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March 25, 2022
VIA EMAIL

Ipswich Planning Board
Town Hall
25 Green Street
Ipswich, MA 01938

RE: 5-11 Washington Street
Initial Drainage and Stormwater Management Review (Task 1)

Mr. Ethan Parsons and Planning Board Members:

As requested, I have conducted an initial drainage and stormwater management review of the above referenced project with respect to regulatory standards of the Planning Board and routine engineering design practice for drainage and stormwater management facilities similar to that being proposed by the Applicant. Pertinent technical material received includes the following plans and documents as prepared by ASB Design Group LLC of Topsfield, MA (unless otherwise noted).

- Plan set entitled “Site Plan Review, 5-11 Washington Street...” consisting of nine (9) sheets number C-1, and C-3 to C-10, including Site Plans, Utility Plans, Grading & Drainage Plans, and Details, all dated October 4, 2021 and revised to March 2, 2022.
- An ‘Existing Conditions’ plan prepared by Donahoe Survey, Inc., of Topsfield MA, dated June 3, 2021 and revised to March 2, 2022.
- A booklet entitled “Application for Site Plan Review Summary Letter – Drainage Review (Revision #5)...” dated March 2, 2022 including a ‘Summary Letter,’ a ‘Project Overview – Revision #5,’ an ‘Operation and Maintenance Plan – Construction Phase,’ an ‘Operation and Maintenance Plan – Post Construction Phase,’ and an Appendix A which includes soil boring information and stormwater calculations.

In addition to the above, the following material was received and examined for background and informational purposes only:

- Landscape Plans prepared by James K. Emmanuel Associates of Marblehead, MA, consisting of three (3) plans all dated February 28, 2022.
- Figures 1, 2, and 5 through 8, all revised to March 2, 2022 as referenced in Appendix A of the booklet previously identified.

At this time, the following comments and opinions are offered for your consideration relative to the proposed drainage and stormwater management design.

Overview: As asserted by the design engineer, it is acknowledged that the proposed development will reduce the amount of impervious area on the subject property, and consequently to total amount of runoff will be slightly lessened. However, the generalized analysis approach does not address more specific impacts from runoff based on the direction of flow off of the site. In addition, the types of stormwater best management practices proposed for implementation require additional calculation and revision to demonstrate that they will function in a suitable fashion for the design storms being considered. Specific issues are presented within the body of this report and are requested such that the design fully demonstrates that the proposal will perform as intended and provide the requisite level of stormwater mitigation.

Stormwater Management & Drainage:

1. No documentation was provided in support of the precipitation values utilized in the calculations. It is noted that the 2 and 10 year precipitation values used are notably less than those published in NOAA Atlas 14. Recalculation of these storm events is requested using appropriate precipitation values.
2. Existing Conditions Hydrology Calculations: Expand and revise the calculations to address the following items:
 - a. Revisions should be conducted to quantify flow in the various direction that runoff occurs off of the site.
 - i. Runoff onto the public way(s) and Town storm drain system should be quantified.
 - ii. Runoff onto the abutting property of EBSCO (to the southeast) should be quantified and consideration should be given to the existing on-site depression which appears to provide both storage volume and recharge.
 - iii. Additional topographic detail should be provided to better define flow from the site onto abutting property of the MBTA (to the northeast) and abutting property of Tzizik (to the northwest).
 - b. A subcatchment map of existing drainage areas should be provided that reflects the areas and flow directions evaluated in the calculations.
 - c. An existing catch basin is mapped in the southern corner of the property, however, a downstream pipe route (i.e., connection to next structure or outfall) is not clearly identified. Since this structure is proposed for reuse by the development, additional information should be provided on the plans relative to downstream conditions of the pipe network.
3. Proposed Conditions Hydrology Calculations: Similar to item 1 above, the proposed (developed) analysis does not provide a breakdown of runoff flowing off the site by direction/location. Proposed conditions calculations should be revised to provide a comparison to the existing conditions calculations such that impacts to the Town drainage system and other abutting properties are quantified.
 - a. It is noted that the post development drainage area for catchment P1 is approximately 4 percent larger than the sum of the individual subcatchment areas used in the stormwater management design. This inconsistency should be explained and clarified.
4. The system profile shown on Plan Sheet C-5 indicates groundwater to be at elevation 21.7 (and is similarly stated on page 5 of the drainage narrative), however, Boring No BB-3 lists groundwater depth at 4.2 feet (which generates a calculated groundwater elevation of 24.8). The design engineer should rectify this inconsistency, noting that the bottom of the

Infiltration Systems is specified to be elevation 24.25 (i.e., at an elevation lower than the groundwater level found in boring BB-3).

5. Stormwater Infiltration Systems: Additional revision of the infiltration system calculations should be conducted such that the calculations accurately reflect what is depicted on the site plans, and to confirm that the systems will perform appropriately.
 - a. Calculations for the connected network formed by Infiltration Systems 1, 2, and 6 should be revised such that the analysis includes the hydraulic impacts associated with the pipe segments connecting the individual systems. Some of the calculation errors or deficiencies are noted below.
 - i. Outlet characteristics for all systems are based on ‘free discharge’ which is not the case. Analysis should be based on dynamic tailwater generated by the down gradient systems. In addition, consideration should be given to the hydraulic capacity of the existing storm drain system to establish whether or not any additional tailwater impacts will be experienced as a result of the proposed connection.
 - ii. As calculated, the peak elevations of the individual systems would imply a reversal of flow direction (i.e., runoff at system 1 would flow towards the Town drainage system, but would also flow towards system 6). In reality, the three systems would tend to equality. Hence, this calculation should be re-evaluated.
 - iii. As calculated, the 100 year peak elevation of system 1 is erroneous (with a peak elevation that is more than 20 feet higher than the pavement grade).
 - iv. The calculated 10 year outflow from Systems 1 and 3 is greater than the calculated inflow (this is also the case for the 100 year storm at System 2 and Rain Garden 7) . This is frequently related to an error in choosing a routing time increment that is too large. Re-evaluation of this calculation should be conducted.
 - v. The 10 year peak storm elevation at system 1 is 0.65 feet higher than the driveway catch basin rims. In my opinion, this flooding depth is excessive for the 10 year storm and should be revised to improve the condition.
 1. In addition to the above, the 10 year storm peak would imply that a higher stage would exist for the 100 year storm. Such an elevation would not be contained on the site, but rather, would flow out the main driveway overland and onto Washington Street. This condition would potentially contradict the mitigation summary asserted for the 100 year storm.
 - vi. It is noted that system ‘discarded’ rate increases with higher storm intensity. This issue should be corrected by the design engineer. Exfiltration (‘discarded’ flow) is generally based on the selected Rawls rate and is not expected to vary dramatically in response to storm intensity.
 - vii. Based on the revised 100 year peak storm elevation calculated, additional refined grading may be required at System 6 (and potentially at Systems 4 and 5 as well) to clarify the intended direction of surface ponded runoff that exceeds the system capacity.
 - b. Infiltration System 3 should be re-evaluated to consider potential tailwater impacts created by the proposed connection to the existing Town drainage system (similar to comment 5.a.i). The current analysis assumes ‘free discharge’ which may not be the case for high intensity storms.

- i. Increases in ‘discarded’ rates for this system should also be evaluated, similar to comment 5.a.vi noted above.
 - c. Infiltration Systems 4 and 5 are calculated to have an overflow outlet, however, an outlet structure is not specified on the plans.
 - i. In addition to the above, outlet pipe size, slope, direction, and outfall location should also be specified on the plans.
6. Rain Gardens: It is noted that all proposed rain gardens are located within the Town right of way rather than on the subject (private) property. No documents were received to indicate that the Applicant has received authorization from the Town to conduct this type of improvement within the public way. It is strongly recommended that the Planning Board solicit the opinion of the Public Works Director relative to these facilities (which, as proposed, will function to serve a private purpose) being located within the Town right of way.
 - a. Calculations assume that all rain gardens are provided with an overflow weir. Plans should be clarified to specify the assumptions made in the calculations.
 - b. Landscape planting for Rain Garden 7 should be specified on the plans.
7. The on-site soil borings indicate, and the design engineer acknowledges, that earthen fill is present on site. In addition, the fill descriptions also note the presence of coal, ash, asphalt, and brick. As such, the specific location of stormwater infiltration practices should be further evaluated for suitability. Reference should be made to the requirements of the MA DEP Stormwater Handbook (refer to Volume 3, Chapter 1: ‘When Fill Materials Are Determined To Be Present’).
 - a. Depending upon the nature of the fill, DEP recommendations may require the material to be removed from the area of infiltration, or alternatively infiltration should be relocated to an area without the presence of unsuitable fill (if such an area exists on the site).
 - b. Additional notes and specification should be provided on the plans which outline work efforts needed to fully comply with the Stormwater Handbook recommendations.
 - c. An evaluation of native soils located below the fill material should be conducted to better classify the naturally occurring soil groups present on the property (i.e., the current soil classification of ‘Urban Land’ is reflective of the disturbed nature of the area, whereas the soil test data and test locations facilitate the ability to approximate locations and physical soil properties of native soils).
8. It is noted that the proposed Infiltration Systems and Rain Gardens are located too close to building foundations and/or property lines. Several locations were observed where the proposed stormwater systems are located approximately 5 to 10 feet from the building foundation, while other locations were located within 4 to 6 feet the front and rear property lines. Based on the MA DEP Stormwater Handbook (Volume 2, Chapter 2) an infiltration trench (which would function similarly to the proposed Infiltration Systems) requires a 20 foot minimum setback from building foundations. In addition, the small Rain Gardens would function similarly to a dry well, which is required to have a 10 foot minimum setback from a building foundation. To resolve this situation, the following options should be considered:
 - a. Provide impermeable membranes between the buildings and the infiltration chamber such that lateral water movement will not adversely impact the building foundations, will not enter the existing building basement, and will not enter the foundation drain system.

- b. Modify the locations of the stormwater facilities to better comply with the MA DEP Stormwater Handbook.
 - c. Engage a geotechnical engineer to determine what measures should be taken to protect against the concerns stated above.
 9. Town of Ipswich Stormwater Regulations require that runoff from the 1-year storm event be detained on site. Calculations should be submitted to demonstrate compliance with this requirement.
 10. Post development calculations assume that proposed patios and walkways will be constructed of 'pervious pavers.' As such, the patio and walkway areas should be specified accordingly on plan sheet C-3, and the 'Walkway Paver Detail' on plan sheet C-7 should be revised to specify a pervious paver type of construction.
 11. Miscellaneous Drainage and Stormwater Management Items.
 - a. A trench dam should be specified for all utility trenches that are proximate to infiltration systems, such that stormwater runoff will not flow along the length of the utility trench.
 - b. Several sections of drain pipe are specified as 6 inch diameter with a slope of 10 percent. In typical pavement drainage systems, a larger diameter pipe and a flatter slope would be provided (a 12 inch pipe size is most typically a minimum standard).
 - c. A mapping of all soils tests and borings should be provided to document locations and to illustrate whether or not a test was performed within each infiltration system location. It is noted that the monitoring well and boring locations shown on plan C-2 were not labelled to correspond to the boring logs.
 - d. Add a note to the plans specifying that all roof runoff shall be conveyed to the Infiltration Systems in accordance with the stormwater management calculations.
 - e. Add a note to the plans specifying that Infiltration Systems and Rain Gardens shall be protected during construction from compaction by equipment, stockpiling, or laydown storage and from pollution associated with construction activity such as vehicle washing, fueling, or concrete washout.
 - f. It is requested that future iterations of the stormwater calculations be provided with full subcatchment data sheets and pond routing, rather than just the summary sheets provided for this review.
 12. Miscellaneous Drafting and Housekeeping Issues.
 - a. Coordinate Infiltration System identification. Inconsistent numbering is provided on plan sheets C-3 and C-4.
 - b. Drainage structure LSDMH#1 is specified at two different locations on plan sheets C-3 and C-4. Callouts should be corrected to provide distinct identifiers.
 - i. A standard dimension manhole should be considered for the LSDMH locations. Based on the anticipated depth of structure, the proposed 30 inch diameter structure would make physical access into the structure difficult.
 - c. The catch basin detail on plan sheet C-5 should be coordinated with the catch basin detail on plan sheet C-8 such that consistent specification is provided.
 - i. The 2 foot diameter weep hole specified on plan sheet C-5 should be deleted from the detail. Such a specification is contrary to the water quality intent of the MA DEP Stormwater Standards.
 - d. The roof drain detail on plan sheet C-5 should clarify the elevations associated with callouts 'ELV A' through 'ELV D.' Numerical elevations were not found.

- e. On plan sheet C-9, coordinate information contained on the Infiltration System 2, Rain Garden 7, and the Overflow Detail to be consistent with information contained on plan sheet C-4.
- f. Correct the discharge pipe DMH reference on the Temporary Sedimentation Basin detail on plan sheet C-10.
- g. Correct Erosion Control Note 'B' on plan sheet C-10. The reference to note 18 was not found elsewhere on the plan.
- h. Include a note on the plans that cross references the requirements of the 'Operation and Maintenance Plan – Post Construction Phase' and the Long Term Pollution Prevention Plan.

DEP Stormwater Management Standards:

1. Standard 3 – Calculations were not provided to demonstrate that the infiltration systems will drain in a 72 hour period.
2. Standard 3 – Calculations were not provided for a mounding analysis. Since the infiltration systems are located closer than 4 feet to groundwater level, a mounding analysis is required.
 - a. It is further noted that groundwater level appears to be based on monitoring well observations. Estimated seasonal high water table (ESHWT) should be provided, based on soil redox features (mottles) or alternatively the monitoring well data should be compared to regional USGS wells and adjusted accordingly.
3. Standard 4 – Provide a Long Term Pollution Prevention Plan (LTPPP) which addresses all topics contained under 'Standard 4' in the 'Checklist for Stormwater Report.'
4. Standard 8 - The 'Operation and Maintenance Plan - Construction Phase' should be revised to provide the following items:
 - a. Specify need for erosion control around perimeter of stockpile areas.
 - b. Add a note that if the site remains idle for a period of more than 30 days, disturbed areas shall be hydroseeded (per Town Stormwater Management Permit Regulations).
 - c. Construction sequencing and identification of the person/entity responsible for plan implementation and compliance are specified to be provided by the Contractor at a later date. It is suggested that this information be provided as part of the application.
 - d. Include provisions for dust control during construction.
 - e. Provide an Inspection and Maintenance Log Form.
5. Standard 8 – Plan items:
 - a. Include a note on the plans referencing the requirements of the 'Operation and Maintenance Plan – Construction Phase' and the SWPPP.
 - b. Portions of the existing and developed site are graded to runoff towards both Washington and Mineral Streets. As such, additional erosion barriers should be specified along the project frontage.
6. Standard 9 – Address and coordinate the following items in the 'Operation and Maintenance Plan – Post Construction Phase':
 - a. Under the heading 'Permanent Operation and Maintenance Items,' two additional items should be added. The first item should specify the obligation of the 'association' to appoint a person, group, or other entity that will be responsible for implementing inspection and maintenance contained in the plan, and provide that information to the Planning Board. The second item should specify the obligation of the 'association' to provide suitable funding to perform the requisite maintenance and inspection.

- b. Revise the inspection interval for catch basins to be consistent with MA DEP Stormwater Handbook recommendations (i.e., inspect four times per year).
 - c. An item should be included to reference the design plan of record and the ‘as-built’ plans for the project.
 - d. Provide estimated annual costs for anticipated inspection and maintenance of the stormwater management system.
 - e. Expand on the inspection and maintenance narrative for the ‘Infiltration System’ and the ‘Rain Garden.’ In particular, specify the number of each type of stormwater best management practices, and elaborate on what inspection/maintenance items should be performed for the ‘Infiltration Systems.’
 - f. Include inspection/maintenance of drain manholes.
 - g. Include inspection/maintenance of pervious walkways and patios on site, to ensure that they are functioning as intended (and as assumed in the calculations).
 - h. Provide an Operation and Maintenance Log Form for the overall system. Include line items for each element, and each system, described in the document.
7. Standard 10 – Provide a signed and fully executed Illicit Discharge Compliance Statement that speaks directly to the presence of any existing or proposed illicit discharges at the project site.

Please feel free to contact me if you have any questions or require any additional clarification of the above comments and opinions.

Very truly yours,

R.E. Puff

Robert E. Puff, Jr., PE

cc: Thad Berry, PE (via email at thadberry2@verizon.net)