Project #18149.00

DRAINAGE ANALYSIS REPORT

F O R

Proposed Gas Station & Convenience Store

91-97 Lowell Road
Hudson, New Hampshire

Tax Map 198, Lot 11, 12, 14, 15, & 16

Owned by
Colbea Enterprises, LLC

December 13, 2023
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Prepared By:

TFM Since 1968

Civil Engineers
Structural Engineers
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1.0 - SUMMARY & PROJECT DESCRIPTION

The project includes the development of a gas station, convenience store, and car wash on 91-97 Lowell Road. The existing Tax Map 198 Lots 11, 12, 14, 15, & 16 is approximately 3.3968 acres and currently contains two garages and a residential home. The site is within the Business Zone and is bordered on three sides by Lowell Road, Atwood Avenue, and Temple Street.

The proposed project is to construct a 5,400 s.f. single story building with a car wash and gas station. Associated improvements include and are not limited to access, grading, utilities, stormwater management system, lighting, and landscaping. The project proposes a total of 8,100 SF building footprint and total 74,663 SF of impervious area within the property lines and approximately 95,663 SF of disturbance to facilitate the development.

This analysis has been completed to verify the project will not pose adverse stormwater effects on-site and off-site. Compared to the pre-development conditions, the post-development stormwater management system has been designed to reduce or have negligent increase, reduces, or increases within regulatory limits the runoff volume, reduces the risk of erosion and sedimentation, and improves stormwater runoff quality. In addition, Best Management Practices are employed to formulate a plan that assures stormwater quality both during and after construction. The following summarizes the findings from the study.

2.0 - CALCULATION METHODS

The design storms analyzed in this study are the 2-year, 10-year, 25, year and 50-year 24-hour storm events. The software program, HydroCAD version 10.00[1] was utilized to calculate the peak runoff rates from these storm events. The program estimates the peak rates using the TR-20 method. A Type III storm pattern was used in the model. Rainfall frequencies for the analyzed region were also incorporated into the model. Rainfall frequencies from the higher of the Extreme Precipitation Rates from Cornell University's Northeast Regional Climate Center (see Appendix A) and Hudson Site Plan Review Regulations were used to determine the storm-event intensities, see Table 1. Design standards were taken from the New Hampshire Stormwater Manual, December 2008[2].

	24-HOUR RAINFALL RATES
Storm-Event (year)	Northeast Regional Climate Center Extreme Precipitation (in)
2	2.96
10	4.46
25	5.64
50	6.74

Table 1 – 24-Hour Rainfall Rates

Time of Concentration is the time it takes for water to flow from the hydraulically most remote point in the watershed (with the longest travel time) to the watershed outlet. This time is

[1] HydroCAD version 10.00, HydroCAD Software Solutions LLC, Chocorua, NH, 2013.
[2] New Hampshire Stormwater Manual: Volume One - Stormwater and Antidegradation, December 2008; Volume Two - Post-Construction Best Management Practices Selection and Design, December 2008; Volume Three - Erosion and Sediment Controls During Construction, December 2008.

determined by calculating the time it takes runoff to travel this route under one of three hydrologic conditions: sheet flow, shallow concentrated flow, or channel flow. Because the Intensity-Duration-Frequency (IDF) curve is steep with short TC's, estimating the actual intensity is subject to error and overestimates actual runoff. Due to this, the TC's are adjusted to a minimum of 6 minutes.

3.0 – EXISTING SITE CONDITIONS

The soils within the proposed area of disturbance are identified in accordance with the Site-Specific Soil Survey (see Appendix B for detail and soil locations). The Site-Specific Soil Survey identifies the soils within the disturbed project area as primarily Windsor loamy sand and Udorthents, sandy (HSG A). These soils are classified as moderately well excessively well drained.

All other areas that contribute runoff to the project site are identified per the NRCS Web Soil (see Appendix B for detail and soil locations). The soil is composed of Hinckley loamy sand. This soil is classified as excessively drained.

Eight test pits and infiltration tests, at least two in/near each basin area, were conducted. In nearly all test pit locations. Infiltration tests were determined per Ksat testing using a Compact Constant Head Permeameter (Amoozemeter) per Env-Wq 1504.14(d). Thought infiltration tests were performed at each test pit, the separation from the Estimated Seasonal Highwater Table (ESHWT) was only able to be obtained in two locations, the subsurface infiltration basin in the southerly most parking area and the infiltration Basin abutting Atwood Ave. The highest Estimated Seasonal High-Water Table (ESWT) observed were: elevation 153.4 (TP-7) at the infiltration basin adjacent to Atwood Ave and elevation 152.25.0 (TP-4) at Subsurface Infiltration Basin #2.

4.0 - PRE-DEVELOPMENT CONDITIONS

The pre-development condition is characterized by six subcatchments composing one watershed, which flows towards the tidal perennial stream, which ultimately discharges to the Merrimack River. Pre-development subcatchment areas are depicted on the attached plan entitled "Pre-Development Drainage Map," see Appendix H.

Stormwater runoff from the site primarily infiltrates into the excessively drained soils on-site. The remaining stormwater runoff discharges towards Temple (POI-1), Tax Map 197 Lot 51 (POI-2), Atwood Avenue (POI-3), Tax Map 198 Lot 13 (POI-4), Lowell Road (POI-5), or Tax Map 198 Lot 17 (POI-6).

In the pre-development condition, the total impervious area is 10,067 SF over a total drainage analysis area of 147,973 SF.

5.0 - POST-DEVELOPMENT CONDITIONS

The post-development condition is characterized by six watersheds divided into many subcatchment areas. Post-development subcatchment areas are depicted on the attached plan entitled "Post-Development Drainage Map," see Appendix H.

In the post-development condition, the total impervious area is 74,663 SF over a total drainage analysis area of 147,973 SF. Impervious area from the project consists of a 5,400 SF footprint gas station and convenience store, 2,700 SF footprint Car wash, 4,440 SF of gas islands and

associated improvements. Five BMP's are proposed to treat and mitigate the stormwater runoff from the impact of the new impervious area from the proposed development. These BMP's, combined with the proposed Jellyfish treatment units provide treatment for 93,636 s.f. of the site (63.3% of total) and 67,322 s.f. of impervious area (90.2% of total).

Eight test pits and infiltration tests, at least two in each basin area, were conducted. In nearly all test pit locations. Infiltration tests were determined per Ksat testing using a Compact Constant Head Permeameter (Amoozemeter) per Env-Wq 1504.14(d). For the two areas being used for infiltration, the design K_{sat} were 5 in/hr. (TP-7 and TP-8) for the infiltration basin and 3.5 in/hr. (TP-03 and TP-04) for the subsurface infiltration basin.

Table 2 summarizes the pre- and post-development peak runoff rates for the 2-year, 10-year, 25-year, and 50-year 24-hour Type III storm events for all discharge. Table 3 summarizes the pre- and post-development peak runoff volumes for the 2-year 24-hour Type III storm events for all discharge.

TABLE 2 – SURFACE WATER PEAK RUNOFF RATE COMPARISON (CF)					
POINT OF INTEREST		DESIGN STORM			
		2-year	10-year	25-year	50-year
POI-1	Pre	0.0	0.1	0.3	0.7
	Post	0.0	0.0	0.0	0.1
POI-2	Pre	0.0	0.0	0.1	0.2
	Post	0.0	0.0	0.0	0.1
POI-3	Pre	0.4	0.7	0.9	1.2
	Post	0.2	0.4	0.6	0.7
POI-4	Pre	0.0	0.0	0.1	0.1
	Post	0.0	0.0	0.0	0.0
POI-5	Pre	0.0	0.1	0.2	0.6
	Post	0.1	0.2	0.3	1.0
POI-6	Pre	0.0	0.0	0.1	0.3
	Post	0.0	0.0	0.1	0.2

Table 2 - Pre- and Post- Development Peak Runoff Rate Comparison

TABLE 3 – SURFACE WATER PEAK RUNOFF VOLUME COMPARISON (CF)		
POINT OF INTEREST		DESIGN STORM
		2-year
POI-1	Pre	41
	Post	0
POI-2	Pre	0
	Post	0
POI-3	Pre	1,113
	Post	617
POI-4	Pre	38
	Post	0
POI-5	Pre	25
	Post	3,743
POI-6	Pre	1
	Post	33

Table 3 - Pre- and Post- Development Peak Runoff Volume Comparison

The proposed project reduces peak rates or insignificant increases of runoff compared to existing conditions for all storm events. Additionally, per NHDES, the 2-year 24-hour storm does not result in an increased peak flow rate and reduces or increases volume within the limits of Env-Wq 1507.05(b)(1) from the pre-development to post-development condition. There will be no adverse effects on the abutting properties from the proposed stormwater management system.

The largest increase occurs where the entrance meets Lowell Road. Though the increase is minimal, the Town has expressed concern about the existing drainage along this road. Per discussion with the Town, Colbea Enterprise has offered to extend the drainage down this road and Birch Street to Second Brook. This entails approximately 520 lf of additional drainage.

Appendices D and F summarize all 24-hour storm events for pre- and post-development drainage calculations using HydroCAD analysis. Appendices E and G provide a full summary of the 10-year, 24-hour storm for the pre- and post-development drainage calculations using HydroCAD analysis.

6.0 – REGULATORY COMPLIANCE

The project meets the stricter of the stormwater standards identified in the New Hampshire Department of Environmental Services (DES) Env-Wq 1500 Alteration of Terrain Regulations and Town stormwater management regulations. The provided BMP's provide treatment to 63.3% of the site and 90.2% of the total impervious on-site.

7.0 – LOW IMPACT DEVELOPMENT

Low impact development is a stormwater management approach which prioritizes the treatment of stormwater runoff close to the source before reaching nearby surface waters while also limiting disturbance during site development. As a part of the proposed project, multiple infiltration practices are proposed to collect runoff from impervious surfaces. There is an above ground bioretention basin with an outlet control structure to collect runoff and allow for infiltration before outleting during larger storms. The remaining infiltration and detention basins are composed of subsurface Stormtech Chambers. The development was designed to limit the total impervious area and the underground chambers are introduced as a method to limit the total disturbed area. Priority was given to the existing woodland and vegetated area with the aboveground bioretention basin placed in a previously disturbed area.

8.0 – BEST MANAGEMENT PRACTICES

Best Management Practices will be developed in accordance with the New Hampshire Stormwater Manual, Volumes Two and Three, December 2008[3] to formulate a plan that assures stormwater quality both during and after construction. The intent of the outlined measures is to minimize erosion and sedimentation during construction, stabilize and protect the site from erosion after construction is complete and mitigate any adverse impacts to stormwater quality resulting from development. Best Management Practices for this project include:

- Temporary practices to be implemented during construction.

- Permanent practices to be implemented after construction.

8.1 – TEMPORARY PRACTICES

1. Erosion, sediment, and stormwater detention measures must be installed as directed by the engineer.
2. All disturbed areas, as well as loam stockpiles, shall be seeded and contained by a silt barrier.
3. Silt barriers must be installed prior to any construction commencing. All erosion control devices including silt barriers and storm drain inlet filters shall be inspected at least once per week and following any rainfall. All necessary maintenance shall be completed within twenty-four (24) hours.
4. Any silt barriers found to be failing must be replaced immediately. Sediment is to be removed from behind the silt fence if found to be one-third the height of the silt barrier or greater.
5. Any area of the site, which has been disturbed and where construction activity will not occur for more than twenty-one (21) days, shall be temporarily stabilized by mulching and seeding.
6. No construction materials shall be buried on-site.
7. After all areas have been stabilized, temporary practices are to be removed, and the area they are removed from must be smoothed and revegetated.

[3] New Hampshire Stormwater Manual: Volume One - Stormwater and Antidegradation, December 2008; Volume Two - Post-Construction Best Management Practices Selection and Design, December 2008; Volume Three - Erosion and Sediment Controls During Construction, December 2008.

8. Areas must be temporarily stabilized within 14 days of disturbance or seeded and mulched within 3 days of final stabilization.
9. After November 15th, incomplete driveways or parking areas must be protected with a minimum of 3" of crushed gravel, meeting the standards of NHDOT item 304.3.
10. An area shall be considered stable if one of the following has occurred:
    a) Base course gravels are installed in areas to be paved.
    b) A minimum of 85% vegetated growth has been established.
    c) A minimum of 3" of non-erosive material such as stone or rip rap has been installed.
    d) Erosion control blankets have been properly installed.

8.2 – PERMANENT PRACTICES

The objectives for developing permanent Best Management Practices for this site include the following:

1. Maintain existing runoff flow characteristics.
    a) Drainage is structured to minimize any offsite increase in runoff.
2. Treatment BMP's are established to ensure the water quality.
3. Maintenance schedules are set to safeguard the long-term working of the stormwater BMP's.

8.3 – BEST MANAGEMENT PRACTICE EFFICIENCIES

Appendix E of Volume 2 of the New Hampshire Stormwater [4] lists the pollutant removal efficiencies of various BMP's. All proposed BMP's meet all state and Town requirements for total suspended solids (TSS) and pollutant removal, Total Nitrogen (TN), and Total Phosphorous (TP).

In-Ground and Subsurface Infiltration Basins (greater than 75 FT from surface water) have a 90% TSS removal efficiency, 60% TN removal efficiency, and 65% TP efficiency.

Contech Jellyfish Filter Stormwater Treatment systems have an 89% TSS removal efficiency, 51% TN removal efficiency, and 59% TP efficiency.

All the stormwater entering the BMP's Contech Jellyfish Filter systems are pretreated with deep sump catch basins and Stormceptors. The deep sumps help to settle sediment and prevent clogging of treatment areas. Underground Storage System #3 receives only roof runoff and does not need pretreatment.

9.0 – CONCLUSION

[4] New Hampshire Stormwater Manual: Volume One - Stormwater and Antidegradation, December 2008; Volume Two - Post-Construction Best Management Practices Selection and Design, December 2008; Volume Three - Erosion and Sediment Controls During Construction, December 2008.

The proposed stormwater management system will treat, infiltrate, and mitigate the runoff generated from the proposed development and provide protection of groundwater and surface waters as required through the Alteration of Terrain Bureau and Town stormwater management regulations. The project has been designed in accordance with NHDES and Town regulations. There is little change in the flow characteristics of the site. The proposed project has been designed to pose no adverse effects on surrounding properties.

Respectfully,
TFMoran, Inc. Seacoast Division

Jack McTigue, PE, CPESC
Project Manager

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