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STORM WATER MANAGEMENT REPORT

THE PEAKS AT SOUTH ORANGE VILLAGE

270 & 299 IRVINGTON AVUENUE TAX LOTS 14-20, BLOCK 2102 LOT 1, BLOCK 2107

TOWNSHIP OF SOUTH ORANGE VILLAGE ESSEX COUNTY

> PROJECT # 1160111 DATE: May 10, 2021

L.S.—No. 30084

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STORM WATER MANAGEMENT REPORT THE PEAKS AT SOUTH ORANGE VILLAGE

INTRODUCTION

This Stormwater Management Report was compiled to assess the anticipated impacts from the proposed redevelopment of the subject properties located in the Township of South Orange Village. This report has been prepared to address the stormwater management ordinance of the Village and New Jersey Department of Environmental Protection. This report accompanies a set of drawings entitled "Preliminary and Final Site Plans for Fairview Village Gardens" which were prepared by Casey and Keller. The set of Preliminary and Final Site Plans illustrate the existing and proposed conditions upon the subject property, as well as provide details for the various stormwater management facilities described herein. Therefore, this report should be reviewed and considered in conjunction with the above referenced Site Plans.

LOCATION and EXISTING SITE DESCRIPTION and TOPOGRAPHY

The properties in question are located on the east and west side of Irvington Avenue. The property is known as 270 and 299 Irvington Avenue and designated on the Village of South Orange Tax Map as Lots 14-20, Block 2102 and Lot 1, Block 2107. The parcels consist of 2.02 acres and 0.16 acres respectively, and both have frontage on Irvington Avenue. The larger parcel (270) consists of a number of single-family dwellings and is bounded by a commercially developed property to the north, and single family residential to the east, west and south. The smaller parcel (299) consists of an existing 1 story retail building and is a corner lot bounded by commercially developed property to the south, and single family residential to the east, west and north. Access to both sites is from Irvington Avenue.

This Zoning for these properties has been designated as a redevelopment area. A redevelopment ordinance has been established for the above referenced properties. The redevelopment plan is entitled "270 Irvington Avenue Redevelopment Plan, The Township of South Orange Village, NJ".

The State Plane Coordinates for the project are E 420345—N 505340. The site is shown on a portion of the U.S.G.S Elisabeth Quadrangle Map.

The larger parcel is considerably lower than the surrounding area. It consists of residential dwellings with a large paved/gravel shared parking area. The site has a low point in the center of the site. Stormwater runoff collects in the center of the site and either is evaporated or overflows out to Irvington Avenue stormwater network system. The smaller parcel has a moderate slope consisting of building roof and paved parking areas which drain directly to Irvington Avenue.

There are no wetland areas on site per a memo entitled "Wetland/Transition Area Investigation" prepared by Environmental Technology Inc., dated March 18, 2021. Additionally, the site is not located in any Flood Hazard Area per NJDEP flood Maps.

The site topography varies, being relatively level in the developed portions of the site and its associated driveways and parking areas. The open rear area has a moderate slope which drains

to the center of the property. The highest elevation in the project area is 105. The lowest point is 98.48 and Irvington Avenue is at approximately elevation 100.

<u>SOILS</u>

From the National Cooperative Soil Survey of the Natural Resources Conservation Service, the soils at the actual project area are identified as:

Boonton, Urban Land (BowrB)

It is characterized with relatively level ground (mostly 0-8% slopes). They are considered to be in Hydrological Group C (slow water infiltration and movement in saturated soils).

Casey and Keller supervised the excavated test pits and produced the results for the percolation tests and the soils' composition. The study determined that the overall seasonal high-water table is relatively low throughout the site (approx. 10') and that the areas of the proposed detention basins have a minimal to no percolation rate. The percolation rate was 0 inches per hour. Much of this is due to the firmly compacted subsoils. Having such unfavorable percolation rates does not allow the design to incorporate infiltration as part of the stormwater management system, but this project is exempt from stormwater recharge as discussed later in the report. Our design has allowed for the maximum allowable contact time to allow some infiltration to occur, though it was not anticipated in our calculations.

PROPOSED PROJECT

The Fairview Village Garden project will provide 49 new apartment units and 13,750sf of retail space in two buildings for 270 Irvington Ave. and 2,900sf of retail and 12 new apartment units for 299 Irvington Ave by adding an addition to the existing building. 299 Irvington Avenue is exempt from the stormwater management regulations because it is not considered a major development. In addition to the proposed buildings construction, the project also includes other associated site improvements, including an underground parking structure, surface parking areas and access drives, landscape, and lighting improvements, as well as connection to the utility systems existing along the site frontage, which includes sanitary and storm sewer, water service, gas, telephone and electric. The proposed improvements result in an area of disturbance of 2.11 acres. All existing site improvements, such as the dwellings, foundations, driveways, and parking areas will be removed.

The stormwater management system would incorporate an underground collection system with trench drains, inlets and pipes. The collected runoff would be directed to surface bioretention basins and rain gardens. In the westerly side of the project site, runoff from adjacent neighbors will be collected within the bio-retention basins and ultimately discharge into a proposed discharge pipe to Irvington Avenue. Due to the unfavorable soils, these basins are designed as Bio-retention basins with underdrains, so the basins will drain within the maximum 72 hours. This design will allow the maximum amount of contact with the underlining soils to allow runoff evapotranspiration, and exfiltration. An infiltration rate was not used in our calculations. Additionally, the landscape areas proposed above the parking garage were considered impervious in our calculations. The bio-retention basins will remove TSS, oils, greases and pathogens. Larger precipitation events would be controlled through discharge control structures with the excess flow directed toward the stormwater sewer network in Irvington Avenue. This would help maintain existing drainage patterns.

TOPOGRAPHIC CONSIDERATIONS

Because of the nature of the site development and the supporting infrastructure as well as designing to balance cuts and fill, the proposed grading would substantially alter the site. However, the grading is designed to keep the proposed drainage close to the existing patterns. The proposed site drainage would be oriented to follow the existing patterns to the proposed detention systems and would have overflow structures to continue to direct flow to Irvington Avenue. The time of concentration to the various basins are based on standard practice by considering both the types of terrain (grass, paved, etc.) and slopes. A comparison of "before" and "after" runoff rates are found later in this report.

NONSTRUCTURAL BEST MANAGEMENT PRACTICES (BMPs)

Stormwater management is an important aspect of the project, not only for the safety and convenience of potential residents, but for the environment as well. Thus, it has been endeavored to include various stormwater management techniques that include both natural and structural means to accomplish that task.

The following low impact, nonstructural, development approaches to site design have been incorporated into this project as per NJDEP storm water management regulations **7:8**; notably:

Much of the proposed building area has been previously disturbed and/or filled. It is these areas where most of the contemplated soil compaction would take place in order to construct the new buildings, parking areas, and drives. In other locations that have not seen extensive disturbance, rubber-tired vehicles would be used to minimize compaction.

Extensive, supplemental landscaping would be added throughout the project site in the form of trees, shrubs, and ground cover. This would enhance esthetics and would help filter runoff.

To enhance the non-structural BMP's several structural elements are included as well:

- Two (2) above ground Bio-Retention Basins which are considered Green Infrastructure BMP's.
- Multiple aboveground Rain Graden/Bio-Retention areas which are considered Green Infrastructure BMP's.

Other source controls that are being employed to prevent and/or minimize the runoff containing pollutants are to provide: (i) inlets with bicycle grates to eliminate trash and debris from flowing into the drainage system. (ii) The application of fertilizer would be in accordance with the soil erosion and sediment control act NJSA 4:24-39 et seq. and implementing rules.

GROUNDWATER RECHARGE

The project site is located with the New Jersey State PA-1 Planning Area, which means areas of previous and intense development (that is, impervious cover, disturbed soils, contaminated areas,

et al.) (NJAC 7:8-5.4 (2). The municipal ordinance, as well as the State's Stormwater Management Rules require every major development to provide for maintaining 100% of the average annual pre-project groundwater recharge volume. This project is exempt from this requirement because it is in Planning Area 1 and is previously developed. Additionally, the soil logs show that recharge cannot take place because of the underlying unsuitable soils.

WATER QUALITY

Water quality requirements are applicable to this development since the proposed development will result in an increase of more than 0.25 acres of additional impervious area. As provided within the Township Stormwater Management Rules Water Quality standards and NJDEP (N.J.A.C.7:8-5.5) apply if there is a net increase of 0.25 acres or more of impervious surface onsite. Therefore, water quality requirements are applicable to this development.

The project will include two (2) bio-retention basins and rain gardens which according to the NJDEP stormwater regulations provide the necessary 80% TSS removal required.

The proposed basins and rain gardens are designed to collect and treat runoff from the water quality storm prior to discharging via underdrains to an inlet (1.25" rainfall within a 2-hour period). Larger storm events will discharge through a control structure to a proposed manhole, and/or via the underdrain system. The basins are designed in accordance with the New Jersey Stormwater Best Management Practices Manual. To provide a water quality benefit in the proposed locations, these areas are conservatively designed to contain water to a maximum depth of 11 inches for Basin 2 and 4 inches for basin 1, were 12 inches maximum is allowed for the water quality storm event. Runoff which is collected and filtrated into the bio-retention/rain garden bed media is collected via an underdrain which connects into the conveyance system on the site. Each basin also has an outlet structure to convey larger runoff volumes contributory to the basins. The outlet structures help preserve the life of the basin by allowing larger flows to reach the downstream conveyance system. The basins are designed to be planted with various native species of plants selected specifically for bio-retention/rain gardens to maximize the potential to improve the quality of water which passes through the facility. The calculations for the basins are provided in Appendix III of this report.

HYDROLOGY AND STORMWATER MANAGEMENT

The project will result in more than 1.0 acre of total disturbance, and increase impervious coverage by more than 0.25 acres, therefore the project meets the definition of "Major Development" as defined in the New Jersey Stormwater Management Regulations (N.J.A.C. 7:8 et seq). The specifics of how the site will comply with the SWM Rules is detailed further in this report.

Runoff Coefficients and Times of Concentration

All of the soils within the project site have been determined to be categorized within "Hydrologic Soil Group C" based upon the Soil Survey of Essex County. Accordingly, the following CN values have been employed for the various existing and proposed combinations of soil types and land cover:

Impervious Surface=	98
Lawn (HSG-C)=	74
Woods (HSG-C)=	70

In addition to CN values, the above referenced NRCS Methodology for estimating stormwater runoff rates and volumes also necessitates the determination of a time of concentration for each subwatershed/drainage area. The times of concentration were estimated in accordance with the criteria given in the SCS 1986 TR-55. A minimum sixminute time of concentration was employed.

The methodology being used is the SCS Runoff Curve Number (CN) method. This methodology is best referenced in the USDA-SCS. 1985. National Engineering Handbook, Section 4 - Hydrology. Washington, D.C.: USDA-SCS.

The SCS runoff equation is

where

$$Q = \frac{(P - Ia)^2}{(P - Ia) + S}$$

To achieve this methodology, we used Hydrocad 10.10-5a, a software that will carry out and tabulate the different storm frequencies.

The stormwater collection system is designed based on the "Rational Method" for determining peak flow rates for the 25-year frequency storm. HYROFLOW was the software instrument used to calculate the collection system. The "Rational Method" Q = CIA where

Q = maximum rate of runoff, flow (cfs)
C = runoff coefficient as outlined in the Residential Site Improvement Standards (RSIS) (NJAC 5:21-7.2)
I = average rainfall intensity (in/hr) from Livingston's Precipitation Frequency Data
A = drainage area (acres)

The Rational formula estimates the peak rate of runoff in a watershed.

Since there are no direct discharges into any NJDEP regulated waters for this project, all stormwater management review would be conducted by local and county agencies.

Peak Flow Attenuation

The above referenced State Stormwater Management Regulations require the peak rate of runoff from the area being developed to be reduced for three storm events/frequencies (2, 10, 100 year). These storm events were modeled to determine the runoff from the site for existing and proposed conditions. Pursuant to the guidelines provided in the Best Management Practices Manual (BMP Manual), these analyses were performed using the NRCS TR55 NOAA D storm distribution. The following rainfall depths were used for each of the design storms.

Storm Frequency (years)	Rainfall Depth (inches)
2	3.44
10	5.22
100	8.66

Township regulations require that the runoff rates emanating from the area of development be reduced as follows:

2 Year Storm	50% of Predevelopment Rate
10 Year Storm	75% of Predevelopment Rate
100 Year Storm	80% of Predevelopment Rate

Table 2 – Required Runoff Reductions

Existing Site Conditions

Most of the overall project site in existing conditions currently drains into the site to a low point. The remaining area drain directly to Irvington Ave. During the smaller storm events, the low point detains runoff and no runoff discharges to the Irvington Avenue, which is a County Road. The larger storm events overtop the low area and discharge via overland flow into the Irvington Avenue storm sewer network. Below is the summary of existing conditions.

TABLE NO. 3										
SUMMARY OF EXISTING PEAK RUNOFF RATES										
Drainage Area Area No.Area (Acres)Runoff Curve No.Time of Concentration (Hours)Q2 (cfs)Q10 (cfs)Q100 (cfs)										
Area-1 EX IMP	0.55	98	0.10	1.74	2.66	4.43				
Area-1 EX PERV	1.12	73	0.10	1.43	3.14	6.82				
Area-3 EX	1.147	90	0.167	2.66	4.42	7.77				
Area-2 EX IMP	0.22	0.10	0.70	1.07	1.79					
Area-2 EX PERV	0.13	0.18	0.39	0.83						
Total Ex	xisting Peak	0.88	1.46	10.05						

Quantity Control (Peak Flow Attenuation)

The project's approach for compliance with the regulatory requirements for "quantity control" are set forth at Subpart 5.4(a)(3)(iii) of the Stormwater Management Regulations (NJAC 7:8). Specifically, stormwater management facilities have been designed to provide for the temporary storage of stormwater to attenuate post-project construction peak runoff rates for the 2, 10 and 100 year storm events. The stormwater management facilities will provide sufficient attenuation to reduce the peak rates of runoff from the developed portion of the project tract by (at least) 50% for the 2-year storm, 25% for the 10-year storm and 20% for the 100-year storm pursuant to the specific requirements of Subpart 5.4(a)(3)(iii).

Table 4 below summarizes the existing peak runoff rates and the "allowable" post-project peak runoff rates for the regulated storms.

TABLE NO. 4SUMMARY OF EXISTING AND "ALLOWABLE" PROPOSED PEAK RATES OF RUNOFF									
STORM	PEAK RU	NOFF RATES (CFS)							
FREQUENCY (YEARS)	EXISTING	ALLOWABLE PROPOSED							
2	0.88	0.44							
10	1.46	1.10							
100	10.05	8.04							

Proposed Site Conditions

As discussed above, the project will provide 49 new apartment units and 13,750sf of retail space in two buildings. In addition to the proposed buildings construction, the project also includes other associated site improvements, including an underground parking structure, surface parking areas and access drives, landscape and lighting improvements. To account for the increase in impervious cover and other changes to the project area, the project is proposing to construct two (2) bio-retention basins and rain gardens to control the rate of post-development runoff. The proposed site improvements would disturb approximately 2.11 acres and increase impervious cover by 15,256 square feet or 0.35 acres. Therefore, the project is subject to the stormwater management rules and regulations promulgated by the N.J. DEP and adopted by most municipalities. These rules require that an analysis be performed for the theoretical 2-, 10-, and 100-year storm frequencies.

The proposed stormwater management system is intended to mimic the existing drainage patterns. Please refer to the Drainage Area Maps for specifics on drainage areas and coverages, and so forth. The basins and rain gardens will provide both water quantity control and water quality control. Basin #1, located at the westerly part of the site, is a bioretention basin. The contributing drainage area is 0.51 acres comprising of lawn area and off-site contributing areas consisting of 1/8-acre residential dwelling. Basin 1 will detain runoff flow during the larger precipitation events to meet the reduction requirements. The discharge from Basin 1 discharges to Basin #2 in order to maximize on evapotranspiration. Basin #2 at the center of the site is also a bio-retention basin with contributing drainage area of 2.47 acres comprising of proposed building roof area, parking area and lawn. Please note that the multiple planter areas located above the underground parking deck were analyzed as impervious area in our calculations.

In order to compare existing and proposed conditions, the Hydrocad software program was used. This software processes and tabulates the results for the different storm frequencies and existing and proposed project site characteristics. The required calculations were made and are attached to this report for existing site conditions and the proposed drainage/detention systems. The "before" and "after" conditions were compared to show that the post-development runoff rates for each proposed drainage area is less than or equal to the existing drainage runoff rate. A comparison of the "before" and "after" runoff conditions is in the below table.

Table No. 5									
"Allowable" versus Post Runoff Rates (cfs)									
Storm Freq. Existing Allowable Post-Project									
2	0.88	0.44	0.37						
10	1.46	1.10	1.05						
100	100 10.05 8.04 6.82								

Table No. 5 above provides a summary of the proposed project peak runoff rates for the regulated storms and a comparison of these values to the previously determined "existing" and "allowable" peak runoff rates. The above table shows that the detention basins would produce post-developed runoff rates that are considerably lower than the site's existing rates of runoff, therefore complying with the NJDEP stormwater management regulations.

DRAIN TIME CALCULATIONS

Calculations were done for the drain time for each basin for the 100-year storm. That is, the requirements are that specific types of basins must drain within a particular time frame. The results of the Drain Time Calculations indicate the basins would drain within the designated time frame, which is 72 hours for each basin. For this project Basin 1 would drain in 15.0 hours; Basin 2 would drain in 55 hours and lastly, the rain gardens will drain in 10 hours.

SEDIMENT BASIN CALCULATIONS

At the start of a major construction project, the protection of any waterways, ponds, streams, storm sewers, and other water bodies is needed from erosion and siltation as they may occur within a construction site despite extensive soil erosion and sediment control measures. It is necessary then to trap sediment originating from eroding areas within the construction site. In order to reduce or abate polluting downstream areas, a capture and storage system for sediment of various sizes would be constructed. The standard practice is to simply use the proposed basins for that purpose. The initial basins would be modified as per the *Standards for Soil Erosion and Sediment Control in New Jersey*. Certain design calculations and specific structures are required to use the basins as sediment basins. The reader is referred to the supporting calculations found at the end of this report. Also, please refer to the various site plan drawings and the storm system details for more information.

CONCLUSION and SUMMARY

The proposed project site has significant existing development on it in the form of residential use, storage areas, parking lots, and connecting driveways. The proposed project would result in an increase in the overall impervious cover from what is existing. A stormwater management system has been proposed that would more or less keep the existing drainage patterns intact. As per the governing regulations, the post-development runoff rates from the 2, 10 and 100-year storms would decrease by 50%, 25% and 20% respectively. The stormwater conveyance system is designed to be adequate for the 25-year storm.

The runoff rates would be managed with discharge control structures in each proposed detention area. The proposed bio-retention basins will provide water quality and address the state water quality requirement to removal at least 80% of suspended solids. Lastly, the project site is located with the New Jersey State PA-1 Planning Area, which means areas of previous and intense development, therefore this project is exempt from recharge. Additionally, the soil logs show that recharge cannot take place because of the underlying unsuitable soils.

Based upon this analysis, it is concluded that the proposed stormwater management system would adequately prevent any flooding conditions at the project site. Further the reduction in runoff flow rates would help reduce the downstream potential for flooding. Finally, the runoff would be naturally treated to remove potential pollutants meeting state regulations.

APPENDIX I

SOIL DATA



USDA Natural Resources Conservation Service Web Soil Survey National Cooperative Soil Survey



Hydrologic Soil Group

Map unit symbol Map unit name		Rating	Acres in AOI	Percent of AOI
BowrB	Boonton - Urban land, Boonton substratum complex, red sandstone lowland, 0 to 8 percent slopes	C	23.6	100.0%
Totals for Area of Intere	est	23.6	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



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D	0	DEPT	87'	94.5'	95	97'	99'		Elevation		Soil Ty	Boring	Addres
PTH OF L	EFPTH OF	H TO STA	56-144"	48-56"	24-48"	8"-24"	0-8"		Depth		e	No.	N
EDGEROCK =	: SEEPAGE =	NDING WATER =	YELLOWISH RED	BROWNISH YELLOW	YELLOWISH RED	DARK REDDISH GRAY	DARK GRAYISH BROWN	INDISC	A .				
>144"	144"	144"	5YR 4/6	10yr 5/6	5YR 4/6	5YR 4/2	10YR 4/2	Chroma	Value	0		Sea	
		AT	NONE	Common 2-20%	NONE	NONE	NONE	Abundance		Color	Water Tabl	son Height	IRVIN
		8:45		Coarse >15mm				Size	Mottles		e Preser	: Water 1	GTON AV
				Distinct				Contrast			nt	Fable	ENUE, SO
		126"	CLAY LOAM	CLAY	CLAY LOAM	CLAY LOAM	CLAY		Texture		126"		UTH ORAN
		AT	5/5/5	10/5/0	8/5/2	8/5/2	8/5/2	Stone	Gravel/	% Coarse			NGE
		11:30	BLOCKY	MASSIVE	BLOCKY	BLOCKY	BLOCKY		Structure		Recorded E	Date:	
			Moist	Moist	Moist	Moist	Moist	Wet	Moist	Drv	y		116011
			faint	distinct	faint	faint	prominent	Coat	or Film	onsistence			1
			common medium irregular	few fine irregular	common medium irregular	common medium irregular	many coarse irregular	Size Shape	Quantity	Pores		1/28/202	
			NONE	NONE	NONE	NONE	SOME		Roots		JAA		
			gradual	gradual	smooth	gradual	clear		Boundary				

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DEI	DE	DEPTH	87.5'	94'	94.5	99.5'		Elevation		Soil Typ	Boring I	Address
TH OF L	FPTH OF	TO STA	54"-144"	48"-54"	8"-48"	0-8"		Depth		Ō	lo.	
EDGEROCK =	SEEPAGE =	NDING WATER =	WEAK RED	BROWNISH	DARK REDDISH GRAY	DARK GRAYISH BROWN	WOISt				2	
>144"	144"	144"	5YR 4/6	10yr 5/6	5YR 4/2	10YR 4/2	Chroma	Value	0		Sea	
		AT	NONE	Common 2-20%	NONE	NONE	Abundance		Color	Water Tabl	son Height	IRVIN
		9:53		Coarse >15mm			Size	Mottles		e Presei	Water	GTON AV
				Distinct			Contrast			#	Table	ENUE, SOI
		132"	CLAY LOAM	CLAY	CLAY LOAM	CLAY		Texture		132"		UTH ORAN
		AT	5/5/5	10/5/0	8/5/2	8/5/2	Stone	Gravel/	% Coarse			NGE
		12:00	BLOCKY	MASSIVE	BLOCKY	BLOCKY		Structure		Recorded E	Date:	
			Moist	Moist	Moist	Moist	Wet	Moist		Ψ.		11601
			faint	distinct	faint	prominent	Coat	Film	onsistence			
			common medium irregular	few fine irregular	common medium irregular	many coarse irregular	Size Shape	Quantity	0		1/28/202	
			NONE	NONE	NONE	SOME		Roots		JAA		
			gradual	gradual	gradual	clear		Boundary				

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כחנ	DE	DEPTH		86	94.5 ¹	95'	99'		Elevations			Soil Type	Boring N	Address
THOFU	PTH OF	TO STAN		52"-156"	48"-52"	12"-48"	0-12"		Depth			U	lo.	
	SEEPAGE =	VDING WATER =		WEAK RED	BROWNISH YELLOW	DARK REDDISH GRAY	DARK GRAYISH BROWN	ISIOIAL					ω	
1450	156"	156"		5YR 4/6	10yr 5/6	5YR 4/2	10YR 4/2	Chroma	Value				Sea	
		AT		NONE	Common 2-20%	NONE	NONE	Abundance				Water Table	son Height	IRVIN
		10:30			Coarse >15mm			Size	Mottles			e Presei	Water	STON AV
					Distinct			Contrast				nt	Table	ENUE, SOL
		132"		CLAY LOAM	CLAY	CLAY LOAM	CLAY		Texture			132"		JTH ORAN
		AT		5/5/5	10/5/0	8/5/2	8/5/2	Stone	Gravel/	Fragments	% Coarse			NGE
		12:05		BLOCKY	MASSIVE	BLOCKY	BLOCKY		Structure			Recorded E	Date:	
				Moist	Moist	Moist	Moist	Wet	Moist	Dry	50	зy		116011
		-		faint	distinct	faint	prominent	Coat	or		onsistence			-
				common medium irregular	few fine irregular	common medium irregular	many coarse irregular	Size	Quantity	Pores			1/28/202	
		-		NONE	NONE	NONE	SOME		Roots	1		JAA	-	
				gradual	gradual	gradual	clear		Boundary					

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DEF	DE	DEPTH		85.5	94'	94.5 ⁻	98.5'		Horizon			Soil Typ	Boring N	Address
TH OF L	EPTH OF	TO STAI		52"-156"	48"-52"	12"-48"	0-12"		Depth			Ø	0.	
EDGEROCK =	SEEPAGE =	VDING WATER =		WEAK RED	BROWNISH YELLOW	DARK REDDISH GRAY	DARK GRAYISH BROWN	WOISC	2				4	
>156"	156"	156"		5YR 4/6	10yr 5/6	5YR 4/2	10YR 4/2	Chroma	Value				Sea	
		AT		NONE	Common 2-20%	NONE	NONE	Abundance			2012	Water Tabl	son Height	IRVIN
		10:45			Coarse >15mm			Size	Mottles			e Presei	Water	GTON AV
					Distinct			Contrast				nt	Fable	ENUE, SOU
		132"		CLAY LOAM	CLAY	CLAY LOAM	CLAY		Texture			132"		UTH ORAN
		AT		5/5/5	10/5/0	8/5/2	8/5/2	Stone	Gravel/	Fragments	% Coarse	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2		NGE
		12:10		BLOCKY	MASSIVE	BLOCKY	BLOCKY		Structure			Recorded E	Date:	
				Moist	Moist	Moist	Moist	Wet	Moist	Dry	S	3y		11601
				faint	distinct	faint	prominent	Coat	or	1	onsistence			1
				common medium irregular	few fine irregular	common medium irregular	many coarse irregular	Size Shape	Quantity	Pores			1/28/202	
		-		NONE	NONE	NONE	SOME		Roots	1		JAA	4	
				gradual	graduał	gradual	clear		Boundary					

Casey & Keller, Inc.

LAND surveyors + civil engineers + PLANNERS N.J. STATE BOARD OF PROFESSIONAL ENGINEERS & LAND SURVEYORS CERTIFICATE OF AUTHORIZATION NO. 24GA27985400

DE		DEPTI		87.9'	95.9'	99.9'		Elevatior			Soil Typ	Boring	Addres:
PTH OF L	DEPTH OF	H TO STAN		48"-120"	12"-48"	0-12"		1 Depth			pe	No.	S
EDGEROCK =	SEEPAGE =	VDING WATER =		WEAK RED	DARK REDDISH GRAY	DARK GRAYISH BROWN	MOISL	5))				σ	
>120"				5YR 4/6	5YR 4/2	10YR 4/2	Chroma	Value				Sea	
		AT		NONE	NONE	NONE	Abundance		COLOF	2010	Water Tabl	son Height	IRVIN
							Size	Mottles			e Prese	Water	GTON AV
							Contrast				nt	Table	ENUE, SOU
				CLAY LOAM	CLAY LOAM	CLAY		Texture					UTH ORAN
		AT		5/5/5	8/5/2	8/5/2	Stone	Gravel/	Fragments	% Coarse			NGE
				BLOCKY	BLOCKY	BLOCKY		Structure			Recorded E	Date:	
				Moist	Moist	Moist	Wet	Moist	Dry	50	Зy		116011
				faint	faint	prominent	Coat	or]	onsistence			1
				common medium irregular	common medium irregular	many coarse irregular	Size Shape	Quantity	Pores			1/28/202	
				NONE	NONE	SOME		Roots			JAA	-	
		-		gradual	gradual	clear		Boundary					

CASEY & KELLER, INC.

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> 258 MAIN STREET, MILLBURN, NEW JERSEY, 07041 VOICE :973-379-3280 FAX: 973-379-7993

> > Date: 12/28/21

Sheet 1 of 1

PERCOLATION TEST DATA

LOCATION OF PROPERTY

Address: IRVINGTON AVENUE.Municipality: SOUTH ORANGELot # 14-20Block # 2102Job No. 1160111

FIELD DATA

Weather Conditions: 28°Recent Rainfall: 01-27-21Technician: JAABackhoe Operator: JIMTest Hole No. 2Depth: 6'Location of Test Hole: AS PER PLAN

SATURATION TEST

Time	Depth	7
10:14	10"	- E FAIL
11:20	10"	

STABILIATION TEST

Time	Depth	

FINAL PERCOLATION RATE	Time	Depth

Rate= 0"

Michael Lanzafama, PE, PLS Lic. #GB30084

APPENDIX II

EXISTING DRAINAGE AREAS RUNOFF CALCULATIONS



Time span=0.00-72.00 hrs, dt=0.05 hrs, 1441 points Runoff by SCS TR-20 method, UH=SCS, Weighted-CN Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment1 EX IMP: 1 EX IMP	Runoff Area=24,054 sf 100.00% Impervious Runoff Depth=3.21" Tc=6.0 min CN=98 Runoff=1.74 cfs 0.148 af
Subcatchment1 EX PER: 1 EX PER	Runoff Area=48,961 sf 0.00% Impervious Runoff Depth=1.14" Tc=6.0 min CN=73 Runoff=1.43 cfs 0.107 af
Subcatchment 2 EX IMP: 2 EX IMP	Runoff Area=9,695 sf 100.00% Impervious Runoff Depth=3.21" Tc=6.0 min CN=98 Runoff=0.70 cfs 0.059 af
Subcatchment 2 EX PER: 2 EX PER	Runoff Area=5,847 sf 0.00% Impervious Runoff Depth=1.20" Tc=6.0 min CN=74 Runoff=0.18 cfs 0.013 af
Subcatchment3 EX: EX3 1/8ac	Runoff Area=1.147 ac 0.00% Impervious Runoff Depth=2.39" Tc=10.0 min CN=90 Runoff=2.66 cfs 0.229 af
Pond 4 LP: 4-LOW POINT	Peak Elev=99.24' Storage=21,035 cf Inflow=5.70 cfs 0.483 af Outflow=0.00 cfs 0.000 af
Link 5 EX-TOTAL: 5 EX-TOTAL COUNTY R	OAD Inflow=0.88 cfs 0.073 af Primary=0.88 cfs 0.073 af

Total Runoff Area = 3.180 acRunoff Volume = 0.556 afAverage Runoff Depth = 2.10"75.64% Pervious = 2.405 ac24.36% Impervious = 0.775 ac

Summary for Subcatchment 1 EX IMP: 1 EX IMP

Runoff = 1.74 cfs @ 12.13 hrs, Volume= 0.148 af, Depth= 3.21"



Summary for Subcatchment 1 EX PER: 1 EX PER

Runoff = 1.43 cfs @ 12.14 hrs, Volume= 0.107 af, Depth= 1.14"



Summary for Subcatchment 2 EX IMP: 2 EX IMP

Runoff = 0.70 cfs @ 12.13 hrs, Volume= 0.059 af, Depth= 3.21"



Summary for Subcatchment 2 EX PER: 2 EX PER

Runoff = 0.18 cfs @ 12.14 hrs, Volume= 0.013 af, Depth= 1.20"

	А	rea (sf)	CN	Description								
*		5,847	74	LAWN								
		5,847		100.00% P	ervious Are	а						
	Tc (min)	Length (feet)	Slope (ft/ft	velocity (ft/sec)	Capacity (cfs)	Description						
	6.0					Direct Entry, MIN TC						
	Subcatchment 2 EX PER: 2 EX PER											
	Hydrograph											
	0.0		+-+	-+-+	+ - + - +							



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Summary for Subcatchment 3 EX: EX3 1/8ac RESIDENTIAL

Runoff = 2.66 cfs @ 12.17 hrs, Volume= 0.229 af, Depth= 2.39"

A	rea (ac) Cl	N Description	n		
*	1.147 9	0 1/8 resider	ntial		
	1.147	100.00% F	Pervious Area		
<u>(m</u>	Tc Length in) (feet)	Slope Velo (ft/ft) (ft/s	city Capacity ec) (cfs)	Description	
10	0.0			Direct Entry,	
		Subca	atchment 3 E	EX: EX3 1/8ac RESIDENTIAL	
			Hydro	graph	
Flow (cfs)	2	2.66 cfs		NOAA 24-hr D 2 year storm Rainfall=3.44" Runoff Area=1.147 ac Runoff Volume=0.229 af Runoff Depth=2.39" Tc=10.0 min CN=90	Runoff
		10 12 14 16 18 20 3		4 36 38 40 42 44 46 48 50 52 54 56 58 60 62 64 66 68 70 72 (base 1)	

Summary for Pond 4 LP: 4-LOW POINT

Inflow Area	a =	2.823 ac,	19.56% Impervi	ious, Inflow l	Depth =	2.05" fo	or 2 year	storm event
Inflow	=	5.70 cfs @	12.14 hrs, Vo	lume=	0.483	af		
Outflow	=	0.00 cfs @	0.00 hrs, Vo	lume=	0.000	af, Atten	= 100%,	Lag= 0.0 min
Primary	=	0.00 cfs @	0.00 hrs, Vo	lume=	0.000	af		-

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs Peak Elev= 99.24' @ 24.60 hrs Surf.Area= 32,970 sf Storage= 21,035 cf

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

Volume	Inv	ert Avail.Sto	orage Storag	e Description		
#1	97.:	29' 56,5	17 cf LOW F	POINT (Prismatio	:)Listed below (Recalc)	
Elevatio (fee	n t)	Surf.Area	Inc.Store	Cum.Store		
97.2 98.0	9 0 0	0 2,345 24,318	0 832 13 332	0 832 14 164		
100.0	0	60,388	42,353	56,517		
Device	Routing	Invert	Outlet Devic	es		
#1	Primary	99.43'	80.0' long > Head (feet) 2.50 3.00 3 Coef. (Englis 2.72 2.81 2	3.0' breadth Br 0.20 0.40 0.60 3.50 4.00 4.50 sh) 2.44 2.58 2. 2.92 2.97 3.07 3	oad-Crested Rectangul 0.80 1.00 1.20 1.40 1 68 2.67 2.65 2.64 2.6 3.32	l ar Weir .60 1.80 2.00 4 2.68 2.68

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=97.29' (Free Discharge) —1=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

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Pond 4 LP: 4-LOW POINT



Summary for Link 5 EX-TOTAL: 5 EX-TOTAL COUNTY ROAD

Inflow Ar	rea =	3.180 ac, 24.36% Impervious, I	nflow Depth = 0.28" for 2 year storm event
Inflow	=	0.88 cfs @ 12.13 hrs, Volume=	0.073 af
Primary	=	0.88 cfs @ 12.13 hrs, Volume=	0.073 af, Atten= 0%, Lag= 0.0 min

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



Link 5 EX-TOTAL: 5 EX-TOTAL COUNTY ROAD

Time span=0.00-72.00 hrs, dt=0.05 hrs, 1441 points Runoff by SCS TR-20 method, UH=SCS, Weighted-CN Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment1 EX IMP: 1 EX IMP	Runoff Area=24,054 sf 100.00% Impervious Runoff Depth=4.98" Tc=6.0 min CN=98 Runoff=2.66 cfs 0.229 af
Subcatchment1 EX PER: 1 EX PER	Runoff Area=48,961 sf 0.00% Impervious Runoff Depth=2.45" Tc=6.0 min CN=73 Runoff=3.14 cfs 0.230 af
Subcatchment2 EX IMP: 2 EX IMP	Runoff Area=9,695 sf 100.00% Impervious Runoff Depth=4.98" Tc=6.0 min CN=98 Runoff=1.07 cfs 0.092 af
Subcatchment2 EX PER: 2 EX PER	Runoff Area=5,847 sf 0.00% Impervious Runoff Depth=2.54" Tc=6.0 min CN=74 Runoff=0.39 cfs 0.028 af
Subcatchment3 EX: EX3 1/8ac	Runoff Area=1.147 ac 0.00% Impervious Runoff Depth=4.09" Tc=10.0 min CN=90 Runoff=4.42 cfs 0.391 af
Pond 4 LP: 4-LOW POINT	Peak Elev=99.44' Storage=28,495 cf Inflow=10.02 cfs 0.850 af Outflow=0.43 cfs 0.208 af
Link 5 EX-TOTAL: 5 EX-TOTAL COUNTY F	ROAD Inflow=1.46 cfs 0.329 af Primary=1.46 cfs 0.329 af
Total Runoff Area = 3.180 a	ac Runoff Volume = 0.971 af Average Runoff Depth = 3.66" 75.64% Pervious = 2.405 ac 24.36% Impervious = 0.775 ac

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Summary for Subcatchment 1 EX IMP: 1 EX IMP

Runoff = 2.66 cfs @ 12.13 hrs, Volume= 0.229 af, Depth= 4.98"



Summary for Subcatchment 1 EX PER: 1 EX PER

3.14 cfs @ 12.13 hrs, Volume= Runoff 0.230 af, Depth= 2.45" =


Runoff = 1.07 cfs @ 12.13 hrs, Volume= 0.092 af, Depth= 4.98"



Summary for Subcatchment 2 EX PER: 2 EX PER

Runoff = 0.39 cfs @ 12.13 hrs, Volume= 0.028 af, Depth= 2.54"

	A	rea (sf)	CN	Description				
*		5,847	74	LAWN				
		5,847	847 100.00% Pervious Area					
	Tc (min)	Length Slope Velocity Capacity Description (feet) (ft/ft) (ft/sec) (cfs)						
	6.0	.0 Direct Entry, MIN TC						
	Subcatchment 2 EX PER: 2 EX PER							
	Hydrograph							



Summary for Subcatchment 3 EX: EX3 1/8ac RESIDENTIAL

Runoff = 4.42 cfs @ 12.17 hrs, Volume= 0.391 af, Depth= 4.09"

	Area	(ac)	CN	Desc	ription				
*	1.	147	90	1/8 re	esidential				
	1.147 100.00% Pervious Area					ous Area			
	Tc (min)	Lengt (fee	th t)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description		
	10.0 Direct Entry,								
	Subcatchment 3 EX: EX3 1/8ac RESIDENTIAL								
		Hydrograph							



Summary for Pond 4 LP: 4-LOW POINT

Inflow A	rea =	2.823 ac, 19.5	6% Impervious,	Inflow Depth =	3.61" for	10 year storm event
Inflow	=	10.02 cfs @ 12	.14 hrs, Volume	e= 0.850	af	
Outflow	=	0.43 cfs @ 15	.06 hrs, Volume	e= 0.208	af, Atten=	96%, Lag= 175.2 min
Primary	=	0.43 cfs @ 15	.06 hrs, Volume	e= 0.208	af	

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs Peak Elev= 99.44' @ 15.06 hrs Surf.Area= 40,314 sf Storage= 28,495 cf

Plug-Flow detention time= 511.0 min calculated for 0.208 af (24% of inflow) Center-of-Mass det. time= 315.2 min (1,113.7 - 798.5)

Volume	Inv	ert Avail	.Storage	Storage	Description			
#1	97.	29' 5	56,517 cf	LOW P	OINT (Prismatio	;)Listed below (R	≀ecalc)	
Elevatio	on	Surf.Area	Inc	.Store	Cum.Store			
(fee	et)	(sq-ft)	(cubio	c-feet)	(cubic-feet)			
97.2	<u>29</u>	0		0	0			
98.0	00	2,345		832	832			
99.0	00	24,318	1	3,332	14,164			
100.0	00	60,388	4	2,353	56,517			
Device	Routing	١n	vert Outle	et Device	S			
#1	Primary	99.	43' 80.0' Head 2.50 Coef 2.72	long x d (feet) 0 3.00 3. . (English 2.81 2.	3.0' breadth Bro 0.20 0.40 0.60 50 4.00 4.50 h) 2.44 2.58 2. 92 2.97 3.07 3	oad-Crested Re 0.80 1.00 1.20 68 2.67 2.65 2 3.32	ctangular Weir 1.40 1.60 1.80 2 64 2.64 2.68 2.6	2.00 38

Primary OutFlow Max=0.30 cfs @ 15.06 hrs HW=99.44' (Free Discharge) —1=Broad-Crested Rectangular Weir (Weir Controls 0.30 cfs @ 0.28 fps)

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Pond 4 LP: 4-LOW POINT



Summary for Link 5 EX-TOTAL: 5 EX-TOTAL COUNTY ROAD

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Inflow A	\rea =	3.180 ac, 24.36% Impervious, Inflow D	Depth = 1.24" for 10 year storm event
Inflow	=	1.46 cfs @ 12.13 hrs, Volume=	0.329 af
Primary	/ =	1.46 cfs @ 12.13 hrs, Volume=	0.329 af, Atten= 0%, Lag= 0.0 min

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



Link 5 EX-TOTAL: 5 EX-TOTAL COUNTY ROAD

Time span=0.00-72.00 hrs, dt=0.05 hrs, 1441 points Runoff by SCS TR-20 method, UH=SCS, Weighted-CN Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment1 EX IMP: 1 EX IMP	Runoff Area=24,054 sf 100.00% Impervious Runoff Depth=8.42" Tc=6.0 min CN=98 Runoff=4.43 cfs 0.387 af
Subcatchment1 EX PER: 1 EX PER	Runoff Area=48,961 sf 0.00% Impervious Runoff Depth=5.40" Tc=6.0 min CN=73 Runoff=6.82 cfs 0.506 af
Subcatchment 2 EX IMP: 2 EX IMP	Runoff Area=9,695 sf 100.00% Impervious Runoff Depth=8.42" Tc=6.0 min CN=98 Runoff=1.79 cfs 0.156 af
Subcatchment 2 EX PER: 2 EX PER	Runoff Area=5,847 sf 0.00% Impervious Runoff Depth=5.52" Tc=6.0 min CN=74 Runoff=0.83 cfs 0.062 af
Subcatchment3 EX: EX3 1/8ac	Runoff Area=1.147 ac 0.00% Impervious Runoff Depth=7.46" Tc=10.0 min CN=90 Runoff=7.77 cfs 0.713 af
Pond 4 LP: 4-LOW POINT	Peak Elev=99.56' Storage=33,398 cf Inflow=18.66 cfs 1.606 af Outflow=9.08 cfs 0.964 af
Link 5 EX-TOTAL: 5 EX-TOTAL COUNTY R	DAD Inflow=10.05 cfs 1.182 af Primary=10.05 cfs 1.182 af
Total Runoff Area = 3 180 ac	Runoff Volume = 1 824 af Average Runoff Denth = 6 88

Total Runoff Area = 3.180 acRunoff Volume = 1.824 afAverage Runoff Depth = 6.88"75.64% Pervious = 2.405 ac24.36% Impervious = 0.775 ac

Summary for Subcatchment 1 EX IMP: 1 EX IMP

Runoff 4.43 cfs @ 12.13 hrs, Volume= = 0.387 af, Depth= 8.42"



Summary for Subcatchment 1 EX PER: 1 EX PER

Runoff = 6.82 cfs @ 12.13 hrs, Volume= 0.506 af, Depth= 5.40"



Summary for Subcatchment 2 EX IMP: 2 EX IMP

Runoff 1.79 cfs @ 12.13 hrs, Volume= = 0.156 af, Depth= 8.42"



Summary for Subcatchment 2 EX PER: 2 EX PER

Runoff 0.83 cfs @ 12.13 hrs, Volume= 0.062 af, Depth= 5.52" =

	A	rea (sf)	CN	Description				
*		5,847	74	LAWN				
		5,847	7 100.00% Pervious Area					
	Tc (min)	Length (feet)	Slope (ft/ft	e Velocity) (ft/sec)	Capacity (cfs)	Description		
	6.0	.0 Direct Entry, MIN TC						
	Subcatchment 2 EX PER: 2 EX PER							



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Summary for Subcatchment 3 EX: EX3 1/8ac RESIDENTIAL

Runoff 7.77 cfs @ 12.17 hrs, Volume= 0.713 af, Depth= 7.46" =

	Area (ac)	CN	Desc	ription				
*	1.1	147	90	1/8 r	esidential				
	1.147 100.00% Pervious Area								
	Tc (min)	Lengt (fee	h t)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description		
	10.0	Direct Entry,							
	Subcatchment 3 EX: EX3 1/8ac RESIDENTIAL								



Summary for Pond 4 LP: 4-LOW POINT

Inflow Ar	ea =	2.823 ac, 19.56% Impervious, Inflow Depth = 6.83" for 100 year storm even	ent
Inflow	=	18.66 cfs @ 12.14 hrs, Volume= 1.606 af	
Outflow	=	9.08 cfs @ 12.30 hrs, Volume= 0.964 af, Atten= 51%, Lag= 9.4 min	
Primary	=	9.08 cfs @ 12.30 hrs, Volume= 0.964 af	

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs Peak Elev= 99.56' @ 12.30 hrs Surf.Area= 44,485 sf Storage= 33,398 cf

Plug-Flow detention time= 237.4 min calculated for 0.964 af (60% of inflow) Center-of-Mass det. time= 118.4 min (903.1 - 784.7)

Volume	١n	vert Avail.Sto	orage Storage	e Description		
#1	97.	29' 56,5	517 cf LOW P	OINT (Prismatic)Listed below (Recalc)	
Elevatio (fee	on et)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)		
97.2 98.0 99.0 100.0	29 00 00 00	0 2,345 24,318 60,388	0 832 13,332 42,353	0 832 14,164 56,517		
Device	Routing	Invert	Outlet Device	es		
#1	Primary	99.43'	80.0' long x Head (feet) 2.50 3.00 3 Coef. (Englis 2.72 2.81 2	3.0' breadth Bro 0.20 0.40 0.60 .50 4.00 4.50 h) 2.44 2.58 2.0 .92 2.97 3.07 3	Dad-Crested Rectangular Weir 0.80 1.00 1.20 1.40 1.60 1.80 68 2.67 2.65 2.64 2.64 2.68 2. .32	2.00 68

Primary OutFlow Max=9.04 cfs @ 12.30 hrs HW=99.56' (Free Discharge) **1=Broad-Crested Rectangular Weir** (Weir Controls 9.04 cfs @ 0.88 fps)

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Pond 4 LP: 4-LOW POINT



Summary for Link 5 EX-TOTAL: 5 EX-TOTAL COUNTY ROAD

Inflow A	Area =	3.180 ac, 24.36% Impervic	ous, Inflow Depth =	4.46" for 100 year storm event
Inflow	=	10.05 cfs @ 12.28 hrs, Vol	ume= 1.182 a	af
Primary	y =	10.05 cfs @ 12.28 hrs, Vol	ume= 1.182 a	af, Atten= 0%, Lag= 0.0 min

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



Link 5 EX-TOTAL: 5 EX-TOTAL COUNTY ROAD

PROPOSED DRAINAGE AREAS RUNOFF CALCULATIONS



NOAA 24-hr D 2 year storm Rainfall=3.44" Printed 5/6/2021

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> Time span=0.00-72.00 hrs, dt=0.05 hrs, 1441 points Runoff by SCS TR-20 method, UH=SCS, Weighted-CN Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment1P IMP: 1P-IMP	Runoff Area=0.990 ac 100.00% Impervious Runoff Depth=3.21" Tc=6.0 min CN=98 Runoff=3.13 cfs 11,524 cf
Subcatchment 1P PER: 1P-PER Flow Length=218	Runoff Area=1.480 ac 0.00% Impervious Runoff Depth=1.81" ' Slope=0.0500 '/' Tc=9.9 min CN=83 Runoff=2.66 cfs 9,714 cf
Subcatchment 2P-A: 2P-A	Runoff Area=0.150 ac 70.00% Impervious Runoff Depth=2.48" Tc=6.0 min CN=91 Runoff=0.41 cfs 1,353 cf
Subcatchment 2P-B: 2PB UNDETAINED	Runoff Area=0.050 ac 60.00% Impervious Runoff Depth=2.21" Tc=6.0 min CN=88 Runoff=0.12 cfs 402 cf
Subcatchment 3P: 3P	Runoff Area=0.510 ac 0.00% Impervious Runoff Depth=1.96" Flow Length=137' Tc=9.5 min CN=85 Runoff=1.01 cfs 3,636 cf
Pond 1P: BIO-BASIN 2	Peak Elev=96.68' Storage=14,557 cf Inflow=5.73 cfs 24,876 cf Outflow=0.31 cfs 24,876 cf
Pond BASIN 1: BASIN 1	Peak Elev=99.37' Storage=1,237 cf Inflow=1.01 cfs 3,636 cf Outflow=0.14 cfs 3,638 cf
Pond RG2: RAIN GARDEN 2	Peak Elev=99.72' Storage=404 cf Inflow=0.41 cfs 1,353 cf Outflow=0.05 cfs 1,353 cf
Link 1L: TO COUNTY	Inflow=0.37 cfs 26,631 cf Primary=0.37 cfs 26,631 cf

Total Runoff Area = 138,521 sf Runoff Volume = 26,629 cf Average Runoff Depth = 2.31" 64.62% Pervious = 89,516 sf 35.38% Impervious = 49,005 sf

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Summary for Subcatchment 1P IMP: 1P-IMP

Runoff = 3.13 cfs @ 12.13 hrs, Volume= 11,524 cf, Depth= 3.21"



Summary for Subcatchment 1P PER: 1P-PER

Runoff = 2.66 cfs @ 12.17 hrs, Volume= 9,714 cf, Depth= 1.81"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs NOAA 24-hr D 2 year storm Rainfall=3.44"

	Area	(ac) (CN Des	cription		
*	0.	680	74 LAV	VN		
*	0.	800	90 1/8 <i>A</i>	AC RESIDE	ENTIAL	
	1. 1.	480 480	83 Wei 100	ghted Aver .00% Pervi	age ous Area	
	Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
	9.4	100	0.0500	0.18		Sheet Flow, SHEET FLOW Grass: Dense n= 0.240 P2= 3.54"
	0.5	118	0.0500	3.60		Shallow Concentrated Flow, SHALLOW FLOW Unpaved Kv= 16.1 fps
	99	218	Total			

Subcatchment 1P PER: 1P-PER



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Summary for Subcatchment 2P-A: 2P-A

Runoff = 0.41 cfs @ 12.13 hrs, Volume= 1,353 cf, Depth= 2.48"

	Area (ac)	CN	Description			
*	0.045	74	rain garden			
*	0.105	98	imp. s/w			
	0.150	91	Weighted Ave	erage		
	0.045		30.00% Pervi	ous Area		
	0.105		70.00% Impei	vious Area		
	Tc Leng (min) (fee	th S et)	Slope Velocity (ft/ft) (ft/sec)	Capacity (cfs)	Description	
	6.0				Direct Entry, min tc	
				Subcatcl	hment 2P-A: 2P-A	
				Hydro	graph	
	0.44 0.42 0.42 0.4		41 cfs		NOAA 24-hr D	Runoff
	0.38			+ - + - +	2 year storm Rainfall=3 44"	-



Summary for Subcatchment 2P-B: 2PB UNDETAINED

Runoff = 0.12 cfs @ 12.13 hrs, Volume= 402 cf, Depth= 2.21"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs NOAA 24-hr D 2 year storm Rainfall=3.44"

	Area	(ac)	CN	Desc	ription		
*	0.	030	98	IMP			
*	0.	020	74	LAW	'N		
	0.	050	88	Weig	hted Aver	age	
	0.	020		40.0	0% Pervio	us Area	
	0.	030		60.0	0% Imperv	vious Area	
	Tc (min)	Lengt (fee	t)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
	6.0						Direct Entry, MIN TC

Subcatchment 2P-B: 2PB UNDETAINED



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Summary for Subcatchment 3P: 3P

Runoff = 1.01 cfs @ 12.17 hrs, Volume= 3,636 cf, Depth= 1.96"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs NOAA 24-hr D 2 year storm Rainfall=3.44"

	Area	(ac)	CN D	escription			
*	0.	160	74 la	wn			
*	0.	350	90 1/	8ac residen	itial		
	0. 0.	510 510	85 W 10	/eighted Ave 00.00% Per	erage vious Area		
_	Tc (min)	Length (feet)	l Slop (ft/1	e Velocity ft) (ft/sec)	/ Capacity) (cfs)	Description	
	9.4	100	0.050	0.18	3	Sheet Flow, sheet flow Grass: Dense n= 0.240 P2= 3.54"	
	0.1	37	0.200	0 7.20)	Shallow Concentrated Flow, shallow Unpaved Kv= 16.1 fps	
	9.5	137	′ Total				

Subcatchment 3P: 3P



Summary for Pond 1P: BIO-BASIN 2

Inflow Area	a =	129,809 sf,	33.22% In	npervious,	Inflow Depth =	2.30"	for 2 ye	ear storm event
Inflow	=	5.73 cfs @	12.14 hrs,	Volume=	24,876 c	f		
Outflow	=	0.31 cfs @	15.75 hrs,	Volume=	24,876 c	f, Atten	= 95%,	Lag= 216.6 min
Primary	=	0.31 cfs @	15.75 hrs,	Volume=	24,876 c	f		

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs Peak Elev= 96.68' @ 15.75 hrs Surf.Area= 7,796 sf Storage= 14,557 cf

Plug-Flow detention time= 920.2 min calculated for 24,876 cf (100% of inflow) Center-of-Mass det. time= 920.1 min (1,734.9 - 814.9)

Volume	Inve	rt Avail.Sto	rage Storage I	Description	
#1	94.5	0' 34,18	89 cf Custom	Stage Data (Pr	ismatic)Listed below (Recalc)
Elevatio	on s	Surf.Area	Inc.Store	Cum.Store	
(fee	et)	(sq-ft)	(cubic-feet)	(cubic-feet)	
94.5	50	0	0	0	
95.0	00	7,429	1,857	1,857	
96.0	00	7,586	7,508	9,365	
97.0	00	7,897	7,742	17,106	
98.0	00	8,235	8,066	25,172	
98.5	50	8,415	4,163	29,335	
99.0	00	11,000	4,854	34,189	
Device	Routing	Invert	Outlet Devices	5	
#1	Primary	92.20'	12.0" Round L= 354.0' RC Inlet / Outlet In n= 0.012, Flow	Culvert P, groove end p overt= 92.20' / 9 w Area= 0.79 sf	orojecting, Ke= 0.200 0.00' S= 0.0062 '/' Cc= 0.900
#2	Device 1	94.50'	0.10 cfs 3" un	derdrain when	above 92.20' Phase-In= 0.50'
#3	Device 1	96.25'	4.0" Vert. Orif Limited to weir	ice/Grate X 2 i	rows with 6.0" cc spacing C= 0.600 ads
#4	Device 1	97.75'	16.0' long x 0 Head (feet) 0. Coef. (English)	0.5' breadth Bro 20 0.40 0.60) 2.80 2.92 3.0	bad-Crested Rectangular Weir 0.80 1.00 08 3.30 3.32
Primary	OutFlow	Max=0.31 cfs (2) 15.75 hrs HW	/=96.68' (Free	Discharge)

-1=Culvert (Passes 0.31 cfs of 4.60 cfs potential flow)

2=3" underdrain (Exfiltration Controls 0.10 cfs)

-3=Orifice/Grate (Orifice Controls 0.21 cfs @ 2.45 fps)

-4=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

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Pond 1P: BIO-BASIN 2



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Summary for Pond BASIN 1: BASIN 1

Inflow A	\rea =	22,216 sf,	0.00% Impervious,	Inflow Depth = $^{\prime}$	1.96" for 2	year storm event
Inflow	=	1.01 cfs @	12.17 hrs, Volume=	3,636 cf		
Outflow	=	0.14 cfs @	13.04 hrs, Volume=	3,638 cf,	Atten= 86%	, Lag= 52.4 min
Primary	′ =	0.14 cfs @	13.04 hrs, Volume=	3,638 cf		

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs Peak Elev= 99.37' @ 13.04 hrs Surf.Area= 2,187 sf Storage= 1,237 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow) Center-of-Mass det. time= 88.6 min (923.9 - 835.3)

Volume	Inve	ert Avail.Sto	rage Storage I	Description	
#1	98.5	50' 9,7	55 cf Custom	Stage Data (Pri	smatic) Listed below (Recalc)
Elevatio	on	Surf.Area	Inc.Store	Cum.Store	
(fee	et)	(sq-ft)	(cubic-feet)	(cubic-feet)	
98.5	50	0	0	0	
99.0	00	1,936	484	484	
100.0	00	2,622	2,279	2,763	
101.0	00	3,405	3,014	5,777	
101.5	50	3,665	1,768	7,544	
102.0)0	5,178	2,211	9,755	
Device	Routing	Invert	Outlet Devices	i	
#1	Primary	95.50'	12.0" Round	Round 12"	
	-		L= 24.0' CMP Inlet / Outlet In n= 0.012 Corr	P, square edge h wert= 95.50' / 95 ugated PP, smo	eadwall, Ke= 0.500 5.00' S= 0.0208 '/' Cc= 0.900 oth interior, Flow Area= 0.79 sf
#2	Device 1	99.25'	6.0" Vert. Orif Limited to weir	ice/Grate X 2 ro	ows with 12.0" cc spacing C= 0.600 ds
#3	Device 1	100.75'	16.0' long x 0 Head (feet) 0.1 Coef. (English)	.5' breadth Bro 20 0.40 0.60 0 2.80 2.92 3.0	ad-Crested Rectangular Weir 0.80 1.00 18 3.30 3.32
#4	Device 1	98.50'	0.10 cfs Exfilt	ration when ab	ove 96.00'

Primary OutFlow Max=0.14 cfs @ 13.04 hrs HW=99.37' (Free Discharge)

-1=Round 12" (Passes 0.14 cfs of 6.94 cfs potential flow)

-2=Orifice/Grate (Orifice Controls 0.04 cfs @ 1.16 fps)

-3=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

-4=Exfiltration (Exfiltration Controls 0.10 cfs)

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Pond BASIN 1: BASIN 1



Summary for Pond RG2: RAIN GARDEN 2

Inflow Are	a =	6,534 sf,	70.00% Impervious,	Inflow Depth =	2.48"	for 2 year storm event
Inflow	=	0.41 cfs @	12.13 hrs, Volume=	1,353 c	of	-
Outflow	=	0.05 cfs @	11.55 hrs, Volume=	1,353 c	f, Atten	= 88%, Lag= 0.0 min
Primary	=	0.05 cfs @	11.55 hrs, Volume=	1,353 c	f	-

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs Peak Elev= 99.72' @ 12.92 hrs Surf.Area= 821 sf Storage= 404 cf

Plug-Flow detention time= 54.2 min calculated for 1,352 cf (100% of inflow) Center-of-Mass det. time= 54.2 min (860.5 - 806.4)

Volume	In	vert Ava	il.Storage	Storage D	escription	
#1	99	0.00'	662 cf	Custom S	tage Data (P	rismatic)Listed below (Recalc)
Elevatio (fee	on et)	Surf.Area (sq-ft)	Inc (cubi	.Store c-feet)	Cum.Store (cubic-feet)	
99.0 100.0	00 00	300 1,023		0 662	0 662	
Device	Routing	g Ir	vert Outle	et Devices		
#1 #2	Primar Primar	y 99 y 99	9.00' 0.05 9.75' 6.0'' Limit	cfs Exfiltra Horiz. Orif ted to weir f	ation when al ice/Grate X7 flow at low hea	bove 97.00' 7 rows C= 0.600 ads
Primary	rimary OutFlow Max=0.05 cfs @ 11.55 hrs HW=99.01' (Free Discharge)					

-1=Exfiltration (Exfiltration Controls 0.05 cfs)

-2=Orifice/Grate (Controls 0.00 cfs)

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Pond RG2: RAIN GARDEN 2



Summary for Link 1L: TO COUNTY

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Inflow A	vrea =	138,521 sf, 35.38% Impervious,	Inflow Depth = 2.31"	for 2 year storm event
Inflow	=	0.37 cfs @ 15.66 hrs, Volume=	26,631 cf	-
Primary	- =	0.37 cfs @ 15.66 hrs, Volume=	26,631 cf, Atter	n= 0%, Lag= 0.0 min

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

Hydrograph Inflow Primary 0.37 cfs 0.37 cfs 0.4 Inflow Area=138,521 sf 0.38 0.36 0.34 0.32 0.3 0.28 0.26 0.24 0.24 0.22 0.22 0.22 0.18 0.16 0.14 0.12-0.1 0.08 0.06 0.04 0.02 Λ 0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42 44 46 48 50 52 54 56 58 60 62 64 66 68 70 72 Time (hours)

Link 1L: TO COUNTY

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> Time span=0.00-72.00 hrs, dt=0.05 hrs, 1441 points Runoff by SCS TR-20 method, UH=SCS, Weighted-CN Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment1P IMP: 1P-IMP	Runoff Area=0.990 ac 100.00% Impervious Runoff Depth=4.98" Tc=6.0 min CN=98 Runoff=4.77 cfs 17,907 cf
Subcatchment 1P PER: 1P- PER Flow Length=218'	Runoff Area=1.480 ac 0.00% Impervious Runoff Depth=3.37" Slope=0.0500 '/' Tc=9.9 min CN=83 Runoff=4.92 cfs 18,126 cf
Subcatchment 2P-A: 2P-A	Runoff Area=0.150 ac 70.00% Impervious Runoff Depth=4.20" Tc=6.0 min CN=91 Runoff=0.67 cfs 2,285 cf
Subcatchment 2P-B: 2PB UNDETAINED	Runoff Area=0.050 ac 60.00% Impervious Runoff Depth=3.88" Tc=6.0 min CN=88 Runoff=0.21 cfs 704 cf
Subcatchment 3P: 3P	Runoff Area=0.510 ac 0.00% Impervious Runoff Depth=3.57" Flow Length=137' Tc=9.5 min CN=85 Runoff=1.80 cfs 6,613 cf
Pond 1P: BIO-BASIN 2	Peak Elev=97.69' Storage=22,620 cf Inflow=9.59 cfs 42,645 cf Outflow=0.94 cfs 42,645 cf
Pond BASIN 1: BASIN 1	Peak Elev=99.71' Storage=2,031 cf Inflow=1.80 cfs 6,613 cf Outflow=0.54 cfs 6,613 cf
Pond RG2: RAIN GARDEN 2	Peak Elev=99.81' Storage=479 cf Inflow=0.67 cfs 2,285 cf Outflow=0.56 cfs 2,285 cf
Link 1L: TO COUNTY	Inflow=1.05 cfs 45,634 cf Primary=1.05 cfs 45,634 cf

Total Runoff Area = 138,521 sf Runoff Volume = 45,634 cf Average Runoff Depth = 3.95" 64.62% Pervious = 89,516 sf 35.38% Impervious = 49,005 sf

Summary for Subcatchment 1P IMP: 1P-IMP

Runoff = 4.77 cfs @ 12.13 hrs, Volume= 17,907 cf, Depth= 4.98"



Summary for Subcatchment 1P PER: 1P-PER

Runoff = 4.92 cfs @ 12.17 hrs, Volume= 18,126 cf, Depth= 3.37"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs NOAA 24-hr D 10 year storm Rainfall=5.22"

	Area	(ac)	CN De	scription		
*	0.	680	74 LA	WN		
*	0.800 90 1/8AC RESIDENTIAL				ENTIAL	
	1. 1.	480 480	83 We 100	Weighted Average 100.00% Pervious Area		
_	Tc (min)	Length (feet)	Slope (ft/ft	e Velocity) (ft/sec)	Capacity (cfs)	Description
	9.4	100	0.0500	0.18		Sheet Flow, SHEET FLOW Grass: Dense n= 0.240 P2= 3.54"
	0.5	118	0.0500	3.60		Shallow Concentrated Flow, SHALLOW FLOW Unpaved Kv= 16.1 fps
	9.9	218	Total			

Subcatchment 1P PER: 1P-PER



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Summary for Subcatchment 2P-A: 2P-A

Runoff = 0.67 cfs @ 12.13 hrs, Volume= 2,285 cf, Depth= 4.20"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs NOAA 24-hr D 10 year storm Rainfall=5.22"

	Area	(ac)	CN	Desc	cription			
*	0.	045	74	rain	garden			
*	0.	105	98	imp.	s/w			
	0.	150	91	Weig	hted Aver	age		
	0.	045		30.0	0% Pervio	us Area		
	0.	105		70.00% Impervious Area				
	Tc (min)	Lengt (fee	h t)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description	
	6.0						Direct Entry, min tc	
						.		

Subcatchment 2P-A: 2P-A



Summary for Subcatchment 2P-B: 2PB UNDETAINED

Runoff = 0.21 cfs @ 12.13 hrs, Volume= 704 cf, Depth= 3.88"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs NOAA 24-hr D 10 year storm Rainfall=5.22"

	Area	(ac)	CN	Desc	ription		
*	0.	030	98	IMP			
*	0.	020	74	LAW	'N		
	0.	050	88	Weig	hted Aver	age	
	0.020 40.00% Pervious Area						
0.030				60.00	0% Imperv	vious Area	
	Тс	Leng	th :	Slope	Velocity	Capacity	Description
	(min)	(fee	et)	(ft/ft)	(ft/sec)	(cfs)	
	6.0						Direct Entry, MIN TC
							-

Subcatchment 2P-B: 2PB UNDETAINED



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Summary for Subcatchment 3P: 3P

Runoff = 1.80 cfs @ 12.17 hrs, Volume= 6,613 cf, Depth= 3.57"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs NOAA 24-hr D 10 year storm Rainfall=5.22"

	Area	(ac)	CN De	scription			
*	0.	0.160 74 lawn					
*	* 0.350 90 1/8ac residential				ial		
0.510 85 Weighted 0.510 100.00%					rage ious Area		
	Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description	
_	9.4	100	0.0500	0.18		Sheet Flow, sheet flow	
	0.1	37	0.2000	7.20		Grass: Dense n= 0.240 P2= 3.54" Shallow Concentrated Flow, shallow Unpaved Kv= 16.1 fps	
	9.5	137	Total				

Subcatchment 3P: 3P


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Summary for Pond 1P: BIO-BASIN 2

Inflow A	Area =	129,809 sf, 33.22% Impervious,	Inflow Depth = 3.94" for 10 year storm event
Inflow	=	9.59 cfs @ 12.15 hrs, Volume=	42,645 cf
Outflov	v =	0.94 cfs @ 13.62 hrs, Volume=	42,645 cf, Atten= 90%, Lag= 88.2 min
Primar	y =	0.94 cfs @ 13.62 hrs, Volume=	42,645 cf

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs Peak Elev= 97.69' @ 13.62 hrs Surf.Area= 8,130 sf Storage= 22,620 cf

Plug-Flow detention time= 665.9 min calculated for 42,645 cf (100% of inflow) Center-of-Mass det. time= 665.8 min (1,469.1 - 803.4)

Volume	Inve	rt Avail.Sto	rage Storage I	Description		
#1	94.5	0' 34,1	89 cf Custom	Stage Data (Pr	ismatic)Listed below (Recalc)	
Elevatio	on i	Surf.Area	Inc.Store	Cum.Store		
(fee	et)	(sq-ft)	(cubic-feet)	(cubic-feet)		
94.5	50	0	0	0		
95.0	00	7,429	1,857	1,857		
96.0	00	7,586	7,508	9,365		
97.0	00	7,897	7,742	17,106		
98.0	00	8,235	8,066	25,172		
98.5	50	8,415	4,163	29,335		
99.0	00	11,000	4,854	34,189		
Device	Routing	Invert	Outlet Devices	5		
#1	Primary	92.20'	12.0" Round L= 354.0' RC Inlet / Outlet In n= 0.012, Flow	Culvert P, groove end p overt= 92.20' / 9 w Area= 0.79 sf	orojecting, Ke= 0.200 0.00' S= 0.0062 '/' Cc= 0.900	
#2	Device 1	94.50'	0.10 cfs 3" un	derdrain when	above 92.20' Phase-In= 0.50'	
#3	Device 1	96.25'	4.0" Vert. Orif Limited to weir	ice/Grate X 2 i	rows with 6.0" cc spacing C= 0.600 ads	
#4	Device 1	97.75'	16.0' long x 0 Head (feet) 0. Coef. (English)	6.0' long x 0.5' breadth Broad-Crested Rectangular Weir lead (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=0.94 cfs (@ 13.62 hrs HW	/=97.69' (Free	Discharge)	

-1=Culvert (Passes 0.94 cfs of 4.99 cfs potential flow)

2=3" underdrain (Exfiltration Controls 0.10 cfs)

-3=Orifice/Grate (Orifice Controls 0.84 cfs @ 4.83 fps)

-4=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

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Pond 1P: BIO-BASIN 2



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Summary for Pond BASIN 1: BASIN 1

Inflow A	Area =	22,216 sf, 0.00% Impervious,	Inflow Depth = 3.57" for 10 year storm event
Inflow	=	1.80 cfs @ 12.17 hrs, Volume=	6,613 cf
Outflow	/ =	0.54 cfs @ 12.47 hrs, Volume=	6,613 cf, Atten= 70%, Lag= 18.0 min
Primary	y =	0.54 cfs @ 12.47 hrs, Volume=	6,613 cf

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs Peak Elev= 99.71' @ 12.47 hrs Surf.Area= 2,423 sf Storage= 2,031 cf

Plug-Flow detention time= 81.0 min calculated for 6,608 cf (100% of inflow) Center-of-Mass det. time= 80.9 min (897.3 - 816.4)

Volume	Inve	rt Avail.Sto	rage Storage I	Description		
#1	98.5	0' 9,75	55 cf Custom	Stage Data (Pris	smatic)Listed below (Recalc)	
Elevatio	on s	Surf.Area	Inc.Store	Cum.Store		
(fee	et)	(sq-ft)	(cubic-feet)	(cubic-feet)		
98.5	50	0	0	0		
99.0	00	1,936	484	484		
100.0	00	2,622	2,279	2,763		
101.0	00	3,405	3,014	5,777		
101.5	50	3,665	1,768	7,544		
102.0	00	5,178	2,211	9,755		
Device	Routing	Invert	Outlet Devices	;		
#1	Primary	95.50'	12.0" Round Round 12" L= 24.0' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 95.50' / 95.00' S= 0.0208 '/' Cc n= 0.012 Corrugated PD amonth interior. Flow Area		eadwall, Ke= 0.500 .00' S= 0.0208 '/' Cc= 0.900 oth interior. Flow Area= 0.79 sf	
#2	#2 Device 1 99.25' 6		6.0" Vert. Orifice/Grate X 2 rows with 12.0" cc spacing C= 0.600 Limited to weir flow at low heads			
#3	Device 1	100.75'	16.0' long x 0.5' breadth Broad-Crested Rectangular We Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32		ad-Crested Rectangular Weir 80 1.00 3 3.30 3.32	
#4	Device 1	98.50'	0.10 cfs Exfilt	ration when abo	ove 96.00'	

Primary OutFlow Max=0.54 cfs @ 12.47 hrs HW=99.71' (Free Discharge)

-1=Round 12" (Passes 0.54 cfs of 7.28 cfs potential flow)

2=Orifice/Grate (Orifice Controls 0.44 cfs @ 2.31 fps)

-3=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

-4=Exfiltration (Exfiltration Controls 0.10 cfs)

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Pond BASIN 1: BASIN 1



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Summary for Pond RG2: RAIN GARDEN 2

Inflow Area	a =	6,534 sf,	70.00% Impervio	s, Inflow Depth =	4.20"	for 10 year sto	orm event
Inflow	=	0.67 cfs @	12.13 hrs, Volume	= 2,285	cf	-	
Outflow	=	0.56 cfs @	12.19 hrs, Volume	= 2,285	cf, Atter	= 16%, Lag= 4	.0 min
Primary	=	0.56 cfs @	12.19 hrs, Volume	= 2,285	cf	-	

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs Peak Elev= 99.81' @ 12.19 hrs Surf.Area= 885 sf Storage= 479 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow) Center-of-Mass det. time= 49.0 min (839.4 - 790.4)

Volume	In	vert Avail.	Storage	Storage D	Description		
#1	99	.00'	662 cf	Custom	Stage Data (P	rismatic)Listed below (Recalc)	
Elevatio	on et)	Surf.Area (sq-ft)	Inc (cubio	.Store c-feet)	Cum.Store (cubic-feet)		
99.0 100.0)0)0	300 1,023		0 662	0 662		
Device	Routing	linve	ert Outle	et Devices			
#1 #2	Primary Primary	99.0 99.7	00' 0.05 75' 6.0'' Limit	 0.05 cfs Exfiltration when above 97.00' 6.0" Horiz. Orifice/Grate X 7 rows C= 0.600 Limited to weir flow at low heads 			
Primary OutFlow Max=0.54 cfs @ 12.19 hrs HW=99.81' (Free Discharge)							

1=Exfiltration (Exfiltration Controls 0.05 cfs)

-2=Orifice/Grate (Weir Controls 0.49 cfs @ 0.78 fps)

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Pond RG2: RAIN GARDEN 2



Summary for Link 1L: TO COUNTY

Printed 5/6/2021

Inflow A	Area =	138,521 sf, 35.38% Impervious,	Inflow Depth = 3.95" for 10 year storm even	nt
Inflow	=	1.05 cfs @ 12.20 hrs, Volume=	45,634 cf	
Primary	/ =	1.05 cfs @ 12.20 hrs, Volume=	45,634 cf, Atten= 0%, Lag= 0.0 min	

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



Link 1L: TO COUNTY

NOAA 24-hr D 100 year storm Rainfall=8.66" Printed 5/6/2021

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> Time span=0.00-72.00 hrs, dt=0.05 hrs, 1441 points Runoff by SCS TR-20 method, UH=SCS, Weighted-CN Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment1P IMP: 1P-IMP	Runoff Area=0.990 ac 100.00% Impervious Runoff Depth=8.42" Tc=6.0 min CN=98 Runoff=7.94 cfs 30,258 cf
Subcatchment 1P PER: 1P- PER Flow Length=218	Runoff Area=1.480 ac 0.00% Impervious Runoff Depth=6.61" ' Slope=0.0500 '/' Tc=9.9 min CN=83 Runoff=9.34 cfs 35,509 cf
Subcatchment 2P-A: 2P-A	Runoff Area=0.150 ac 70.00% Impervious Runoff Depth=7.58" Tc=6.0 min CN=91 Runoff=1.16 cfs 4,126 cf
Subcatchment 2P-B: 2PB UNDETAINED	Runoff Area=0.050 ac 60.00% Impervious Runoff Depth=7.21" Tc=6.0 min CN=88 Runoff=0.38 cfs 1,309 cf
Subcatchment 3P: 3P	Runoff Area=0.510 ac 0.00% Impervious Runoff Depth=6.85" Flow Length=137' Tc=9.5 min CN=85 Runoff=3.35 cfs 12,684 cf
Pond 1P: BIO-BASIN 2	Peak Elev=98.78' Storage=31,870 cf Inflow=17.66 cfs 78,455 cf Outflow=5.38 cfs 78,455 cf
Pond BASIN 1: BASIN 1	Peak Elev=100.43' Storage=3,959 cf Inflow=3.35 cfs 12,684 cf Outflow=1.10 cfs 12,688 cf
Pond RG2: RAIN GARDEN 2	Peak Elev=99.85' Storage=514 cf Inflow=1.16 cfs 4,126 cf Outflow=1.15 cfs 4,126 cf
Link 1L: TO COUNTY	Inflow=6.82 cfs 83,890 cf Primary=6.82 cfs 83,890 cf

Total Runoff Area = 138,521 sf Runoff Volume = 83,886 cf Average Runoff Depth = 7.27" 64.62% Pervious = 89,516 sf 35.38% Impervious = 49,005 sf

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Summary for Subcatchment 1P IMP: 1P-IMP

Runoff = 7.94 cfs @ 12.13 hrs, Volume= 30,258 cf, Depth= 8.42"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs NOAA 24-hr D 100 year storm Rainfall=8.66"



0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42 44 46 48 50 52 54 56 58 60 62 64 66 68 70 72 Time (hours)

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Summary for Subcatchment 1P PER: 1P-PER

Runoff = 9.34 cfs @ 12.17 hrs, Volume= 35,509 cf, Depth= 6.61"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs NOAA 24-hr D 100 year storm Rainfall=8.66"

	Area	(ac) (CN Des	cription		
*	0.	680	74 LAV	VN		
*	0.	800	90 1/8 <i>A</i>	AC RESIDE	ENTIAL	
	1. 1.	480 480	83 Wei 100	ghted Aver .00% Pervi	age ous Area	
	Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
	9.4	100	0.0500	0.18		Sheet Flow, SHEET FLOW
	0.5	118	0.0500	3.60		Shallow Concentrated Flow, SHALLOW FLOW Unpaved Kv= 16.1 fps
	99	218	Total			

Subcatchment 1P PER: 1P-PER



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Summary for Subcatchment 2P-A: 2P-A

Runoff = 1.16 cfs @ 12.13 hrs, Volume= 4,126 cf, Depth= 7.58"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs NOAA 24-hr D 100 year storm Rainfall=8.66"



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Summary for Subcatchment 2P-B: 2PB UNDETAINED

Runoff = 0.38 cfs @ 12.13 hrs, Volume= 1,309 cf, Depth= 7.21"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs NOAA 24-hr D 100 year storm Rainfall=8.66"

	6.0						Direct Entry, MIN TC
	(min)	(fee	et)	(ft/ft)	(ft/sec)	(cfs)	
	Тс	Leng	th :	Slope	Velocity	Capacity	Description
	0.	030		60.00	0% Imperv	vious Area	
	0.	020		40.00	0% Pervio	us Area	
	0.	050	88	Weig	hted Aver	age	
*	0.	020	74	LAW	'N		
*	0.	030	98	IMP			
	Area	(ac)	CN	Desc	ription		

Subcatchment 2P-B: 2PB UNDETAINED



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Summary for Subcatchment 3P: 3P

Runoff = 3.35 cfs @ 12.16 hrs, Volume= 12,684 cf, Depth= 6.85"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs NOAA 24-hr D 100 year storm Rainfall=8.66"

	Area	(ac)	CN Des	cription			
*	0.	160	74 law	n			
*	0.	350	90 1/8a	ac residenti	al		
	0.51085Weighted Average0.510100.00% Pervious Area				age ous Area		
	Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description	
	9.4	100	0.0500	0.18		Sheet Flow, sheet flow Grass: Dense n= 0.240 P2= 3.54"	
	0.1	37	0.2000	7.20		Shallow Concentrated Flow, shallow Unpaved Kv= 16.1 fps	
	9.5	137	Total				

Subcatchment 3P: 3P



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Summary for Pond 1P: BIO-BASIN 2

Inflow /	Area =	129,809 sf, 33.22% Impervious,	Inflow Depth = 7.25" for 100 year storm event
Inflow	=	17.66 cfs @ 12.15 hrs, Volume=	78,455 cf
Outflov	v =	5.38 cfs @ 12.49 hrs, Volume=	78,455 cf, Atten= 70%, Lag= 20.4 min
Primar	y =	5.38 cfs @ 12.49 hrs, Volume=	78,455 cf

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs Peak Elev= 98.78' @ 12.49 hrs Surf.Area= 9,850 sf Storage= 31,870 cf

Plug-Flow detention time= 424.7 min calculated for 78,401 cf (100% of inflow) Center-of-Mass det. time= 426.1 min (1,216.5 - 790.4)

Volume	Inve	ert Avail.Sto	rage Storage	Description					
#1	94.5	0' 34,1	89 cf Custom	Stage Data (Pr	rismatic)Listed below (Recalc)				
Elevatio	on	Surf.Area	Inc.Store	Cum.Store					
(fee	et)	(sq-ft)	(cubic-feet)	(cubic-feet)					
94.	50	0	0	0					
95.0	00	7,429	1,857	1,857					
96.0	00	7,586	7,508	9,365					
97.0	00	7,897	7,742	17,106					
98.0	00	8,235	8,066	25,172					
98.	50	8,415	4,163	29,335					
99.0	00	11,000	4,854	34,189					
Device	Routing	Invert	Outlet Devices	3					
#1	Primary	92.20'	12.0" Round L= 354.0' RC Inlet / Outlet Ir n= 0.012. Flor	Culvert P, groove end p overt= 92.20' / 9 w Area= 0.79 sf	orojecting, Ke= 0.200 0.00' S= 0.0062 '/' Cc= 0.900				
#2	Device 1	94.50'	0.10 cfs 3" ur	0.10 cfs 3" underdrain when above 92.20' Phase-In= 0.50'					
#3	Device 1	96.25'	4.0" Vert. Orif Limited to weil	fice/Grate X 2 in flow at low hea	rows with 6.0" cc spacing C= 0.600 ads				
#4	Device 1	97.75'	16.0' 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=5.38 cfs @ 12.49 hrs HW=98.78' (Free Discharge)									

-1=Culvert (Barrel Controls 5.38 cfs @ 6.85 fps) **-2=3" underdrain** (Passes < 0.10 cfs potential flow)

-3=Orifice/Grate (Passes < 1.22 cfs potential flow)

-4=Broad-Crested Rectangular Weir (Passes < 55.27 cfs potential flow)

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Pond 1P: BIO-BASIN 2



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Summary for Pond BASIN 1: BASIN 1

Inflow A	rea =	22,216 sf, 0.00% Impervious,	Inflow Depth = 6.85" for 100 year storm event
Inflow	=	3.35 cfs @ 12.16 hrs, Volume=	12,684 cf
Outflow	=	1.10 cfs @ 12.42 hrs, Volume=	12,688 cf, Atten= 67%, Lag= 15.5 min
Primary	=	1.10 cfs @ 12.42 hrs, Volume=	12,688 cf

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs Peak Elev= 100.43' @ 12.42 hrs Surf.Area= 2,958 sf Storage= 3,959 cf

Plug-Flow detention time= 78.6 min calculated for 12,679 cf (100% of inflow) Center-of-Mass det. time= 78.7 min (875.0 - 796.3)

Volume	Inve	ert Avail.Sto	rage Storage I	Description			
#1	98.5	50' 9,7	55 cf Custom	Stage Data (Pris	smatic)Listed below (Recalc)		
Elevatio	on	Surf.Area	Inc.Store	Cum.Store			
(fee	et)	(sq-ft)	(cubic-feet)	(cubic-feet)			
98.5	50	0	0	0			
99.0	00	1,936	484	484			
100.0	00	2,622	2,279	2,763			
101.0	00	3,405	3,014	5,777			
101.5	50	3,665	1,768	7,544			
102.0	00	5,178	2,211	9,755			
Device	Routing	Invert	Outlet Devices	i			
#1	Primary	95.50'	12.0" Round	Round 12"			
			L= 24.0' CMP	, square edge h	eadwall, Ke= 0.500		
			Inlet / Outlet In	vert= 95.50' / 95	.00' S= 0.0208 '/' Cc= 0.900		
			n= 0.012 Corr	ugated PP, smo	oth interior, Flow Area= 0.79 sf		
#2	Device 1	99.25'	6.0" Vert. Orifice/Grate X 2 rows with 12.0" cc spacing C= 0.600				
			Limited to weir	flow at low head			
#3	Device 1	100.75	16.0° long x 0	.5' breadth Broa	ad-Crested Rectangular Weir		
			Head (leet) U.	20 0.40 0.60 0			
#1	Dovice 1	09 501	0 10 ofo Exfilt) 2.00 2.92 3.04 ration when she	0 3.30 3.32		
#4	Device	90.00	U. TU CIS EXIIIL		JVE 30.00		

Primary OutFlow Max=1.10 cfs @ 12.42 hrs HW=100.43' (Free Discharge)

-**1=Round 12"** (Passes 1.10 cfs of 7.96 cfs potential flow)

2=Orifice/Grate (Orifice Controls 1.00 cfs @ 3.87 fps)

-3=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

-4=Exfiltration (Exfiltration Controls 0.10 cfs)

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Pond BASIN 1: BASIN 1



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Summary for Pond RG2: RAIN GARDEN 2

Inflow A	rea =	6,534 sf, 70.00% Impervious,	Inflow Depth = 7.58" for 100 year storm event
Inflow	=	1.16 cfs @ 12.13 hrs, Volume=	4,126 cf
Outflow	=	1.15 cfs @ 12.14 hrs, Volume=	4,126 cf, Atten= 1%, Lag= 0.9 min
Primary	=	1.15 cfs @ 12.14 hrs, Volume=	4,126 cf

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs Peak Elev= 99.85' @ 12.14 hrs Surf.Area= 913 sf Storage= 514 cf

Plug-Flow detention time= 42.0 min calculated for 4,123 cf (100% of inflow) Center-of-Mass det. time= 41.9 min (815.6 - 773.7)

Volume	Inv	<u>ert</u> Avail.S	Storage	Storage De	escription				
#1	99.	00'	662 cf	Custom S	tage Data (F	Prismatic)Listed below (Recalc)			
Elevatio (fee	on et)	Surf.Area (sq-ft)	Inc (cubio	.Store c-feet)	Cum.Store (cubic-feet)				
99.0	00	300		0	0				
100.0	00	1,023		662	662				
Device	Routing	Inve	rt Outle	et Devices					
#1	Primary	99.0	0' 0.05	cfs Exfiltra	tion when a	bove 97.00'			
#2	Primary	99.7	5' 6.0'' Limit	6.0" Horiz. Orifice/Grate X 7 rows C= 0.600 Limited to weir flow at low heads					
Primary OutFlow Max=1.12 cfs @ 12.14 hrs HW=99.85' (Free Discharge)									

1=Exfiltration (Exfiltration Controls 0.05 cfs)

2=Orifice/Grate (Weir Controls 1.07 cfs @ 1.01 fps)

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Pond RG2: RAIN GARDEN 2



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Summary for Link 1L: TO COUNTY

Inflow	Area =	138,521 sf, 35.38% Impervious,	Inflow Depth = 7.27"	for 100 year storm event
Inflow	=	6.82 cfs @ 12.17 hrs, Volume=	83,890 cf	
Primar	ту =	6.82 cfs @ 12.17 hrs, Volume=	83,890 cf, Atter	ı= 0%, Lag= 0.0 min

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

Link 1L: TO COUNTY



APPENDIX III

WATER QUALITY CALCULATIONS



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Time span=0.00-72.00 hrs, dt=0.05 hrs, 1441 points Runoff by SCS TR-20 method, UH=SCS, Weighted-CN Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment1P IMP: 1P-IMP	Runoff Area=0.990 ac 100.00% Impervious Runoff Depth=1.03" Tc=6.0 min CN=98 Runoff=2.80 cfs 3,718 cf
Subcatchment 1P PER: 1P- PER Flow Length=218'	Runoff Area=1.480 ac 0.00% Impervious Runoff Depth=0.24" Slope=0.0500 '/' Tc=9.9 min CN=83 Runoff=0.87 cfs 1,313 cf
Subcatchment 2P-A: 2P-A	Runoff Area=0.150 ac 70.00% Impervious Runoff Depth=0.54" Tc=6.0 min CN=91 Runoff=0.24 cfs 295 cf
Subcatchment 2P-B: 2PB UNDETAINED	Runoff Area=0.050 ac 60.00% Impervious Runoff Depth=0.41" Tc=6.0 min CN=88 Runoff=0.06 cfs 74 cf
Subcatchment 3P: 3P	Runoff Area=0.510 ac 0.00% Impervious Runoff Depth=0.30" Flow Length=137' Tc=9.5 min CN=85 Runoff=0.39 cfs 560 cf
Pond 1P: BIO-BASIN 2	Peak Elev=95.42' Storage=4,977 cf Inflow=3.41 cfs 5,594 cf Outflow=0.10 cfs 5,594 cf
Pond BASIN 1: BASIN 1	Peak Elev=98.85' Storage=235 cf Inflow=0.39 cfs 560 cf Outflow=0.10 cfs 563 cf
Pond RG2: RAIN GARDEN 2	Peak Elev=99.33' Storage=140 cf Inflow=0.24 cfs 295 cf Outflow=0.05 cfs 297 cf
Link 1L: TO COUNTY	Inflow=0.21 cfs 5,965 cf Primary=0.21 cfs 5,965 cf

Total Runoff Area = 138,521 sf Runoff Volume = 5,960 cf Average Runoff Depth = 0.52" 64.62% Pervious = 89,516 sf 35.38% Impervious = 49,005 sf

Summary for Subcatchment 1P IMP: 1P-IMP

Runoff 2.80 cfs @ 1.14 hrs, Volume= 3,718 cf, Depth= 1.03" =

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs Water Quality Storm Water Quality Rainfall=1.25"



Summary for Subcatchment 1P PER: 1P-PER

1,313 cf, Depth= 0.24" Runoff 0.87 cfs @ 1.24 hrs, Volume= =

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs Water Quality Storm Water Quality Rainfall=1.25"

	Area	(ac) C	N Des	cription		
*	0.	680	74 LAW	/N		
*	0.	800	90 1/8A	C RESIDE	ENTIAL	
1.48083Weighted Average1.480100.00% Pervious Area					age ous Area	
	Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
	9.4	100	0.0500	0.18		Sheet Flow, SHEET FLOW Grass: Dense n= 0.240 P2= 3.54"
	0.5	118	0.0500	3.60		Shallow Concentrated Flow, SHALLOW FLOW Unpaved Kv= 16.1 fps
	٩q	218	Total			

Subcatchment 1P PER: 1P-PER



Summary for Subcatchment 2P-A: 2P-A

Runoff 1.16 hrs, Volume= 0.24 cfs @ 295 cf, Depth= 0.54" =

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs Water Quality Storm Water Quality Rainfall=1.25"

	Area (a	ic)	CN	Desc	ription		
*	0.04	45	74	rain g	garden		
*	0.10	05	98	imp.	s/w		
	0.1	50	91	Weig	hted Aver	age	
	0.045 30.00% Pervious Area					us Area	
	0.10	0.105 70.00% Impervious Area					
	Tc L (min)	_ength (feet)) S	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
	6.0						Direct Entry, min tc

Subcatchment 2P-A: 2P-A



Summary for Subcatchment 2P-B: 2PB UNDETAINED

Runoff 1.17 hrs, Volume= 0.06 cfs @ 74 cf, Depth= 0.41" =

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs Water Quality Storm Water Quality Rainfall=1.25"

	Area	(ac)	CN	Desc	ription		
*	0.	030	98	IMP			
*	0.	020	74	LAW	'N		
	0.	050	88	Weig	hted Aver	age	
	0.020 40.00% Pervious Area					us Area	
	0.030 60.00% Impervious Area				0% Imperv	vious Area	
	Tc (min)	Leng (fee	th :t)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
	6.0						Direct Entry, MIN TC

Subcatchment 2P-B: 2PB UNDETAINED



Summary for Subcatchment 3P: 3P

560 cf, Depth= 0.30" Runoff 0.39 cfs @ 1.22 hrs, Volume= =

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs Water Quality Storm Water Quality Rainfall=1.25"

	Area	(ac) (CN Des	cription		
*	0.	160	74 lawr	l		
*	0.	350	90 1/8a	ac residenti	al	
0.51085Weighted Average0.510100.00% Pervious Area						
	Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
	9.4	100	0.0500	0.18		Sheet Flow, sheet flow Grass: Dense n= 0.240 P2= 3.54"
	0.1	37	0.2000	7.20		Shallow Concentrated Flow, shallow Unpaved Kv= 16.1 fps
	95	137	Total			

Subcatchment 3P: 3P



Summary for Pond 1P: BIO-BASIN 2

Inflow Are	a =	129,809 sf,	33.22% Impervious,	Inflow Depth =	0.52"	for Water Quality event
Inflow	=	3.41 cfs @	1.16 hrs, Volume=	5,594 c	f	-
Outflow	=	0.10 cfs @	1.20 hrs, Volume=	5,594 c	f, Atter	n= 97%, Lag= 2.4 min
Primary	=	0.10 cfs @	1.20 hrs, Volume=	5,594 c	f	-

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs Peak Elev= 95.42' @ 2.60 hrs Surf.Area= 7,495 sf Storage= 4,977 cf

Plug-Flow detention time= 457.8 min calculated for 5,591 cf (100% of inflow) Center-of-Mass det. time= 458.3 min (538.0 - 79.7)

Volume	Inve	rt Avail.Sto	orage Storage	Description	
#1	94.5	0' 34,1	89 cf Custom	Stage Data (Pr	rismatic)Listed below (Recalc)
Elevation	on s	Surf.Area	Inc.Store	Cum.Store	
(fee	et)	(sq-ft)	(cubic-feet)	(cubic-feet)	
94.	50	0	0	0	
95.0	00	7,429	1,857	1,857	
96.0	00	7,586	7,508	9,365	
97.0	00	7,897	7,742	17,106	
98.0	00	8,235	8,066	25,172	
98.	50	8,415	4,163	29,335	
99.0	00	11,000	4,854	34,189	
Device	Routing	Invert	Outlet Device:	S	
#1	Primary	92.20'	12.0" Round L= 354.0' RC Inlet / Outlet In n= 0.012 Flo	Culvert CP, groove end p nvert= 92.20' / 9 w Area= 0 79 sf	orojecting, Ke= 0.200 0.00' S= 0.0062 '/' Cc= 0.900
#2	Device 1	94.50'	0.10 cfs 3" ur	nderdrain when	above 92.20' Phase-In= 0.50'
#3	Device 1	96.25'	4.0" Vert. Ori Limited to wei	fice/Grate X 2 r flow at low hea	rows with 6.0" cc spacing C= 0.600 ads
#4	Device 1	97.75'	16.0' long x (Head (feet) 0 Coef. (English	0.5' breadth Bro .20 0.40 0.60 n) 2.80 2.92 3.0	Dad-Crested Rectangular Weir 0.80 1.00 08 3.30 3.32
Primary 1=Cι	/ OutFlow J lvert (Pas	Max=0.10 cfs (ses 0.10 cfs of	@ 1.20 hrs HW 3.89 cfs potenti	=95.07' (Free [ial flow)	Discharge)

-2=3" underdrain (Exfiltration Controls 0.10 cfs)

-3=Orifice/Grate (Controls 0.00 cfs)

-4=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

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Pond 1P: BIO-BASIN 2



Summary for Pond BASIN 1: BASIN 1

Inflow Ar	ea =	22,216 sf,	0.00% Impervious,	Inflow Depth =	0.30"	for	Water Quality event
Inflow	=	0.39 cfs @	1.22 hrs, Volume=	560 c	f		
Outflow	=	0.10 cfs @	1.10 hrs, Volume=	563 c	f, Atter	ר= 7	4%, Lag= 0.0 min
Primary	=	0.10 cfs @	1.10 hrs, Volume=	563 c	f		-

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs Peak Elev= 98.85' @ 1.65 hrs Surf.Area= 1,348 sf Storage= 235 cf

Plug-Flow detention time= 25.2 min calculated for 560 cf (100% of inflow) Center-of-Mass det. time= 25.5 min (110.6 - 85.1)

Volume	Inve	ert Avail.Sto	orage Storage	Description	
#1	98.5	50' 9,7	55 cf Custom	Stage Data (Pris	smatic)Listed below (Recalc)
Elevatio	on	Surf.Area	Inc.Store	Cum.Store	
(fee	et)	(sq-ft)	(cubic-feet)	(cubic-feet)	
98.5	50	0	0	0	
99.0	00	1,936	484	484	
100.0	00	2,622	2,279	2,763	
101.0	00	3,405	3,014	5,777	
101.5	50	3,665	1,768	7,544	
102.0	00	5,178	2,211	9,755	
Device	Routing	Invert	Outlet Devices	5	
#1	Primary	95.50'	12.0" Round	Round 12"	
	·		L= 24.0' CMF Inlet / Outlet In n= 0.012 Con	P, square edge h nvert= 95.50' / 95 rugated PP, smoo	eadwall, Ke= 0.500 .00' S= 0.0208 '/' Cc= 0.900 oth interior, Flow Area= 0.79 sf
#2	Device 1	99.25'	6.0" Vert. Ori Limited to wei	fice/Grate X 2 ro r flow at low head	ws with 12.0" cc spacing C= 0.600 Is
#3	Device 1	100.75'	16.0' long x (Head (feet) 0 Coef, (English	0.5' breadth Broa .20 0.40 0.60 0 0) 2.80 2.92 3.0	ad-Crested Rectangular Weir .80 1.00 8 3.30 3.32
#4	Device 1	98.50'	0.10 cfs Exfil	tration when abo	ve 96.00'

Primary OutFlow Max=0.10 cfs @ 1.10 hrs HW=98.54' (Free Discharge)

-1=Round 12" (Passes 0.10 cfs of 6.03 cfs potential flow)

-2=Orifice/Grate (Controls 0.00 cfs)

-3=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

-4=Exfiltration (Exfiltration Controls 0.10 cfs)

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Pond BASIN 1: BASIN 1



Summary for Pond RG2: RAIN GARDEN 2

Inflow Are	ea =	6,534 sf,	70.00% Impervious,	Inflow Depth =	0.54"	for Water Quality event
Inflow	=	0.24 cfs @	1.16 hrs, Volume=	295 c	f	-
Outflow	=	0.05 cfs @	1.05 hrs, Volume=	297 c	f, Atter	n= 79%, Lag= 0.0 min
Primary	=	0.05 cfs @	1.05 hrs, Volume=	297 c	f	-

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs Peak Elev= 99.33' @ 1.45 hrs Surf.Area= 541 sf Storage= 140 cf

Plug-Flow detention time= 29.2 min calculated for 295 cf (100% of inflow) Center-of-Mass det. time= 29.5 min (107.9 - 78.4)

Volume	In	vert Avail.	Storage	Storage D	escription	
#1	99	.00'	662 cf	Custom S	tage Data (P	rismatic)Listed below (Recalc)
Elevatio (fee	on et)	Surf.Area (sq-ft)	Inc (cubio	.Store c-feet)	Cum.Store (cubic-feet)	
99.0 100.0	00 00	300 1,023		0 662	0 662	
Device	Routing	g Inve	ert Outle	et Devices		
#1 #2	Primary Primary	/ 99.0 / 99.7	00' 0.05 75' 6.0'' Limit	cfs Exfiltra Horiz. Orif red to weir f	ation when al ice/Grate X7 low at low hea	bove 97.00' 7 rows C= 0.600 ads
Primary	OutFlo	w Max=0.05 c	fs @ 1.05	hrs HW=9	9.03' (Free l	Discharge)

-1=Exfiltration (Exfiltration Controls 0.05 cfs)

-2=Orifice/Grate (Controls 0.00 cfs)

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Pond RG2: RAIN GARDEN 2



1160111-PROP-7-SCSWater Quality StormWater Quality Rainfall=1.25"Prepared by {enter your company name here}Printed 5/6/2021HydroCAD® 10.10-5a s/n 03272 © 2020 HydroCAD Software Solutions LLCPrinted 5/6/2021

Summary for Link 1L: TO COUNTY

Inflow /	Area =	138,521 sf,	35.38% Impervious,	Inflow Depth =	0.52"	for Water Quality event
Inflow	=	0.21 cfs @	1.17 hrs, Volume=	5,965 c	f	-
Primar	y =	0.21 cfs @	1.17 hrs, Volume=	5,965 c	f, Atter	n= 0%, Lag= 0.0 min

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

Link 1L: TO COUNTY



APPENDIX IV DRAIN TIME CALCULATIONS
1160111-PROP-7-SCS

Prepared by {enter your company name here}	Printed	5/6/2021
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Hydrograph for Pond BASIN 1: BASIN 1

Time	Inflow	Storage	Elevation	Primary
(hours)	(cfs)	(cubic-feet)	(feet)	(cfs)
0.00	0.00	0	98.50	0.00
2.50	0.00	0	98.50	0.00
5.00	0.02	0	98.51	0.02
7.50	0.05	1	98.52	0.05
10.00	0.13	38	98.64	0.10
12.50	0.88	3,924	100.42	1.09
15.00	0.15	1,423	99.45	0.21
17.50	0.09	1,124	99.31	0.11
20.00	0.07	866	99.19	0.10
22.50	0.05	513	99.02	0.10
25.00	0.00	0	98.50	0.00
27.50	0.00	0	98.50	0.00
30.00	0.00	0	98.50	0.00
32.50	0.00	0	98.50	0.00
35.00	0.00	0	98.50	0.00
37.50	0.00	0	98.50	0.00
40.00	0.00	0	98.50	0.00
42.50	0.00	0	98.50	0.00
45.00	0.00	0	98.50	0.00
47.50	0.00	0	98.50	0.00
50.00	0.00	0	98.50	0.00
52.50	0.00	0	98.50	0.00
55.00	0.00	0	98.50	0.00
57.50	0.00	0	98.50	0.00
60.00	0.00	0	98.50	0.00
62.50	0.00	0	98.50	0.00
65.00	0.00	0	98.50	0.00
67.50	0.00	0	98.50	0.00
70.00	0.00	0	98.50	0.00

1160111-PROP-7-SCS

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Hydrograph for Pond 1P: BIO-BASIN 2

Time	Inflow	Storage	Elevation	Primary
(hours)	(cfs)	(cubic-feet)	(feet)	(cfs)
0.00	0.00	0	94.50	0.00
2.50	0.09	252	94.68	0.04
5.00	0.18	893	94.85	0.07
7.50	0.37	2,390	95.07	0.10
10.00	0.85	6,453	95.61	0.10
12.50	5.24	31,867	98.78	5.38
15.00	0.91	23,182	97.76	1.03
17.50	0.54	21,090	97.50	0.86
20.00	0.43	18,379	97.16	0.67
22.50	0.37	16,734	96.95	0.49
25.00	0.00	15,162	96.75	0.34
27.50	0.00	12,779	96.45	0.18
30.00	0.00	11,584	96.29	0.10
32.50	0.00	10,677	96.17	0.10
35.00	0.00	9,777	96.05	0.10
37.50	0.00	8,877	95.94	0.10
40.00	0.00	7,977	95.82	0.10
42.50	0.00	7,077	95.70	0.10
45.00	0.00	6,177	95.58	0.10
47.50	0.00	5,277	95.46	0.10
50.00	0.00	4,377	95.34	0.10
52.50	0.00	3,477	95.22	0.10
55.00	0.00	2,577	95.10	0.10
57.50	0.00	1,681	94.98	0.10
60.00	0.00	935	94.85	0.07
62.50	0.00	406	94.73	0.05
65.00	0.00	96	94.61	0.02
67.50	0.00	2	94.50	0.00
70.00	0.00	0	94.50	0.00

1160111-PROP-7-SCS

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Hydrograph for Pond RG2: RAIN GARDEN 2

Time	Inflow	Storage	Elevation	Primary
(hours)	(cfs)	(cubic-feet)	(feet)	(cfs)
0.00	0.00	0	99.00	0.00
2.50	0.00	0	99.00	0.00
5.00	0.01	1	99.00	0.01
7.50	0.02	1	99.00	0.02
10.00	0.05	3	99.01	0.05
12.50	0.24	455	99.78	0.25
15.00	0.04	424	99.74	0.05
17.50	0.03	276	99.55	0.05
20.00	0.02	25	99.08	0.05
22.50	0.02	1	99.00	0.02
25.00	0.00	0	99.00	0.00
27.50	0.00	0	99.00	0.00
30.00	0.00	0	99.00	0.00
32.50	0.00	0	99.00	0.00
35.00	0.00	0	99.00	0.00
37.50	0.00	0	99.00	0.00
40.00	0.00	0	99.00	0.00
42.50	0.00	0	99.00	0.00
45.00	0.00	0	99.00	0.00
47.50	0.00	0	99.00	0.00
50.00	0.00	0	99.00	0.00
52.50	0.00	0	99.00	0.00
55.00	0.00	0	99.00	0.00
57.50	0.00	0	99.00	0.00
60.00	0.00	0	99.00	0.00
62.50	0.00	0	99.00	0.00
65.00	0.00	0	99.00	0.00
67.50	0.00	0	99.00	0.00
70.00	0.00	0	99.00	0.00

APPENDIX V

DRAINAGE COLLECTION SYSTEM CALCULATIONS

Hydraflow Storm Sewers Extension for Autodesk® Civil 3D® Plan



Storm Sewer Tabulation

Station		Len	Drng A	rea	Rnoff	Area x C		Тс		Rain	Total	Сар	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To		Incr	Total	-coerr	Incr	Total	Inlet	Syst	-(1)	now	TUII		Size	Slope	Dn	Up	Dn	Up	Dn	Up	-
	Line	(ft)	(ac)	(ac)	(C)			(min)	(min)	(in/hr)	(cfs)	(cfs)	(ft/s)	(in)	(%)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	
1	End	73.595	0.14	1.11	0.86	0.12	1.06	10.0	10.4	6.4	6.79	7.01	6.35	15	1.01	95.00	95.74	95.99	96.79	98.00	98.50	FES-B2
2	1	76.000	0.17	0.97	0.86	0.15	0.94	10.0	10.1	6.5	6.07	7.00	5.07	15	1.00	95.39	96.15	96.79	97.28	98.50	98.50	B2-B3
3	2	26.000	0.80	0.80	0.99	0.79	0.79	10.0	10.0	6.5	5.15	7.00	4.21	15	1.00	96.15	96.41	97.49	97.62	98.50	98.50	B3-B4
4	End	33.000	0.19	0.25	0.99	0.19	0.24	10.0	12.3	6.0	1.43	3.86	3.83	12	1.00	95.00	95.33	95.46	95.84	98.00	100.50	fes-c2
5	4	60.000	0.06	0.06	0.86	0.05	0.05	10.0	10.0	6.5	0.34	3.86	0.46	12	1.00	94.43	95.03	95.84	95.84	100.50	99.25	C2-C3
Proje	ct File:	B-SYS ⁻	TEM.stn	n												Numbe	r of lines: 5	5		Run Da	te: 5/6/202	21
NOT	ES:Inte	nsity = 1	06.91 /	(Inlet tim	ne + 13.9	0) ^ 0.88	3; Returi	n period	=Yrs. 25	; c = c	ire=el	lip b = b	юх			1				I		

APPENDIX VI

SEDIMENT BASIN CALCULATIONS

Casey & Keller, Inc. 258 Main St Millburn,N.J. 07041 Phone: (973) 379-3280 Fax: (973) 379-7993

South Orange Essex County 1160111 05/5/2021

WEST SEDIMENT BASIN CALCULATION

2 year storm volume





95.00

95.47

97.50

ft

ft

ft

Bottom of Basin =

Crest Elevation =

Dewatering Hole Elevation =



CURVE 24-1

Standards for Soil Erosion and Sediment Control in New Jersey

24-8

FIGURE 24-1



24-9

APPENDIX VIII

DRAINAGE AREA MAPS





