Drainage Analysis

35 Newmarket Road

Tax Map 6, Lot 11-7

Durham, New Hampshire

Prepared for:

Great Bay Kennel

Prepared on:

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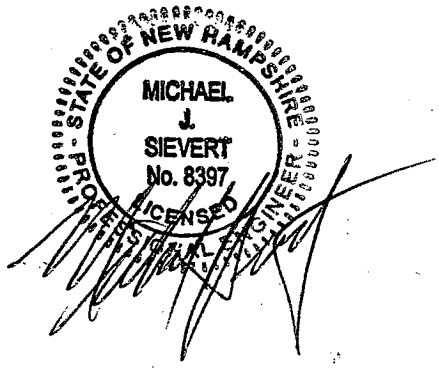

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Project Background / Purpose

Great Bay Kennel is constructing a new canine day care building at 35 Newmarket Road. The parcel is located in the Residence Coastal District (RC) in Durham, New Hampshire. The proposal involves the removal of the existing canine day care building and the construction of a new two-story canine day care building with an accessory apartment. A new access drive and seven parking spaces are proposed off the existing drive.

Pre-Development Conditions

The 11.44 acre property includes the kennel building, canine day care building and the owner's residence. The parcel shares an access drive with Lot 11-8 which contains a veterinary clinic. The subject parcel is located within the Shoreland Protection and Historic Districts. There is no disturbance to areas located within the Shoreland Protection District.

The on site soils are Hollis Charlton very rocky fine sandy loam and Buxton silt loam per the NRCS Soil Survey for Strafford County. These two soils are classified as Hydrologic Soil Group C. Hollis Charlton comprises most of the area that is within the limits of construction. Hollis Charlton is consistent with the soils found during test pits for the septic system.

The area of the parcel that will undergo development is located directly to the south of the access drive. This area slopes toward the roadside swale along Route 108 which is identified as Point of Analysis 1 (POA 1). From this point runoff eventually reaches the Oyster River approximately 500 feet north of the access drive.

The enclosed Pre-Development portion of the Drainage Plan (Attachment 1) depicts the contributing runoff areas that are generated from the proposed development of this property. The watershed areas have been determined via inspection by our office as well as a topographical survey. The watershed boundary only encompasses areas that are directly impacted by the development of the site. The hydrologic evaluation of the existing runoff conditions is provided in the Pre-Development Drainage Analysis (Attachment 2).

Subcatchment 1 is the contributing watershed area that drains to POA 1. Runoff flows down the hill and into the swale along Route 108. The cover types used in the model are woods, rooftops, gravel and lawn areas. The lawn areas located on the hillside are considered to be in poor condition while all other grass areas are considered to be in good condition. An existing hillside ditch system (trench drain) which consists of a series of 1 foot wide gravel trenches with 4 inch perforated pipe collect and transport runoff to an existing dry well at the base of the hill adjacent to the fence. The ditches that were visible are shown on the plan although the exact pipe configuration to the dry well is unknown. This dry well and ditch system is not modeled in the analysis for this reason providing a more conservative approach.

removed from the site. The proposal involves the construction of a new 2-story day care building with an accessory apartment. The project will incorporate 7 new parking spaces.

The location of the POA used in the Pre-Development Analysis has been maintained for the Post-Development Analysis. The hydrologic evaluation of the proposed runoff conditions is provided in the enclosed 11-035 POST HydroCAD™ output (Attachment 3). The subcatchment areas have changed to reflect the proposed grading of the site. The overall outer boundary has been maintained. The cover types are the same as in the Pre-Development; woods, rooftop, gravel and lawn areas.

Subcatchments 1A and 1B are collected in the proposed bioretention system. The bioretention system has been designed to mitigate the effects of increased impervious coverage on the lot by filtrating and infiltrating stormwater. The swale will run along the bottom of the hill at the edge of the existing wooded buffer along Route 108 and collect runoff from nearly all of the new impervious areas. A sediment forebay will allow for the settling of suspended solids from stormwater generated in the gravel parking lot prior to entering the bioretention system. An underdrain system will collect runoff that does not infiltrate into the ground and outlet it within the vegetated buffer. This under drain system will also tie into the closed drainage system within Subcatchment 1C, which consists of a drip strip and catchbasin located on the uphill side of the proposed building. A spillway is provided for larger storm events. The spillway is 60 feet long and 4 feet wide to promote the dispersion of stormwater as sheet flow.

In addition, a proposed hillside ditch further up the hill will intercept runoff and mitigate potential erosion of the slope. The existing hillside ditch and underdrain system will be modified to the minimal extent practicable. One ditch will be removed and a portion of one ditch will be relocated and the underdrain tied into the existing dry well located at the base of the hill. This dry well will be uncovered to ensure there is a free draining overflow outlet. There is a decrease in runoff volume and peak rate of runoff reaching the existing dry well to ensure the original design capacity is maintained. If during constructio,n the dry well is determined to not be functioning, it shall be filled in and decommissioned.

The design infiltration rate for the bioretention system was determined per the NHDES Alteration of Terrain rules. The saturated hydraulic conductivity (Ksat) for the limiting layer of the Hollis Charlton soil series is taken as 14.11 micro meters per second which converts to 2.0 in/hr (Attachment 5). A 50% multiplier is applied in accordance with NHDES (Attachment 7). The resultant design infiltration rate is 1.0 in/hr.

Subcatchment 1C comprises the area draining below the proposed hillside swale toward the rear of the proposed building. Runoff from this area is collected in a catchbasin and drip strip and transported to the underdrain system of the bioretention system. Subcatchment 1D is the area that will continue to flow directly into the swale along Route 108.

Comparison of Pre- vs. Post-Conditions

This analysis compares the runoff rates for the 1-inch, 2, 10, 25 and 100-year USDA/SCS Type III 24-hour storm events using the HydroCAD™ stormwater modeling

system. The HydroCAD™ stormwater program models the runoff based on the SCS TR-20 method and the time of concentration based on the SCS TR-55 method. The following table compares the peak rate of discharge at POA 1 as shown on the Drainage Plan. The reduction in peak rate of discharge is attributed to the lag time detention and infiltration functions of the bioretention system.

Table 1: Peak Rate of Discharge (cfs)

Storm	Pre	Post	Difference
1 Inch	0.04	0.01	-0.03
2 Year	2.52	1.34	-1.18
10 Year	4.94	4.33	-0.61
25 Year	6.56	5.73	-0.83
100 Year	9.03	7.86	-1.17

Table 2: Discharge Volume (cubic feet)

Storm	Pre	Post	Difference
1 Inch	508	103	-405
2 Year	9,824	9,515	-309
10 Year	18,739	18,539	-200
25 Year	24,786	24,629	-157
100 Year	34,163	34,039	-124

There are decreases in peak rate of runoff and discharge volume in all storm events. The model does not account for infiltration within the existing hillside ditch system.

Water Quality Volume Calculations (WQv)
Per the NHDES Stormwater Manual,
WQv = (P)(Rv)(A)

P = 1" of rainfall

Rv = unitless runoff coefficient = Rv = 0.05 + 0.9(I)

I = percent impervious cover draining to analysis point converted to decimal form

A = total site area draining to the analysis point

I = 0.100 (10.0% is the total impervious area of modeled subwatershed)

Rv = 0.05 + 0.9(0.100) = 0.14

A= 104,435 sf (total area of modeled watershed)

WQv = 1"/(12"/ft) x (0.14) x (104,435 sf)
WQv = 1,218 cf

A factor of 0.4 is applied to HSG C soils. Applying this factor to the water quality volume (WQv) results in a required infiltration volume of 487 cubic feet. In the 1" storm

Table 3: Bioretention System Infiltration Volume	
Storm	Volume Infiltrated (cf)
1 inch	591
2 Year	1,049
10 Year	1,171
25 Year	1,236
100 Year	1,330

As shown in Table 3, the bioretention system will infiltrate more than the required volume of runoff during the 1-inch through 100-year storm events.

Erosion & Sediment Control

The temporary and permanent practices used to prevent and minimize erosion and sedimentation on site are recommended in the New Hampshire Stormwater Manual, December 2008.

The installation of Silt Soxx™ at the perimeter of construction areas will provide sediment retention during the construction phase of the development. Stone check dams will be installed in the swale and turf reinforcement matting will be utilized on the bioretention system spillway and swale to prevent erosion. A maintenance plan has been developed for the erosion control structures and stormwater treatment systems.

Conclusion

The enclosed comparative hydrologic and hydraulic models provide sufficient evidence that the proposed bioretention system will mitigate both the typical increase in peak rate of stormwater discharge and the overall volume of surface discharge resulting from the increased impervious coverage associated with the construction of the new building. The use of erosion and sediment controls and proper construction practices will further minimize the impact of this project.