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Planning for the Future

February 9, 2018

Town of Chapel Hill
Planning Department
405 Martin Luther King Jr. Blvd.
Chapel Hill, NC 27514

Reference: **Site Plan Application**
Purefoy Road Apartments
111 Purefoy Road
Chapel Hill, NC 27514
Pin: 9788419609

Jay,

Enclosed please find the revised Site Plan Application for the Purefoy Road Apartment project. The project is located at 111 Purefoy Road, Chapel Hill, NC 27514 (PIN: 9788419609). The 1.3 acre site is currently zoned R-4, medium density residential.

Site Plan - Project Narrative:

Developer is seeking approval of a small multi-family development as represented on the attached Site Plans.

Project scope includes demolition of the existing 1 story, 2,470 square foot structure on-site today. The developer then proposes to construct two new multi-family structures on the property. Building #1 to the south is proposed to be 3 dwelling units totaling 4,512 gross square feet and includes 12 bedrooms. Building #2 to the north is proposed to be 4 dwelling units totaling 6,016 gross square feet and includes 16 bedrooms.

The overall total proposed building area on-site will be 10,528 gross square feet, 7 dwelling units, and 28 total bedrooms.

Associated with the new multi-family structures the developer is proposing necessary site related improvements as required by the Town of Chapel Hill, OWASA and Orange County.

SITE PLAN REVIEW APPLICATION



TOWN OF CHAPEL HILL
Planning Department
405 Martin Luther King Jr. Blvd
phone (919) 968-2728 fax (919) 969-2014
www.townofchapelhill.org

Parcel Identifier Number (PIN): _____ Date: _____

Section A: Project Information

Project Name: _____
Property Address: _____ Zip Code: _____
Use Groups (A, B, and/or C): _____ Existing Zoning District: _____
Project Description: _____

Section B: Applicant, Owner and/or Contract Purchaser Information

Applicant Information (to whom correspondence will be mailed)

Name: _____
Address: _____
City: _____ State: _____ Zip Code: _____
Phone: _____ Email: _____

The undersigned applicant hereby certifies that, to the best of his knowledge and belief, all information supplied with this application is true and accurate.

Signature: _____ Date: _____

Owner/Contract Purchaser Information:

Owner **Contract Purchaser**

Name: _____
Address: _____
City: _____ State: _____ Zip Code: _____
Phone: _____ Email: _____

The undersigned applicant hereby certifies that, to the best of his knowledge and belief, all information supplied with this application is true and accurate.

Signature: _____ Date: _____



PROJECT FACT SHEET

TOWN OF CHAPEL HILL

Planning Department

Section A: Project Information

Application type: _____ Date: _____

Project Name: _____

Use Type: (check/list all that apply)

Office/Institutional Residential Mixed-Use Other: _____

Overlay District: (check all those that apply)

Historic District Neighborhood Conservation District Airport Hazard Zone

Section B: Land Area

Net Land Area (NLA): Area within zoning lot boundaries		NLA=		sq. ft.
Choose one, or both, of the following (a or b,) not to exceed 10% of NLA	a) Credited Street Area (total adjacent frontage) x ½ width of public right-of-way	CSA=		sq. ft.
	b) Credited Permanent Open Space (total adjacent frontage) x ½ public or dedicated open space	COS=		sq. ft.
TOTAL: NLA + CSA and/or COS = Gross Land Area (not to exceed NLA + 10%)		GLA=		sq. ft.

Section C: Special Protection Areas, Land Disturbance, and Impervious Area

Special Protection Areas: (check all those that apply)

Jordan Buffer Resource Conservation District 100 Year Floodplain Watershed Protection District

Land Disturbance	Total (sq ft)
Area of Land Disturbance (Includes: Footprint of proposed activity plus work area envelope, staging area for materials, access/equipment paths, all grading, including off-site clearing)	
Area of Land Disturbance within RCD	
Area of Land Disturbance within Jordan Buffer	

Impervious Areas	Existing (sq ft)	Demolition (sq ft)	Proposed (sq ft)	Total (sq ft)
Impervious Surface Area (ISA)				
Impervious Surface Ratio: Percent Impervious Surface Area of Gross Land Area (ISA/NET) %				
If located in Watershed Protection District, % of impervious surface on 7/1/1993				



PROJECT FACT SHEET

TOWN OF CHAPEL HILL

Planning Department

Section D: Dimensions

Dimensional Unit (sq ft)	Existing (sq ft)	Demolition (sq ft)	Proposed (sq ft)	Total (sq ft)
Number of Buildings				
Number of Floors				
Recreational Space				

Residential Space				
Dimensional Unit (sq ft)	Existing (sq ft)	Demolition (sq ft)	Proposed (sq ft)	Total (sq ft)
Floor Area (all floors – heated and unheated)				
Total Square Footage of All Units				
Total Square Footage of Affordable Units				
Total Residential Density				
Number of Dwelling Units				
Number of Affordable Dwelling Units				
Number of Single Bedroom Units				
Number of Two Bedroom Units				
Number of Three Bedroom Units				

Non-Residential Space (Gross Floor Area in Square Feet)					
Use Type	Existing	Proposed	Uses	Existing	Proposed
Commercial					
Restaurant			# of Seats		
Government					
Institutional					
Medical					
Office					
Hotel			# of Rooms		
Industrial					
Place of Worship			# of Seats		
Other					

Dimensional Requirements		Required by Ordinance	Existing	Proposed
Setbacks (minimum)	Street			
	Interior (neighboring property lines)			
	Solar (northern property line)			
Height (maximum)	Primary			
	Secondary			
Streets	Frontages			
	Widths			



PROJECT FACT SHEET

TOWN OF CHAPEL HILL

Planning Department

Section F: Adjoining or Connecting Streets and Sidewalks

(Note: For approval of proposed street names, contact the Engineering Department)

Street Name	Right-of-way Width	Pavement Width	Number of Lanes	Existing Sidewalk*	Existing curb/gutter
				<input type="checkbox"/> Yes	<input type="checkbox"/> Yes
				<input type="checkbox"/> Yes	<input type="checkbox"/> Yes

List Proposed Points of Access (Ex: Number, Street Name):

*If existing sidewalks do not exist and the applicant is adding sidewalks, please provide the following information:

Sidewalk Information			
Street Names	Dimensions	Surface	Handicapped Ramps
			<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A
			<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A

Section G: Parking Information

Parking Spaces	Minimum	Maximum	Proposed
Regular Spaces			
Handicap Spaces			
Total Spaces			
Loading Spaces			
Bicycle Spaces			
Surface Type			

Section H: Landscape Buffers

Location (North, South, Street, Etc.)	Minimum Width	Proposed Width	Alternate Buffer	Modify Buffer
			<input type="checkbox"/> Yes	<input type="checkbox"/> Yes
			<input type="checkbox"/> Yes	<input type="checkbox"/> Yes
			<input type="checkbox"/> Yes	<input type="checkbox"/> Yes
			<input type="checkbox"/> Yes	<input type="checkbox"/> Yes



PROJECT FACT SHEET

TOWN OF CHAPEL HILL

Planning Department

Section I: Land Use Intensity

Existing Zoning District:

Proposed Zoning Change (if any):

Note: Refer to Table 3.8-1 (Dimensional Matrix) in the Land Use Management Ordinance for help completing this table.

Zoning – Area – Ratio			Impervious Surface Thresholds			Minimum and Maximum Limitations	
Zoning District(s)	Floor Area Ratio (FAR)	Recreation Space Ratio (RSR)	Low Density Residential (0.24)	High Density Residential (0.50)	Non-Residential (0.70)	Maximum Floor Area (MFA) = FAR x GLA	Minimum Recreation Space (MSR) = RSR x GLA
TOTAL							
RCD Streamside		0.01					
RCD Managed		0.019					
RCD Upland							

Section J: Utility Service

Check all that apply

Water	<input type="checkbox"/> OWASA	<input type="checkbox"/> Individual Well	<input type="checkbox"/> Community Well	<input type="checkbox"/> Other
Sewer	<input type="checkbox"/> OWASA	<input type="checkbox"/> Individual Septic Tank	<input type="checkbox"/> Community Package Plant	<input type="checkbox"/> Other
Electrical	<input type="checkbox"/> Underground	<input type="checkbox"/> Above Ground		
Telephone	<input type="checkbox"/> Underground	<input type="checkbox"/> Above Ground		
Solid Waste	<input type="checkbox"/> Town	<input type="checkbox"/> Private		



**SITE PLAN REVIEW APPLICATION
SUBMITTAL REQUIREMENTS
TOWN OF CHAPEL HILL
Planning Department**

The following must accompany your application. Failure to do so will result in your application being considered incomplete. For assistance with this application, please contact the Chapel Hill Planning Department (Planning) at (919)968-2728 or at planning@townofchapelhill.org. For detailed information, please refer to the Description of Detailed Information handout.

X	Application fee (including Engineering Review fee) (refer to fee schedule) Amount Paid \$ <input type="text"/>
X	Pre-application meeting – with appropriate staff
X	Digital Files - provide digital files of all plans and documents
X	Recorded Plat or Deed of Property
X	Project Fact Sheet
X	Traffic Impact Statement – completed by Town’s consultant (or exemption)
X	Mailing list of owners of property within 1,000 feet perimeter of subject property (see GIS notification tool)
X	Mailing fee for above mailing list (mailing fee is double due to 2 mailing) Amount Paid \$ <input type="text"/>
X	Written Narrative describing the proposal
X	Resource Conservation District, Floodplain, & Jordan Buffers Determination - necessary for all submittals
N/A	Jurisdictional Wetland Determination – if applicable
N/A	Resource Conservation District Encroachment Exemption or Variance (determined by Planning)
N/A	Jordan Buffer Authorization Certificate or Mitigation Plan Approval (determined by Planning)
X	Reduced Site Plan Set (reduced to 8.5"x11")

Stormwater Impact Statement (1 copy to be submitted)

- a) Written narrative describing existing & proposed conditions, anticipated stormwater impacts and management structures and strategies to mitigate impacts
- b) Description of land uses and area (in square footage)
- c) Existing and proposed Impervious surface area in square feet for all subareas and project area
- d) Ground cover and uses information
- e) Soil information (classification, infiltration rates, depth to groundwater and bedrock)
- f) Time of concentration calculations and assumptions
- g) Topography (2-foot contours)
- h) Pertinent on-site and off-site drainage conditions
- i) Upstream and/or downstream volumes
- j) Discharges and velocities
- k) Backwater elevations and effects on existing drainage conveyance facilities
- l) Location of jurisdictional wetlands and regulatory FEMA Special Flood Hazard Areas
- m) Water quality volume calculations
- n) Drainage areas and sub-areas delineated
- o) Peak discharge calculations and rates (1, 2, and 25-year storms)
- p) Hydrographs for pre- & post-development without mitigation, post-development with mitigation
- q) Volume calculations and documentation of retention for 2-year storm
- r) 85% TSS removal for post-development stormwater run-off



- s) Nutrient loading calculations
- t) BMP sizing calculations
- u) Pipe sizing calculations and schedule (include HGL & EGL calculations and profiles)

Plan Sets (10 copies to be submitted no larger than 24"x36")

Plans should be legible and clearly drawn. All plan sets sheets should include the following:

- Project Name
- Legend
- Labels
- North Arrow (North oriented toward top of page)
- Property Boundaries with bearing and distances
- Scale (Engineering), denoted graphically and numerically
- Setbacks
- Streams, RCD Boundary, Jordan Riparian Buffer Boundary, Floodplain, and Wetlands Boundary, where applicable
- Revision dates and professional seals and signatures, as applicable

Area Map

- a) Project name, applicant, contact information, location, PIN, & legend
- b) Dedicated open space, parks, greenways
- c) Overlay Districts, if applicable
- d) Property lines, zoning district boundaries, land uses, project names of site and surrounding properties, significant buildings, corporate limit lines
- e) Existing roads (public & private), rights-of-way, sidewalks, driveways, vehicular parking areas, bicycle parking, handicapped parking, street names.
- f) 1,000' notification boundary

Existing Conditions Plan

- a) Slopes, soils, environmental constraints, existing vegetation, and any existing land features
- b) Location of all existing structures and uses
- c) Existing property line and right-of-way lines
- d) Existing utilities & easements including location & sizes of water, sewer, electrical, & drainage lines
- e) Nearest fire hydrants
- f) Nearest bus shelters and transit facilities
- g) Existing topography at minimum 2-foot intervals and finished grade
- h) Natural drainage features & water bodies, floodways, floodplain, RCD, Jordan Buffers, & Watershed boundaries



Detailed Site Plan

- a) Existing and proposed building locations
- b) Description & analysis of adjacent land uses, roads, topography, soils, drainage patterns, environmental constraints, features, existing vegetation, vistas (on & off-site)
- c) Location, arrangement, & dimension of vehicular parking, width of aisles and bays, angle of parking, number of spaces, handicapped parking, bicycle parking . Typical pavement sections & surface type
- d) Location of existing and proposed fire hydrants
- e) Location and dimension of all vehicle entrances, exits, and drives
- f) Dimensioned street cross-sections and rights-of-way widths
- g) Pavement and curb & gutter construction details
- h) Dimensioned sidewalk and tree lawn cross-sections
- i) Proposed transit improvements including bus pull-off and/or bus shelter
- j) Required landscape buffers (or proposed alternate/modified buffers)
- k) Required recreation area/space (including written statement of recreation plans)
- l) Refuse collection facilities (existing and proposed) or shared dumpster agreement
- m) Construction parking, staging, storage area, and construction trailer location
- n) Sight distance triangles at intersections
- o) Proposed location of street lights and underground utility lines and/or conduit lines to be installed
- p) Easements
- q) Clearing and construction limits
- r) Traffic Calming Plan – detailed construction designs of devices proposed & associated sign & marking plan

Stormwater Management Plan

- a) Topography (2-foot contours)
- b) Existing drainage conditions
- c) RCD and Jordan Riparian Buffer delineation and boundary (perennial & intermittent streams, note ephemeral streams on site)
- d) Proposed drainage and stormwater conditions
- e) Drainage conveyance system (piping)
- f) Roof drains
- g) Easements
- h) BMP plans, dimensions, details, and cross-sections
- i) Planting and stabilization plans and specifications

Landscape Protection Plan

- a) Rare, specimen, and significant tree survey within 50 feet of construction area
- b) Rare and specimen tree critical root zones
- c) Rare and specimen trees proposed to be removed
- d) Certified arborist tree evaluation, if applicable



- e) Significant tree stand survey
- f) Clearing limit line
- g) Proposed tree protection /silt fence location
- h) Pre-construction/demolition conference note
- j) Landscape protection supervisor note
- k) Existing and proposed tree canopy calculations, if applicable

Planting Plan

- a) Dimensioned and labeled perimeter landscape bufferyard
- b) Off-site buffer
- c) Landscape buffer and parking lot planting plan (including planting strip between parking and building, entryway planting, and 35% shading requirement)

Steep Slope Plan

- a) Classify and quantify slopes 0-10%, 10-15%, 15-25% and 25% and greater
- b) Show and quantify areas of disturbance in each slope category
- c) Provide/show specialized site design and construction techniques

Grading and Erosion Control Plan

- a) Topography (2-foot contours)
- b) Limits of Disturbance
- c) Pertinent off-site drainage features
- d) Existing and proposed impervious surface tallies

Streetscape Plan, if applicable

- a) Public right-of-way existing conditions plan
- b) Streetscape demolition plan
- c) Streetscape proposed improvement plan
- d) Streetscape proposed utility plan and details
- e) Streetscape proposed pavement/sidewalk details
- f) Streetscape proposed furnishing details
- g) Streetscape proposed lighting details



Solid Waste Plan

- a) Preliminary Solid Waste Management Plan
- b) Existing and proposed dumpster pads
- c) Proposed dumpster pad layout design
- d) Proposed heavy duty pavement locations and pavement construction detail
- e) Preliminary Shared dumpster agreement, if applicable

Construction Management Plan

- a) Construction trailer location
- b) Location of construction personnel parking and construction equipment parking
- c) Location and size of staging and materials storage area
- d) Description of emergency vehicle access to and around project site during construction
- e) Delivery truck routes shown or noted on plan sheets

Energy Management Plan

- a) Description of how project will be 20% more energy efficient than ASHRAE Standards
- b) Description of utilization of sustainable forms of energy (Solar, Wind, Hydroelectric, and Biofuels)
- c) Participation in NC GreenPower program
- d) Description of how project will ensure indoor air quality, adequate access to natural lighting, and allow for proposed utilization of sustainable energy
- e) Description of how project will maintain commitment to energy efficiency and reduced carbon footprint over time
- f) Description of how the project's Transportation Management Plan will support efforts to reduce energy consumption as it affects the community

Exterior Elevations

- a) An outline of each elevation of the building, including the finished grade line along the foundation (height of building measured from mean natural grade).



Coulter|Jewell|Thames, PA

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p919.682.0368 f919.688.5646

Planning for the Future

February 9, 2018

Town of Chapel Hill
Planning Department
405 Martin Luther King Jr. Blvd.
Chapel Hill, NC 27514-5705

Reference: Response to Second Review Comments
Purefoy Road Apartments - 111 Purefoy Rd.

Jay:

Enclosed with this letter please find ten (10) plan sets of the revised Site Plan for the above referenced project. In addition, we have addressed the review comments as follows:

FIRE:

1. FIRE APPARATUS ACCESS ROADS; Any fire apparatus access roads, (any public/private street, parking lot access, fire lanes and access roadways), used for fire department access shall be all weather and designed to carry the imposed load of fire apparatus weighing at least 80,000 lbs. Fire apparatus access roads shall have a minimum width of 20' exclusive of shoulders with an overhead clearance of at least 13'-6" for structures not exceeding 30' in height and shall provide access to within 150' of all exterior portions of the building. Structures exceeding 30' in height shall be provided with an aerial apparatus access road 26' in width in the immediate vicinity of the building or portion thereof and shall provide at least one of the required access roads to be located not less than 15' and not more than 30' from the structure parallel to one entire side of the structure. NC FPC 2012 502.1, 503.1.1, 503.2.1, D102.1 AERIAL ACCESS IS REQUIRED IF STRUCTURE IS IN EXCESS OF 30' "OR" 3 STORIES IN HEIGHT. (*Fire*)

Applicant Response: Proposed fire apparatus access road will be all weather pavement of sufficient structure to support the above noted fire apparatus weight. Proposed building has been revised to a two story structure and does not exceed 30 feet in height therefore an aerial apparatus access roadway of 26 foot width shall not be required for this project. A 20 foot wide fire apparatus access road has been provided to achieve access to within 150' of all exterior portions of the proposed building.

2. DEAD END ACCESS ROADS; Dead end fire apparatus access roads exceeding 150' shall have a designated turn around required. The turnaround shall meet one of the design standards of NC FPC 2012, Appendix D table D 103.4 PROPOSED ACCESS RD EXCEEDS 160' (*Fire*)

Applicant Response: Proposed fire apparatus access road has been revised to be no longer than 150 feet in length. Please reference heavy duty pavement hatch on SD-2.0 site layout plan and also revised “no parking fire lane” sign locations which identify the limits of the fire apparatus access road.

3. FIRE HYDRANTS; The addition of any required hydrants to serve the submitted building must flow a minimum of 2500 gpm per Town Engineering Standards unless approved by the fire code official. The farthest hydrant serving a proposed structure must be no more than 500' distant. A maximum distance of 500' spacing between hydrants must be maintained unless otherwise approved by the fire code official. Lesser spacing distances may be required. A minimum working space of 3' must be maintained around all hydrants. Where hydrants are subject to physical impact, physical protection may be required, NC FPC 2012, 507.5.6. The minimum number of required hydrants and their spacing must meet NC FPC 2012, Appendix C, table C 105.1
MINIMUM 3 FEET WORKING SPACE MUST BE MAINTAINED AROUND HYDRANT. LANDSCAPE PLAN SD- 7.0 (Fire)

Applicant Response: Fire flow report has been provided. Based on a preliminary analysis of the existing system, the Town's minimum fire flow of 2,500 gpm at 20 psi is not obtainable at this location due to limitations of the existing water system. It should also be understood OWASA just recently completed (2016) water main improvements within Purefoy Road. With that said, a flow of 2,350 gpm can be obtained with a residual pressure of 21.04 psi. According to Table B105.1 in Appendix B of the NC Fire Code, the required fire flow for Type V-B construction is 2,750 gpm. Since an automatic sprinkler system will be installed, the required fire flow can be reduced by up to 50%. The provided fire flow of 2,350 gpm is a reduction of approximately 15%. Given this, the provided fire flow of 2,350 gpm should be acceptable and approvable by the fire code official. Proposed hydrant is also located within 500 feet of the proposed structure and a minimum working space of 3' has been maintained around the proposed hydrant. Prior fire flow report has been included again with this resubmittal package.

4. FIRE PROTECTION AND UTILITY PLAN; shall include the fire flow report: for a hydrant within 500' of each building, provide the calculated gallons per minute of with a residual pressure of 20 pounds per square inch. The calculations should be sealed by a professional engineer licensed in the State of NC and accompanied by a water supply flow test conducted within one year of the submittal. Reference Town Design Manual for required gallons per minute. PER TOWN DESIGN MANUAL FIRE FLOW MUST MEET MINIMUM 2500 GPM (Fire)

Applicant Response: Please see response to comment number 3 above.

5. FIRE DEPARTMENT CONNECTIONS, LOCATIONS; Any required FDC's for any buildings shall meet the design and installation requirements for the current, approved edition of NFPA 13, 13D, 13R, or 14 of the NC FPC 2012 and Town Ordinances; 7-38 for location. FDC's shall be installed on the street/ address side of the building and within 100' of a hydrant or unless otherwise approved by the fire code official and shall not be obstructed or hindered by parking or landscaping. FDC's shall be equipped with NST. SHALL NOT BE OBSTRUCTED OR HINDERED BY LANDSCAPING (Fire)
Applicant Response: FDC locations have been revised with this resubmittal. FDC's have been located within 100 feet of the proposed fire hydrant on-site and on the street/firefighting side of the proposed structure. Please note proposed landscape planting obstructions have been moved away from FDC connection locations.

6. FIRE DEPARTMENT CONNECTIONS, INSTALLATION; A working space of not less than 36" in width and depth and a working space of 78" in height shall be provided on all sides with the exception of wall mounted FDC's unless otherwise approved by the fire code official. The FDC's where required must be physically protected by an approved barrier from impacts. NC FPC 2012, 912.1, 912.2 912.2.1, 912.3.2, 312 SHALL NOT BE OBSTRUCTED OR HINDERED BY LANDSCAPING (*Fire*)
 Applicant Response: FDC locations have been revised with this resubmittal. Please note proposed landscape planting obstructions have been moved away from FDC connection locations.

7. AERIALS; Where a building exceeds 30' in height OR 3 stories above the lowest level of Fire Department Access, overhead power and utility lines shall not be allowed within the aerial apparatus access roadway and the roadway shall have an unobstructed width of 26' exclusive of the shoulders. At least one of the apparatus access roadways shall be located within a minimum of 15' and maximum of 30' from one complete side of the building. NC FPC 2012 D105.1, D105.2, D105.3 PROPOSED STRUCTURE IS 3 STORIES (*Fire*)
 Applicant Response: Proposed buildings have been revised to two story structures and does not exceed 30 feet in height therefore an aerial apparatus access roadway of 26 foot width shall not be required for this project. Please also reference note #7 within Utility Plan Notes 2/SD-5.0 which states "power, telephone, cable and gas services to buildings shall be underground".

8. BUILDING HEIGHT; Buildings exceeding 30 feet or three stories in height must have at least two means of fire apparatus access separated by at least one half the diagonal distance of the building. NC FPC 2012, D104.1, D104.3 PROPOSED STRUCTURE IS 3 STORIES (*Fire*)
 Applicant Response: Proposed building has been revised to a two story structure and does not exceed 30 feet in height therefore two means of fire apparatus access shall not be required for this project.

9. FIRE APPARATUS ACCESS FOR CHFD: All fire department access determinations shall be based upon CHFD apparatus specifications (data specs provided by Office of the Fire Marshal/Life Safety Division) and field verification. All proposed fire department access designs shall be reviewed and shall also pass field inspection. (*Fire*)
 Applicant Response: Noted, Thank you.

LANDSCAPE TREE PROTECTION:

10. Tree Canopy Measurement: canopy overhanging overhead utilities and canopy provided by trees on neighboring property are not eligible to be counted because it can be removed by Duke Energy or by neighboring property owners. (*Urban Forestry*)
 Applicant Response: Existing and proposed tree canopy coverage diagrams have been updated accordingly.

11. To save a rare 16-inch cedar and protect more of the critical root zone of the adjacent rare 30 inch oak, as required by LUMO 5.7.2(b)(2,4) shift the front walkway NE 10-12 feet toward the proposed front parking spaces and use curbing or low edging/walls to minimize grading on the west side of the walkway. (*Urban Forestry*)

Applicant Response: Proposed front walkway has been shifted approximately 20 feet north east to minimize grading impacts to adjacent existing trees.

12. To protect more of the critical root zone of the rare 24-inch triple hickory, as required by LUMO 5.7.2(b)(2,4) abandon the existing sanitary sewer line in place without excavating, adjust the route of the proposed sanitary sewer connection so that the cleanout is about 15-18 feet east of the cleanout shown on the plan and tie into the manhole on the northeast side instead of the north side, Also once the 16 inch maple is removed (cut flush leaving the stump and root mat in place) move the tree protection fence north of the hickory to the limits of grading and excavation for roof drains. (*Urban Forestry*)

Applicant Response: We have visited the project site again to verify the Surveyors labeling for tree #19. Tree #19 as listed in the tree table "24" Triple Hickory" has been miss identified by the Surveyor. We have confirmed this tree is not a Hickory tree but is actually a Hackberry, *Celtis occidentalis*. Further a multi-leader hackberry tree is not typical of this tree species and for this reason should not be considered a "rare" tree as it does not resemble typical configuration for the species. As much of the existing root mat for tree #18, 16" Red Maple will be left in place as possible while still allowing for development of this project. Grading has been minimized this side of the new building to quickly tie back into existing grade.

13. To protect more of the critical root zone of the rare 48-inch Bald Cypress, as required by LUMO 5.7.6(b)(2,4), minimize encroachment of the retaining wall for the parking and stormwater storage as well as the stormwater outlet. We note that the aisle adjacent to parking spaces shown is about 9 feet wider than the minimum. Is that width to accommodate additional parallel parking spaces or is the size necessary for the underground stormwater facility? If the stormwater storage can be reshaped, we recommend moving the retaining wall at least 15 feet closer to the parking/building. Revise grading to redirect the swale to channel to outflow from the stormwater storage facility farther east away from the 48 inch Bald Cypress. Since no landscaping is proposed between the building and the parking, the parking could be shifted 5 feet closer to the building. (*Urban Forestry*)

Applicant Response: Proposed parking area, retaining wall and stormwater outlet have been shifted north east as much as possible to further minimize impact to the root zone of the 48" Bald Cypress. Revised parking has been designed to minimum LUMO dimensional requirements.

14. To better protect existing trees, limit the amount of landscaping in buffers within critical root zones. This may require alternative or modified buffers. (*Urban Forestry*)

Applicant Response: Developer is now requesting alternate buffers on three sides of the project to better protect existing vegetation at the property's edge. The south and east landscape buffers have been located 10 further inside the property than required to better protect existing vegetation at the property edge. The norther buffer has been modified to limit impacts on existing tree root zones while still providing for an opaque evergreen screen from the adjacent property. The following note has also been added to the landscape plan sheets. "Landscape contractor shall field locate all new landscape plantings around existing large (2" or greater) tree roots to lessen the impact to existing trees surrounding the project site".

15. With the final plan application, include a construction detail of the retaining wall, including a guard rail at the top. (*Urban Forestry*)

Applicant Response: Noted, Thank you. Construction details of the proposed retaining wall including protective fence will be provided with final ZCP Plans.

RECREATION:

16. We are in support of the proposal to pay 100% of the required recreation space as a payment in lieu. Payment should be made prior to issuance of the first Zoning compliance Permit. (*Parks and Recreation*)

Applicant Response: Noted, Thank you.

REFUSE RECYCLING:

17. Propose an alternative method of collecting solid waste which is under the Town's jurisdiction as Public Works is the provider for refuse collection. Typically 5 units would be issued 5 roll carts. We note that the proposed use is equivalent to seven 4-bedroom residences. 160 square feet of concrete proposed for staging 12 roll carts between Purefoy Road and the ditch is excessive and not conducive for long term maintenance of the right-of-way. (*Urban Forestry*)

Applicant Response: Developer is now committing to private trash collection service for this project. The following note has been added to general conditions of approval notes on the cover sheet "Owner shall contract with private trash collection company for pick-up of refuse and recyclables. Pick-up shall occur at a frequency that ensures a safe and sanitary facility". Trash collection will occur directly from the trash corral rear of the property. 7 roll carts will be provided for refuse and 7 roll carts will be provided for recyclables collection. Frequency of pick-up will be adjusted as needed to ensure sufficient capacity and to ensure a safe and sanitary facility.

18. The current refuse plans do not comply with LUMO 5.13(b) which requires the provision of secure, safe and sanitary facilities for the storage and pickup of solid waste and recyclables. This section further requires that the facilities be appropriate to the type and size of the development being served. We do not believe that 6 roll carts will be sufficient to service the equivalent of seven four bedroom units. Further, based on existing multi-family properties on Purefoy Road with roll cart collection we believe that the five roll carts will not be taken to the street or returned to the corral in a timely fashion on a regular basis as required by Town Code. We recommend either private collection service, or a dumpster installed to Town standards. We believe that such a condition would be in accordance with the Planning Commission's ability to "impose such reasonable conditions on an approval as will ensure compliance with applicable regulations." [LUMO 4.7.2(b)(3)] (*Urban Forestry*)

Applicant Response: Applicant Response: Developer is now committing to private trash collection service for this project. The following note has been added to general conditions of approval notes on the cover sheet "Owner shall contract with private trash collection company for pick-up of refuse and recyclables. Pick-up shall occur at a frequency that ensures a safe and sanitary facility". Trash collection will occur directly from the trash corral rear of the property. 7 roll carts will be provided for refuse and 7 roll carts will be provided for recyclables collection. Frequency of pick-up will be adjusted as needed to ensure sufficient capacity and to ensure a safe and sanitary facility.

STORMWATER MANAGEMENT:

19. Note 11 on plan sheet SD3.0 references the bioretention basin. Address. (*Stormwater*)
Applicant Response: Note #11 has been revised to reference "stormwater treatment facility" as opposed to "bioretention basin".

20. The filterra unit is not an approved stormwater control measure in the North Carolina design manual. Use only approved stormwater control measure. (*Stormwater*)
Applicant Response: Applicant is now proposing a Storm Filter treatment system which is an approved stormwater control measure in the North Carolina design manual

21. The driveway area is also bypassing filterra #1. Address. (*Stormwater*)
Applicant Response: All surface drainage from proposed driveway and parking is being collected in curb inlets.

22. Provide spot elevation over the curb and gutter along the parking area at the location of the underground detention system. (*Stormwater*)
Applicant Response: Spot elevations will be provided with ZCP plans. Adequate cover is being provided over underground stormwater devices.

23. Label all concrete flumes/Curb Inlet to the filterra units appropriately on the plan sheet. (*Stormwater*)
Applicant Response: All curb inlets have been labeled appropriately on the Grading and Drainage Plan sheet.

24. The post-development drainage delineation map to SCM in the calculation document is not clear to me. Differentiate the areas that drains to filterra 1 and 2 with different colors. (*Stormwater*)
Applicant Response: The post-development drainage area maps have been updated.

25. Add note to the plan sheet that mulch shall not be placed around the filterra units in order to minimize the transport of mulch into the units. (*Stormwater*)
Applicant Response: Filterra units are no longer being used for this project. The above note is no longer needed.

26. The curb inlet hood and cover shall be pre-cast curb inlet hoods and covers stating, "Dump No Waste! Drains to Jordan Lake", in accordance with the specifications of the Town Standard Detail SD-5A, for all new curb inlets for private, Town and State rights-of-way. (*Stormwater*)
Applicant Response: The above note has been added to sheet SD-3.0 Grading and Stormwater Drainage Plan. Please refer to 2/SD-3.0 note #12.

27. The sum of the impervious area treated by filterra 1 and 2 is 12,106 sf which is less than the total proposed impervious area of 17,546 sf. Address. (*Stormwater*)
Applicant Response: A Storm Filter is proposed in lieu of the Filterras. The proposed development results in an increase in impervious surface of 14,558 sf. The proposed Storm Filter treats runoff from 15,937 sf of impervious area.

28. Add note the grading sheet SD3, that the contractor should contact Town of Chapel Hill Stormwater Management Division to schedule preconstruction meeting prior to land disturbance on the site. (*Stormwater*)
Applicant Response: The above note has been added to sheet SD-3.0 Grading and Stormwater Drainage Plan. Please refer to 2/SD-3.0 note #13.
29. Add note to the plan sheet that HVAC condensate and floor drains under a roof shall not be discharged into storm sewer pipe. (*Stormwater*)
Applicant Response: The above note has been added to sheet SD-3.0 Grading and Stormwater Drainage Plan. Please refer to 2/SD-3.0 note #14.
30. Add note to the plan sheet that all roof drain plumbing intended to discharge to storm sewer pipe not shown on approved plan sheet are not approved. Any discharge to storm sewer pipe not approved will need a review and approval from the Stormwater Management Division. (*Stormwater*)
Applicant Response: The above note has been added to sheet SD-3.0 Grading and Stormwater Drainage Plan. Please refer to 2/SD-3.0 note #15.
31. A FES with a concrete curtain at the end shall be provided on the outlet pipe from the outlet structure. A detail of the FES with concrete curtain shall be provided on the plan sheet. (*Stormwater*)
Applicant Response: Retaining wall noted on plans will serve as the headwall for the stormwater outlet pipe.
32. Provide on the erosion control plan a concrete washout location. A detail of the concrete wash out should be provided. (*Stormwater*)
Applicant Response: Concrete washout pit location is now shown and labeled on the erosion control plan. Concrete washout pit detail has been added to erosion control plan sheet.
33. Add note to grading plan sheet, that prior to land disturbance on the site, a preconstruction conference with the Town of Chapel Hill Stormwater Management Division shall be scheduled by contractor. (*Stormwater*)
Applicant Response: See comment response for comment #28 above.
34. Label on the post-development drainage delineation map to SCM, the area in terms of impervious and pervious bypassing treatment and detention. (*Stormwater*)
Applicant Response: The post-development drainage area map to SCM has been updated.
35. Plan sheet SD7 has the outlet pipe from the underground detention going under tree roots which is not allow. Address. (*Stormwater*)
Applicant Response: Stormwater outlet location has been shifted to minimize impact to existing tree roots.

Note: There are no comments 36-39.

PLANNING:

40. Sidewalk does not appear to extend across property's full frontage - stops short of southwest corner. Is there a reason for this? (*Long Range/Transportation*)

Applicant Response: The proposed sidewalk does extend across the full frontage of the actual deeded property. There is a deed gap in the southwest corner of the property along Purefoy Road.

41. Clarify that net land area calculations on coversheet and application reflect proposed post-ROW dedication. (*Current Development*)

Applicant Response: Net land area and gross land area numbers have been updated on the cover sheet and application to reflect post-ROW dedication numbers.

42. Proposed 20-foot Type C Landscape Buffer adjacent to Kehillah conflicts with proposed drainage swale. Kehillah has written to staff expressing support of a 6-foot tall solid wooden fence. We recommend such a fence adjacent to the driveway and modifying the planting density to more appropriately reflect and protect existing specimen trees on the Kehillah property as required by LUMO 5.7.6(b)(2). Staff would be supportive of an "Alternative Buffer" on this lot line provided that Kehillah remains supportive of the same. (*Current Development*)

Applicant Response: Applicant is now requesting an alternate 20-foot Type C Landscape Buffer adjacent to the Kehillah property with the understanding of Staff and Kehillah support this request. Proposed planting materials within the norther buffer has been modified to limit impacts on existing tree root zones while still providing for an opaque evergreen screen from the adjacent property. A 6-foot tall solid wooden fence has been provided with this resubmittal. Grading within this buffer area has also been minimized.

43. Show Front Yard Parking calculation on site plan demonstrating compliance with LUMO 5.9.9 and Appx. B, 5.3 (*Current Development*)

Applicant Response: Front yard parking calculations have been added to the SD-2.0 site layout plan sheet. Current project is proposing 14.64% parking/driveways within the front yard area which is well below the 25% maximum requirement for this project.

44. Revise Cover sheet and application form: Existing use is Dwelling Unit, Single Family with Accessory Apartment (*Current Development*)

Applicant Response: Existing land use listed on the cover sheet has been revised to "Dwelling unit, single family w/ accessory apartment". Project description on the 1st page of the site plan application has been revised to indicate "Construction of two new multi-family structures containing 7 dwelling units".

45. Confirm / clarify amount of land disturbance occurring in ROW vs any other off-site ROW. (*Current Development*)

Applicant Response: Land disturbance numbers on the cover sheet have been updated to further break out ROW disturbance and off-site ROW disturbance areas.

46. Call out approximate area of ROW dedication in square feet. Also Show proposed Right of Way dedication on sheet SD-1 (*Current Development*)
Applicant Response: ROW dedication is now shown and labeled on SD-1.0 ex. conditions and demolition plan sheet. The square foot area of ROW dedication has also been labeled on both SD-1.0 and SD-2.0. Please note approximately 3,049 SF +/- of ROW is being dedicated with this project.
47. Condition for Planning Commission: Right of Way Dedication Plat required prior to issuance of Final Plans Zoning Compliance Permit (*Current Development*)
Applicant Response: The above note has been added to sheet SD-0.0 Cover Sheet. Please refer to the General Conditions of Approval note #3.
48. Cover sheet: Note that Secondary Height, Building Setback and Solar Setback (25' minimum are all governed by LUMO Appendix B Division 5: Mason Farm/Whitehead Circle Neighborhood Conservation District (*Current Development*)
Applicant Response: The above note has been added to sheet SD-0.0 Cover Sheet. Please refer to the General Conditions of Approval note #4.
49. Condition for Planning Commission: Recreation Space Payment in Lieu of \$27,897.82 is required prior to Issuance of a Final Plans Zoning Compliance Permit (*Current Development*)
Applicant Response: The above note has been added to sheet SD-0.0 Cover Sheet. Please refer to the General Conditions of Approval note #5.
50. Coversheet and Application form: Report Density based on Gross Land Area per LUMO 3.8.2(c) (*Current Development*)
Applicant Response: Density calculations on the application form and coversheet have been revised based on gross land area.
51. Coversheet and Application form: Correct bike parking minimum to reflect LUMO 5.9.7 (*Current Development*)
Applicant Response: Bike parking calculations have been updated on the cover sheet and application form per LUMO 5.9.7.
52. Identify reserved parking space for motorcycle / mopeds on plans per LUMO 5.9.5.(L) (*Current Development*)
Applicant Response: Motorcycle parking only space has been identified on SD-2.0 site layout plan. Additionally a "motorcycle parking only sign" has been indicated in front of this parking space.
53. Sheets A 3.1 and 3.2 Show LUMO defined building envelope. Height Envelope per building is relative to mean finished grade along street facade per LUMO 3.8.2(f-g) and Appendix A: Definitions (*Current Development*)
Applicant Response: Please see sheet A1.1 for building envelope as measured from mean finished grade along the street façade.

54. Application form: Revise sidewalk material from Asphalt to Concrete (page 4) (*Current Development*)
Applicant Response: Sidewalk material has been revised from asphalt to concrete on page four of the site plan application.
55. Condition for Planning Commission: 5 foot sidewalk to be installed according to approved plans prior to issuance of first Certificate of Occupancy (*Current Development*)
Applicant Response: The above note has been added to sheet SD-0.0 Cover Sheet. Please refer to the General Conditions of Approval note #6.
56. Sheet SD 2.0 remedy not conflict: 4/SD 2.0 #9 and 7/SD 2.0 #5. also in #5 revise phone number for 919-969-5096 (*Current Development*)
Applicant Response: Note conflict 5/SD-2.0 #9 and 7/SD-2.0 #5&6 and phone number in #5 have been revised.
57. Condition for Planning Commission: Above ground utility lines are required to be buried in accordance with LUMO 5.12.2. Utility Plans demonstrating compliance with this requirement shall be submitted prior to issuance of a Final Plans Zoning Compliance Permit. (*Current Development*)
Applicant Response: The above note has been added to sheet SD-0.0 Cover Sheet. Please refer to the General Conditions of Approval note #7.
58. Application form: (1) Page 1: correct description: The existing structure is a single family dwelling with Accessory Apartment. The proposed structure is a multi-family building containing 4 units. (2) confirm that distance from north (solar) setback is measured along N-S axis as required by LUMO 3.8.2(j). (2) Page 4 correct parking figures: 12 regular spaces are proposed. It would also make sense to note that there is no min/max for regular spaces - just for total spaces. Correct Bike Parking minimum (*Current Development*)
Applicant Response: Project description on page one of the application form has been revised. Solar setback distances have been revised on the application form (measured along N-S axis). Parking information has been revised on page four of the application form.
59. Vehicular Parking: While the proposed plan is in compliance with LUMO 5.9.7 we do not believe it matches the intent in LUMO 5.1.1 in providing for developments arranged in a safe, orderly manner that matches the proposed use intensity of the site. We believe that the site design poses a significant code enforcement risk with a deficit, assuming a conservative estimate of one occupant per room, of 15 vehicular spaces. We are concerned that the driveway, which also serves as a fire lane, will be blocked by parked cars preventing access of emergency vehicles. We are interested in working with the applicant to mitigate this code enforcement risk such as agreeing lease restrictions to limit the number of occupants per room and/or unit, "unbundling" parking spaces from leases, and commitment to engaging a private towing service to remove any vehicles not parked in a marked space. We believe that such conditions would be in accordance with the Planning Commission's ability to "impose such reasonable conditions on an approval as will ensure compliance with applicable regulations." [LUMO 4.7.2(b)(3)] We strongly recommend the applicant revise plans to propose a number of bedrooms that is in better

alignment with the maximum allowable number of vehicular parking spaces. (*Current Development*)

Applicant Response: Developer is now proposing seven dwelling units which will allow a maximum of 18 vehicular parking spaces per the LUMO. In addition to the 18 vehicular parking spaces proposed the developer is providing 30 bicycle parking spaces. Developer is willing to further discuss lease terms with TOCH Planning staff.

60. Sidewalk: Based on the proposed intensity of the site and the applicant's anticipated heavy bike and pedestrian flows from the site, extend the 5-foot sidewalk approximately 330 feet to Mason Farm Road, along the Town's existing ROW in front of the Kehillah and provide in accordance with LUMO 5.8.1(e). We believe that such a requirement is practicable, is roughly proportional, and directly related to expected impacts from this proposed development. (*Current Development*)

Applicant Response: There is not rational nexus to extend a sidewalk to Mason Farms Road associated with this project. Additionally there would be significant impact to the Kehillah property including removal of many mature trees along Purefoy Road, grading which likely would extend onto the Kehillah property and possibly relocation of existing playground fences thus creating smaller playground areas.

61. The deck on the east elevation is still abutting and oriented towards single family residential properties to the south. We recommend that the orientation and location be revised or that the staircase be enclosed so as to mitigate the potential for noise ordinance violations resulting from use of the deck. We note that the current property has been the location of noise ordinance violations within the last year. (*Current Development*)

Applicant Response: Thank you for this comment. There is no requirement of the LUMO to enclose the staircase. Property owner will continue to work with tenants regarding any noise concerns.

INSPECTIONS:

62. No more comments from inspections (*Inspections*)

Applicant Response: Noted, thank you.

ENGINEERING:

63. The proposed 4'X40' (160 square foot) roll cart pad would require an encroachment agreement based upon size. At this time an encroachment for such roll carts is not approvable as it presents a safety hazard for vehicular traffic on Purefoy Rd with the potential for one or more of the 12 carts to tip over into the street and a water quality hazard with the same potential for a cart to tip over into the ditch. (*Engineering*)

Applicant Response: Proposed roll cart pad has been removed from the edge of Purefoy Road.

64. Proposed double-stack parking does not comply with standards for stalls and aisles set forth in the Town's standard details and specifications [LUMO 5.9.5(e)] (*Engineering*)

Applicant Response: Double-stack parking has been removed.

65. Proposed 35-foot wide drive aisle in rear parking area appears to be additional parking area. The standard drive aisle width for a single bay of parking is 20 feet. On a related note, stormwater control measures are allowed to be placed under parking spaces, provided that accesses are within the drive aisle. (*Engineering*)

Applicant Response: Proposed rear parking has been revised per ToCH design standards to minimum dimensional requirements. Access to underground stormwater control measure will be provided within drive aisle.

66. Provide curb and gutter on both sides of driveway. (*Engineering*)

Applicant Response: Curb and gutter has been provided as needed along proposed driveway for stormwater conveyance purposes. The driveway proposed is a private driveway and the LUMO does not require curb and gutter on both sides.

[NO CATEGORY]:

67. Provide how the 2-year post-development volume with treatment 31,510 cf (i.e. in section of the runoff analysis summary) was computed. The calculation document shows that 0.565 af runoff was generated from the 2-year bypass for basin 1 and 0.269 af outflow from detention system making a total of 0.834 af (i.e. 36,329 cf). Address. (*Stormwater*)

Applicant Response: The pre-development 2-yr runoff volume was calculated to be 2919 cf (0.067 ac-ft), and the post-development 2-yr runoff volume was calculated to be 5576 cf (0.128 ac-ft) with no detention/treatment. The increase in 2-yr volume is detained and released over a 2-5 day period by the proposed Storm Filter and underground detention system. The total volume detained during the 2-yr storm event was calculated to be 2,669 cf. So, the 2-yr runoff volume that is not controlled is 2,907 cf which is less than the pre-development volume. In addition, the 2-yr volume that bypasses the detention system was calculated to be 2,134 cf (0.049 ac-ft). So, the difference, 773 cf, will be released by the Storm Filter and detention system over a period of time that occurs after the peak from the rainfall event and the 2 day minimum requirement of the Town of Chapel Hill. So, the net effect will be that the downstream properties should see a lower runoff volume during the 2-yr storm than occurs under the current conditions.

OWASA:

Purefoy Road Apartments
OWASA 2nd Site Plan Review Comments
Nick Parker – 2017-06-15

Preston,

I reviewed the drawings dated 5/26/17 and have comments to share:

- There are likely better ways to provide water services to Building 2 instead of 5 new taps to the main in the road. Consider 1 tap with main extension into site.
Applicant Response: A private water main has been extended onto the site in an effort to simplify the new water supply system.
- Include a sewer service for Building 1.
Applicant Response: There are now two proposed sewer services tying to the existing SSMH.

- Sewer services will need to be ductile iron pipe from cleanout to manhole.
Applicant Response: Plan labels on utility plan have been revised to indicate ductile iron pipe from the existing sanitary sewer manhole to the first cleanout.

Please call if you have any questions or require additional information.

Sincerely,
Coulter Jewell Thames, P.A.

Andrew J. Porter, RLA
Landscape Architect



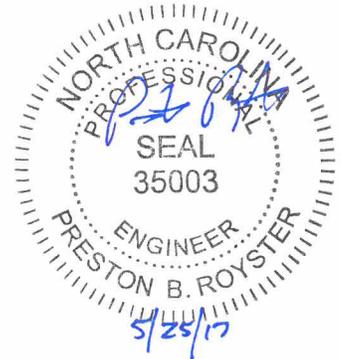
Coulter | Jewell | Thames, P.A.

Purefoy Road Apartments

FIRE FLOW ANALYSIS

Site Plan Submittal

PIN #
9788-41-9609



Calculations By: Preston B. Royster, PE

**Coulter Jewell Thames, P.A.
111 West Main Street
Durham, NC 27701
Ph: 919-682-0368
Fax: 919-688-5646**

NC Board of Engineers & Surveyors License No. C-1209

May 25, 2017

Project Description and Summary:

The Purefoy Road Apartments Project is located at 111 Purefoy Road, Chapel Hill, NC 27514. The project involves one building addition to an existing residence, construction of two new duplexes, concrete sidewalks, and paved driveways and parking spaces.

As part of this project, a new fire hydrant is proposed that will be tapped off the existing 8" main along the frontage of the site. The only proposed water line extensions onto the site are for domestic flow and NFPA 13 sprinkler systems.

The existing site is fed by the OWASA water system. There is an existing 8" line in Purefoy Rd along the site's frontage. The proposed hydrant will be tapped directly off of the existing main.

Based on a preliminary analysis of the existing system, the Town's minimum fire flow of 2,500 gpm at 20 psi is not obtainable at this location due to limitations of the existing water system. With that said, a flow of 2,350 gpm can be obtained with a residual pressure of 21.04 psi. According to Table B105.1 in Appendix B of the NC Fire Code, the required fire flow for Type V-B construction and a 9,576 sf building (the new, larger building) is 2,750 gpm. Since an automatic sprinkler system will be installed, the required fire flow can be reduced by up to 50%. The provided fire flow of 2,350 gpm is a reduction of approximately 15%. Given this, the provided fire flow of 2,350 gpm should be acceptable.

The water system was modeled using WaterCAD v8i. The proposed hydrant is represented by node "FH-1" in the model. With a fire flow demand of 2,350 gpm, we were able to obtain a pressure of 21.04 psi. This meets the minimum required flow based on Table B150.1 in the NC Fire Code and is close to the Town of Chapel Hill's required flow of 2,500 gpm.

Copies of the final calculations from the WaterCAD model and the fire flow test results are attached. In summary, this study indicates that this development can be constructed as proposed and provide adequate fire flow according to the methodologies described above.

FIRE FLOW CALCULATIONS

Orange Water And Sewer Authority



Fire Flow Test Report

Location Purefoy Road

Test Made By: Crew 4 Time: 08:20 AM Date: 06/21/16

Requested By: Andy Porter Phone: (919) 682-0368

Date Requested: 6/14/2016 FAX: _____

Flow Hydrant No. 1915 Gauge Hydrant No. 800

Hydrant Make Flow: American Darling Nozzle Size: 2½"

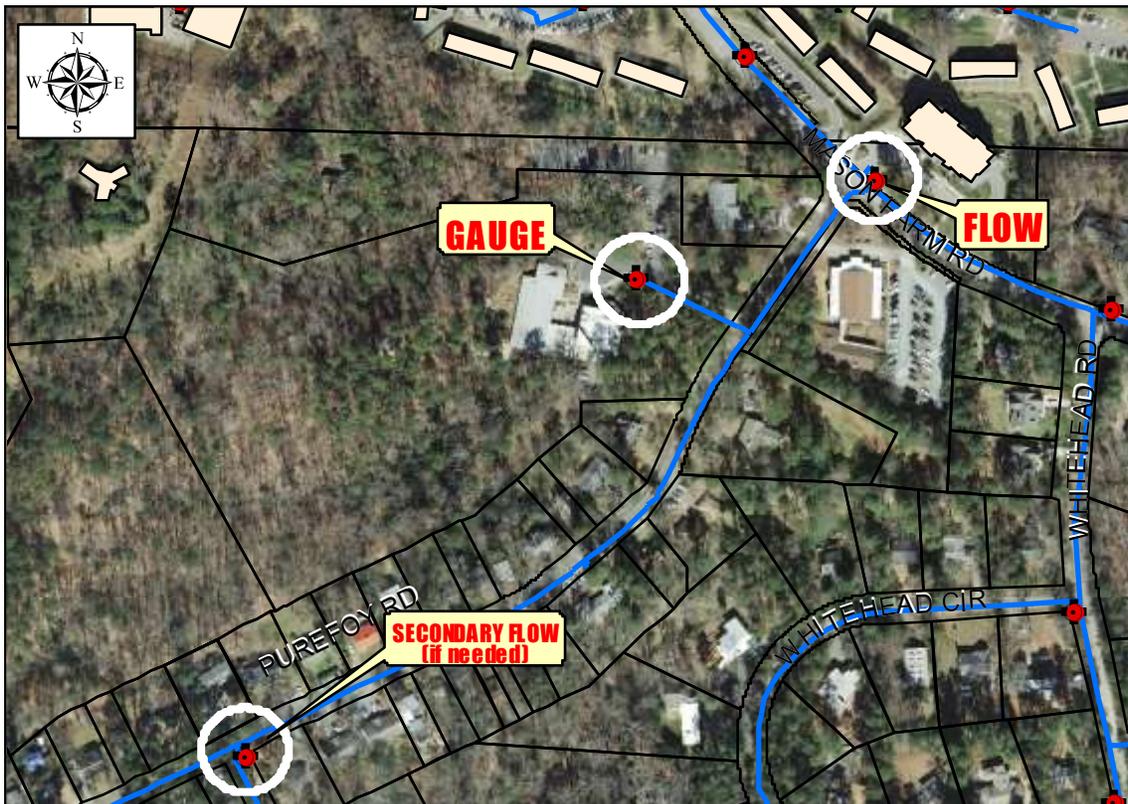
Hydrant Make Gauge: CLOW Nozzle Size: 2½"

Expected Static Pressure (PSI): _____ (Approx.)

Static Pressure (PSI): 86 Pitot Reading: 80 / 65

Residual Pressure (PSI) 72 Flow (GPM): 1500 / 1350

Sketch:



WATER PRESSURE ROUTING

PROJECT : Purefoy Road Apartments

DATE: 05/01/17

FIRE FLOW TEST RESULTS

Flow Hydrants: 1915

Pressure Hydrant: 800

Date of Flow: 6/21/2016

STATIC = 86 PSI

= **198.6 FT**

RESID. = 72 PSI

= **166.3 FT**

FLOW = **1500 GPM**

Q@20 = **3465.3 GPM**

R@20 = 20.0 PSI

= **46.2 FT**

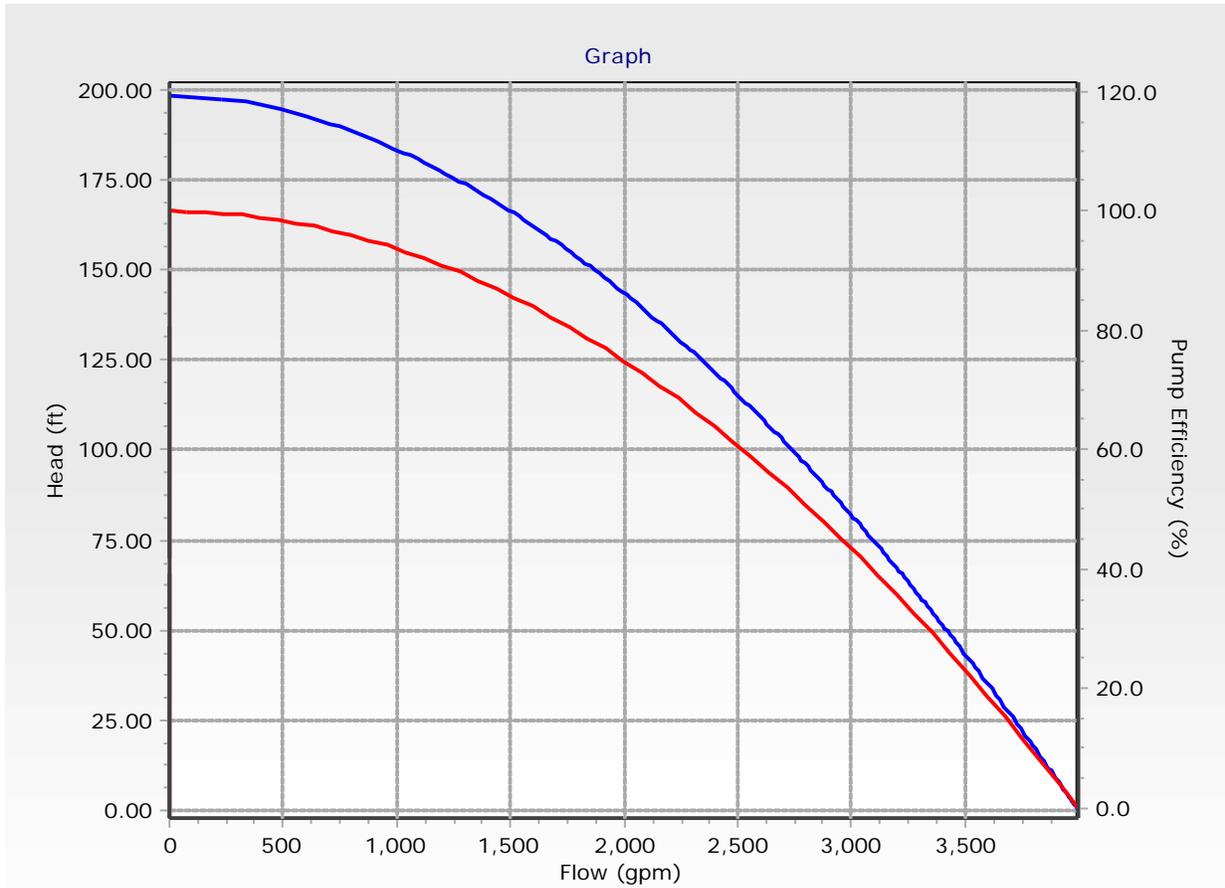
FlexTable: Pump Table

ID	Label	Elevation (ft)	Pump Definition	Status (Initial)	Hydraulic Grade (Suction) (ft)
34	PMP-1	434.00	Pump Definition - 1	On	434.00
Hydraulic Grade (Discharge) (ft)	Flow (Total) (gpm)	Pump Head (ft)			
558.39	2,350	124.39			

Pump Definition Detailed Report: Pump Definition - 1

Element Details			
ID	35	Notes	
Label	Pump Definition - 1		
Pump Definition Type			
Pump Definition Type	Standard (3 Point)	Design Head	166.30 ft
Shutoff Flow	0 gpm	Maximum Operating Flow	3,465 gpm
Shutoff Head	198.60 ft	Maximum Operating Head	46.20 ft
Design Flow	1,500 gpm		
Pump Efficiency Type			
Pump Efficiency Type	Best Efficiency Point	Motor Efficiency	100.0 %
BEP Efficiency	100.0 %	Is Variable Speed Drive?	False
BEP Flow	0 gpm		
Transient (Physical)			
Inertia (Pump and Motor)	0.000 lb-ft ²	Specific Speed	SI=25, US=1280
Speed (Full)	0 rpm	Reverse Spin Allowed?	True

Pump Definition Detailed Report: Pump Definition - 1



FlexTable: Pipe Table

ID	Label	Length (Scaled) (ft)	Start Node	Stop Node	Diameter (in)	Material	Hazen-Williams C	Has Check Valve?
36	P-1	34	R-1	PMP-1	48.0	Ductile Iron	150.0	False
37	P-2	33	PMP-1	J-1	48.0	Ductile Iron	150.0	False
38	P-3	86	J-1	J-2	8.0	Ductile Iron	110.0	False
39	P-4	24	J-2	FH-1	6.0	Ductile Iron	120.0	False
Minor Loss Coefficient (Local)	Flow (gpm)	Velocity (ft/s)	Headloss Gradient (ft/ft)	Has User Defined Length?	Length (User Defined) (ft)			
0.000	2,350	0.42	0.000	True	1			
0.000	2,350	0.42	0.000	True	1			
0.000	2,350	15.00	0.146	True	285			
0.000	2,350	26.67	1.210	True	24			

FlexTable: Junction Table

ID	Label	Elevation (ft)	Zone	Demand Collection	Demand (gpm)	Hydraulic Grade (ft)	Pressure (psi)
30	J-1	434.00	<None>	<Collection: 0 items>	0	558.39	53.82
31	J-2	440.00	<None>	<Collection: 0 items>	0	516.67	33.17
32	FH-1	439.00	<None>	<Collection: 1 items>	2,350	487.64	21.04



Coulter | Jewell | Thames, PA

Purefoy Road Apartments

STORMWATER IMPACT STATEMENT

PIN:
9788-41-9609

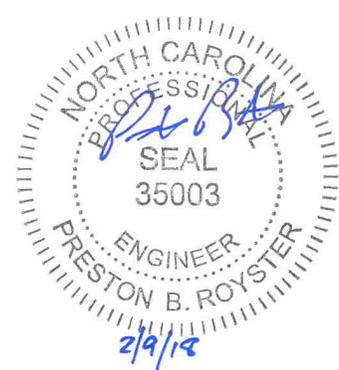
Calculations By: Jacy C. Jennings, PE
Checked By: Preston B. Royster, PE

Coulter Jewell Thames, P.A.
111 West Main Street
Durham, NC 27701
Ph: 919-682-0368
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NC Board of Engineers & Surveyors License #C-1209

Project # 1642

May 24, 2017
Revised: February 9, 2018



Project Description and Summary

The Purefoy Road Apartments Project is located at 111 Purefoy Road, Chapel Hill, NC 27514. The project involves the construction of two apartment buildings, concrete sidewalks, and paved driveways and parking spaces. Calculations for peak discharge, runoff volume, and water quality treatment for all of the proposed improvements are provided.

The Purefoy Road Apartments site is currently zoned R-4 Medium Density Residential. Soils on the site include Appling-Urban Land Complex (hydrologic soil group B), and Wedowee (hydrologic soil group B). The proposed site is located in the Cape Fear River Basin within the Jordan Lake watershed protection district.

Per the Town of Chapel Hill stormwater ordinance, the stormwater runoff rate leaving the site under post-development conditions may not exceed the stormwater runoff rate under pre-development conditions for the 1-year, 2-year, and 25-year storms. The additional runoff volume from the pre-development to post-development conditions for the 2-year storm must also be captured on-site.

Methodology

- The Orange County Soil Survey is used to identify the soil types located on the site.
- HydroCAD software is used to calculate pre- and post-development peak flow rates and volumes for each sub-basin. HydroCAD uses the SCS TR-20 method to develop hydrographs.
- HydroCAD software is used to calculate the composite curve number for each sub-basin. HydroCAD uses the NRCS TR-55 method for calculation composite curve numbers.

Discussion of Results

Q1/Q2/Q25:

For the peak discharge calculations, the 1.3 acre site was analyzed as a single basin. An analysis point was set at the lowest point on the southern property line. Under pre-development conditions, the time of concentration for the site was calculated to be 5.0 minutes. Under post-development conditions, the minimum time of concentration, 5.0 minutes, was used. As a result of the proposed improvements, there is an increase in runoff from the 1-year, 2-year, and 25-year storms. An underground detention system is proposed to provide attenuation.

With the addition of the underground detention system, the peak flow is reduced by 15.8% for the 1-yr storm, 20.5% for the 2-yr storm, and 4.6% for the 25-yr storm. In addition, the underground detention system is designed to safely pass the 100-yr storm.

2-yr Runoff Volume:

Per the Town of Chapel Hill Design Manual, “the post-development stormwater runoff rate leaving the site shall not exceed the pre-development (existing conditions) stormwater runoff rate leaving the site for the local 1-year, 2-year, and 25-year storm events.” In addition, “the post-development stormwater runoff volume leaving the site shall not exceed the pre-development (existing conditions) stormwater runoff volume leaving the site for the local 2-year frequency, 24-hour duration storm event.” The stormwater runoff volume for the site under pre-development conditions was calculated to be 2,919 cf and the post-development volume was calculated to be 5,576 cf. Because there is an increase of 2,657 cf, stormwater control measures are proposed to provide detention. The proposed underground detention system, including splitter box, outlet structure, and associated pipe conveyance, provides 2,669 cf of storage during the 2-yr storm which is sufficient for what is required.

85% TSS Removal:

The Town of Chapel Hill Design Manual states that BMP’s shall be designed to remove 85% average total suspended solids from the post-development stormwater runoff.

The proposed project results in an increase in impervious surface of approximately 14,558 sf. As a result, a BMP must be installed to treat for 85% TSS removal for the additional impervious surface added.

In order to meet this requirement, a StormFilter is proposed. The total impervious area that drains to the StormFilter is 15,937 sf. Since the amount of impervious surface draining to the StormFilter is greater than the proposed increase in impervious surface, the requirement for treating the runoff from all added impervious surface for 85% TSS removal is met.

Calculations for the StormFilter is included.

Conclusion:

Because the increase in impervious surfaces as a result of this project resulted in an increase in peak flow for the 1-year, 2-year, and 25-year storms, and in runoff volume for the 2-year storm, detention and treatment are proposed in the form of an underground detention system and StormFilter.

**STORMWATER PEAK
RUNOFF CALCULATIONS**

Run-off Summary

Drainage Basin	Pre-Dev						Post-Dev						Percentage Increase			Remark
	Tc	Area	CN	Q1	Q2	Q25	Tc	Area	CN	Q1	Q2	Q25	Q1	Q2	Q25	
	<i>min</i>	<i>ac</i>		<i>cfs</i>	<i>cfs</i>	<i>cfs</i>	<i>min</i>	<i>ac</i>		<i>cfs</i>	<i>cfs</i>	<i>cfs</i>	%	%	%	
Site	5.0	1.30	62	0.76	1.32	5.04	5.0	1.30	73	2.03	2.84	7.43	167.1	115.2	47.4	DETENTION REQUIRED
To Detention							5.0	0.41	94	0.07	0.10	1.94				
Bypass Detention							5.0	0.89	63	0.59	0.99	3.59				
Combined Hydrograph								1.30		0.64	1.05	4.81	-15.8	-20.5	-4.6	



Pre-Dev Site



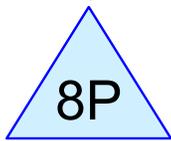
Post-Dev Site



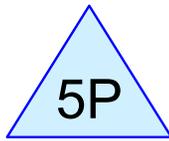
To Detention



Bypass Detention



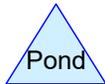
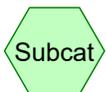
WQV Detention



Underground Detention



Combined Hydrograph



Drainage Diagram for STORM STUDY - 1642 JCJ
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STORM STUDY - 1642 JCJ

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Summary for Subcatchment 1S: Pre-Dev Site

Runoff = 0.76 cfs @ 11.98 hrs, Volume= 0.043 af, Depth> 0.40"

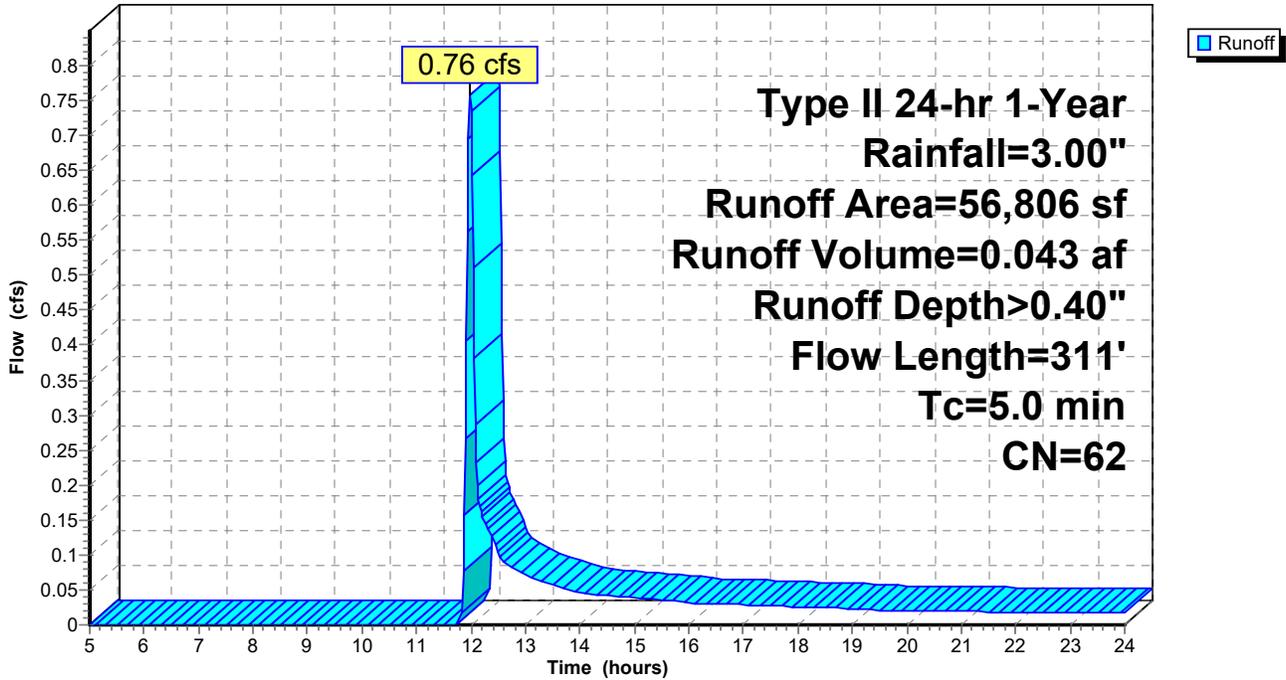
Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-24.00 hrs, dt= 0.02 hrs
 Type II 24-hr 1-Year Rainfall=3.00"

Area (sf)	CN	Description
5,744	98	Paved parking, HSG B
23,611	55	Woods, Good, HSG B
27,451	61	>75% Grass cover, Good, HSG B
56,806	62	Weighted Average
51,062		89.89% Pervious Area
5,744		10.11% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.9	11	0.0900	0.21		Sheet Flow, Grass: Short n= 0.150 P2= 3.50"
0.8	79	0.0630	1.68	0.19	Trap/Vee/Rect Channel Flow, Bot.W=0.00' D=0.10' Z= 7.0 & 15.0 '/' Top.W=2.20' n= 0.030
0.9	106	0.0940	2.06	0.52	Trap/Vee/Rect Channel Flow, Bot.W=0.00' D=0.10' Z= 25.0 '/' Top.W=5.00' n= 0.030
1.3	115	0.0480	1.47	0.29	Trap/Vee/Rect Channel Flow, Bot.W=0.00' D=0.10' Z= 20.0 '/' Top.W=4.00' n= 0.030
1.1					Direct Entry, Adjust to Minimum Tc
5.0	311	Total			

Subcatchment 1S: Pre-Dev Site

Hydrograph



STORM STUDY - 1642 JCJ

Type II 24-hr 1-Year Rainfall=3.00"

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Summary for Subcatchment 2S: Post-Dev Site

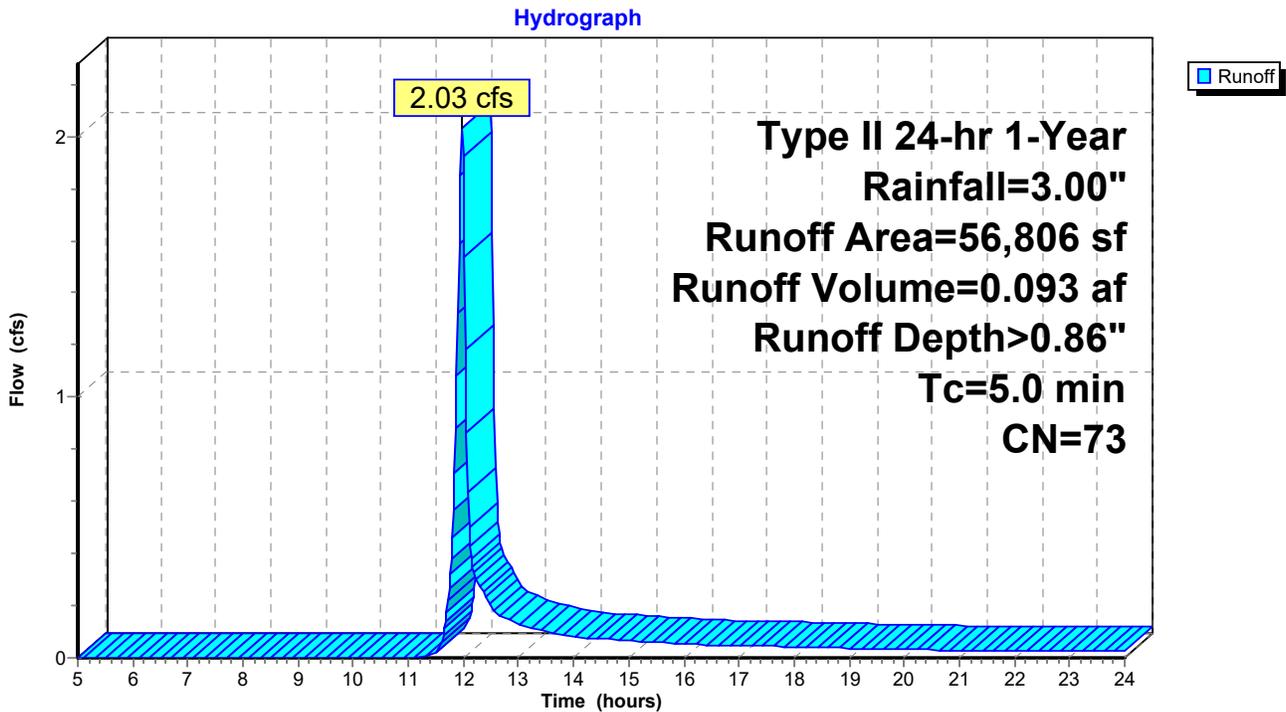
Runoff = 2.03 cfs @ 11.97 hrs, Volume= 0.093 af, Depth> 0.86"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-24.00 hrs, dt= 0.02 hrs
 Type II 24-hr 1-Year Rainfall=3.00"

Area (sf)	CN	Description
20,302	98	Paved parking, HSG B
12,182	55	Woods, Good, HSG B
24,322	61	>75% Grass cover, Good, HSG B
56,806	73	Weighted Average
36,504		64.26% Pervious Area
20,302		35.74% Impervious Area

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

Subcatchment 2S: Post-Dev Site



STORM STUDY - 1642 JCJ

Type II 24-hr 1-Year Rainfall=3.00"

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Summary for Subcatchment 3S: To Detention

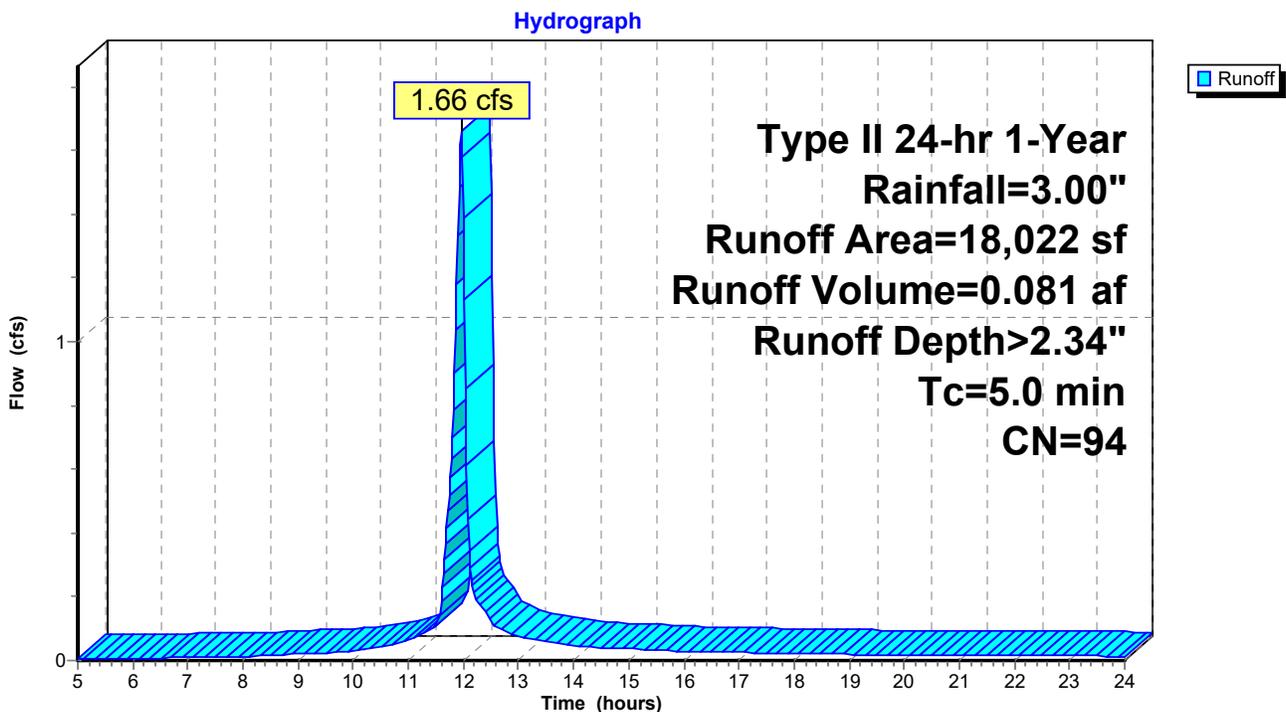
Runoff = 1.66 cfs @ 11.96 hrs, Volume= 0.081 af, Depth> 2.34"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-24.00 hrs, dt= 0.02 hrs
 Type II 24-hr 1-Year Rainfall=3.00"

Area (sf)	CN	Description
15,937	98	Paved parking, HSG B
2,085	61	>75% Grass cover, Good, HSG B
18,022	94	Weighted Average
2,085		11.57% Pervious Area
15,937		88.43% Impervious Area

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

Subcatchment 3S: To Detention



STORM STUDY - 1642 JCJ

Type II 24-hr 1-Year Rainfall=3.00"

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Summary for Subcatchment 4S: Bypass Detention

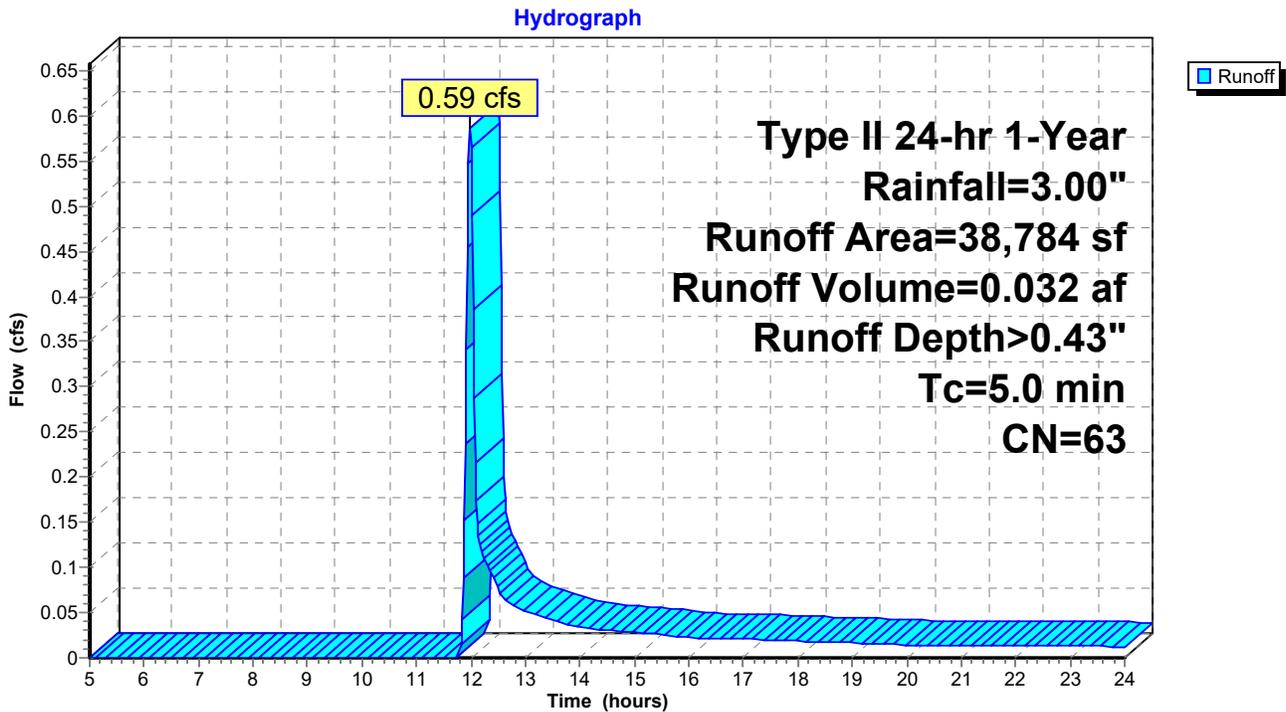
Runoff = 0.59 cfs @ 11.98 hrs, Volume= 0.032 af, Depth> 0.43"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-24.00 hrs, dt= 0.02 hrs
 Type II 24-hr 1-Year Rainfall=3.00"

Area (sf)	CN	Description
4,365	98	Paved parking, HSG B
12,182	55	Woods, Good, HSG B
22,237	61	>75% Grass cover, Good, HSG B
38,784	63	Weighted Average
34,419		88.75% Pervious Area
4,365		11.25% Impervious Area

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

Subcatchment 4S: Bypass Detention



STORM STUDY - 1642 JCJ

Type II 24-hr 1-Year Rainfall=3.00"

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Summary for Pond 5P: Underground Detention

Inflow = 1.71 cfs @ 11.92 hrs, Volume= 0.032 af
 Outflow = 0.04 cfs @ 13.28 hrs, Volume= 0.031 af, Atten= 98%, Lag= 81.8 min
 Primary = 0.04 cfs @ 13.28 hrs, Volume= 0.031 af

Routing by Stor-Ind method, Time Span= 5.00-24.00 hrs, dt= 0.02 hrs
 Peak Elev= 422.55' @ 13.28 hrs Surf.Area= 649 sf Storage= 1,059 cf

Plug-Flow detention time= 294.6 min calculated for 0.031 af (97% of inflow)
 Center-of-Mass det. time= 290.0 min (1,032.5 - 742.5)

Volume	Invert	Avail.Storage	Storage Description
#1	420.40'	2,572 cf	60.0" D x 131.0'L Pipe Storage

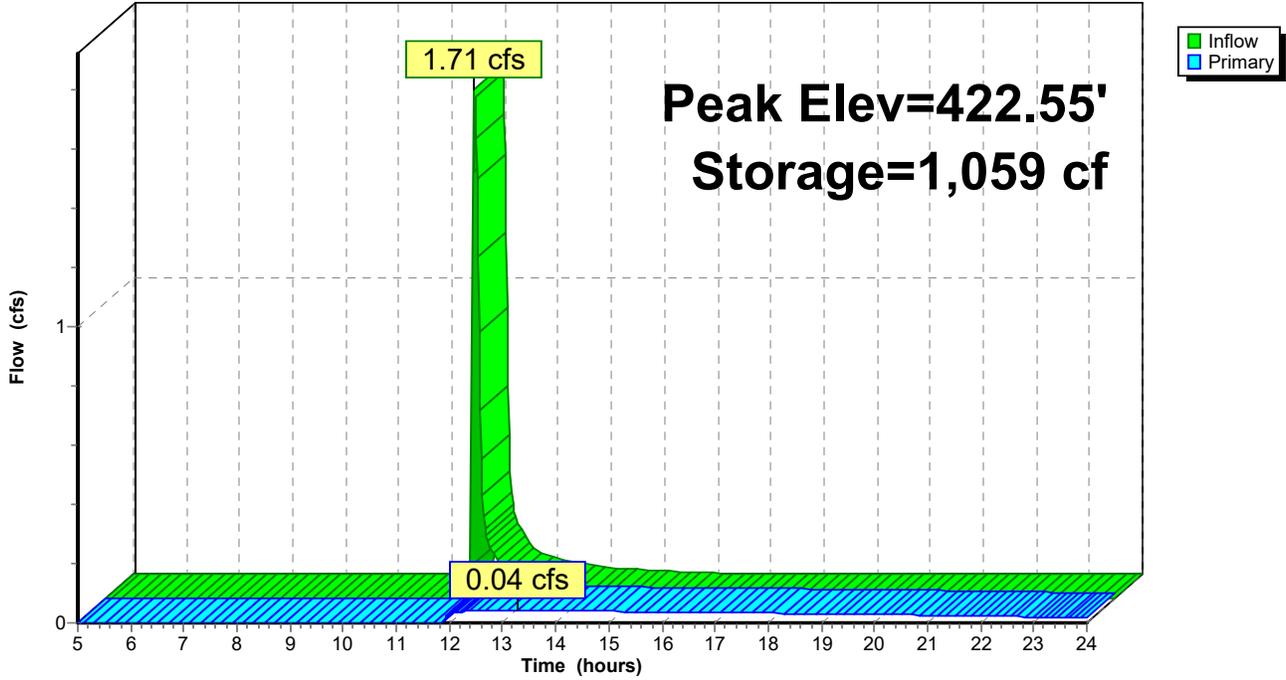
Device	Routing	Invert	Outlet Devices
#1	Primary	420.10'	18.0" Round Culvert L= 8.0' RCP, square edge headwall, Ke= 0.500 Outlet Invert= 420.00' S= 0.0125 '/' Cc= 0.900 n= 0.013 Concrete pipe, bends & connections
#2	Device 1	420.20'	1.0" Vert. Orifice/Grate C= 0.600
#3	Device 1	423.20'	16.0" W x 2.0" H Vert. Orifice/Grate C= 0.600
#4	Device 1	425.15'	6.0' long x 0.5' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Primary OutFlow Max=0.04 cfs @ 13.28 hrs HW=422.55' (Free Discharge)

- 1=Culvert (Passes 0.04 cfs of 11.10 cfs potential flow)
- 2=Orifice/Grate (Orifice Controls 0.04 cfs @ 7.32 fps)
- 3=Orifice/Grate (Controls 0.00 cfs)
- 4=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Pond 5P: Underground Detention

Hydrograph



STORM STUDY - 1642 JCJ

Type II 24-hr 1-Year Rainfall=3.00"

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Summary for Pond 8P: WQV Detention

Inflow Area = 0.414 ac, 88.43% Impervious, Inflow Depth > 2.34" for 1-Year event
 Inflow = 1.66 cfs @ 11.96 hrs, Volume= 0.081 af
 Outflow = 1.74 cfs @ 11.92 hrs, Volume= 0.063 af, Atten= 0%, Lag= 0.0 min
 Primary = 0.03 cfs @ 11.92 hrs, Volume= 0.031 af
 Secondary = 1.71 cfs @ 11.92 hrs, Volume= 0.032 af

Routing by Stor-Ind method, Time Span= 5.00-24.00 hrs, dt= 0.02 hrs
 Peak Elev= 425.75' @ 11.92 hrs Surf.Area= 165 sf Storage= 1,023 cf

Plug-Flow detention time= 160.4 min calculated for 0.063 af (78% of inflow)
 Center-of-Mass det. time= 76.2 min (861.7 - 785.5)

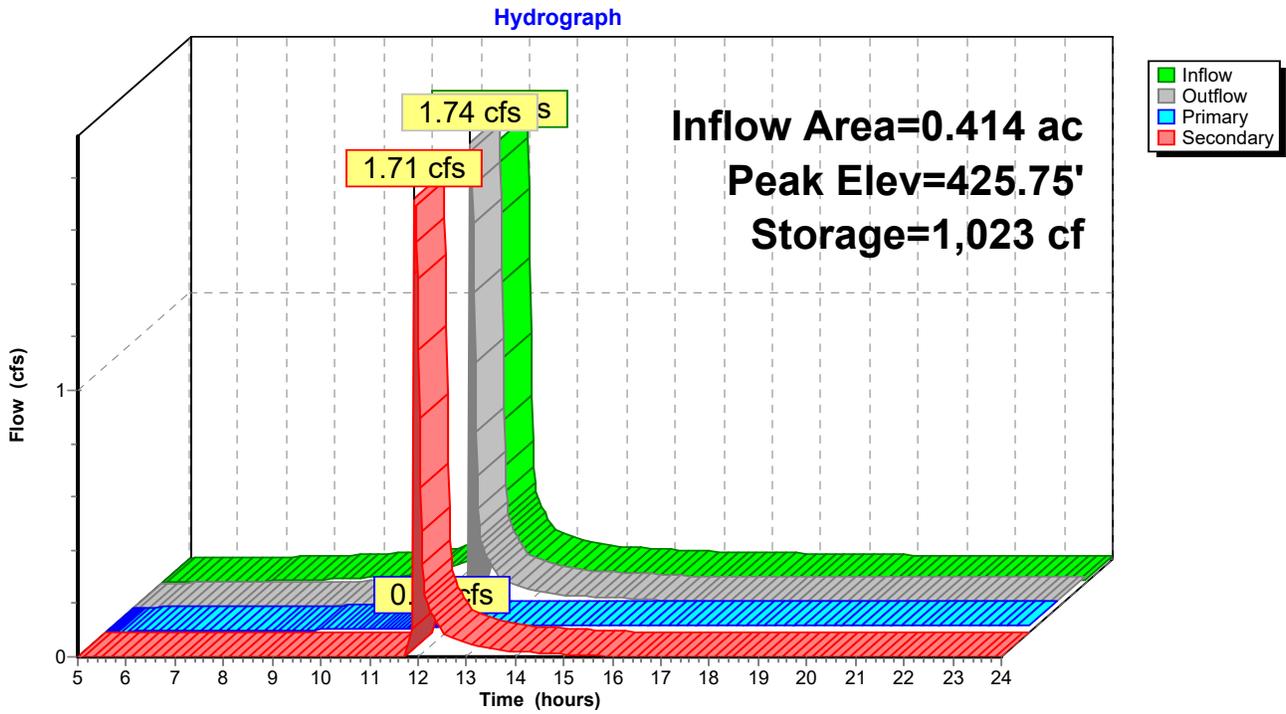
Volume	Invert	Avail.Storage	Storage Description
#1	421.25'	1,080 cf	60.0" D x 55.0'L Pipe Storage

Device	Routing	Invert	Outlet Devices
#1	Primary	421.25'	0.4" Horiz. Orifice/Grate X 3.00 C= 0.600 Limited to weir flow at low heads
#2	Secondary	425.55'	7.0' long x 0.5' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Primary OutFlow Max=0.03 cfs @ 11.92 hrs HW=425.75' (Free Discharge)
 ↳ **1=Orifice/Grate** (Orifice Controls 0.03 cfs @ 10.21 fps)

Secondary OutFlow Max=1.71 cfs @ 11.92 hrs HW=425.75' (Free Discharge)
 ↳ **2=Broad-Crested Rectangular Weir** (Weir Controls 1.71 cfs @ 1.24 fps)

Pond 8P: WQV Detention



STORM STUDY - 1642 JCJ

Type II 24-hr 1-Year Rainfall=3.00"

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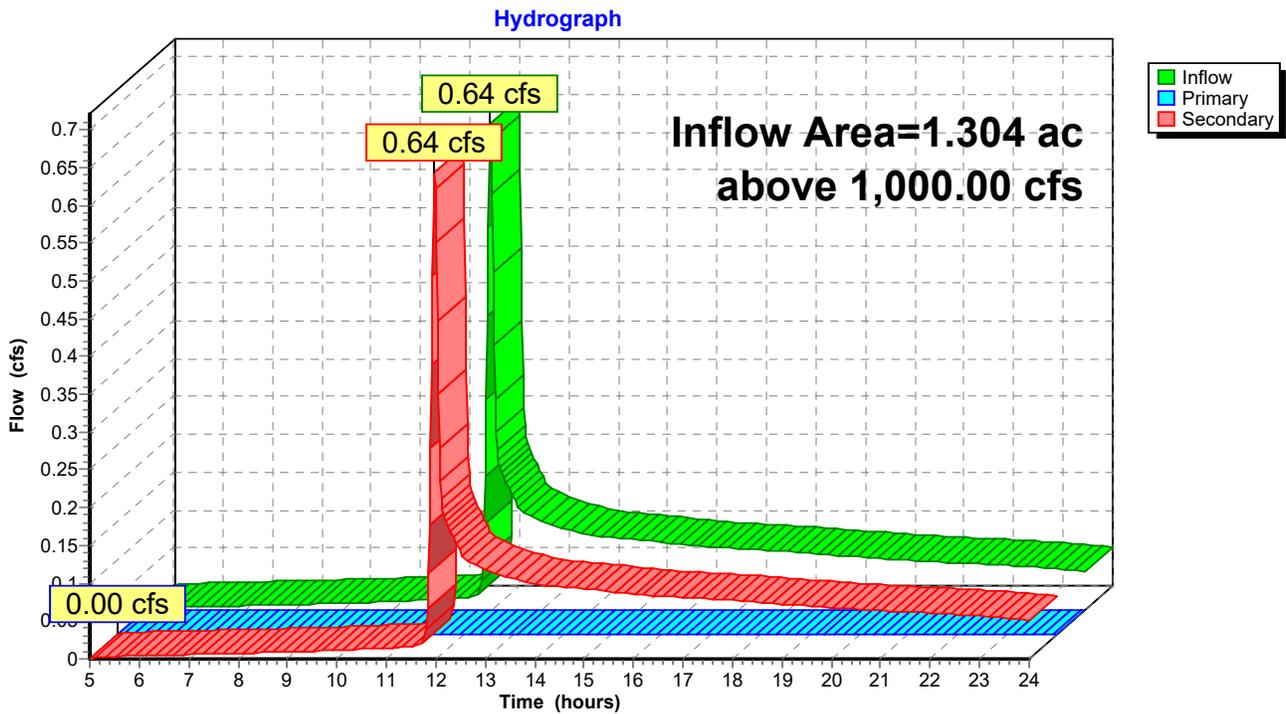
Page 11

Summary for Link 6L: Combined Hydrograph

Inflow Area = 1.304 ac, 35.74% Impervious, Inflow Depth > 0.86" for 1-Year event
Inflow = 0.64 cfs @ 11.98 hrs, Volume= 0.094 af
Primary = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min
Secondary = 0.64 cfs @ 11.98 hrs, Volume= 0.094 af

Primary outflow = Inflow above 1,000.00 cfs, Time Span= 5.00-24.00 hrs, dt= 0.02 hrs

Link 6L: Combined Hydrograph



STORM STUDY - 1642 JCJ

Type II 24-hr 2-Year Rainfall=3.50"

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Summary for Subcatchment 1S: Pre-Dev Site

Runoff = 1.32 cfs @ 11.98 hrs, Volume= 0.067 af, Depth> 0.61"

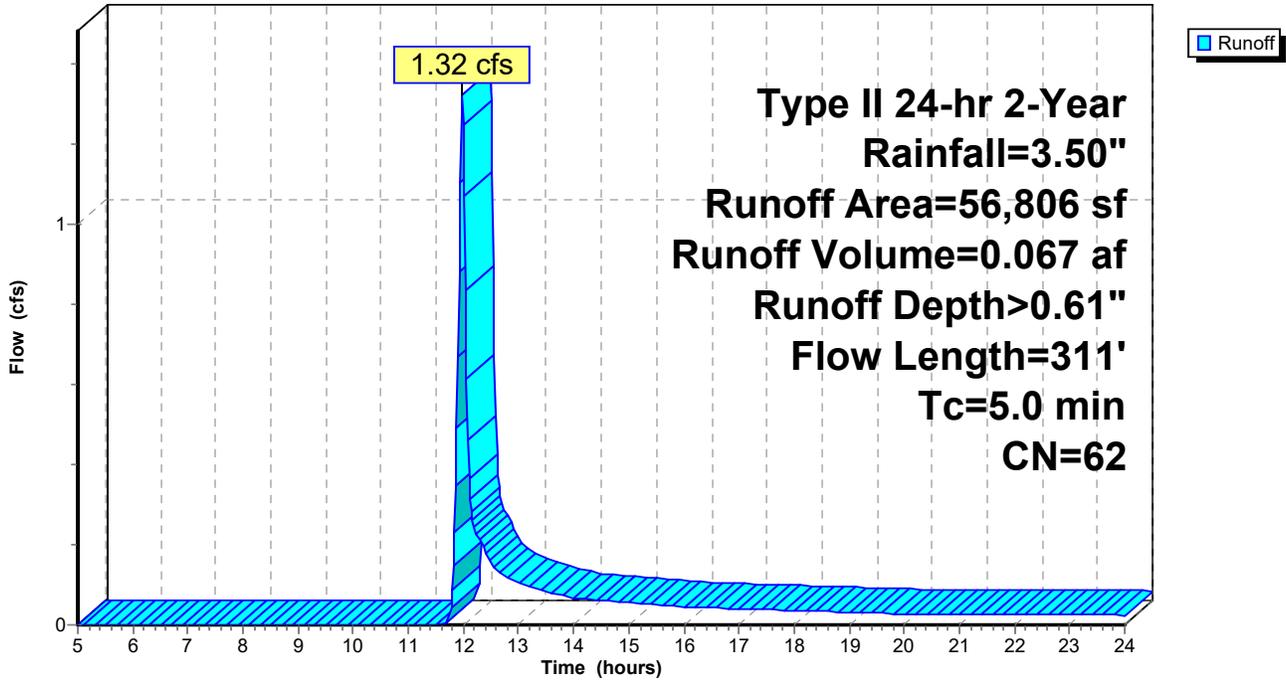
Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-24.00 hrs, dt= 0.02 hrs
Type II 24-hr 2-Year Rainfall=3.50"

Area (sf)	CN	Description
5,744	98	Paved parking, HSG B
23,611	55	Woods, Good, HSG B
27,451	61	>75% Grass cover, Good, HSG B
56,806	62	Weighted Average
51,062		89.89% Pervious Area
5,744		10.11% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.9	11	0.0900	0.21		Sheet Flow, Grass: Short n= 0.150 P2= 3.50"
0.8	79	0.0630	1.68	0.19	Trap/Vee/Rect Channel Flow, Bot.W=0.00' D=0.10' Z= 7.0 & 15.0 '/' Top.W=2.20' n= 0.030
0.9	106	0.0940	2.06	0.52	Trap/Vee/Rect Channel Flow, Bot.W=0.00' D=0.10' Z= 25.0 '/' Top.W=5.00' n= 0.030
1.3	115	0.0480	1.47	0.29	Trap/Vee/Rect Channel Flow, Bot.W=0.00' D=0.10' Z= 20.0 '/' Top.W=4.00' n= 0.030
1.1					Direct Entry, Adjust to Minimum Tc
5.0	311	Total			

Subcatchment 1S: Pre-Dev Site

Hydrograph



STORM STUDY - 1642 JCJ

Type II 24-hr 2-Year Rainfall=3.50"

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Summary for Subcatchment 2S: Post-Dev Site

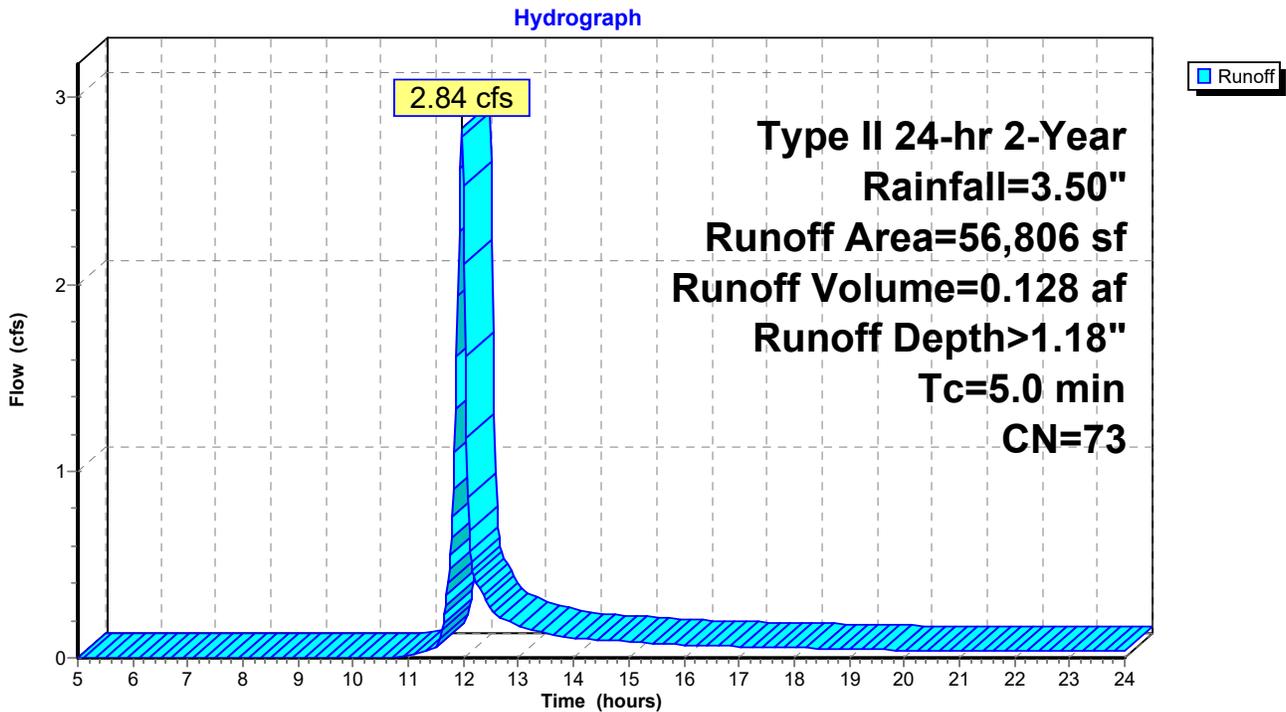
Runoff = 2.84 cfs @ 11.97 hrs, Volume= 0.128 af, Depth> 1.18"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-24.00 hrs, dt= 0.02 hrs
Type II 24-hr 2-Year Rainfall=3.50"

Area (sf)	CN	Description
20,302	98	Paved parking, HSG B
12,182	55	Woods, Good, HSG B
24,322	61	>75% Grass cover, Good, HSG B
56,806	73	Weighted Average
36,504		64.26% Pervious Area
20,302		35.74% Impervious Area

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

Subcatchment 2S: Post-Dev Site



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Type II 24-hr 2-Year Rainfall=3.50"

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Summary for Subcatchment 3S: To Detention

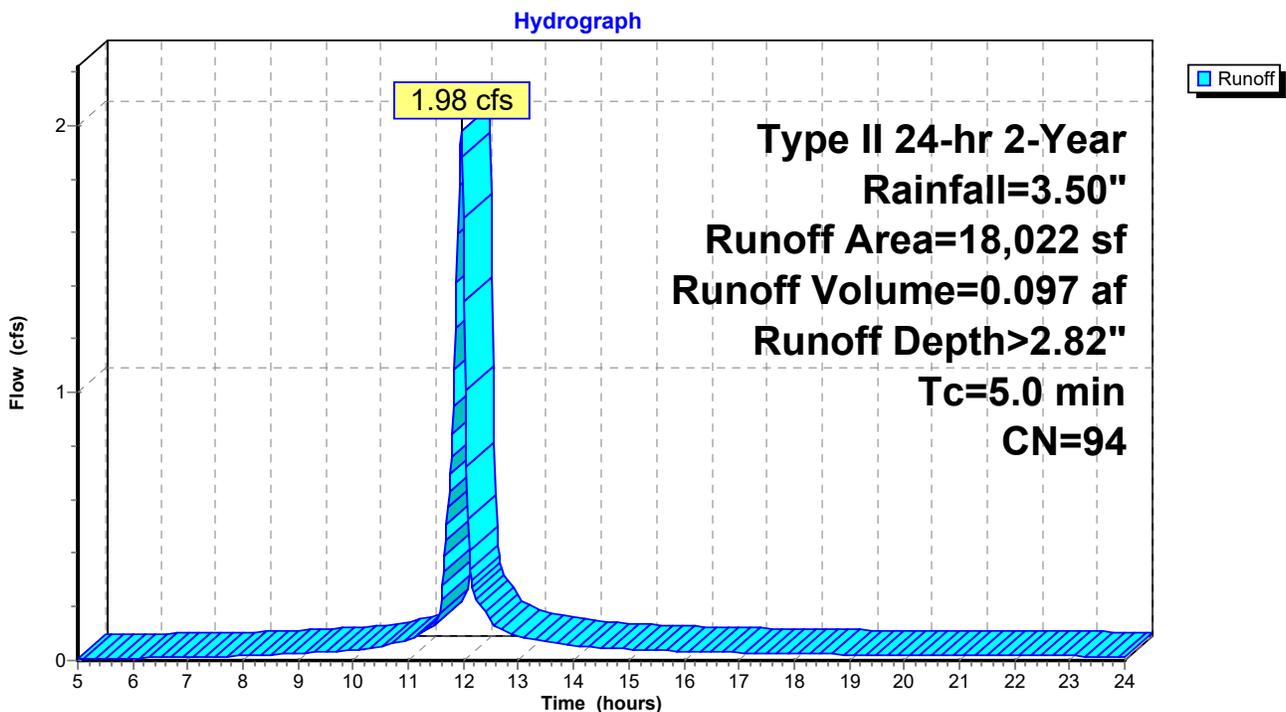
Runoff = 1.98 cfs @ 11.96 hrs, Volume= 0.097 af, Depth> 2.82"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-24.00 hrs, dt= 0.02 hrs
 Type II 24-hr 2-Year Rainfall=3.50"

Area (sf)	CN	Description
15,937	98	Paved parking, HSG B
2,085	61	>75% Grass cover, Good, HSG B
18,022	94	Weighted Average
2,085		11.57% Pervious Area
15,937		88.43% Impervious Area

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

Subcatchment 3S: To Detention



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Type II 24-hr 2-Year Rainfall=3.50"

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Summary for Subcatchment 4S: Bypass Detention

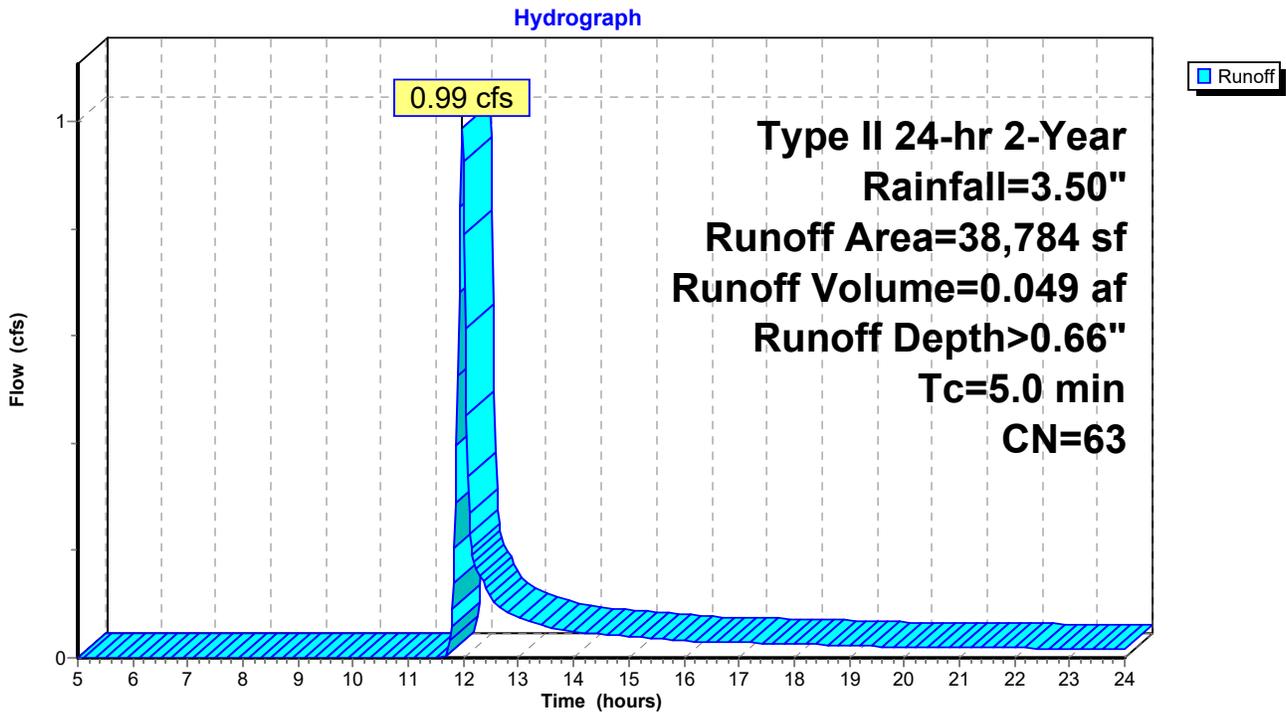
Runoff = 0.99 cfs @ 11.98 hrs, Volume= 0.049 af, Depth> 0.66"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-24.00 hrs, dt= 0.02 hrs
 Type II 24-hr 2-Year Rainfall=3.50"

Area (sf)	CN	Description
4,365	98	Paved parking, HSG B
12,182	55	Woods, Good, HSG B
22,237	61	>75% Grass cover, Good, HSG B
38,784	63	Weighted Average
34,419		88.75% Pervious Area
4,365		11.25% Impervious Area

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

Subcatchment 4S: Bypass Detention



STORM STUDY - 1642 JCJ

Type II 24-hr 2-Year Rainfall=3.50"

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Summary for Pond 5P: Underground Detention

Inflow = 1.94 cfs @ 11.96 hrs, Volume= 0.046 af
 Outflow = 0.07 cfs @ 12.90 hrs, Volume= 0.040 af, Atten= 96%, Lag= 56.5 min
 Primary = 0.07 cfs @ 12.90 hrs, Volume= 0.040 af

Routing by Stor-Ind method, Time Span= 5.00-24.00 hrs, dt= 0.02 hrs
 Peak Elev= 423.23' @ 12.90 hrs Surf.Area= 649 sf Storage= 1,501 cf

Plug-Flow detention time= 311.2 min calculated for 0.040 af (86% of inflow)
 Center-of-Mass det. time= 292.2 min (1,036.6 - 744.4)

Volume	Invert	Avail.Storage	Storage Description
#1	420.40'	2,572 cf	60.0" D x 131.0'L Pipe Storage

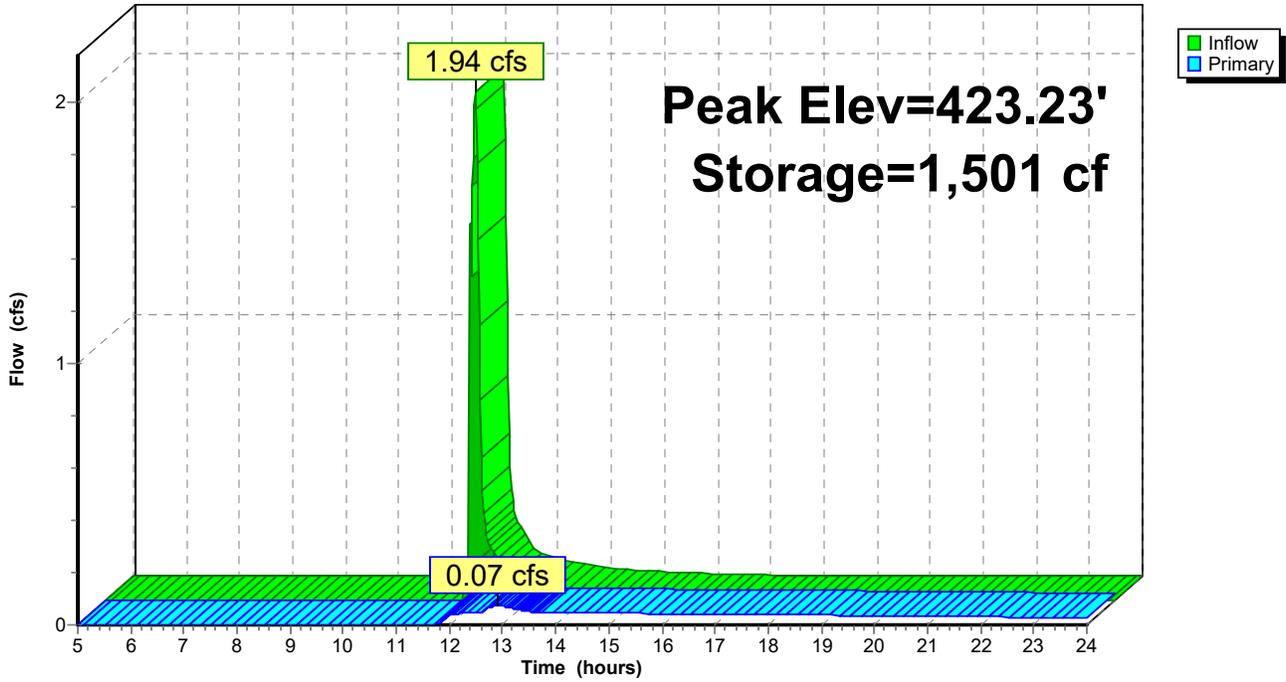
Device	Routing	Invert	Outlet Devices
#1	Primary	420.10'	18.0" Round Culvert L= 8.0' RCP, square edge headwall, Ke= 0.500 Outlet Invert= 420.00' S= 0.0125 '/' Cc= 0.900 n= 0.013 Concrete pipe, bends & connections
#2	Device 1	420.20'	1.0" Vert. Orifice/Grate C= 0.600
#3	Device 1	423.20'	16.0" W x 2.0" H Vert. Orifice/Grate C= 0.600
#4	Device 1	425.15'	6.0' long x 0.5' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Primary OutFlow Max=0.07 cfs @ 12.90 hrs HW=423.23' (Free Discharge)

- 1=Culvert (Passes 0.07 cfs of 13.12 cfs potential flow)
- 2=Orifice/Grate (Orifice Controls 0.05 cfs @ 8.32 fps)
- 3=Orifice/Grate (Orifice Controls 0.02 cfs @ 0.55 fps)
- 4=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Pond 5P: Underground Detention

Hydrograph



STORM STUDY - 1642 JCJ

Type II 24-hr 2-Year Rainfall=3.50"

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Summary for Pond 8P: WQV Detention

Inflow Area = 0.414 ac, 88.43% Impervious, Inflow Depth > 2.82" for 2-Year event
 Inflow = 1.98 cfs @ 11.96 hrs, Volume= 0.097 af
 Outflow = 1.97 cfs @ 11.96 hrs, Volume= 0.078 af, Atten= 0%, Lag= 0.1 min
 Primary = 0.03 cfs @ 11.96 hrs, Volume= 0.032 af
 Secondary = 1.94 cfs @ 11.96 hrs, Volume= 0.046 af

Routing by Stor-Ind method, Time Span= 5.00-24.00 hrs, dt= 0.02 hrs
 Peak Elev= 425.76' @ 11.96 hrs Surf.Area= 163 sf Storage= 1,026 cf

Plug-Flow detention time= 137.3 min calculated for 0.078 af (80% of inflow)
 Center-of-Mass det. time= 58.0 min (839.3 - 781.3)

Volume	Invert	Avail.Storage	Storage Description
#1	421.25'	1,080 cf	60.0" D x 55.0'L Pipe Storage

Device	Routing	Invert	Outlet Devices
#1	Primary	421.25'	0.4" Horiz. Orifice/Grate X 3.00 C= 0.600 Limited to weir flow at low heads
#2	Secondary	425.55'	7.0' long x 0.5' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Primary OutFlow Max=0.03 cfs @ 11.96 hrs HW=425.76' (Free Discharge)
 ↳1=Orifice/Grate (Orifice Controls 0.03 cfs @ 10.23 fps)

Secondary OutFlow Max=1.93 cfs @ 11.96 hrs HW=425.76' (Free Discharge)
 ↳2=Broad-Crested Rectangular Weir (Weir Controls 1.93 cfs @ 1.30 fps)

STORM STUDY - 1642 JCJ

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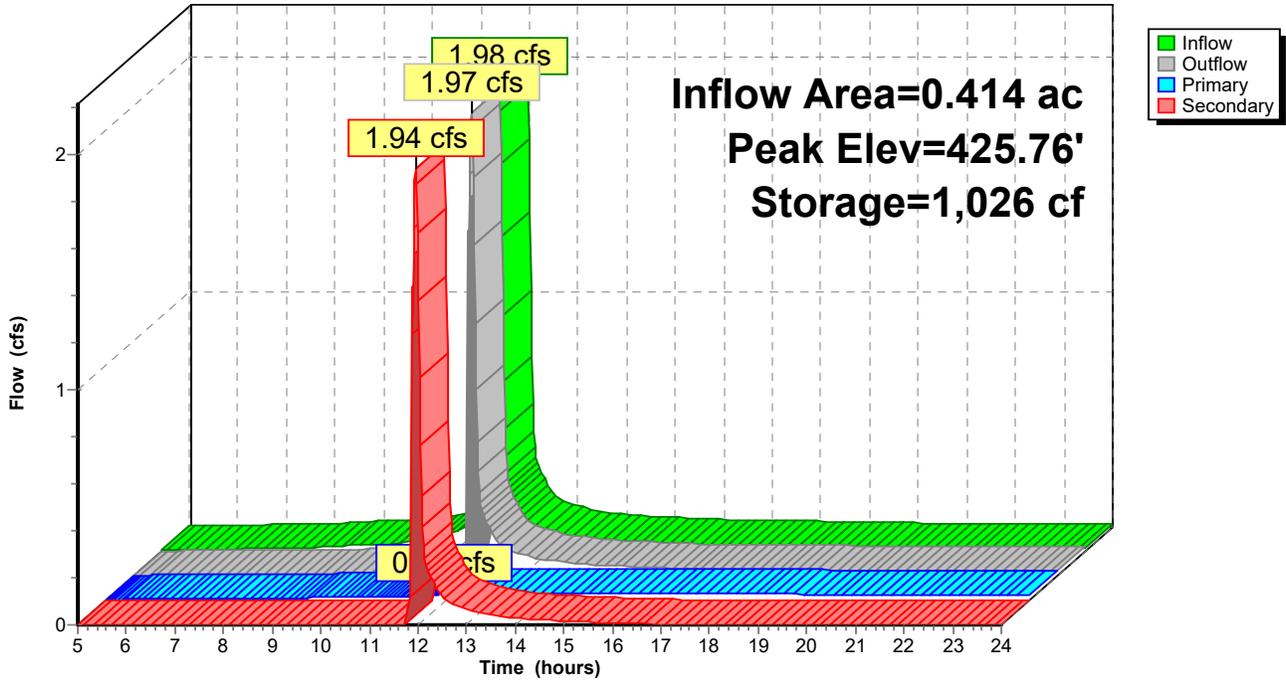
Type II 24-hr 2-Year Rainfall=3.50"

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Page 20

Pond 8P: WQV Detention

Hydrograph



STORM STUDY - 1642 JCJ

Type II 24-hr 2-Year Rainfall=3.50"

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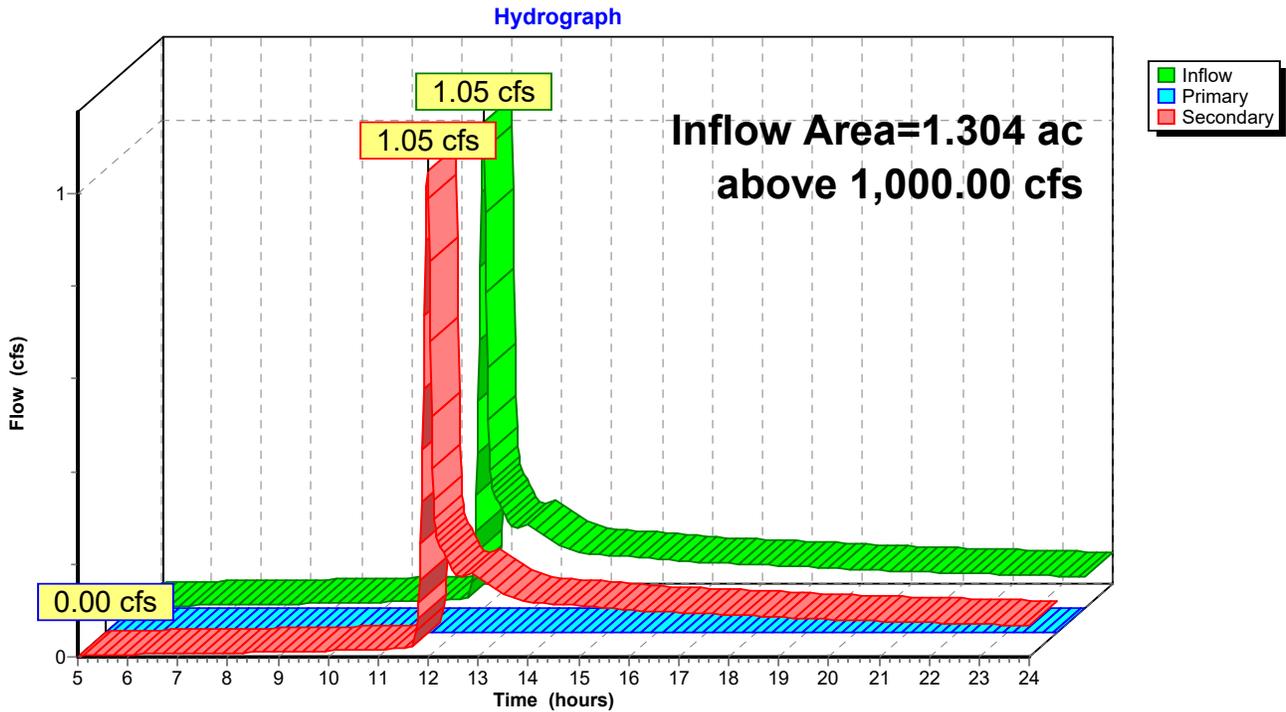
Page 21

Summary for Link 6L: Combined Hydrograph

Inflow Area = 1.304 ac, 35.74% Impervious, Inflow Depth > 1.10" for 2-Year event
Inflow = 1.05 cfs @ 11.98 hrs, Volume= 0.120 af
Primary = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min
Secondary = 1.05 cfs @ 11.98 hrs, Volume= 0.120 af

Primary outflow = Inflow above 1,000.00 cfs, Time Span= 5.00-24.00 hrs, dt= 0.02 hrs

Link 6L: Combined Hydrograph



STORM STUDY - 1642 JCJ

Type II 24-hr 25-Year Rainfall=6.00"

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Summary for Subcatchment 1S: Pre-Dev Site

Runoff = 5.04 cfs @ 11.97 hrs, Volume= 0.227 af, Depth> 2.09"

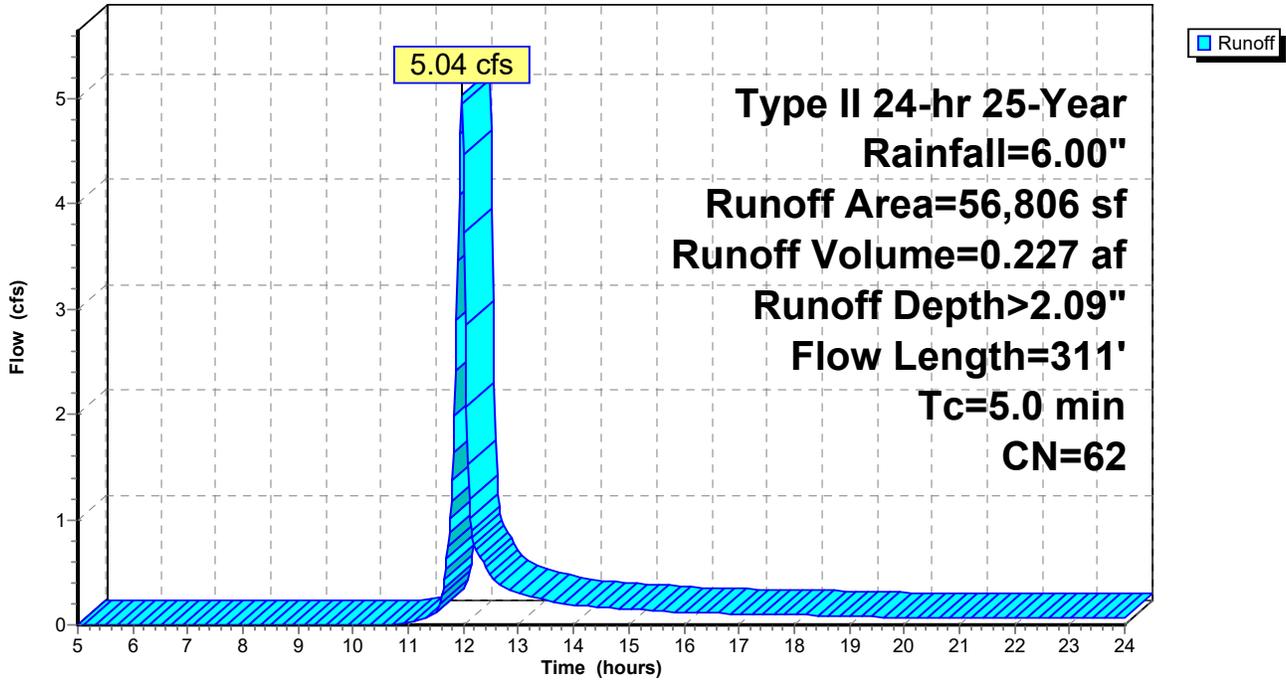
Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-24.00 hrs, dt= 0.02 hrs
 Type II 24-hr 25-Year Rainfall=6.00"

Area (sf)	CN	Description
5,744	98	Paved parking, HSG B
23,611	55	Woods, Good, HSG B
27,451	61	>75% Grass cover, Good, HSG B
56,806	62	Weighted Average
51,062		89.89% Pervious Area
5,744		10.11% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.9	11	0.0900	0.21		Sheet Flow, Grass: Short n= 0.150 P2= 3.50"
0.8	79	0.0630	1.68	0.19	Trap/Vee/Rect Channel Flow, Bot.W=0.00' D=0.10' Z= 7.0 & 15.0 '/' Top.W=2.20' n= 0.030
0.9	106	0.0940	2.06	0.52	Trap/Vee/Rect Channel Flow, Bot.W=0.00' D=0.10' Z= 25.0 '/' Top.W=5.00' n= 0.030
1.3	115	0.0480	1.47	0.29	Trap/Vee/Rect Channel Flow, Bot.W=0.00' D=0.10' Z= 20.0 '/' Top.W=4.00' n= 0.030
1.1					Direct Entry, Adjust to Minimum Tc
5.0	311	Total			

Subcatchment 1S: Pre-Dev Site

Hydrograph



STORM STUDY - 1642 JCJ

Type II 24-hr 25-Year Rainfall=6.00"

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Summary for Subcatchment 2S: Post-Dev Site

Runoff = 7.43 cfs @ 11.96 hrs, Volume= 0.335 af, Depth> 3.08"

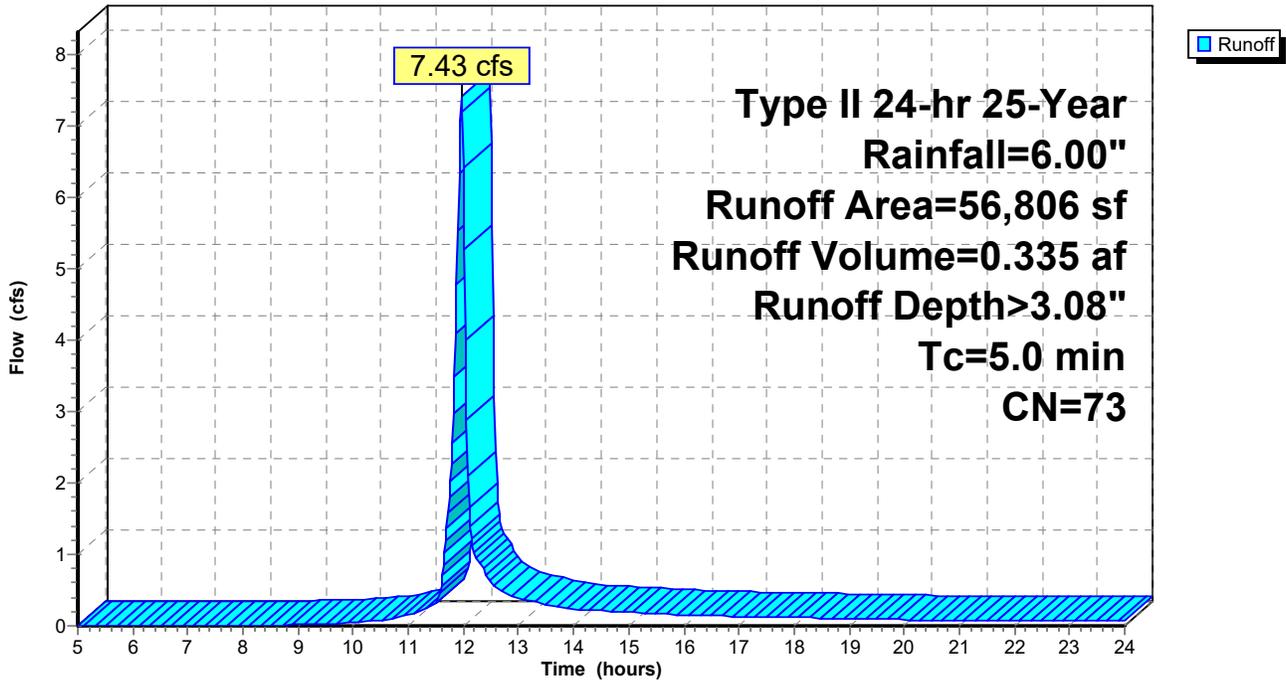
Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-24.00 hrs, dt= 0.02 hrs
Type II 24-hr 25-Year Rainfall=6.00"

Area (sf)	CN	Description
20,302	98	Paved parking, HSG B
12,182	55	Woods, Good, HSG B
24,322	61	>75% Grass cover, Good, HSG B
56,806	73	Weighted Average
36,504		64.26% Pervious Area
20,302		35.74% Impervious Area

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

Subcatchment 2S: Post-Dev Site

Hydrograph



STORM STUDY - 1642 JCJ

Type II 24-hr 25-Year Rainfall=6.00"

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Summary for Subcatchment 3S: To Detention

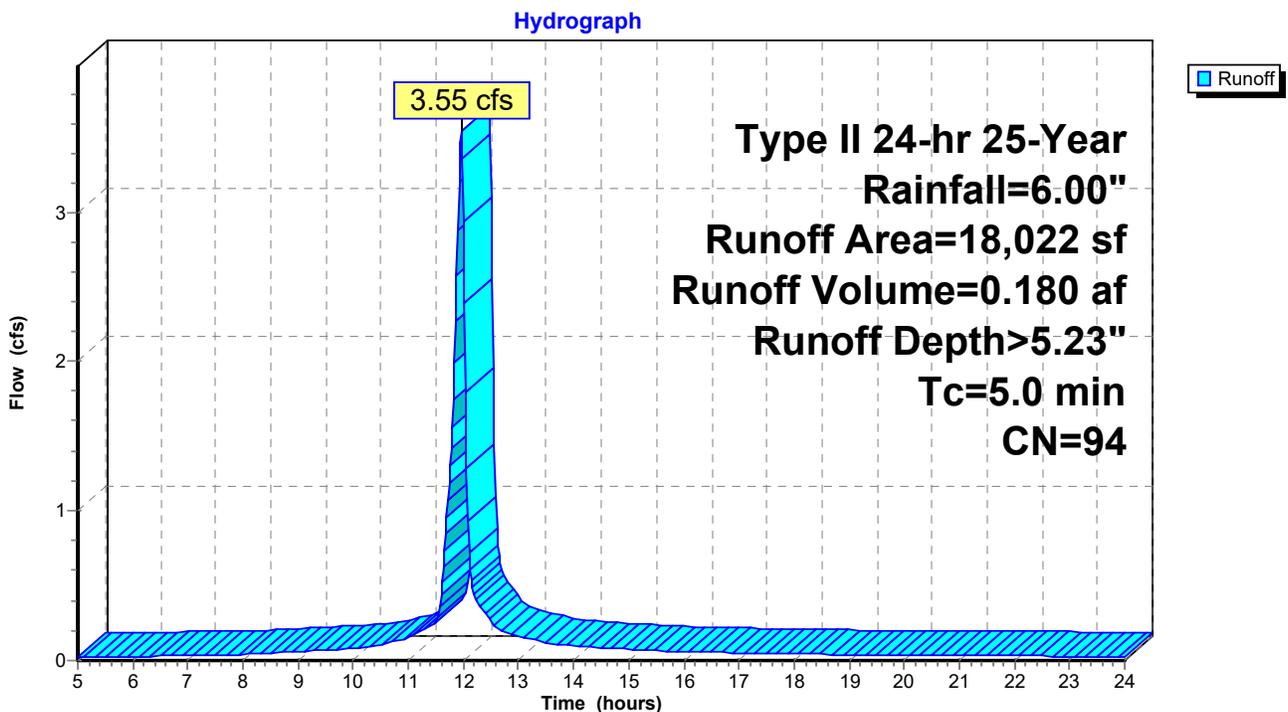
Runoff = 3.55 cfs @ 11.96 hrs, Volume= 0.180 af, Depth> 5.23"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-24.00 hrs, dt= 0.02 hrs
 Type II 24-hr 25-Year Rainfall=6.00"

Area (sf)	CN	Description
15,937	98	Paved parking, HSG B
2,085	61	>75% Grass cover, Good, HSG B
18,022	94	Weighted Average
2,085		11.57% Pervious Area
15,937		88.43% Impervious Area

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

Subcatchment 3S: To Detention



STORM STUDY - 1642 JCJ

Type II 24-hr 25-Year Rainfall=6.00"

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Summary for Subcatchment 4S: Bypass Detention

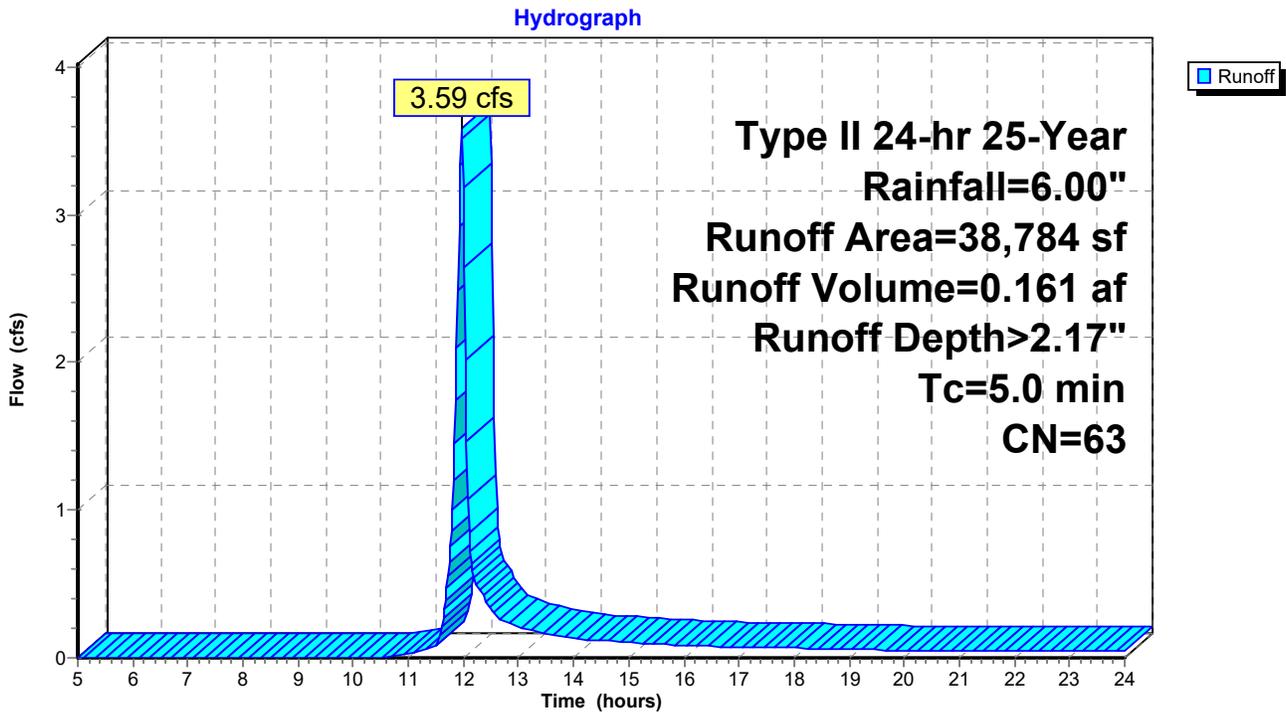
Runoff = 3.59 cfs @ 11.97 hrs, Volume= 0.161 af, Depth> 2.17"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-24.00 hrs, dt= 0.02 hrs
 Type II 24-hr 25-Year Rainfall=6.00"

Area (sf)	CN	Description
4,365	98	Paved parking, HSG B
12,182	55	Woods, Good, HSG B
22,237	61	>75% Grass cover, Good, HSG B
38,784	63	Weighted Average
34,419		88.75% Pervious Area
4,365		11.25% Impervious Area

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

Subcatchment 4S: Bypass Detention



STORM STUDY - 1642 JCJ

Type II 24-hr 25-Year Rainfall=6.00"

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Summary for Pond 5P: Underground Detention

Inflow = 3.52 cfs @ 11.96 hrs, Volume= 0.122 af
 Outflow = 1.92 cfs @ 12.04 hrs, Volume= 0.108 af, Atten= 46%, Lag= 5.0 min
 Primary = 1.92 cfs @ 12.04 hrs, Volume= 0.108 af

Routing by Stor-Ind method, Time Span= 5.00-24.00 hrs, dt= 0.02 hrs
 Peak Elev= 425.23' @ 12.04 hrs Surf.Area= 238 sf Storage= 2,545 cf

Plug-Flow detention time= 139.1 min calculated for 0.108 af (88% of inflow)
 Center-of-Mass det. time= 106.6 min (865.7 - 759.1)

Volume	Invert	Avail.Storage	Storage Description
#1	420.40'	2,572 cf	60.0" D x 131.0'L Pipe Storage

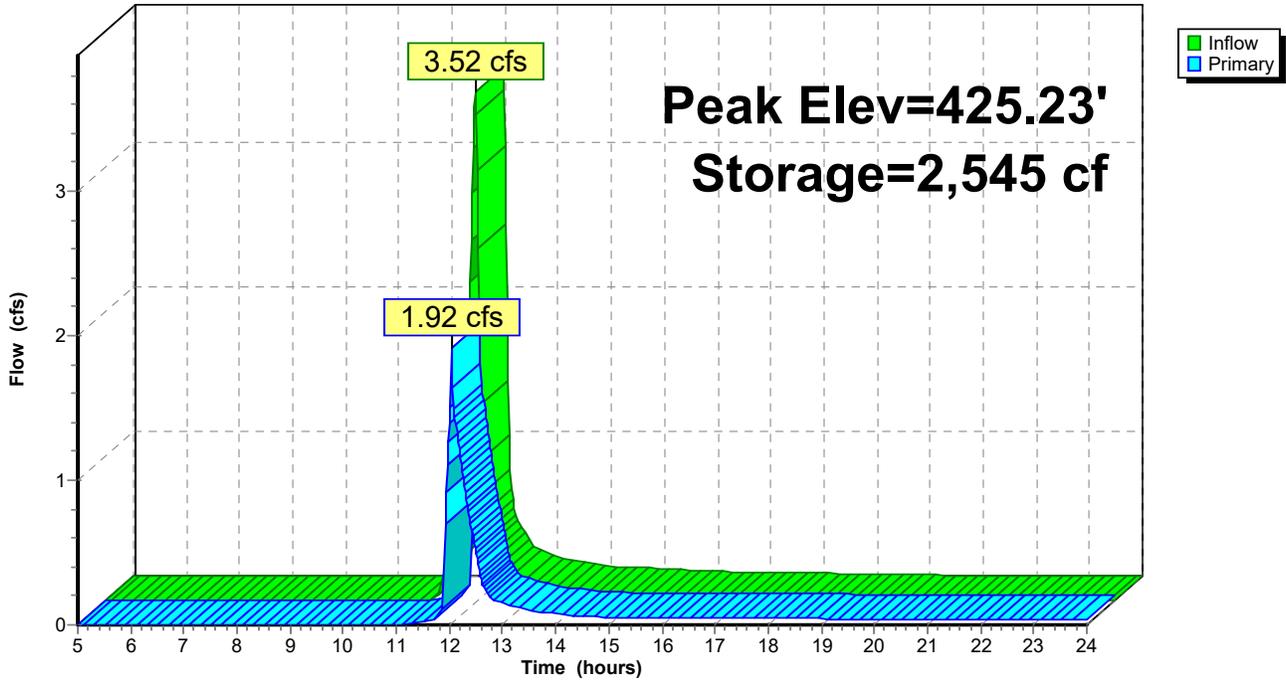
Device	Routing	Invert	Outlet Devices
#1	Primary	420.10'	18.0" Round Culvert L= 8.0' RCP, square edge headwall, Ke= 0.500 Outlet Invert= 420.00' S= 0.0125 '/' Cc= 0.900 n= 0.013 Concrete pipe, bends & connections
#2	Device 1	420.20'	1.0" Vert. Orifice/Grate C= 0.600
#3	Device 1	423.20'	16.0" W x 2.0" H Vert. Orifice/Grate C= 0.600
#4	Device 1	425.15'	6.0' long x 0.5' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Primary OutFlow Max=1.86 cfs @ 12.04 hrs HW=425.22' (Free Discharge)

- 1=Culvert (Passes 1.86 cfs of 17.79 cfs potential flow)
- 2=Orifice/Grate (Orifice Controls 0.06 cfs @ 10.74 fps)
- 3=Orifice/Grate (Orifice Controls 1.49 cfs @ 6.70 fps)
- 4=Broad-Crested Rectangular Weir (Weir Controls 0.32 cfs @ 0.75 fps)

Pond 5P: Underground Detention

Hydrograph



STORM STUDY - 1642 JCJ

Type II 24-hr 25-Year Rainfall=6.00"

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Summary for Pond 8P: WQV Detention

Inflow Area = 0.414 ac, 88.43% Impervious, Inflow Depth > 5.23" for 25-Year event
 Inflow = 3.55 cfs @ 11.96 hrs, Volume= 0.180 af
 Outflow = 3.55 cfs @ 11.96 hrs, Volume= 0.157 af, Atten= 0%, Lag= 0.1 min
 Primary = 0.03 cfs @ 11.96 hrs, Volume= 0.035 af
 Secondary = 3.52 cfs @ 11.96 hrs, Volume= 0.122 af

Routing by Stor-Ind method, Time Span= 5.00-24.00 hrs, dt= 0.02 hrs
 Peak Elev= 425.86' @ 11.96 hrs Surf.Area= 147 sf Storage= 1,041 cf

Plug-Flow detention time= 90.2 min calculated for 0.157 af (87% of inflow)
 Center-of-Mass det. time= 30.2 min (800.3 - 770.1)

Volume	Invert	Avail.Storage	Storage Description
#1	421.25'	1,080 cf	60.0" D x 55.0'L Pipe Storage

Device	Routing	Invert	Outlet Devices
#1	Primary	421.25'	0.4" Horiz. Orifice/Grate X 3.00 C= 0.600 Limited to weir flow at low heads
#2	Secondary	425.55'	7.0' long x 0.5' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Primary OutFlow Max=0.03 cfs @ 11.96 hrs HW=425.86' (Free Discharge)
 ↑1=Orifice/Grate (Orifice Controls 0.03 cfs @ 10.34 fps)

Secondary OutFlow Max=3.50 cfs @ 11.96 hrs HW=425.86' (Free Discharge)
 ↑2=Broad-Crested Rectangular Weir (Weir Controls 3.50 cfs @ 1.60 fps)

STORM STUDY - 1642 JCJ

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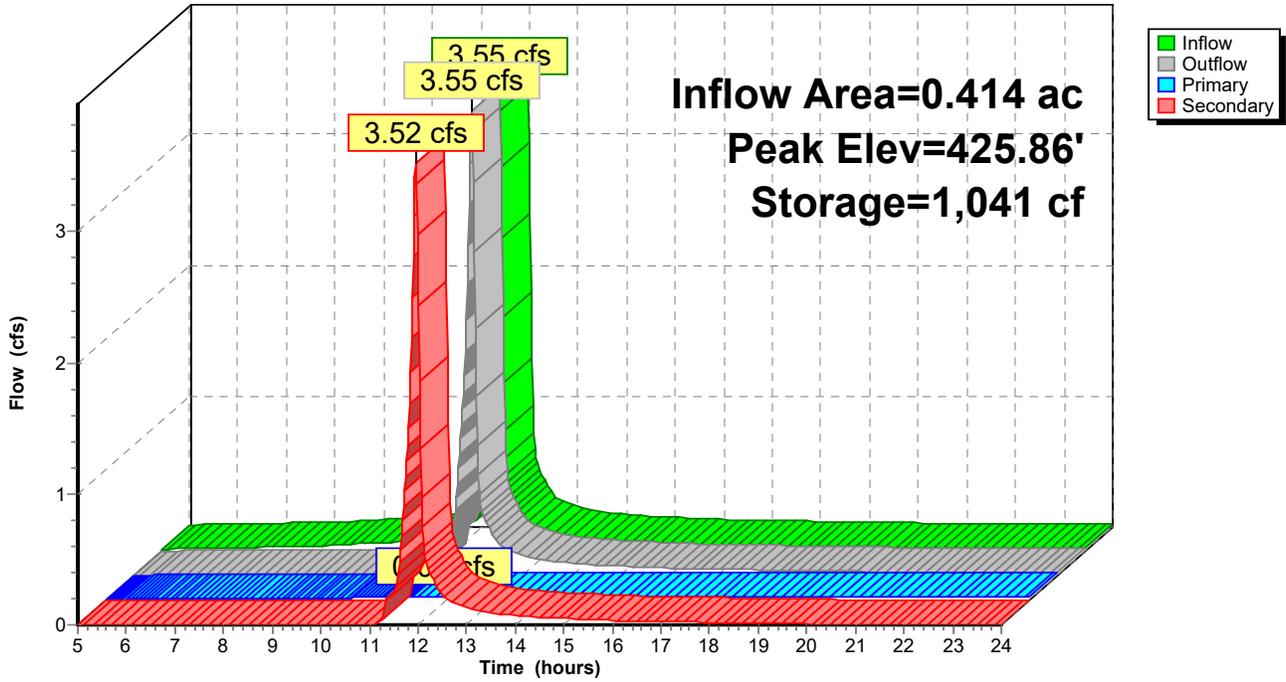
Type II 24-hr 25-Year Rainfall=6.00"

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Pond 8P: WQV Detention

Hydrograph



STORM STUDY - 1642 JCJ

Type II 24-hr 25-Year Rainfall=6.00"

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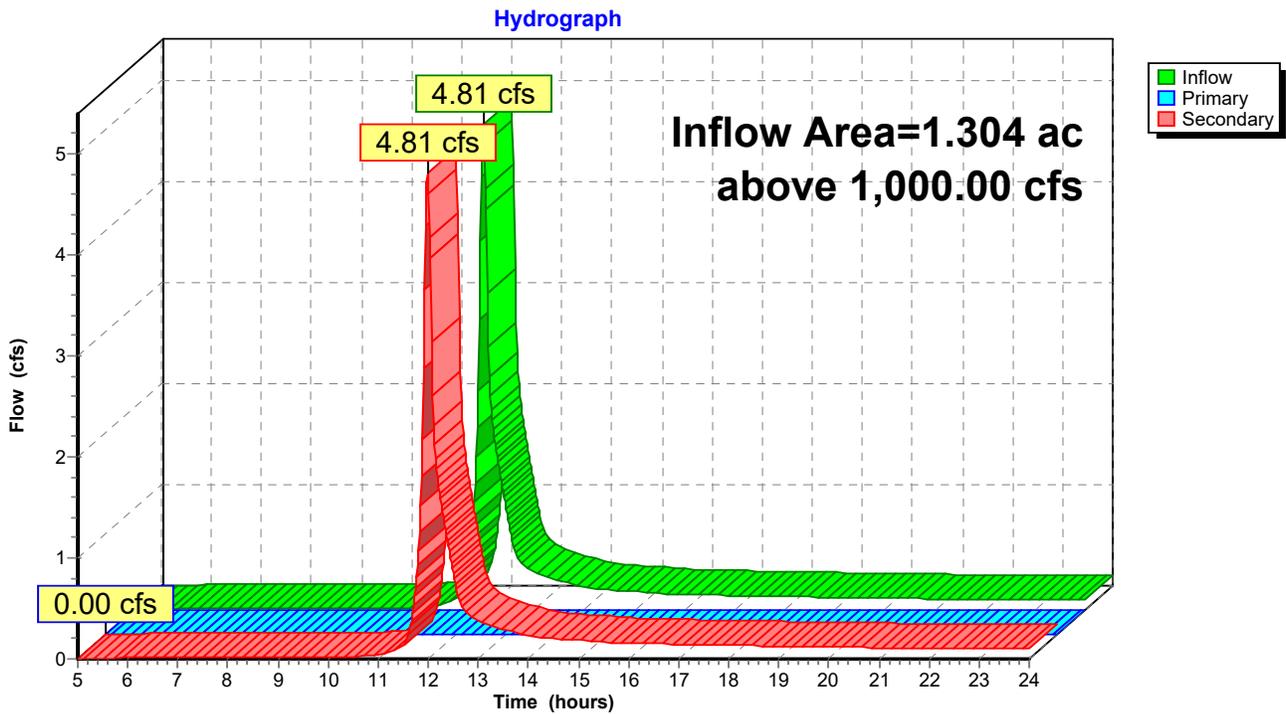
Page 31

Summary for Link 6L: Combined Hydrograph

Inflow Area = 1.304 ac, 35.74% Impervious, Inflow Depth > 2.80" for 25-Year event
Inflow = 4.81 cfs @ 11.98 hrs, Volume= 0.304 af
Primary = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min
Secondary = 4.81 cfs @ 11.98 hrs, Volume= 0.304 af

Primary outflow = Inflow above 1,000.00 cfs, Time Span= 5.00-24.00 hrs, dt= 0.02 hrs

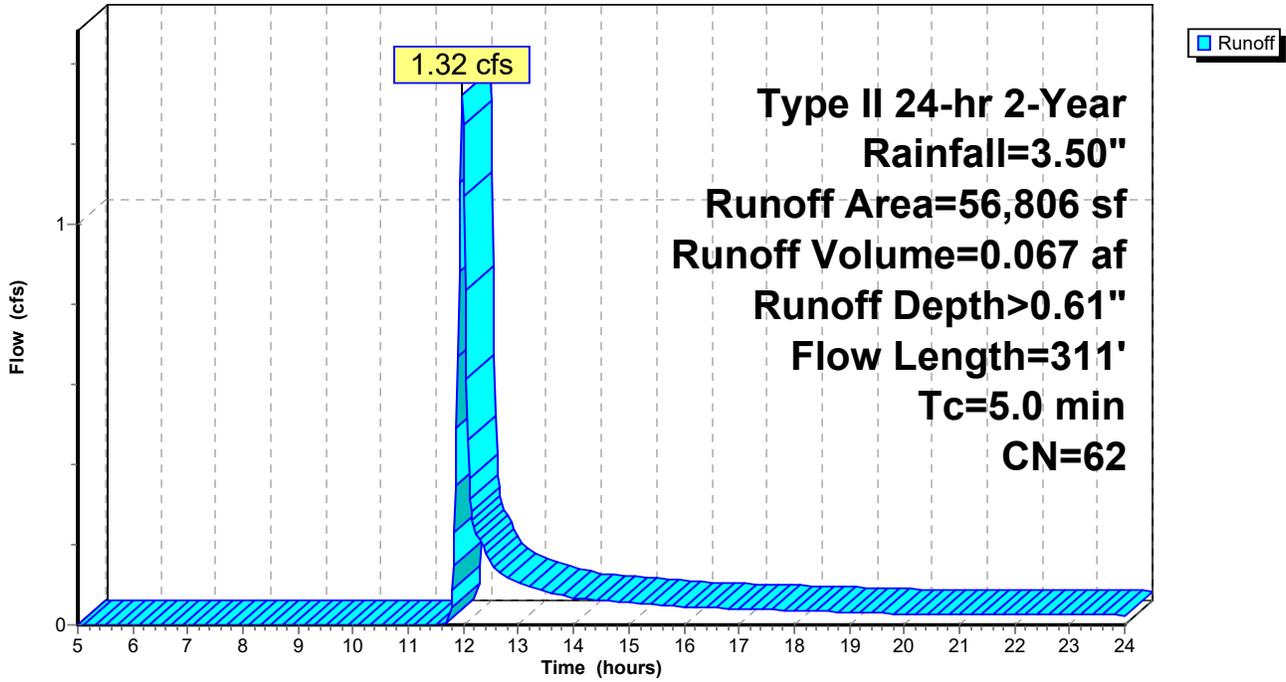
Link 6L: Combined Hydrograph



**STORMWATER VOLUME
CALCULATIONS (2-YR STORM)**

Subcatchment 1S: Pre-Dev Site

Hydrograph



STORM STUDY - 1642 JCJ

Type II 24-hr 2-Year Rainfall=3.50"

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Summary for Subcatchment 2S: Post-Dev Site

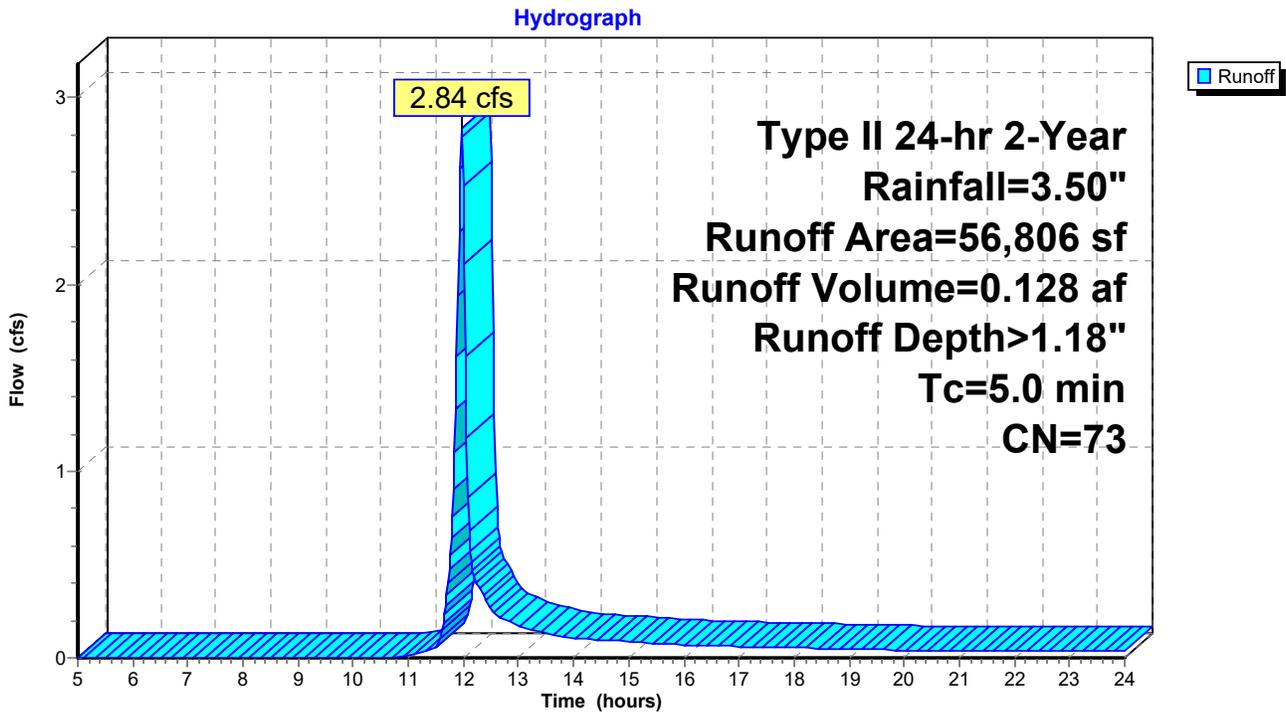
Runoff = 2.84 cfs @ 11.97 hrs, Volume= 0.128 af, Depth> 1.18"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-24.00 hrs, dt= 0.02 hrs
 Type II 24-hr 2-Year Rainfall=3.50"

Area (sf)	CN	Description
20,302	98	Paved parking, HSG B
12,182	55	Woods, Good, HSG B
24,322	61	>75% Grass cover, Good, HSG B
56,806	73	Weighted Average
36,504		64.26% Pervious Area
20,302		35.74% Impervious Area

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

Subcatchment 2S: Post-Dev Site



STORM STUDY - 1642 JCJ

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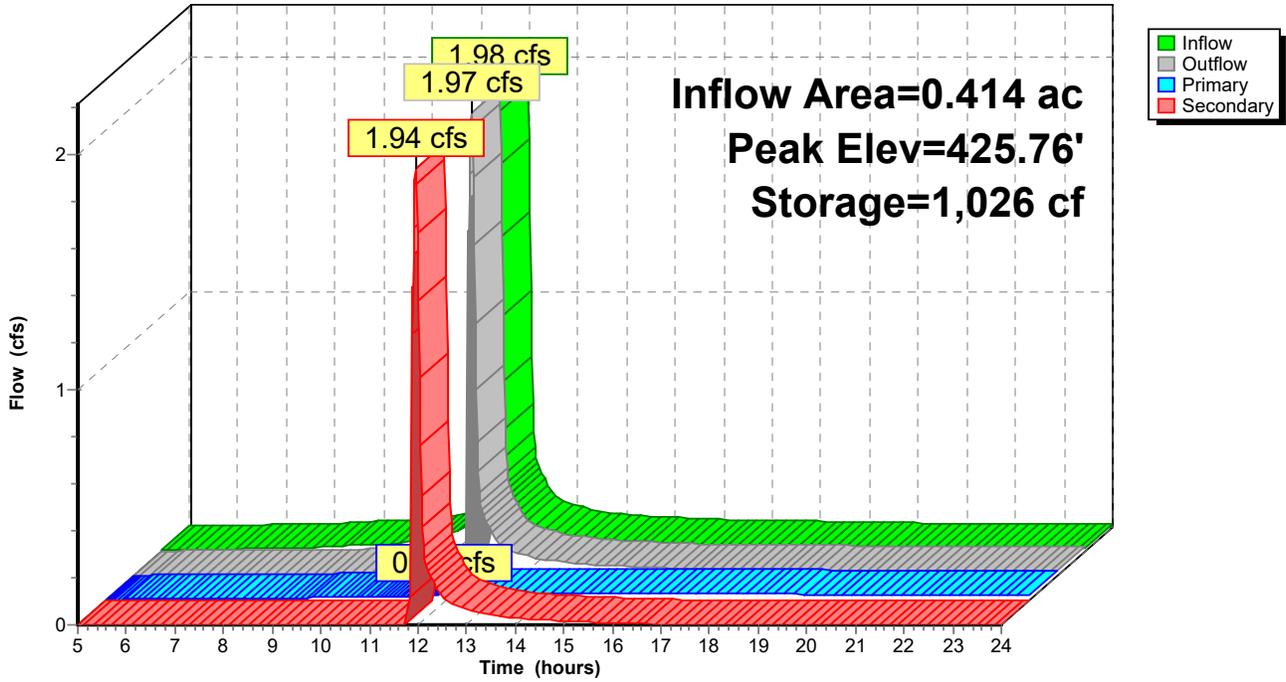
Type II 24-hr 2-Year Rainfall=3.50"

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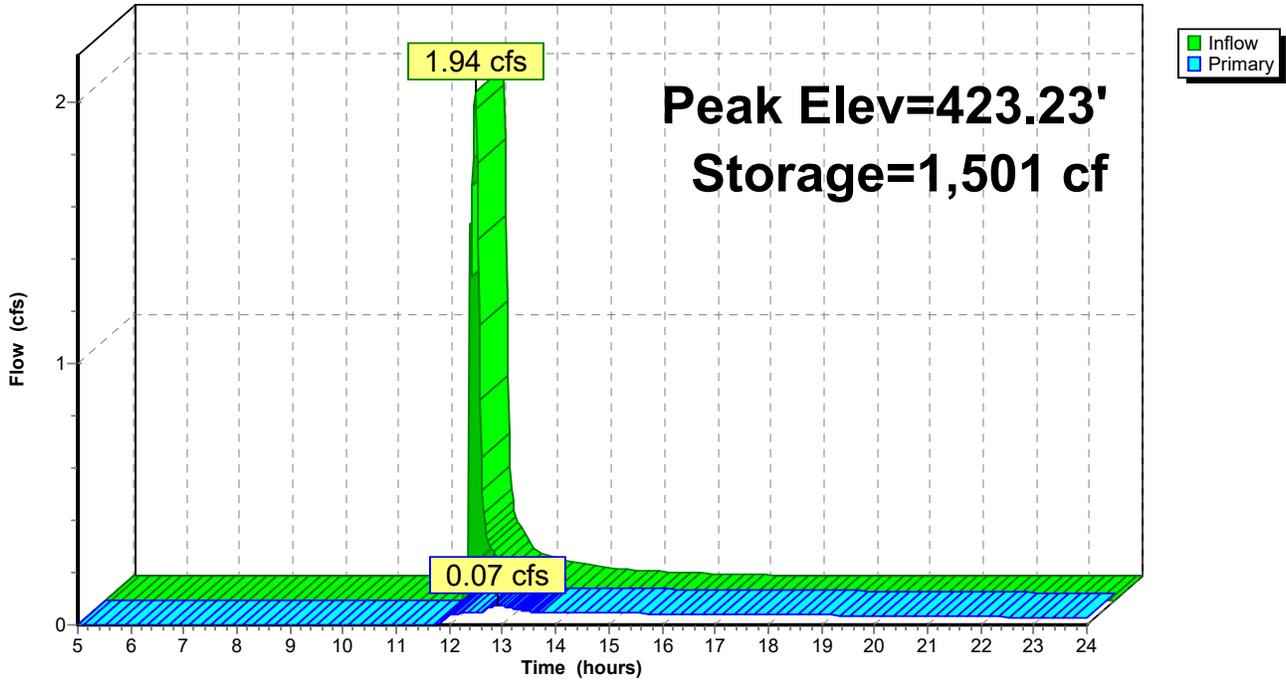
Pond 8P: WQV Detention

Hydrograph



Pond 5P: Underground Detention

Hydrograph



DRAINAGE AREA MAPS



COULTER JEWELL THAMES, P.A.
 111 WEST MAIN ST
 DURHAM, NC 27701
 (919) 682-0368

PUREFOY ROAD APARTMENTS
 PRE-DEVELOPMENT DRAINAGE AREA MAP

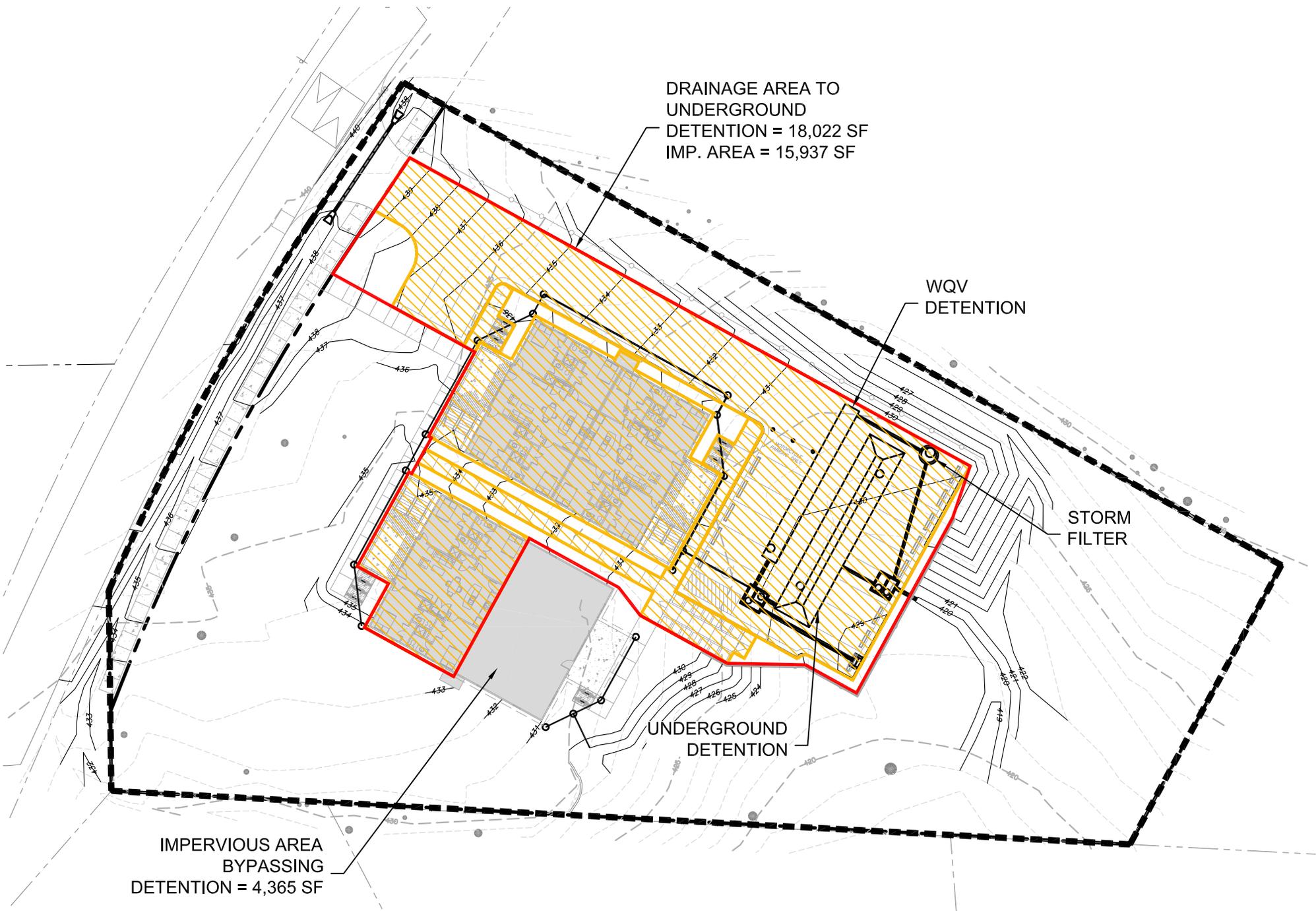
DATE: 05/24/2017
 SCALE: 1" = 40'
 DRAWN BY: TRM



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 111 WEST MAIN ST
 DURHAM, NC 27701
 (919) 682-0368

PUREFOY ROAD APARTMENTS
 POST-DEVELOPMENT DRAINAGE AREA MAP

DATE: 02/07/2018
 SCALE: 1" = 40'
 DRAWN BY: TRM



DRAINAGE AREA TO
UNDERGROUND
DETENTION = 18,022 SF
IMP. AREA = 15,937 SF

WQV
DETENTION

STORM
FILTER

UNDERGROUND
DETENTION

IMPERVIOUS AREA
BYPASSING
DETENTION = 4,365 SF

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111 WEST MAIN ST
DURHAM, NC 27701
(919) 682-0368

PUREFOY ROAD APARTMENTS
POST-DEVELOPMENT DRAINAGE AREA MAP TO SCM

DATE: 02/07/2018
SCALE: 1" = 40'
DRAWN BY: JCJ

STORMFILTER CALCULATIONS



Coulter | Jewell | Thames, PA

Project Name: PUREFOY ROAD APT
Project Number: 1642

By: JCJ
Date: 1/15/2018

Revised:
Date:

Storm Filter Detention Sizing

Drainage Area = 0.41 ac
Impervious Area = 0.37 ac

Water Quality Volume: Simple Method

$$WQV = 3630 * Rd * Rv * Ad$$

WQV = Runoff Volume (cf)

Rd = Design storm rainfall depth = 1.0 in

Rv = Runoff coefficient (unitless)

Ad = Drainage area (ac)

$$Rv = 0.5 + 0.9 * Ia$$

Ia = Impervious fraction = 0.88

$$Rv = 0.85$$

Required runoff Volume

$$WQV = 1,270 \text{ cf}$$

Adjusted Water Quality Volume:

$$WQV(\text{adj}) = (0.75) * WQV$$

$$WQV(\text{adj}) = 953 \text{ cf}$$

Volume Provided

$$V = 988 \text{ cf}$$

Volume StormFilter Outflow & Orifice Calculation

Chapel Hill, NC

Input	Calculated
-------	------------

Project Name:	Purefoy Road Apts	Date:	1/31/18
Contech No:	577,657	By:	KMR

Discharge flow rate from StormFilter:

Restrictor Disc Diameter (in)	0.443	x3 orifices
Restrictor Disc Diameter (ft)	0.037	

Restrictor Disk Calibration:

The Volume StormFilter restrictor disc is calibrated to flow at 7.5 gpm at 10 feet of head, or 1 gpm/sf or less for all cartridge sizes

Orifice Coefficient	0.61
Area of Restrictor Disc (sf)	0.0011
Head, h (ft)	10
Flow, Q (cfs)	0.017
Flow, Q (gpm)	7.5

$$Q = cA\sqrt{2Gh}$$

$$Q = (0.61) \left(\frac{0.037^2}{4} \pi \right) \sqrt{2(32.2)(10)}$$

$$Q = 0.017 \text{ cfs} = 7.5 \text{ GPM}$$

Purefoy Road Apts Specific Data:

Max. Head, h, on Cartridges (ft)	5.5
Number of cartridges	3

During the worst-case scenario, there is 5.5 feet of head available on the orifice.

Flow Rate per Cartridge:

Flow, Q (cfs)	0.0123
Flow, Q (gpm)	5.52

$$Q = cA\sqrt{2Gh}$$

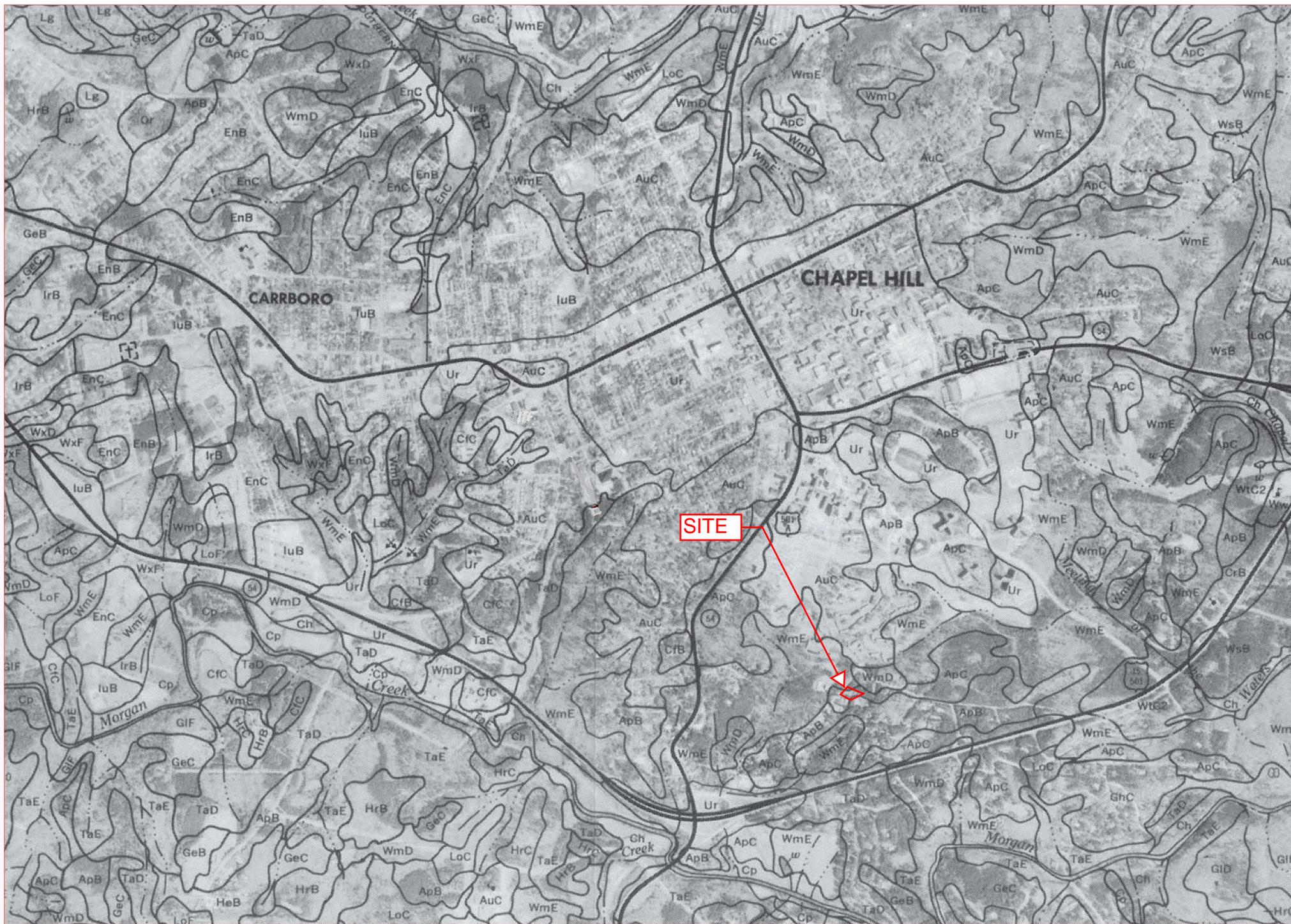
With 5.5 of head available, each cartridge will discharge 5.52 gpm, or 0.0123 cfs. Since 5.52 gpm is less than the 1 GPM/sf flow rate of 11.25 GPM for the 27-inch cartridge, the mass loading calculations are preserved and 3 cartridges are suitable for this site.

Total Unit Outflow:

Flow, Q (cfs) per cartridge	0.0123	
Flow, Q (cfs) total	0.0369	(Q = No. Cartridges x Flow per Cartridge)

With 3 cartridges, the total StormFilter discharge outflow rate is 0.0369 cfs during the worst-case scenario.

SOILS, FLOOD, and USGS MAPS



Coulter Jewell Thames, PA
111 West Main Street
Durham, NC 27701
(919) 682-0368

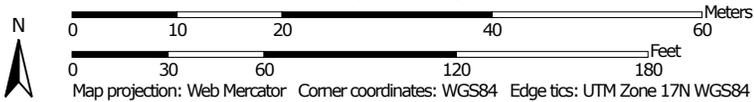
ORANGE COUNTY SOIL SURVEY
Purefoy Road Apartments

October 7, 2016
SCALE: 1"=2000'

Hydrologic Soil Group—Orange County, North Carolina



Map Scale: 1:716 if printed on A landscape (11" x 8.5") sheet.



MAP LEGEND

Area of Interest (AOI)

 Area of Interest (AOI)

Soils

Soil Rating Polygons

 A
 A/D
 B
 B/D
 C
 C/D
 D
 Not rated or not available

Soil Rating Lines

 A
 A/D
 B
 B/D
 C
 C/D
 D
 Not rated or not available

Soil Rating Points

 A
 A/D
 B
 B/D

 C
 C/D
 D
 Not rated or not available

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: <http://websoilsurvey.nrcs.usda.gov>
 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: Orange County, North Carolina
 Survey Area Data: Version 15, Sep 16, 2015

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

Date(s) aerial images were photographed: Apr 27, 2014—May 6, 2014

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.

Hydrologic Soil Group

Hydrologic Soil Group— Summary by Map Unit — Orange County, North Carolina (NC135)				
Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
ApB	Appling sandy loam, 2 to 6 percent slopes	B	0.4	30.5%
ApC	Appling sandy loam, 6 to 10 percent slopes	B	0.9	69.5%
Totals for Area of Interest			1.2	100.0%

Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

Aggregation Method: Dominant Condition

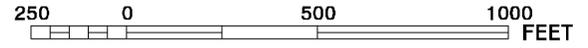
Component Percent Cutoff: None Specified

Tie-break Rule: Higher



GRID NORTH

MAP SCALE 1" = 500' (1 : 6,000)



NFIP

PANEL 9788J

FIRM
FLOOD INSURANCE RATE MAP
 NORTH CAROLINA

PANEL 9788

(SEE LOCATOR DIAGRAM OR MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	CID No.	PANEL	SUFFIX
CARRBORO, TOWN OF	370275	9788	J
CHAPEL HILL, TOWN OF	370180	9788	J
ORANGE COUNTY	370342	9788	J

Notice to User: The Map Number shown below should be used when placing map orders; the Community Number shown above should be used on insurance applications for the subject community.

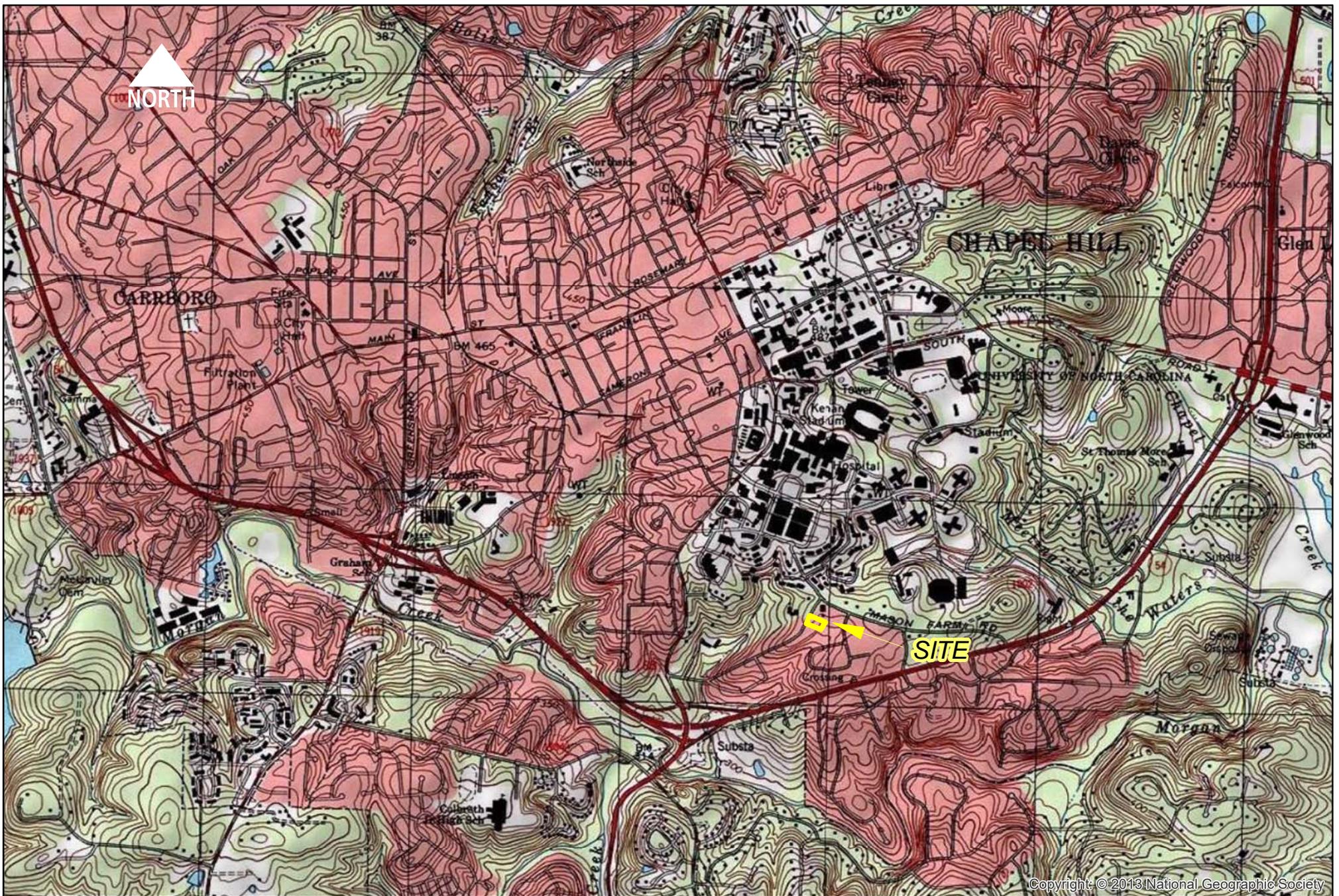
EFFECTIVE DATE
 FEBRUARY 2, 2007

MAP NUMBER
 3710978800J



State of North Carolina
 Federal Emergency Management Agency

This is an official copy of a portion of the above referenced flood map. It was extracted using F-MIT On-Line. This map does not reflect changes or amendments which may have been made subsequent to the date on the title block. For the latest product information about National Flood Insurance Program flood maps check the FEMA Flood Map Store at www.msc.fema.gov



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USGS QUAD MAP - CHAPEL HILL
PUREFOY RD APARTMENTS

OCTOBER 7, 2016
SCALE: 1" = 2000'

CULVERT ANALYSIS



Project Name: Purefoy Road Apts By: TRM
 Project Number: 1642 Date: 10.10.2016

Revised: JCJ
 Date: 2/7/2018

Culvert Calculations

Culvert #1

DRAINAGE AREA = 5,132 SF
 0.12 AC.

IMPERVIOUS = 2,368 SF C = 0.95

GRASS = 2,764 SF C = 0.35

WOODED = - SF C = 0.2

COMPOSITE C-VALUE = 0.63

Discharge - Q = CiA

i10 = 7.22 in/hr

Q10 = 0.53 cfs

Outlet Protection Calculations

OUTLET: Culvert #1

Inputs:

Pipe Diameter = 15 in
 Slope = 1.00%
 Q(10) = 0.53 cfs
 v(10) = 3.18 fps
 Zone: 1

Apron Materials:

Minimum- Stone Filling (Fine) - Cl. 'A'
 Proposed- Stone Filling (Fine) - Cl. 'A'

Apron Dimensions:

Length

Multiplier 3
 To Protect Culvert (L1) = 3.75 ft
 Multiplier 4
 To Protect Scour (L2) = 5 ft

Width

W = 3.75 ft

Thickness

Th = 12 in

Outlet Protection Calculations

OUTLET: Detention

Inputs:

Pipe Diameter = 15 in
 Slope = 1.00%
 Q(10) = 1.12 cfs (HydroCAD)
 v(10) = 3.95 fps
 Zone: 1

Apron Materials:

Minimum- Stone Filling (Fine) - Cl. 'A'
 Proposed- Stone Filling (Fine) - Cl. 'A'

Apron Dimensions:

Length

Multiplier 3
 To Protect Culvert (L1) = 3.75 ft
 Multiplier 4
 To Protect Scour (L2) = 5 ft

Width

W = 3.75 ft

Thickness

Th = 12 in

Worksheet for Circular Pipe - 1

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.013	
Channel Slope	0.01000	ft/ft
Diameter	1.25	ft
Discharge	0.53	ft ³ /s

Results

Normal Depth	0.24	ft
Flow Area	0.17	ft ²
Wetted Perimeter	1.14	ft
Hydraulic Radius	0.15	ft
Top Width	0.99	ft
Critical Depth	0.28	ft
Percent Full	19.4	%
Critical Slope	0.00527	ft/ft
Velocity	3.18	ft/s
Velocity Head	0.16	ft
Specific Energy	0.40	ft
Froude Number	1.36	
Maximum Discharge	6.95	ft ³ /s
Discharge Full	6.46	ft ³ /s
Slope Full	0.00007	ft/ft
Flow Type	SuperCritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	19.37	%
Downstream Velocity	Infinity	ft/s

Worksheet for Circular Pipe - Detention

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.013	
Channel Slope	0.01000	ft/ft
Diameter	1.25	ft
Discharge	1.12	ft ³ /s

Results

Normal Depth	0.35	ft
Flow Area	0.28	ft ²
Wetted Perimeter	1.40	ft
Hydraulic Radius	0.20	ft
Top Width	1.12	ft
Critical Depth	0.42	ft
Percent Full	28.2	%
Critical Slope	0.00523	ft/ft
Velocity	3.95	ft/s
Velocity Head	0.24	ft
Specific Energy	0.59	ft
Froude Number	1.38	
Maximum Discharge	6.95	ft ³ /s
Discharge Full	6.46	ft ³ /s
Slope Full	0.00030	ft/ft
Flow Type	SuperCritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	28.18	%
Downstream Velocity	Infinity	ft/s