# **DRAINAGE REPORT**

# **Adventure Camper Rentals, LLC**

Tax Map 6 Lot 16 Route 4 Nottingham, NH

**April 18, 2022** 

Prepared For:

Adventure Camper Rentals, LLC
30 Mill Road
Northwood, NH 03261

Prepared by: **RJB Engineering, LLC**2 Glendale Road
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In Association with:

N.H. Land Consultants, PLLC 683C First NH Turnpike Northwood, NH 03261

# Adventure Camper Rentals, LLC Tax Map 6, Lot 16, Nottingham, NH

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#### Adventure Camper Rentals, LLC Tax Map 6, Lot 16, Nottingham, NH

#### INTRODUCTION:

This project is a proposed commercial site plan located on NH Route 4 in Nottingham, NH. The project includes the construction of 1 building including a garage and office space and gravel parking/display area. Additional site improvements include drainage, utilities, and other related site improvements. The total area of disturbance for the construction of the site is approximately 37,000 sf. or 0.85 acres.

#### PREDEVELOPMENT CONDITIONS:

The subject property is located on NH Route 4, just westerly of Smoke Street. The total property area is 10.72 acres and has 1,313+/- feet of frontage on NH Route 4.

There are wetland pockets throughout the property and runs southerly to a power line easement and eventually under Kennard Road, eventually to Little River. The site is undeveloped and mostly wooded. The site slopes towards the powerline on the property with varying slopes from gently sloping to steep slopes. The entire site is 43B/C-Canton, fine sandy loam, very stony. This soil has a relatively highwater table, well drained and is classified as aHydrological Group B soil.

The site drainage is one drainage area. The drainage area drains to the west into an existing wetland complex, which flows southerly to Kennard Road and Little River. The total watershed area included in the analysis is 0.85 acres.

#### POST DEVELOPMENT CONDITIONS:

This expansion to the site will include construction of a driveway, open area for display of campers, parking and a small building (1,485 sq ft) and related site improvements for drainage. The drainage system is open swales, forebays, small detention pond that will discharge to wetland complex to the west on the subject site. There is no change proposed to existing drainage patterns on the property.

Drainage from proposed impervious areas is routed through the detention pond strategically located on the lower side of the site between the improvements and existing wetland complex. The detention basin is designed to detain peak stormwater flows so that post development stormwater flows are less than pre-development stormwater flows.

#### **DESIGN METHODOLOGY:**

The drainage analysis in this study was completed using HydroCad Version 10.0-25, a stormwater modeling program utilizing TR-20 and TR-55 methodology. This program performs both the hydrologic computations for determination of runoff flows, and the hydraulic calculations for pipe, ditch, and pond design. Calculations were performed for the 25-year return frequency storms per Section 10.3 of the Nottingham Site Plan Review Regulations.Precipitation estimates were taken from the Northeast Regional Climate Center Extreme Precipitation Tables. The following design parameters were used:

Rainfall distribution: 25-year storm rainfall:

Type III 5.86 inches

#### Adventure Camper Rentals, LLC Tax Map 6, Lot 16, Nottingham, NH

#### **DESIGN ANALYSIS:**

Stormwater flows were analyzed to one, Westerly, design node. Peak runoff flows have been evaluated to ensure that post-development flows and volumes don't exceed predevelopment flows and volumes. Mitigation for increased flows from the additional impervious surfaces has been provided by including the proposed detention systems as previously described. The peak flows are shown in the accompanying table:

Storm Event	PRE-DEVELOPMENT FLOWS (CFS)	POST-DEVELOPMENT FLOWS (CFS)
25-year		
100R	1.67	1.52
Result		-0.15

#### STORMWATER TREATMENT:

Stormwater treatment is provided to reduce pollutants and sediment from discharging into downstream public waters. As previously noted above, several best management practices are proposed for this project.

The detention pond is designed with a sediment forebay. The forebay provides pretreatment of runoff for initial settling of coarse sediments. Roadside swales are designed to be stone lined to protect against erosion and sediment transportation.

#### **EROSION CONTROL:**

This site has moderate slopes and potentially wet soil conditions. Cut and fill slopes should therefore be carefully monitored until vegetation is fully established and they are fully stabilized. Several best management practices are proposed to minimize erosion during construction. Following are some of the practices required for the development:

- Proper construction sequencing
- Minimizing disturbed area as much as practical
- Silt Fence
- Stone lined swales
- Stabilized construction entrance

# Adventure Camper Rentals, LLC Tax Map 6, Lot 16, Nottingham, NH

# **EXTREME PRECIPITATION TABLES**

# **Extreme Precipitation Tables**

# **Northeast Regional Climate Center**

Data represents point estimates calculated from partial duration series. All precipitation amounts are displayed in inches.

# **Extreme Precipitation Estimates**

	5min	10min	15min	30min	60min	120min		1hr	2hr	3hr	6hr	12hr	24hr	48hr		1day	2day	4day	7day	10day	
25yr	0.47	0.75	0.95	1.31	1.75	2.29	25yr	1.51	2.10	2.71	3.52	4.55	5.86	6.73	25yr	5.19	6.47	7.33	8.58	9.59	25yr

#### **Lower Confidence Limits**

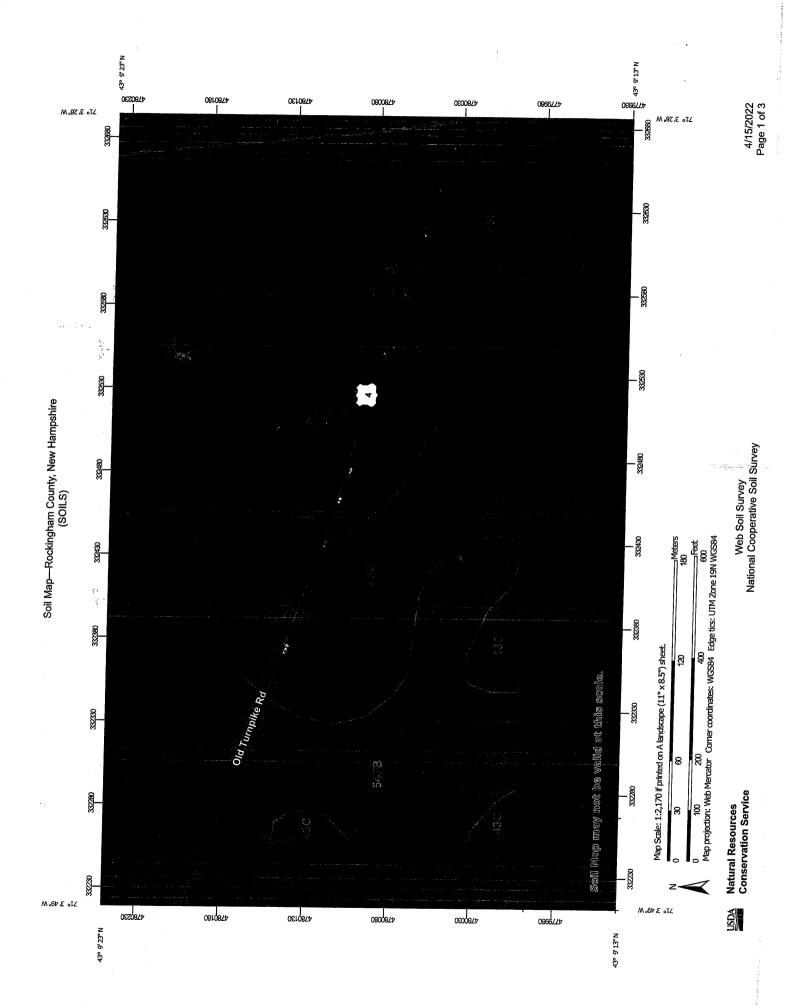
Constitution of the last of th	and the second the second	5min	10min	15min	30min	60min	120min		1hr	2hr	3hr	6hr	12hr	24hr	48hr		1day	2day	4day	7day	10day	
Total Company of the Land	25yr	0.44	0.67	0.83	1.19	1.57	1.90	25yr	1.35	1.86	2.11	2.82	3.63	4.67	5.28	25yr	4.13	5.08	5.90	7.50	8.36	25yr

#### **Upper Confidence Limits**

	5min	10min	15min	30min	60min	120min		1hr	2hr	3hr	6hr	12hr	24hr	48hr		1day	2day	4day	7day	10day	
25yr	0.57	0.86	1.07	1.53	2.02	2.47	25yr	1.74	2.42	2.85	3.84	4.80	7.04	8.32	25yr	6.23	8.00	8.90	9.72	10.79	25yr



**WEB SOILS** 



# **MAP LEGEND**

tures	Water Features	Blowout	9
Special Line Featu	N.	Special Point Features	Special
Other	Ø	Soil Map Unit Points	.92
Wet Spot	()	Soil Map Unit Lines	}
Very Stony Spot	6	Soil Map Unit Polygons	
Stony Spot	0	(AOI)	Soils
Spoil Area	W	Area of Interest (AOI)	Area or in

oint Features	*	Special Line Features
Blowout	Water Features	ures
Borrow Pit	\	Streams and Canals
Clay Opot	Transportation	tion
day opor	Ī	Rails
Closed Depression	ì	and the second s
Gravel Dit	ł	merstate Highways
	No. of the last of	US Routes

0

Clay Snot	Hallsportation	ation
and abou	Ī	Rails
Closed Depression		
	}	Interstate High
Gravel Pit		
	No.	US Routes
Gravelly Spot		
and Guaran		Major Roads
Landfill		•
		Local Roads
Lava Flow		



Marsh or swamp

Mine or Quarry

Miscellaneous Water

Perennial Water

Rock Outcrop Saline Spot Sandy Spot

# Please rely on the bar scale on each map sheet for map

measurements.

contrasting soils that could have been shown at a more detailed

misunderstanding of the detail of mapping and accuracy of soil Enlargement of maps beyond the scale of mapping can cause

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

line placement. The maps do not show the small areas of

The soil surveys that comprise your AOI were mapped at

1:24,000.

MAP INFORMATION

Source of Map: Natural Resources Conservation Service Web Soil Survey URL

Coordinate System: Web Mercator (EPSG:3857)

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

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

Soil Survey Area: Rockingham County, New Hampshire Survey Area Data: Version 24, Aug 31, 2021

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger. Date(s) aerial images were photographed: Aug 28, 2015—May

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

Severely Eroded Spot

Slide or Slip

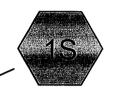
Sinkhole

Sodic Spot

# **Map Unit Legend**

11 - 51 - 20 Jane 1, 7 av	Established		
Map Unit S	ymbol Map Unit Name	Acres in AOI	Percent of AOI
43B	Canton fine sandy loam, 0 to 8 percent slopes, very stony	4.8	26.1%
43C	Canton fine sandy loam, 8 to 15 percent slopes, very stony	5.6	30.6%
547B	Walpole very fine sandy loam, 3 to 8 percent slopes, very stony	7.9	43.3%
Totals for Area of	Interest	18.3	100.0%

**25-YEAR PRE-DEVELOPMENT** 



Sub 1



Design point









Routing Diagram for existing
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existing
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# **Area Listing (all nodes)**

Area	CN	Description
 (acres)		(subcatchment-numbers)
0.049	98	Gravel access (1S)
0.788	55	Woods, Good, HSG B (1S)
0.836	57	TOTAL AREA

existing

Type II 24-hr 25 YR - 24 HR Rainfall=5.86"

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Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Sub 1

Runoff Area=36,433 sf 5.80% Impervious Runoff Depth>1.42" Flow Length=266' Tc=13.6 min CN=57 Runoff=1.67 cfs 0.099 af

Reach 100R: Design point

Inflow=1.67 cfs 0.099 af Outflow=1.67 cfs 0.099 af

Total Runoff Area = 0.836 ac Runoff Volume = 0.099 af Average Runoff Depth = 1.42" 94.20% Pervious = 0.788 ac 5.80% Impervious = 0.049 ac Prepared by New Hampshire Land Consultants, PLLC HydroCAD® 10.00-25 s/n 04695 © 2019 HydroCAD Software Solutions LLC

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#### **Summary for Subcatchment 1S: Sub 1**

Runoff

1.67 cfs @ 12.07 hrs, Volume=

0.099 af, Depth> 1.42"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs Type II 24-hr 25 YR - 24 HR Rainfall=5.86"

	P	rea (sf)	CN	Description	}	
•	*	2,113 34,320	98 55	Gravel acco	ess	
•		36,433 34,320 2,113	57	Weighted A 94.20% Pe 5.80% Impe	verage rvious Area	
	Tc (min)	Length (feet)	Slope (ft/ft	•	Capacity (cfs)	Description
•	10.7	50	0.0300	0.08		Sheet Flow, 1
	0.4	22	0.0300	0.87		Woods: Light underbrush n= 0.400 P2= 3.06" <b>Shallow Concentrated Flow, 2</b> Woodland Kv= 5.0 fps
	0.1	16	0.0300	2.79		Shallow Concentrated Flow, 3
_	2.4	178	0.0620	1.24	·	Unpaved Kv= 16.1 fps Shallow Concentrated Flow, 4 Woodland Kv= 5.0 fps
	13.6	266	Total			

#### Summary for Reach 100R: Design point

Inflow Area =

5.80% Impervious, Inflow Depth > 1.42" for 25 YR - 24 HR event

Inflow

1.67 cfs @ 12.07 hrs, Volume=

0.099 af

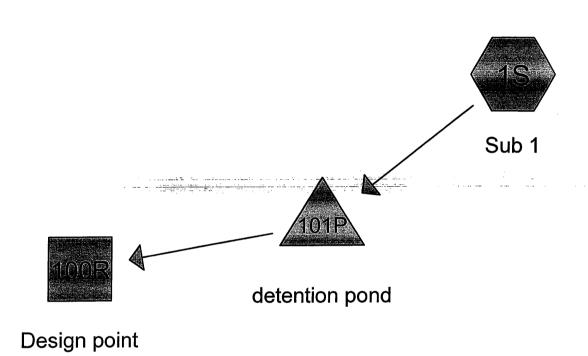
Outflow

1.67 cfs @ 12.07 hrs, Volume=

0.099 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

**25-YEAR POST-DEVELOPMENT** 











proposed
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# **Area Listing (all nodes)**

Area	CN	Description
(acres)		(subcatchment-numbers)
0.357	61	>75% Grass cover, Good, HSG B (1S)
0.095	98	Bldg, impervious (1S)
0.305	98	Gravel access/parking (1S)
0.079	55	Woods, Good, HSG B (1S)
0.836	78	TOTAL AREA

proposed
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# Pipe Listing (all nodes)

Line	# Node	In-Invert	Out-Invert	Length	Slope	n	Diam/Width	Height	Inside-Fill
	Numbe	er (feet)	(feet)	(feet)	(ft/ft)		(inches)	(inches)	(inches)
	1 101P	258.00	257.50	30.0	0.0167	0.012	12.0	0.0	0.0

proposed

Type II 24-hr 25 YR - 24 HR Rainfall=5.86"

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Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Sub 1

Runoff Area=36,433 sf 47.80% Impervious Runoff Depth>3.19" Flow Length=310' Tc=15.5 min CN=78 Runoff=3.64 cfs 0.223 af

Reach 100R: Design point

Inflow=1.52 cfs 0.219 af Outflow=1.52 cfs 0.219 af

Pond 101P: detention pond

nd Peak Elev=259.68' Storage=2,743 cf Inflow=3.64 cfs 0.223 af Primary=1.52 cfs 0.219 af Secondary=0.00 cfs 0.000 af Outflow=1.52 cfs 0.219 af

Total Runoff Area = 0.836 ac Runoff Volume = 0.223 af Average Runoff Depth = 3.19" 52.20% Pervious = 0.437 ac 47.80% Impervious = 0.400 ac

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# Summary for Subcatchment 1S: Sub 1

Runoff

3.64 cfs @ 12.08 hrs, Volume=

0.223 af, Depth> 3.19"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs Type II 24-hr 25 YR - 24 HR Rainfall=5.86"

-		Area (sf)	CN	Description	1			
*		13,291	98	Gravel acc	ess/parking			
		3,463	55	Woods, Go	od, HSG B			
*		4,125	98	Bldg, imper	vious			
-		15,554	61	>75% Gras	s cover, G	ood, HSG B		
		36,433		Neighted A				
		19,017			rvious Area			
		17,416	4	17.80% Imp	pervious Ar	ea		
				•				
	Tc	Length	Slope	Velocity	Capacity	Description		
_	(min)	(feet)	(ft/ft)	(ft/sec)	(cfs)	<u>.                                      </u>		
	12.4	60	0.0300	0.08		Sheet Flow, 1		
						Woods: Light underbrush n= 0.400	P2= 3.06"	
	3.1	250	0.0360	1.33	•	Shallow Concentrated Flow, 2	1 2 0.00	and the second
_						Short Grass Pasture Kv= 7.0 fps		The state of the s
	15.5	310	Total					

# Summary for Reach 100R: Design point

Inflow Area =

0.836 ac, 47.80% Impervious, Inflow Depth > 3.14" for 25 YR - 24 HR event

Inflow = Outflow =

1.52 cfs @ 12.28 hrs, Volume= 1.52 cfs @ 12.28 hrs, Volume=

0.219 af 0.219 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

# Summary for Pond 101P: detention pond

Inflow Area =	0.836 ac, 47.80% Impervious, Inflow	Depth > 3.19" for 25 YR - 24 HR event
Inflow =	3.64 cfs @ 12.08 hrs, Volume=	0.223 af
	1.52 cfs @ 12.28 hrs, Volume=	0.219 af, Atten= 58%, Lag= 12.2 min
Primary =	1.52 cfs @ 12.28 hrs, Volume=	0.219 af
Secondary =	0.00 cfs @ 5.00 hrs, Volume=	0.000 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs / 3 Peak Elev= 259.68' @ 12.28 hrs Surf.Area= 2,127 sf Storage= 2,743 cf Flood Elev= 262.50' Surf.Area= 3,885 sf Storage= 9,655 cf

Plug-Flow detention time= 27.4 min calculated for 0.219 af (98% of inflow) Center-of-Mass det. time= 20.8 min ( 806.0 - 785.2 )

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Volume	Invert	Avail.Sto	rage Storage	Description	
#1	258.00'	9,6	55 cf Custom	Stage Data (Prismatic) Listed below (Recalc)	
Elevation		ırf.Area	Inc.Store	Cum.Store	
(fee	€τ)	(sq-ft)	(cubic-feet)	(cubic-feet)	
258.0	00	1,140	0	0	
260.0	00	2,315	3,455	3,455	
262.0	00	3,885	6,200	9,655	
Device	Routing	Invert	Outlet Devices	s	
#1	Primary	258.00'	12.0" Round	Culvert L= 30.0' Ke= 0.500	
			Inlet / Outlet Ir	nvert= 258.00' / 257.50' S= 0.0167 '/' Cc= 0.900	
			n= 0.012, Flo	w Area= 0.79 sf	
#2	Device 1	258.00'	7.0" Vert. Orif	fice/Grate C= 0.600	
#3	Device 1	261.00'	2.0" x 2.0" Ho	oriz. Orifice/Grate C= 0.600	
			Limited to weil	r flow at low heads	
#4	Secondary	262.00'	10.0' long x 5	5.0' breadth Broad-Crested Rectangular Weir	
	-			.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00	0
				50 4.00 4.50 5.00 5.50	
				2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65	
				66 2.68 2.70 2.74 2.79 2.88	

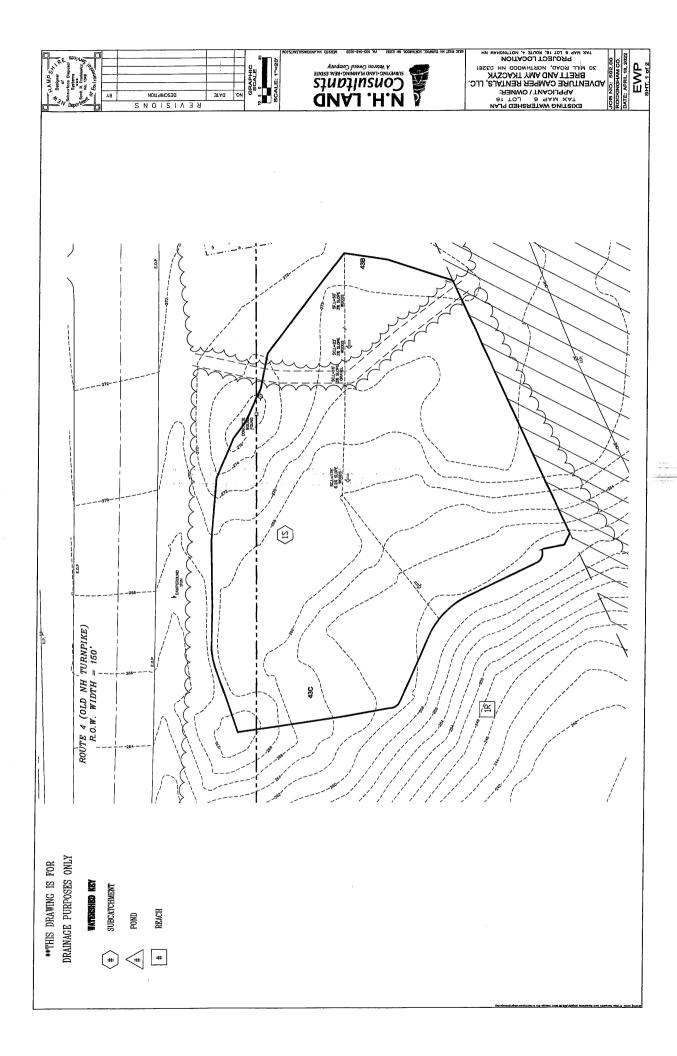
Primary OutFlow Max=1.51 cfs @ 12.28 hrs HW=259.68' (Free Discharge)

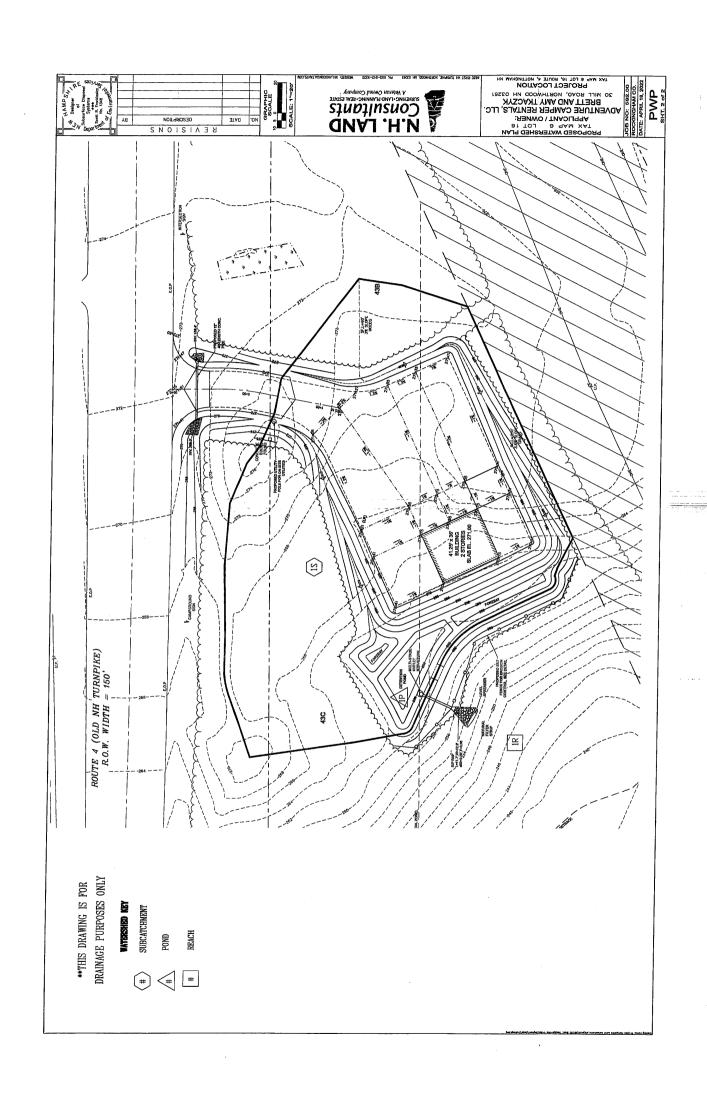
1=Culvert (Passes 1.51 cfs of 4.10 cfs potential flow)

**~2=Orifice/Grate** (Orifice Controls 1.51 cfs @ 5.66 fps) **~3=Orifice/Grate** ( Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 5.00 hrs HW=258.00' (Free Discharge)
4=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

**DRAINAGE AREA PLANS** 





**RIPRAP CALCULATIONS** 

# **RIP RAP CALCULATIONS**

ADVENTURE CAMPER RENTALS, LLC Brett & Amy Tkaczyk Nottingham, NH

**RJB Engineering** 

2 Glendale Road Concord, NH 03301 18-Apr-22

The Rip Rap was sized for a 25 year storm.

# TAILWATER < HALF THE Do

 $La = (1.8 \times Q) / D03/2 + (7 \times D0)$  W = La + D0 or defined channel width $d50 = (0.02 \times Q4/3) / (TW \times D0)$ 

Culvert or	Tailwater	Discharge	Diameter	Length of	Width of	d50-Median Stone	Actual	Thickness
Catch Basin	(Feet)	(C.F.S.)	of Pipe	Rip Rap	Rip Rap	Rip Rap	Rip Rap	of Apron
(Sta. No.)	TW	Q	Do	La (feet)	W (feet)	d50 (feet)	(Feet)	(Feet)
15" ADS	0.25	2.28	1.25	11.7	12.9	0.19	0.25	0.38

Table 7-24 R	ecommende	d Rip Rap	Gradation 1	Ranges
d50 Size =	0.25	Feet	3	Inches
% of Weight Sn	naller	Size of Stone (Inches)		
Than the Given	d50 Size	From		To
100%		5		6
85%		4		5
50%		3		5
15%		1		2