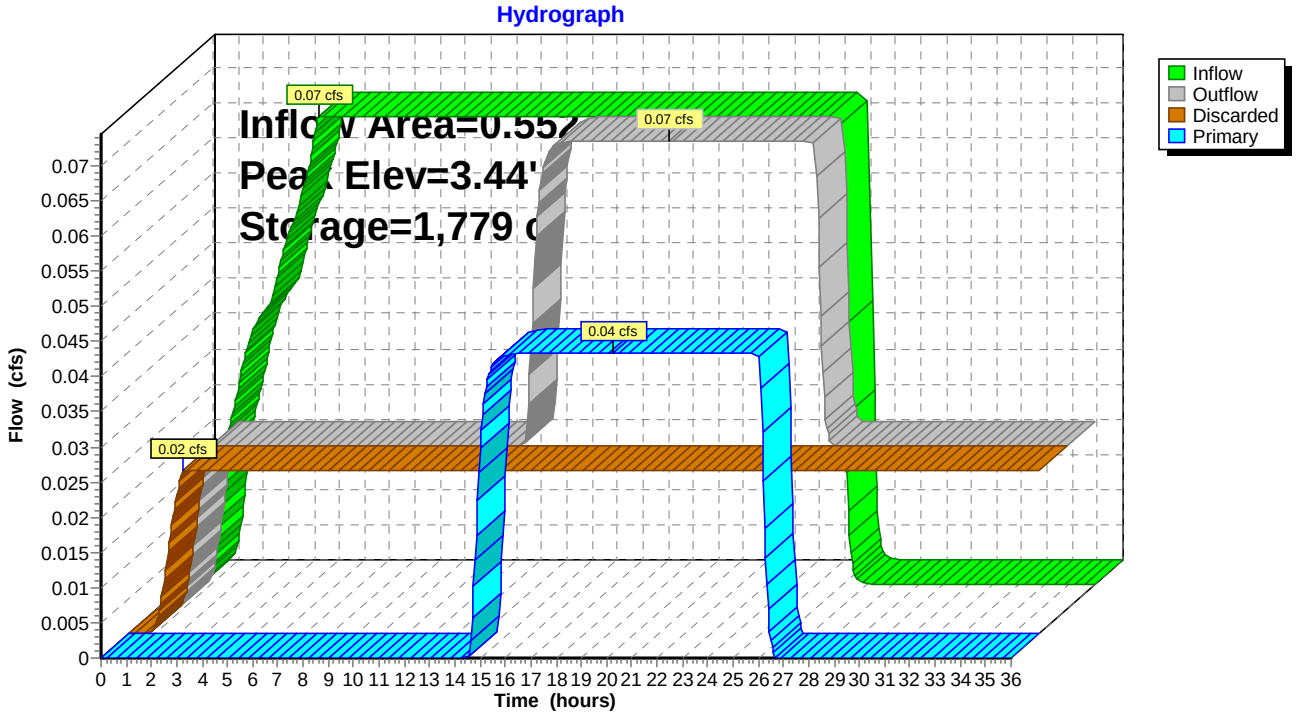
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
0.00	1,436	0	0
4.00	1,436	5,744	5,744

Device	Routing	Invert	Outlet Devices
#1	Discarded	0.00'	**0.700 in/hr Exfiltration over Surface area**
#2	Primary	3.33'	**8.0" Vert. Underdrain** C= 0.600 Limited to weir flow at low heads

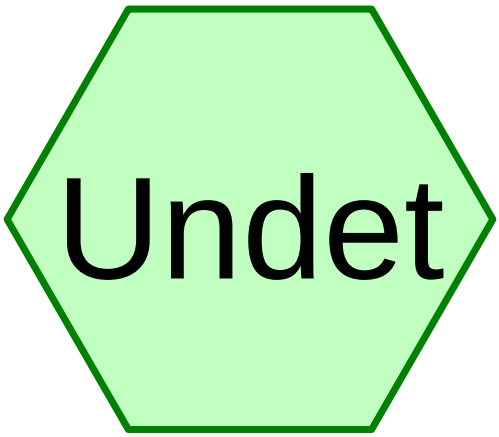
Discarded OutFlow Max=0.02 cfs @ 2.10 hrs HW=0.04' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.02 cfs)

Primary OutFlow Max=0.04 cfs @ 20.25 hrs HW=3.44' (Free Discharge)
↑—**2=Underdrain** (Orifice Controls 0.04 cfs @ 1.13 fps)

Pond 3 - DR: PB 3 - DR



EAST



Undetained

Subcat Reach Pond Link

Routing Diagram for EAST (Reed Rd) Site Prelim Hydrograph
Prepared by Multi/Tech Engineering Services, Printed 2/17/2021

Summary for Subcatchment Undet: Undetained

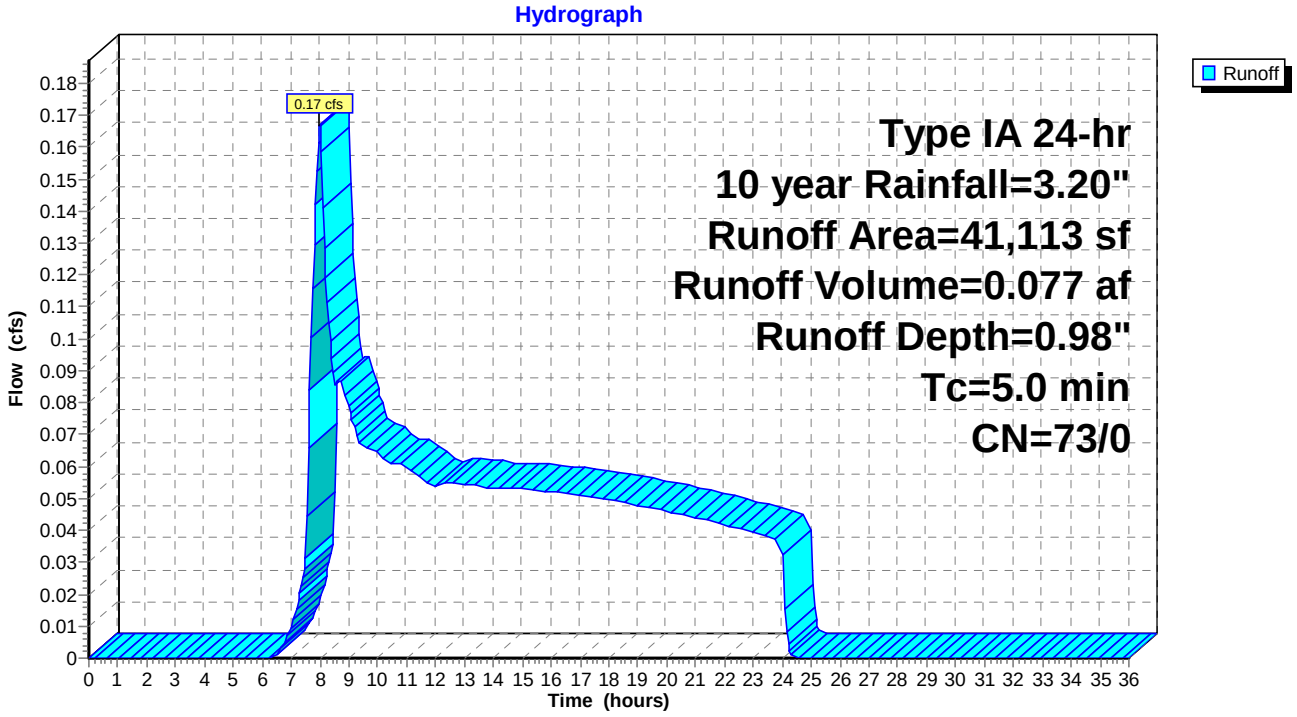
Runoff = 0.17 cfs @ 8.00 hrs, Volume= 0.077 af, Depth= 0.98"

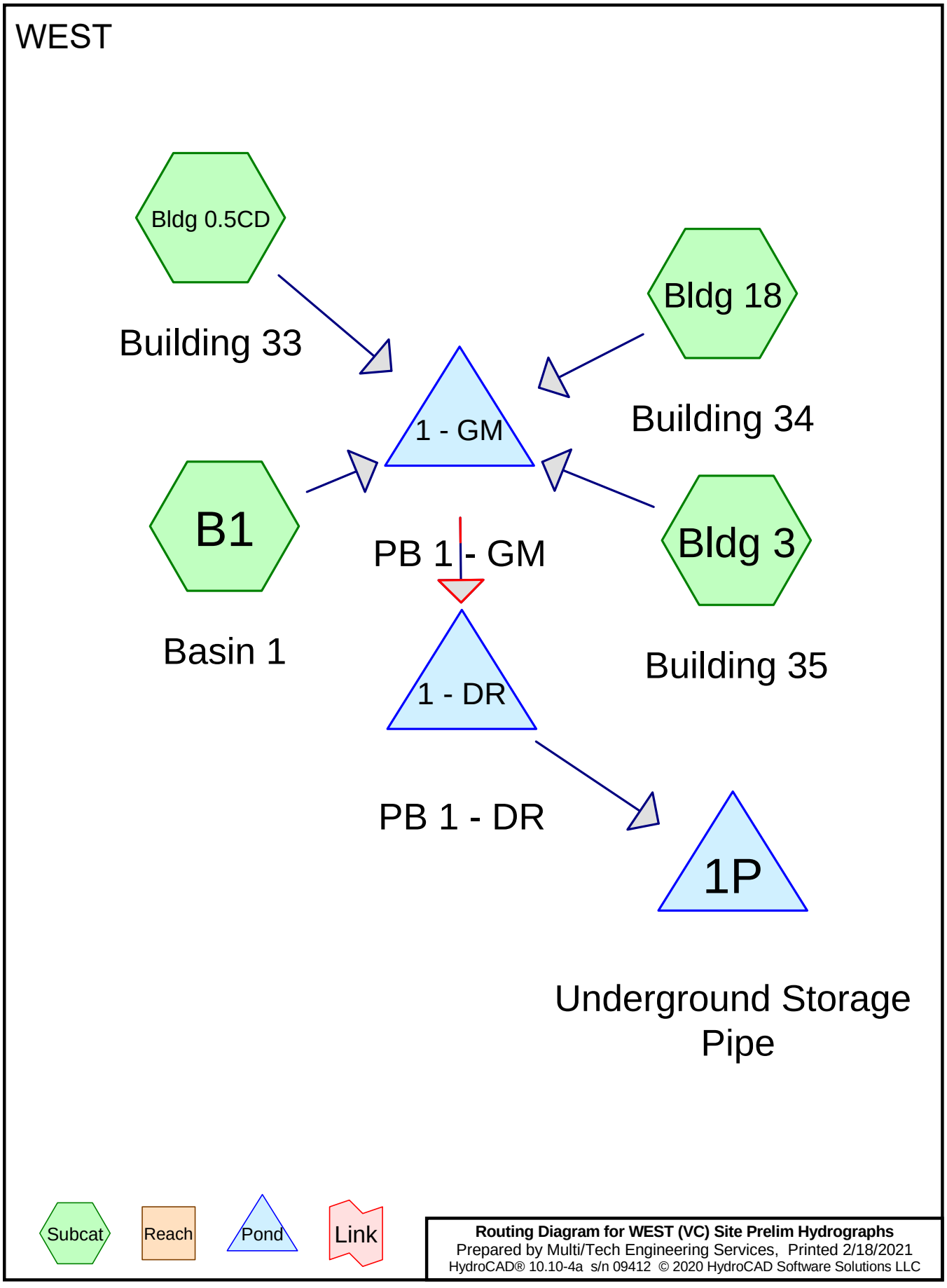
Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type IA 24-hr 10 year Rainfall=3.20"

	Area (sf)	CN	Description
	3,680	74	>75% Grass cover, Good, HSG C
	3,296	74	>75% Grass cover, Good, HSG C
	7,604	74	>75% Grass cover, Good, HSG C
	1,317	74	>75% Grass cover, Good, HSG C
*	25,216	72	City of Salem Predeveloped, HSG C
	41,113	73	Weighted Average
	41,113	73	100.00% Pervious Area

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

Subcatchment Undet: Undetained




WEST
Bldg 0.5CD
Building 33
Bldg 18
Building 34
1 - GM
B1
Basin 1
PB 1 - GM
Bldg 3
Building 35
1 - DR
PB 1 - DR
1P
Underground Storage Pipe
Subcat
Reach
Pond
Link
Routing Diagram for WEST (VC) Site Prelim Hydrographs
Prepared by Multi/Tech Engineering Services, Printed 2/18/2021
HydroCAD® 10.10-4a s/n 09412 © 2020 HydroCAD Software Solutions LLC

Summary for Subcatchment B1: Basin 1

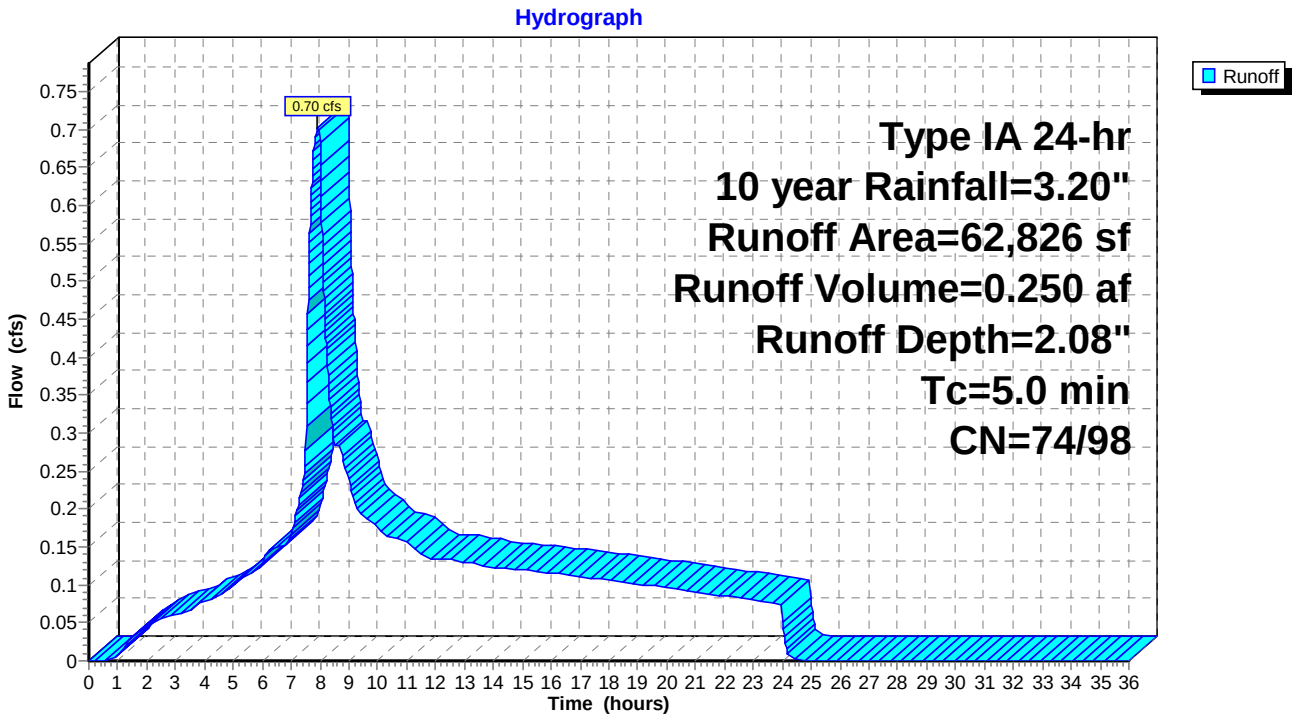
Runoff = 0.70 cfs @ 7.92 hrs, Volume= 0.250 af, Depth= 2.08"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type IA 24-hr 10 year Rainfall=3.20"

	Area (sf)	CN	Description
	33,861	98	Paved parking, HSG C
	27,754	74	>75% Grass cover, Good, HSG C
*	1,211	72	Planter Box
	62,826	87	Weighted Average
	28,965	74	46.10% Pervious Area
	33,861	98	53.90% Impervious Area

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

Subcatchment B1: Basin 1



Summary for Subcatchment Bldg 0.5CD: Building 33

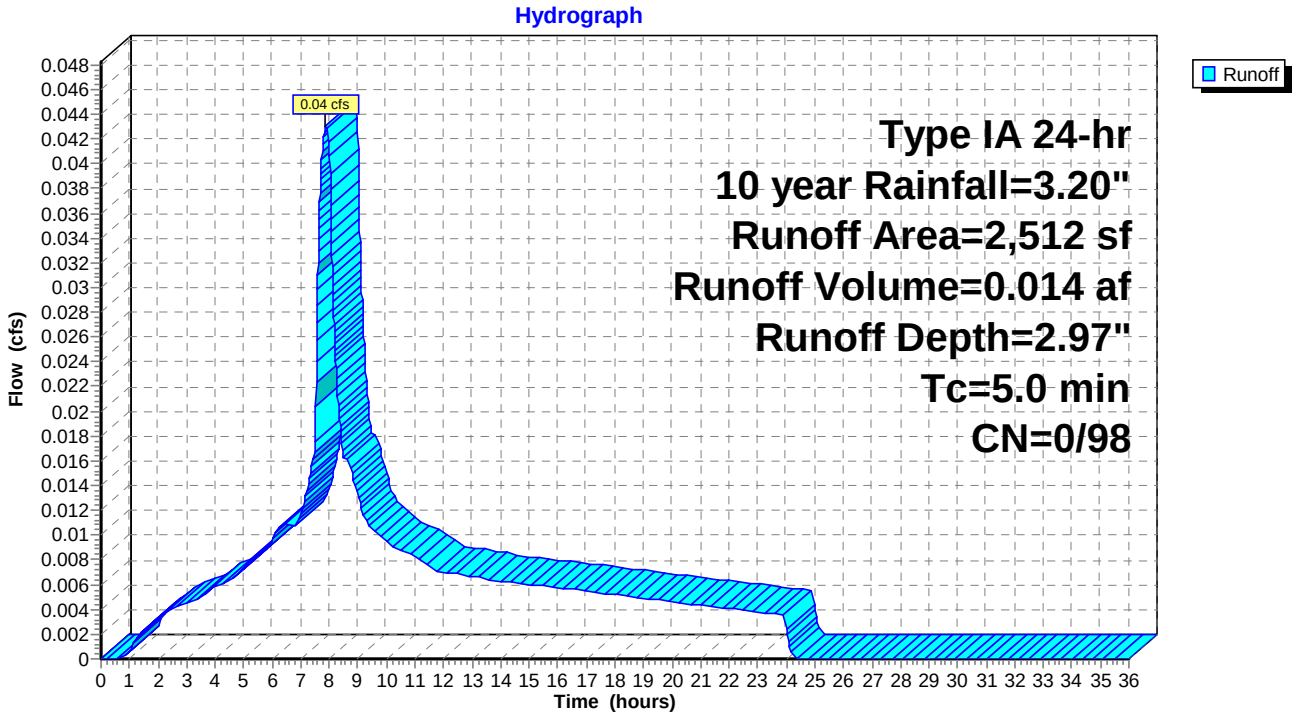
Runoff = 0.04 cfs @ 7.88 hrs, Volume= 0.014 af, Depth= 2.97"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type IA 24-hr 10 year Rainfall=3.20"

Area (sf)	CN	Description
2,512	98	Roofs, HSG C
2,512	98	100.00% Impervious Area

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

Subcatchment Bldg 0.5CD: Building 33



Summary for Subcatchment Bldg 18: Building 34

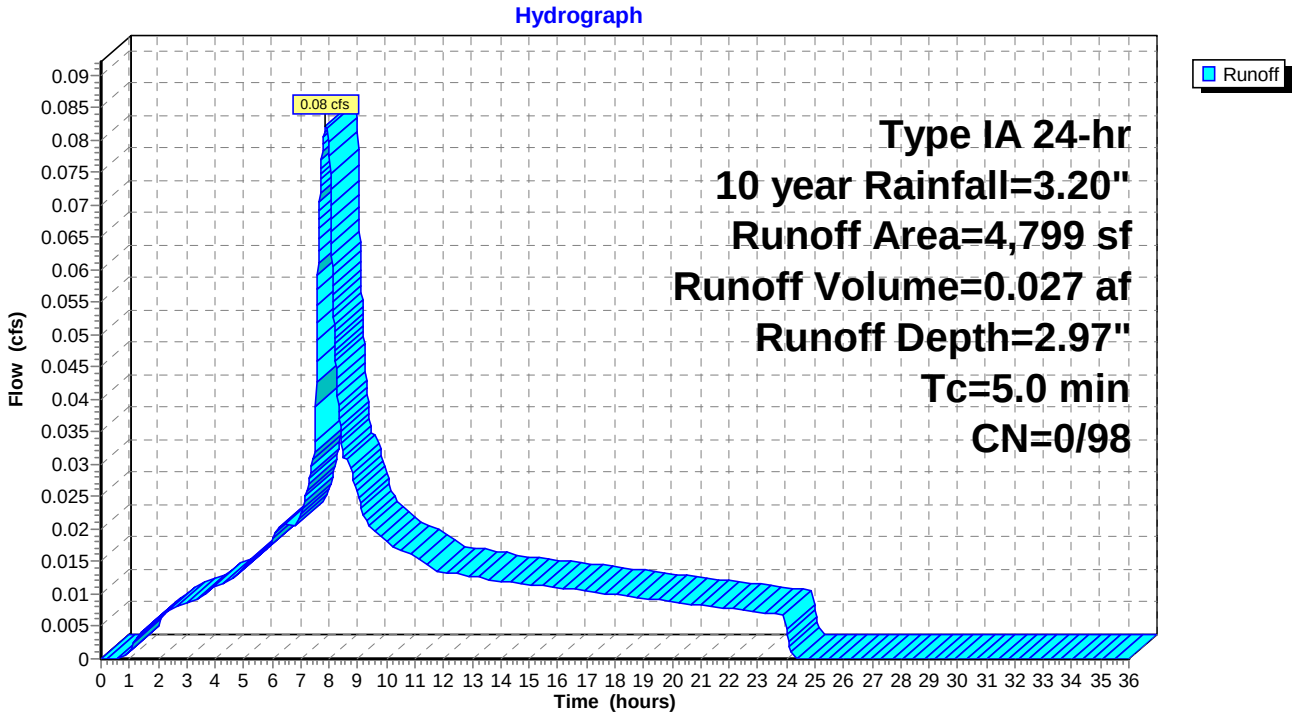
Runoff = 0.08 cfs @ 7.88 hrs, Volume= 0.027 af, Depth= 2.97"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type IA 24-hr 10 year Rainfall=3.20"

Area (sf)	CN	Description
4,799	98	Roofs, HSG C
4,799	98	100.00% Impervious Area

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

Subcatchment Bldg 18: Building 34



Summary for Subcatchment Bldg 3: Building 35

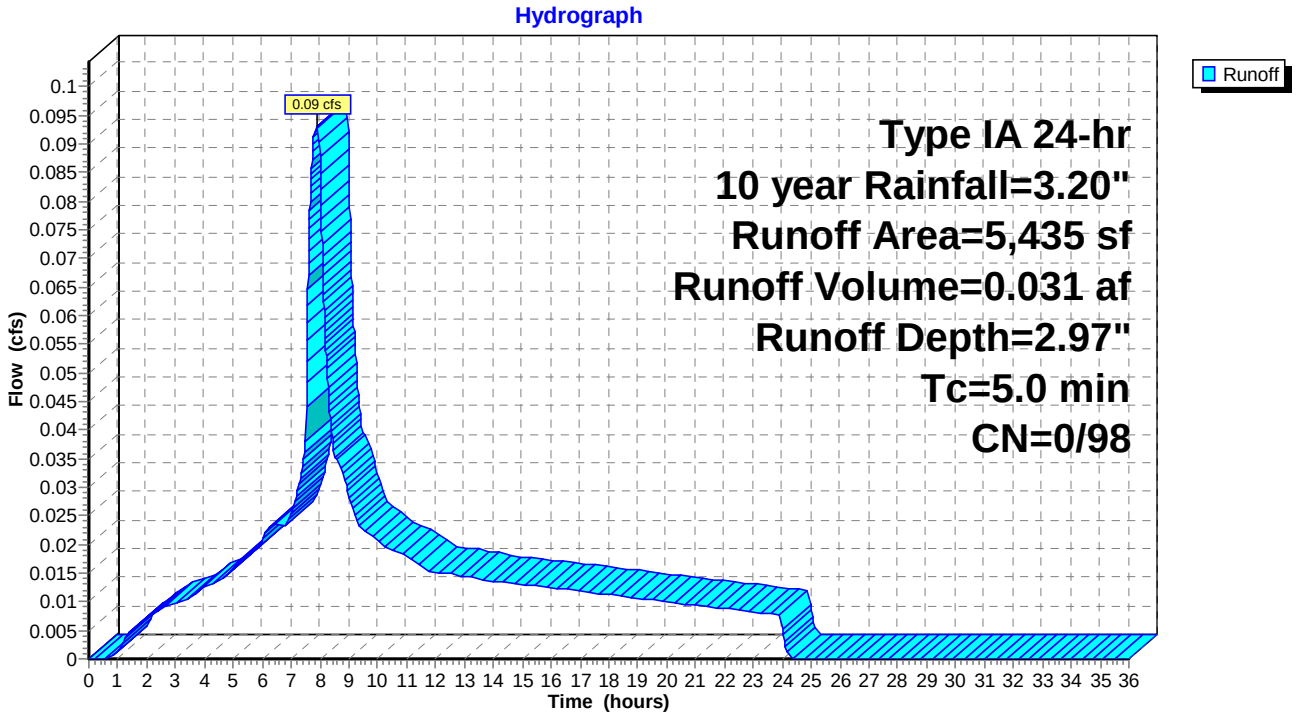
Runoff = 0.09 cfs @ 7.88 hrs, Volume= 0.031 af, Depth= 2.97"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type IA 24-hr 10 year Rainfall=3.20"

Area (sf)	CN	Description
5,435	98	Roofs, HSG C
5,435	98	100.00% Impervious Area

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

Subcatchment Bldg 3: Building 35



Summary for Pond 1 - GM: PB 1 - GM

Inflow Area = 1.735 ac, 61.67% Impervious, Inflow Depth = 2.23" for 10 year event
Inflow = 0.92 cfs @ 7.91 hrs, Volume= 0.322 af
Outflow = 0.91 cfs @ 7.96 hrs, Volume= 0.322 af, Atten= 1%, Lag= 3.4 min
Primary = 0.06 cfs @ 2.01 hrs, Volume= 0.150 af
Secondary = 0.86 cfs @ 7.96 hrs, Volume= 0.172 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 5.69' @ 7.96 hrs Surf.Area= 1,229 sf Storage= 2,078 cf

Plug-Flow detention time= 184.1 min calculated for 0.322 af (100% of inflow)
Center-of-Mass det. time= 184.2 min (884.7 - 700.6)

Volume	Invert	Avail.Storage	Storage Description
#1	4.00'	2,458 cf	**Planter Box Storage (Prismatic)** Listed below (Recalc)

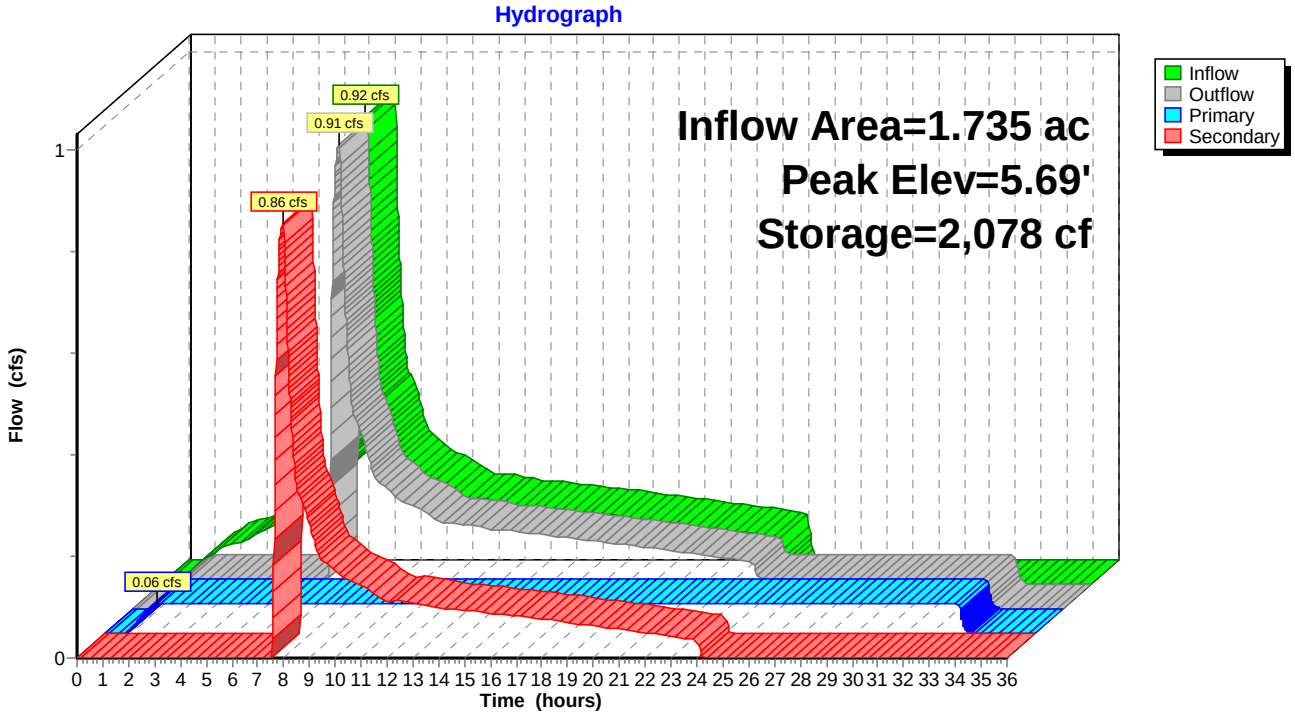
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
4.00	1,229	0	0
6.00	1,229	2,458	2,458

Device	Routing	Invert	Outlet Devices
#1	Primary	4.00'	**2.000 in/hr Flow through Growing Media over Surface area**
#2	Secondary	5.50'	**12.0" Horiz. Rock Box** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.06 cfs @ 2.01 hrs HW=4.02' (Free Discharge)
↑—**1=Flow through Growing Media** (Exfiltration Controls 0.06 cfs)

Secondary OutFlow Max=0.86 cfs @ 7.96 hrs HW=5.69' (Free Discharge)
↑—**2=Rock Box** (Weir Controls 0.86 cfs @ 1.43 fps)

Pond 1 - GM: PB 1 - GM



Summary for Pond 1 - DR: PB 1 - DR

Inflow Area = 1.735 ac, 61.67% Impervious, Inflow Depth = 2.23" for 10 year event
Inflow = 0.91 cfs @ 7.96 hrs, Volume= 0.322 af
Outflow = 0.89 cfs @ 8.03 hrs, Volume= 0.296 af, Atten= 3%, Lag= 4.0 min
Discarded = 0.02 cfs @ 1.45 hrs, Volume= 0.057 af
Primary = 0.87 cfs @ 8.03 hrs, Volume= 0.238 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 3.48' @ 8.03 hrs Surf.Area= 1,229 sf Storage= 1,538 cf

Plug-Flow detention time= 163.7 min calculated for 0.295 af (92% of inflow)
Center-of-Mass det. time= 79.5 min (964.2 - 884.7)

Volume	Invert	Avail.Storage	Storage Description
#1	0.00'	1,770 cf	**Drain Rock Storage (Prismatic)** Listed below (Recalc) 4,916 cf Overall x 36.0% Voids

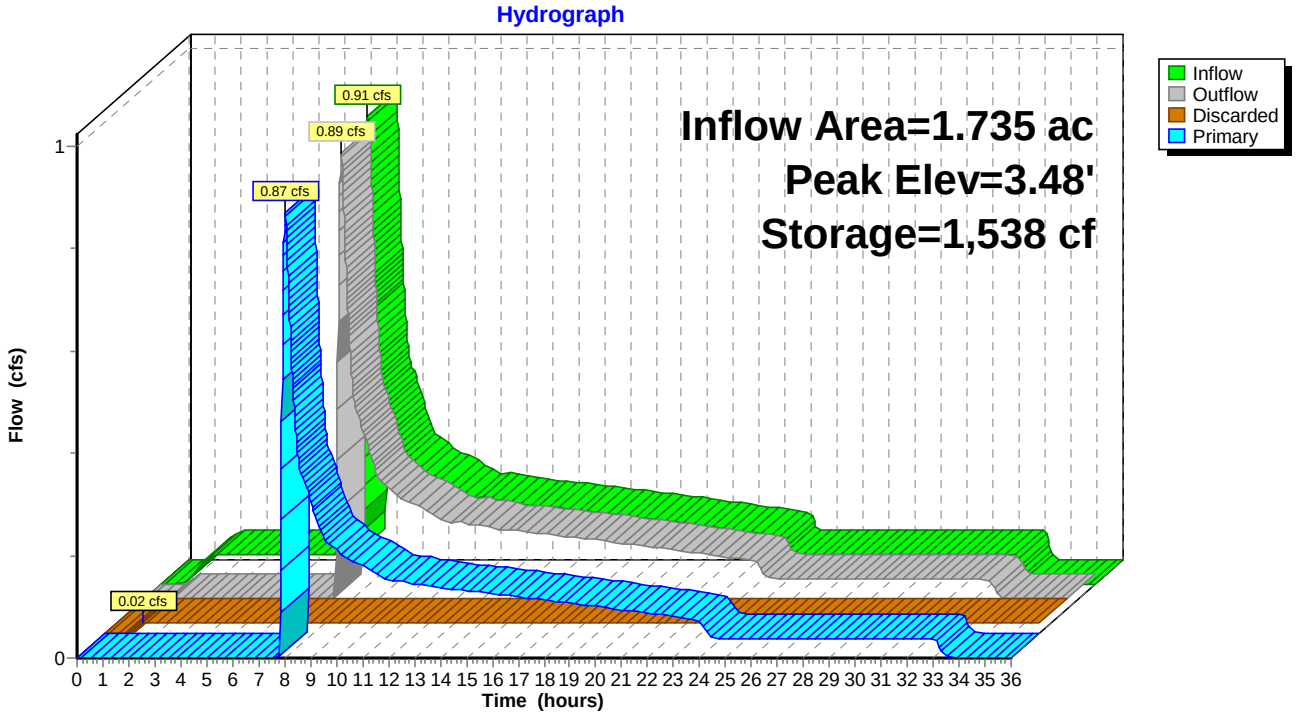
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
0.00	1,229	0	0
4.00	1,229	4,916	4,916

Device	Routing	Invert	Outlet Devices
#1	Discarded	0.00'	**0.700 in/hr Native Infiltration over Surface area**
#2	Primary	3.00'	**12.0" Vert. Underdrain** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.02 cfs @ 1.45 hrs HW=0.04' (Free Discharge)
↑—**1=Native Infiltration** (Exfiltration Controls 0.02 cfs)

Primary OutFlow Max=0.87 cfs @ 8.03 hrs HW=3.48' (Free Discharge)
↑—**2=Underdrain** (Orifice Controls 0.87 cfs @ 2.35 fps)

Pond 1 - DR: PB 1 - DR



Summary for Pond 1P: Underground Storage Pipe

Inflow Area = 1.735 ac, 61.67% Impervious, Inflow Depth = 1.65" for 10 year event
Inflow = 0.87 cfs @ 8.03 hrs, Volume= 0.238 af
Outflow = 0.18 cfs @ 11.05 hrs, Volume= 0.181 af, Atten= 79%, Lag= 181.3 min
Primary = 0.18 cfs @ 11.05 hrs, Volume= 0.181 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 2.85' @ 11.05 hrs Surf.Area= 0.025 ac Storage= 0.066 af

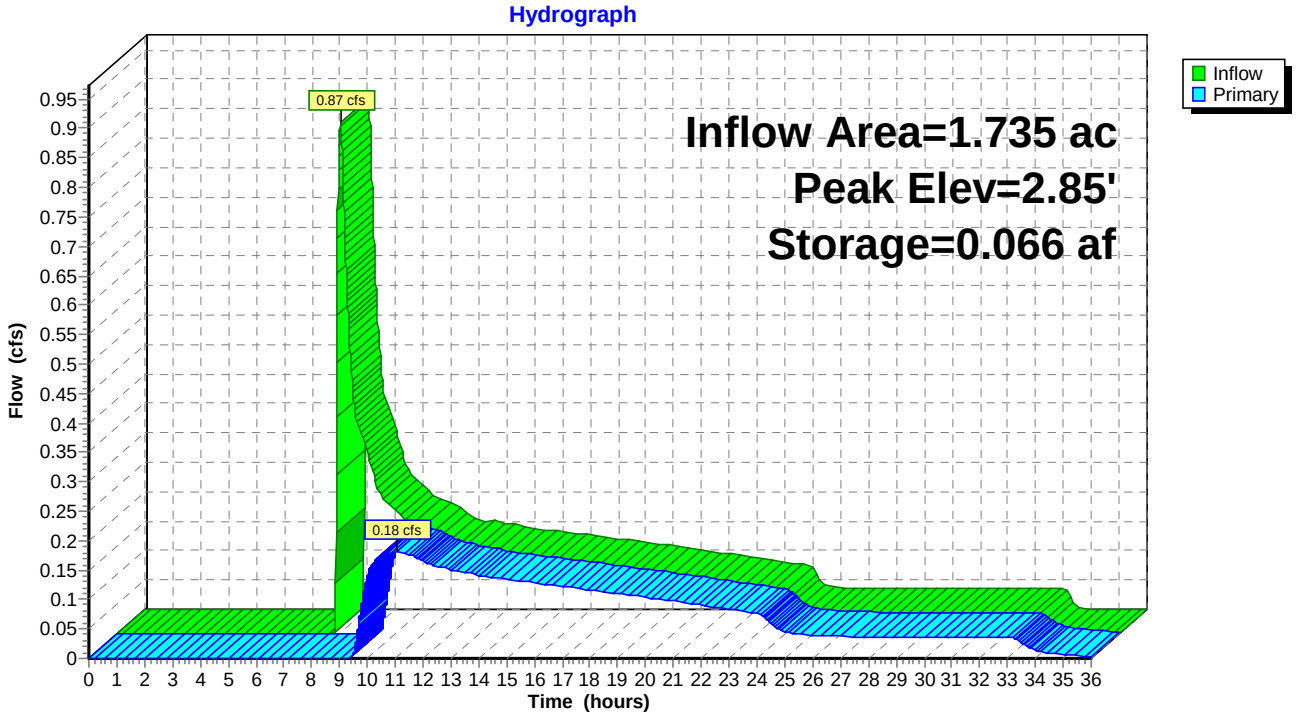
Plug-Flow detention time= 358.2 min calculated for 0.180 af (76% of inflow)
Center-of-Mass det. time= 170.5 min (1,098.0 - 927.5)

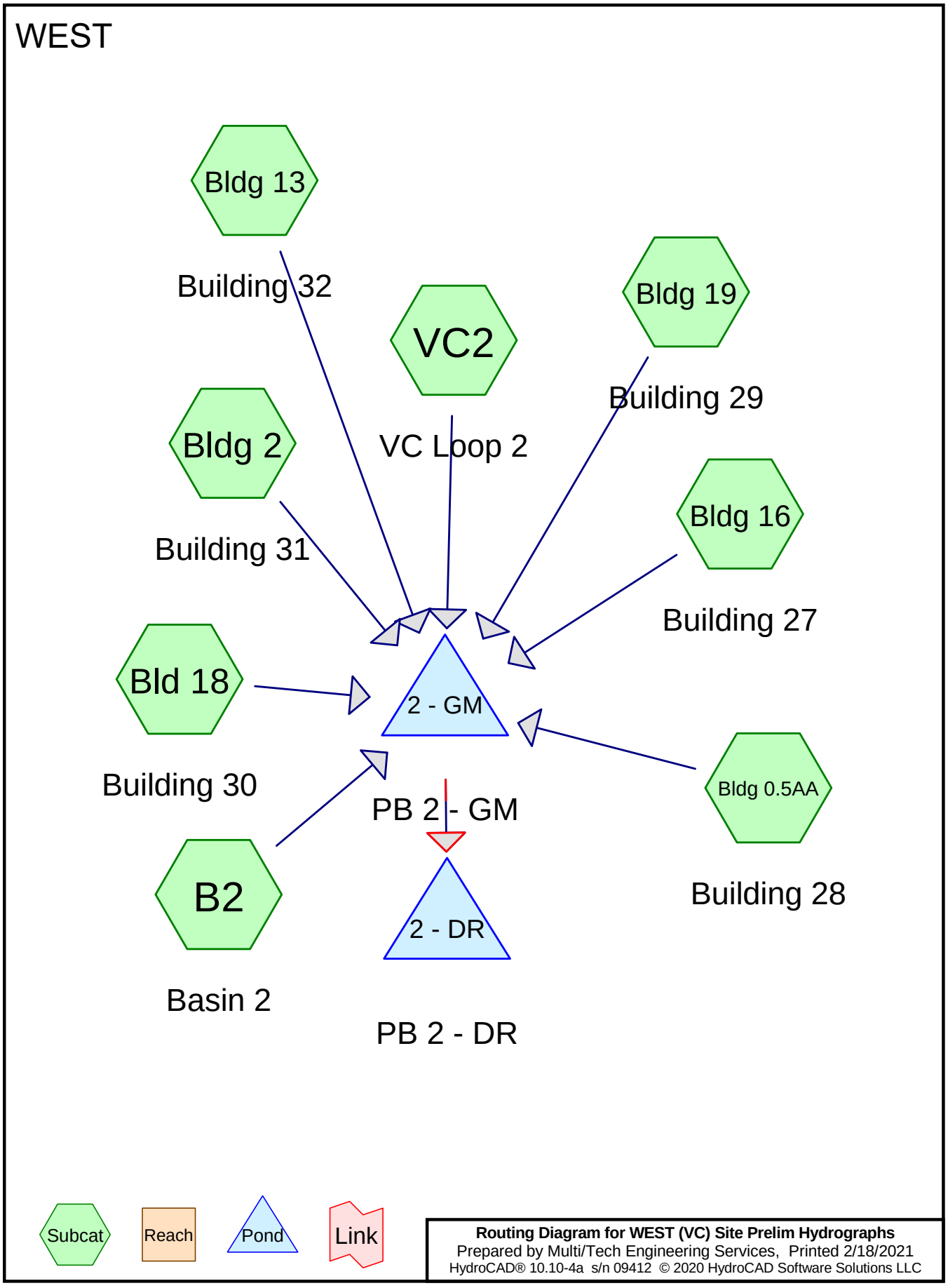
Volume	Invert	Avail.Storage	Storage Description
#1	0.00'	0.087 af	**48.0" Round Pipe Storage** L= 300.0'

Device	Routing	Invert	Outlet Devices
#1	Primary	2.50'	**4.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.18 cfs @ 11.05 hrs HW=2.85' (Free Discharge)
↑—**1=Orifice/Grate** (Orifice Controls 0.18 cfs @ 2.07 fps)

Pond 1P: Underground Storage Pipe




WEST
Bldg 13
Building 32
VC2
VC Loop 2
Bldg 19
Building 29
Bldg 2
Building 31
Bldg 16
Building 27
Bld 18
Building 30
2 - GM
Bldg 0.5AA
Building 28
PB 2 - GM
B2
Basin 2
2 - DR
PB 2 - DR
Subcat
Reach
Pond
Link
Routing Diagram for WEST (VC) Site Prelim Hydrographs
Prepared by Multi/Tech Engineering Services, Printed 2/18/2021
HydroCAD® 10.10-4a s/n 09412 © 2020 HydroCAD Software Solutions LLC

Summary for Subcatchment B2: Basin 2

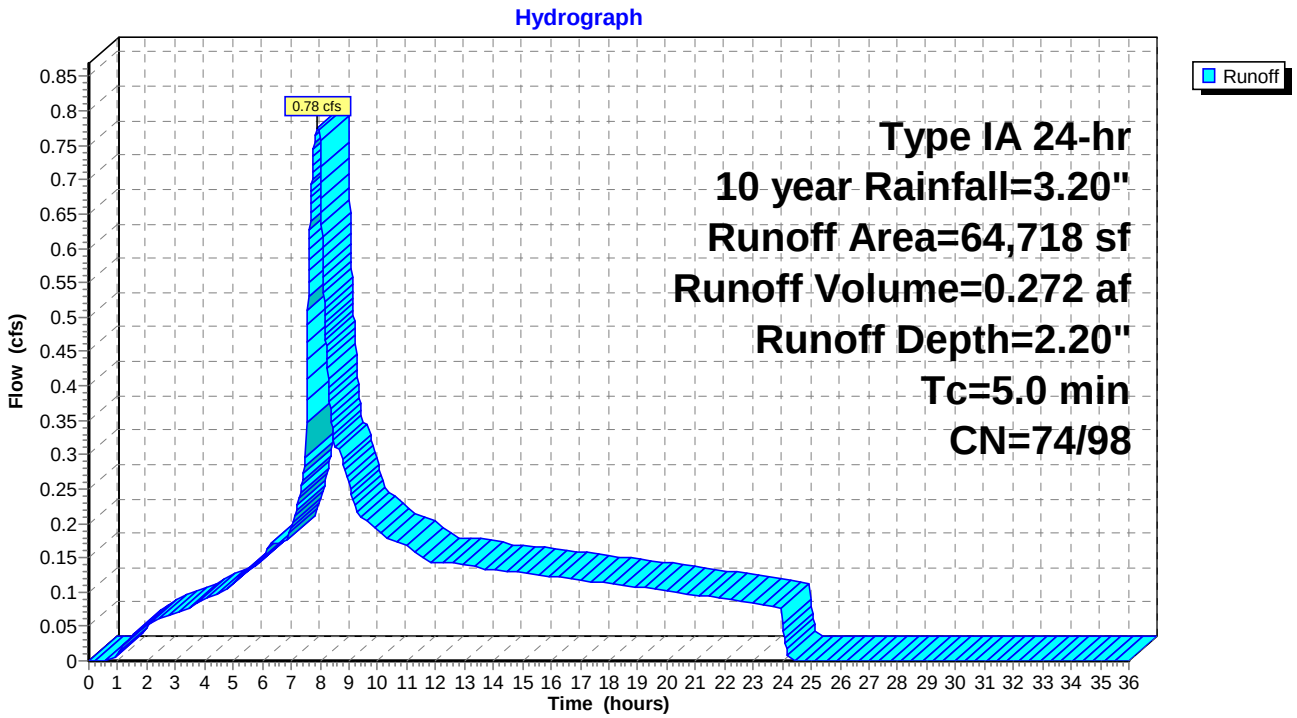
Runoff = 0.78 cfs @ 7.91 hrs, Volume= 0.272 af, Depth= 2.20"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type IA 24-hr 10 year Rainfall=3.20"

	Area (sf)	CN	Description
	21,385	74	>75% Grass cover, Good, HSG C
	38,965	98	Paved parking, HSG C
*	4,368	72	Planter Box
	64,718	88	Weighted Average
	25,753	74	39.79% Pervious Area
	38,965	98	60.21% Impervious Area

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

Subcatchment B2: Basin 2



Summary for Subcatchment Bld 18: Building 30

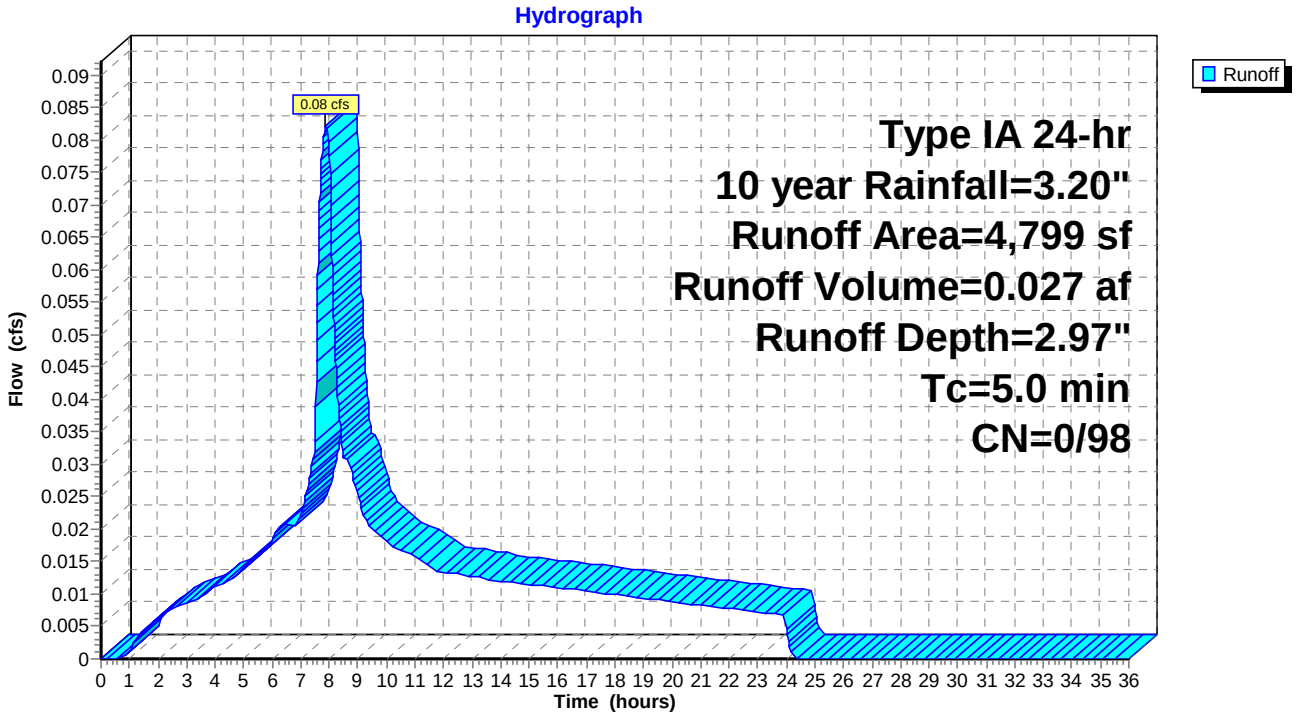
Runoff = 0.08 cfs @ 7.88 hrs, Volume= 0.027 af, Depth= 2.97"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type IA 24-hr 10 year Rainfall=3.20"

Area (sf)	CN	Description
4,799	98	Roofs, HSG C
4,799	98	100.00% Impervious Area

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

Subcatchment Bld 18: Building 30



Summary for Subcatchment Bldg 0.5AA: Building 28

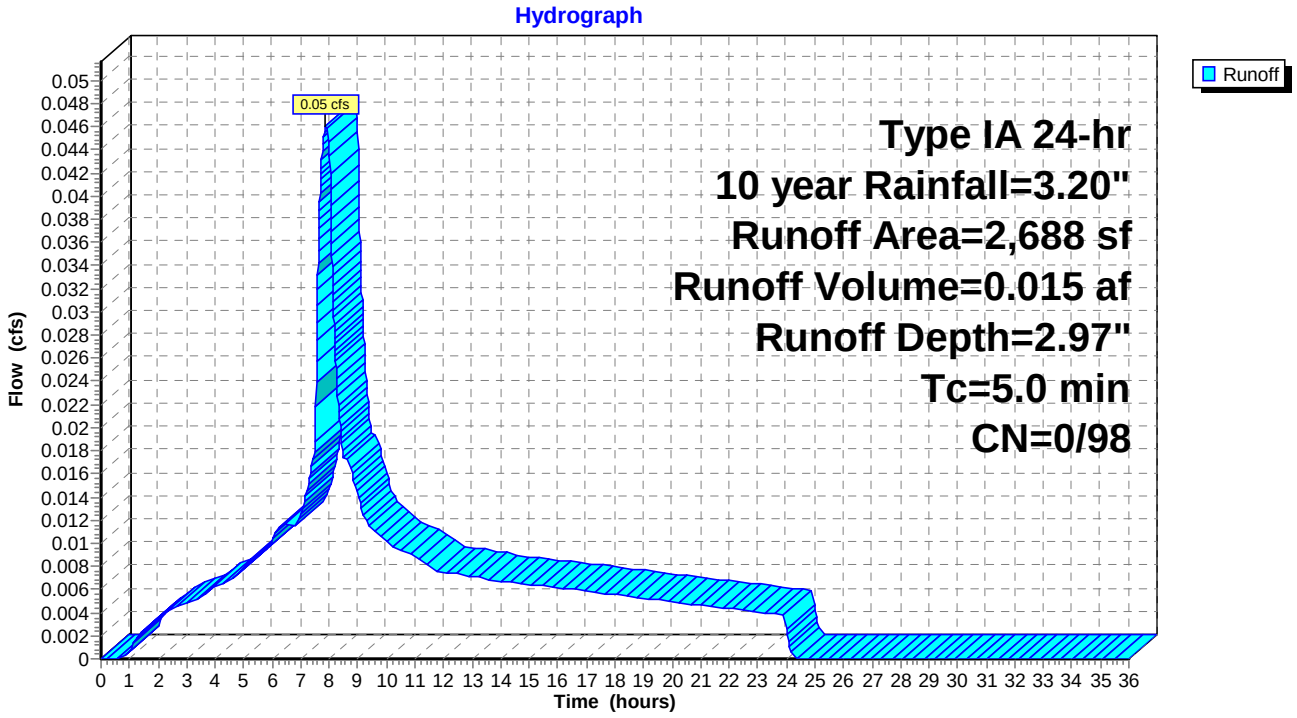
Runoff = 0.05 cfs @ 7.88 hrs, Volume= 0.015 af, Depth= 2.97"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type IA 24-hr 10 year Rainfall=3.20"

Area (sf)	CN	Description
2,688	98	Roofs, HSG C
2,688	98	100.00% Impervious Area

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

Subcatchment Bldg 0.5AA: Building 28



Summary for Subcatchment Bldg 13: Building 32

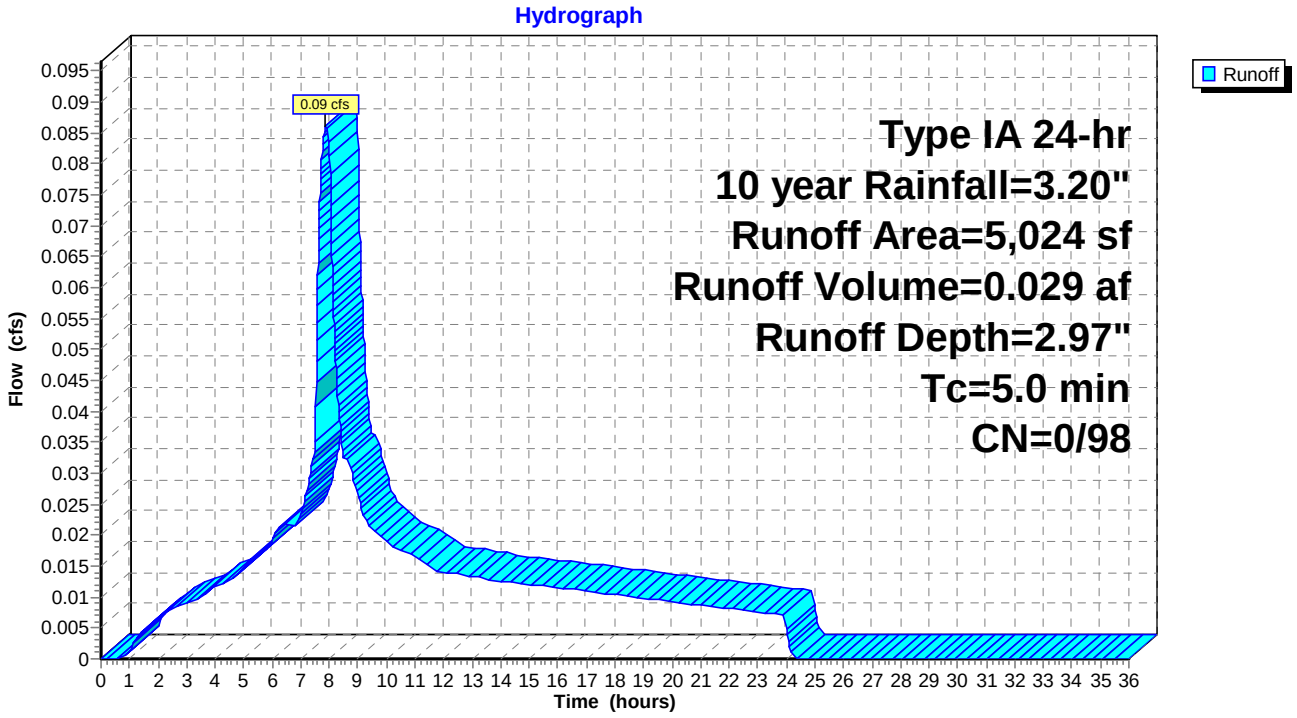
Runoff = 0.09 cfs @ 7.88 hrs, Volume= 0.029 af, Depth= 2.97"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type IA 24-hr 10 year Rainfall=3.20"

Area (sf)	CN	Description
5,024	98	Roofs, HSG C
5,024	98	100.00% Impervious Area

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

Subcatchment Bldg 13: Building 32



Summary for Subcatchment Bldg 16: Building 27

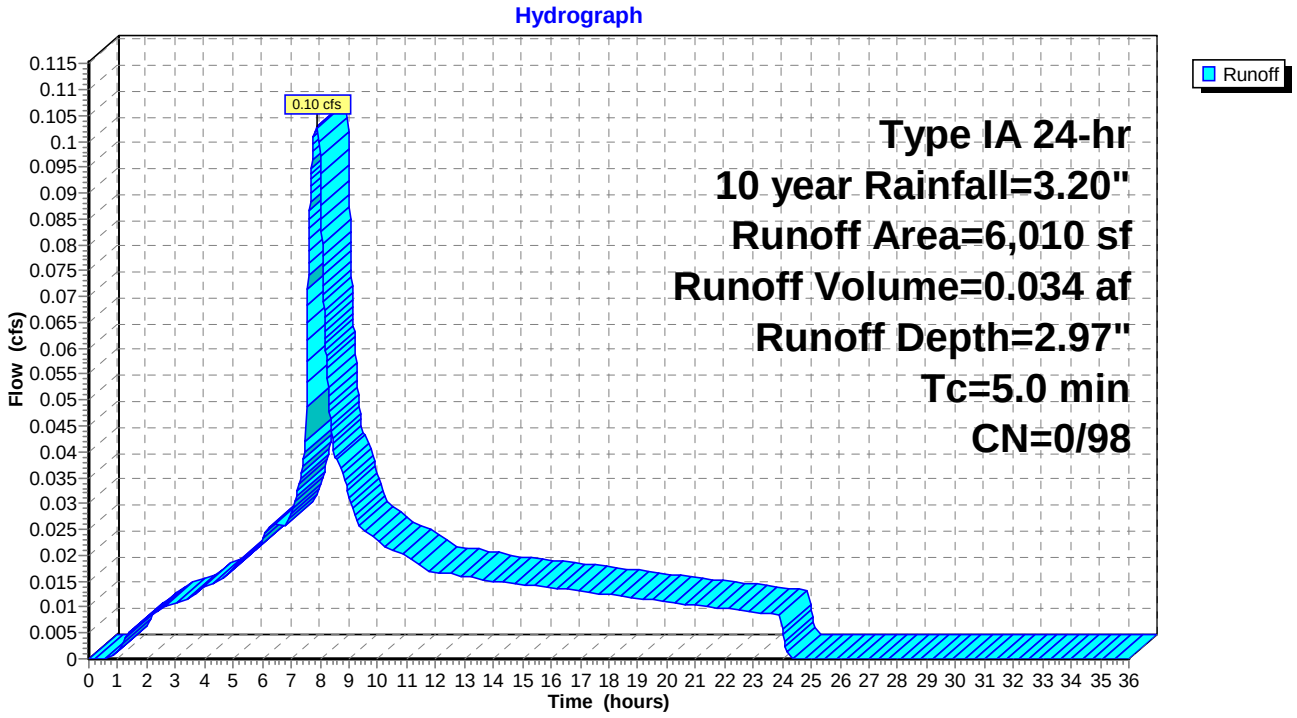
Runoff = 0.10 cfs @ 7.88 hrs, Volume= 0.034 af, Depth= 2.97"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type IA 24-hr 10 year Rainfall=3.20"

Area (sf)	CN	Description
6,010	98	Roofs, HSG C
6,010	98	100.00% Impervious Area

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

Subcatchment Bldg 16: Building 27



Summary for Subcatchment Bldg 19: Building 29

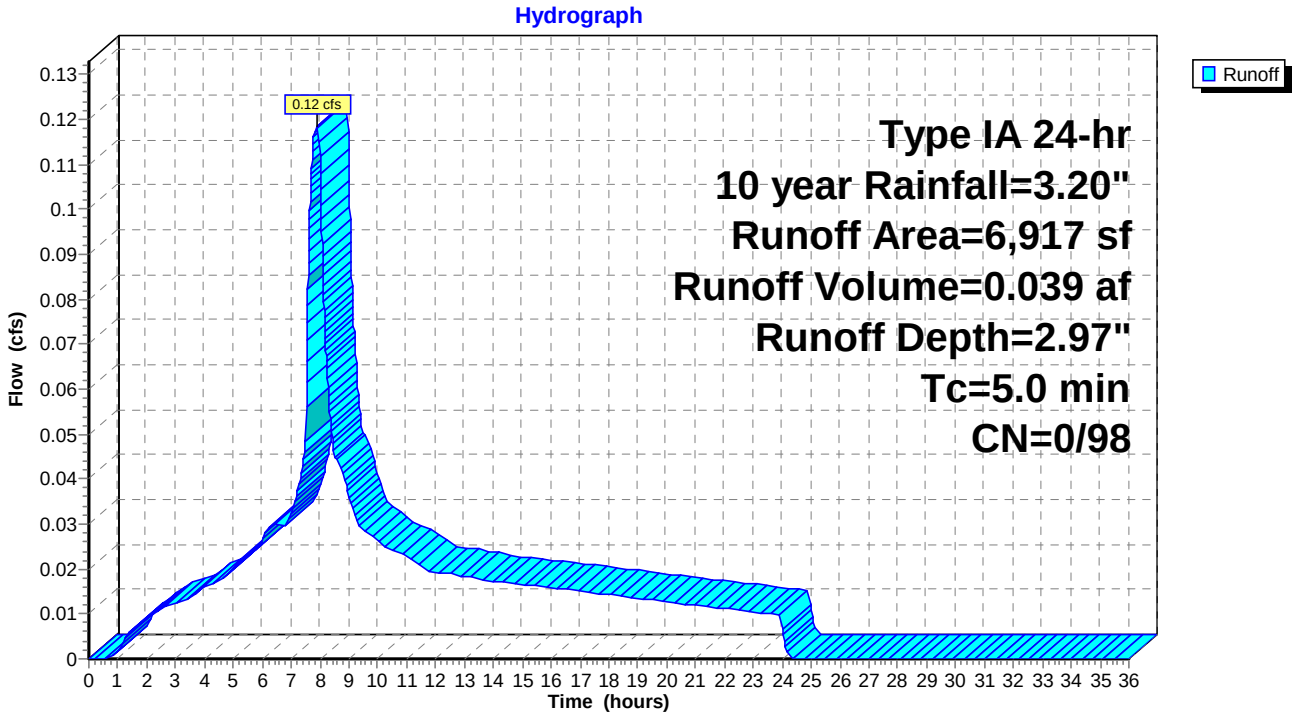
Runoff = 0.12 cfs @ 7.88 hrs, Volume= 0.039 af, Depth= 2.97"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type IA 24-hr 10 year Rainfall=3.20"

Area (sf)	CN	Description
6,917	98	Roofs, HSG C
6,917	98	100.00% Impervious Area

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

Subcatchment Bldg 19: Building 29



Summary for Subcatchment Bldg 2: Building 31

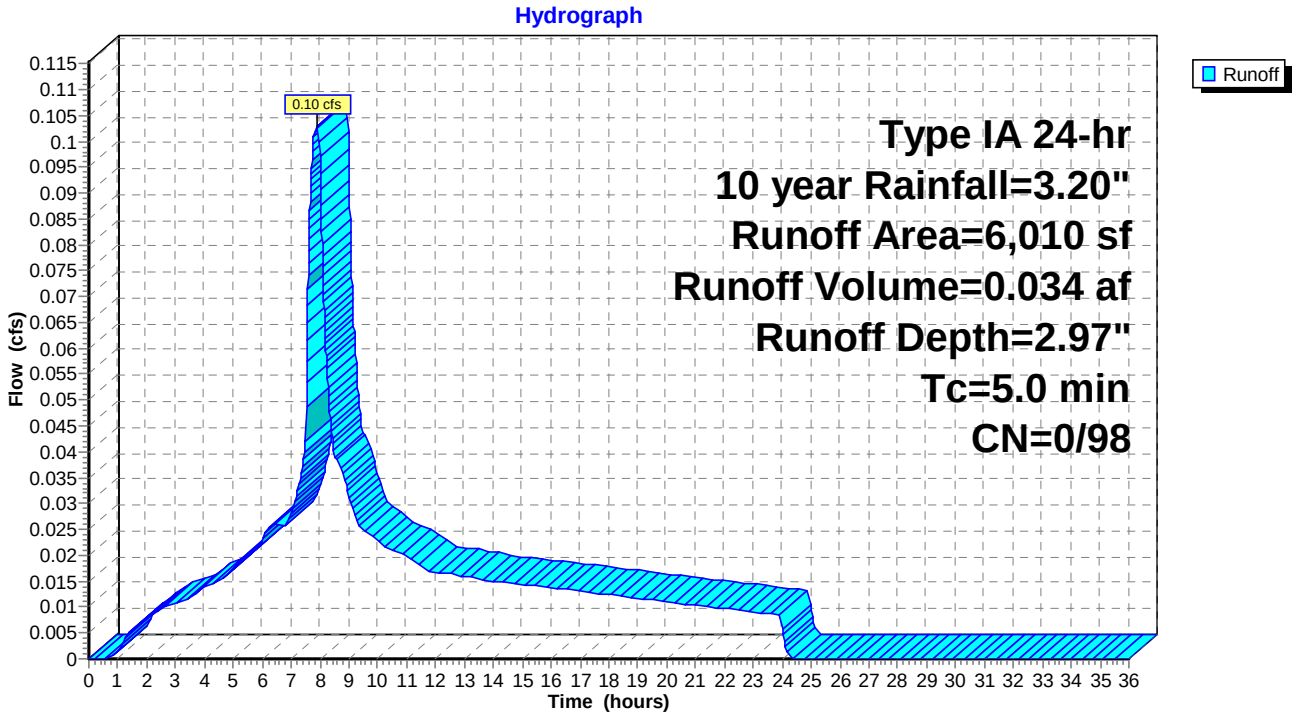
Runoff = 0.10 cfs @ 7.88 hrs, Volume= 0.034 af, Depth= 2.97"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type IA 24-hr 10 year Rainfall=3.20"

Area (sf)	CN	Description
6,010	98	Roofs, HSG C
6,010	98	100.00% Impervious Area

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

Subcatchment Bldg 2: Building 31



Summary for Subcatchment VC2: VC Loop 2

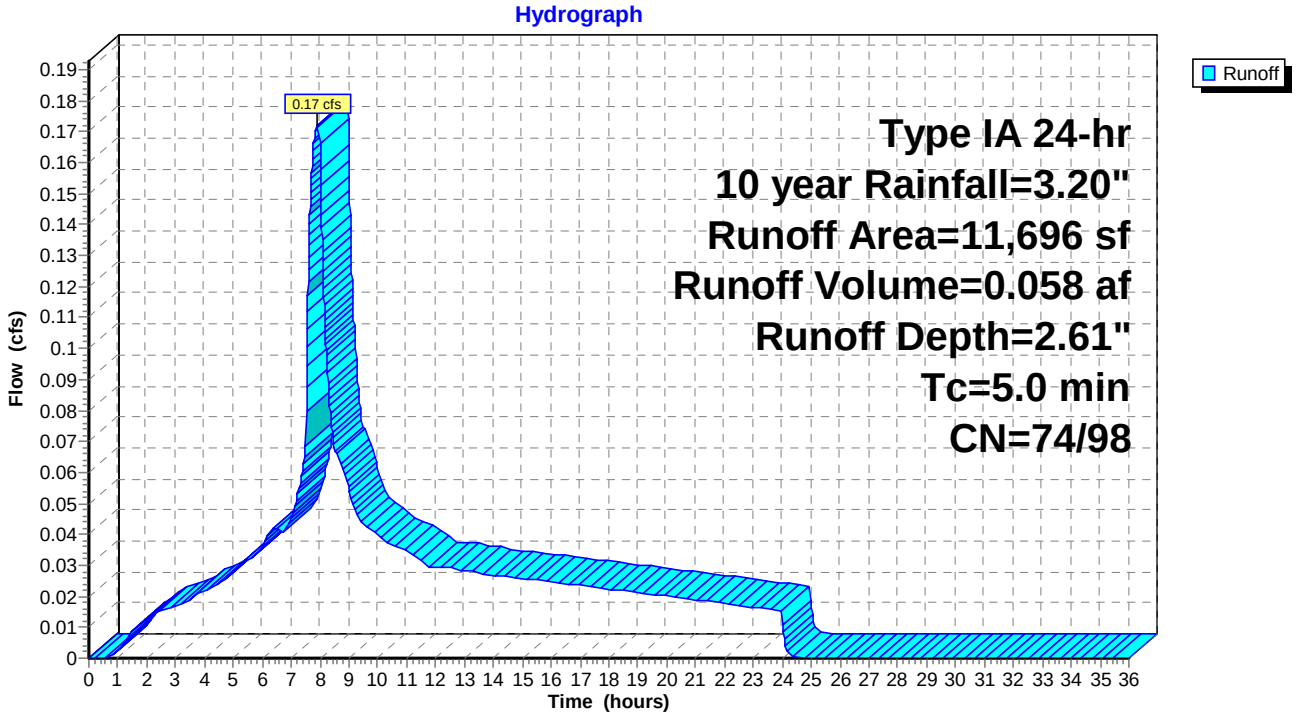
Runoff = 0.17 cfs @ 7.89 hrs, Volume= 0.058 af, Depth= 2.61"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type IA 24-hr 10 year Rainfall=3.20"

Area (sf)	CN	Description
2,181	74	>75% Grass cover, Good, HSG C
9,515	98	Paved parking, HSG C
11,696	94	Weighted Average
2,181	74	18.65% Pervious Area
9,515	98	81.35% Impervious Area

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

Subcatchment VC2: VC Loop 2



Summary for Pond 2 - GM: PB 2 - GM

Inflow Area = 2.476 ac, 74.10% Impervious, Inflow Depth = 2.47" for 10 year event
Inflow = 1.49 cfs @ 7.90 hrs, Volume= 0.509 af
Outflow = 0.21 cfs @ 4.74 hrs, Volume= 0.509 af, Atten= 86%, Lag= 0.0 min
Primary = 0.21 cfs @ 4.74 hrs, Volume= 0.509 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 5.50' @ 17.08 hrs Surf.Area= 4,519 sf Storage= 6,774 cf

Plug-Flow detention time= 341.2 min calculated for 0.509 af (100% of inflow)
Center-of-Mass det. time= 341.3 min (1,028.0 - 686.8)

Volume	Invert	Avail.Storage	Storage Description
#1	4.00'	9,038 cf	**Planter Box Storage (Prismatic)** Listed below (Recalc)

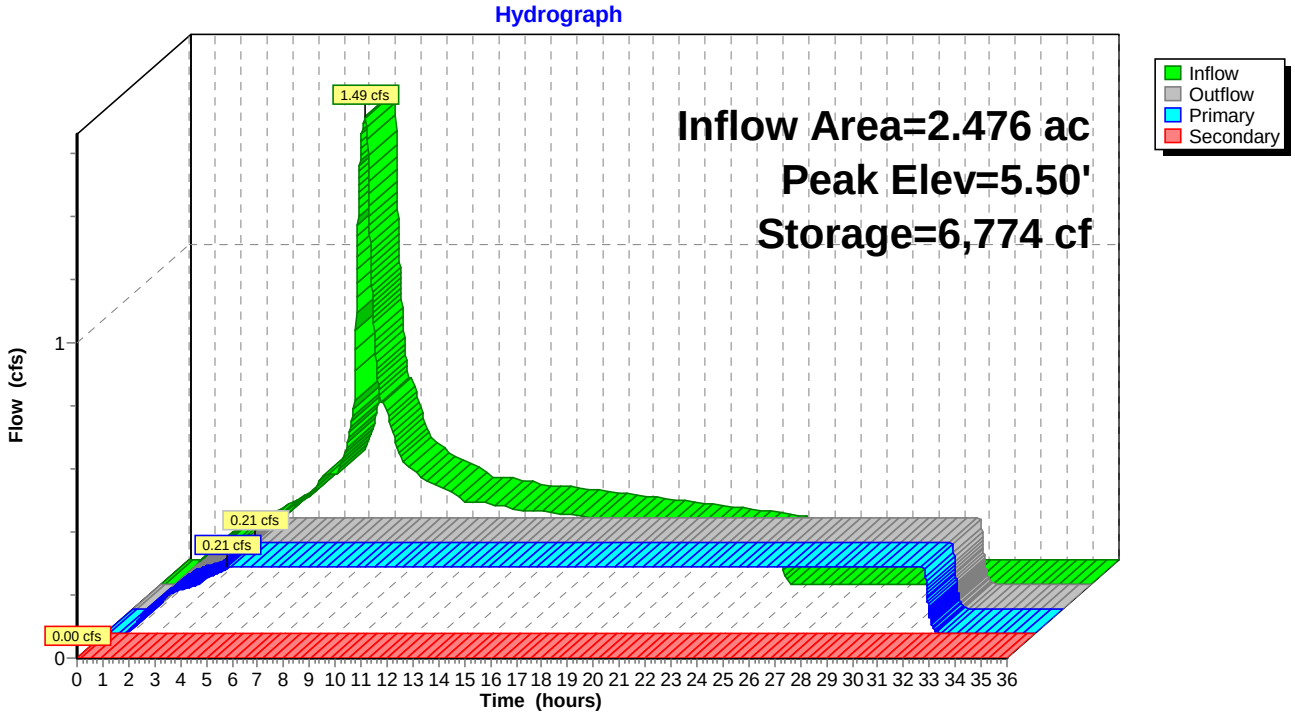
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
4.00	4,519	0	0
5.00	4,519	4,519	4,519
6.00	4,519	4,519	9,038

Device	Routing	Invert	Outlet Devices
#1	Primary	4.00'	**2.000 in/hr Flow through Growing Media over Surface area**
#2	Secondary	5.50'	**8.0" Horiz. Rock Box** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.21 cfs @ 4.74 hrs HW=4.02' (Free Discharge)
↑—**1=Flow through Growing Media** (Exfiltration Controls 0.21 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=4.00' (Free Discharge)
↑—**2=Rock Box** (Controls 0.00 cfs)

Pond 2 - GM: PB 2 - GM



Summary for Pond 2 - DR: PB 2 - DR

Inflow Area = 2.476 ac, 74.10% Impervious, Inflow Depth = 2.47" for 10 year event
Inflow = 0.21 cfs @ 4.74 hrs, Volume= 0.509 af
Outflow = 0.21 cfs @ 24.98 hrs, Volume= 0.405 af, Atten= 0%, Lag= 1,214.4 min
Discarded = 0.07 cfs @ 1.90 hrs, Volume= 0.209 af
Primary = 0.14 cfs @ 24.98 hrs, Volume= 0.195 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 3.53' @ 24.98 hrs Surf.Area= 4,519 sf Storage= 5,744 cf

Plug-Flow detention time= 412.5 min calculated for 0.404 af (79% of inflow)
Center-of-Mass det. time= 230.7 min (1,258.7 - 1,028.0)

Volume	Invert	Avail.Storage	Storage Description
#1	0.00'	6,507 cf	**Drain Rock Storage (Prismatic)** Listed below (Recalc) 18,076 cf Overall x 36.0% Voids

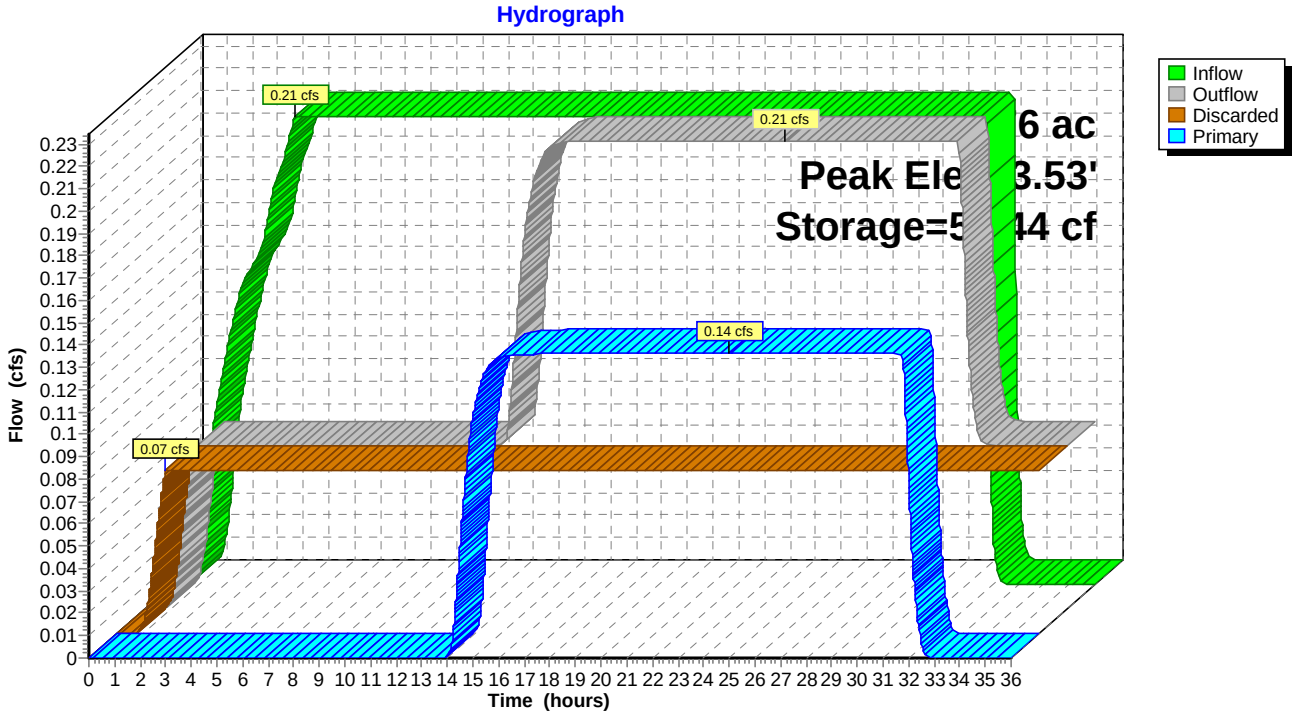
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
0.00	4,519	0	0
4.00	4,519	18,076	18,076

Device	Routing	Invert	Outlet Devices
#1	Discarded	0.00'	**0.700 in/hr Native Infiltration over Surface area**
#2	Primary	3.33'	**8.0" Vert. Underdrain** C= 0.600 Limited to weir flow at low heads

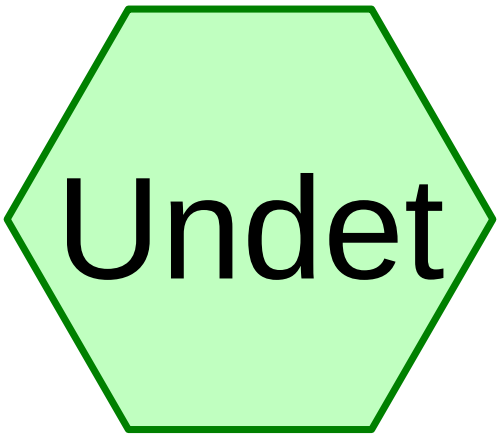
Discarded OutFlow Max=0.07 cfs @ 1.90 hrs HW=0.04' (Free Discharge)
↑—**1=Native Infiltration** (Exfiltration Controls 0.07 cfs)

Primary OutFlow Max=0.14 cfs @ 24.98 hrs HW=3.53' (Free Discharge)
↑—**2=Underdrain** (Orifice Controls 0.14 cfs @ 1.53 fps)

Pond 2 - DR: PB 2 - DR



WEST



Undetained

Subcat Reach Pond Link

Routing Diagram for WEST (VC) Site Prelim Hydrographs
Prepared by Multi/Tech Engineering Services, Printed 2/18/2021

Summary for Subcatchment Undet: Undetained

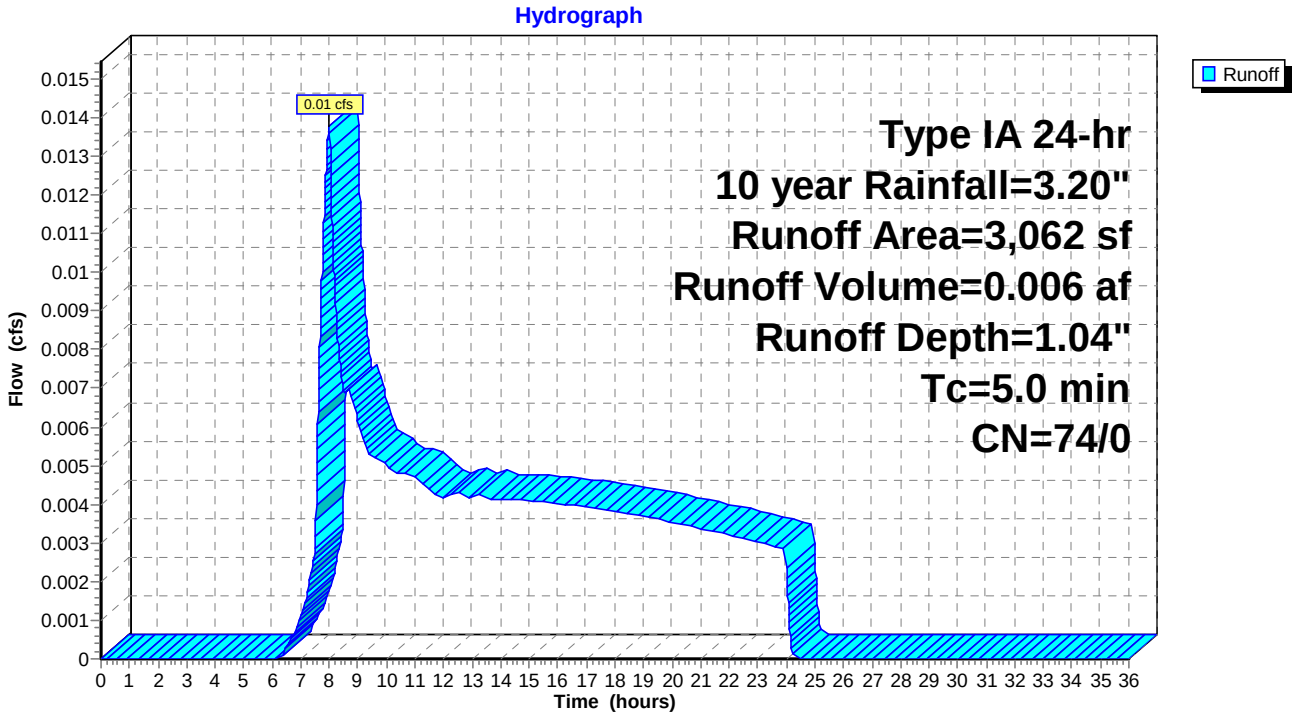
Runoff = 0.01 cfs @ 8.00 hrs, Volume= 0.006 af, Depth= 1.04"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type IA 24-hr 10 year Rainfall=3.20"

Area (sf)	CN	Description
3,062	74	>75% Grass cover, Good, HSG C
3,062	74	100.00% Pervious Area

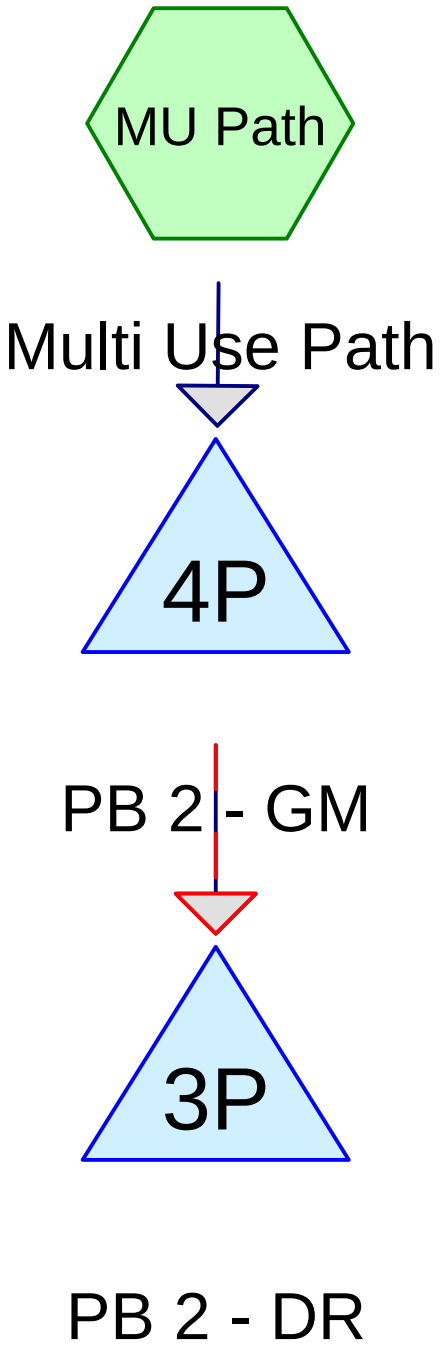
Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment Undet: Undetained



APPENDIX D: 25 YEAR HYDROGRAPHS

EAST



Subcat Reach Pond Link

Routing Diagram for EAST (Reed Rd) Site Prelim Hydrograph
Prepared by Multi/Tech Engineering Services, Printed 2/17/2021

Summary for Subcatchment MU Path: Multi Use Path

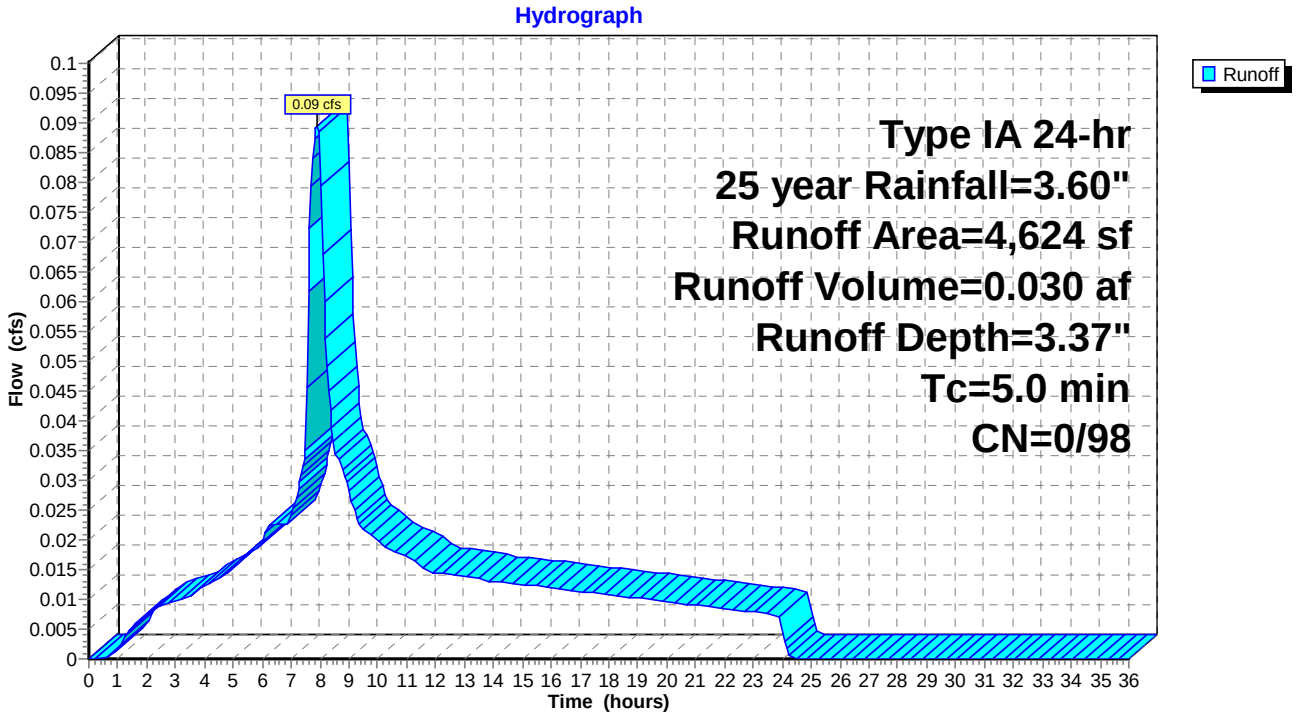
Runoff = 0.09 cfs @ 7.90 hrs, Volume= 0.030 af, Depth= 3.37"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type IA 24-hr 25 year Rainfall=3.60"

Area (sf)	CN	Description
4,624	98	Unconnected pavement, HSG C
4,624	98	100.00% Impervious Area

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

Subcatchment MU Path: Multi Use Path



Summary for Pond 4P: PB 2 - GM

Inflow Area = 0.106 ac,100.00% Impervious, Inflow Depth = 3.37" for 25 year event
Inflow = 0.09 cfs @ 7.90 hrs, Volume= 0.030 af
Outflow = 0.09 cfs @ 7.90 hrs, Volume= 0.030 af, Atten= 0%, Lag= 0.0 min
Primary = 0.09 cfs @ 7.90 hrs, Volume= 0.030 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 4.00' @ 7.90 hrs Surf.Area= 4,624 sf Storage= 0 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= (not calculated: outflow precedes inflow)

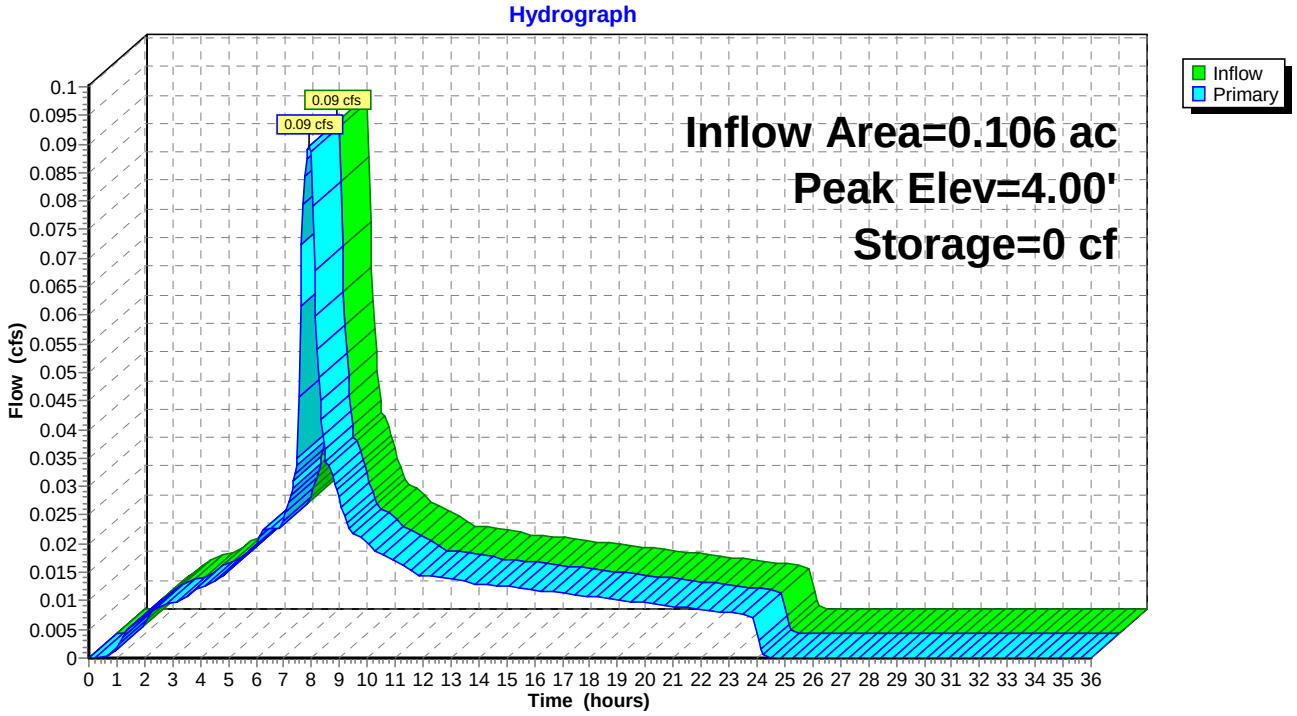
Volume	Invert	Avail.Storage	Storage Description
#1	4.00'	0 cf	**Growing Media (Prismatic)** Listed below (Recalc) 1,526 cf Overall x 0.0% Voids

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
4.00	4,624	0	0
4.33	4,624	1,526	1,526

Device	Routing	Invert	Outlet Devices
#1	Primary	4.00'	**100.000 in/hr Exfiltration over Surface area**

Primary OutFlow Max=10.70 cfs @ 7.90 hrs HW=4.00' (Free Discharge)
1=Exfiltration (Exfiltration Controls 10.70 cfs)

Pond 4P: PB 2 - GM



Summary for Pond 3P: PB 2 - DR

Inflow Area = 0.106 ac,100.00% Impervious, Inflow Depth = 3.37" for 25 year event
Inflow = 0.09 cfs @ 7.90 hrs, Volume= 0.030 af
Outflow = 0.03 cfs @ 7.55 hrs, Volume= 0.030 af, Atten= 64%, Lag= 0.0 min
Discarded = 0.03 cfs @ 7.55 hrs, Volume= 0.030 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 0.08' @ 8.76 hrs Surf.Area= 4,624 sf Storage= 135 cf

Plug-Flow detention time= 22.3 min calculated for 0.030 af (100% of inflow)
Center-of-Mass det. time= 22.3 min (685.6 - 663.3)

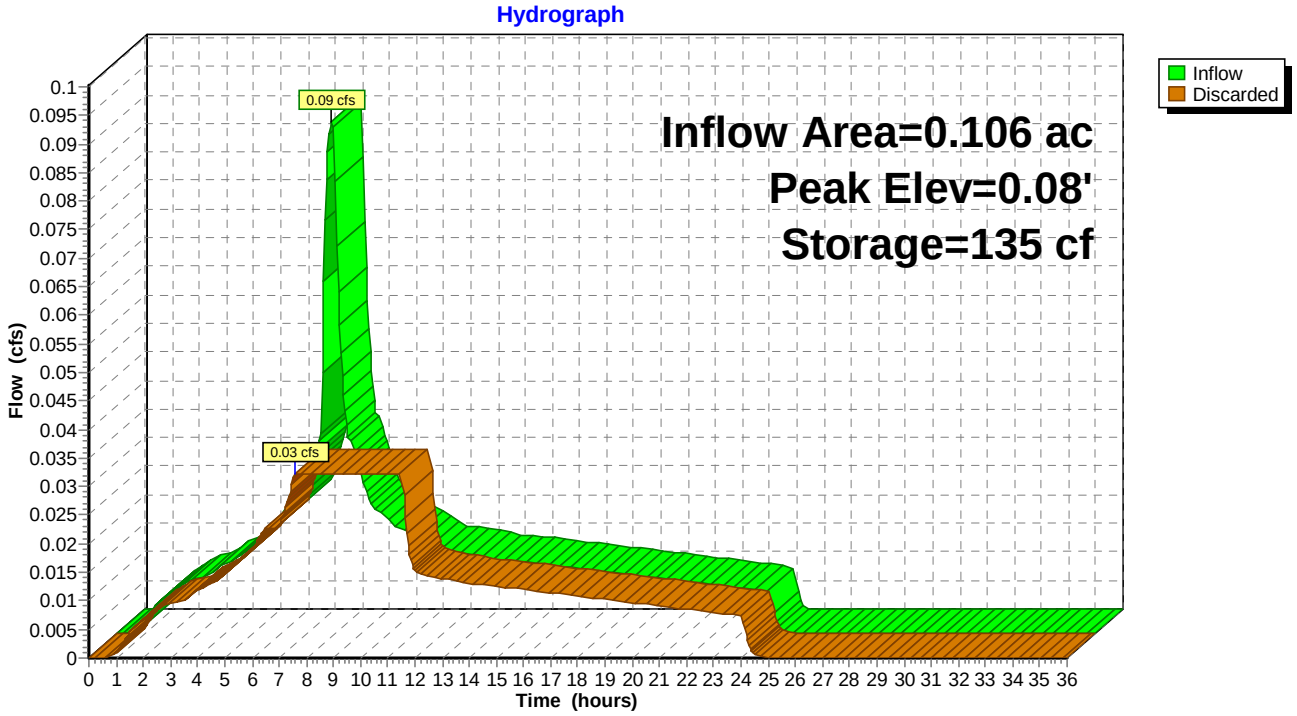
Volume	Invert	Avail.Storage	Storage Description
#1	0.00'	1,665 cf	**Drain Rock (Prismatic)** Listed below (Recalc) 4,624 cf Overall x 36.0% Voids

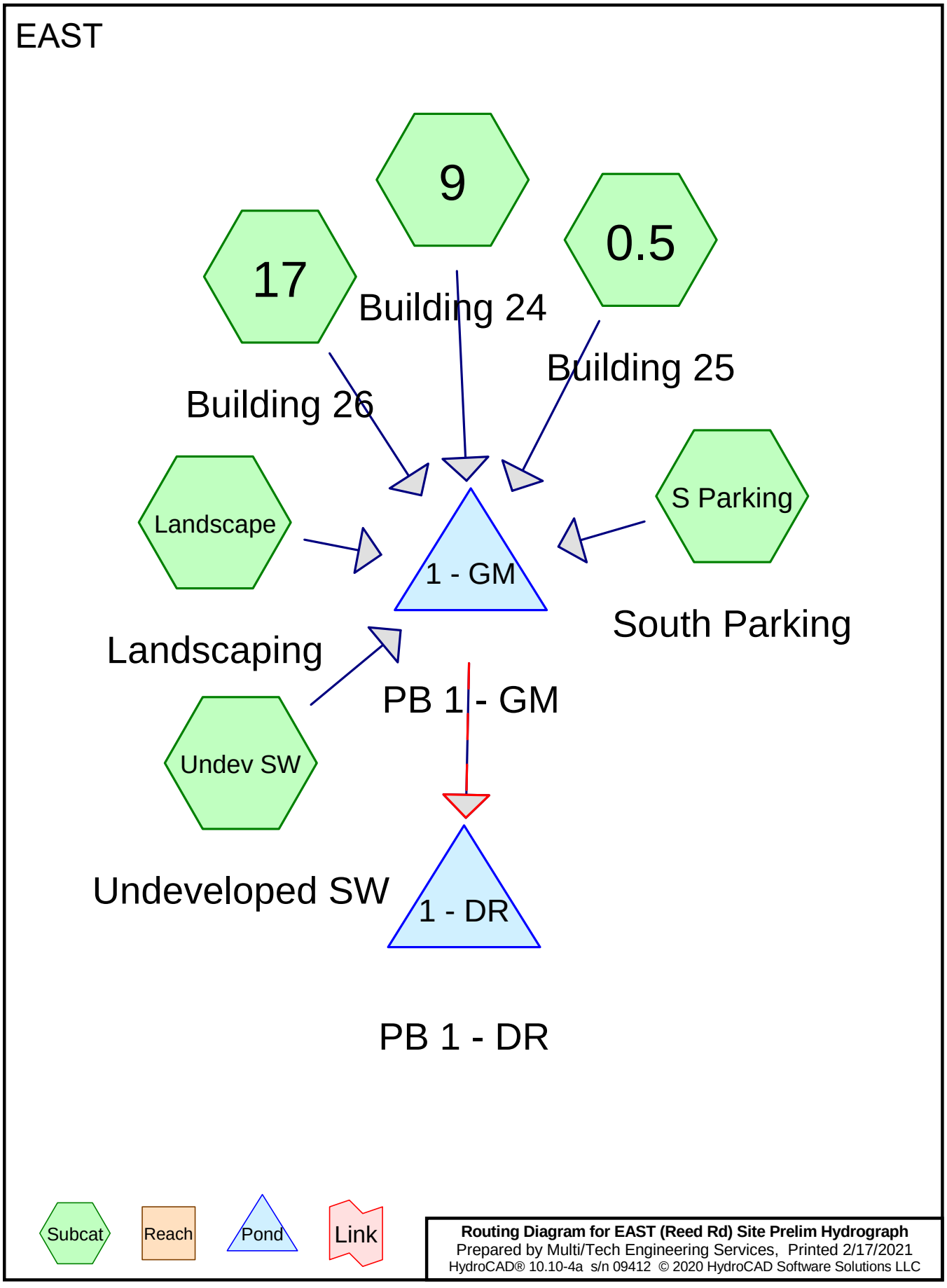
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
0.00	4,624	0	0
1.00	4,624	4,624	4,624

Device	Routing	Invert	Outlet Devices
#1	Discarded	0.00'	**0.300 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.03 cfs @ 7.55 hrs HW=0.01' (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 0.03 cfs)

Pond 3P: PB 2 - DR





Routing Diagram for EAST (Reed Rd) Site Prelim Hydrograph
Prepared by Multi/Tech Engineering Services, Printed 2/17/2021

Summary for Subcatchment 0.5: Building 25

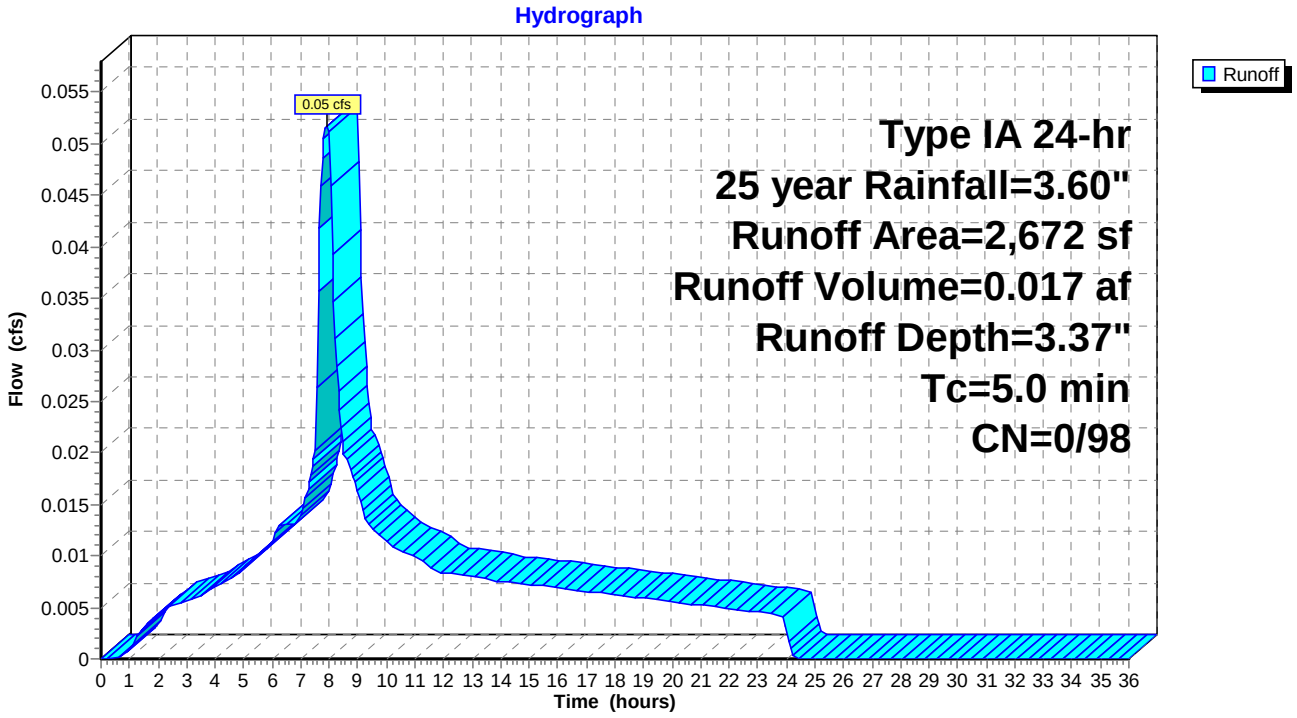
Runoff = 0.05 cfs @ 7.90 hrs, Volume= 0.017 af, Depth= 3.37"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type IA 24-hr 25 year Rainfall=3.60"

Area (sf)	CN	Description
2,672	98	Roofs, HSG C
2,672	98	100.00% Impervious Area

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

Subcatchment 0.5: Building 25



Summary for Subcatchment 9: Building 24

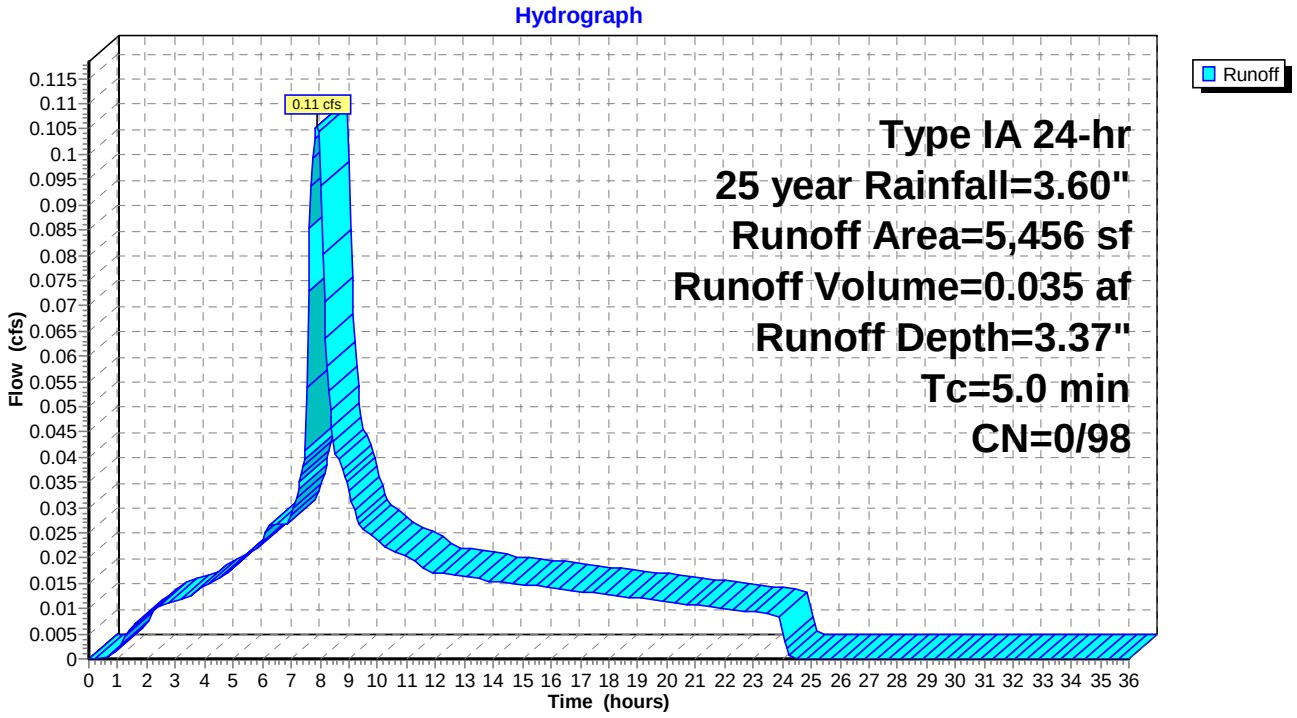
Runoff = 0.11 cfs @ 7.90 hrs, Volume= 0.035 af, Depth= 3.37"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type IA 24-hr 25 year Rainfall=3.60"

Area (sf)	CN	Description
5,456	98	Roofs, HSG C
5,456	98	100.00% Impervious Area

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

Subcatchment 9: Building 24



Summary for Subcatchment 17: Building 26

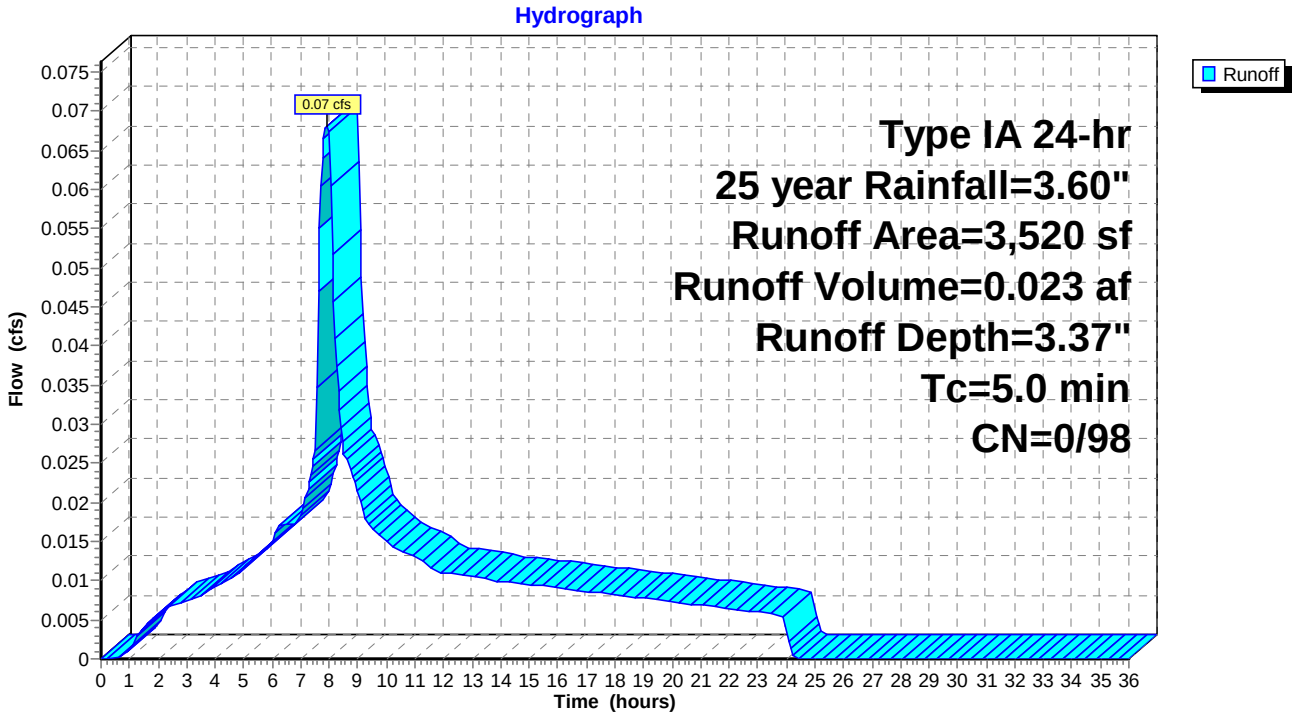
Runoff = 0.07 cfs @ 7.90 hrs, Volume= 0.023 af, Depth= 3.37"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type IA 24-hr 25 year Rainfall=3.60"

Area (sf)	CN	Description
3,520	98	Roofs, HSG C
3,520	98	100.00% Impervious Area

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

Subcatchment 17: Building 26



Summary for Subcatchment Landscape: Landscaping

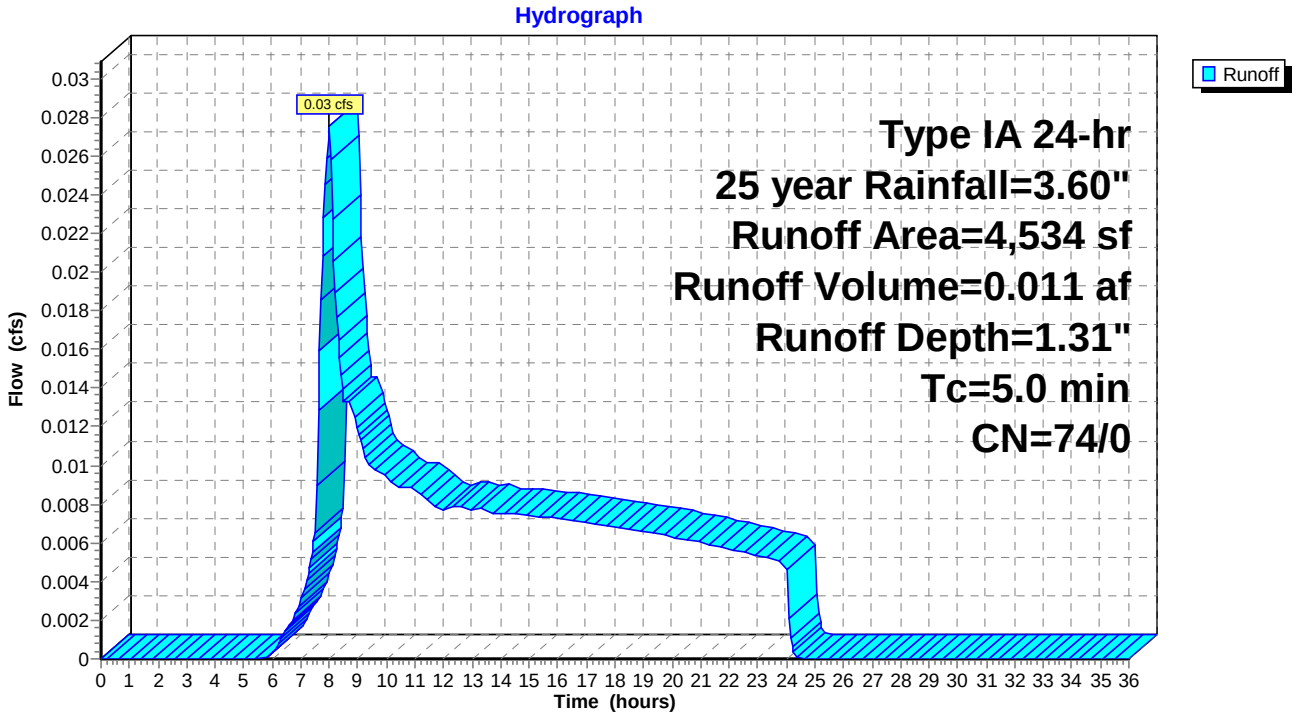
Runoff = 0.03 cfs @ 7.99 hrs, Volume= 0.011 af, Depth= 1.31"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type IA 24-hr 25 year Rainfall=3.60"

Area (sf)	CN	Description
4,534	74	>75% Grass cover, Good, HSG C
4,534	74	100.00% Pervious Area

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

Subcatchment Landscape: Landscaping



Summary for Subcatchment S Parking: South Parking

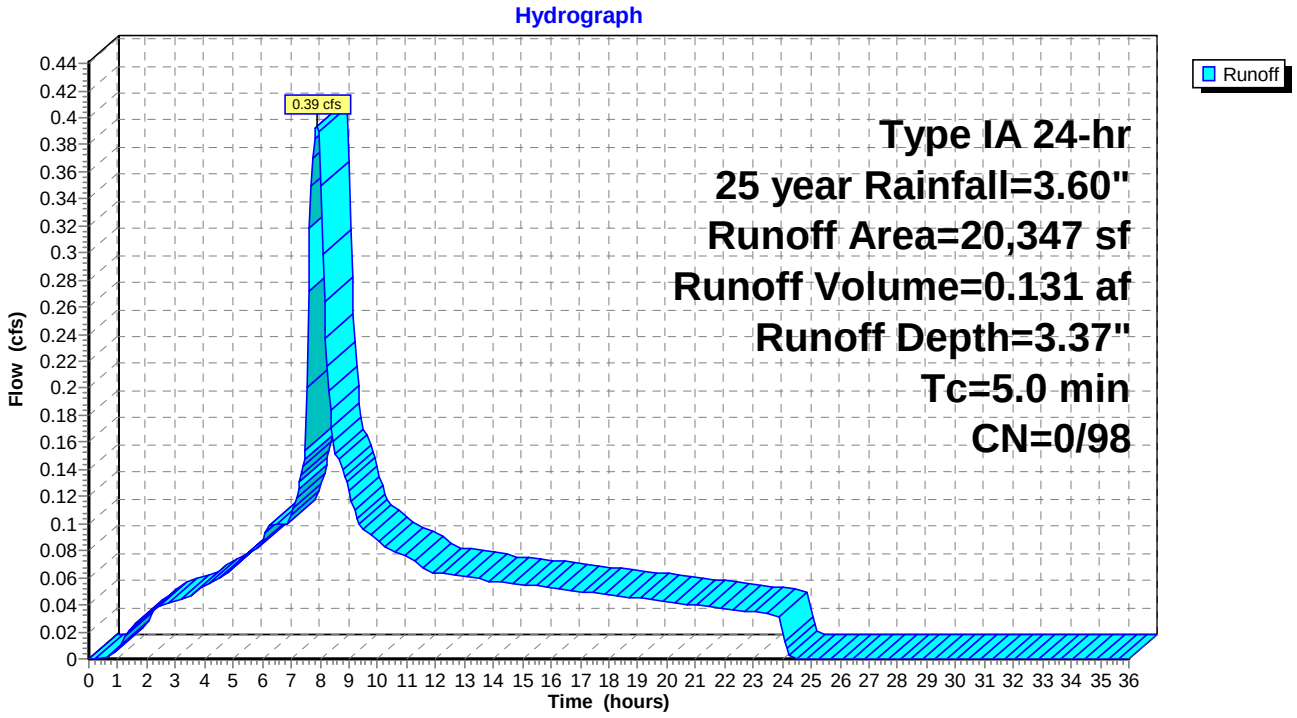
Runoff = 0.39 cfs @ 7.90 hrs, Volume= 0.131 af, Depth= 3.37"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type IA 24-hr 25 year Rainfall=3.60"

Area (sf)	CN	Description
20,347	98	Paved parking, HSG C
20,347	98	100.00% Impervious Area

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

Subcatchment S Parking: South Parking



Summary for Subcatchment Undev SW: Undeveloped SW

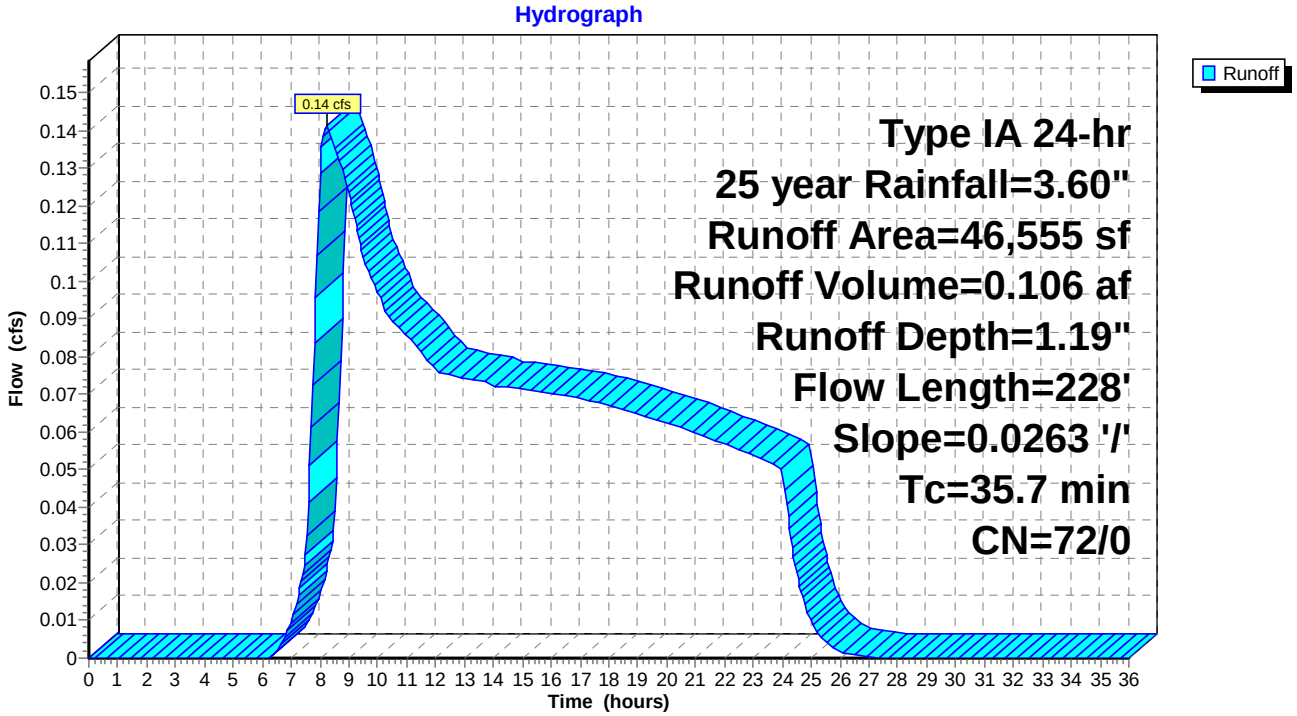
Runoff = 0.14 cfs @ 8.25 hrs, Volume= 0.106 af, Depth= 1.19"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type IA 24-hr 25 year Rainfall=3.60"

	Area (sf)	CN	Description
*	46,555	72	City of Salem Predeveloped, HSG C
	46,555	72	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
35.7	228	0.0263	0.11		**Sheet Flow,** n= 0.300 P2= 2.20"

Subcatchment Undev SW: Undeveloped SW



Summary for Pond 1 - GM: PB 1 - GM

Inflow Area = 1.907 ac, 38.51% Impervious, Inflow Depth = 2.03" for 25 year event
Inflow = 0.76 cfs @ 7.97 hrs, Volume= 0.323 af
Outflow = 0.14 cfs @ 6.15 hrs, Volume= 0.323 af, Atten= 82%, Lag= 0.0 min
Primary = 0.14 cfs @ 6.15 hrs, Volume= 0.323 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 5.28' @ 19.42 hrs Surf.Area= 3,008 sf Storage= 3,850 cf

Plug-Flow detention time= 294.0 min calculated for 0.323 af (100% of inflow)
Center-of-Mass det. time= 294.2 min (1,039.2 - 744.9)

Volume	Invert	Avail.Storage	Storage Description
#1	4.00'	6,016 cf	**Growing Media (Prismatic)** Listed below (Recalc)

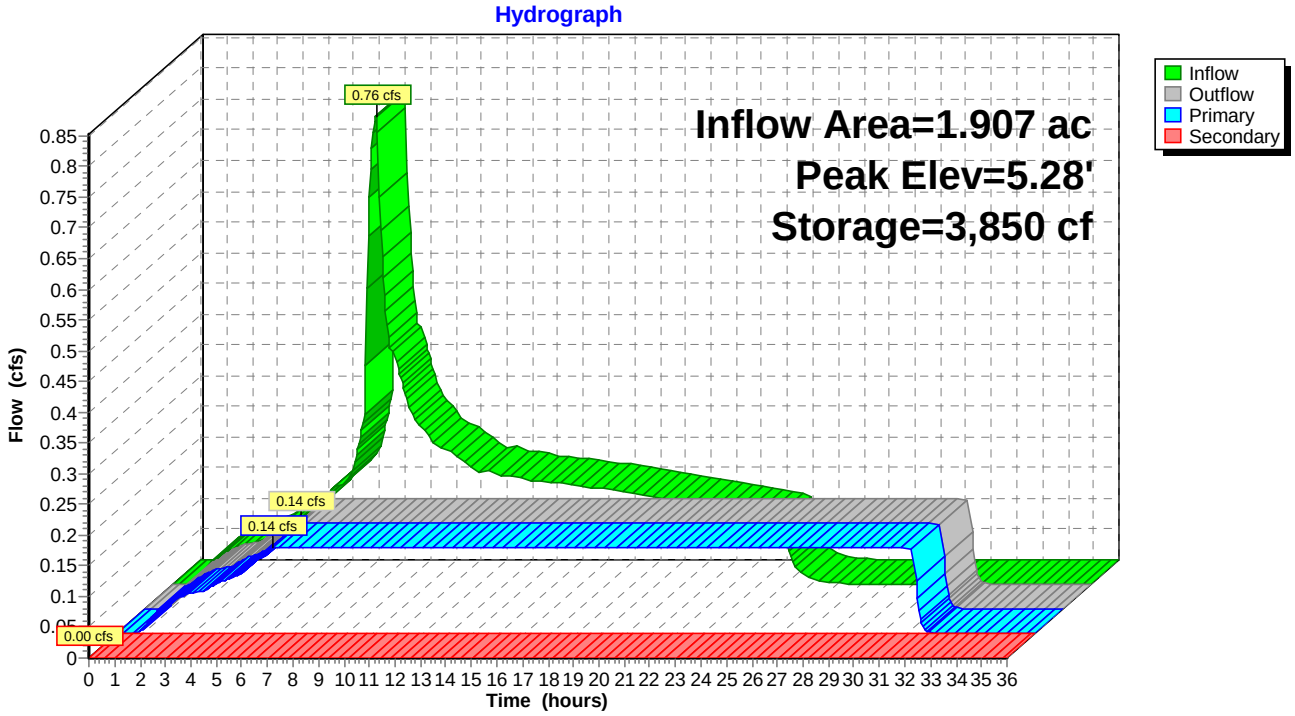
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
4.00	3,008	0	0
6.00	3,008	6,016	6,016

Device	Routing	Invert	Outlet Devices
#1	Primary	4.00'	**2.000 in/hr Exfiltration over Surface area**
#2	Secondary	5.50'	**7.0" Horiz. Rock Box** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.14 cfs @ 6.15 hrs HW=4.02' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.14 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=4.00' (Free Discharge)
└**2=Rock Box** (Controls 0.00 cfs)

Pond 1 - GM: PB 1 - GM



Summary for Pond 1 - DR: PB 1 - DR

Inflow Area = 1.907 ac, 38.51% Impervious, Inflow Depth = 2.03" for 25 year event
Inflow = 0.14 cfs @ 6.15 hrs, Volume= 0.323 af
Outflow = 0.14 cfs @ 24.25 hrs, Volume= 0.256 af, Atten= 0%, Lag= 1,086.0 min
Discarded = 0.05 cfs @ 2.35 hrs, Volume= 0.139 af
Primary = 0.09 cfs @ 24.25 hrs, Volume= 0.117 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 3.49' @ 24.25 hrs Surf.Area= 3,008 sf Storage= 3,781 cf

Plug-Flow detention time= 399.8 min calculated for 0.256 af (79% of inflow)
Center-of-Mass det. time= 224.6 min (1,263.7 - 1,039.2)

Volume	Invert	Avail.Storage	Storage Description
#1	0.00'	4,332 cf	**Drain Rock (Prismatic)** Listed below (Recalc) 12,032 cf Overall x 36.0% Voids

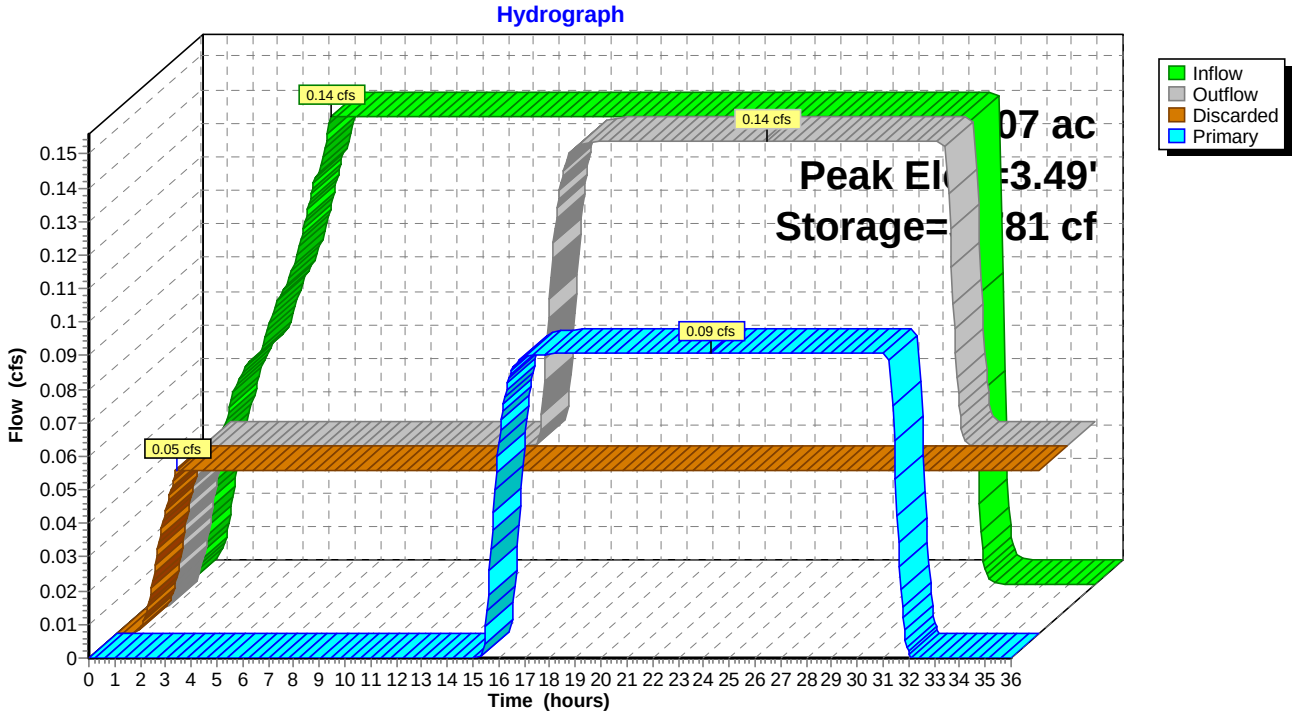
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
0.00	3,008	0	0
4.00	3,008	12,032	12,032

Device	Routing	Invert	Outlet Devices
#1	Discarded	0.00'	**0.700 in/hr Exfiltration over Surface area**
#2	Primary	3.33'	**8.0" Vert. Underdrain** C= 0.600 Limited to weir flow at low heads

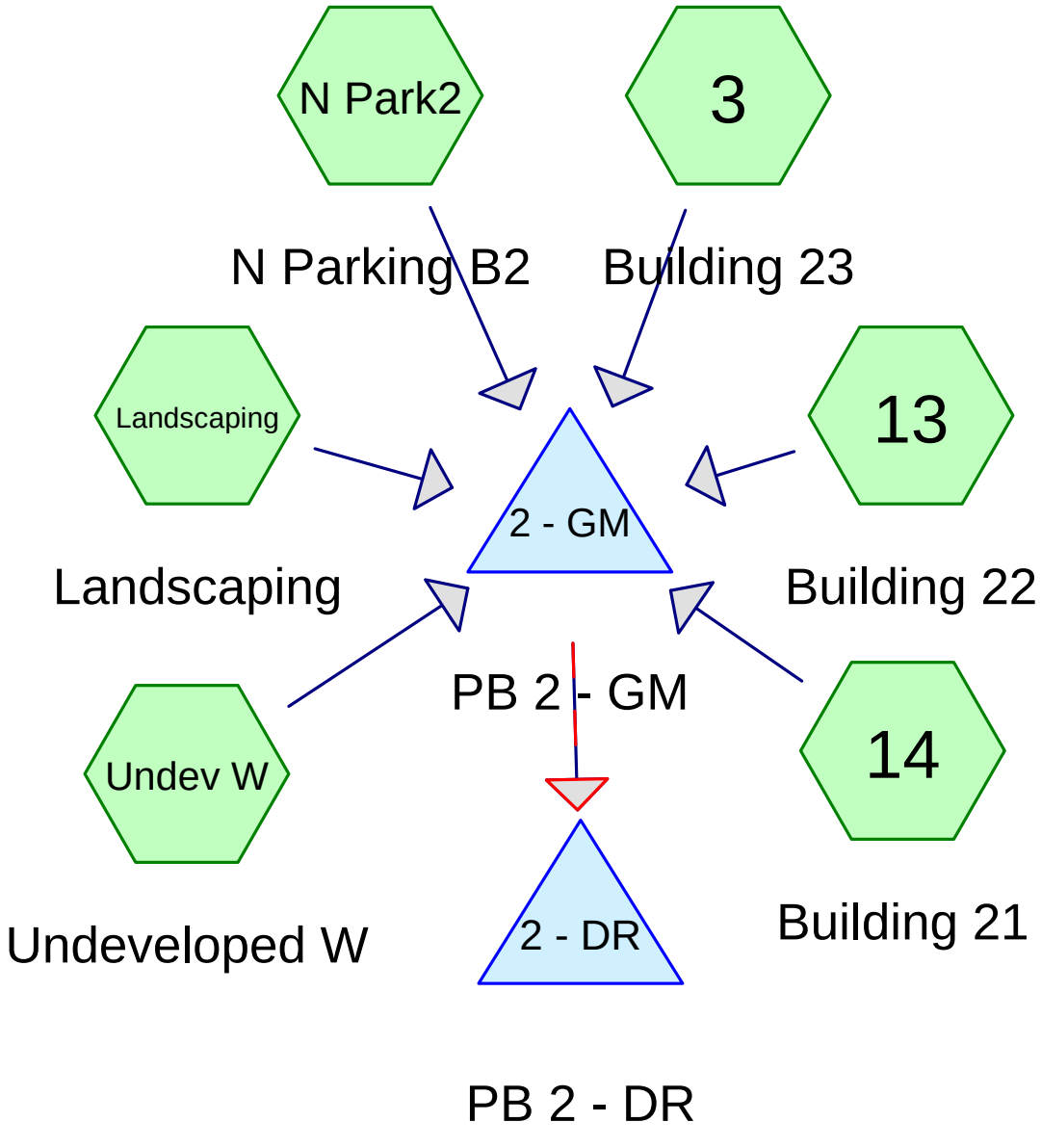
Discarded OutFlow Max=0.05 cfs @ 2.35 hrs HW=0.04' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.05 cfs)

Primary OutFlow Max=0.09 cfs @ 24.25 hrs HW=3.49' (Free Discharge)
↑—**2=Underdrain** (Orifice Controls 0.09 cfs @ 1.37 fps)

Pond 1 - DR: PB 1 - DR



EAST



Subcat Reach Pond Link

Routing Diagram for EAST (Reed Rd) Site Prelim Hydrograph
Prepared by Multi/Tech Engineering Services, Printed 2/17/2021

Summary for Subcatchment 3: Building 23

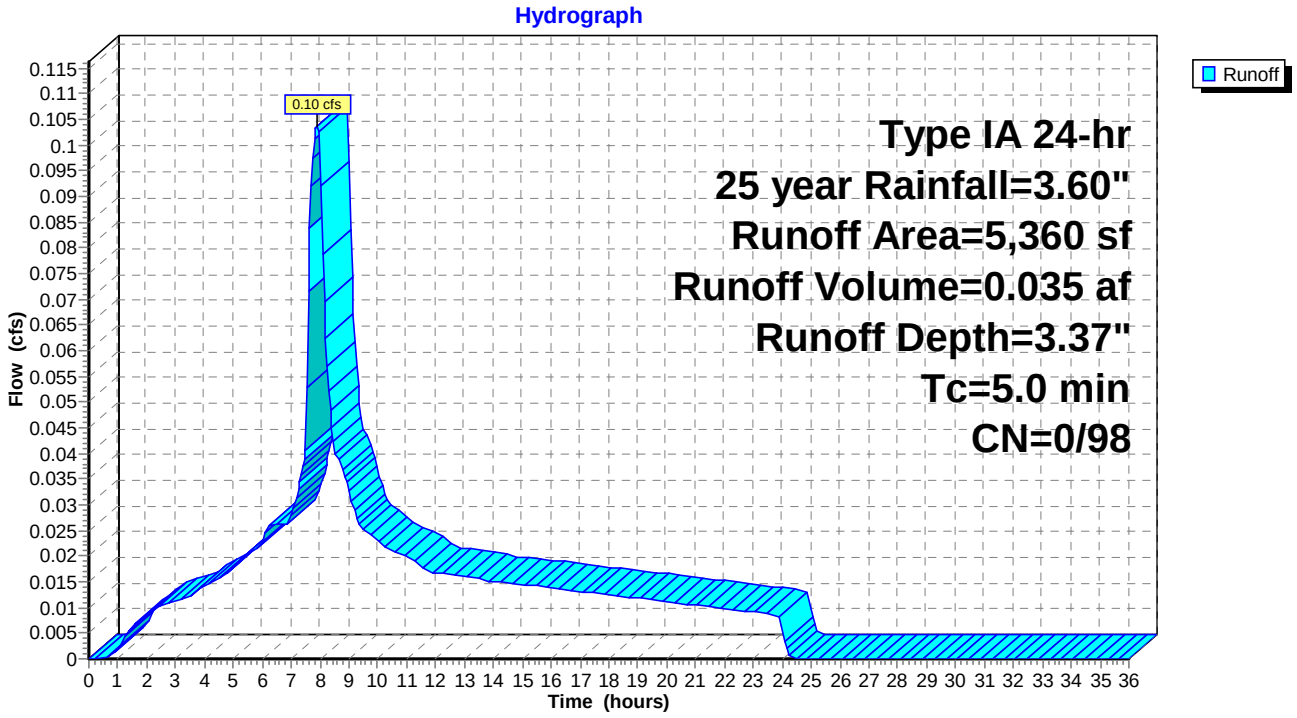
Runoff = 0.10 cfs @ 7.90 hrs, Volume= 0.035 af, Depth= 3.37"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type IA 24-hr 25 year Rainfall=3.60"

Area (sf)	CN	Description
5,360	98	Roofs, HSG C
5,360	98	100.00% Impervious Area

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

Subcatchment 3: Building 23



Summary for Subcatchment 13: Building 22

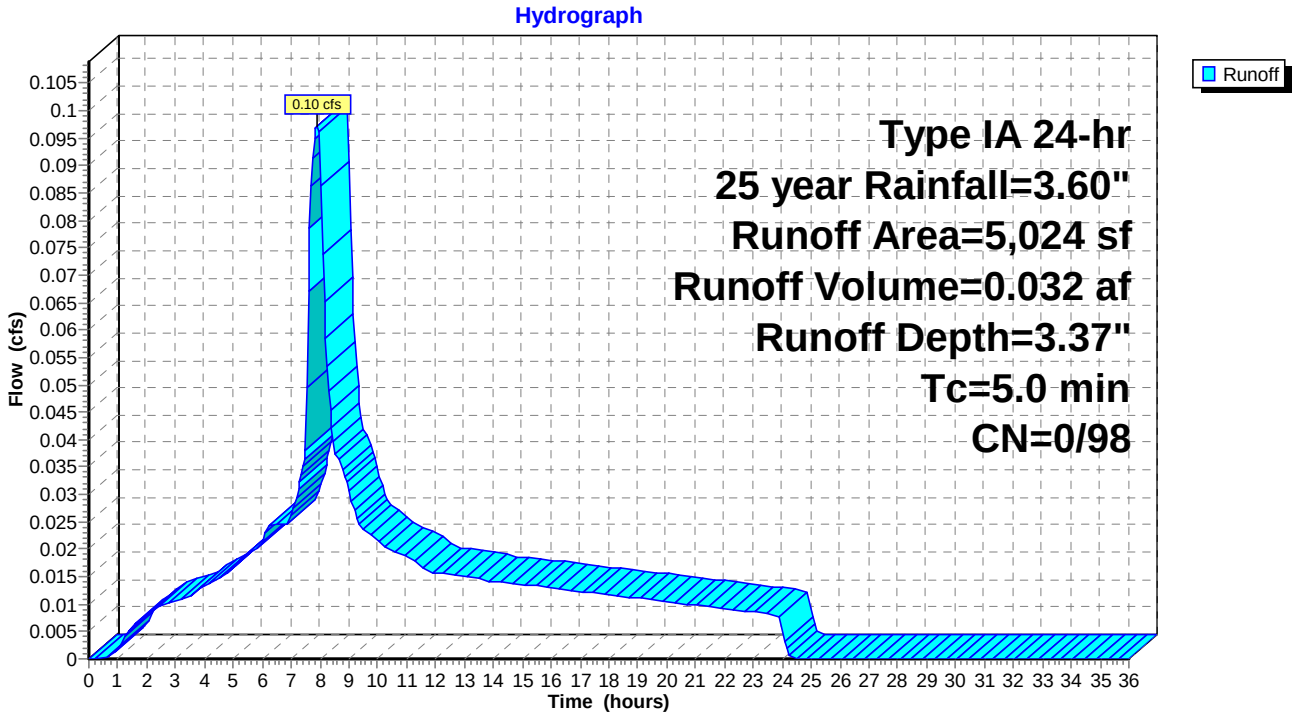
Runoff = 0.10 cfs @ 7.90 hrs, Volume= 0.032 af, Depth= 3.37"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type IA 24-hr 25 year Rainfall=3.60"

Area (sf)	CN	Description
5,024	98	Roofs, HSG C
5,024	98	100.00% Impervious Area

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

Subcatchment 13: Building 22



Summary for Subcatchment 14: Building 21

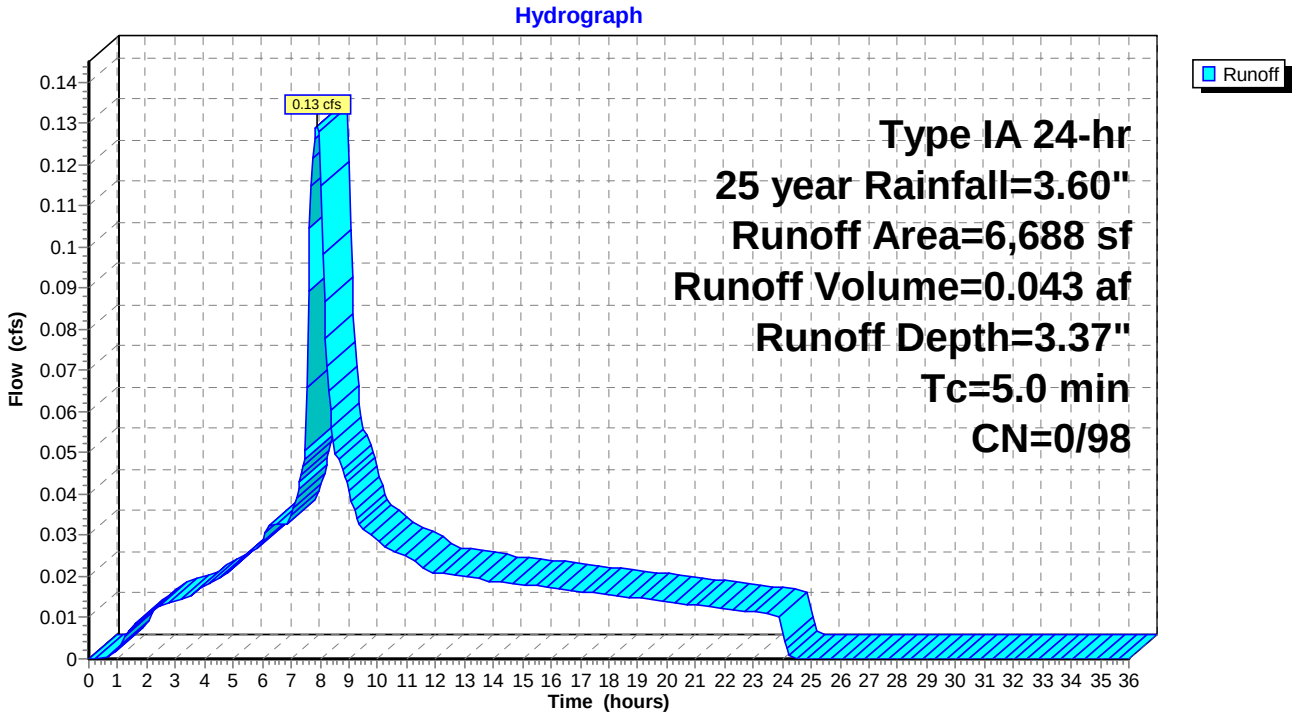
Runoff = 0.13 cfs @ 7.90 hrs, Volume= 0.043 af, Depth= 3.37"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type IA 24-hr 25 year Rainfall=3.60"

Area (sf)	CN	Description
6,688	98	Roofs, HSG C
6,688	98	100.00% Impervious Area

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

Subcatchment 14: Building 21



Summary for Subcatchment Landscaping: Landscaping

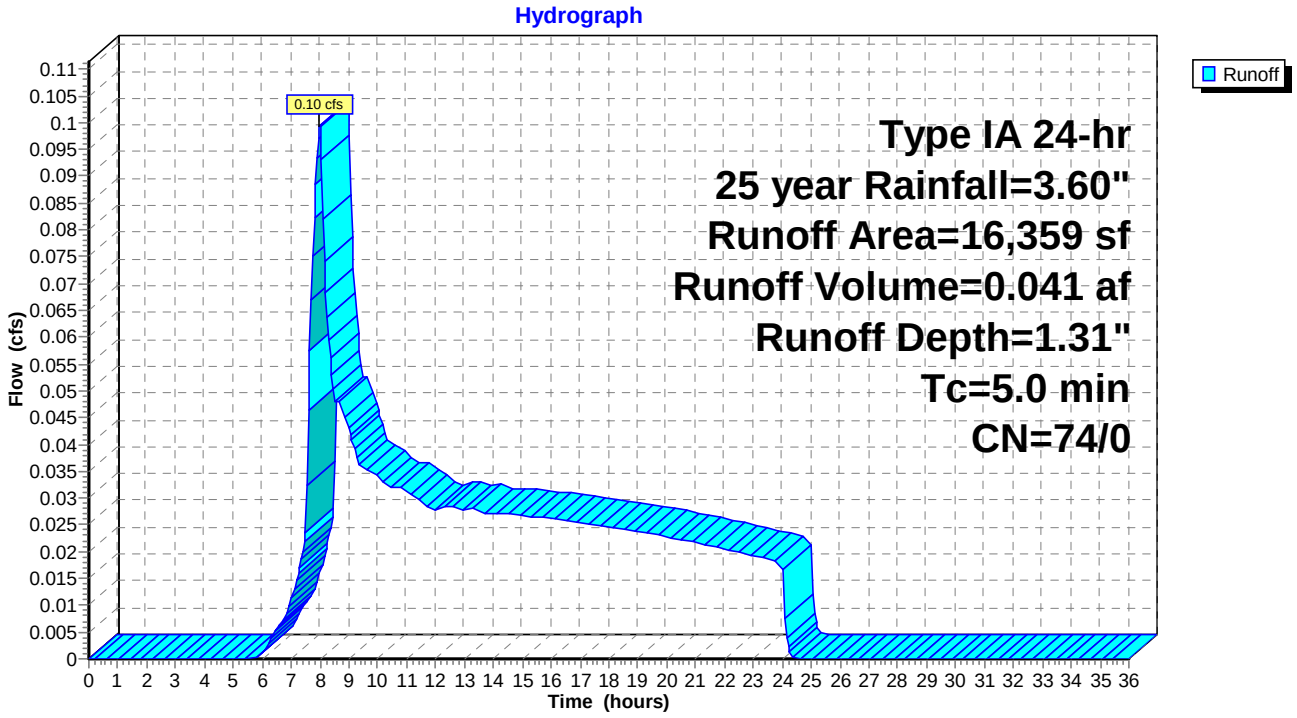
Runoff = 0.10 cfs @ 7.99 hrs, Volume= 0.041 af, Depth= 1.31"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type IA 24-hr 25 year Rainfall=3.60"

Area (sf)	CN	Description
16,359	74	>75% Grass cover, Good, HSG C
16,359	74	100.00% Pervious Area

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

Subcatchment Landscaping: Landscaping



Summary for Subcatchment N Park2: N Parking B2

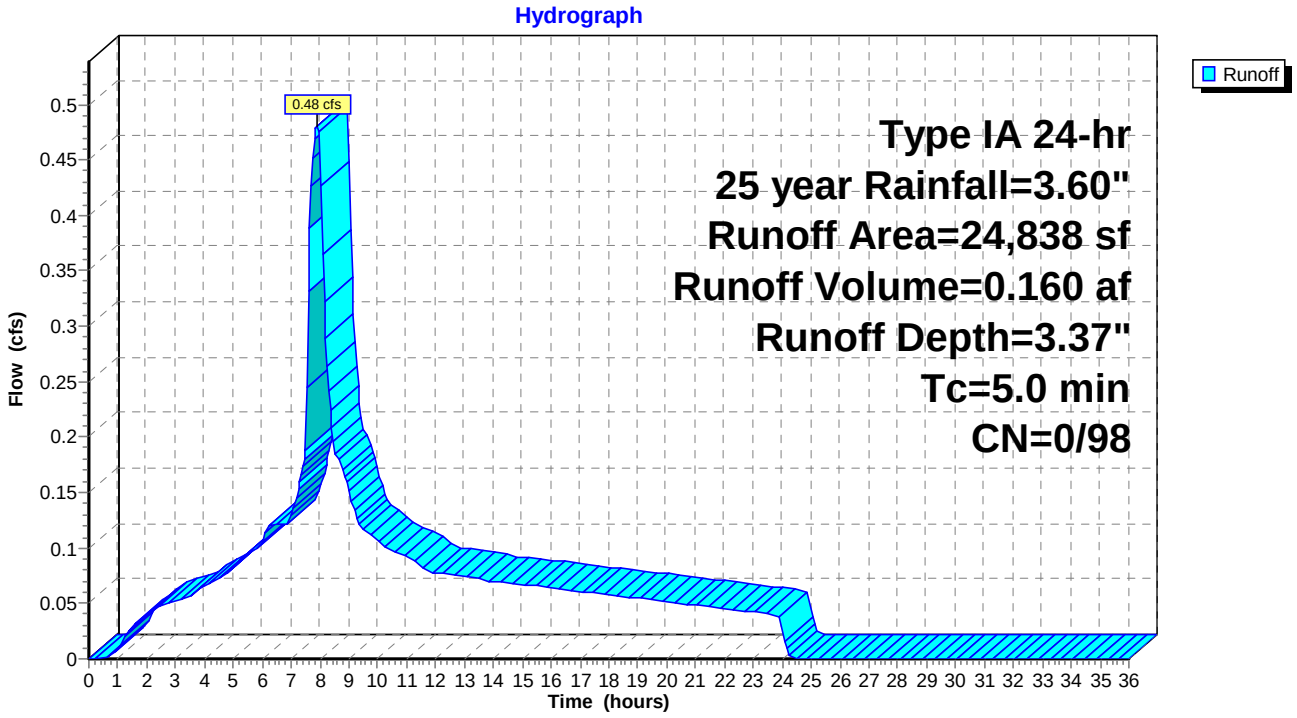
Runoff = 0.48 cfs @ 7.90 hrs, Volume= 0.160 af, Depth= 3.37"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type IA 24-hr 25 year Rainfall=3.60"

Area (sf)	CN	Description
24,838	98	Unconnected pavement, HSG C
24,838	98	100.00% Impervious Area

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

Subcatchment N Park2: N Parking B2



Summary for Subcatchment Undev W: Undeveloped W

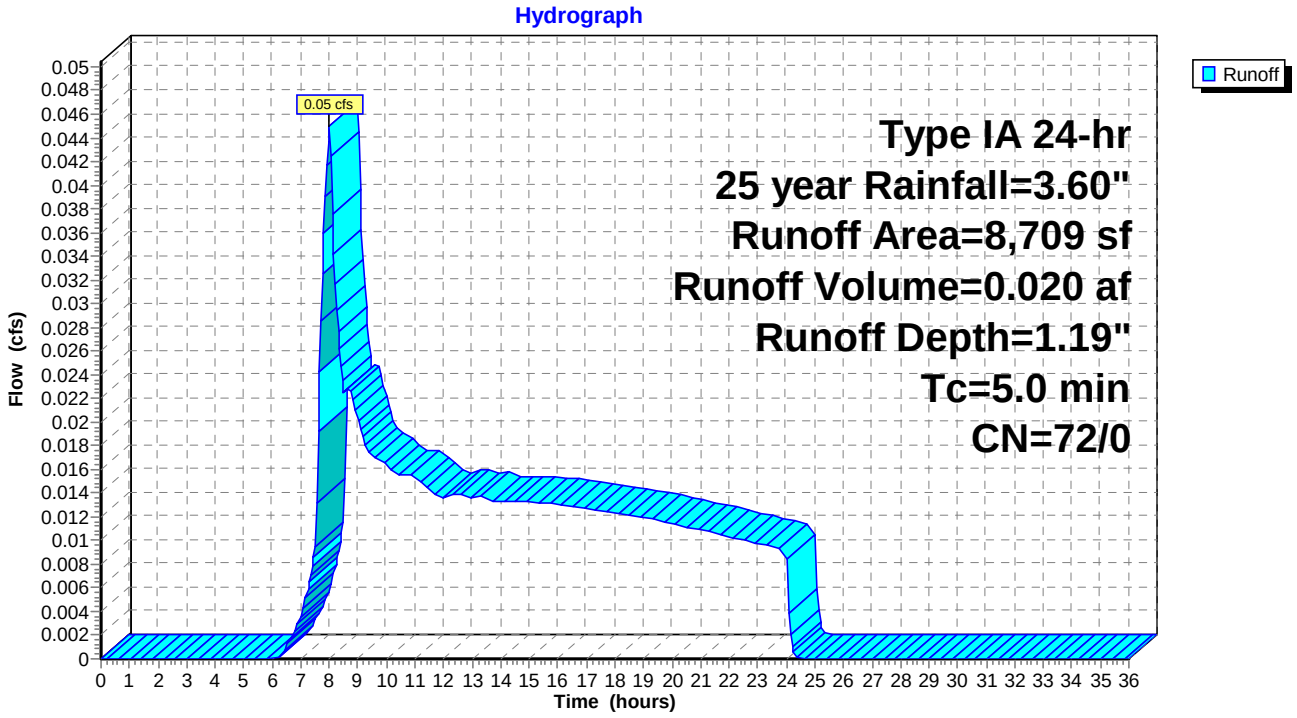
Runoff = 0.05 cfs @ 7.99 hrs, Volume= 0.020 af, Depth= 1.19"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type IA 24-hr 25 year Rainfall=3.60"

	Area (sf)	CN	Description
*	8,709	72	City of Salem Undeveloped, HSG C
	8,709	72	100.00% Pervious Area

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

Subcatchment Undev W: Undeveloped W



Summary for Pond 2 - GM: PB 2 - GM

Inflow Area = 1.538 ac, 62.57% Impervious, Inflow Depth = 2.58" for 25 year event
Inflow = 0.95 cfs @ 7.92 hrs, Volume= 0.331 af
Outflow = 0.21 cfs @ 10.73 hrs, Volume= 0.331 af, Atten= 78%, Lag= 168.5 min
Primary = 0.11 cfs @ 4.35 hrs, Volume= 0.291 af
Secondary = 0.10 cfs @ 10.73 hrs, Volume= 0.040 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 5.56' @ 10.73 hrs Surf.Area= 2,482 sf Storage= 3,880 cf

Plug-Flow detention time= 322.3 min calculated for 0.331 af (100% of inflow)
Center-of-Mass det. time= 322.3 min (1,020.4 - 698.2)

Volume	Invert	Avail.Storage	Storage Description
#1	4.00'	4,964 cf	**Growing Media (Prismatic)** Listed below (Recalc)

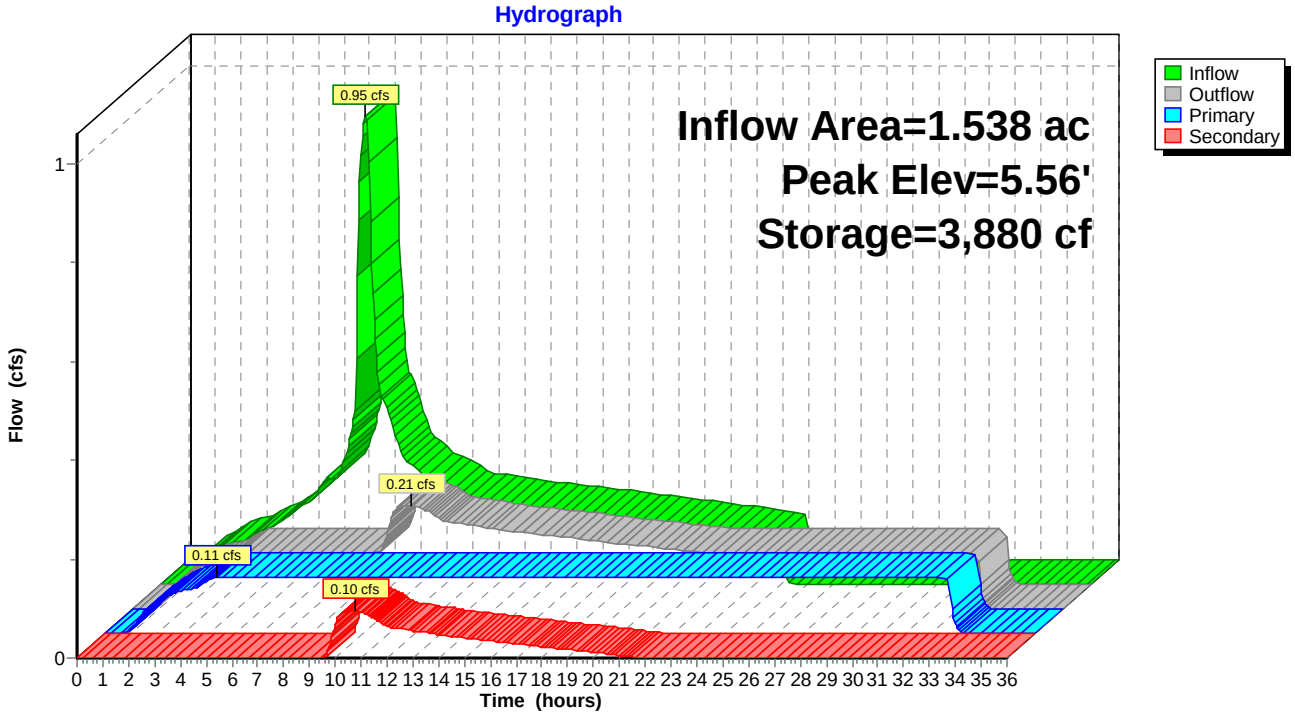
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
4.00	2,482	0	0
6.00	2,482	4,964	4,964

Device	Routing	Invert	Outlet Devices
#1	Primary	4.00'	**2.000 in/hr Exfiltration over Surface area**
#2	Secondary	5.50'	**7.0" Horiz. Rock Box** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.11 cfs @ 4.35 hrs HW=4.02' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.11 cfs)

Secondary OutFlow Max=0.09 cfs @ 10.73 hrs HW=5.56' (Free Discharge)
↑—**2=Rock Box** (Weir Controls 0.09 cfs @ 0.82 fps)

Pond 2 - GM: PB 2 - GM



Summary for Pond 2 - DR: PB 2 - DR

Inflow Area = 1.538 ac, 62.57% Impervious, Inflow Depth = 2.58" for 25 year event
Inflow = 0.21 cfs @ 10.73 hrs, Volume= 0.331 af
Outflow = 0.17 cfs @ 12.71 hrs, Volume= 0.271 af, Atten= 17%, Lag= 118.5 min
Discarded = 0.04 cfs @ 1.75 hrs, Volume= 0.115 af
Primary = 0.13 cfs @ 12.71 hrs, Volume= 0.156 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 3.53' @ 12.71 hrs Surf.Area= 2,482 sf Storage= 3,153 cf

Plug-Flow detention time= 356.9 min calculated for 0.270 af (82% of inflow)
Center-of-Mass det. time= 189.5 min (1,209.9 - 1,020.4)

Volume	Invert	Avail.Storage	Storage Description
#1	0.00'	3,574 cf	**Drain Rock (Prismatic)** Listed below (Recalc) 9,928 cf Overall x 36.0% Voids

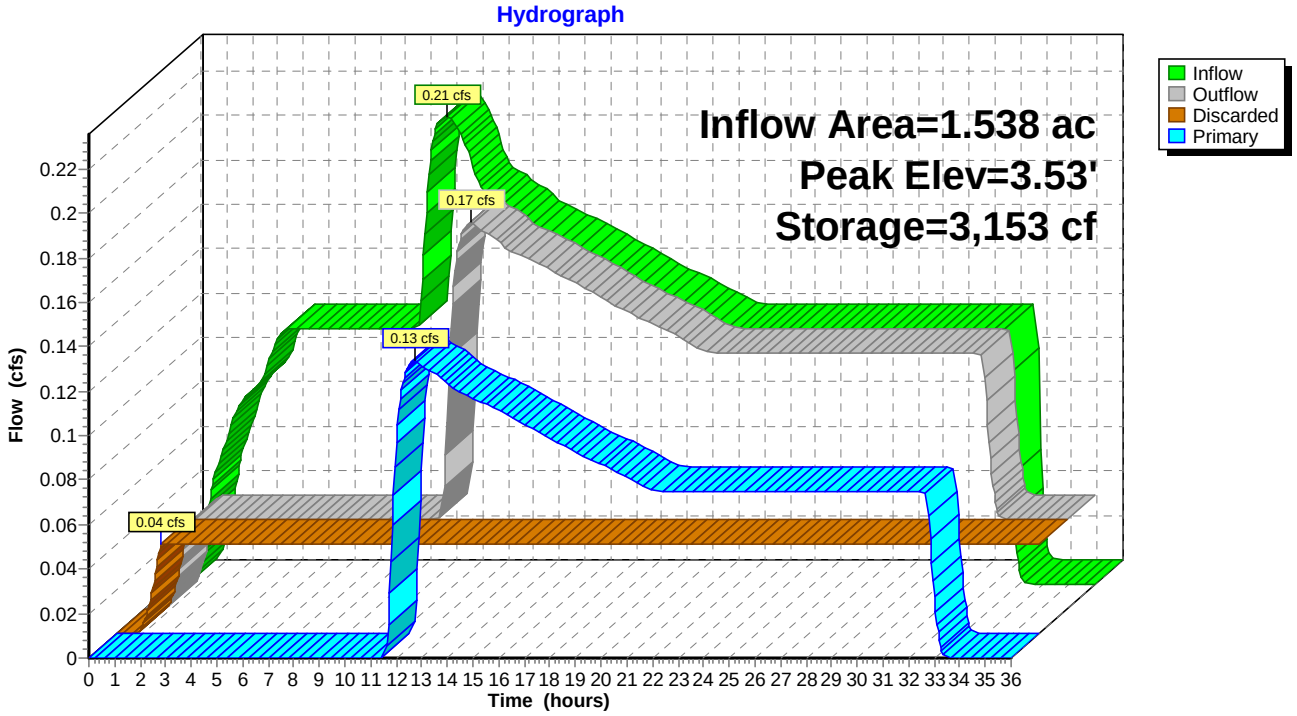
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
0.00	2,482	0	0
4.00	2,482	9,928	9,928

Device	Routing	Invert	Outlet Devices
#1	Discarded	0.00'	**0.700 in/hr Exfiltration over Surface area**
#2	Primary	3.33'	**8.0" Vert. Underdrain** C= 0.600 Limited to weir flow at low heads

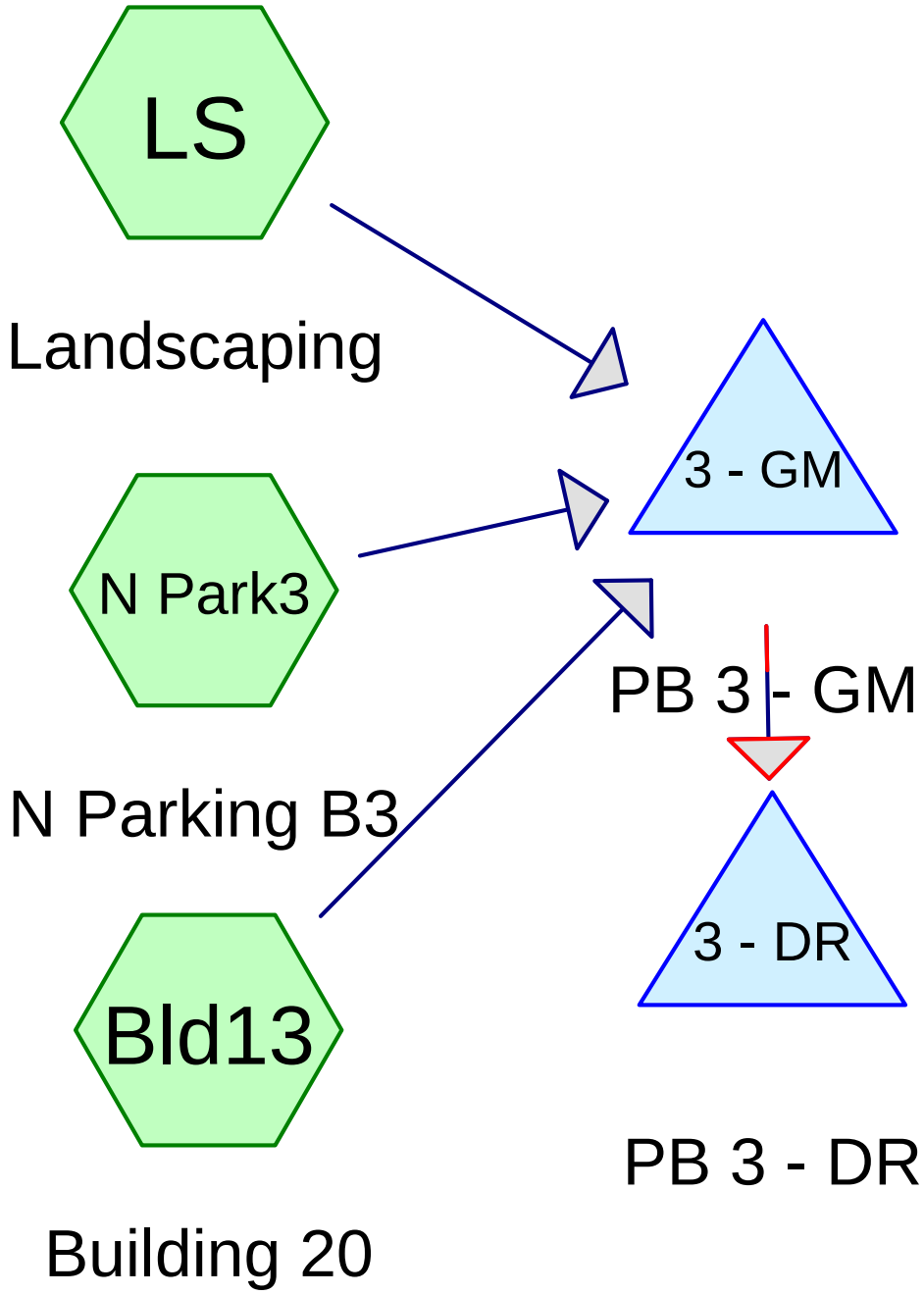
Discarded OutFlow Max=0.04 cfs @ 1.75 hrs HW=0.04' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.04 cfs)

Primary OutFlow Max=0.13 cfs @ 12.71 hrs HW=3.53' (Free Discharge)
↑—**2=Underdrain** (Orifice Controls 0.13 cfs @ 1.52 fps)

Pond 2 - DR: PB 2 - DR



EAST



Subcat Reach Pond Link

Routing Diagram for EAST (Reed Rd) Site Prelim Hydrograph
Prepared by Multi/Tech Engineering Services, Printed 2/17/2021

Summary for Subcatchment Bld13: Building 20

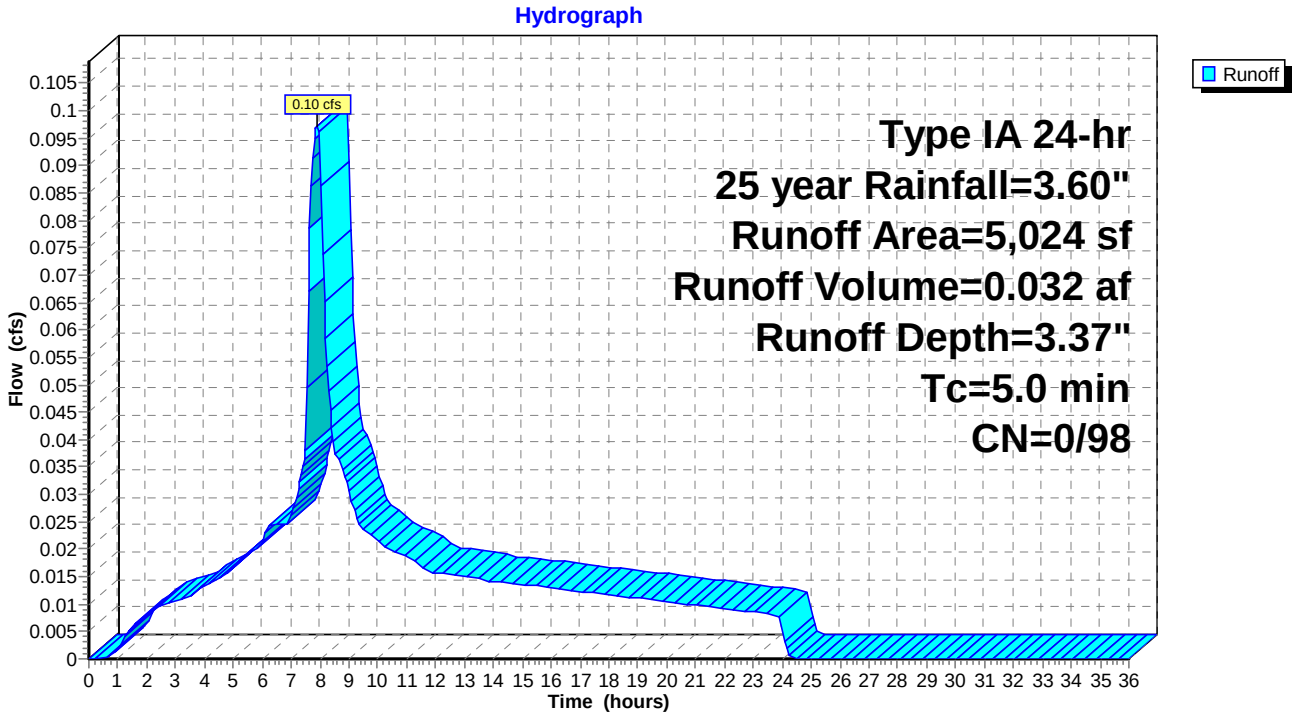
Runoff = 0.10 cfs @ 7.90 hrs, Volume= 0.032 af, Depth= 3.37"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type IA 24-hr 25 year Rainfall=3.60"

Area (sf)	CN	Description
5,024	98	Roofs, HSG C
5,024	98	100.00% Impervious Area

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

Subcatchment Bld13: Building 20



Summary for Subcatchment LS: Landscaping

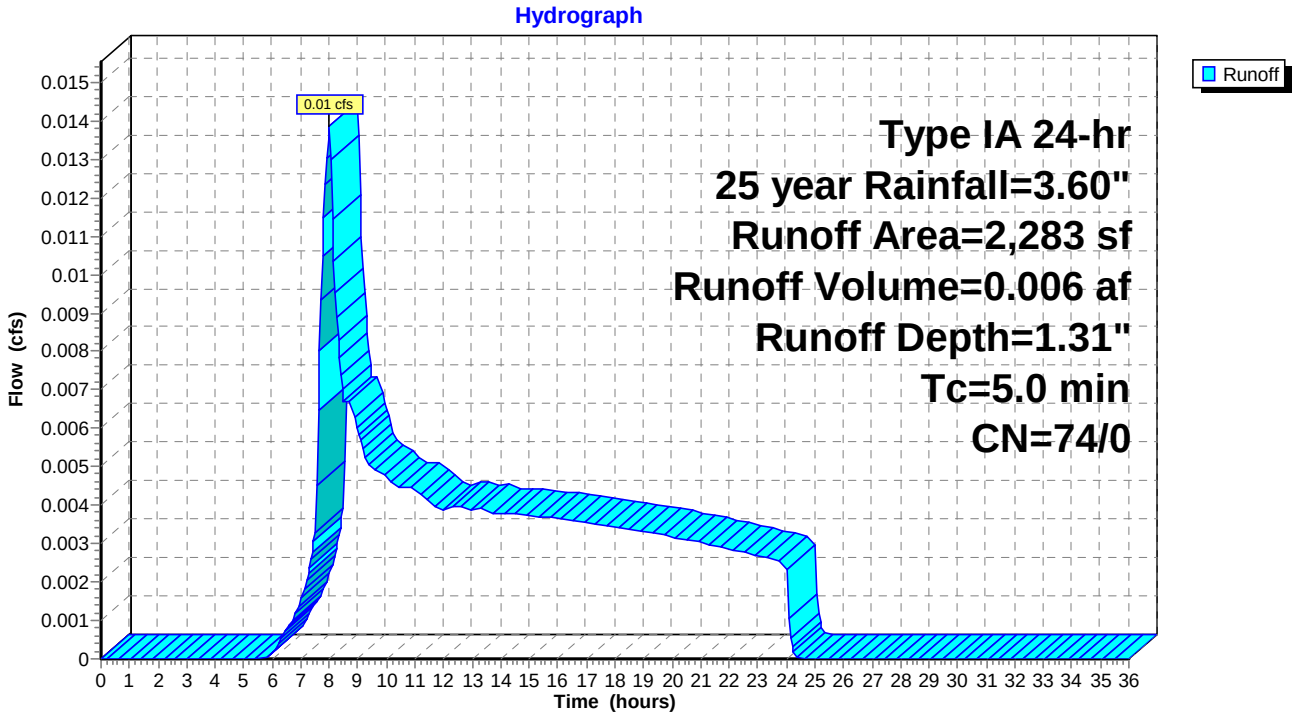
Runoff = 0.01 cfs @ 7.99 hrs, Volume= 0.006 af, Depth= 1.31"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type IA 24-hr 25 year Rainfall=3.60"

Area (sf)	CN	Description
2,283	74	>75% Grass cover, Good, HSG C
2,283	74	100.00% Pervious Area

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

Subcatchment LS: Landscaping



Summary for Subcatchment N Park3: N Parking B3

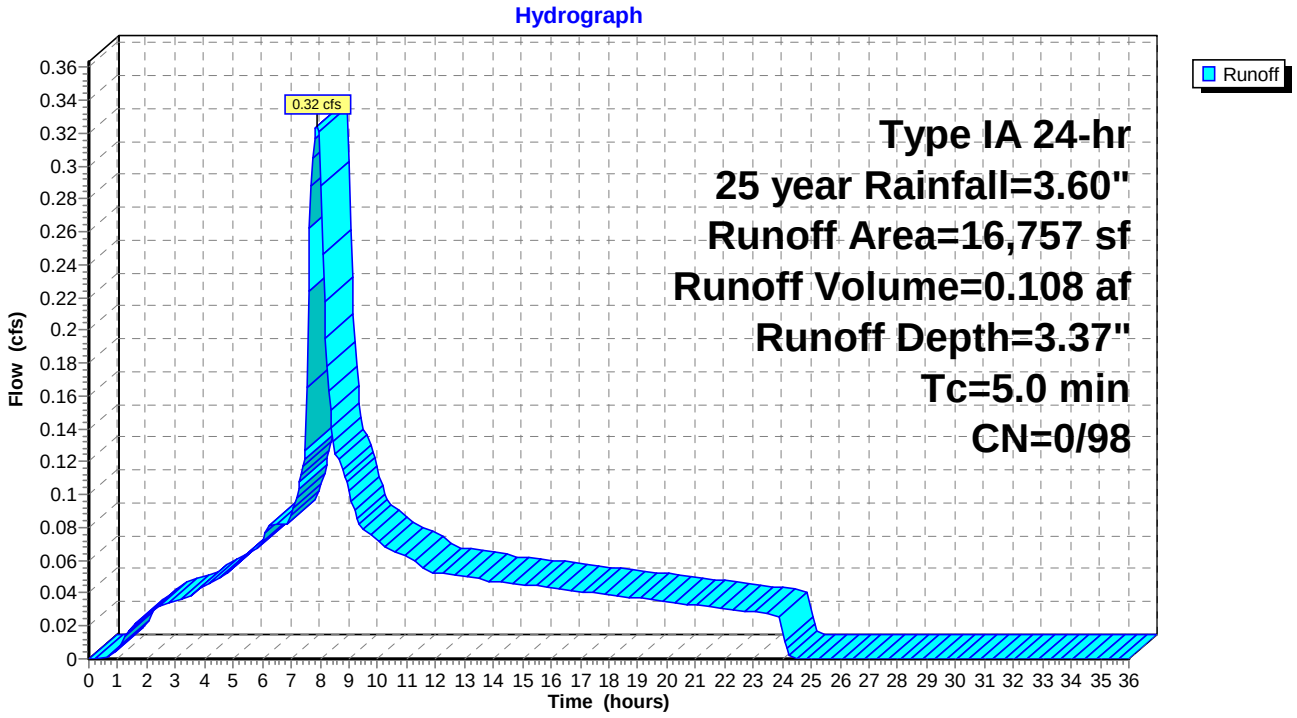
Runoff = 0.32 cfs @ 7.90 hrs, Volume= 0.108 af, Depth= 3.37"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type IA 24-hr 25 year Rainfall=3.60"

Area (sf)	CN	Description
16,757	98	Paved parking, HSG C
16,757	98	100.00% Impervious Area

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

Subcatchment N Park3: N Parking B3



Summary for Pond 3 - GM: PB 3 - GM

Inflow Area = 0.552 ac, 90.51% Impervious, Inflow Depth = 3.17" for 25 year event
Inflow = 0.43 cfs @ 7.90 hrs, Volume= 0.146 af
Outflow = 0.07 cfs @ 4.85 hrs, Volume= 0.146 af, Atten= 85%, Lag= 0.0 min
Primary = 0.07 cfs @ 4.85 hrs, Volume= 0.146 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 5.20' @ 13.60 hrs Surf.Area= 1,436 sf Storage= 1,727 cf

Plug-Flow detention time= 269.5 min calculated for 0.146 af (100% of inflow)
Center-of-Mass det. time= 269.5 min (940.1 - 670.6)

Volume	Invert	Avail.Storage	Storage Description
#1	4.00'	2,872 cf	**Growing Media (Prismatic)** Listed below (Recalc)

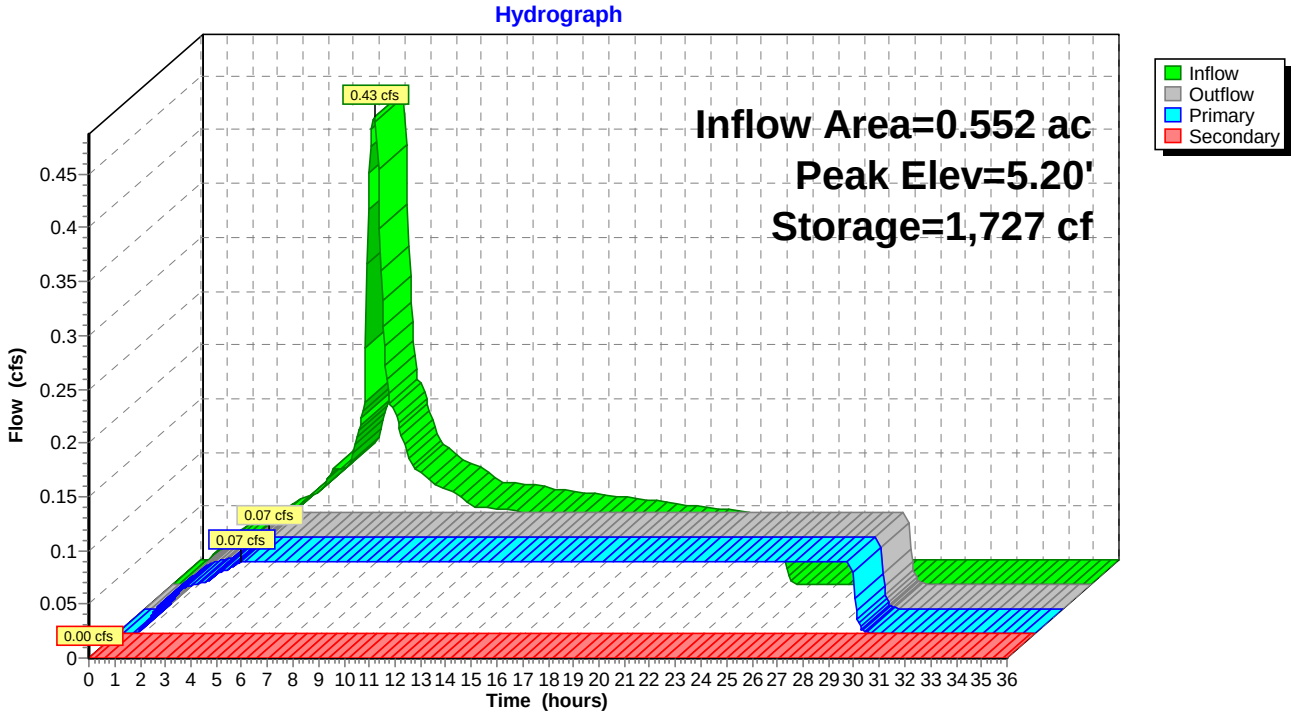
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
4.00	1,436	0	0
6.00	1,436	2,872	2,872

Device	Routing	Invert	Outlet Devices
#1	Primary	4.00'	**2.000 in/hr Exfiltration over Surface area**
#2	Secondary	5.50'	**7.0" Horiz. Rock Box** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.07 cfs @ 4.85 hrs HW=4.02' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.07 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=4.00' (Free Discharge)
↑—**2=Rock Box** (Controls 0.00 cfs)

Pond 3 - GM: PB 3 - GM



Summary for Pond 3 - DR: PB 3 - DR

Inflow Area = 0.552 ac, 90.51% Impervious, Inflow Depth = 3.17" for 25 year event
Inflow = 0.07 cfs @ 4.85 hrs, Volume= 0.146 af
Outflow = 0.07 cfs @ 19.70 hrs, Volume= 0.119 af, Atten= 0%, Lag= 891.0 min
Discarded = 0.02 cfs @ 1.85 hrs, Volume= 0.067 af
Primary = 0.04 cfs @ 19.70 hrs, Volume= 0.052 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 3.44' @ 19.65 hrs Surf.Area= 1,436 sf Storage= 1,779 cf

Plug-Flow detention time= 410.0 min calculated for 0.119 af (82% of inflow)
Center-of-Mass det. time= 262.6 min (1,202.7 - 940.1)

Volume	Invert	Avail.Storage	Storage Description
#1	0.00'	2,068 cf	**Drain Rock (Prismatic)** Listed below (Recalc) 5,744 cf Overall x 36.0% Voids

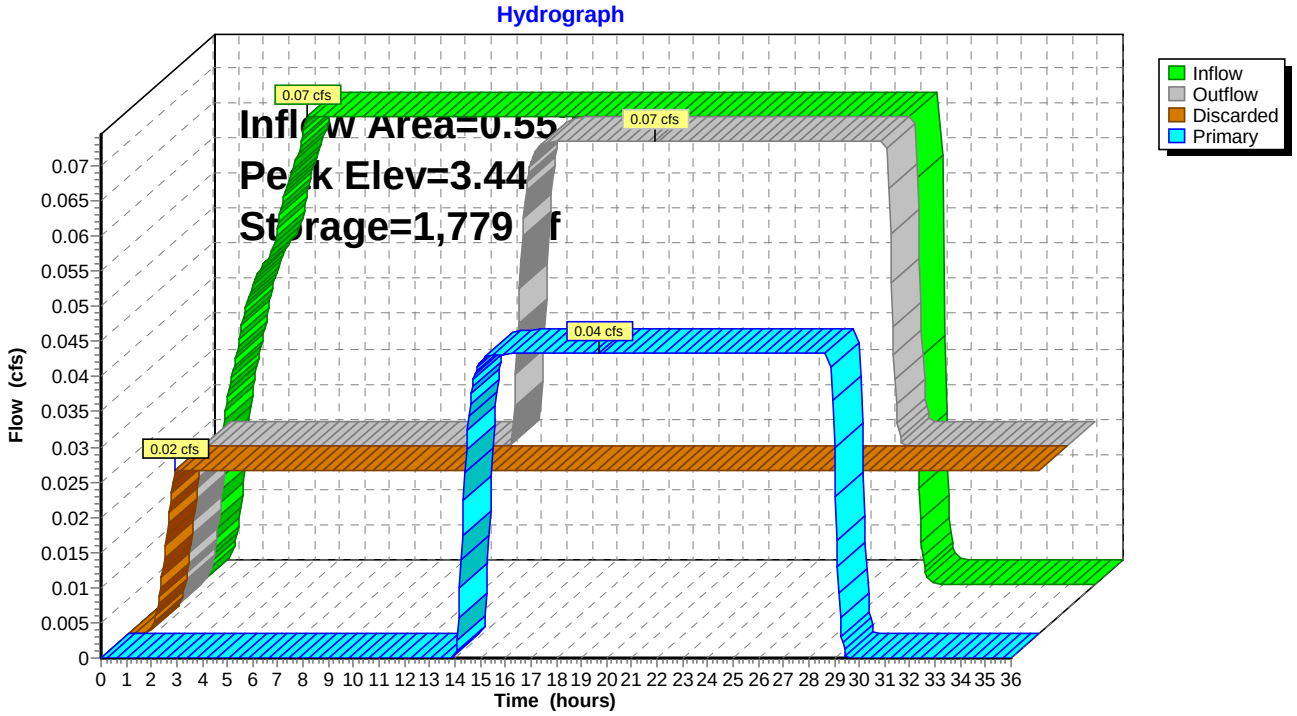
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
0.00	1,436	0	0
4.00	1,436	5,744	5,744

Device	Routing	Invert	Outlet Devices
#1	Discarded	0.00'	**0.700 in/hr Exfiltration over Surface area**
#2	Primary	3.33'	**8.0" Vert. Underdrain** C= 0.600 Limited to weir flow at low heads

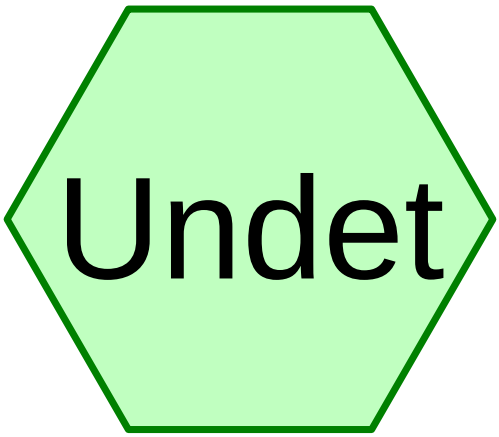
Discarded OutFlow Max=0.02 cfs @ 1.85 hrs HW=0.04' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.02 cfs)

Primary OutFlow Max=0.04 cfs @ 19.70 hrs HW=3.44' (Free Discharge)
↑—**2=Underdrain** (Orifice Controls 0.04 cfs @ 1.13 fps)

Pond 3 - DR: PB 3 - DR



EAST



Undetained

Subcat Reach Pond Link

Routing Diagram for EAST (Reed Rd) Site Prelim Hydrograph
Prepared by Multi/Tech Engineering Services, Printed 2/17/2021

Summary for Subcatchment Undet: Undetained

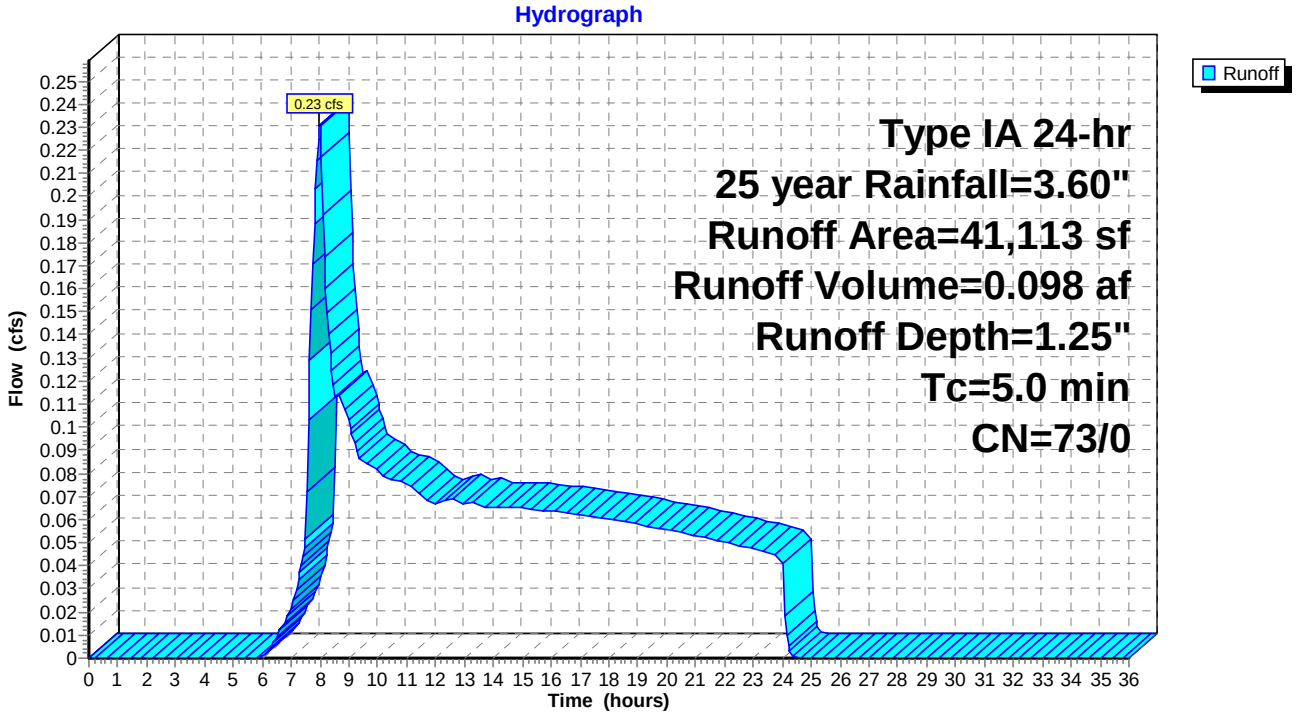
Runoff = 0.23 cfs @ 7.99 hrs, Volume= 0.098 af, Depth= 1.25"

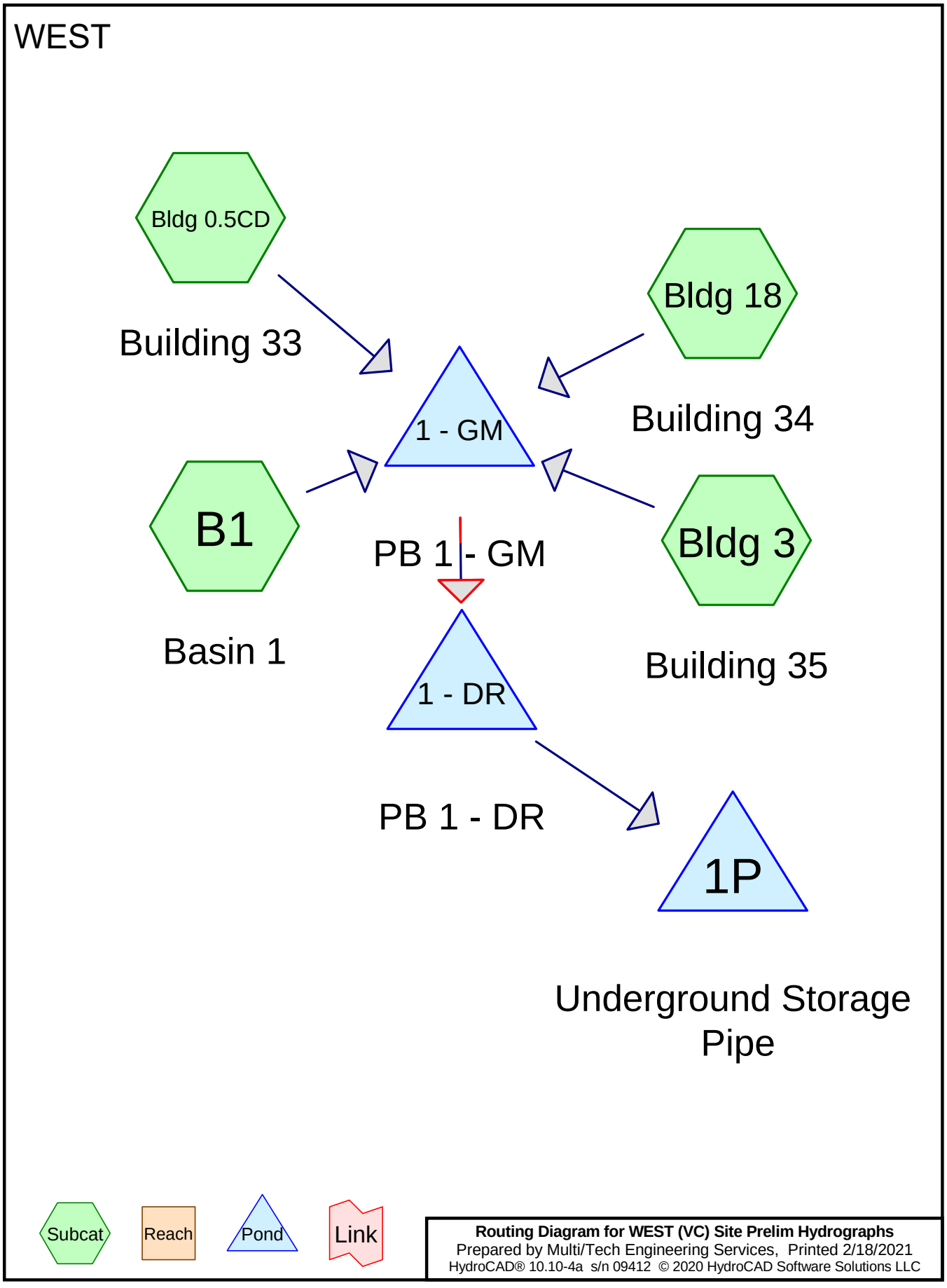
Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type IA 24-hr 25 year Rainfall=3.60"

	Area (sf)	CN	Description
	3,680	74	>75% Grass cover, Good, HSG C
	3,296	74	>75% Grass cover, Good, HSG C
	7,604	74	>75% Grass cover, Good, HSG C
	1,317	74	>75% Grass cover, Good, HSG C
*	25,216	72	City of Salem Predeveloped, HSG C
	41,113	73	Weighted Average
	41,113	73	100.00% Pervious Area

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

Subcatchment Undet: Undetained




WEST
Bldg 0.5CD
Building 33
Bldg 18
Building 34
1 - GM
B1
Basin 1
PB 1 - GM
Bldg 3
Building 35
1 - DR
PB 1 - DR
1P
Underground Storage Pipe
Subcat
Reach
Pond
Link
Routing Diagram for WEST (VC) Site Prelim Hydrographs
Prepared by Multi/Tech Engineering Services, Printed 2/18/2021
HydroCAD® 10.10-4a s/n 09412 © 2020 HydroCAD Software Solutions LLC

Summary for Subcatchment B1: Basin 1

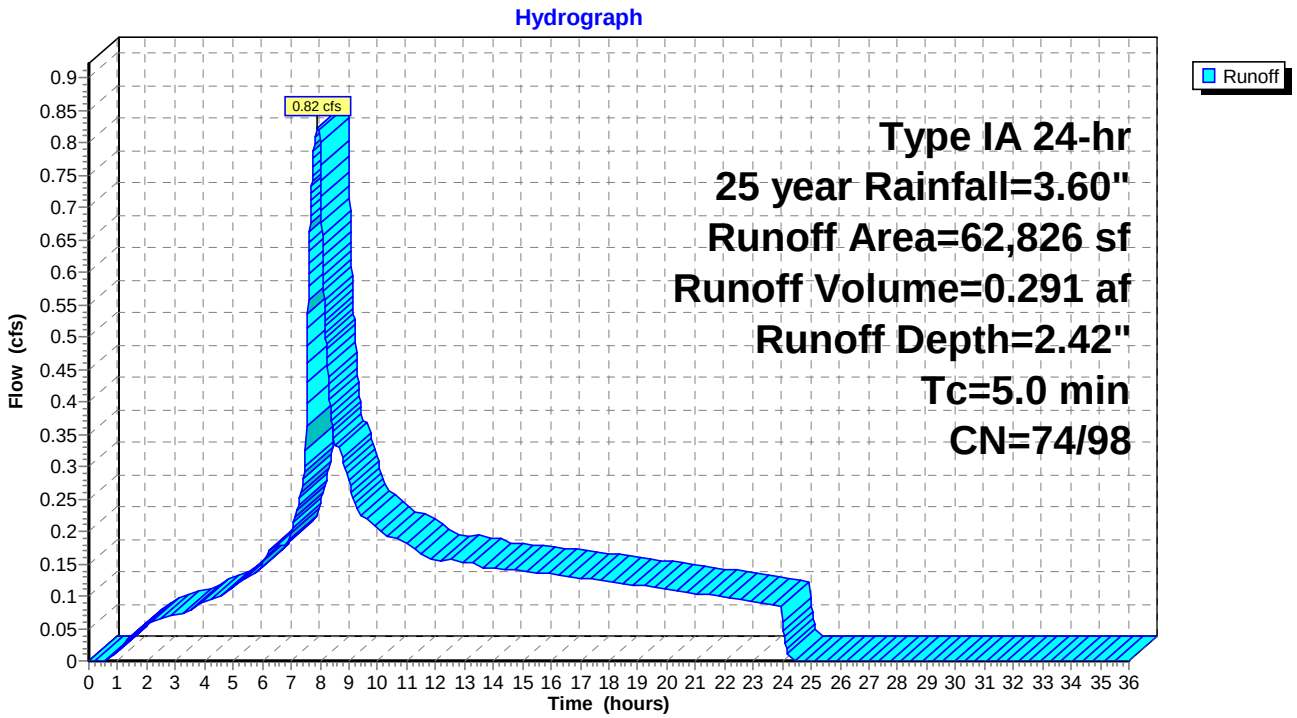
Runoff = 0.82 cfs @ 7.91 hrs, Volume= 0.291 af, Depth= 2.42"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type IA 24-hr 25 year Rainfall=3.60"

	Area (sf)	CN	Description
	33,861	98	Paved parking, HSG C
	27,754	74	>75% Grass cover, Good, HSG C
*	1,211	72	Planter Box
	62,826	87	Weighted Average
	28,965	74	46.10% Pervious Area
	33,861	98	53.90% Impervious Area

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

Subcatchment B1: Basin 1



Summary for Subcatchment Bldg 0.5CD: Building 33

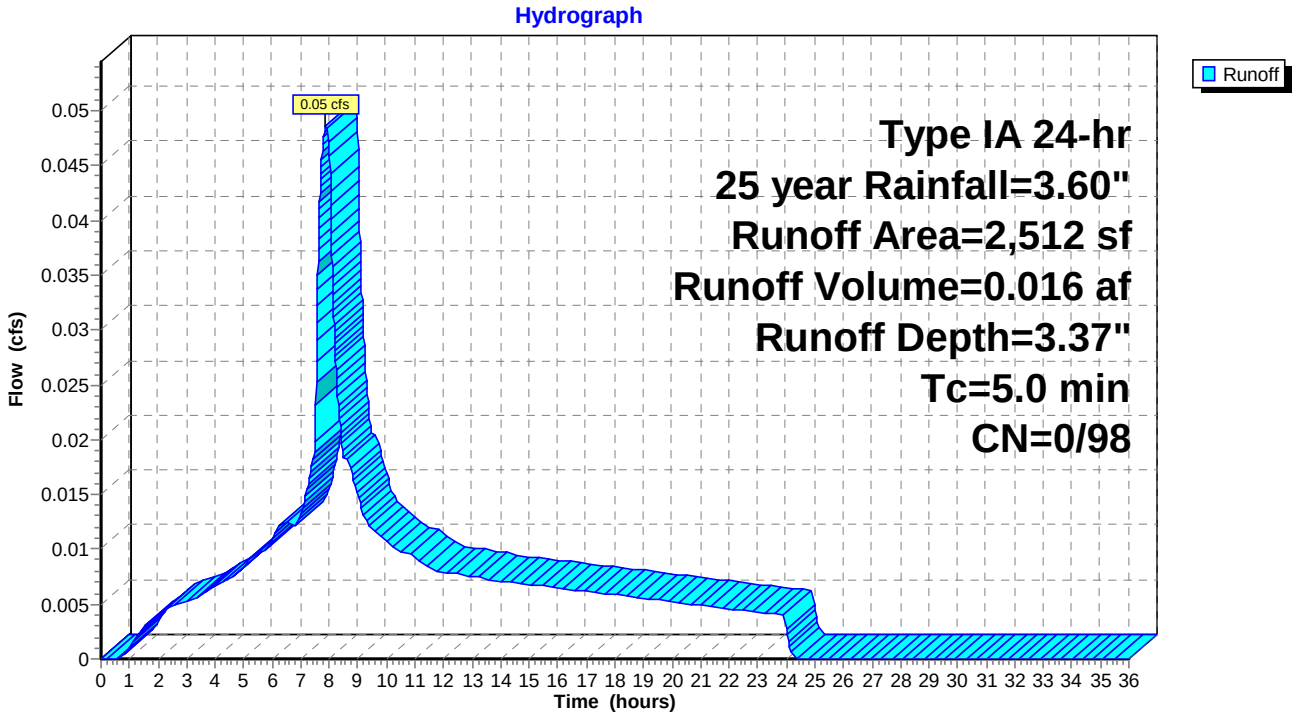
Runoff = 0.05 cfs @ 7.88 hrs, Volume= 0.016 af, Depth= 3.37"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type IA 24-hr 25 year Rainfall=3.60"

Area (sf)	CN	Description
2,512	98	Roofs, HSG C
2,512	98	100.00% Impervious Area

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

Subcatchment Bldg 0.5CD: Building 33



Summary for Subcatchment Bldg 18: Building 34

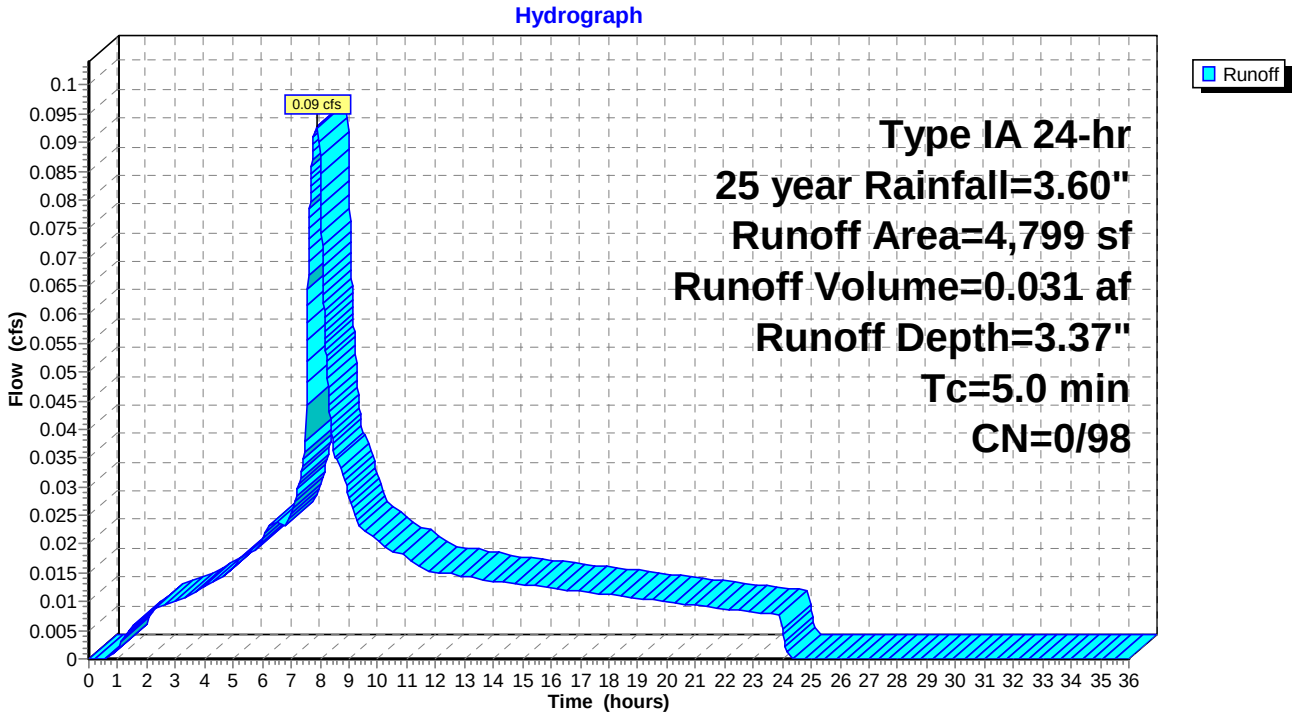
Runoff = 0.09 cfs @ 7.88 hrs, Volume= 0.031 af, Depth= 3.37"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type IA 24-hr 25 year Rainfall=3.60"

Area (sf)	CN	Description
4,799	98	Roofs, HSG C
4,799	98	100.00% Impervious Area

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

Subcatchment Bldg 18: Building 34



Summary for Subcatchment Bldg 3: Building 35

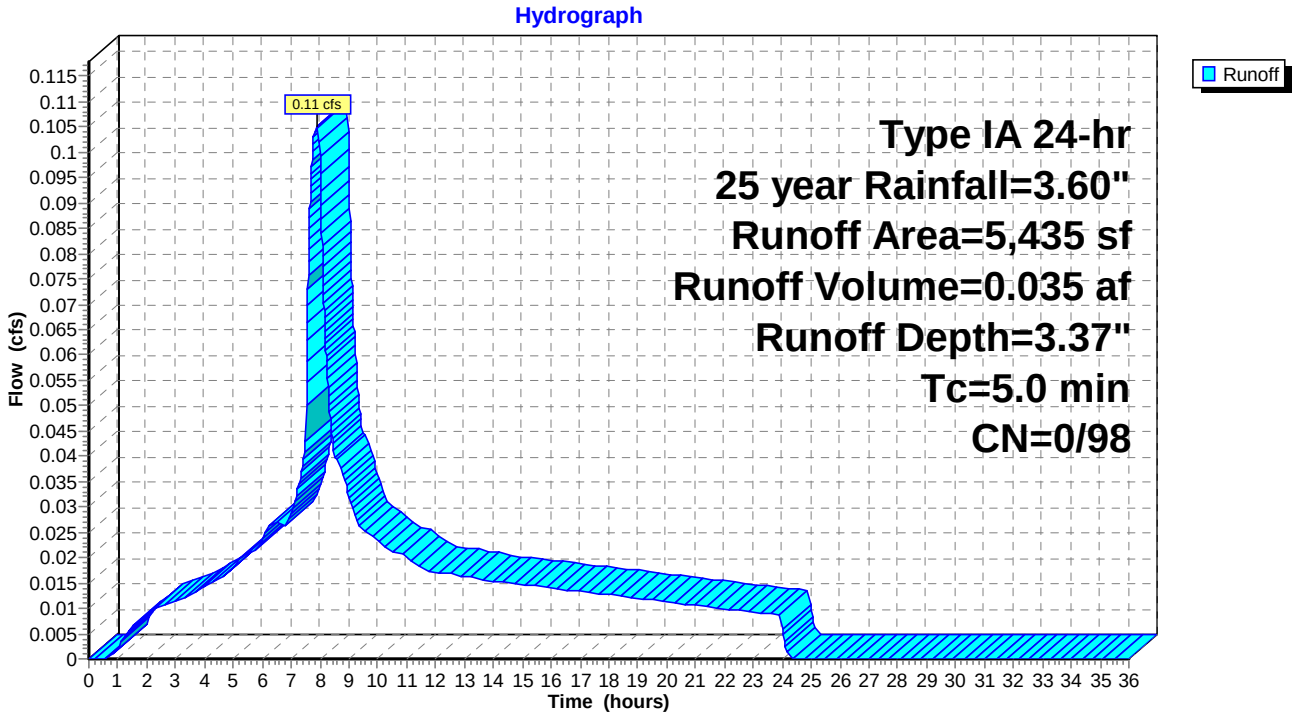
Runoff = 0.11 cfs @ 7.88 hrs, Volume= 0.035 af, Depth= 3.37"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type IA 24-hr 25 year Rainfall=3.60"

Area (sf)	CN	Description
5,435	98	Roofs, HSG C
5,435	98	100.00% Impervious Area

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

Subcatchment Bldg 3: Building 35



Summary for Pond 1 - GM: PB 1 - GM

Inflow Area = 1.735 ac, 61.67% Impervious, Inflow Depth = 2.58" for 25 year event
Inflow = 1.07 cfs @ 7.91 hrs, Volume= 0.373 af
Outflow = 1.06 cfs @ 7.96 hrs, Volume= 0.373 af, Atten= 1%, Lag= 3.0 min
Primary = 0.06 cfs @ 1.68 hrs, Volume= 0.150 af
Secondary = 1.01 cfs @ 7.96 hrs, Volume= 0.222 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 5.71' @ 7.96 hrs Surf.Area= 1,229 sf Storage= 2,105 cf

Plug-Flow detention time= 163.6 min calculated for 0.373 af (100% of inflow)
Center-of-Mass det. time= 163.7 min (861.9 - 698.2)

Volume	Invert	Avail.Storage	Storage Description
#1	4.00'	2,458 cf	**Planter Box Storage (Prismatic)** Listed below (Recalc)

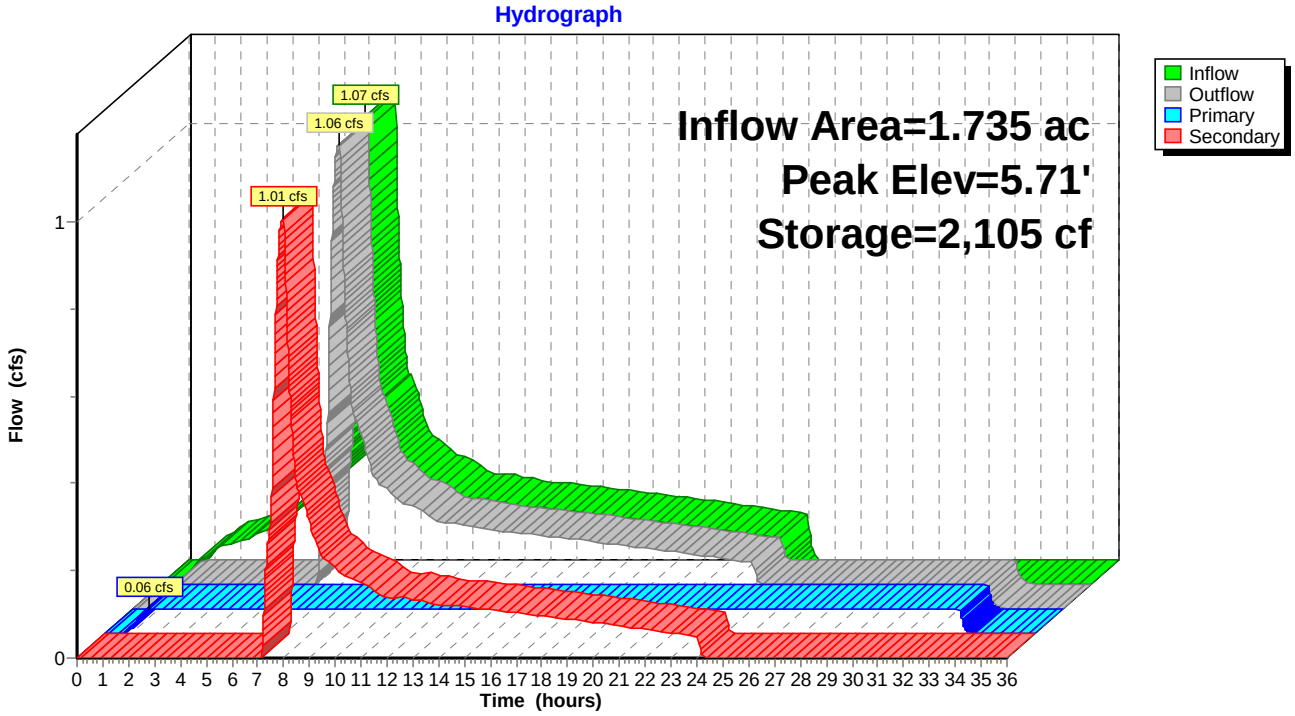
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
4.00	1,229	0	0
6.00	1,229	2,458	2,458

Device	Routing	Invert	Outlet Devices
#1	Primary	4.00'	**2.000 in/hr Flow through Growing Media over Surface area**
#2	Secondary	5.50'	**12.0" Horiz. Rock Box** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.06 cfs @ 1.68 hrs HW=4.02' (Free Discharge)
↑—**1=Flow through Growing Media** (Exfiltration Controls 0.06 cfs)

Secondary OutFlow Max=1.01 cfs @ 7.96 hrs HW=5.71' (Free Discharge)
↑—**2=Rock Box** (Weir Controls 1.01 cfs @ 1.51 fps)

Pond 1 - GM: PB 1 - GM



Summary for Pond 1 - DR: PB 1 - DR

Inflow Area = 1.735 ac, 61.67% Impervious, Inflow Depth = 2.58" for 25 year event
Inflow = 1.06 cfs @ 7.96 hrs, Volume= 0.373 af
Outflow = 1.06 cfs @ 7.99 hrs, Volume= 0.346 af, Atten= 0%, Lag= 2.3 min
Discarded = 0.02 cfs @ 1.34 hrs, Volume= 0.057 af
Primary = 1.04 cfs @ 7.99 hrs, Volume= 0.289 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 3.53' @ 7.99 hrs Surf.Area= 1,229 sf Storage= 1,561 cf

Plug-Flow detention time= 141.5 min calculated for 0.346 af (93% of inflow)
Center-of-Mass det. time= 67.7 min (929.6 - 861.9)

Volume	Invert	Avail.Storage	Storage Description
#1	0.00'	1,770 cf	**Drain Rock Storage (Prismatic)** Listed below (Recalc) 4,916 cf Overall x 36.0% Voids

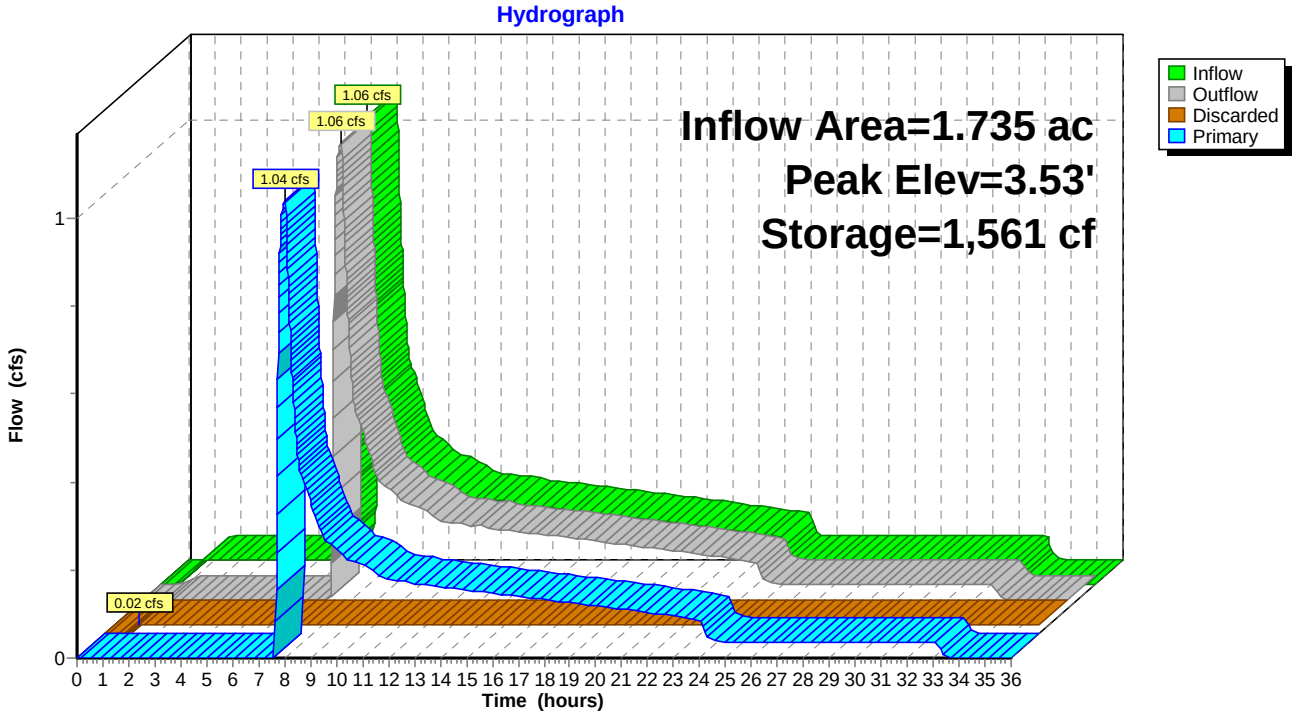
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
0.00	1,229	0	0
4.00	1,229	4,916	4,916

Device	Routing	Invert	Outlet Devices
#1	Discarded	0.00'	**0.700 in/hr Native Infiltration over Surface area**
#2	Primary	3.00'	**12.0" Vert. Underdrain** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.02 cfs @ 1.34 hrs HW=0.04' (Free Discharge)
↑—**1=Native Infiltration** (Exfiltration Controls 0.02 cfs)

Primary OutFlow Max=1.04 cfs @ 7.99 hrs HW=3.53' (Free Discharge)
↑—**2=Underdrain** (Orifice Controls 1.04 cfs @ 2.47 fps)

Pond 1 - DR: PB 1 - DR



Summary for Pond 1P: Underground Storage Pipe

Inflow Area = 1.735 ac, 61.67% Impervious, Inflow Depth = 2.00" for 25 year event
Inflow = 1.04 cfs @ 7.99 hrs, Volume= 0.289 af
Outflow = 0.25 cfs @ 9.95 hrs, Volume= 0.231 af, Atten= 76%, Lag= 117.3 min
Primary = 0.25 cfs @ 9.95 hrs, Volume= 0.231 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 3.02' @ 9.95 hrs Surf.Area= 0.024 ac Storage= 0.070 af

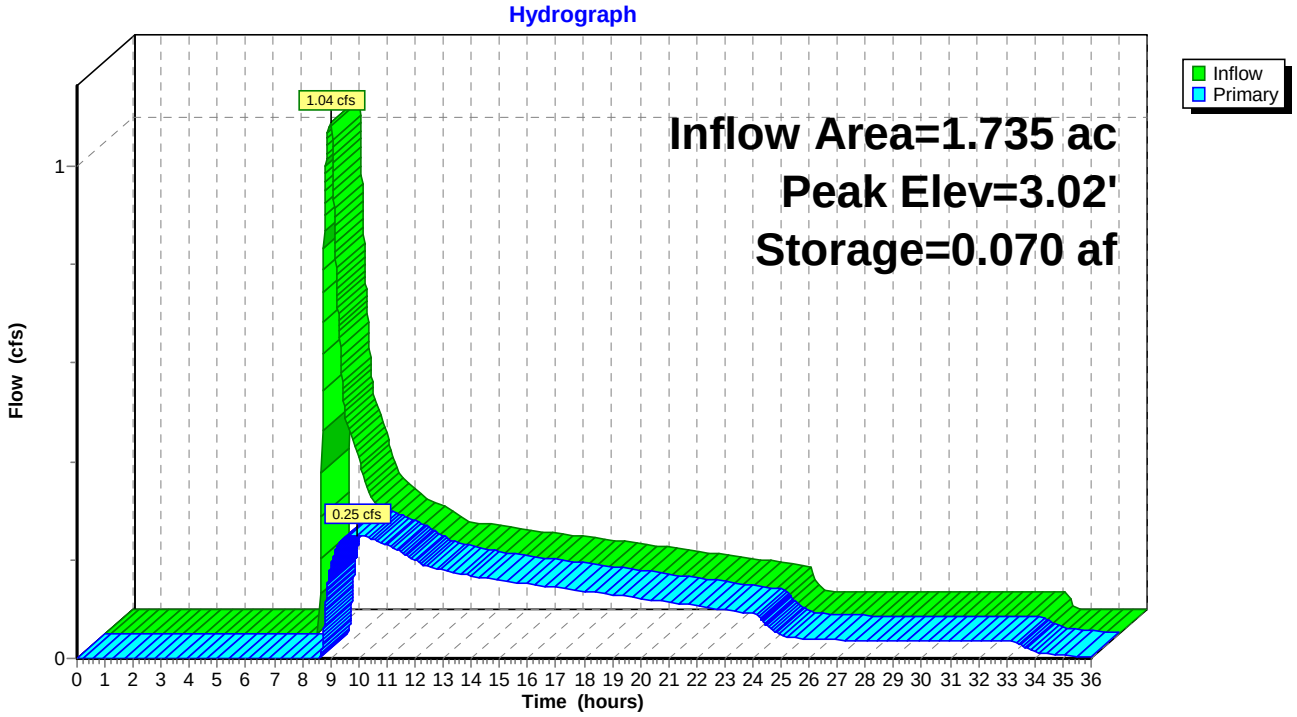
Plug-Flow detention time= 295.8 min calculated for 0.231 af (80% of inflow)
Center-of-Mass det. time= 137.8 min (1,030.8 - 893.0)

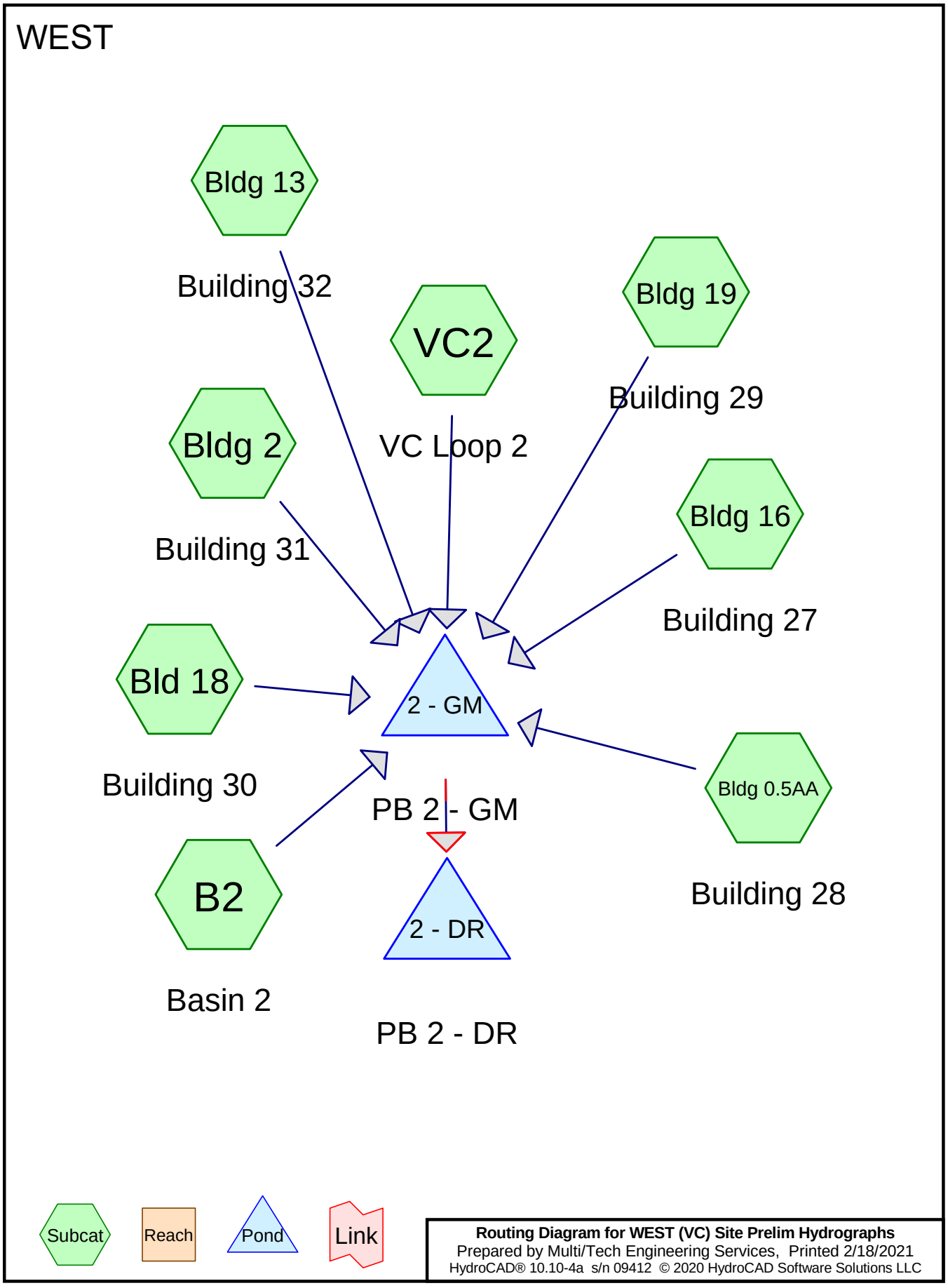
Volume	Invert	Avail.Storage	Storage Description
#1	0.00'	0.087 af	**48.0" Round Pipe Storage** L= 300.0'

Device	Routing	Invert	Outlet Devices
#1	Primary	2.50'	**4.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.25 cfs @ 9.95 hrs HW=3.02' (Free Discharge)
↳**1=Orifice/Grate** (Orifice Controls 0.25 cfs @ 2.88 fps)

Pond 1P: Underground Storage Pipe




WEST
Bldg 13
Building 32
VC2
VC Loop 2
Bldg 19
Building 29
Bldg 2
Building 31
Bldg 16
Building 27
Bld 18
Building 30
2 - GM
Bldg 0.5AA
Building 28
PB 2 - GM
B2
Basin 2
2 - DR
PB 2 - DR
Subcat
Reach
Pond
Link
Routing Diagram for WEST (VC) Site Prelim Hydrographs
Prepared by Multi/Tech Engineering Services, Printed 2/18/2021
HydroCAD® 10.10-4a s/n 09412 © 2020 HydroCAD Software Solutions LLC

Summary for Subcatchment B2: Basin 2

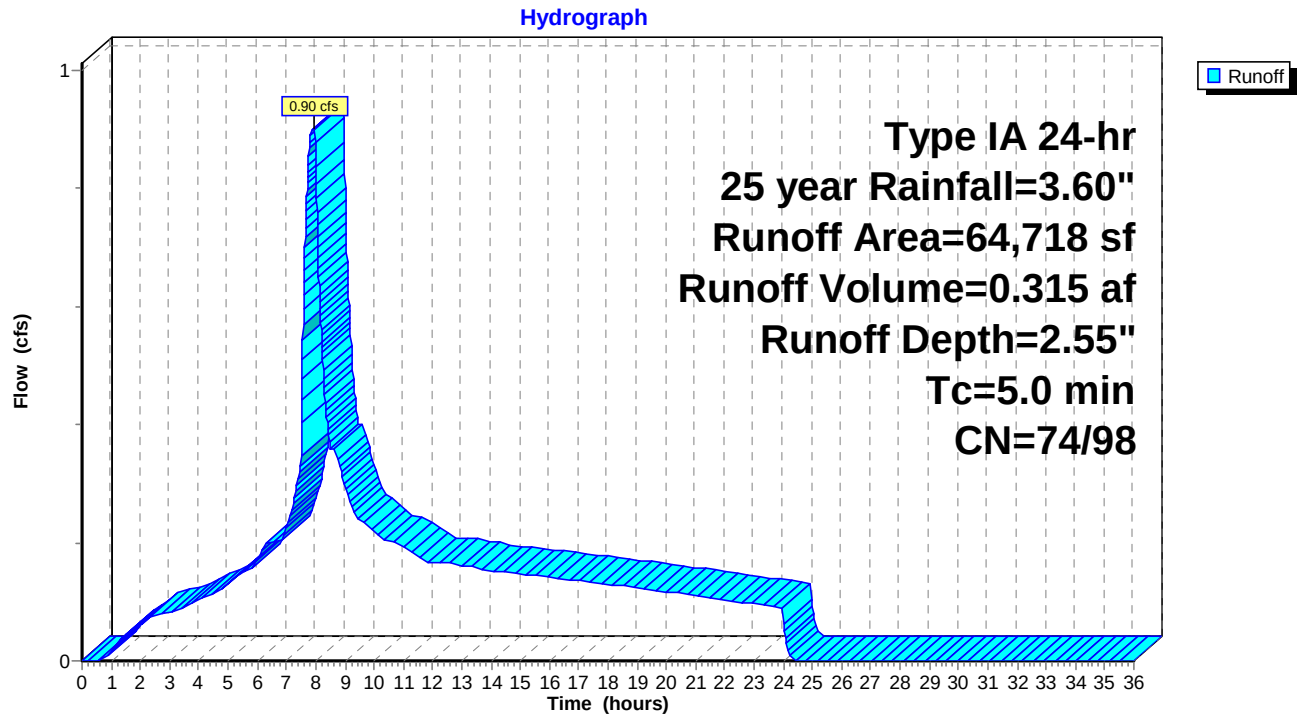
Runoff = 0.90 cfs @ 7.91 hrs, Volume= 0.315 af, Depth= 2.55"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type IA 24-hr 25 year Rainfall=3.60"

	Area (sf)	CN	Description
	21,385	74	>75% Grass cover, Good, HSG C
	38,965	98	Paved parking, HSG C
*	4,368	72	Planter Box
	64,718	88	Weighted Average
	25,753	74	39.79% Pervious Area
	38,965	98	60.21% Impervious Area

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

Subcatchment B2: Basin 2



Summary for Subcatchment Bld 18: Building 30

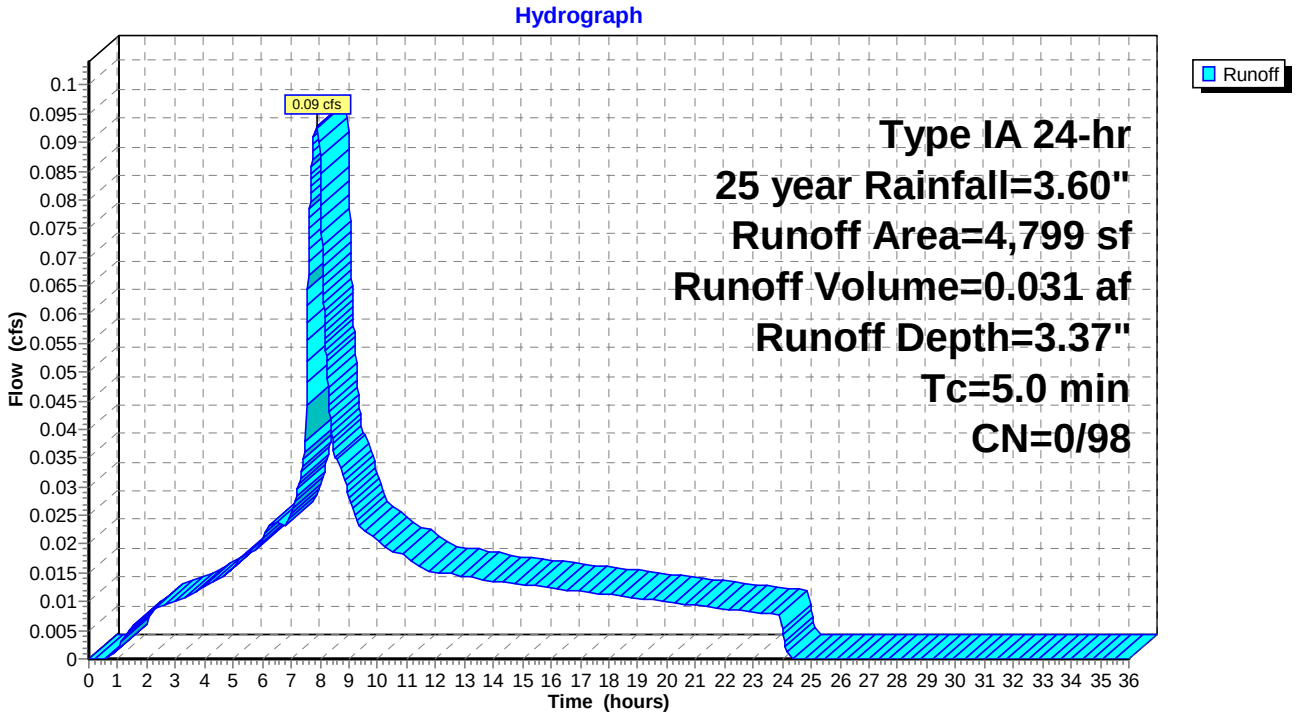
Runoff = 0.09 cfs @ 7.88 hrs, Volume= 0.031 af, Depth= 3.37"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type IA 24-hr 25 year Rainfall=3.60"

Area (sf)	CN	Description
4,799	98	Roofs, HSG C
4,799	98	100.00% Impervious Area

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

Subcatchment Bld 18: Building 30



Summary for Subcatchment Bldg 0.5AA: Building 28

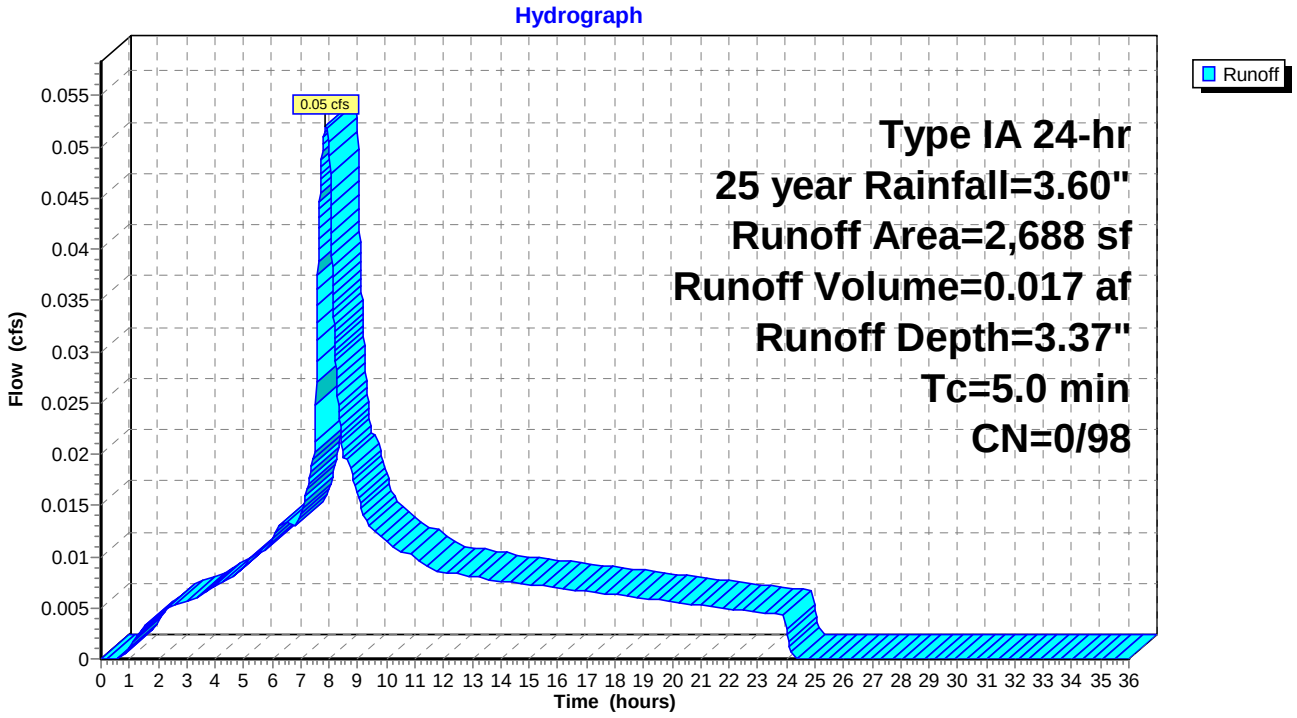
Runoff = 0.05 cfs @ 7.88 hrs, Volume= 0.017 af, Depth= 3.37"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type IA 24-hr 25 year Rainfall=3.60"

Area (sf)	CN	Description
2,688	98	Roofs, HSG C
2,688	98	100.00% Impervious Area

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

Subcatchment Bldg 0.5AA: Building 28



Summary for Subcatchment Bldg 13: Building 32

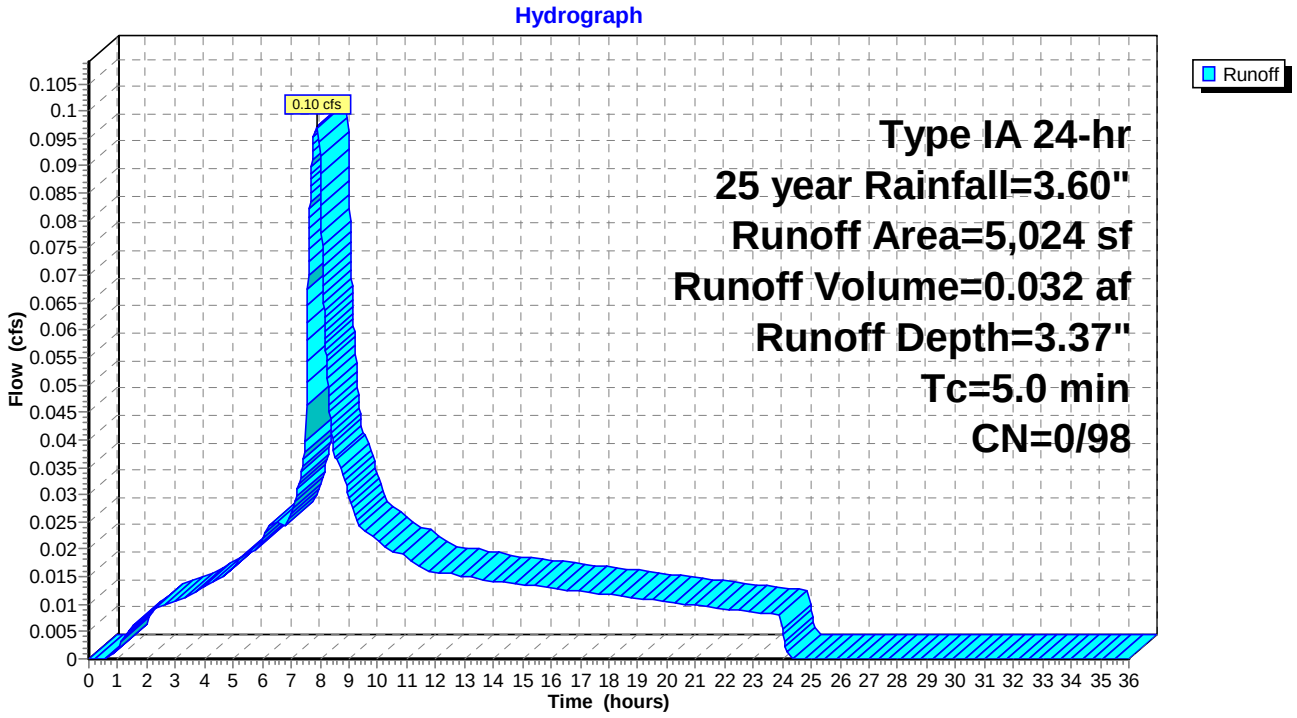
Runoff = 0.10 cfs @ 7.88 hrs, Volume= 0.032 af, Depth= 3.37"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type IA 24-hr 25 year Rainfall=3.60"

Area (sf)	CN	Description
5,024	98	Roofs, HSG C
5,024	98	100.00% Impervious Area

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

Subcatchment Bldg 13: Building 32



Summary for Subcatchment Bldg 16: Building 27

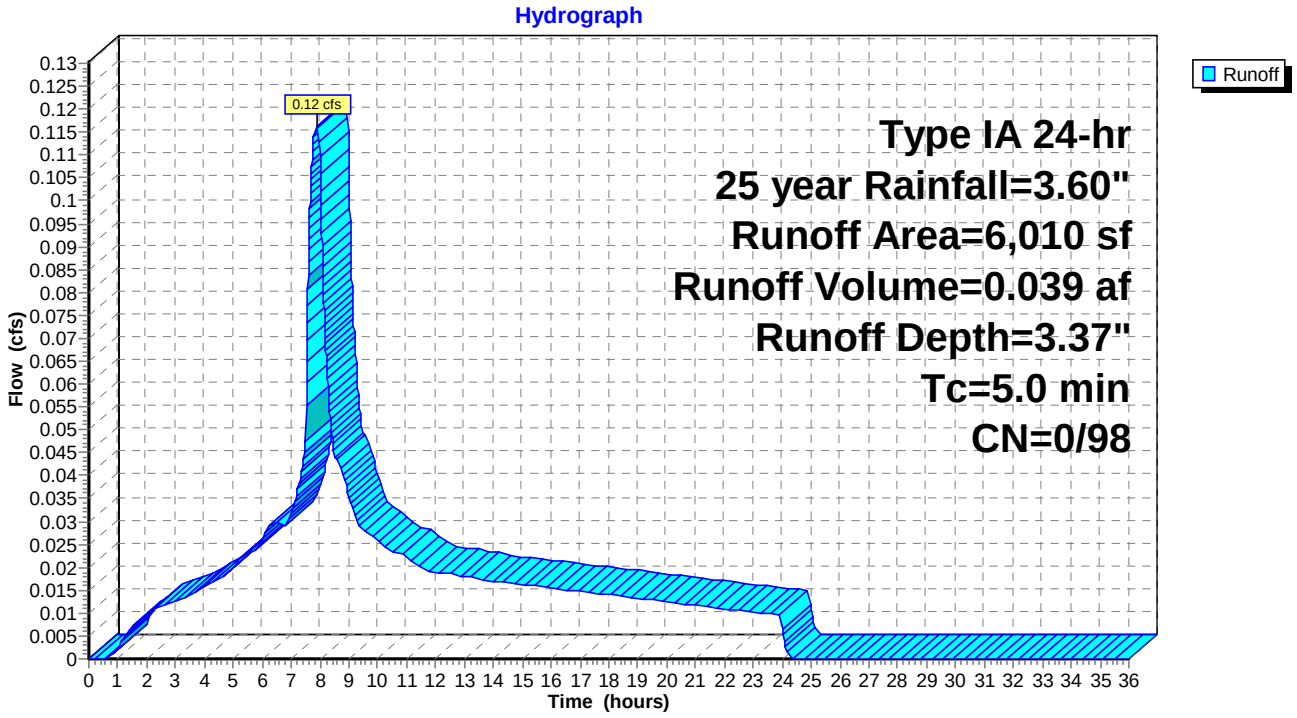
Runoff = 0.12 cfs @ 7.88 hrs, Volume= 0.039 af, Depth= 3.37"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type IA 24-hr 25 year Rainfall=3.60"

Area (sf)	CN	Description
6,010	98	Roofs, HSG C
6,010	98	100.00% Impervious Area

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

Subcatchment Bldg 16: Building 27



Summary for Subcatchment Bldg 19: Building 29

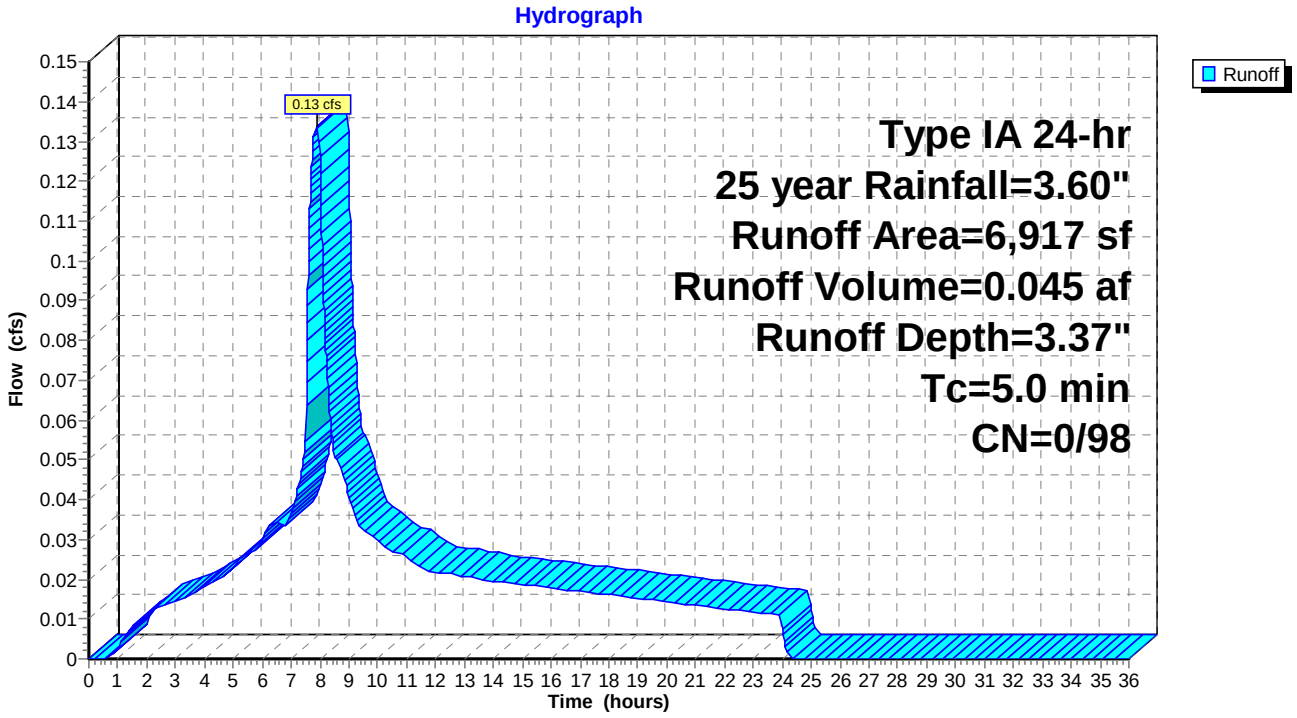
Runoff = 0.13 cfs @ 7.88 hrs, Volume= 0.045 af, Depth= 3.37"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type IA 24-hr 25 year Rainfall=3.60"

Area (sf)	CN	Description
6,917	98	Roofs, HSG C
6,917	98	100.00% Impervious Area

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

Subcatchment Bldg 19: Building 29



Summary for Subcatchment Bldg 2: Building 31

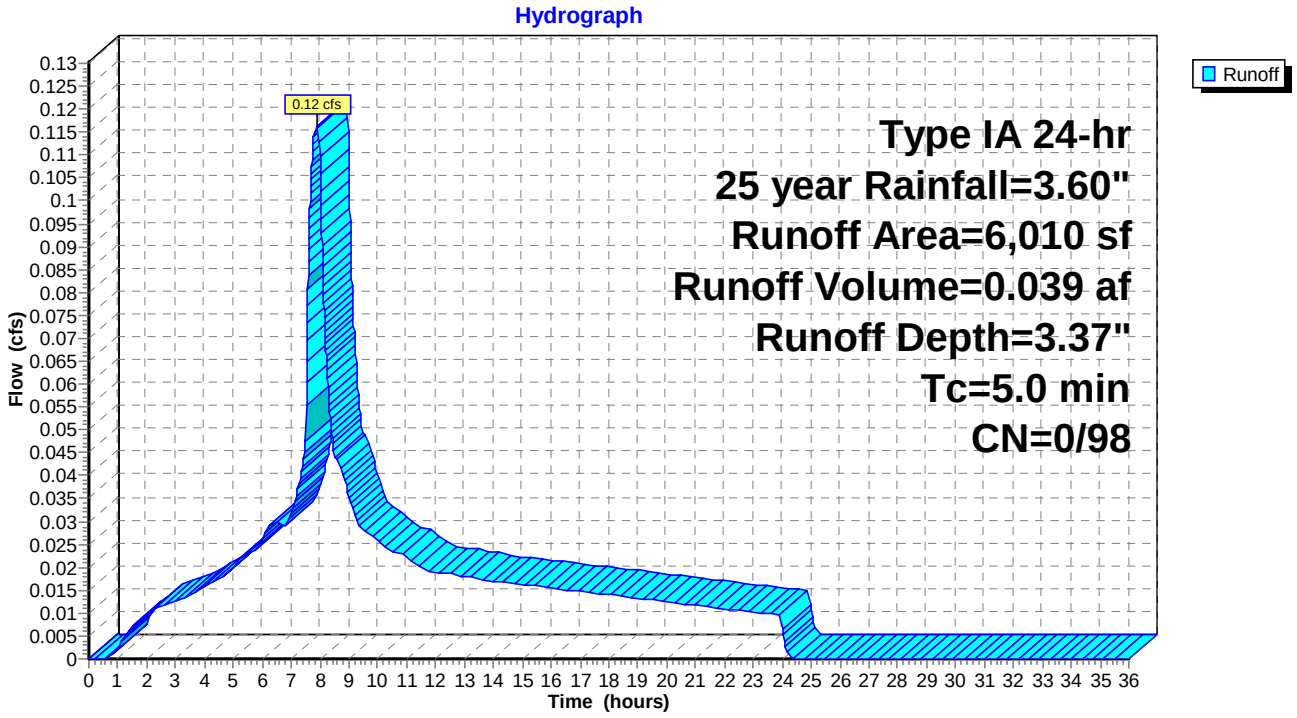
Runoff = 0.12 cfs @ 7.88 hrs, Volume= 0.039 af, Depth= 3.37"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type IA 24-hr 25 year Rainfall=3.60"

Area (sf)	CN	Description
6,010	98	Roofs, HSG C
6,010	98	100.00% Impervious Area

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

Subcatchment Bldg 2: Building 31



Summary for Subcatchment VC2: VC Loop 2

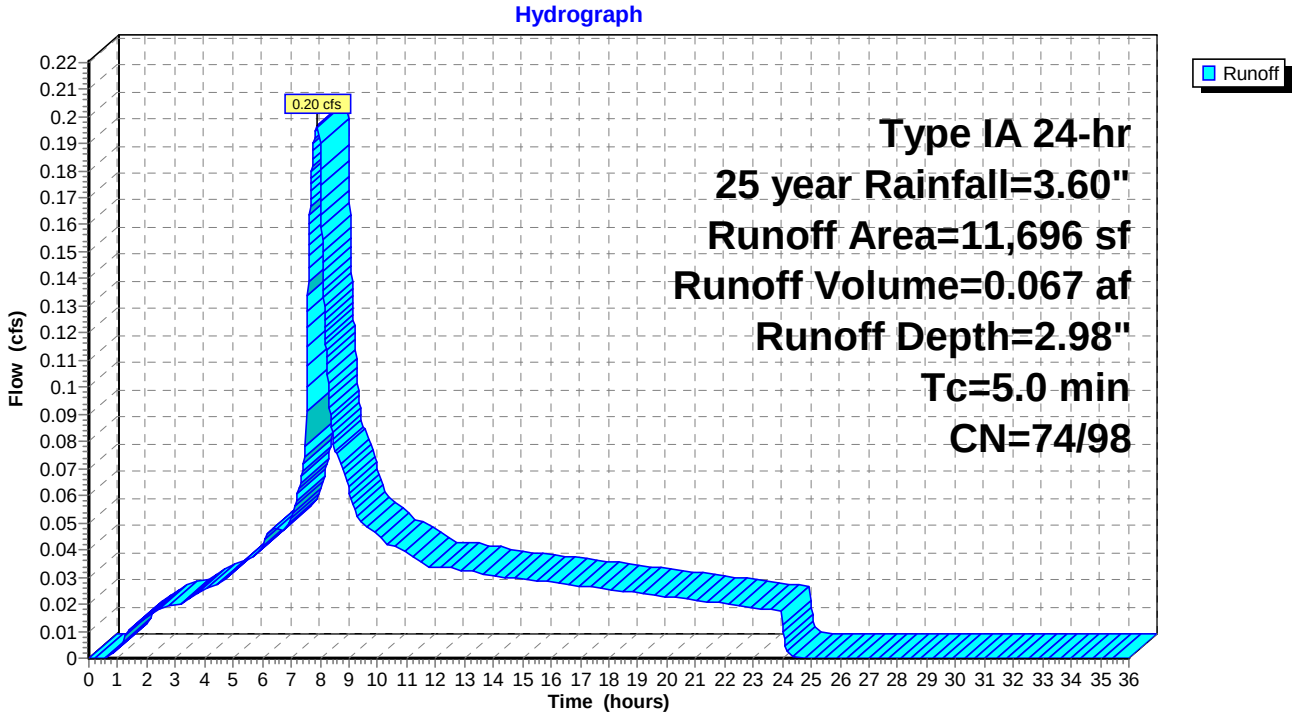
Runoff = 0.20 cfs @ 7.89 hrs, Volume= 0.067 af, Depth= 2.98"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type IA 24-hr 25 year Rainfall=3.60"

Area (sf)	CN	Description
2,181	74	>75% Grass cover, Good, HSG C
9,515	98	Paved parking, HSG C
11,696	94	Weighted Average
2,181	74	18.65% Pervious Area
9,515	98	81.35% Impervious Area

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

Subcatchment VC2: VC Loop 2



Summary for Pond 2 - GM: PB 2 - GM

Inflow Area = 2.476 ac, 74.10% Impervious, Inflow Depth = 2.83" for 25 year event
Inflow = 1.71 cfs @ 7.89 hrs, Volume= 0.585 af
Outflow = 0.36 cfs @ 10.85 hrs, Volume= 0.585 af, Atten= 79%, Lag= 177.1 min
Primary = 0.21 cfs @ 4.02 hrs, Volume= 0.528 af
Secondary = 0.15 cfs @ 10.85 hrs, Volume= 0.057 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 5.58' @ 10.85 hrs Surf.Area= 4,519 sf Storage= 7,130 cf

Plug-Flow detention time= 329.1 min calculated for 0.585 af (100% of inflow)
Center-of-Mass det. time= 329.1 min (1,013.4 - 684.3)

Volume	Invert	Avail.Storage	Storage Description
#1	4.00'	9,038 cf	**Planter Box Storage (Prismatic)** Listed below (Recalc)

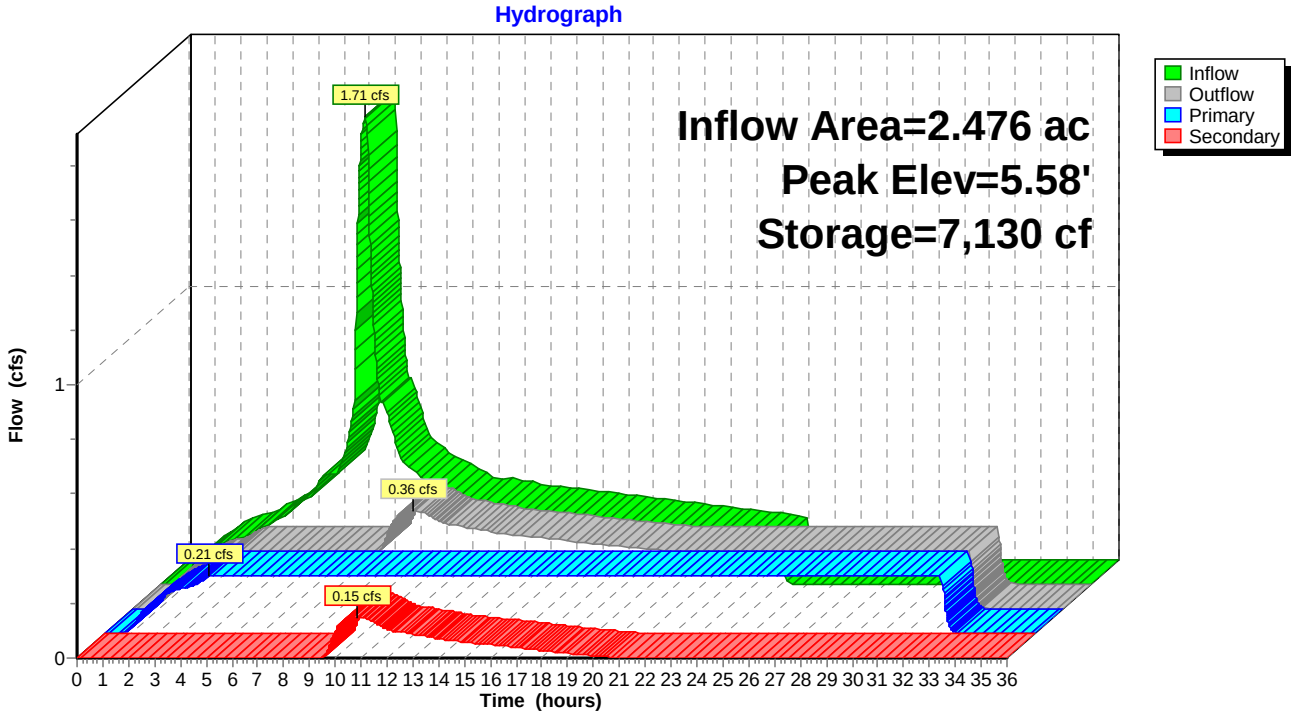
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
4.00	4,519	0	0
5.00	4,519	4,519	4,519
6.00	4,519	4,519	9,038

Device	Routing	Invert	Outlet Devices
#1	Primary	4.00'	**2.000 in/hr Flow through Growing Media over Surface area**
#2	Secondary	5.50'	**8.0" Horiz. Rock Box** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.21 cfs @ 4.02 hrs HW=4.02' (Free Discharge)
↑—**1=Flow through Growing Media** (Exfiltration Controls 0.21 cfs)

Secondary OutFlow Max=0.15 cfs @ 10.85 hrs HW=5.58' (Free Discharge)
↑—**2=Rock Box** (Weir Controls 0.15 cfs @ 0.91 fps)

Pond 2 - GM: PB 2 - GM



Summary for Pond 2 - DR: PB 2 - DR

Inflow Area = 2.476 ac, 74.10% Impervious, Inflow Depth = 2.83" for 25 year event
Inflow = 0.36 cfs @ 10.85 hrs, Volume= 0.585 af
Outflow = 0.29 cfs @ 13.06 hrs, Volume= 0.476 af, Atten= 18%, Lag= 132.9 min
Discarded = 0.07 cfs @ 1.68 hrs, Volume= 0.210 af
Primary = 0.22 cfs @ 13.06 hrs, Volume= 0.266 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 3.59' @ 13.06 hrs Surf.Area= 4,519 sf Storage= 5,842 cf

Plug-Flow detention time= 373.2 min calculated for 0.476 af (81% of inflow)
Center-of-Mass det. time= 201.6 min (1,215.0 - 1,013.4)

Volume	Invert	Avail.Storage	Storage Description
#1	0.00'	6,507 cf	**Drain Rock Storage (Prismatic)** Listed below (Recalc) 18,076 cf Overall x 36.0% Voids

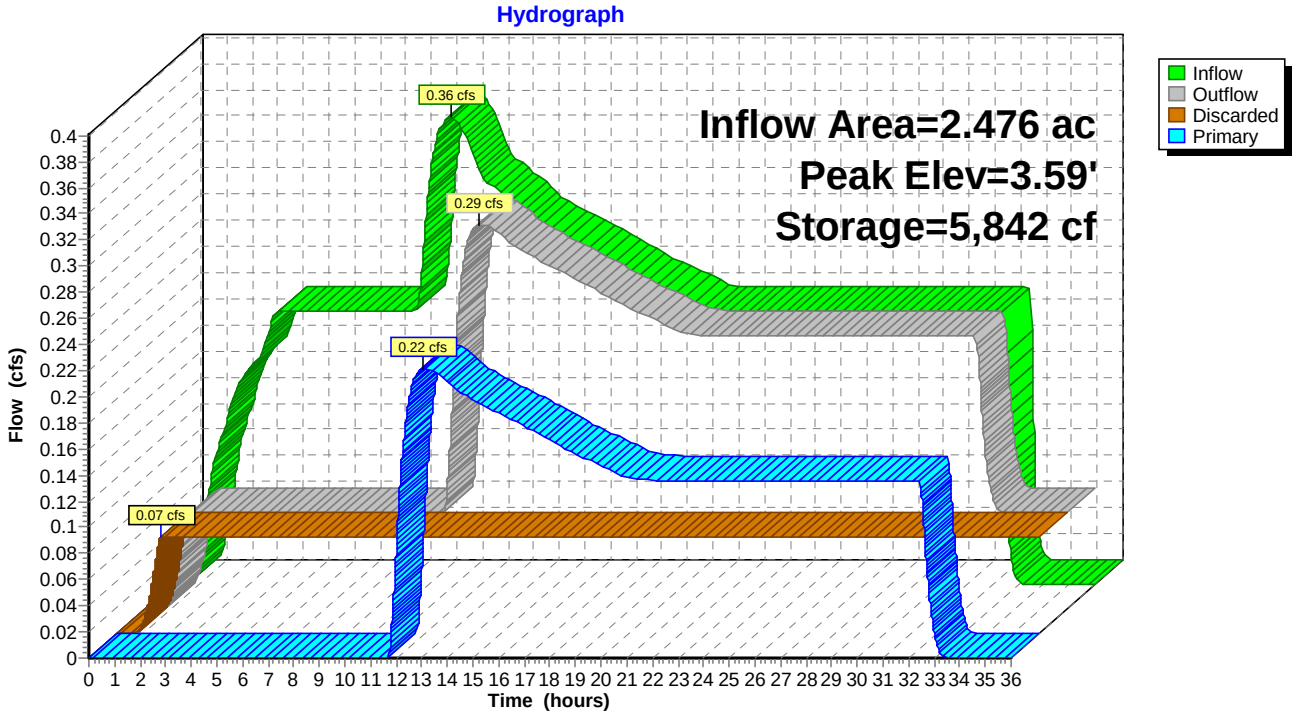
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
0.00	4,519	0	0
4.00	4,519	18,076	18,076

Device	Routing	Invert	Outlet Devices
#1	Discarded	0.00'	**0.700 in/hr Native Infiltration over Surface area**
#2	Primary	3.33'	**8.0" Vert. Underdrain** C= 0.600 Limited to weir flow at low heads

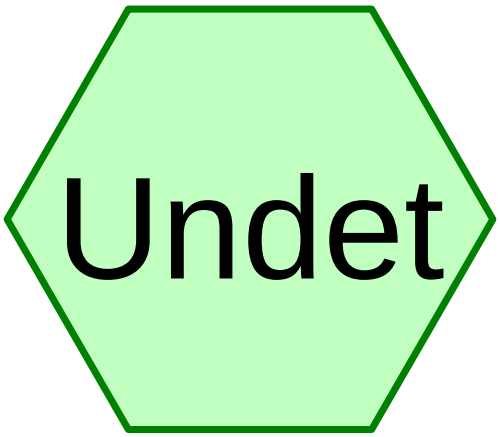
Discarded OutFlow Max=0.07 cfs @ 1.68 hrs HW=0.04' (Free Discharge)
↑—**1=Native Infiltration** (Exfiltration Controls 0.07 cfs)

Primary OutFlow Max=0.22 cfs @ 13.06 hrs HW=3.59' (Free Discharge)
↑—**2=Underdrain** (Orifice Controls 0.22 cfs @ 1.74 fps)

Pond 2 - DR: PB 2 - DR



WEST



Undetained

Subcat Reach Pond Link

Routing Diagram for WEST (VC) Site Prelim Hydrographs
Prepared by Multi/Tech Engineering Services, Printed 2/18/2021

Summary for Subcatchment Undet: Undetained

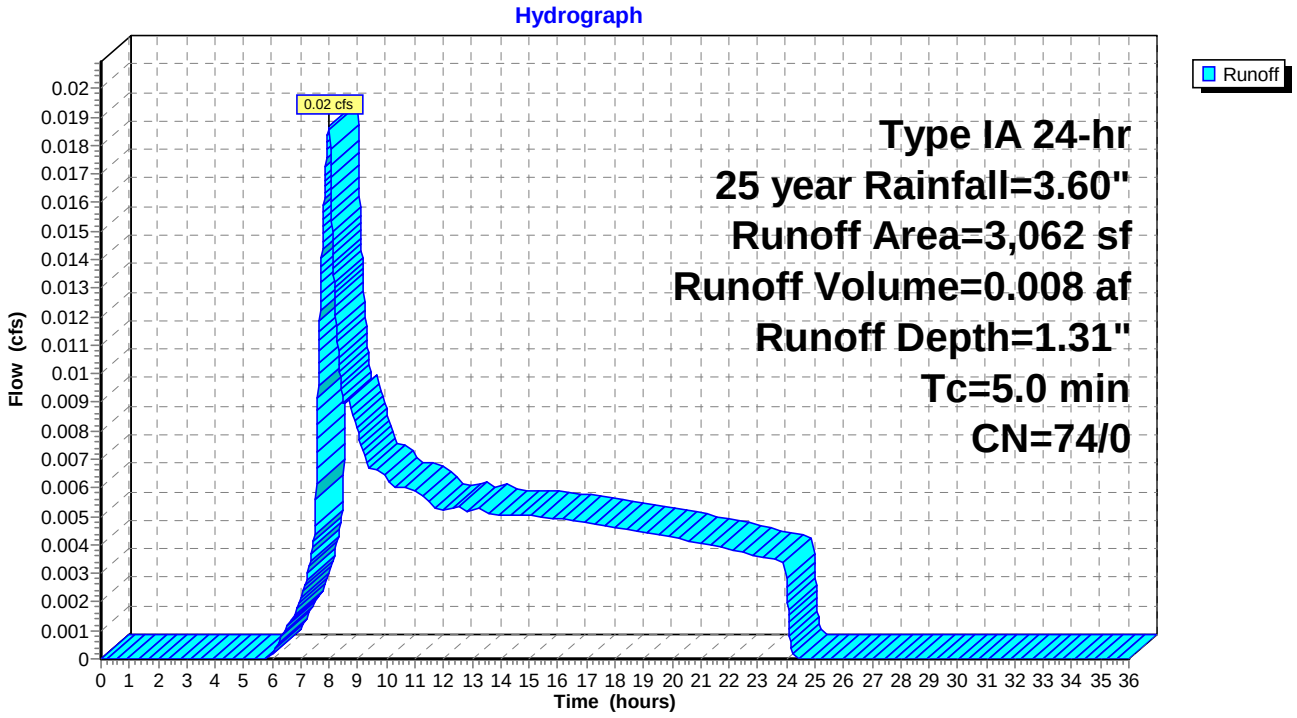
Runoff = 0.02 cfs @ 8.00 hrs, Volume= 0.008 af, Depth= 1.31"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type IA 24-hr 25 year Rainfall=3.60"

Area (sf)	CN	Description
3,062	74	>75% Grass cover, Good, HSG C
3,062	74	100.00% Pervious Area

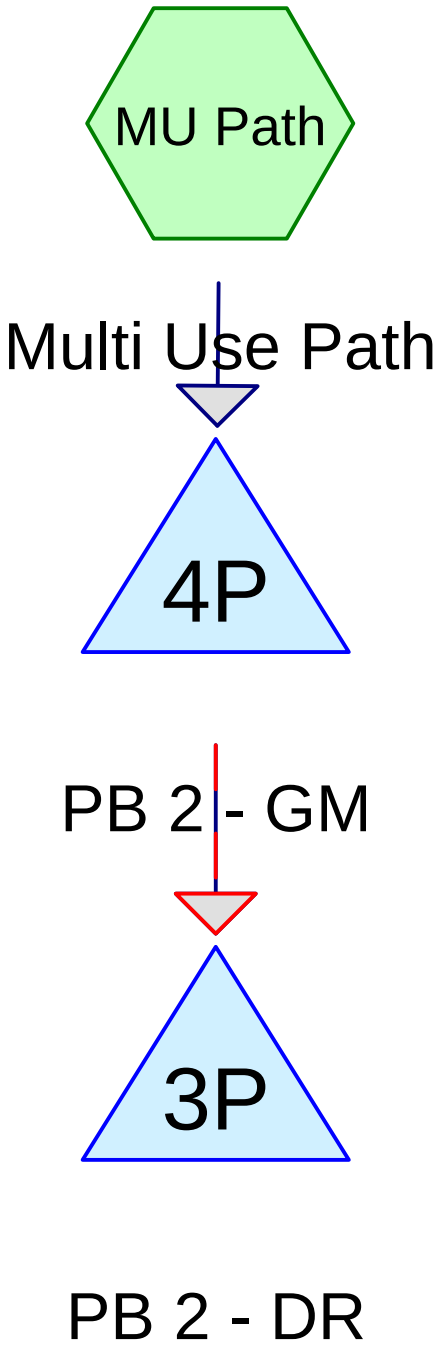
Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment Undet: Undetained



APPENDIX F: 100 YEAR HYDROGRAPHS

EAST



Subcat Reach Pond Link

Routing Diagram for EAST (Reed Rd) Site Prelim Hydrograph
Prepared by Multi/Tech Engineering Services, Printed 2/17/2021

Summary for Subcatchment MU Path: Multi Use Path

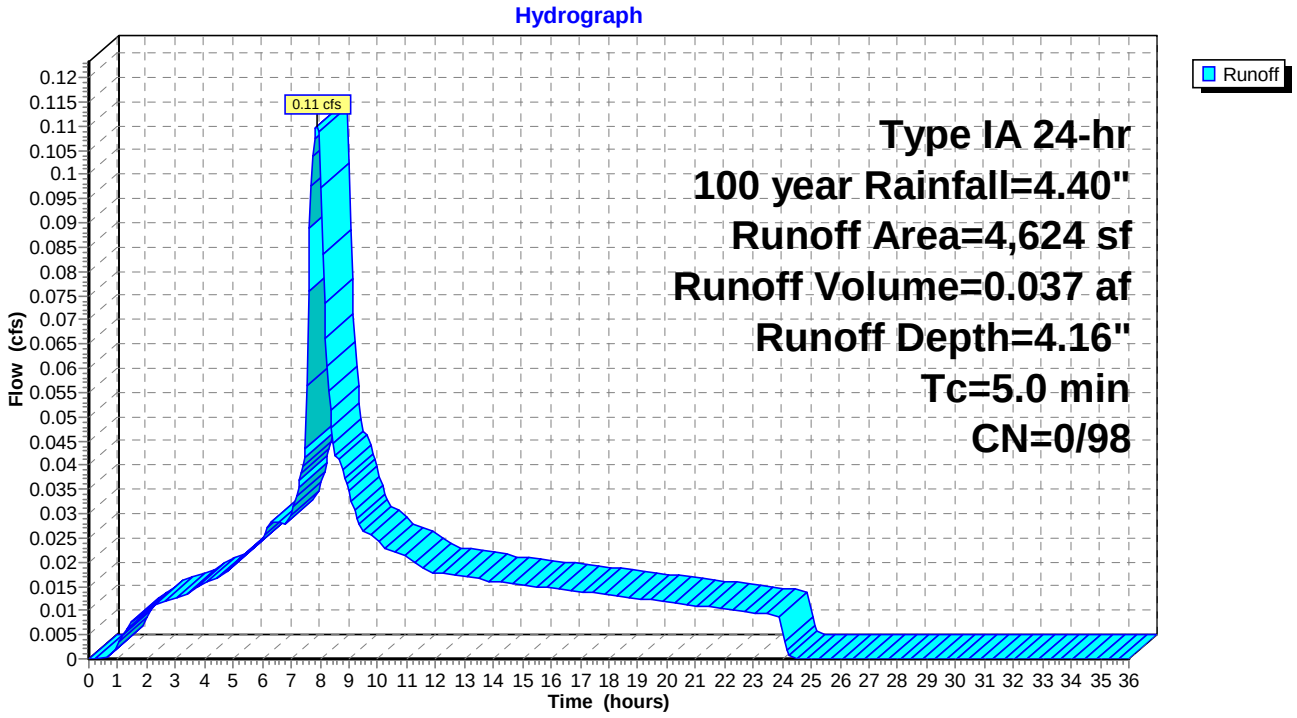
Runoff = 0.11 cfs @ 7.90 hrs, Volume= 0.037 af, Depth= 4.16"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type IA 24-hr 100 year Rainfall=4.40"

Area (sf)	CN	Description
4,624	98	Unconnected pavement, HSG C
4,624	98	100.00% Impervious Area

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

Subcatchment MU Path: Multi Use Path



Summary for Pond 4P: PB 2 - GM

Inflow Area = 0.106 ac,100.00% Impervious, Inflow Depth = 4.16" for 100 year event
Inflow = 0.11 cfs @ 7.90 hrs, Volume= 0.037 af
Outflow = 0.11 cfs @ 7.90 hrs, Volume= 0.037 af, Atten= 0%, Lag= 0.0 min
Primary = 0.11 cfs @ 7.90 hrs, Volume= 0.037 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 4.00' @ 7.90 hrs Surf.Area= 4,624 sf Storage= 0 cf

Plug-Flow detention time= 0.0 min calculated for 0.037 af (100% of inflow)
Center-of-Mass det. time= (not calculated: outflow precedes inflow)

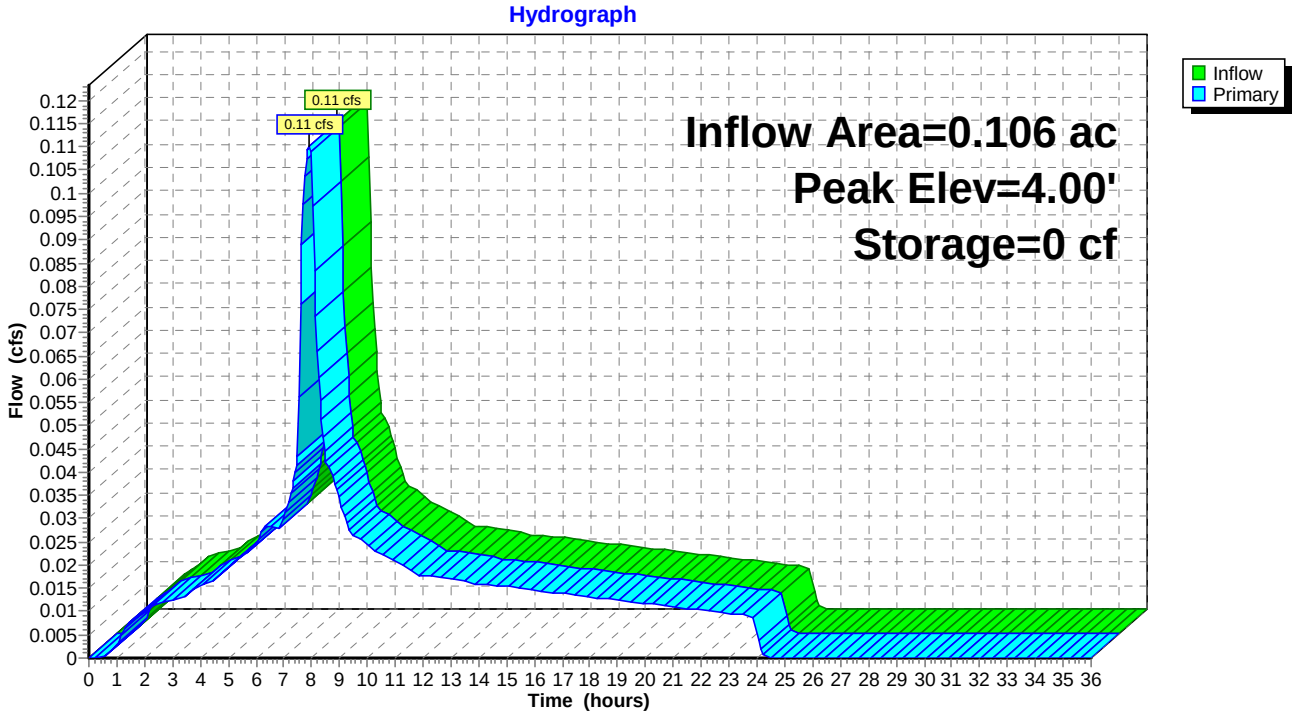
Volume	Invert	Avail.Storage	Storage Description
#1	4.00'	0 cf	**Growing Media (Prismatic)** Listed below (Recalc) 1,526 cf Overall x 0.0% Voids

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
4.00	4,624	0	0
4.33	4,624	1,526	1,526

Device	Routing	Invert	Outlet Devices
#1	Primary	4.00'	**100.000 in/hr Exfiltration over Surface area**

Primary OutFlow Max=10.70 cfs @ 7.90 hrs HW=4.00' (Free Discharge)
1=Exfiltration (Exfiltration Controls 10.70 cfs)

Pond 4P: PB 2 - GM



Summary for Pond 3P: PB 2 - DR

Inflow Area = 0.106 ac,100.00% Impervious, Inflow Depth = 4.16" for 100 year event
Inflow = 0.11 cfs @ 7.90 hrs, Volume= 0.037 af
Outflow = 0.03 cfs @ 7.25 hrs, Volume= 0.037 af, Atten= 71%, Lag= 0.0 min
Discarded = 0.03 cfs @ 7.25 hrs, Volume= 0.037 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 0.12' @ 9.10 hrs Surf.Area= 4,624 sf Storage= 206 cf

Plug-Flow detention time= 36.1 min calculated for 0.037 af (100% of inflow)
Center-of-Mass det. time= 36.0 min (694.6 - 658.6)

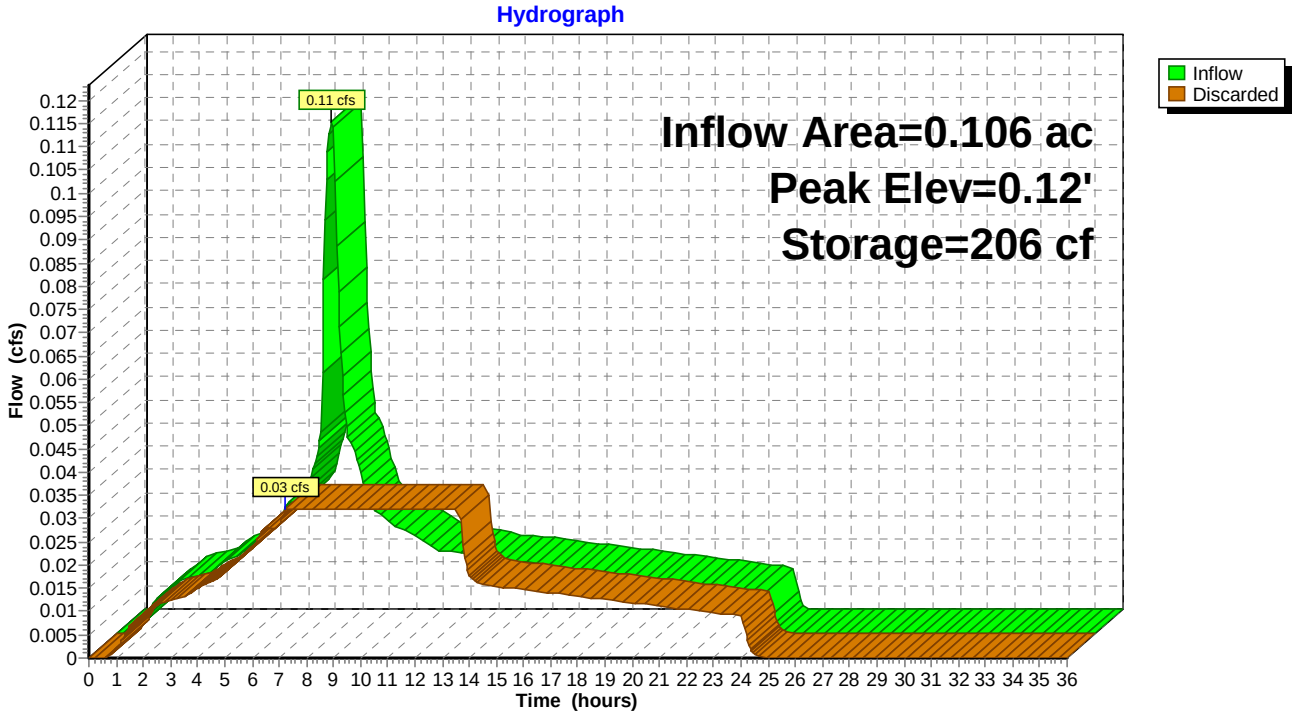
Volume	Invert	Avail.Storage	Storage Description
#1	0.00'	1,665 cf	**Drain Rock (Prismatic)** Listed below (Recalc) 4,624 cf Overall x 36.0% Voids

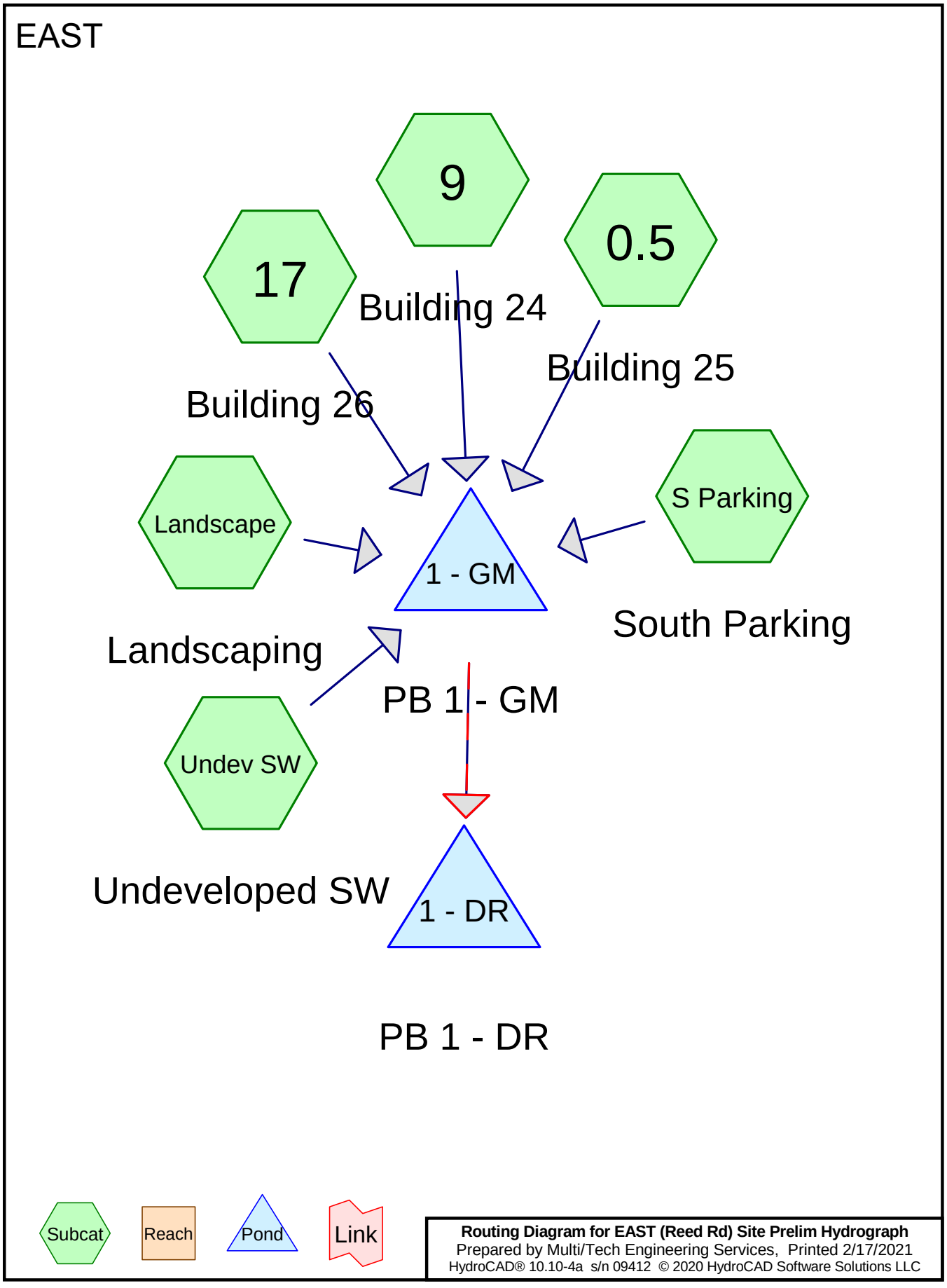
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
0.00	4,624	0	0
1.00	4,624	4,624	4,624

Device	Routing	Invert	Outlet Devices
#1	Discarded	0.00'	**0.300 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.03 cfs @ 7.25 hrs HW=0.01' (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 0.03 cfs)

Pond 3P: PB 2 - DR





Routing Diagram for EAST (Reed Rd) Site Prelim Hydrograph
Prepared by Multi/Tech Engineering Services, Printed 2/17/2021

Summary for Subcatchment 0.5: Building 25

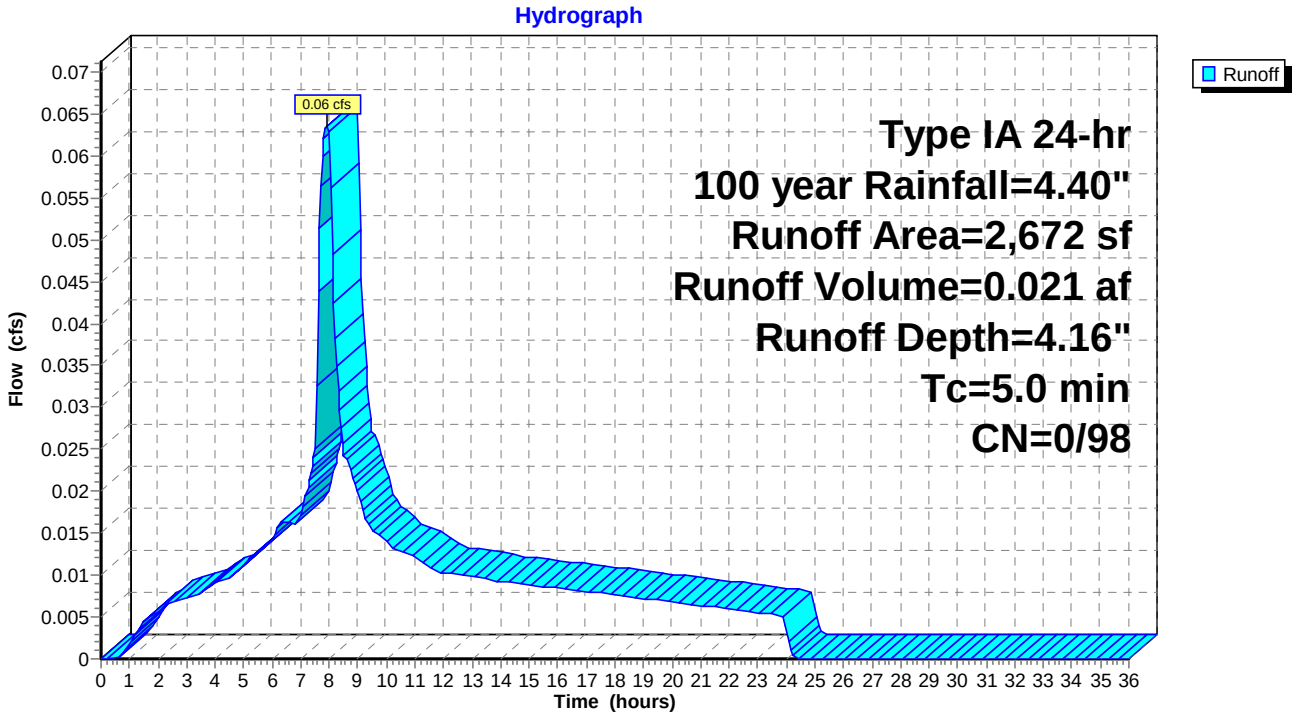
Runoff = 0.06 cfs @ 7.90 hrs, Volume= 0.021 af, Depth= 4.16"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type IA 24-hr 100 year Rainfall=4.40"

Area (sf)	CN	Description
2,672	98	Roofs, HSG C
2,672	98	100.00% Impervious Area

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

Subcatchment 0.5: Building 25



Summary for Subcatchment 9: Building 24

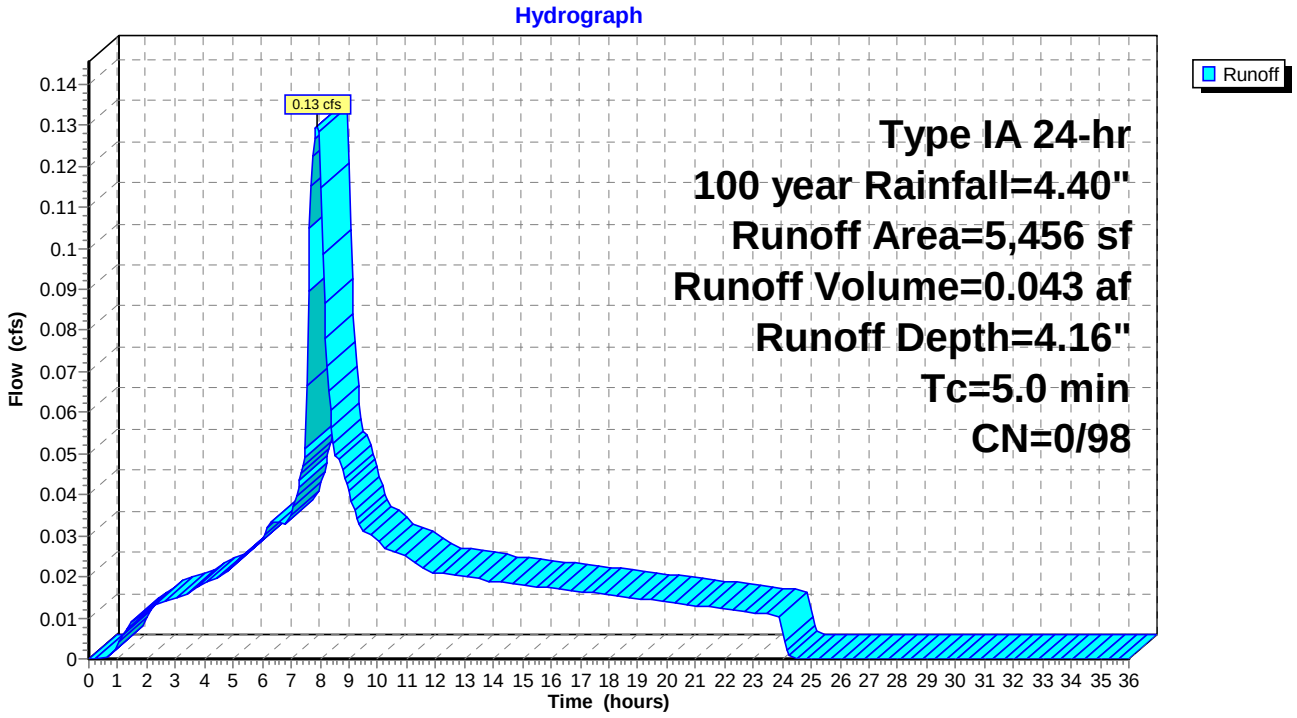
Runoff = 0.13 cfs @ 7.90 hrs, Volume= 0.043 af, Depth= 4.16"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type IA 24-hr 100 year Rainfall=4.40"

Area (sf)	CN	Description
5,456	98	Roofs, HSG C
5,456	98	100.00% Impervious Area

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

Subcatchment 9: Building 24



Summary for Subcatchment 17: Building 26

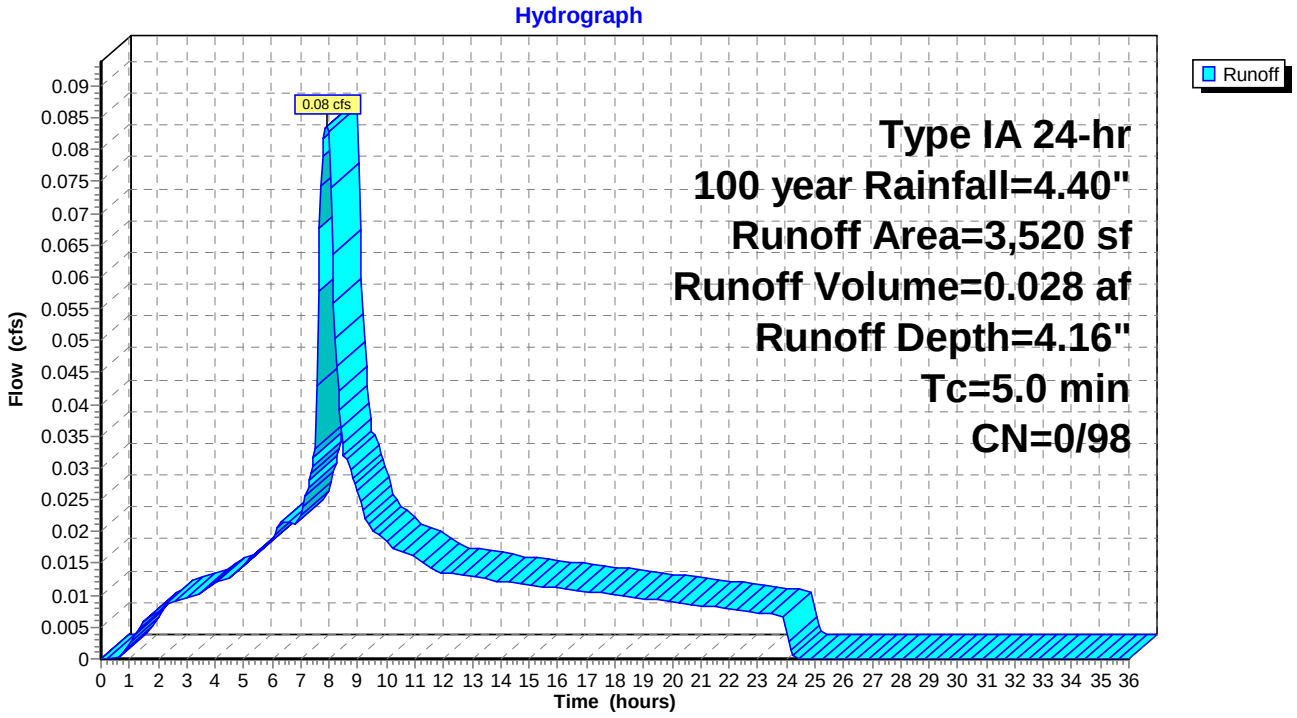
Runoff = 0.08 cfs @ 7.90 hrs, Volume= 0.028 af, Depth= 4.16"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type IA 24-hr 100 year Rainfall=4.40"

Area (sf)	CN	Description
3,520	98	Roofs, HSG C
3,520	98	100.00% Impervious Area

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

Subcatchment 17: Building 26



Summary for Subcatchment Landscape: Landscaping

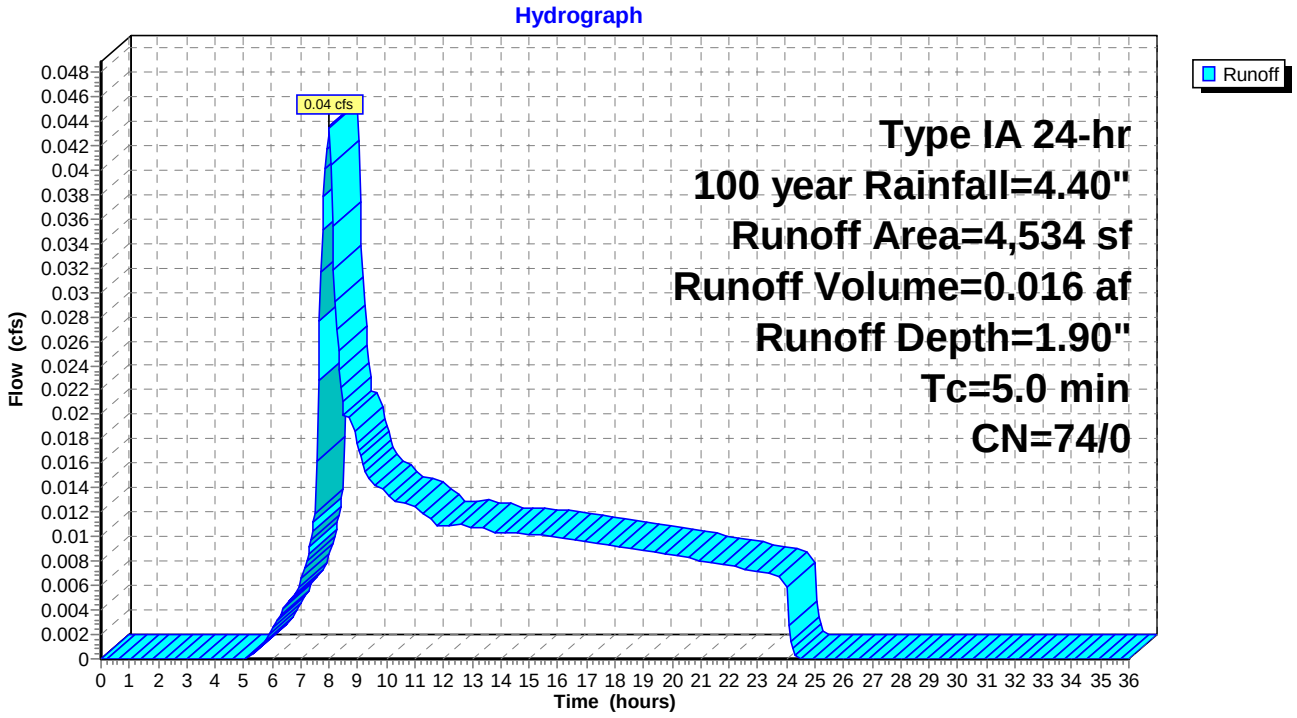
Runoff = 0.04 cfs @ 7.98 hrs, Volume= 0.016 af, Depth= 1.90"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type IA 24-hr 100 year Rainfall=4.40"

Area (sf)	CN	Description
4,534	74	>75% Grass cover, Good, HSG C
4,534	74	100.00% Pervious Area

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

Subcatchment Landscape: Landscaping



Summary for Subcatchment S Parking: South Parking

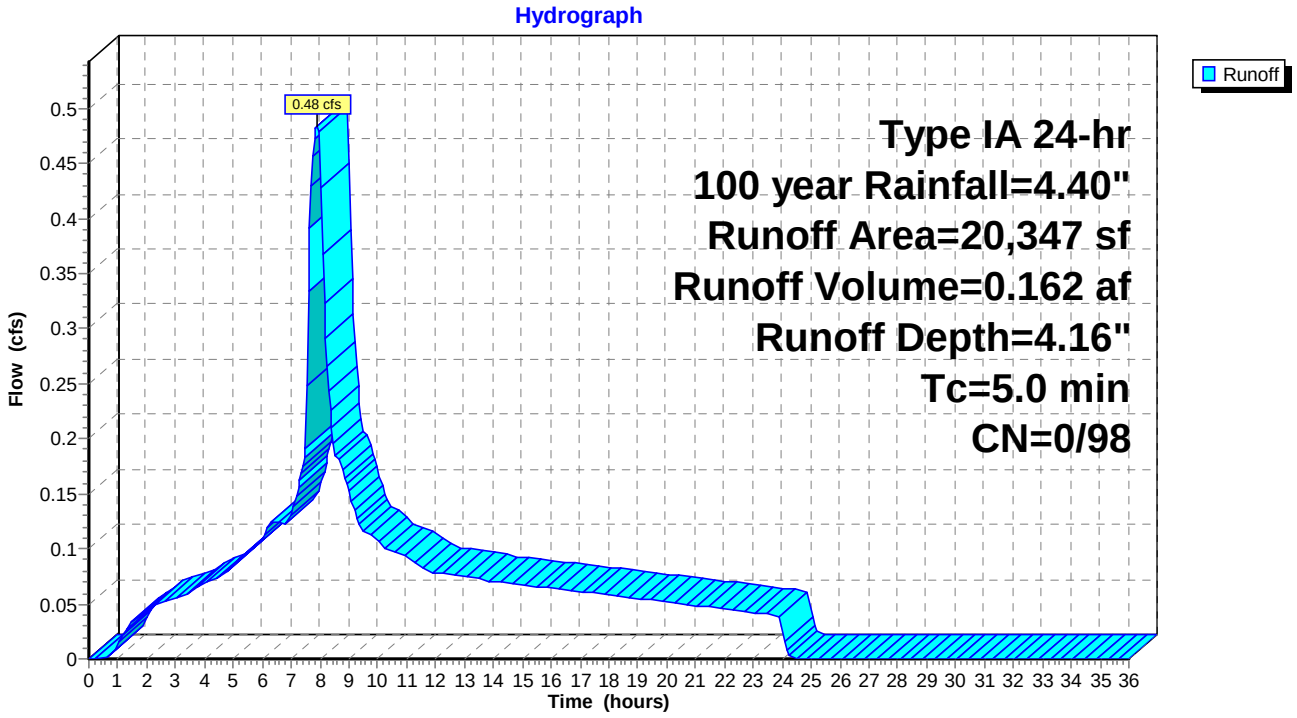
Runoff = 0.48 cfs @ 7.90 hrs, Volume= 0.162 af, Depth= 4.16"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type IA 24-hr 100 year Rainfall=4.40"

Area (sf)	CN	Description
20,347	98	Paved parking, HSG C
20,347	98	100.00% Impervious Area

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

Subcatchment S Parking: South Parking



Summary for Subcatchment Undev SW: Undeveloped SW

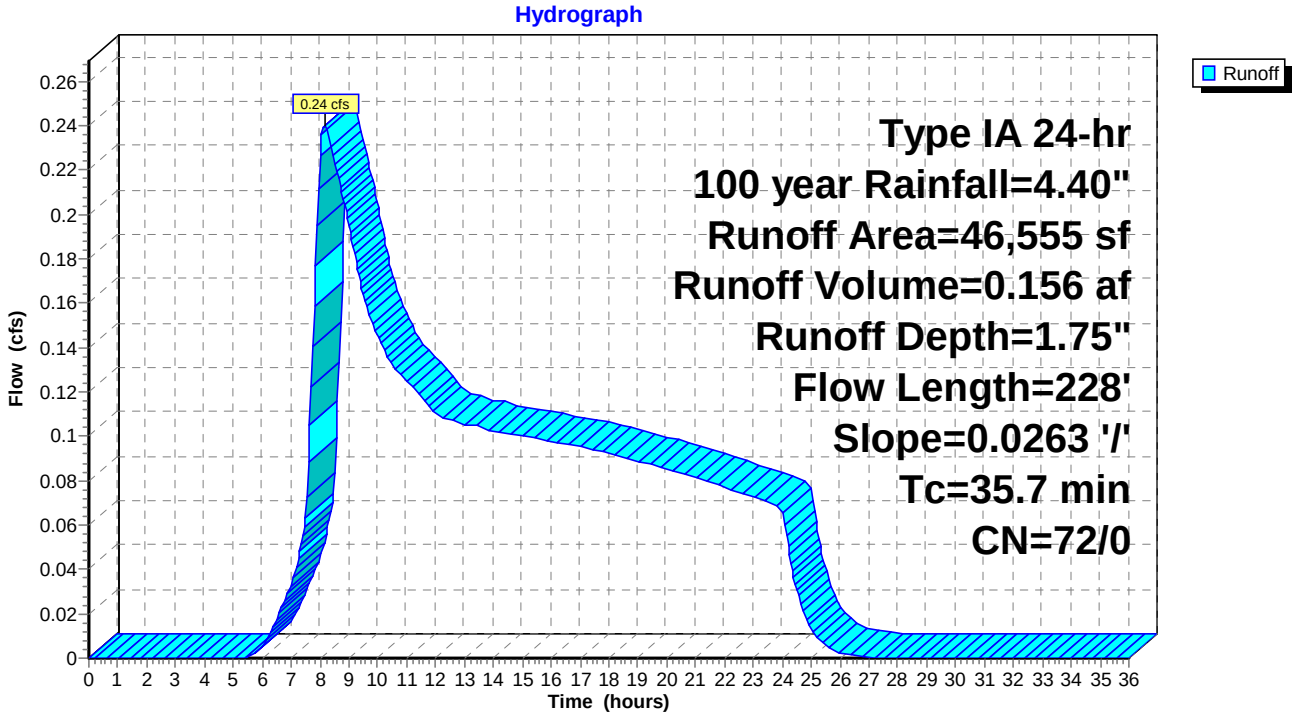
Runoff = 0.24 cfs @ 8.18 hrs, Volume= 0.156 af, Depth= 1.75"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type IA 24-hr 100 year Rainfall=4.40"

	Area (sf)	CN	Description
*	46,555	72	City of Salem Predeveloped, HSG C
	46,555	72	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
35.7	228	0.0263	0.11		**Sheet Flow,** n= 0.300 P2= 2.20"

Subcatchment Undev SW: Undeveloped SW



Summary for Pond 1 - GM: PB 1 - GM

Inflow Area = 1.907 ac, 38.51% Impervious, Inflow Depth = 2.69" for 100 year event
Inflow = 1.02 cfs @ 7.98 hrs, Volume= 0.427 af
Outflow = 0.28 cfs @ 11.18 hrs, Volume= 0.427 af, Atten= 73%, Lag= 192.3 min
Primary = 0.14 cfs @ 5.25 hrs, Volume= 0.354 af
Secondary = 0.14 cfs @ 11.18 hrs, Volume= 0.073 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 5.58' @ 11.18 hrs Surf.Area= 3,008 sf Storage= 4,753 cf

Plug-Flow detention time= 307.3 min calculated for 0.427 af (100% of inflow)
Center-of-Mass det. time= 307.6 min (1,048.5 - 740.9)

Volume	Invert	Avail.Storage	Storage Description
#1	4.00'	6,016 cf	**Growing Media (Prismatic)** Listed below (Recalc)

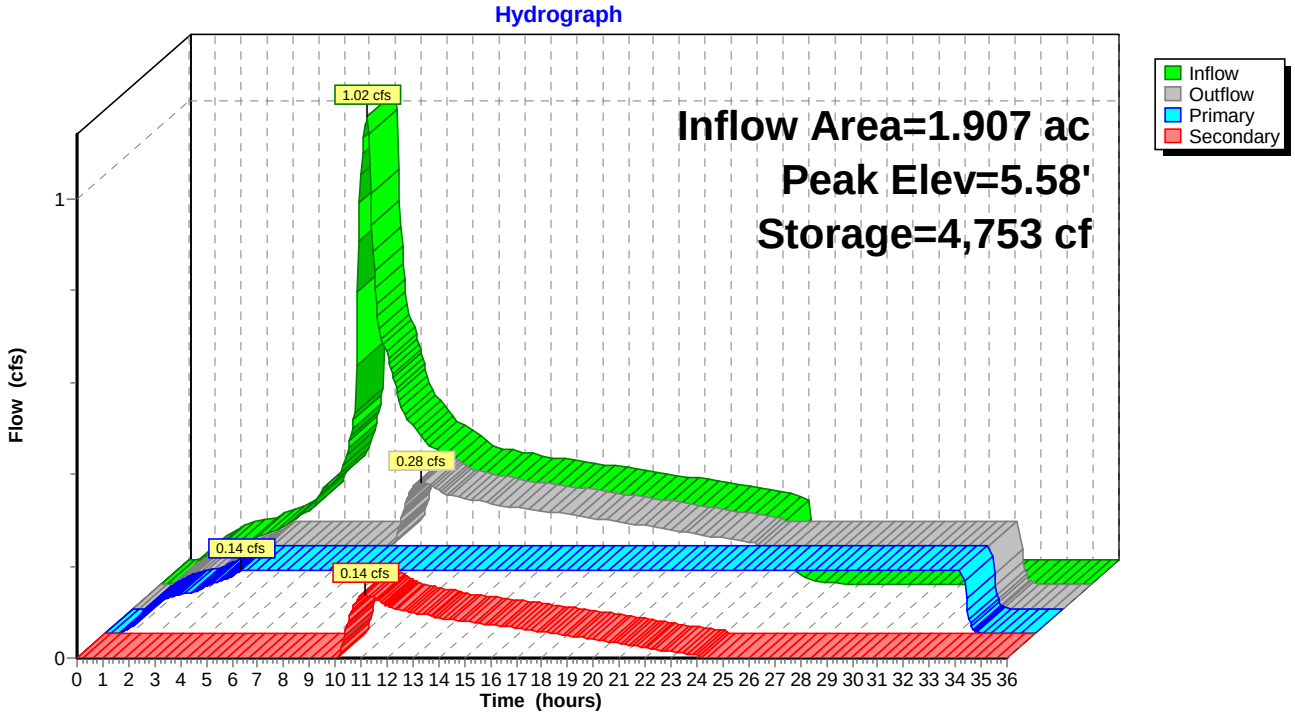
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
4.00	3,008	0	0
6.00	3,008	6,016	6,016

Device	Routing	Invert	Outlet Devices
#1	Primary	4.00'	**2.000 in/hr Exfiltration over Surface area**
#2	Secondary	5.50'	**7.0" Horiz. Rock Box** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.14 cfs @ 5.25 hrs HW=4.02' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.14 cfs)

Secondary OutFlow Max=0.14 cfs @ 11.18 hrs HW=5.58' (Free Discharge)
└**2=Rock Box** (Weir Controls 0.14 cfs @ 0.93 fps)

Pond 1 - GM: PB 1 - GM



Summary for Pond 1 - DR: PB 1 - DR

Inflow Area = 1.907 ac, 38.51% Impervious, Inflow Depth = 2.69" for 100 year event
Inflow = 0.28 cfs @ 11.18 hrs, Volume= 0.427 af
Outflow = 0.24 cfs @ 13.28 hrs, Volume= 0.352 af, Atten= 14%, Lag= 125.6 min
Discarded = 0.05 cfs @ 1.85 hrs, Volume= 0.140 af
Primary = 0.19 cfs @ 13.28 hrs, Volume= 0.212 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 3.57' @ 13.28 hrs Surf.Area= 3,008 sf Storage= 3,864 cf

Plug-Flow detention time= 331.0 min calculated for 0.351 af (82% of inflow)
Center-of-Mass det. time= 169.4 min (1,217.9 - 1,048.5)

Volume	Invert	Avail.Storage	Storage Description
#1	0.00'	4,332 cf	**Drain Rock (Prismatic)** Listed below (Recalc) 12,032 cf Overall x 36.0% Voids

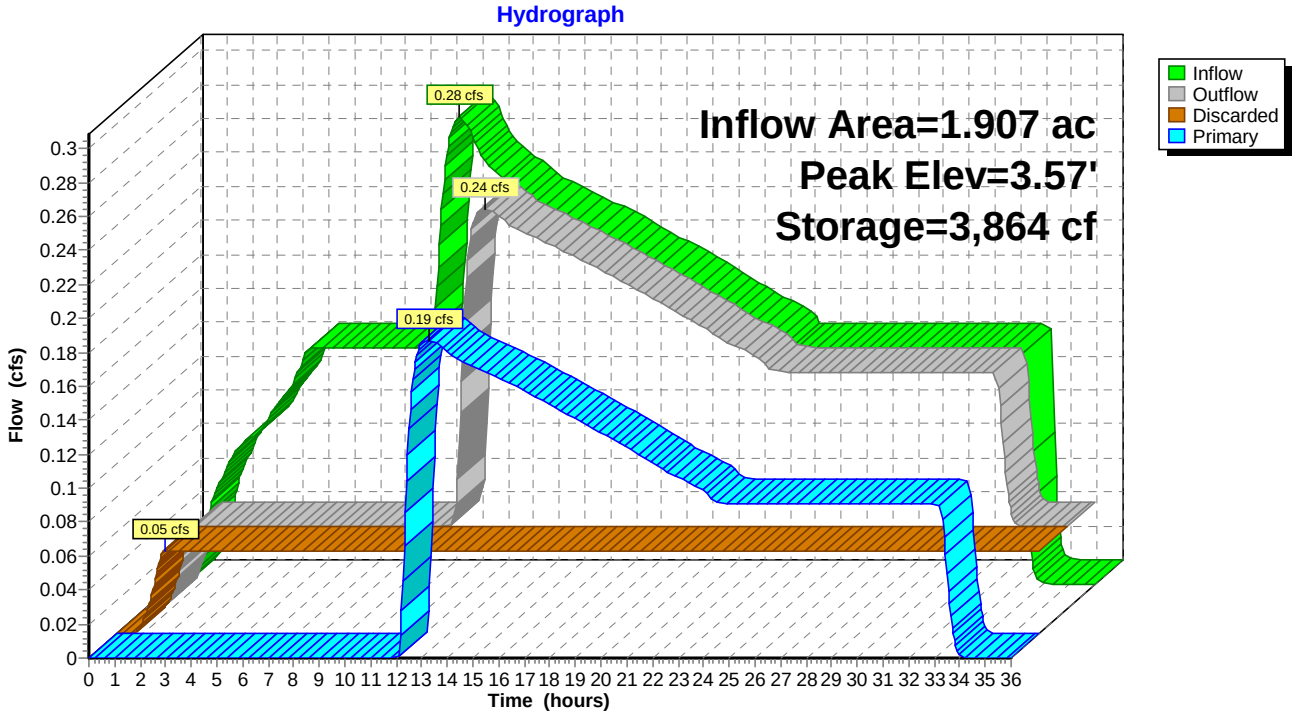
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
0.00	3,008	0	0
4.00	3,008	12,032	12,032

Device	Routing	Invert	Outlet Devices
#1	Discarded	0.00'	**0.700 in/hr Exfiltration over Surface area**
#2	Primary	3.33'	**8.0" Vert. Underdrain** C= 0.600 Limited to weir flow at low heads

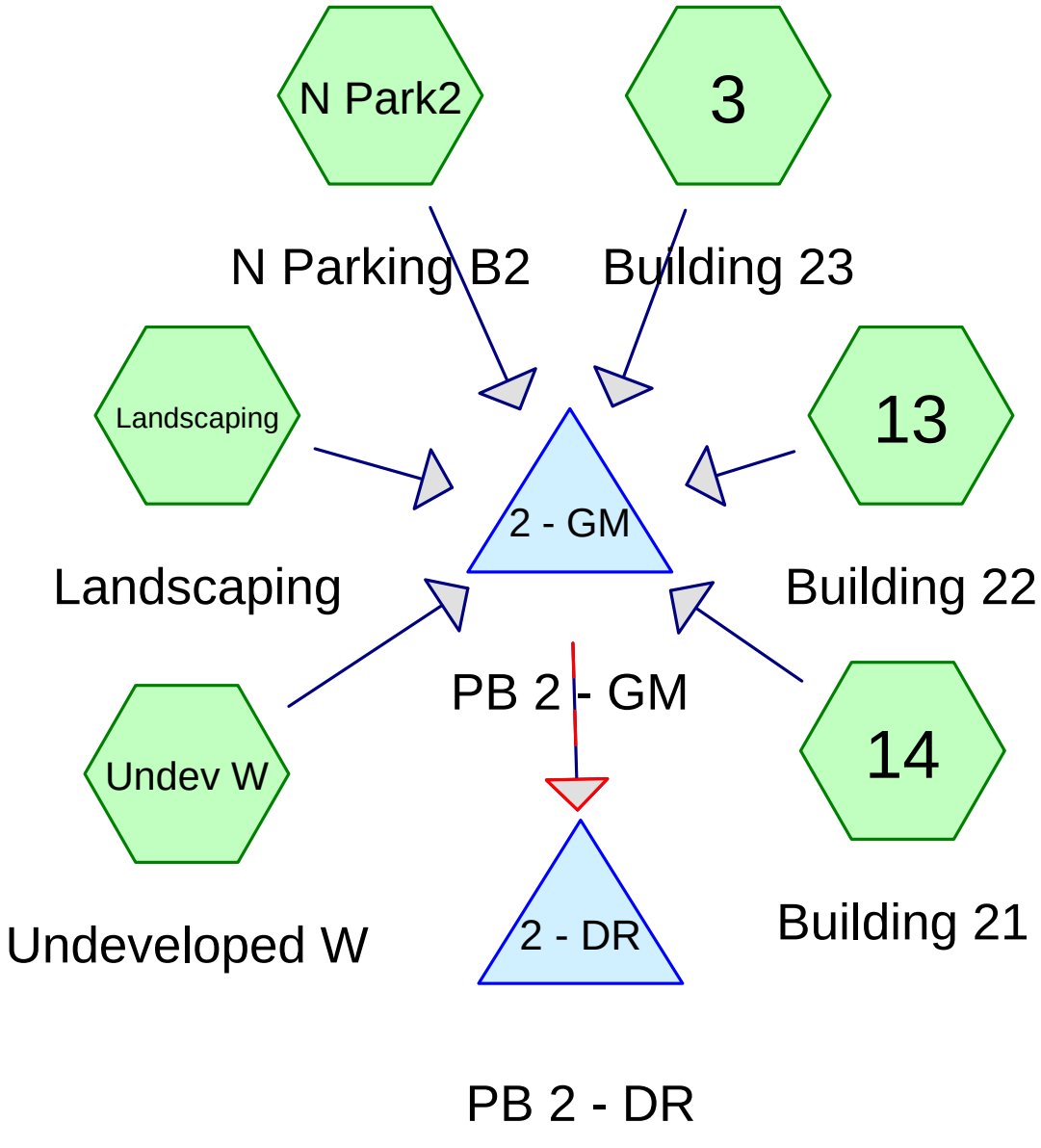
Discarded OutFlow Max=0.05 cfs @ 1.85 hrs HW=0.04' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.05 cfs)

Primary OutFlow Max=0.19 cfs @ 13.28 hrs HW=3.57' (Free Discharge)
↑—**2=Underdrain** (Orifice Controls 0.19 cfs @ 1.66 fps)

Pond 1 - DR: PB 1 - DR



EAST



Subcat Reach Pond Link

Routing Diagram for EAST (Reed Rd) Site Prelim Hydrograph
Prepared by Multi/Tech Engineering Services, Printed 2/17/2021

Summary for Subcatchment 3: Building 23

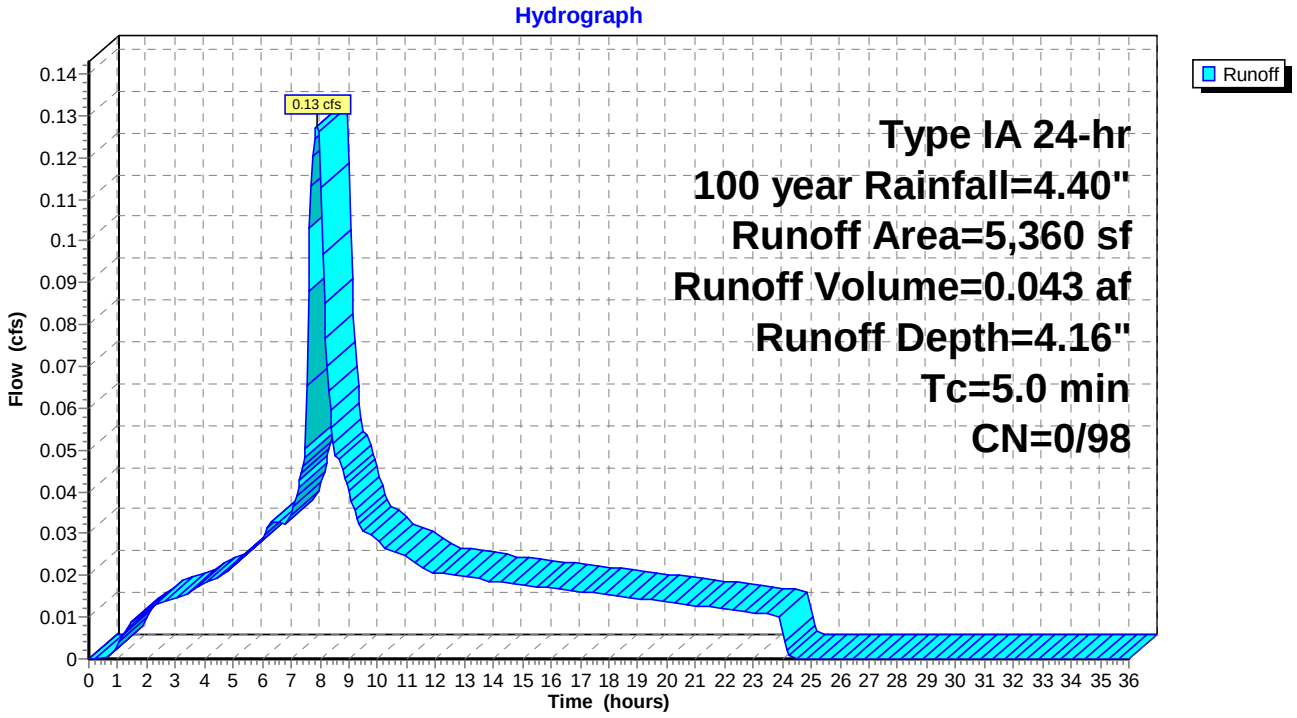
Runoff = 0.13 cfs @ 7.90 hrs, Volume= 0.043 af, Depth= 4.16"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type IA 24-hr 100 year Rainfall=4.40"

Area (sf)	CN	Description
5,360	98	Roofs, HSG C
5,360	98	100.00% Impervious Area

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

Subcatchment 3: Building 23



Summary for Subcatchment 13: Building 22

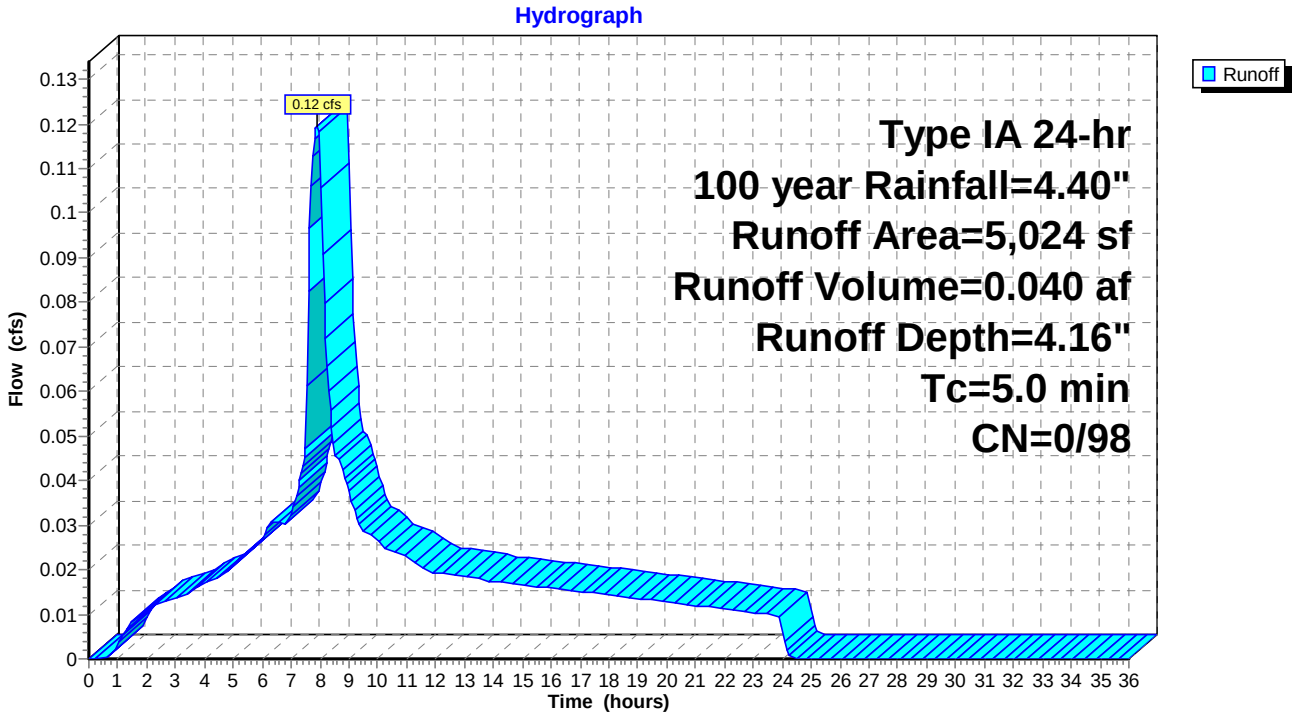
Runoff = 0.12 cfs @ 7.90 hrs, Volume= 0.040 af, Depth= 4.16"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type IA 24-hr 100 year Rainfall=4.40"

Area (sf)	CN	Description
5,024	98	Roofs, HSG C
5,024	98	100.00% Impervious Area

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

Subcatchment 13: Building 22



Summary for Subcatchment 14: Building 21

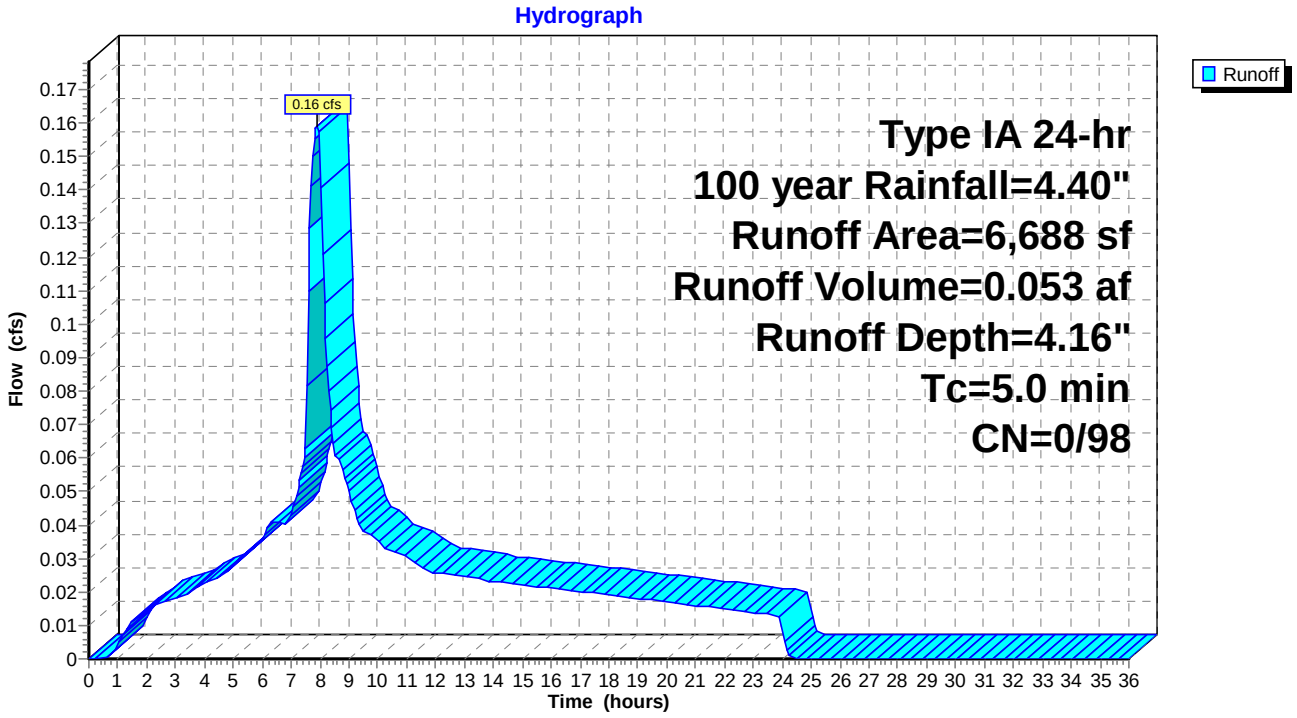
Runoff = 0.16 cfs @ 7.90 hrs, Volume= 0.053 af, Depth= 4.16"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type IA 24-hr 100 year Rainfall=4.40"

Area (sf)	CN	Description
6,688	98	Roofs, HSG C
6,688	98	100.00% Impervious Area

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

Subcatchment 14: Building 21



Summary for Subcatchment Landscaping: Landscaping

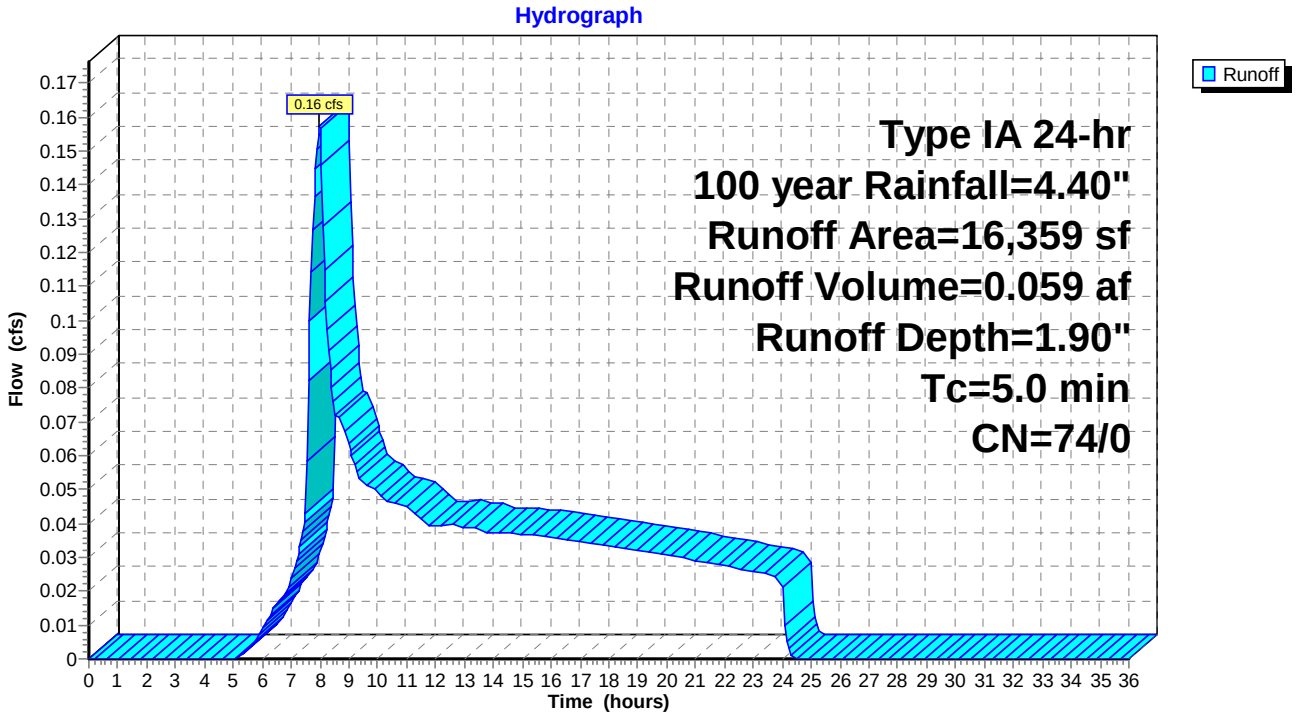
Runoff = 0.16 cfs @ 7.98 hrs, Volume= 0.059 af, Depth= 1.90"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type IA 24-hr 100 year Rainfall=4.40"

Area (sf)	CN	Description
16,359	74	>75% Grass cover, Good, HSG C
16,359	74	100.00% Pervious Area

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

Subcatchment Landscaping: Landscaping



Summary for Subcatchment N Park2: N Parking B2

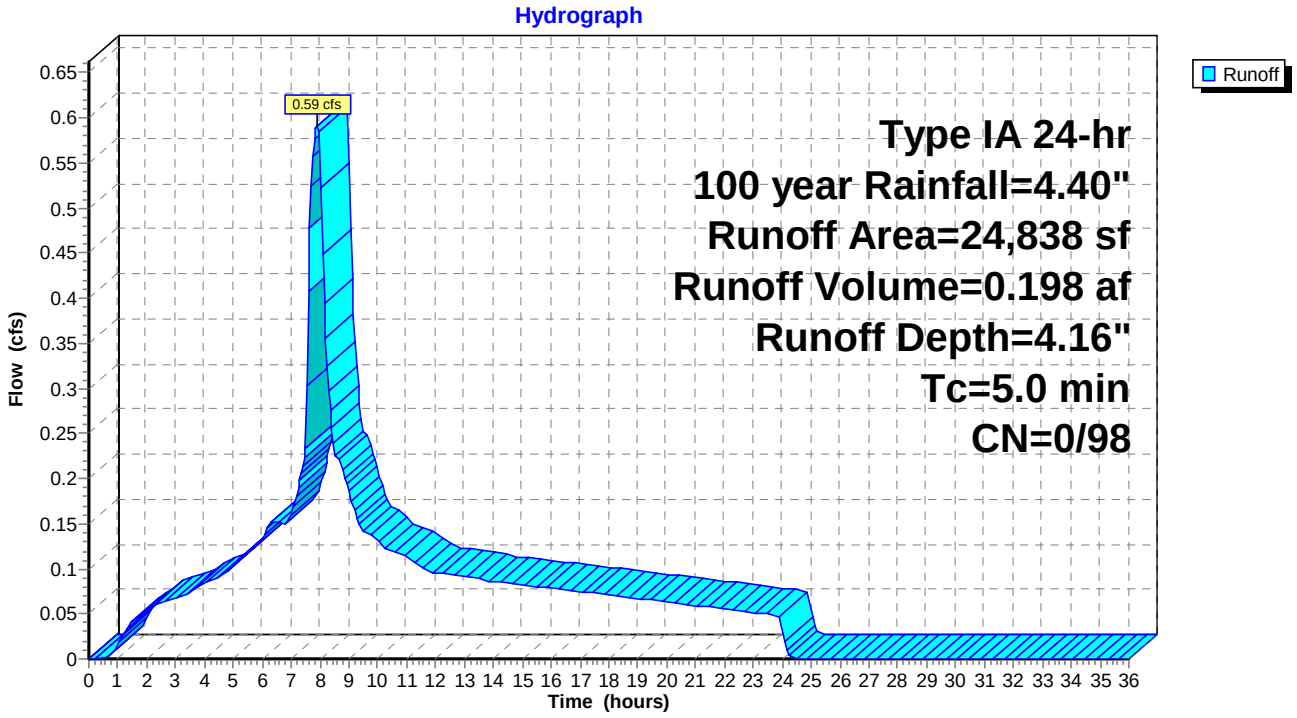
Runoff = 0.59 cfs @ 7.90 hrs, Volume= 0.198 af, Depth= 4.16"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type IA 24-hr 100 year Rainfall=4.40"

Area (sf)	CN	Description
24,838	98	Unconnected pavement, HSG C
24,838	98	100.00% Impervious Area

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

Subcatchment N Park2: N Parking B2



Summary for Subcatchment Undev W: Undeveloped W

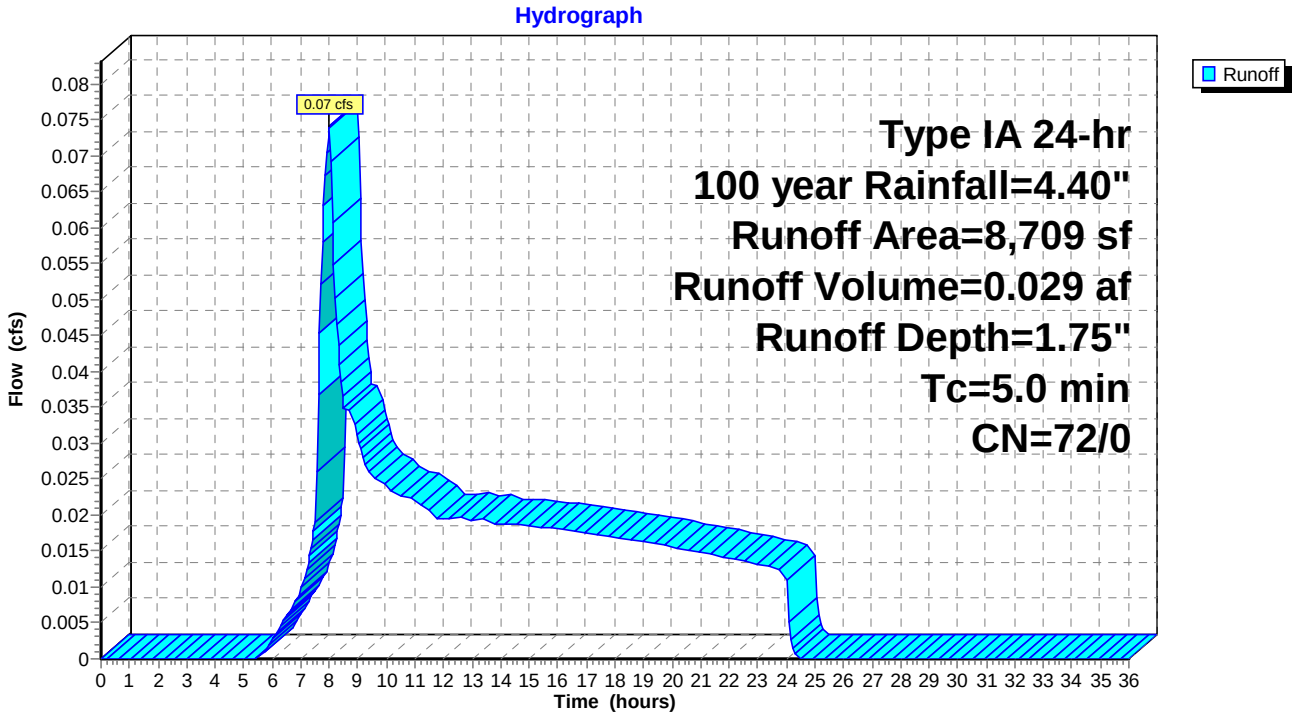
Runoff = 0.07 cfs @ 7.99 hrs, Volume= 0.029 af, Depth= 1.75"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type IA 24-hr 100 year Rainfall=4.40"

	Area (sf)	CN	Description
*	8,709	72	City of Salem Undeveloped, HSG C
	8,709	72	100.00% Pervious Area

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

Subcatchment Undev W: Undeveloped W



Summary for Pond 2 - GM: PB 2 - GM

Inflow Area = 1.538 ac, 62.57% Impervious, Inflow Depth = 3.30" for 100 year event
Inflow = 1.22 cfs @ 7.92 hrs, Volume= 0.422 af
Outflow = 0.47 cfs @ 8.72 hrs, Volume= 0.422 af, Atten= 61%, Lag= 47.8 min
Primary = 0.11 cfs @ 3.30 hrs, Volume= 0.300 af
Secondary = 0.36 cfs @ 8.72 hrs, Volume= 0.122 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 5.65' @ 8.72 hrs Surf.Area= 2,482 sf Storage= 4,100 cf

Plug-Flow detention time= 268.9 min calculated for 0.422 af (100% of inflow)
Center-of-Mass det. time= 268.9 min (963.0 - 694.1)

Volume	Invert	Avail.Storage	Storage Description
#1	4.00'	4,964 cf	**Growing Media (Prismatic)** Listed below (Recalc)

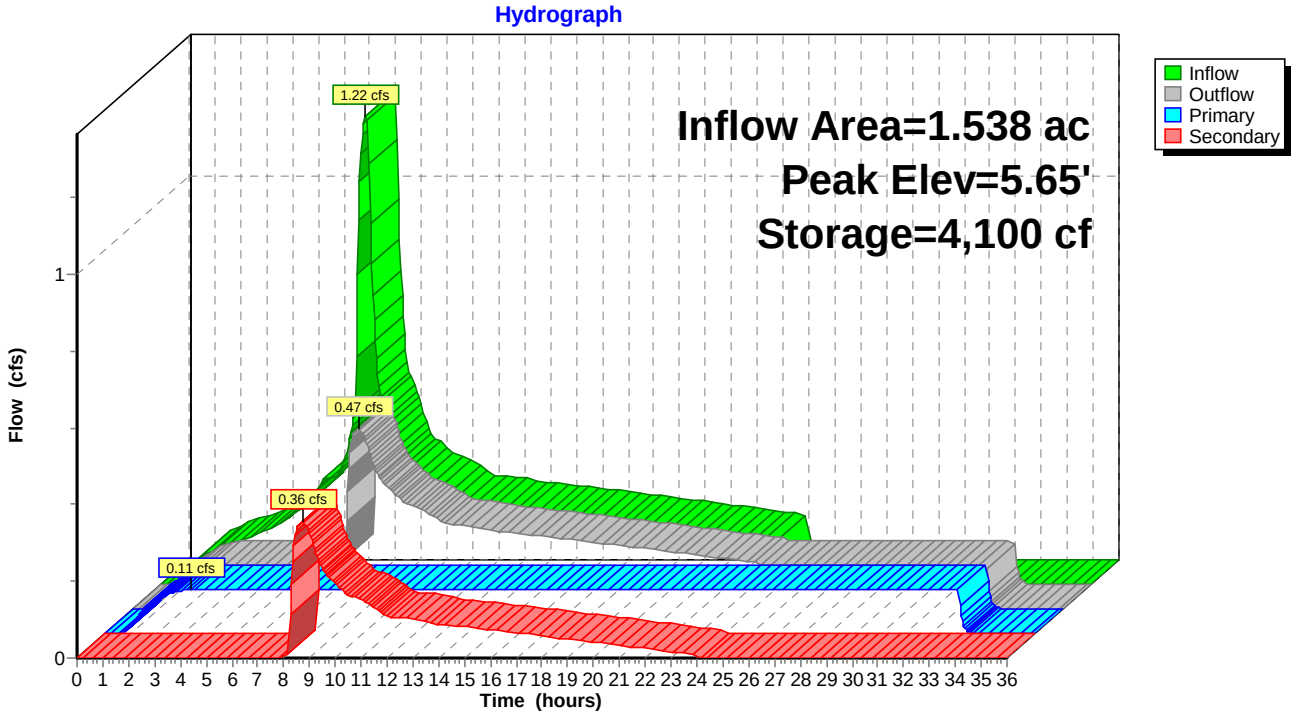
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
4.00	2,482	0	0
6.00	2,482	4,964	4,964

Device	Routing	Invert	Outlet Devices
#1	Primary	4.00'	**2.000 in/hr Exfiltration over Surface area**
#2	Secondary	5.50'	**7.0" Horiz. Rock Box** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.11 cfs @ 3.30 hrs HW=4.02' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.11 cfs)

Secondary OutFlow Max=0.36 cfs @ 8.72 hrs HW=5.65' (Free Discharge)
↑—**2=Rock Box** (Weir Controls 0.36 cfs @ 1.27 fps)

Pond 2 - GM: PB 2 - GM



Summary for Pond 2 - DR: PB 2 - DR

Inflow Area = 1.538 ac, 62.57% Impervious, Inflow Depth = 3.30" for 100 year event
Inflow = 0.47 cfs @ 8.72 hrs, Volume= 0.422 af
Outflow = 0.33 cfs @ 9.69 hrs, Volume= 0.361 af, Atten= 30%, Lag= 58.4 min
Discarded = 0.04 cfs @ 1.50 hrs, Volume= 0.116 af
Primary = 0.29 cfs @ 9.69 hrs, Volume= 0.246 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 3.63' @ 9.69 hrs Surf.Area= 2,482 sf Storage= 3,246 cf

Plug-Flow detention time= 286.8 min calculated for 0.361 af (85% of inflow)
Center-of-Mass det. time= 146.5 min (1,109.5 - 963.0)

Volume	Invert	Avail.Storage	Storage Description
#1	0.00'	3,574 cf	**Drain Rock (Prismatic)** Listed below (Recalc) 9,928 cf Overall x 36.0% Voids

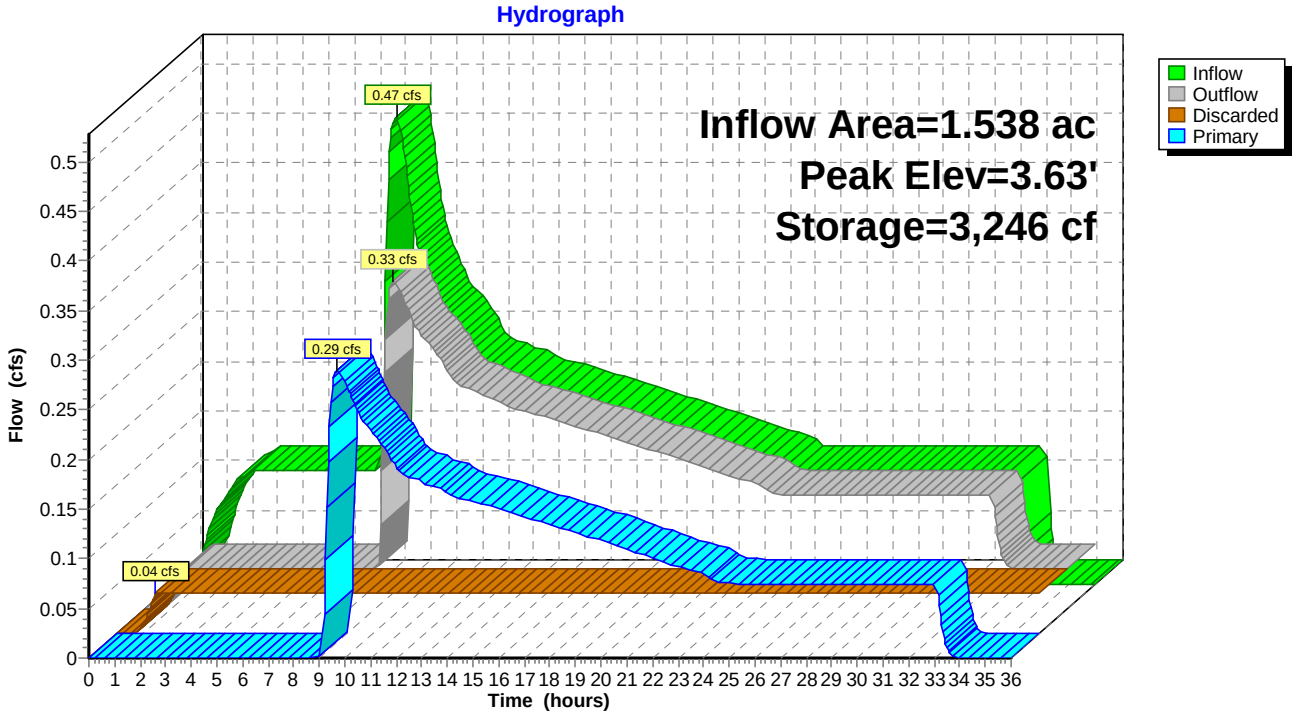
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
0.00	2,482	0	0
4.00	2,482	9,928	9,928

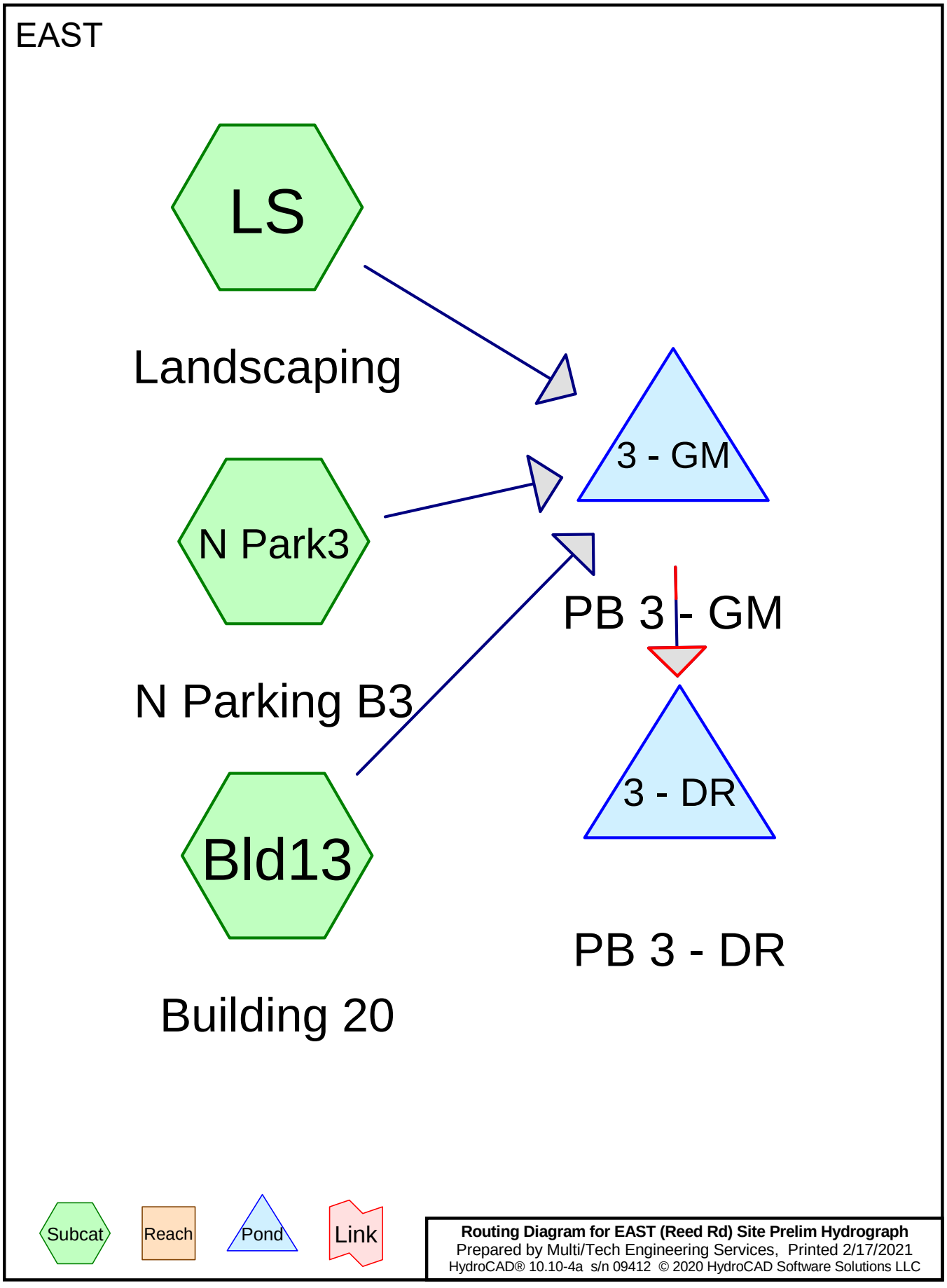
Device	Routing	Invert	Outlet Devices
#1	Discarded	0.00'	**0.700 in/hr Exfiltration over Surface area**
#2	Primary	3.33'	**8.0" Vert. Underdrain** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.04 cfs @ 1.50 hrs HW=0.04' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.04 cfs)

Primary OutFlow Max=0.29 cfs @ 9.69 hrs HW=3.63' (Free Discharge)
↑—**2=Underdrain** (Orifice Controls 0.29 cfs @ 1.87 fps)

Pond 2 - DR: PB 2 - DR




EAST
LS
Landscaping
3 - GM
N Park3
PB 3 - GM
N Parking B3
3 - DR
Bld13
PB 3 - DR
Building 20
Subcat
Reach
Pond
Link
Routing Diagram for EAST (Reed Rd) Site Prelim Hydrograph
Prepared by Multi/Tech Engineering Services, Printed 2/17/2021
HydroCAD® 10.10-4a s/n 09412 © 2020 HydroCAD Software Solutions LLC

Summary for Subcatchment Bld13: Building 20

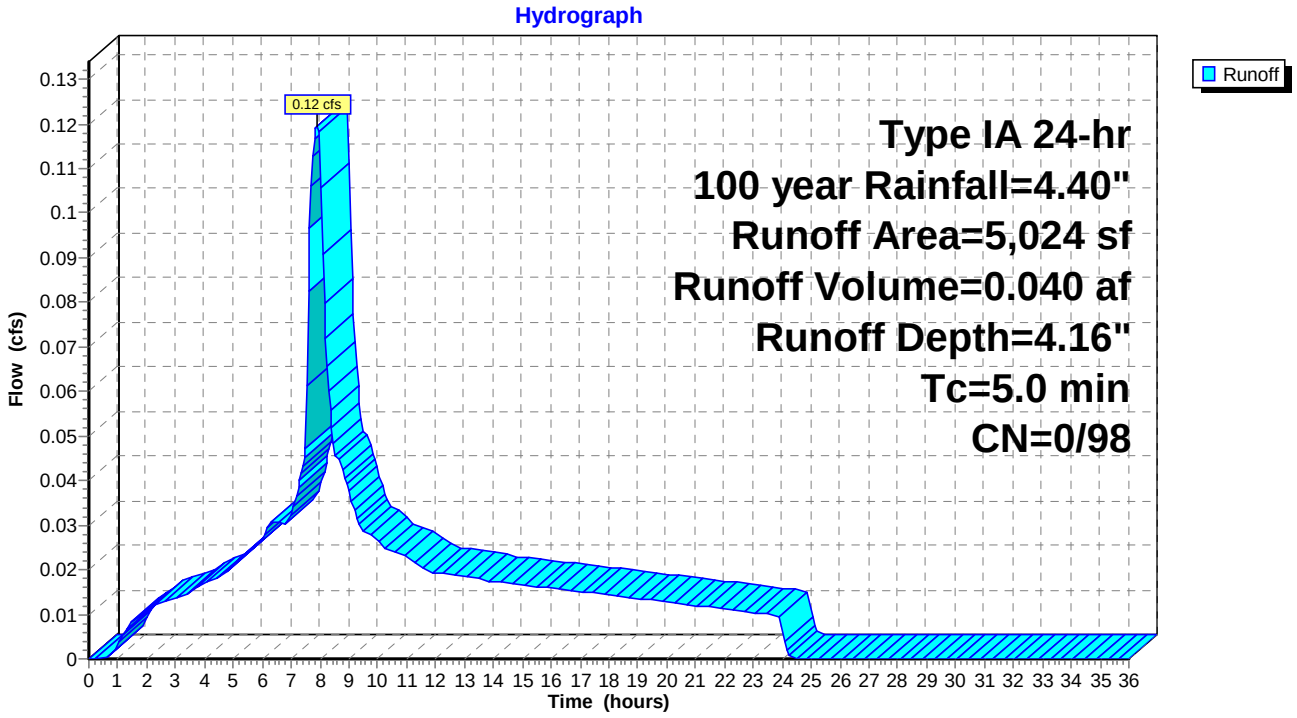
Runoff = 0.12 cfs @ 7.90 hrs, Volume= 0.040 af, Depth= 4.16"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type IA 24-hr 100 year Rainfall=4.40"

Area (sf)	CN	Description
5,024	98	Roofs, HSG C
5,024	98	100.00% Impervious Area

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

Subcatchment Bld13: Building 20



Summary for Subcatchment LS: Landscaping

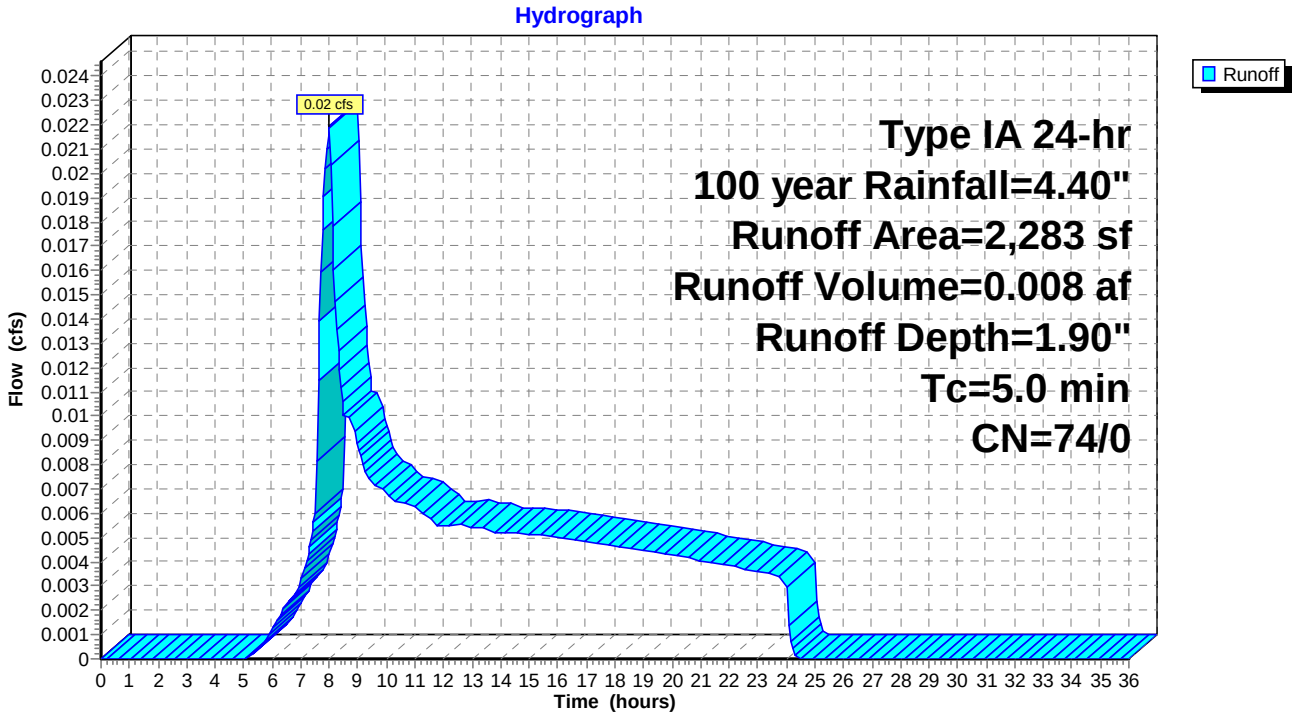
Runoff = 0.02 cfs @ 7.98 hrs, Volume= 0.008 af, Depth= 1.90"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type IA 24-hr 100 year Rainfall=4.40"

Area (sf)	CN	Description
2,283	74	>75% Grass cover, Good, HSG C
2,283	74	100.00% Pervious Area

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

Subcatchment LS: Landscaping



Summary for Subcatchment N Park3: N Parking B3

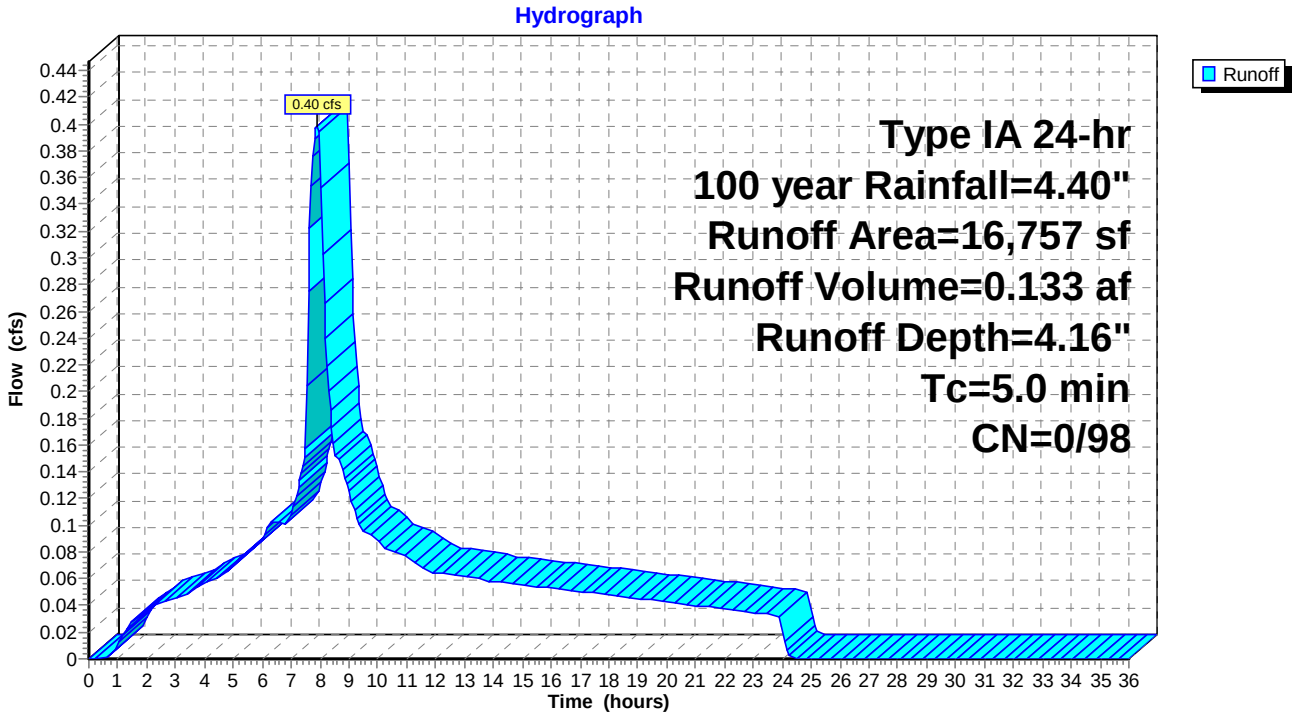
Runoff = 0.40 cfs @ 7.90 hrs, Volume= 0.133 af, Depth= 4.16"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type IA 24-hr 100 year Rainfall=4.40"

Area (sf)	CN	Description
16,757	98	Paved parking, HSG C
16,757	98	100.00% Impervious Area

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

Subcatchment N Park3: N Parking B3



Summary for Pond 3 - GM: PB 3 - GM

Inflow Area = 0.552 ac, 90.51% Impervious, Inflow Depth = 3.95" for 100 year event
Inflow = 0.54 cfs @ 7.90 hrs, Volume= 0.182 af
Outflow = 0.12 cfs @ 10.03 hrs, Volume= 0.182 af, Atten= 78%, Lag= 127.8 min
Primary = 0.07 cfs @ 3.75 hrs, Volume= 0.167 af
Secondary = 0.05 cfs @ 10.03 hrs, Volume= 0.015 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 5.54' @ 10.03 hrs Surf.Area= 1,436 sf Storage= 2,216 cf

Plug-Flow detention time= 326.8 min calculated for 0.182 af (100% of inflow)
Center-of-Mass det. time= 327.1 min (993.2 - 666.1)

Volume	Invert	Avail.Storage	Storage Description
#1	4.00'	2,872 cf	**Growing Media (Prismatic)** Listed below (Recalc)

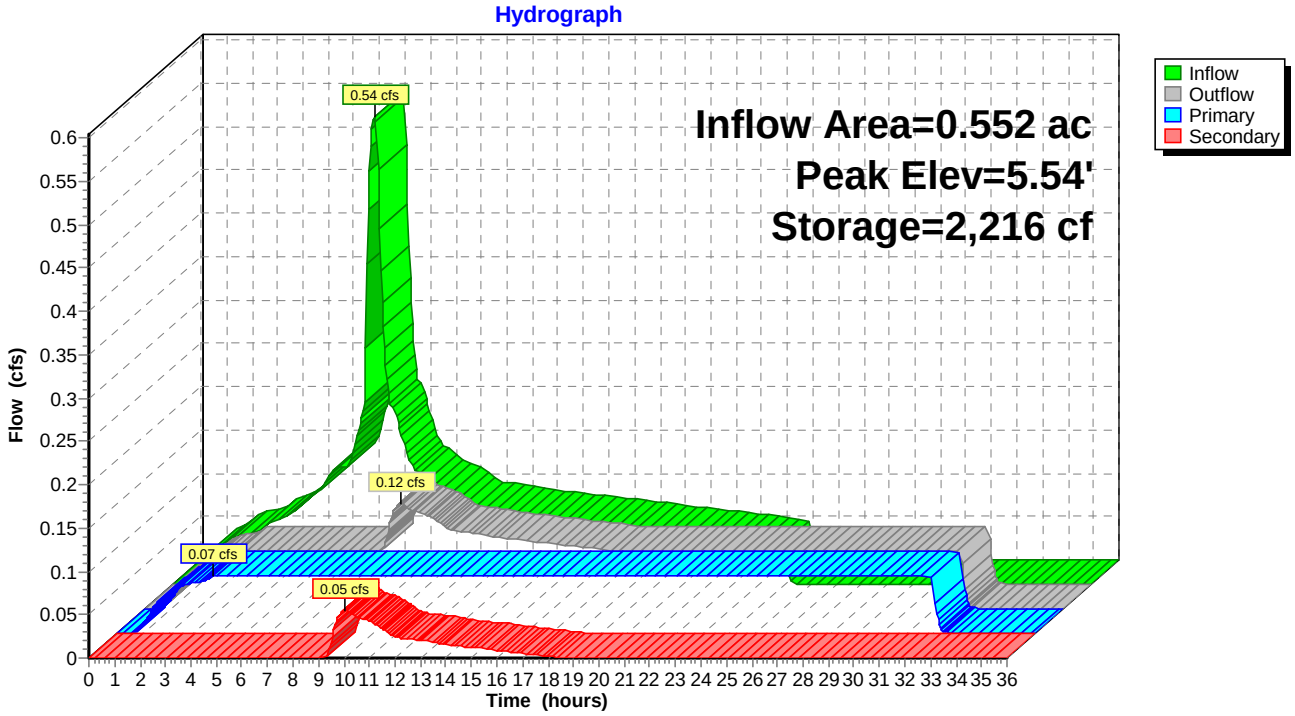
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
4.00	1,436	0	0
6.00	1,436	2,872	2,872

Device	Routing	Invert	Outlet Devices
#1	Primary	4.00'	**2.000 in/hr Exfiltration over Surface area**
#2	Secondary	5.50'	**7.0" Horiz. Rock Box** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.07 cfs @ 3.75 hrs HW=4.02' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.07 cfs)

Secondary OutFlow Max=0.05 cfs @ 10.03 hrs HW=5.54' (Free Discharge)
↑—**2=Rock Box** (Weir Controls 0.05 cfs @ 0.68 fps)

Pond 3 - GM: PB 3 - GM



Summary for Pond 3 - DR: PB 3 - DR

Inflow Area = 0.552 ac, 90.51% Impervious, Inflow Depth = 3.95" for 100 year event
Inflow = 0.12 cfs @ 10.03 hrs, Volume= 0.182 af
Outflow = 0.09 cfs @ 11.95 hrs, Volume= 0.149 af, Atten= 24%, Lag= 115.2 min
Discarded = 0.02 cfs @ 1.55 hrs, Volume= 0.067 af
Primary = 0.07 cfs @ 11.95 hrs, Volume= 0.082 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 3.47' @ 11.95 hrs Surf.Area= 1,436 sf Storage= 1,794 cf

Plug-Flow detention time= 373.4 min calculated for 0.149 af (82% of inflow)
Center-of-Mass det. time= 206.2 min (1,199.4 - 993.2)

Volume	Invert	Avail.Storage	Storage Description
#1	0.00'	2,068 cf	**Drain Rock (Prismatic)** Listed below (Recalc) 5,744 cf Overall x 36.0% Voids

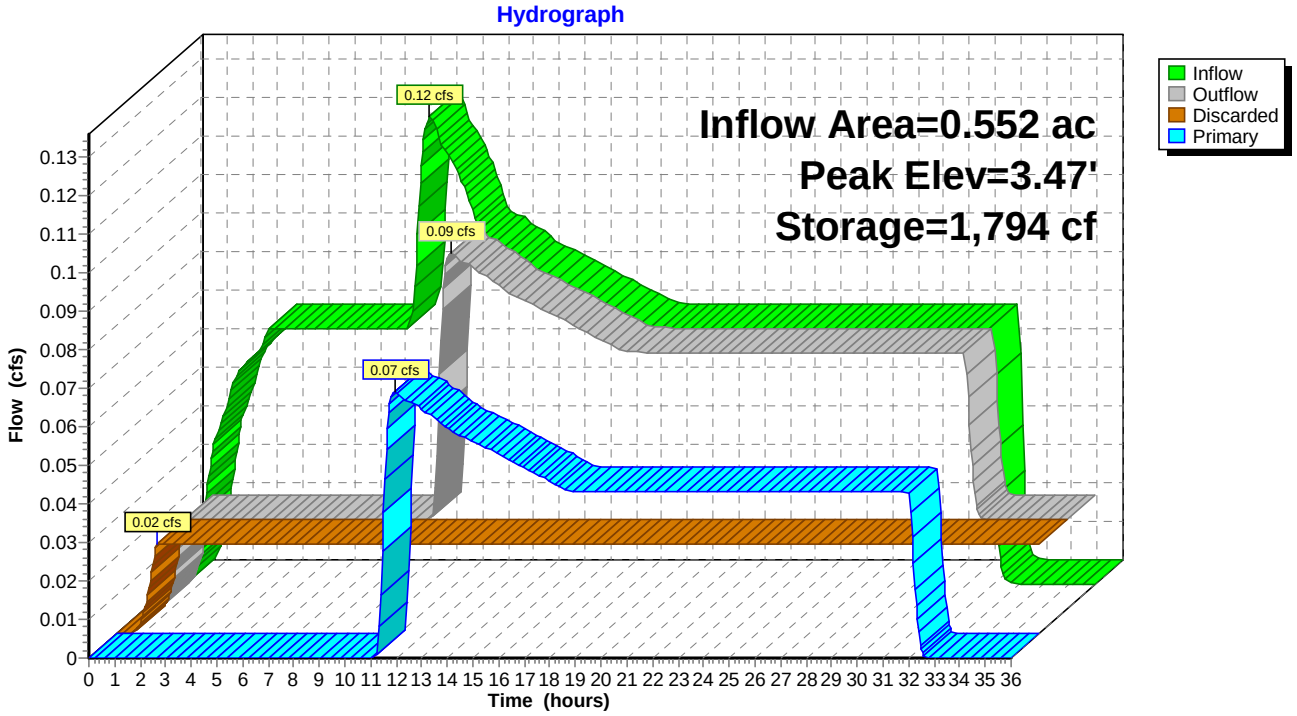
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
0.00	1,436	0	0
4.00	1,436	5,744	5,744

Device	Routing	Invert	Outlet Devices
#1	Discarded	0.00'	**0.700 in/hr Exfiltration over Surface area**
#2	Primary	3.33'	**8.0" Vert. Underdrain** C= 0.600 Limited to weir flow at low heads

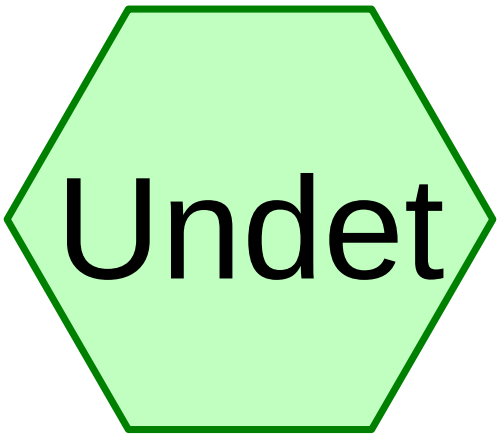
Discarded OutFlow Max=0.02 cfs @ 1.55 hrs HW=0.04' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.02 cfs)

Primary OutFlow Max=0.07 cfs @ 11.95 hrs HW=3.47' (Free Discharge)
↑—**2=Underdrain** (Orifice Controls 0.07 cfs @ 1.27 fps)

Pond 3 - DR: PB 3 - DR



EAST



Undetained

Subcat Reach Pond Link

Routing Diagram for EAST (Reed Rd) Site Prelim Hydrograph
Prepared by Multi/Tech Engineering Services, Printed 2/17/2021

Summary for Subcatchment Undet: Undetained

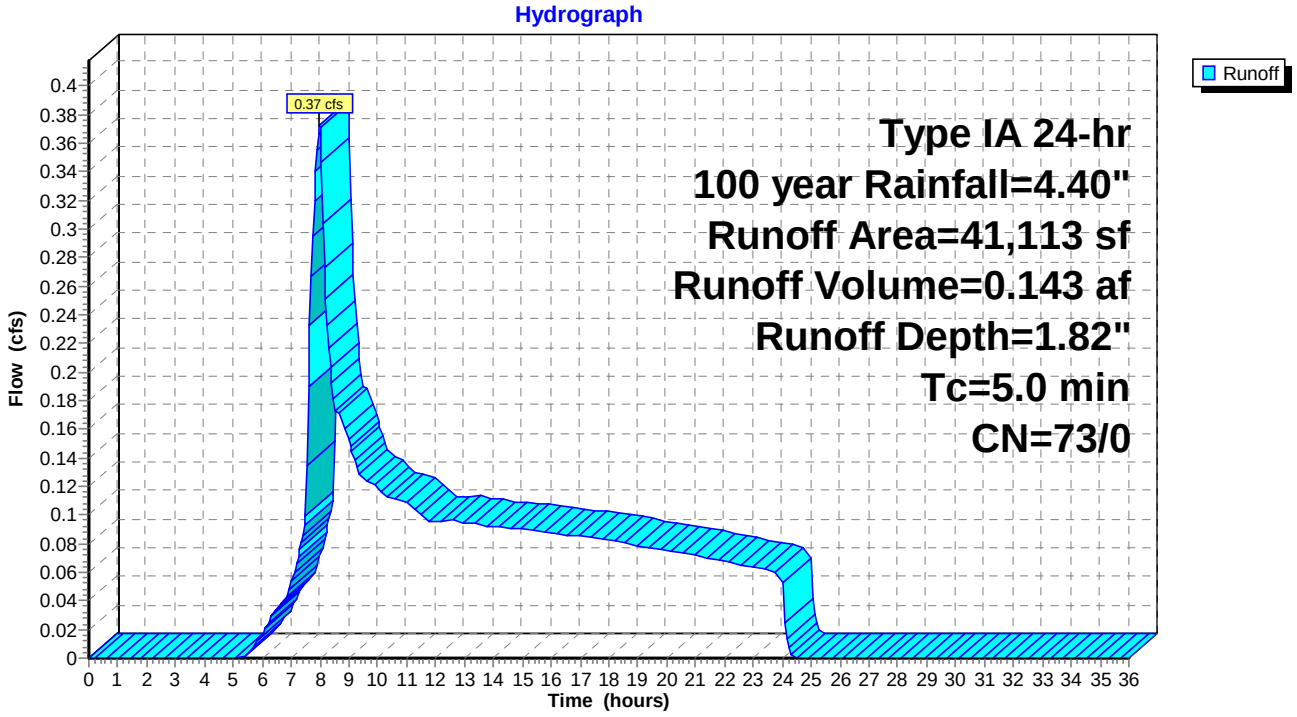
Runoff = 0.37 cfs @ 7.98 hrs, Volume= 0.143 af, Depth= 1.82"

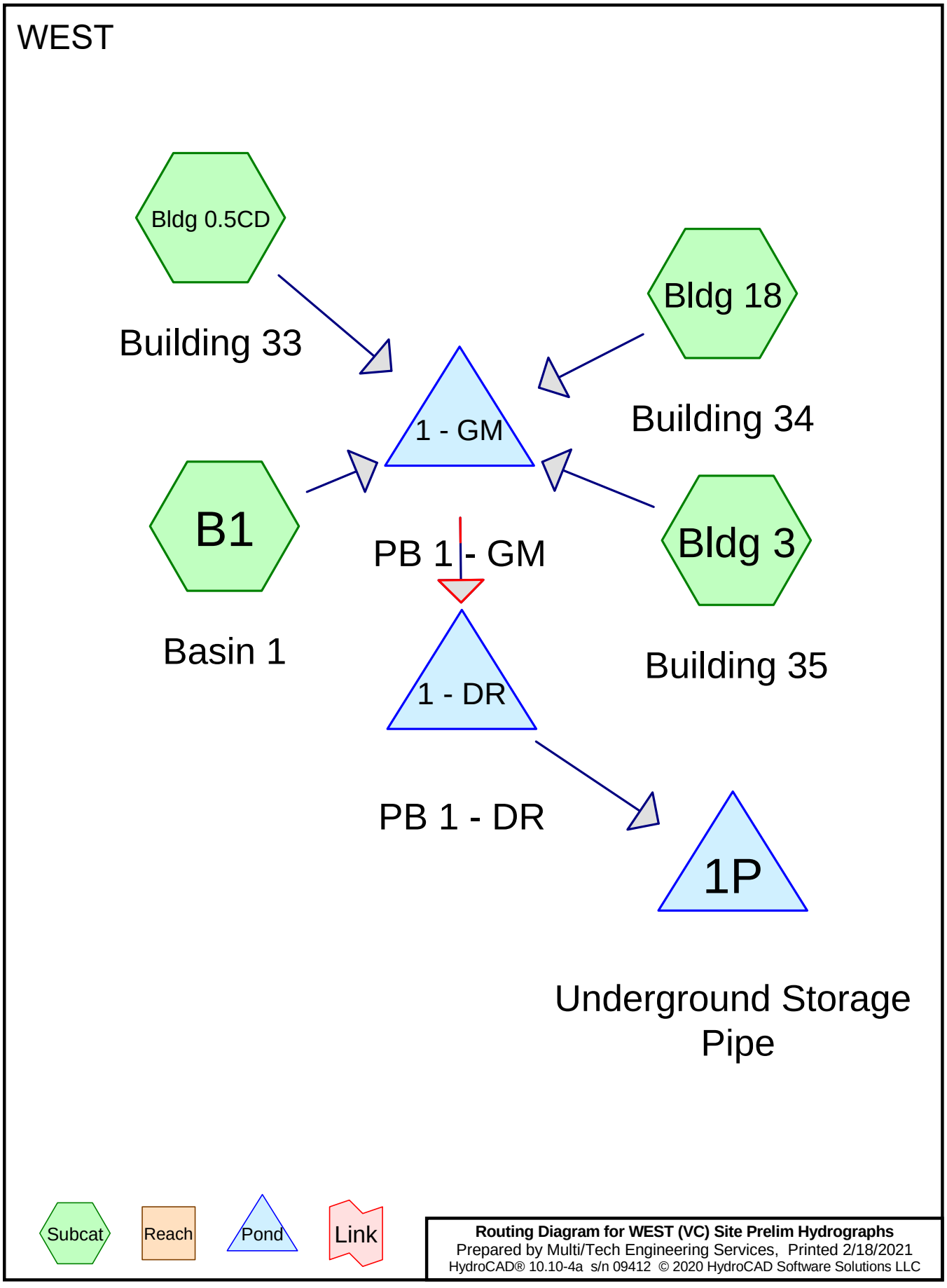
Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type IA 24-hr 100 year Rainfall=4.40"

	Area (sf)	CN	Description
	3,680	74	>75% Grass cover, Good, HSG C
	3,296	74	>75% Grass cover, Good, HSG C
	7,604	74	>75% Grass cover, Good, HSG C
	1,317	74	>75% Grass cover, Good, HSG C
*	25,216	72	City of Salem Predeveloped, HSG C
	41,113	73	Weighted Average
	41,113	73	100.00% Pervious Area

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

Subcatchment Undet: Undetained




WEST
Bldg 0.5CD
Building 33
Bldg 18
Building 34
1 - GM
B1
Basin 1
PB 1 - GM
Bldg 3
Building 35
1 - DR
PB 1 - DR
1P
Underground Storage Pipe
Subcat
Reach
Pond
Link
Routing Diagram for WEST (VC) Site Prelim Hydrographs
Prepared by Multi/Tech Engineering Services, Printed 2/18/2021
HydroCAD® 10.10-4a s/n 09412 © 2020 HydroCAD Software Solutions LLC

Summary for Subcatchment B1: Basin 1

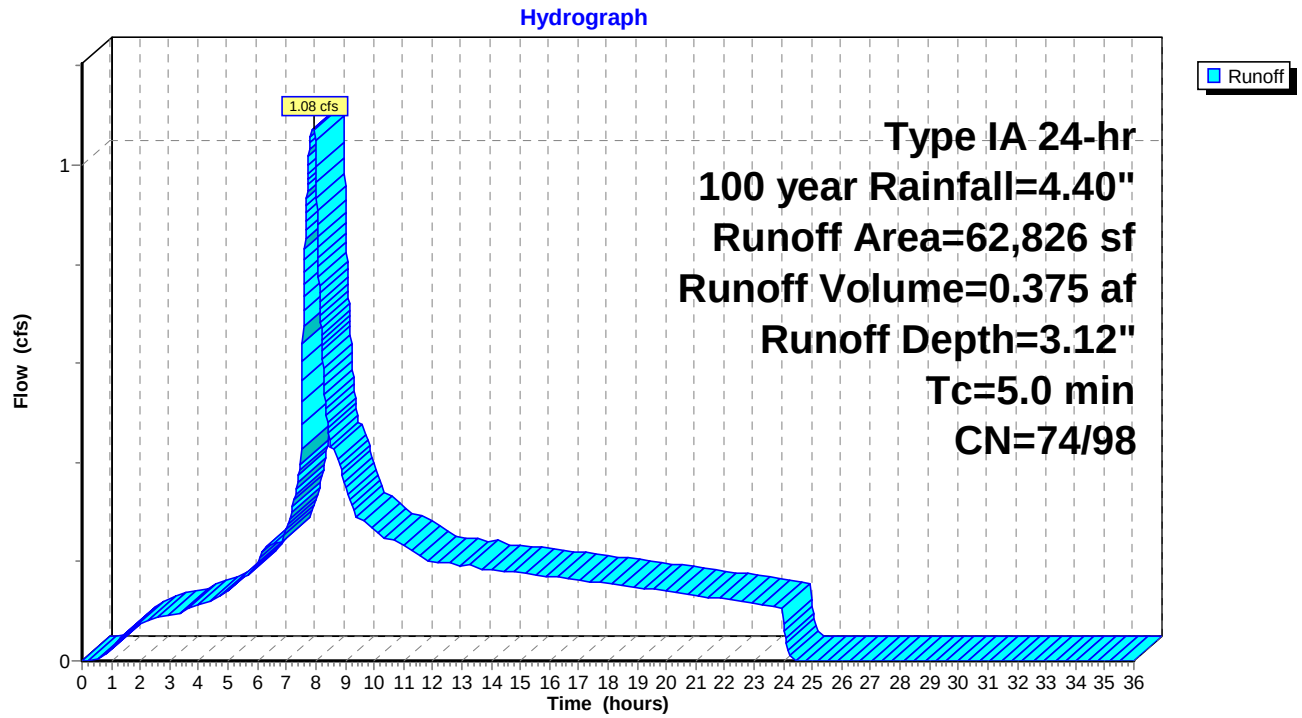
Runoff = 1.08 cfs @ 7.91 hrs, Volume= 0.375 af, Depth= 3.12"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type IA 24-hr 100 year Rainfall=4.40"

	Area (sf)	CN	Description
	33,861	98	Paved parking, HSG C
	27,754	74	>75% Grass cover, Good, HSG C
*	1,211	72	Planter Box
	62,826	87	Weighted Average
	28,965	74	46.10% Pervious Area
	33,861	98	53.90% Impervious Area

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

Subcatchment B1: Basin 1



Summary for Subcatchment Bldg 0.5CD: Building 33

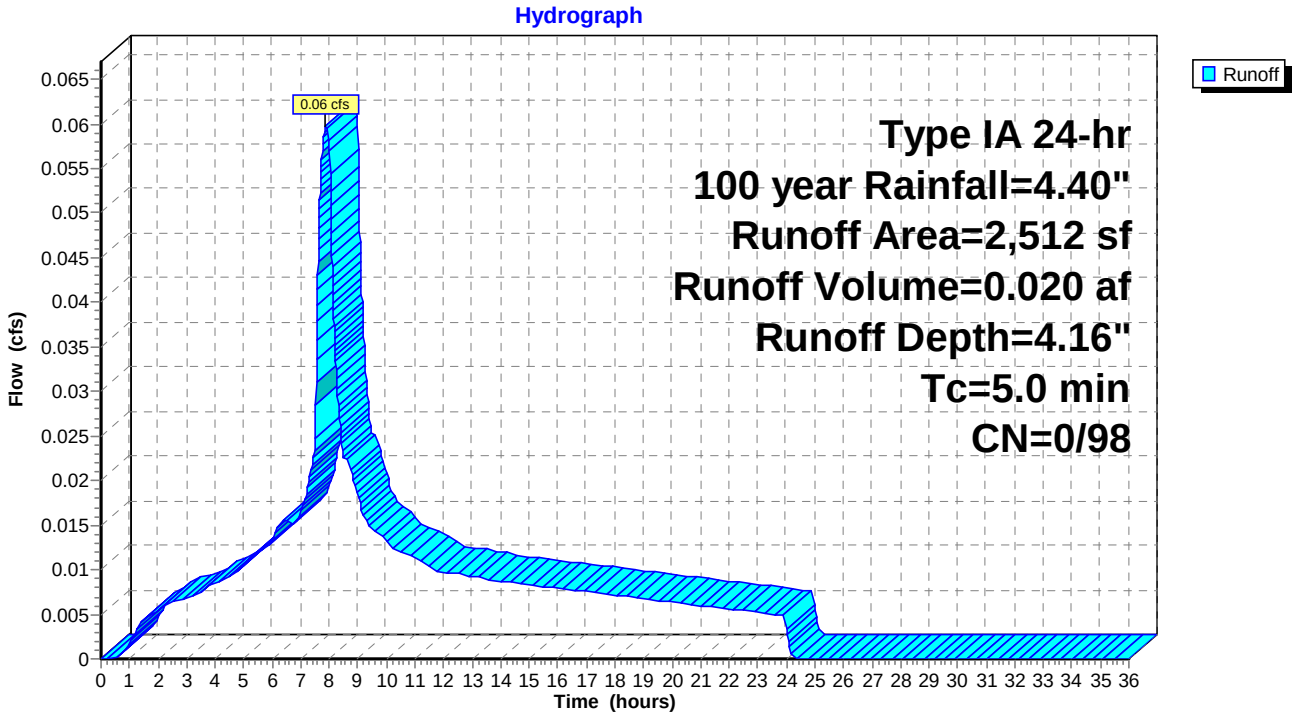
Runoff = 0.06 cfs @ 7.88 hrs, Volume= 0.020 af, Depth= 4.16"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type IA 24-hr 100 year Rainfall=4.40"

Area (sf)	CN	Description
2,512	98	Roofs, HSG C
2,512	98	100.00% Impervious Area

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

Subcatchment Bldg 0.5CD: Building 33



Summary for Subcatchment Bldg 18: Building 34

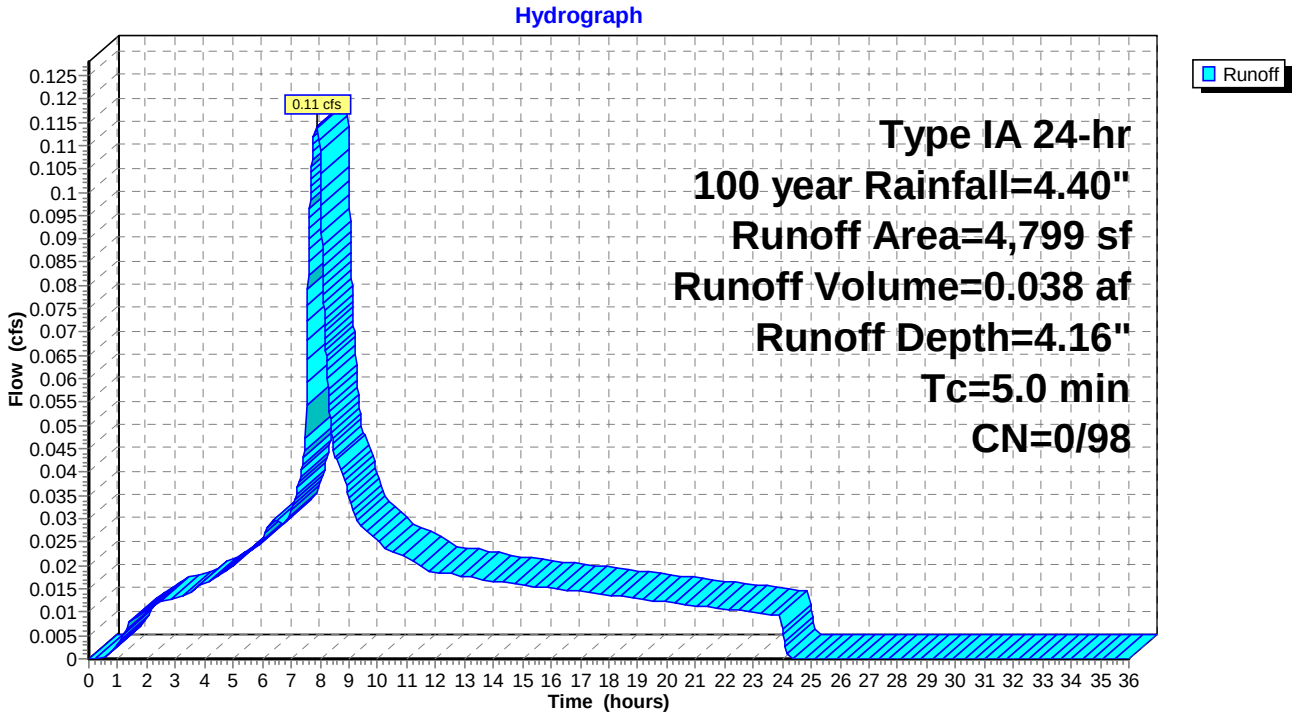
Runoff = 0.11 cfs @ 7.88 hrs, Volume= 0.038 af, Depth= 4.16"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type IA 24-hr 100 year Rainfall=4.40"

Area (sf)	CN	Description
4,799	98	Roofs, HSG C
4,799	98	100.00% Impervious Area

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

Subcatchment Bldg 18: Building 34



Summary for Subcatchment Bldg 3: Building 35

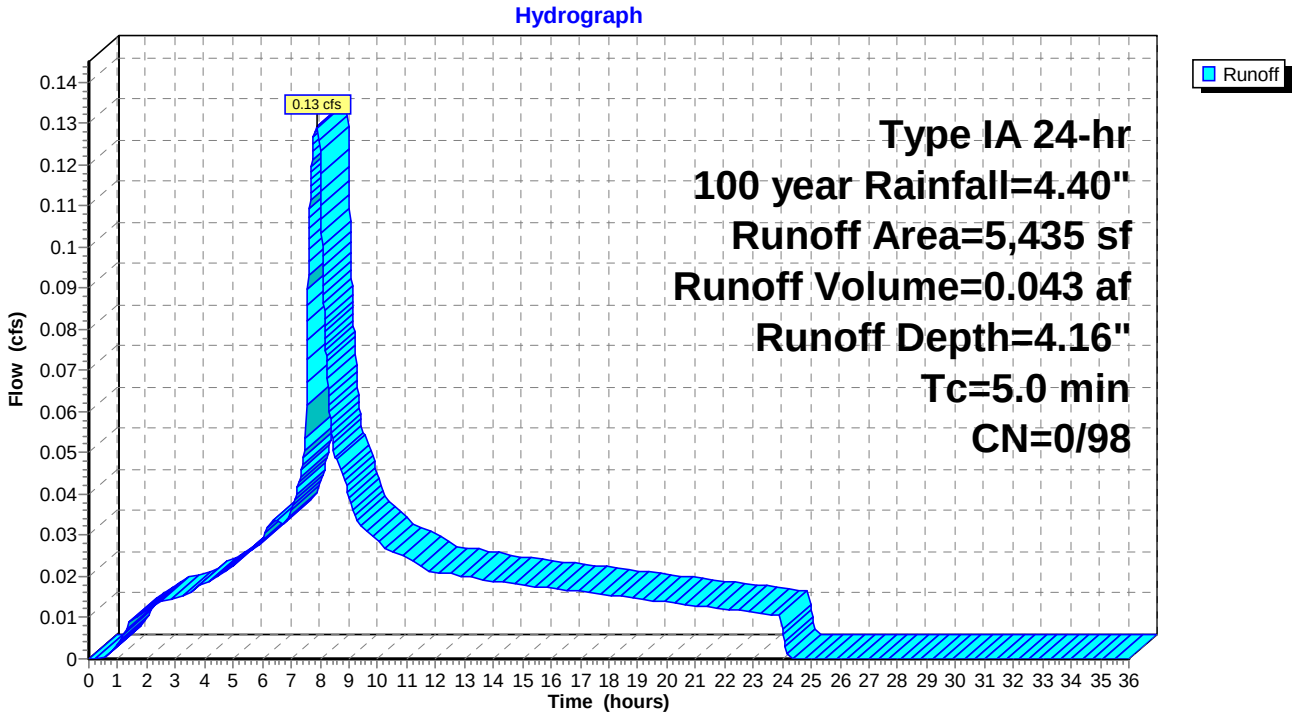
Runoff = 0.13 cfs @ 7.88 hrs, Volume= 0.043 af, Depth= 4.16"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type IA 24-hr 100 year Rainfall=4.40"

Area (sf)	CN	Description
5,435	98	Roofs, HSG C
5,435	98	100.00% Impervious Area

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

Subcatchment Bldg 3: Building 35



Summary for Pond 1 - GM: PB 1 - GM

Inflow Area = 1.735 ac, 61.67% Impervious, Inflow Depth = 3.29" for 100 year event
Inflow = 1.38 cfs @ 7.90 hrs, Volume= 0.476 af
Outflow = 1.37 cfs @ 7.95 hrs, Volume= 0.476 af, Atten= 1%, Lag= 2.7 min
Primary = 0.06 cfs @ 1.35 hrs, Volume= 0.152 af
Secondary = 1.31 cfs @ 7.95 hrs, Volume= 0.325 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 5.75' @ 7.95 hrs Surf.Area= 1,229 sf Storage= 2,155 cf

Plug-Flow detention time= 134.1 min calculated for 0.476 af (100% of inflow)
Center-of-Mass det. time= 134.1 min (828.0 - 694.0)

Volume	Invert	Avail.Storage	Storage Description
#1	4.00'	2,458 cf	**Planter Box Storage (Prismatic)** Listed below (Recalc)

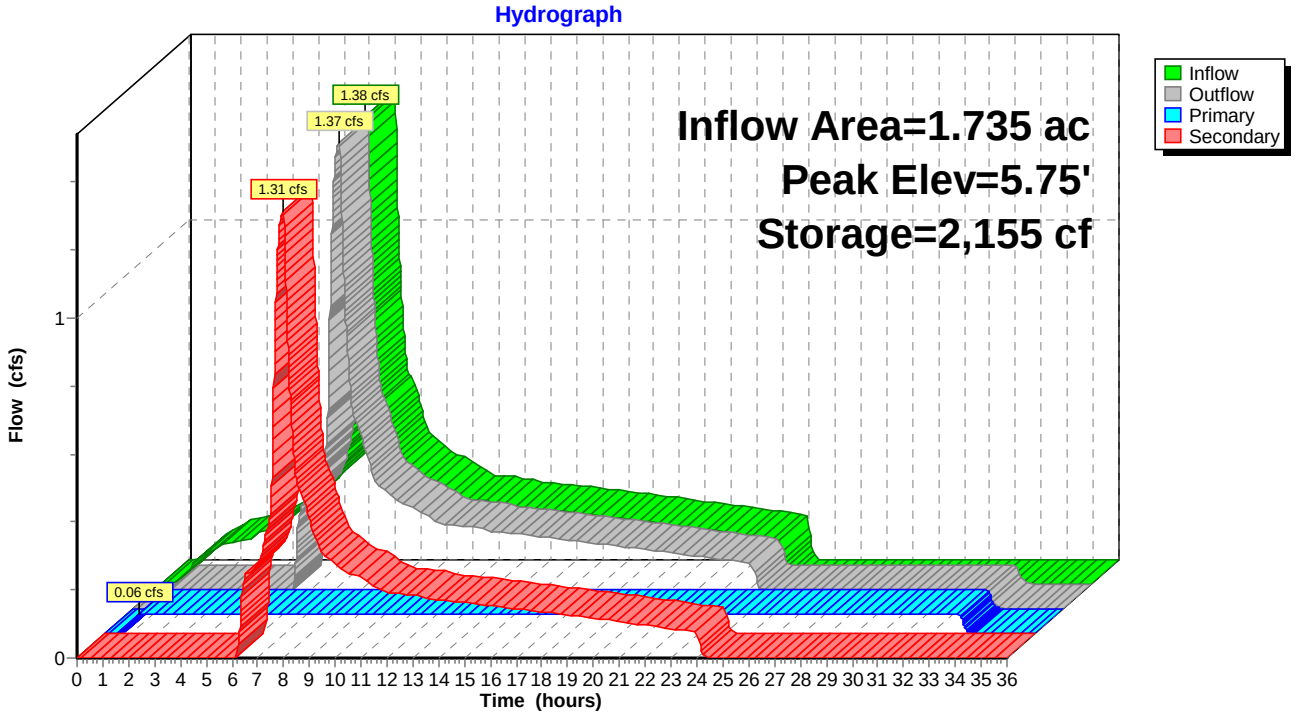
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
4.00	1,229	0	0
6.00	1,229	2,458	2,458

Device	Routing	Invert	Outlet Devices
#1	Primary	4.00'	**2.000 in/hr Flow through Growing Media over Surface area**
#2	Secondary	5.50'	**12.0" Horiz. Rock Box** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.06 cfs @ 1.35 hrs HW=4.02' (Free Discharge)
↑—**1=Flow through Growing Media** (Exfiltration Controls 0.06 cfs)

Secondary OutFlow Max=1.31 cfs @ 7.95 hrs HW=5.75' (Free Discharge)
↑—**2=Rock Box** (Weir Controls 1.31 cfs @ 1.65 fps)

Pond 1 - GM: PB 1 - GM



Summary for Pond 1 - DR: PB 1 - DR

Inflow Area = 1.735 ac, 61.67% Impervious, Inflow Depth = 3.29" for 100 year event
Inflow = 1.37 cfs @ 7.95 hrs, Volume= 0.476 af
Outflow = 1.37 cfs @ 7.98 hrs, Volume= 0.450 af, Atten= 0%, Lag= 2.0 min
Discarded = 0.02 cfs @ 1.17 hrs, Volume= 0.058 af
Primary = 1.35 cfs @ 7.98 hrs, Volume= 0.392 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 3.61' @ 7.98 hrs Surf.Area= 1,229 sf Storage= 1,599 cf

Plug-Flow detention time= 111.9 min calculated for 0.450 af (94% of inflow)
Center-of-Mass det. time= 52.8 min (880.9 - 828.0)

Volume	Invert	Avail.Storage	Storage Description
#1	0.00'	1,770 cf	**Drain Rock Storage (Prismatic)** Listed below (Recalc) 4,916 cf Overall x 36.0% Voids

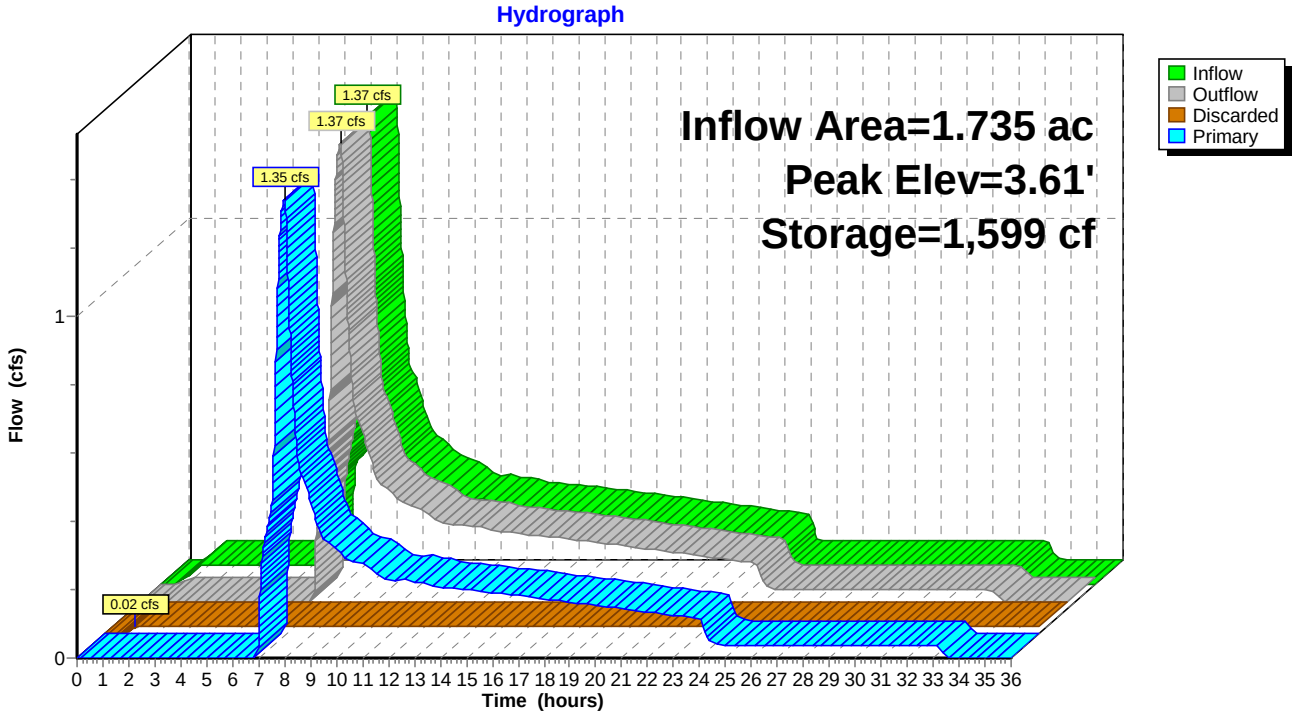
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
0.00	1,229	0	0
4.00	1,229	4,916	4,916

Device	Routing	Invert	Outlet Devices
#1	Discarded	0.00'	**0.700 in/hr Native Infiltration over Surface area**
#2	Primary	3.00'	**12.0" Vert. Underdrain** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.02 cfs @ 1.17 hrs HW=0.04' (Free Discharge)
↑—**1=Native Infiltration** (Exfiltration Controls 0.02 cfs)

Primary OutFlow Max=1.35 cfs @ 7.98 hrs HW=3.61' (Free Discharge)
↑—**2=Underdrain** (Orifice Controls 1.35 cfs @ 2.67 fps)

Pond 1 - DR: PB 1 - DR



Summary for Pond 1P: Underground Storage Pipe

Inflow Area = 1.735 ac, 61.67% Impervious, Inflow Depth = 2.71" for 100 year event
Inflow = 1.35 cfs @ 7.98 hrs, Volume= 0.392 af
Outflow = 0.46 cfs @ 9.01 hrs, Volume= 0.334 af, Atten= 66%, Lag= 61.9 min
Primary = 0.46 cfs @ 9.01 hrs, Volume= 0.334 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 3.85' @ 9.01 hrs Surf.Area= 0.011 ac Storage= 0.085 af

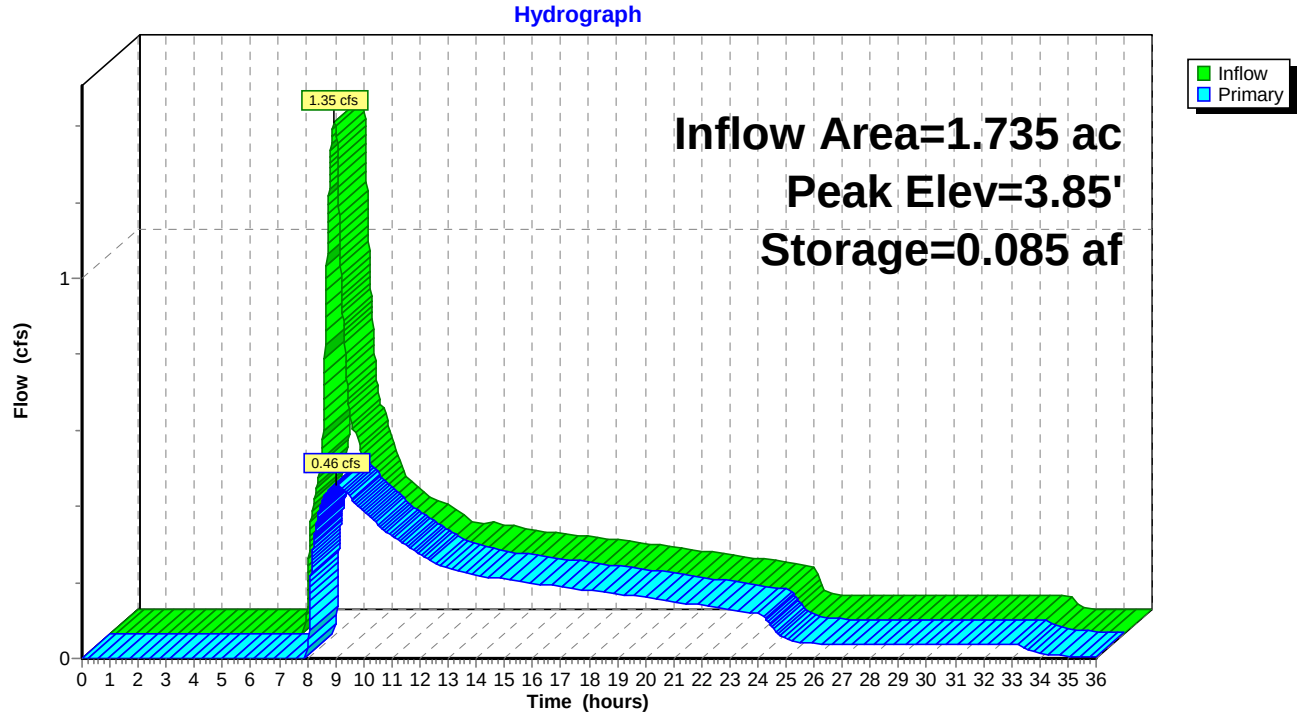
Plug-Flow detention time= 224.5 min calculated for 0.334 af (85% of inflow)
Center-of-Mass det. time= 104.8 min (952.1 - 847.3)

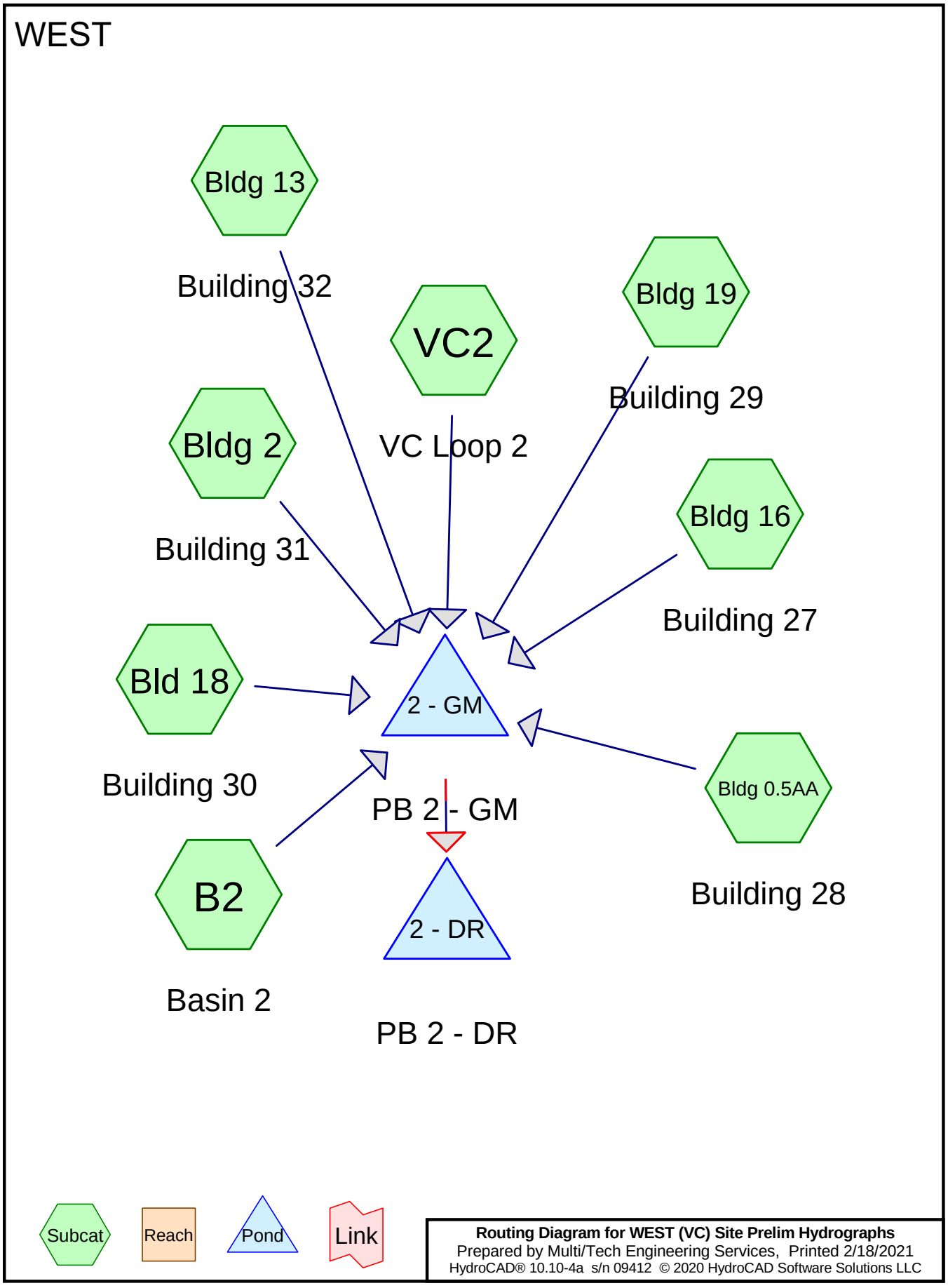
Volume	Invert	Avail.Storage	Storage Description
#1	0.00'	0.087 af	**48.0" Round Pipe Storage** L= 300.0'

Device	Routing	Invert	Outlet Devices
#1	Primary	2.50'	**4.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.46 cfs @ 9.01 hrs HW=3.85' (Free Discharge)
1=Orifice/Grate (Orifice Controls 0.46 cfs @ 5.23 fps)

Pond 1P: Underground Storage Pipe




WEST
Bldg 13
Building 32
VC2
VC Loop 2
Bldg 19
Building 29
Bldg 2
Building 31
Bldg 16
Building 27
Bld 18
Building 30
2 - GM
PB 2 - GM
Bldg 0.5AA
Building 28
B2
Basin 2
2 - DR
PB 2 - DR
Subcat
Reach
Pond
Link
Routing Diagram for WEST (VC) Site Prelim Hydrographs
Prepared by Multi/Tech Engineering Services, Printed 2/18/2021
HydroCAD® 10.10-4a s/n 09412 © 2020 HydroCAD Software Solutions LLC

Summary for Subcatchment B2: Basin 2

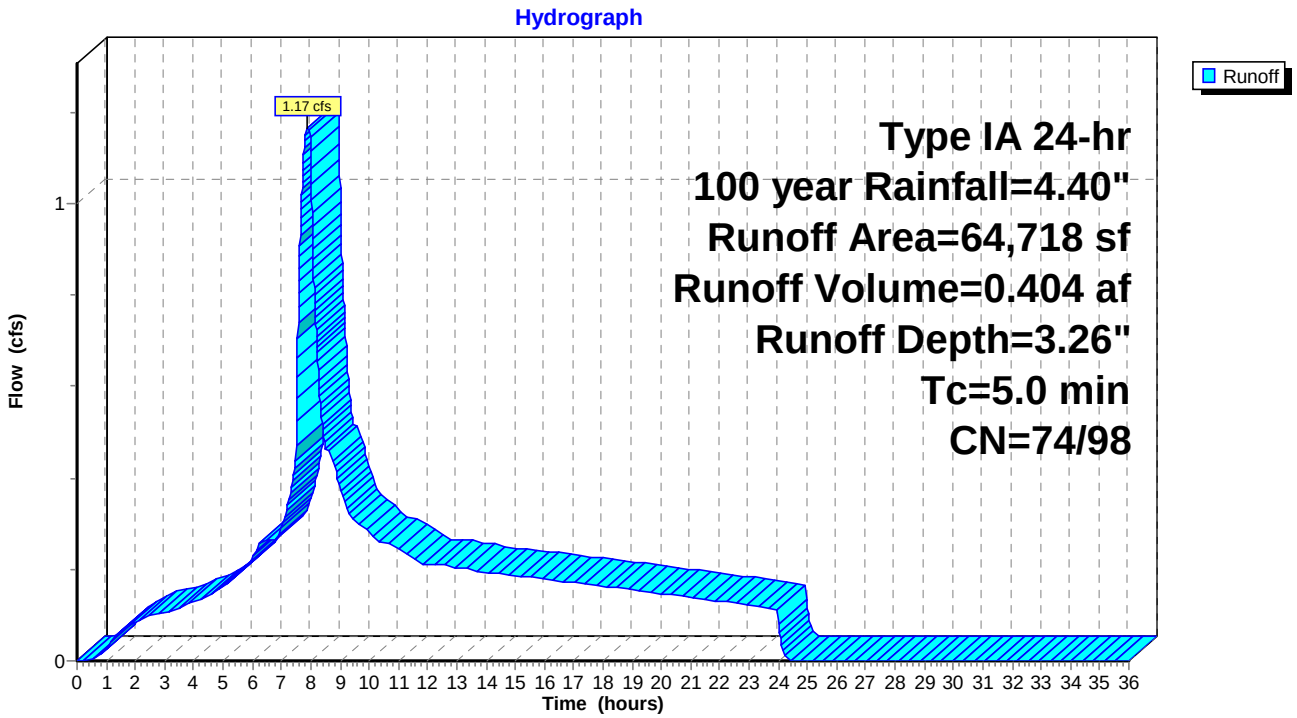
Runoff = 1.17 cfs @ 7.90 hrs, Volume= 0.404 af, Depth= 3.26"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type IA 24-hr 100 year Rainfall=4.40"

	Area (sf)	CN	Description
	21,385	74	>75% Grass cover, Good, HSG C
	38,965	98	Paved parking, HSG C
*	4,368	72	Planter Box
	64,718	88	Weighted Average
	25,753	74	39.79% Pervious Area
	38,965	98	60.21% Impervious Area

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

Subcatchment B2: Basin 2



Summary for Subcatchment Bld 18: Building 30

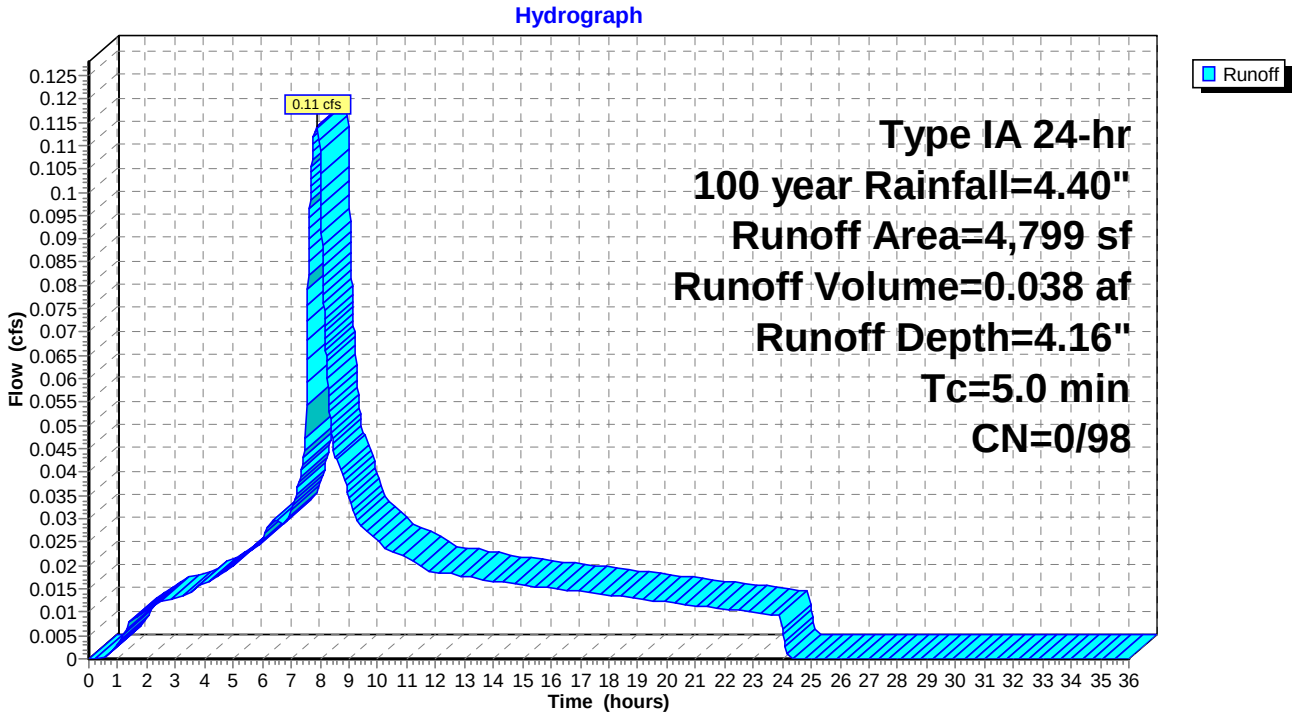
Runoff = 0.11 cfs @ 7.88 hrs, Volume= 0.038 af, Depth= 4.16"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type IA 24-hr 100 year Rainfall=4.40"

Area (sf)	CN	Description
4,799	98	Roofs, HSG C
4,799	98	100.00% Impervious Area

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

Subcatchment Bld 18: Building 30



Summary for Subcatchment Bldg 0.5AA: Building 28

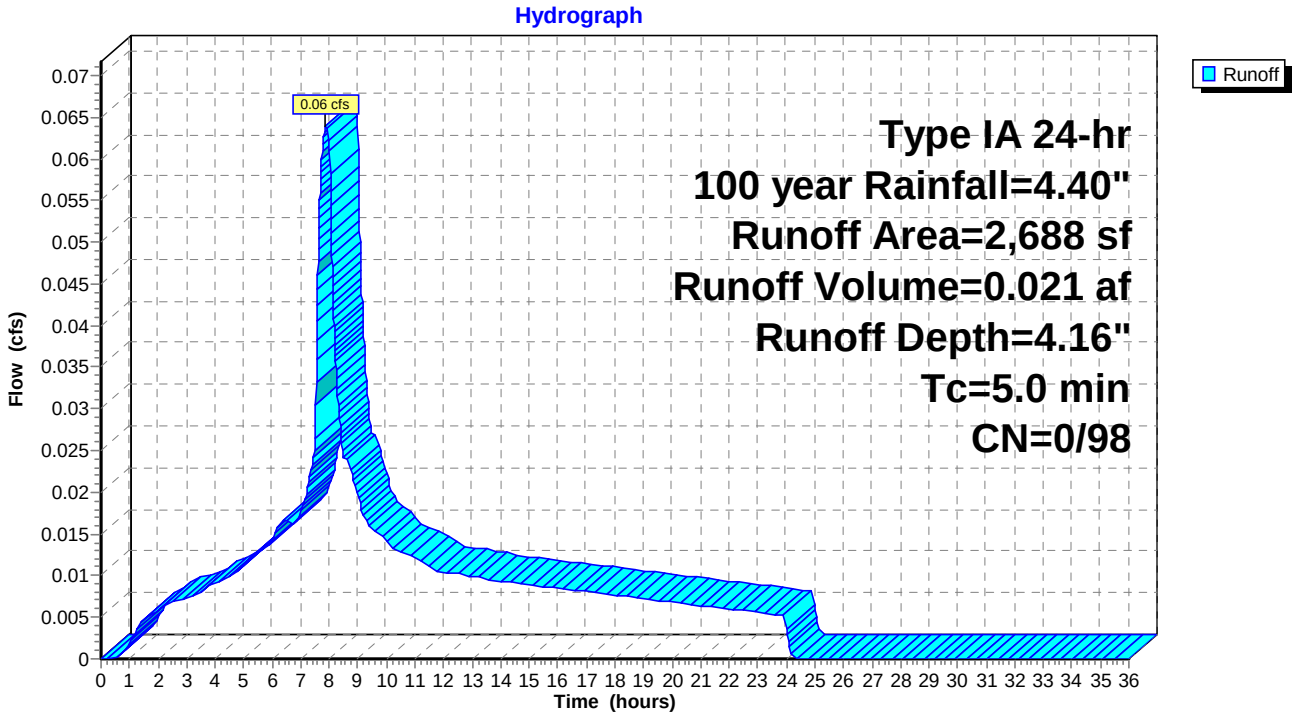
Runoff = 0.06 cfs @ 7.88 hrs, Volume= 0.021 af, Depth= 4.16"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type IA 24-hr 100 year Rainfall=4.40"

Area (sf)	CN	Description
2,688	98	Roofs, HSG C
2,688	98	100.00% Impervious Area

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

Subcatchment Bldg 0.5AA: Building 28



Summary for Subcatchment Bldg 13: Building 32

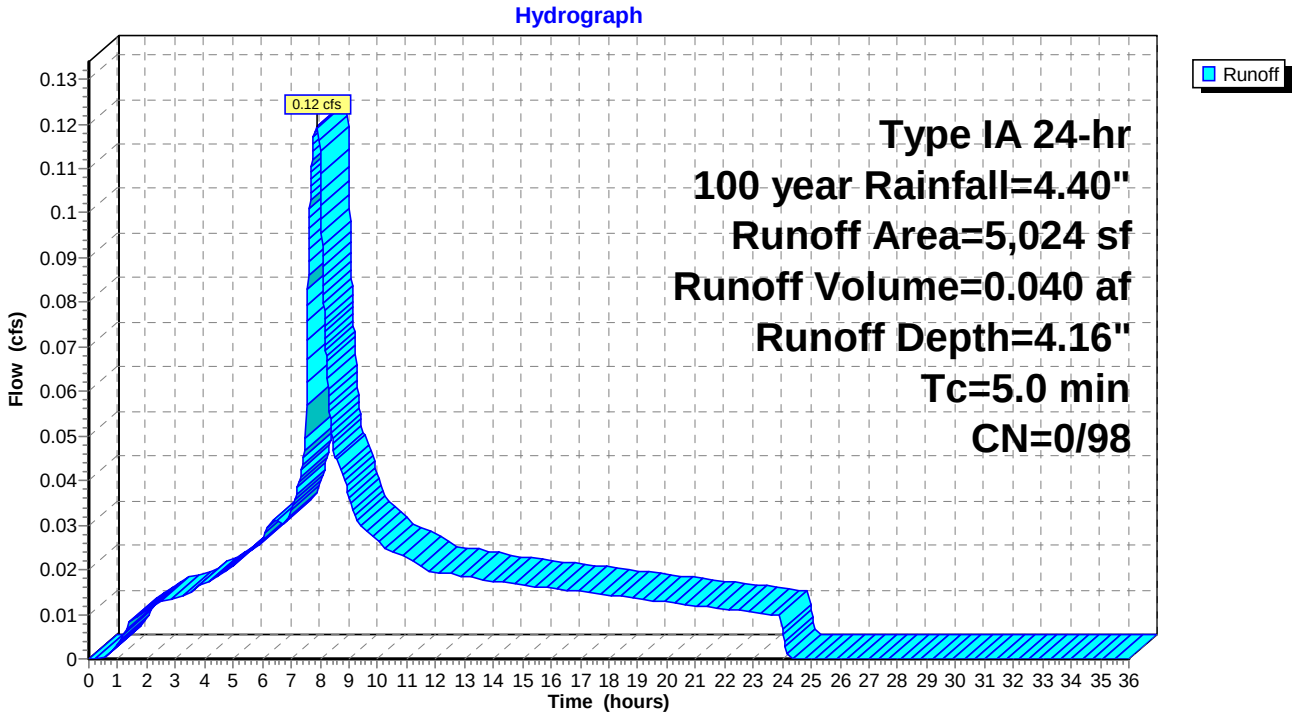
Runoff = 0.12 cfs @ 7.88 hrs, Volume= 0.040 af, Depth= 4.16"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type IA 24-hr 100 year Rainfall=4.40"

Area (sf)	CN	Description
5,024	98	Roofs, HSG C
5,024	98	100.00% Impervious Area

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

Subcatchment Bldg 13: Building 32



Summary for Subcatchment Bldg 16: Building 27

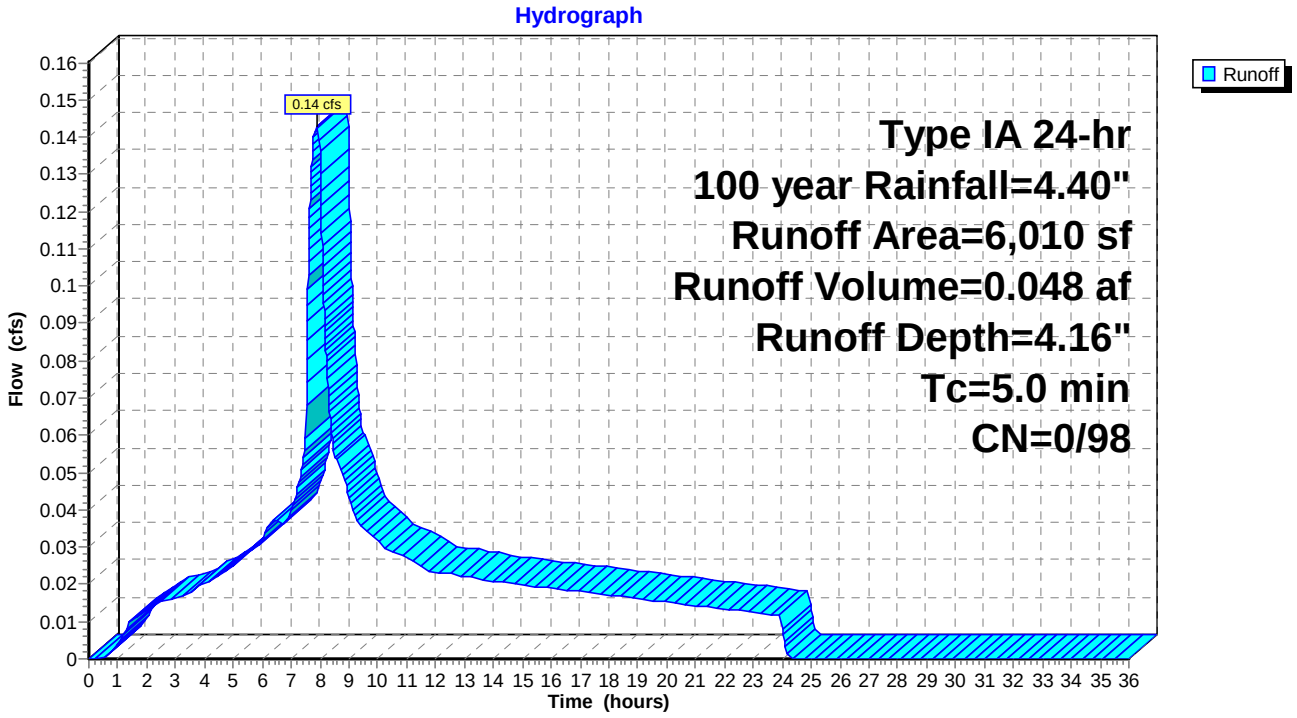
Runoff = 0.14 cfs @ 7.88 hrs, Volume= 0.048 af, Depth= 4.16"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type IA 24-hr 100 year Rainfall=4.40"

Area (sf)	CN	Description
6,010	98	Roofs, HSG C
6,010	98	100.00% Impervious Area

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

Subcatchment Bldg 16: Building 27



Summary for Subcatchment Bldg 19: Building 29

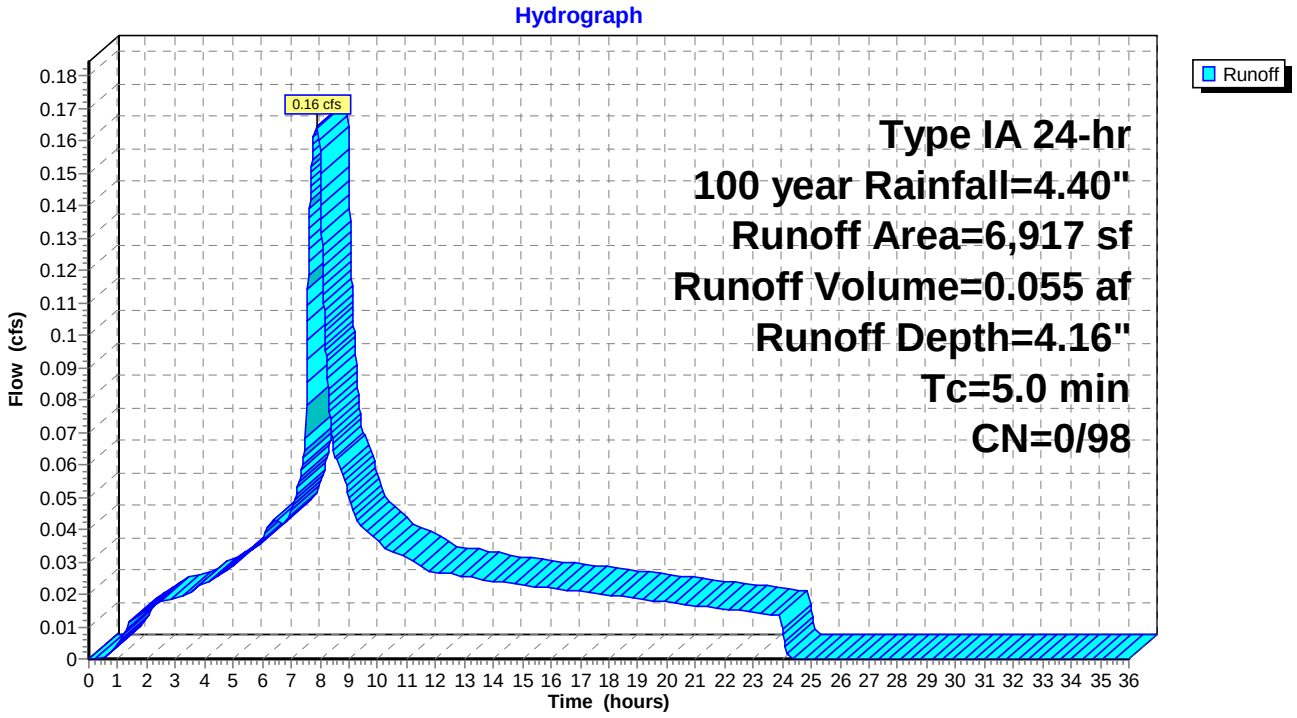
Runoff = 0.16 cfs @ 7.88 hrs, Volume= 0.055 af, Depth= 4.16"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type IA 24-hr 100 year Rainfall=4.40"

Area (sf)	CN	Description
6,917	98	Roofs, HSG C
6,917	98	100.00% Impervious Area

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

Subcatchment Bldg 19: Building 29



Summary for Subcatchment Bldg 2: Building 31

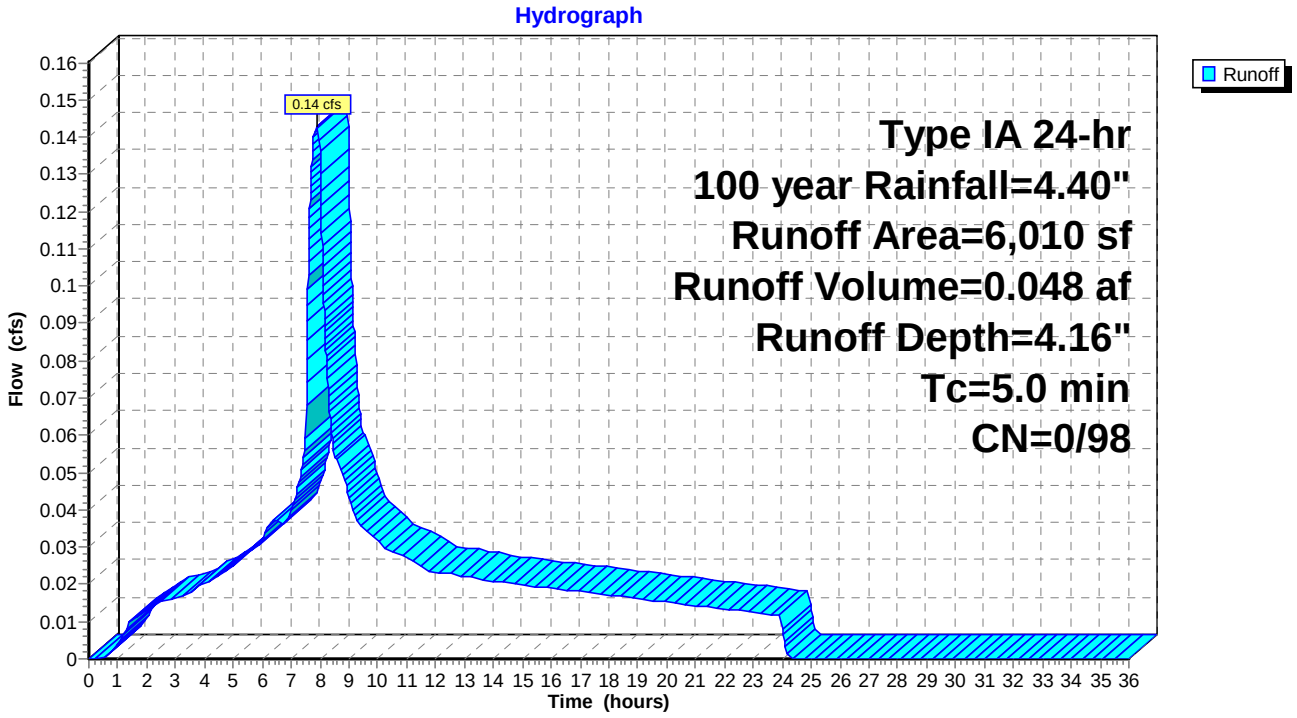
Runoff = 0.14 cfs @ 7.88 hrs, Volume= 0.048 af, Depth= 4.16"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type IA 24-hr 100 year Rainfall=4.40"

Area (sf)	CN	Description
6,010	98	Roofs, HSG C
6,010	98	100.00% Impervious Area

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

Subcatchment Bldg 2: Building 31



Summary for Subcatchment VC2: VC Loop 2

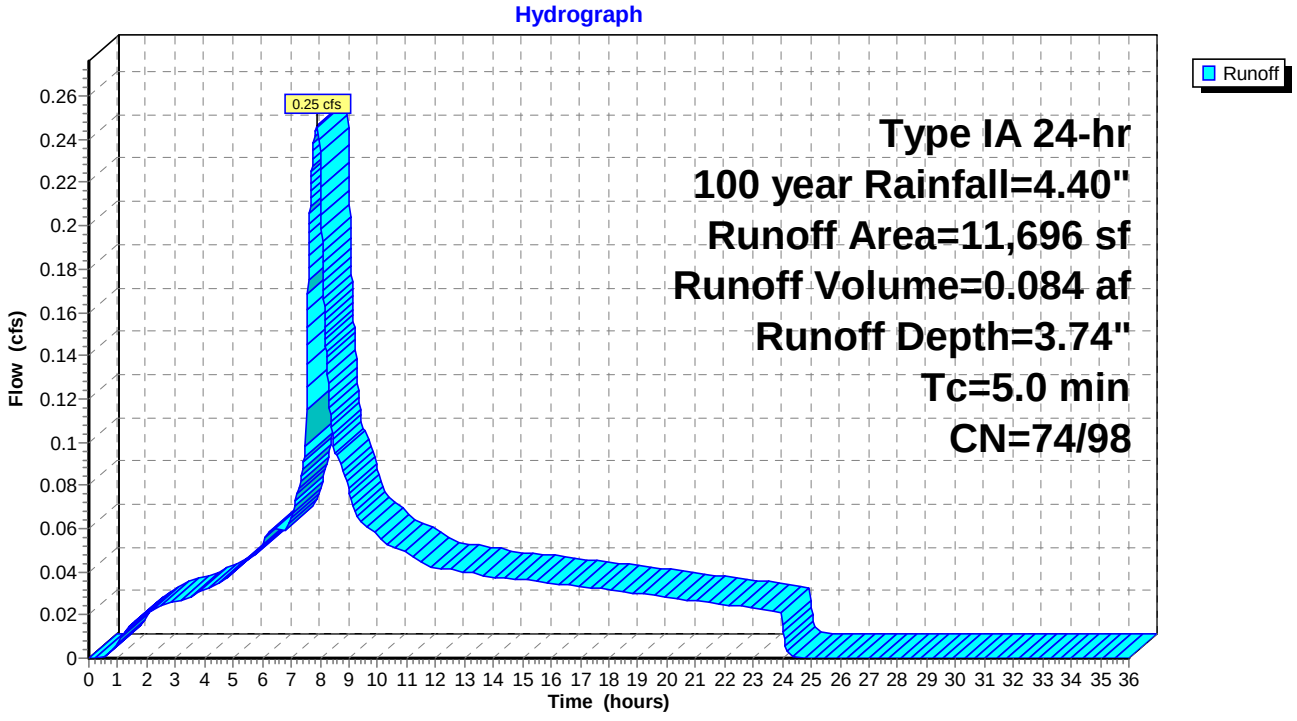
Runoff = 0.25 cfs @ 7.89 hrs, Volume= 0.084 af, Depth= 3.74"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type IA 24-hr 100 year Rainfall=4.40"

Area (sf)	CN	Description
2,181	74	>75% Grass cover, Good, HSG C
9,515	98	Paved parking, HSG C
11,696	94	Weighted Average
2,181	74	18.65% Pervious Area
9,515	98	81.35% Impervious Area

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

Subcatchment VC2: VC Loop 2



Summary for Pond 2 - GM: PB 2 - GM

Inflow Area = 2.476 ac, 74.10% Impervious, Inflow Depth = 3.58" for 100 year event
Inflow = 2.16 cfs @ 7.89 hrs, Volume= 0.738 af
Outflow = 0.78 cfs @ 8.79 hrs, Volume= 0.738 af, Atten= 64%, Lag= 53.8 min
Primary = 0.21 cfs @ 2.76 hrs, Volume= 0.546 af
Secondary = 0.57 cfs @ 8.79 hrs, Volume= 0.192 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 5.69' @ 8.79 hrs Surf.Area= 4,519 sf Storage= 7,639 cf

Plug-Flow detention time= 282.3 min calculated for 0.738 af (100% of inflow)
Center-of-Mass det. time= 282.2 min (962.4 - 680.2)

Volume	Invert	Avail.Storage	Storage Description
#1	4.00'	9,038 cf	**Planter Box Storage (Prismatic)** Listed below (Recalc)

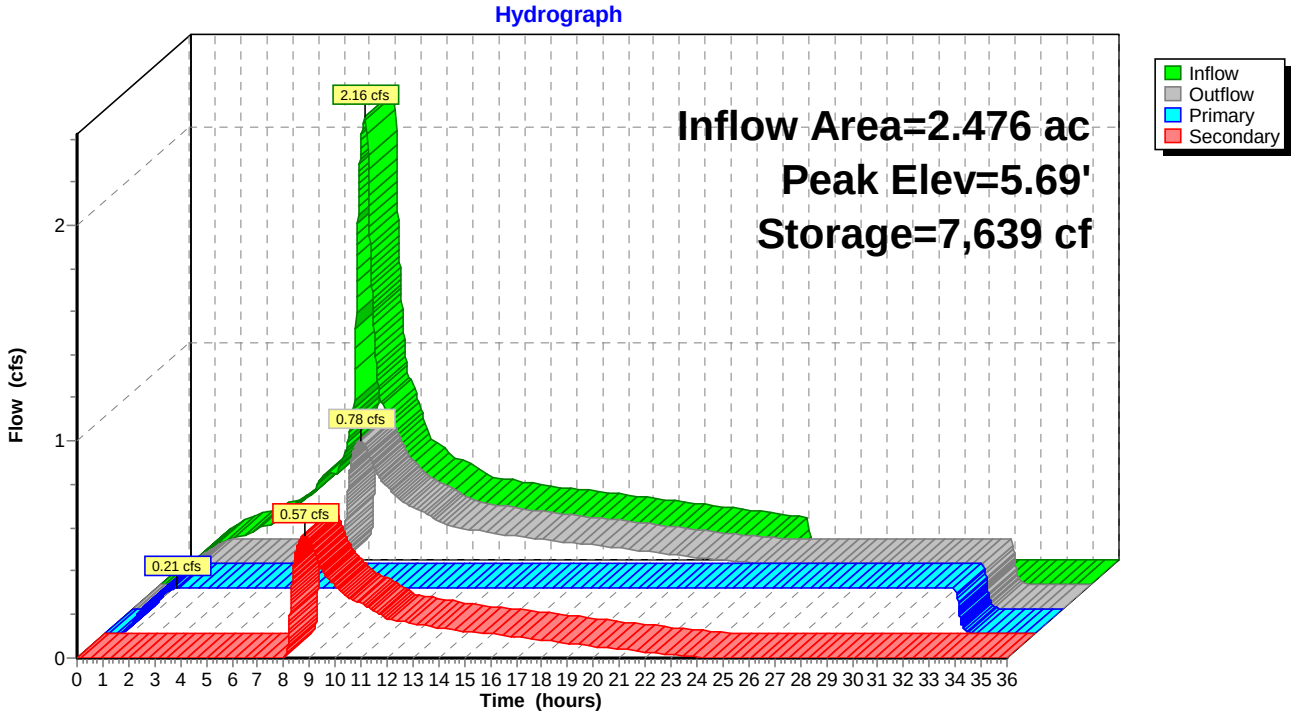
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
4.00	4,519	0	0
5.00	4,519	4,519	4,519
6.00	4,519	4,519	9,038

Device	Routing	Invert	Outlet Devices
#1	Primary	4.00'	**2.000 in/hr Flow through Growing Media over Surface area**
#2	Secondary	5.50'	**8.0" Horiz. Rock Box** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.21 cfs @ 2.76 hrs HW=4.02' (Free Discharge)
↑—**1=Flow through Growing Media** (Exfiltration Controls 0.21 cfs)

Secondary OutFlow Max=0.57 cfs @ 8.79 hrs HW=5.69' (Free Discharge)
↑—**2=Rock Box** (Weir Controls 0.57 cfs @ 1.43 fps)

Pond 2 - GM: PB 2 - GM



Summary for Pond 2 - DR: PB 2 - DR

Inflow Area = 2.476 ac, 74.10% Impervious, Inflow Depth = 3.58" for 100 year event
Inflow = 0.78 cfs @ 8.79 hrs, Volume= 0.738 af
Outflow = 0.54 cfs @ 10.02 hrs, Volume= 0.626 af, Atten= 30%, Lag= 73.8 min
Discarded = 0.07 cfs @ 1.43 hrs, Volume= 0.211 af
Primary = 0.47 cfs @ 10.02 hrs, Volume= 0.415 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 3.73' @ 10.02 hrs Surf.Area= 4,519 sf Storage= 6,066 cf

Plug-Flow detention time= 306.2 min calculated for 0.626 af (85% of inflow)
Center-of-Mass det. time= 157.9 min (1,120.3 - 962.4)

Volume	Invert	Avail.Storage	Storage Description
#1	0.00'	6,507 cf	**Drain Rock Storage (Prismatic)** Listed below (Recalc) 18,076 cf Overall x 36.0% Voids

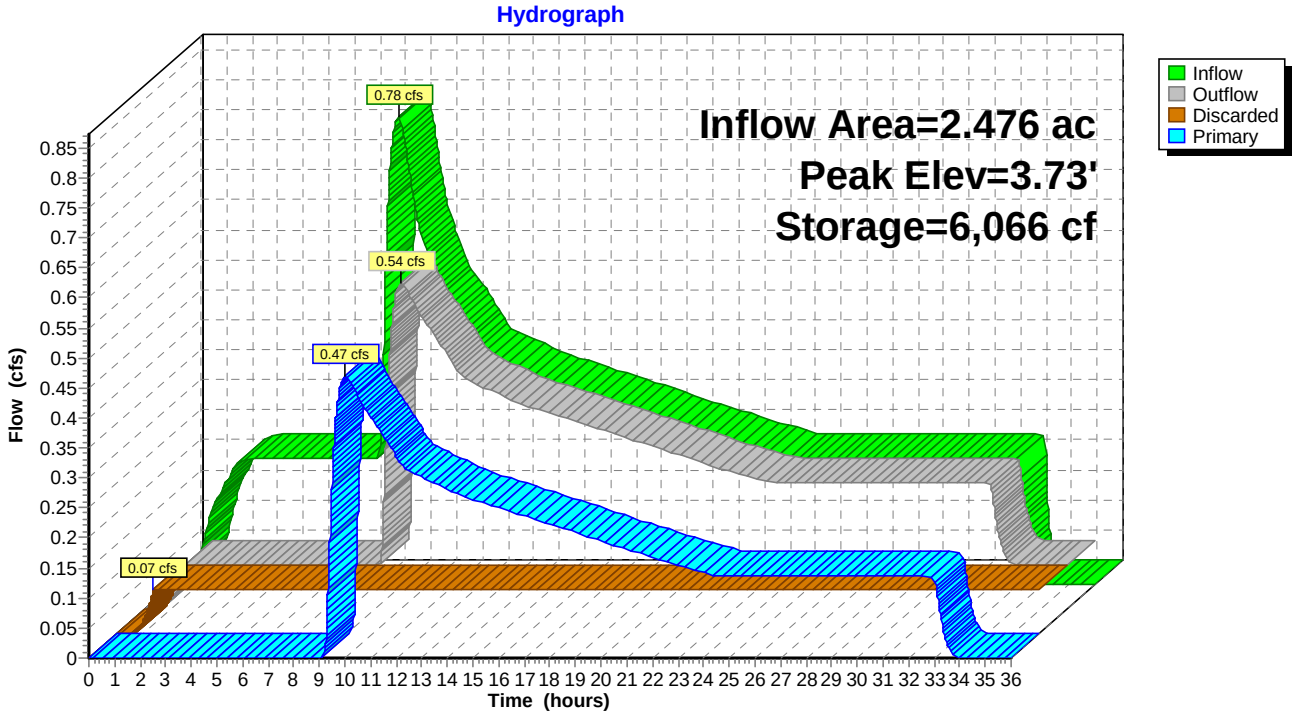
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
0.00	4,519	0	0
4.00	4,519	18,076	18,076

Device	Routing	Invert	Outlet Devices
#1	Discarded	0.00'	**0.700 in/hr Native Infiltration over Surface area**
#2	Primary	3.33'	**8.0" Vert. Underdrain** C= 0.600 Limited to weir flow at low heads

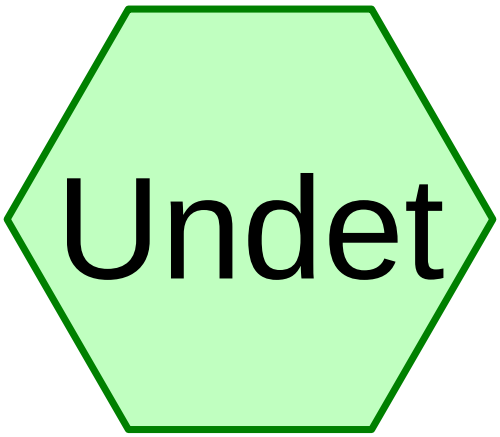
Discarded OutFlow Max=0.07 cfs @ 1.43 hrs HW=0.04' (Free Discharge)
↑—**1=Native Infiltration** (Exfiltration Controls 0.07 cfs)

Primary OutFlow Max=0.47 cfs @ 10.02 hrs HW=3.73' (Free Discharge)
↑—**2=Underdrain** (Orifice Controls 0.47 cfs @ 2.15 fps)

Pond 2 - DR: PB 2 - DR



WEST



Undetained

Subcat Reach Pond Link

Routing Diagram for WEST (VC) Site Prelim Hydrographs
Prepared by Multi/Tech Engineering Services, Printed 2/18/2021

Summary for Subcatchment Undet: Undetained

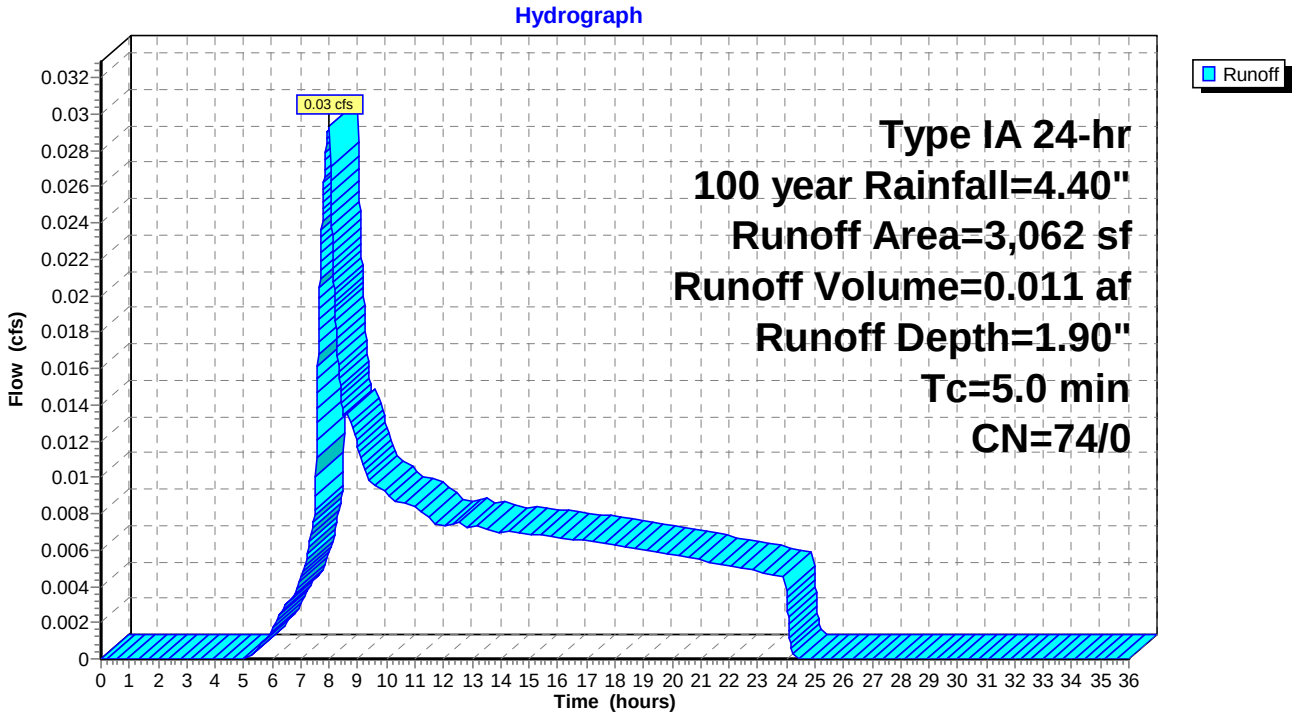
Runoff = 0.03 cfs @ 7.99 hrs, Volume= 0.011 af, Depth= 1.90"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type IA 24-hr 100 year Rainfall=4.40"

Area (sf)	CN	Description
3,062	74	>75% Grass cover, Good, HSG C
3,062	74	100.00% Pervious Area

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

Subcatchment Undet: Undetained



APPENDIX G: FACILITY MAINTENANCE CHECKLIST

Appendix B to 109-011 – Facility Maintenance Forms

1. Stormwater Planter

Stormwater Planters are designed to allow runoff to filter through layers of topsoil (thus capturing pollutants) and then either infiltrate into the native soils (infiltration planter) or be collected in a pipe to be discharged off-site (filtration planter). The planter is sized to accept runoff and temporarily store the water in a reservoir on top of the soil. The filtration planter is designed with an impervious bottom or is placed on an impervious surface. Water should drain through the planter within 24 hours after a storm event.

Inspections

All facility components and vegetation shall be inspected for proper operations and structural stability. *These inspections shall occur, at a minimum, quarterly for the first two years from the date of installation, and two times per year thereafter.* It is recommended that a visual inspection be made within 48 hours after each major storm event to ensure proper function. The facility owner must keep a log, recording all inspection dates, observations, and maintenance activities. The following items shall be inspected and maintained as stated:

Date: ____/____/_____ Inspector's Name: _____

Downspout from rooftop or sheet flow from paving allows unimpeded stormwater flow to the planter.

- □ Debris shall be removed routinely and upon discovery.
- □ Damaged pipe shall be repaired upon discovery.

Inspection Comments: _____

_____

Splash blocks prevent splashing against adjacent structures and convey water without disrupting media.

- □ Any deficiencies in structure such as cracking, rotting, and failure shall be repaired.

Inspection Comments: _____

_____

Planter reservoir receives and detains stormwater prior to infiltration. Water should drain from planter within 24 hours of storm event.

- □ Sources of clogging shall be identified and corrected.
- □ Topsoil may need to be amended with sand or compost, or replaced.

Inspection Comments: _____

_____

Amended soils consisting of sand, compost, drain rock, and topsoil shall allow stormwater to percolate uniformly through the planter.

- □ The planter shall be excavated and cleaned, and gravel or soil shall be replaced to correct low infiltration rates.
- □ Holes that are not consistent with the design and allow water to flow directly through the planter to the ground shall be plugged.
- □ Sediment accumulation shall be hand-removed with minimum damage to vegetation using proper erosion control measures. Sediment shall be removed if it is more than 4 inches thick or so thick as to damage or kill vegetation.
- □ Litter and debris shall be removed.

Inspection Comments: _____

_____

Appendix B to 109-011 – Facility Maintenance Forms

1. Stormwater Planter (continued)

Planter shall contain filter media and vegetation.

- □ Structural deficiencies in the planter including rot, cracks, and failure shall be repaired.

Inspection Comments: _____

_____

Overflow pipe safely conveys flow exceeding reservoir capacity to an approved stormwater receiving system.

- □ Overflow pipe shall be kept clear at all times.
- □ Damaged pipe shall be repaired or replaced upon discovery.

Inspection Comments: _____

_____

Vegetation shall be healthy and dense enough to provide filtering while protecting underlying soils from erosion. Proper horticultural practices shall be employed to ensure plants are vigorous and healthy.

- □ Mulch shall be replenished as needed, but not inhibiting water flow.
- □ Vegetation, large shrubs, or trees that limit access or interfere with planter operation shall be pruned or removed.
- □ Fallen leaves and debris from deciduous plant foliage shall be raked and removed.
- □ Nuisance or prohibited vegetation from the City of Salem Non-Native Invasive Plant list shall be removed when discovered. Invasive vegetation shall be removed upon discovery.
- □ Dead vegetation shall be removed upon discovery.
- □ Vegetation shall be replaced as soon as possible to maintain cover density and control erosion where soils are exposed.

Inspection Comments: _____

_____

Debris and litter shall be removed to ensure stormwater infiltration and to prevent clogging of overflow drains and interference with plant growth.

Inspection Comments: _____

Spill prevention measures shall be exercised when handling substances that contaminate stormwater.

- □ Releases of pollutants shall be corrected and reported to the City as soon as identified.

Inspection Comments: _____

Training and/or written guidance information for O&M of stormwater planters shall be provided to all property owners and tenants. This Facility Maintenance Form can be used to meet this requirement.

Inspection Comments: _____

Access to the stormwater planter shall be safe and efficient. Egress and ingress routes shall be maintained to design standards. Roadways shall be maintained to accommodate size and weight of vehicles, if applicable.

- □ Obstacles preventing maintenance personnel and/or equipment access to the stormwater planter shall be removed.
- □ Gravel or ground cover shall be added if erosion has occurred.

Inspection Comments: _____

_____

Appendix B to 109-011 – Facility Maintenance Forms

1. Stormwater Planter (continued)

Nuisance insects and rodents shall not be harbored in the stormwater planter.

Pest control measures shall be taken when nuisance insects/rodents are found to be present.

- □ Holes in the ground located in and around the stormwater planter shall be filled and compacted.

Inspection Comments: _____

_____

APPENDIX H: GRADING & DRAINAGE PLANS

TYPICAL SIDEWALK AND PARKING SECTION

-NTS-

TYPICAL PRIVATE ROAD AND DRIVE AISLE SECTION

-NTS-

MULTI/TECH
ENGINEERING SERVICES, INC.
1155 13th ST. S.E. SALEM, OR. 97302
(503) 363-9227 FAX (503) 364-1260
www.mtengineering.net office@mtengineering.net

GRADING & DRAINAGE PLAN (WEST)

THE GROVE AT FAIRVIEW 2

NO CHANGES, MODIFICATIONS OR REPRODUCTIONS TO BE MADE TO THESE DRAWINGS WITHOUT WRITTEN AUTHORIZATION FROM THE DESIGN ENGINEER.

DIMENSIONS & NOTES TAKE PRECEDENCE OVER GRAPHICAL REPRESENTATION.

7111p SDR12+ORD

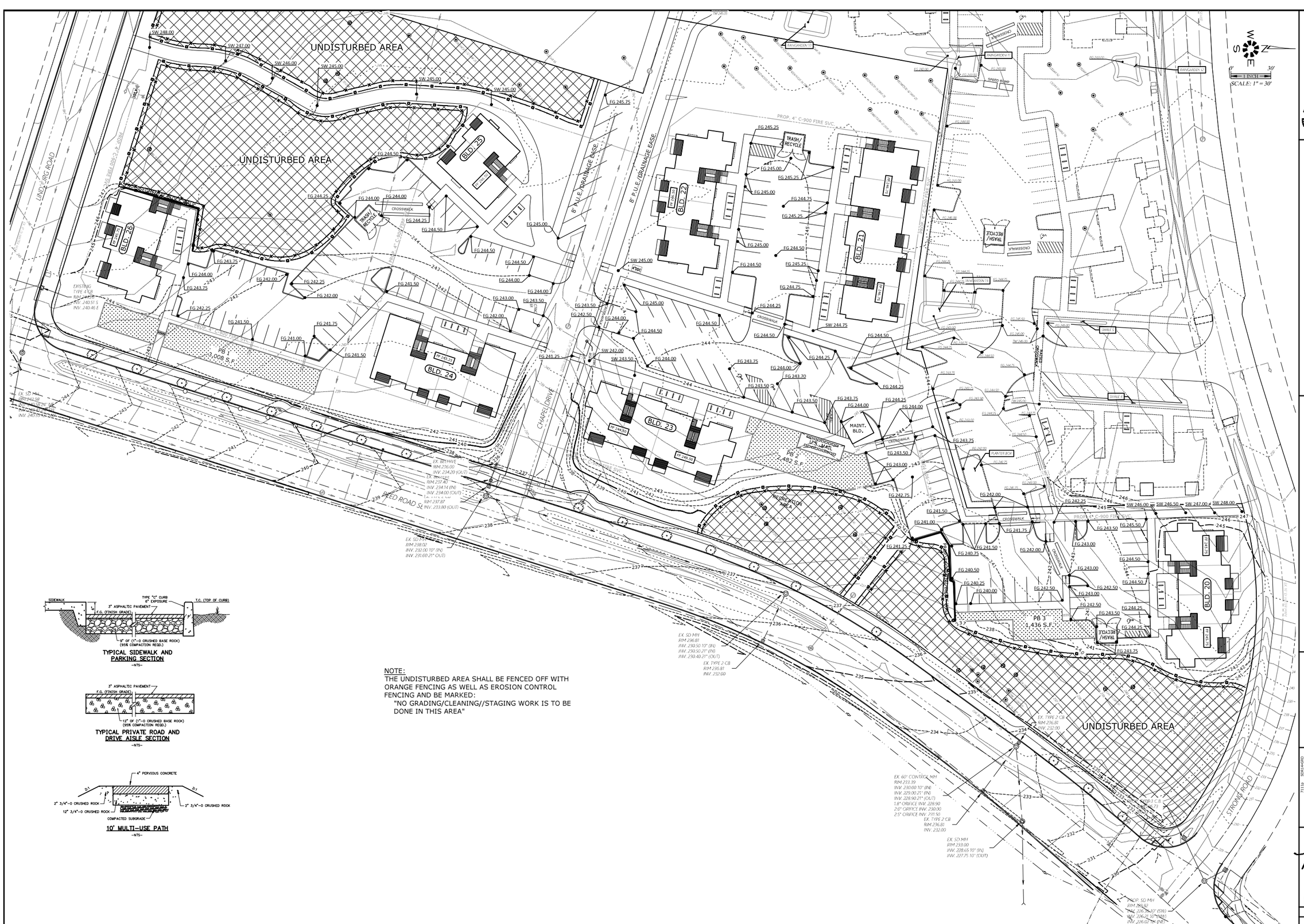
Design: M.D.G.
Drawn: C.D.S.
Checked: B.M.G.
Date: ---
Scale: AS SHOWN

REGISTERED PROFESSIONAL ENGINEER
OREGON
JANUARY 19, 1979
MARK B. GRENZ

EXPIRES: 06-30-2021

JOB # 7111

SDR12



TYPICAL SIDEWALK AND PARKING SECTION

-NTS-

TYPICAL PRIVATE ROAD AND DRIVE AISLE SECTION

-NTS-

10' MULTI-USE PATH

-NTS-

NOTE:
THE UNDISTURBED AREA SHALL BE FENCED OFF WITH ORANGE FENCING AS WELL AS EROSION CONTROL FENCING AND BE MARKED:
"NO GRADING/CLEANING//STAGING WORK IS TO BE DONE IN THIS AREA"

MULTI/TECH
ENGINEERING SERVICES, INC.
1155 13th ST. S.E. SALEM, OR. 97302
(503) 363-9227 FAX: (503) 363-1155
www.mtengineering.net office@mtengineering.net

GRADING & DRAINAGE PLAN (EAST)

THE GROVE AT FAIRVIEW 2

7111p SDR14.dwg

Design: M.D.G.
Drawn: C.D.S.
Checked: B.M.G.
Date: —
Scale: AS SHOWN

REGISTERED PROFESSIONAL ENGINEER
OREGON
JULY 14, 1978
MARK D. GRENZ

EXPIRES: 06-30-2021

JOB # 7111

SDR14