DRAINAGE REPORT

TWO LOT SUBDIVISION
LITCHFIELD, CONNECTICUT

Prepared For:

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Job #01039

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SECTION 1.0

STORMWATER ANALYSIS

1.1 PREAMBLE

The intent of this report to summarize the Stormwater Management Study for The Two Lot Subdivision Proposal based on DYMAR's evaluation of the regulatory criteria, existing site conditions and proposed development plan. It is the objective of the development team to present to the town of Litchfield (Town) all of the pertinent site factors which have influenced the plan in an effort to solidify a final design proposal, which can find a balance between quality, technical adequacy, and environmental protection. Specific to this mission is the assessment of the stormwater management opportunities, constraints and the various competing site factors that are important to the design and layout of stormwater systems. The initial goal is to identify a "technical" approach, which has sufficient merit to minimize impacts based on an evaluation of alternative management approaches for controlling the quantity and quality of water leaving the site. Elements, which were most critical in developing a Stormwater Plan, including the following:

A. An inventory and inspection of the site soils and superficial geology, wetland / watercourses, surface drainage and runoff patterns, general forms of vegetation, topographic shapes, slopes and orientation, and relationships to adjoining properties.

B. The preparation of a viable site development plan.

C. Review of zoning and land use regulations.

D. Review of infrastructure capacity, demands, and standards.

E. Assessment of off-site impacts, engineering and construction practices.

F. Identification of stormwater control and the Best Management Practices (BMP) to minimize impacts.

In summary, this analysis aided the design team to develop a site plan, which optimizes the location of the residential building sites and the infrastructure system, while minimizing impacts to the existing environs to the maximum extent practicable within the technology available.

1.2 STUDY PURPOSE

The general purpose of this study is to 1) provide capacity estimates for the existing hydraulic structures and detention basins located downstream of the subject property based on as-built conditions surveyed by DYMAR, 2) to analyze and provide quantitative estimates of how the development proposal affects the existing infrastructure and downstream properties utilizing accepted engineering methodologies and 3) to provide recommended stormwater practices which align itself with the current guidelines adopted by the Town and the Connecticut Department of Energy and Environmental Protection (CTDEEP) for

water quality and water quantity planning, design and implementation. This includes the Town of Roxbury's Subdivision and Road Standards, the "2000 Connecticut Guidelines for Soil Erosion and Sediment Control", the "2004 Connecticut Stormwater Quality Manual" and the "Connecticut Department of Transportation Drainage Manual". These CTDEEP and CTDOT publications were used for this project and are available to designers and regulators as reference guides in developing technically sound design solutions for source controls and pollution prevention in managing stormwater during construction and over the long term.

1.3 EXISTING SITE CONDITIONS

The subject property is located at 19 Little Pitch Road in Litchfield, CT within the Residential Zone RR with access off of Little Pitch Road. The site encompasses an area of 9.03 +/- acres and contains 1.86 +/- acres of wetlands and watercourses. The elevations on the property range from 930'+/- to 973'+/- with an average slope of 9%. The site is bounded by residential developments to the north, east and west and by Little Pitch Road to the south. Located on-site are one occupied residence. The remainder of the site consists of undeveloped, lightly wooded areas with wetlands and a watercourse in the central portion of the lot.

Refer to Figure #2 for predevelopment site conditions mapping and drainage area delineations.

Refer to Table #4 for predevelopment flows at the Analysis Points.

1.4 PROPOSED DEVELOPMENT PLAN

The current proposal is for the subdivision into two lots and development of the new lot for residential occupation. The site layout plan also includes construction of utilities in addition to earthwork activity. All residences shall be served by proposed on-site private wells and private septic systems and individual driveways connected to Little Pitch Road. Lot #2 (the new lot) is to be served by a rain garden and underground detention system for water quality treatment and detention. The underground detention systems have been sized for the Water Quality Volume of the roof and driveway. The underground chambers are typically double rows of Cultec Contactor 150HD series consisting of in lengths ranging from 30 to 60 feet. DYMAR also recommends the following to be incorporated into the final design and construction:

A. The installation of sedimentation flocculation logs during construction to increase settlement of granular materials in the proposed temporary sedimentation traps.

B. The construction of sediment traps for soil erosion control during construction and the installation of silt fence.

C. A maintenance and inspection program to be implemented to detect when systems must be cleaned and provide for the removal of settled material on a periodic basis to reestablish capacity with BMP's.

D. To provide a storm water system design that addresses both water quality and quantity during and post-construction, effectively not increasing the peak rate of runoff.

1.5 METHODOLOGY

The design storm criteria outlined for the evaluation of storm water management facilities is as follows:

DESIGN APPLICATION	DESIGN FREQUENCY
• Storm Drainage Collection System	10
• Evaluation Impact for Development Peak Runoff	2, 5, 10, & 25 Year

Hydrologic and hydraulic estimates were based on the following technical theorems, methods and practices of drainage analysis and design in the assessment of pre- and post-development conditions:

A. ***Hydrologic Runoff Estimates***

- Hydraulic Concept: The Rational Unit Hydrograph Method was used to establish peak flow and maximum water surface elevation. The peak flow is equal to the formula Q=CIA, with the receding limbs of the hydrograph equal to twice the time to peak. The water surface elevations were calculated based on routing incoming hydrographs through a calculated reservoir. This methodology is consistent with the analysis originally prepared for the Stop & Shop surface detention basins.
- Storm Frequencies Analyzed: 2, 5, 10, & 25 year storm.
- Runoff Coefficients "C": A weighted value was utilized based on published empirical coefficients representing the relationship between rainfall and runoff.
- Time of Concentration: Overland flow time estimates were made based on Seelye and shallow concentrated flow charts and Manning's equation for time of concentrations in combination with TR-55 worksheets.
- Rainfall Intensity "I": The 5, 15 and 60 minute precipitation values for the 2 and 100 year storm frequencies from the "NOAA Atlas 14, Volume 10" were used to generate the I-D-F curves. The data from these curves was then used to obtain rainfall intensity values for various times of concentrations and storm frequencies.
- Drainage Areas: Estimated from a digital planimeter utilizing aerial topography.
- Capacity Analysis of Hydraulic Structures: Location and hydraulic characteristics interpreted from field observations, existing reports, and field survey data; capacities reflect estimates for normal flow and headwater assumptions with of without tail water control, depending on site conditions.

B. ***Water Quality Volumes Calculations***

An analysis of the proposed impervious area and the availability for at-grade detention and infiltration of runoff to treat the first flush of the storm events. The analysis was based on the following assumptions and estimates:

- Water Quality Volume: Connecticut Department of Environmental Protection "2004 Stormwater Quality Manual."

1.6 SUMMARY AND CONCLUSIONS

Drainage Areas (D.A.) A and B were analyzed for their runoff contributions to Analysis Point (A.P.) 1 and 2 respectivvely. For the post-development conditions, D.A. #A was split up into two distinct subareas (S.A.) #A1, #A2. S.A. #A1 represents the runoff from the development that is not conveyed to the proposed underground detention. S.A. #A2 runoff is captured and detained by the detention system before release off-site. The runoff from the proposed building rooftops is collected by a separate system and conveyed to an underground groundwater recharge gallery system. Typically, rooftop runoff is not considered to be contaminated as is parking lot runoff and therefore may discharge directly to groundwater. Drainage Area B was split into three areas B1, B2 and B3 for the roof and driveway areas represented by B2 and B3 with the remainder of the drainage area as undeveloped in its natural state in area B1.

The peak flow generated by the pre- and post-development flows at A.P. #1 for the 25-year storm is 3.2+/- cfs and 3.2+/- cfs, respectively, for a reduction of 0% over pre-development levels. At A.P. #2, the flow for the 25-year storm dropped from 1.34 to 1.31 cfs for the post-development conditions.

Reference is made to Table #4 which summarizes the comparison of pre- and post-development flow estimates for all storm events.

1.7 RECOMMENDATIONS

The following Best Management Practices should be employed to protect wetlands, watercourses and the quality of water affected by the project:

A. During construction, closely follow the Connecticut Department of Environmental Protection's (CTDEP) guidelines for Erosion and Sediment Control.

B. Identify a site monitor to regularly inspect the sediment and erosion controls throughout the construction period and provide reports to the City.

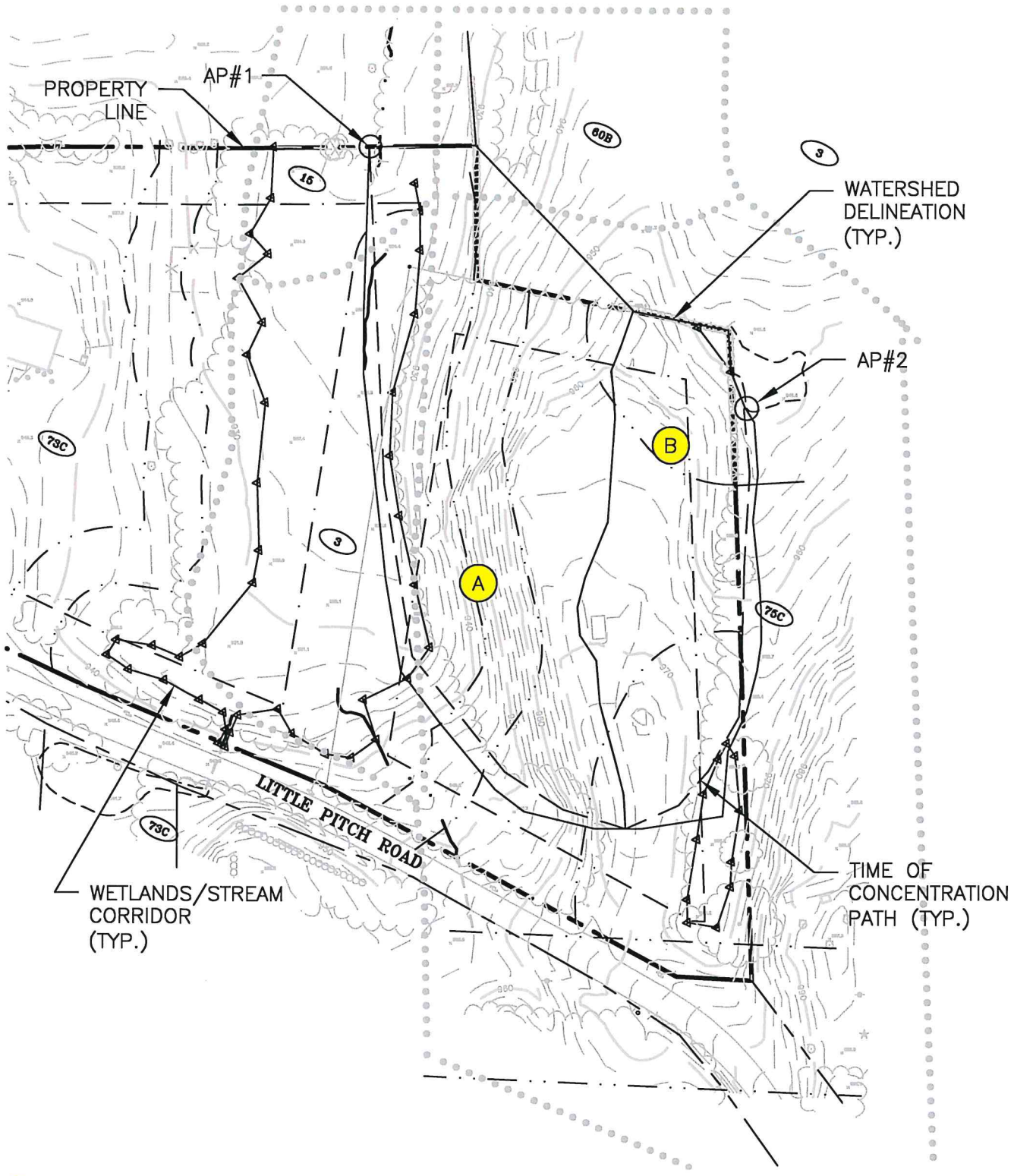
C. Incorporate two-foot sumps in all catch basins with hooded outlets to trap road sands, debris, and oily water.

D. Stormwater collected from rainfall and snow melt will be ultimately distributed to subsurface water treatment and detention systems before discharging to wetlands and watercourses.

E. During construction, sediment traps and swales shall be provided with wet storage areas and polymer systems to provide water quality retention times appropriate to remove particulate materials and pollutants during and after construction.

F. Employ an annual maintenance program for the inspection and maintenance of permanent stormwater controls to assure that the systems operate effectively which is supported by a set-aside monetary fund used strictly for stormwater management.

APPENDIX A – FIGURES & TABLES



WATERSHED SUBAREA
WATERSHED DELINEATION
TRAVEL PATH

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PRE-DEVELOPMENT WATERSHED MAP

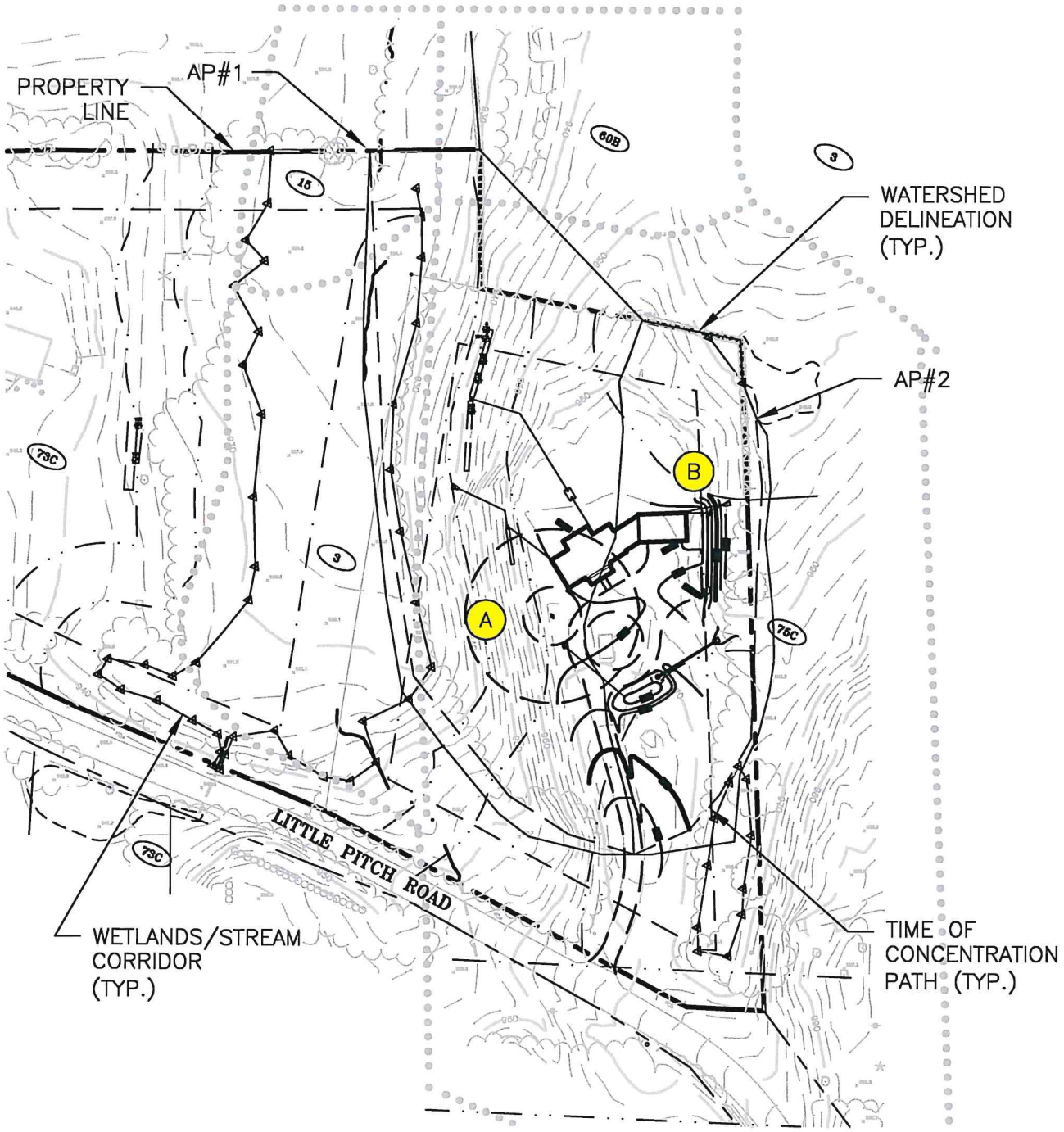
LITCHFIELD, CONNECTICUT

All measurements are approximate and are subject to final verification by this office.

0" 1" 2"

Job No: 01039
Scale : 1" = 100'

FIGURE No. 2



WATERSHED SUBAREA

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POST-DEVELOPMENT WATERSHED MAP

LITCHFIELD, CONNECTICUT

All measurements are approximate and are subject to final verification by this office.

0" 1" 2"

Job No: 01039
Scale : 1" = 100'

FIGURE No. 3

Basin Model

Hydrology Studio v 3.0.0.18

Project Name:

04-08-2021

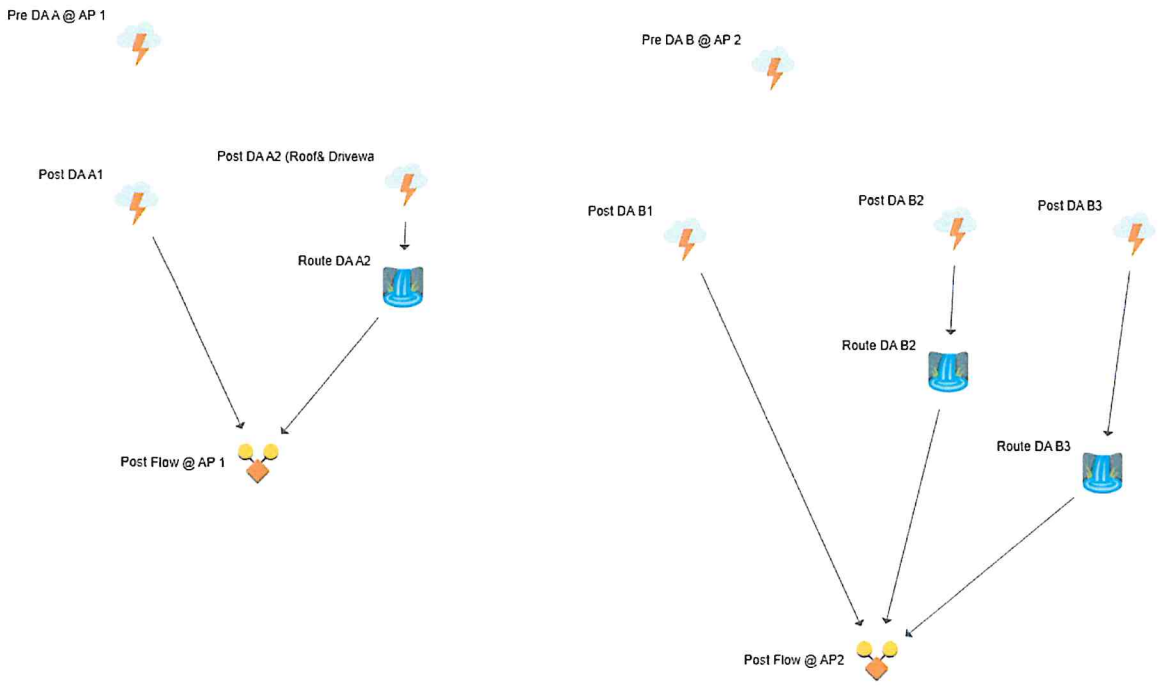

TABLE 1
WATERSHED MODEL CHARACTERISTICS
PRE-DEVELOPMENT ANALYSIS

Drainage Area Designation	Area (Acres)	Average "C" Value	Time of Concentration (Min.)
A	2.46	0.22	14
B	1.29	0.24	23
Total	**3.75**		

TABLE 2
WATERSHED MODEL CHARACTERISTICS
POST-DEVELOPMENT ANALYSIS

Drainage Area Designation	Area (Acres)	Average "C" Value	Time of Concentration (Min.)
A1	2.25	0.23	14
A2	0.21	0.90	5
B1	0.76	0.33	23
B2	0.18	0.90	5
B3	0.35	0.90	5
Total	**3.75**		

Hydrograph by Return Period

Project Name:

Hydrology Studio v 3.0.0.18

04-08-2021

Hyd. No.	Hydrograph Type	Hydrograph Name	Peak Outflow (cfs)							
			1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr
1	Rational	Pre DA A @ AP 1		1.650		2.060	2.393	3.138		
2	Rational	Pre DA B @ AP 2		0.705		0.878	1.020	1.336		
3	Rational	Post DA A1		1.578		1.969	2.288	3.001		
4	Rational	Post DA A2 (Roof& Drivewa		0.959		1.194	1.388	1.821		
5	Pond Route	Route DA A2		0.786		0.942	1.069	1.345		
6	Junction	Post Flow @ AP 1		1.640		2.042	2.414	3.248		
7	Rational	Post DA B1		0.571		0.711	0.827	1.083		
8	Rational	Post DA B2		0.822		1.023	1.190	1.561		
9	Pond Route	Route DA B2		0.328		0.377	0.416	0.496		
10	Rational	Post DA B3		1.598		1.989	2.314	3.035		
11	Pond Route	Route DA B3		0.000		0.000	0.000	0.000		
12	Junction	Post Flow @ AP2		0.615		0.777	0.929	1.313		

TABLE 4

COMPARISON OF PRE- AND POST-DEVELOPMENT DRAINAGE ESTIMATES

Pt. No. Design Storm	AP #1 Pre- (cfs)	Post (cfs)	Diff (%)
2-YR	1.65	1.64	-0.01
5-YR	2.06	2.04	-0.01
10-YR	2.39	2.41	0.01
25-YR	3.14	3.25	0.04

Pt. No. Design Storm	AP #2 Pre- (cfs)	Post (cfs)	Diff (%)
2-YR	0.71	0.62	-0.13
5-YR	0.88	0.78	-0.12
10-YR	1.02	0.93	-0.09
25-YR	1.34	1.31	-0.02

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Project: Little Pitch Subdivision
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Date : 4/8/2021
Designed By : S.A.L.

Water Quality Volume Calculations

(Based on Conn. DEP 2004 Stormwater Quality Manual)

Post Construction Development

WQV = 1"xRxA/12
WQV = Water Quality Volume (ac-ft)
R = Volumetric Runoff Coeffecient = 0.05+0.009xI
I = Percent Impervious Cover
A = Site Area (ac)

Stormwater Management Area (Drainage Area)	Drainage Area	Impervious Cover	Vol. Runoff Coefficient	Required Water Quality Volume		Provided Water Quality Volume		Recommended Practice
	(ac)	%		(ac-ft)	(cf)	(ac-ft)	(cf)	
Area #1 (Roof & Turnaround)	0.22	66.80	0.65	0.01	520	0.02	871	Cultec 150, Rain Garden
Area #2 (Garage & Driveway)	0.09	90.50	0.86	0.01	276	0.01	305	Cultec 150
Area #3 (Driveway)	0.28	55.00	0.55	0.01	554	0.01	566	Rain Garden