

Date January 14, 2021
To Wrentham Board of Health
From Mark S. Bartlett, PE
Thomas C. Houston, PE, AICP
Project Wrentham Highlands – Senior Living Community, 20 Hancock Street and
1139 West Street, Wrentham, MA, Norfolk County
Subject Stormwater Review of Site Plans & Stormwater Management

Professional Services Corporation, PC (PSC) has reviewed the Site Plans and Stormwater Report for the above noted project on behalf of the Wrentham Board of Health.

Wrentham Highlands, LLC (Applicant) proposes to develop two parcels (Assessors Map G-03 Block 1, Parcels 14 and 19) for a Senior Living Community (SLC) to be known as Wrentham Highlands (the Project) at 1139 West Street as well as 20 Hancock Street in Wrentham, MA (the Site). The Site plans and stormwater report were filed with the Board of Health for review under the Wrentham Stormwater Regulations. The Project will involve the construction of a SLC with fifteen (15) single-family homes at 1139 West Street, and a mix of duplex and triplex style buildings totaling 31 units at 20 Hancock Street, for a total of 46 units throughout the development of the two parcels. The development will create a new systems of roads (22-foot wide) with a sidewalk typically on one side, and will utilize municipal water and private electric throughout and will be serviced by two on-site community septic systems; and, stormwater from the new impervious surfaces (roads and driveways) will be collected and managed through standard curb and gutter systems with catch basins, drain lines and manholes to direct drainage to sediment forebays for pretreatment prior to release to several infiltration ponds. House roof runoff will be collected by gravel drip edge areas that will infiltrate the roof runoff directly.

The Applicant's watershed data for the Site areas to be developed¹ indicate that the project at 1139 West Street will result in about 2.6-acres of impervious area, and the project at 20 Hancock

¹ The watershed analysis is limited to the area that is being developed, about 19.2 acres. The overall Site, for both parcels combined, is 40.5 acres



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Street will also result in about 2.6 -acres of impervious area, for total impervious area of about 5.2-acres (about 27% of the area being developed). The existing condition within these same limits has minimal impervious area of about 0.41 acres which is about 2.1% of the project area being developed. This amounts to a very significant increase in impervious area for the Project Site. The Project Site is bounded to the north by West Street and two Town owned parcels (Fire Department), and six residential lots; and it is bounded to the east by Hancock Street and three residential lots. There are six larger parcels to the south and west that surround the Site. Burnt Swamp Brook flows from north to south about 2000-feet east of the Site. There are two tributaries to Burnt Swamp Brook on the Site: One which flows north to south along the border between the two Site parcels (west side of the 20 Hancock Street parcel); and the other tributary flows north to south along the west side of the 1139 West Street parcel. Both tributaries have significant bordering vegetated wetland areas. These streams and wetland areas appear to merge on the Site about 1300-feet south of West Street, and then this stream & wetland system joins other tributaries and Burnt Swamp Brook further south.

As part of obtaining a Certificate of Approval from the Board of Health under the Board's "Regulation for Storm Water and Runoff Management (April 1991, amended March 2009)" (RSRM), the project must comply with the latest version of the Massachusetts Stormwater Handbook (SWH)². Because the SLC Project requires a Special Permit and Site Plan Approval from the Wrentham Planning Board this stormwater review also considers Planning Board provisions for drainage if they are different or more stringent than the RSRM. The SLC project also requires an Order of Conditions from the Conservation Commission per the Town of Wrentham Wetland Protection Bylaw (Art.7.31 of Wrentham General Bylaws), and a Massachusetts DEP Order of Conditions (MGL c. 30, §§ 61 through 62H). Therefore, this review of Project stormwater management is for consideration by the Board of Health and by these other noted authorities.

The Applicant's Site Plans and Stormwater Report submittal were prepared by Howard Stein Hudson of Chelmsford, MA. We offer the following comments for consideration.

SUBMITTAL

- A. "Site Plan for Wrentham Highlands, 1139 West Street, 20 Hancock Street, Wrentham, MA" prepared by Howard Stein Hudson of Chelmsford, MA, dated November 9, 2020 consisting of 35 sheets.

² Included by reference in sections 3.a and 3.h of the Regulations for Stormwater and Runoff Management



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- B. "Supplemental Data Report, 20 Hancock Street, 1139 West Street Wrentham, MA" (the Project Stormwater Report) prepared by Howard Stein Hudson of Chelmsford, MA, dated November 2020.
- C. Architectural Plans by JD LaGrasse & Associates, Inc. of Andover, MA, dated November 6, 2020 consisting of 25 drawings

REFERENCE

- A. "Regulation for Storm Water and Runoff Management (April 1991)," voted March 15, 1991, amended March 23, 2009, Wrentham Board of Health.
- B. "Stormwater Handbook," Massachusetts Department of Environmental Protection.
- C. Wrentham Rules and Regulations Governing the Subdivision of Land, revised through June 16, 2016 (PBRR), specifically Sections 5.2 and 6.1 that pertain to drainage.

REGULATIONS FOR STORM WATER AND RUNOFF MANAGEMENT

Compliance of the Submittal with the Wrentham Board of Health's "Regulation for Storm Water and Runoff Management" (RSRM) are summarized hereinafter.

Executive Summary

The RSRM states six general goals for submitted stormwater management designs. As a form of executive summary, each of these goals is restated below along with our general comments on the degree to which the Project complies with the goals.

- A. ***Reproduce, as nearly as possible, the hydrological conditions in the ground and surface waters prior to development.*** Project Site topography is being significantly changed with filling and rise in grade, and there will be significant increase in impervious area (5.2-acres, 27% of the developed area). The stormwater management design is seeking to maintain peak flow and volume of stormwater runoff to levels that currently run off the land. The Applicant proposes to do this by directing Project runoff to one of six (6) infiltration basins; and by proposing to recharge roof runoff at each home site. However, it is not yet clear if the peak flow and volume of stormwater will be controlled in this way, because the submittal has flaws which need to be corrected to properly analyze the impacts. The significant submittal flaws include (1) the need for field testing (which is



missing) to document in-situ infiltration rates³ that will be appropriate for the infiltration practices, (2) the need for additional test pit soil evaluations to adequately document proper separation of all infiltration practices from Estimated Seasonal High Groundwater (ESHGW) elevations, and (3) the need to revise the plans and report content to fully comply with the Town's RSRM and the Massachusetts SWH.

Another important issue that the Applicant should resolve (to meet this RSRM goal) is to properly manage stormwater that currently flows onto the Site from abutting properties. The Site is known to have shallow depth to high groundwater per NRCS⁴ and have large areas of fairly flat topography (typically 1-percent slope), and these areas serve to accept and store storm flows from abutting land. The Site land is subject to flooding after heavy rainfall events (see testimony from abutters)⁵ and, it is clear from review of the Project plans that the Site flooding is due in large part from receiving storm flow from upgradient properties. Unless the Applicant's Site plan properly manages this issue of "flow coming from offsite" there could be an undesirable blocking effect from the significant change in Site grades. This effect could increase flooding on upgradient abutter land depending on channelization and flow of flows⁶ around the developed Site perimeter. See comments 5 and 33.

- B. Reduce storm water pollution to the "Maximum Extent Possible" (MEP) using Best Management Practices (BMPs).** The Applicant's submittals currently appear to meet this goal, but we defer final opinion until later design review, after the flaws noted above are corrected.
- C. Have an acceptable future maintenance burden.** The Applicant's submittals currently appear to meet this goal, but we defer final opinion until later design review, after the flaws noted above are corrected.
- D. Have a neutral effect on the natural and human environment.** See our comments under goal A above.

³ The saturated hydraulic conductivity rate utilized by the Applicant is **8.27 inches/hour**, which is the most rapid rate allowed for a soil in Hydrologic Soil Group A. We believe this approach grossly overstates the ability of proposed infiltration systems to recharge stormwater to the Site water table. Site data indicate soils to be within Hydrologic Soil Group B, for which the Massachusetts SWH allows Infiltration Rates of only **0.52 to 1.02 inches/hour**. **For this reason, significant field testing as required by the Town's RSRM is critically important.**

⁴ USDA Natural Resources Conservation Service soils reports

⁵ Ref. letters from abutters: Sozio, Dawe, Pond, Rook, Jones, Duggan, Ihley, Lyon, Zitomer and Moriarty.

⁶ Site perimeter flows will be from abutter stormwater plus any overflow from certain infiltration basins at the Site



Also, the proposed use of drip edge stone recharge systems located along foundations of homes are potentially problematic for homeowners with full basements; and these infiltration practices (presumably to help meet SWH Standard 2 for control of peak discharges) do not comply with the Massachusetts SWH for trench drains and drywells which require setbacks from building foundations of 20-feet and 10-feet respectively (and a 20-foot setback seems to be more appropriate in this instance). One of the architect plans shows a bulkhead for basement access: The Applicant should explain if the proposed homes will have full basements or not. If full basements are proposed, we would recommend against the use of the drip edge systems and suggest the Applicant consider collection of roof runoff to be directed either to the infiltration basin areas or to separate dry wells (perhaps serving multiple home sites) located 20-foot minimum from any foundations. See comment 26 under discussion of SWH Standard 2.

Also, if homes will have full basements, then the Applicant should consider also the relationship of basement floor elevations to ESHGW levels across the Site, and if foundation underdrains will be installed, then such features should be shown on the Grading and Drainage plans and on detail sheets. Also see comments 26 and 35.

- E. ***Be appropriate for the site, given physical restraints.*** See our comments under goal A above.

Also, the proposed use of wick drains within the six infiltration basins is not appropriate because it will violate the 2-foot minimum and preferred 4-foot set back from ESHGW as established by the Massachusetts SWH and the Town RSRM. These wick drains will extend close to, or in some cases into and below ESHGW levels where such elevations have been determined to date. The Applicant needs to eliminate these features from the proposed infiltration basins; or alternatively, defend their use as justifiable engineering design in the face of the noted regulation restrictions. See comment 22.

- F. ***Provide a sufficient level of health and environmental protection during the construction phase.*** The Applicant's submittals currently appear to meet this goal subject to some suggested improvements noted in this review, but this is subject to final consideration after the flaws noted above are corrected.

In short, as a close to this executive summary, the proposed project may meet the RSRM goals if the concerns raised in this review are properly addressed.



Comments on Acceptable Stormwater Management Plan requirements⁷

The RSMR (item 1, page 2) requires the Applicant to ***“Capture and treat the “FIRST FLUSH” of storm, usually defined herein ... as the runoff from the first 2-inches of precipitation...”*** The Applicant’s Site plans and stormwater report demonstrate adequate plans to address this for capture of 1-inch, but this needs to be upgraded to 2-inches to meet this requirement. Also, we defer on final comment until the other flaws in the submittal are corrected. See comment 9.

The RSMR (item 2, page 2) requires that the plan ***“Not cause an increase or decrease in either the total volume of runoff discharged offsite, or total rate of runoff discharged offsite, as compared with the respective discharge offsite prior to the development. Such condition shall be required for storms of 2-inch, 2- year, 10-year, 50-year, and 100-year frequency events.”***

The proposed stormwater management design seeks to maintain peak flow and volume of stormwater runoff to levels that currently run off the land. The Applicant proposes to do this by directing Site runoff to one of six (6) infiltration basins; and by proposing recharge of roof runoff at each home site. However, it is not yet clear if the peak flow and volume of stormwater will be controlled in this way, because the submittal has assumed an infiltration rate that is too high and not document by field testing. These field testing data gaps need to be filled. Based on required field testing results, the infiltration designs will need to be revised, at which time a revised analysis of peak flow and volume control can be submitted:

1. The Applicant needs to conduct field testing to document in-situ infiltration rates for the proposed infiltration practices. The RSMR (item 4, page 4) requires ***“all permeability testing for determination of soil permeability for infiltration design shall be in-situ field bore hole tests”***. We recommend that the Applicant conduct in-situ borehole falling head permeability tests at the locations noted below, and all field testing (observation pits and infiltration tests) should be witnessed by a qualified Town representative:
 - a. One (1) permeability test in the middle of each area for Infiltration Basins 1, 2 and 3; two (2) permeability tests in each area for Infiltration Basins 4 and 5; and three (3) permeability tests in the area for Infiltration Basin 6.
 - b. Because drip edge infiltration systems are proposed for each of the 46 proposed home sites, the soils that will receive these points of recharge should be tested for permeability. If the Applicant continues to propose these systems, then we recommend that borehole permeability tests be conducted at least 12 locations,

⁷ See page 2 of the Regulations for Stormwater and Runoff Management



spaced evenly among the proposed home sites in each half of the development (i.e., 12 in the West Street half and 12 in the Hancock Street half).

2. The Applicant needs to conduct additional test pit soil evaluations to properly document soils conditions and properly identify the separation of all proposed infiltration practices from the Estimated Seasonal High Groundwater (ESHGW) elevation. We recommend that the Applicant conduct at least nine (9) additional test pit evaluations at the locations noted below, and all field testing should be witnessed by a qualified Town representative:
 - a. Two (2) test pits spaced evenly at the area for Infiltration Basin 1;
 - b. Two (2) test pits at the area for Infiltration Basin 4, one in the center, and one at the north end;
 - c. Three (3) test pits spaced evenly within the area for Infiltration Basin 5; and
 - d. Two (2) additional test pits in the area for Infiltration Basin 6, spaced evenly at the north side of the proposed basin.

The RSMR (item 3, page 2) requires that the plan ***“Include source controls and design of BMPs including, but not limited to, Infiltration and Detention Structures, LID Techniques, Bioretention Areas, and Constructed Storm Water Wetlands in accordance with procedures acceptable to the Board of Health...”***: The Applicant’s Site plans and stormwater report demonstrate adequate plans to address this requirement. However, we defer on final comment until the other flaws in the submittal are corrected. Also, see comment 31.

The RSMR (item 5, page 4) requires: ***“If detention or retention ponds are utilized, they shall have interior slopes no steeper than 4 horizontal to 1 vertical. Maximum design water depth shall not exceed three (3) feet except in permanent ponds. Minimum bottom slope for “dry” detention areas shall be two (2) percent. A safety bench, a minimum of 10 feet wide shall be provided. Detention or retention areas shall not be constructed within existing stream bed or wetland areas.”*** The proposed stormwater management design seeks to maintain peak flow and volume of stormwater runoff by utilizing infiltration retention ponds. Therefore, the following corrections are needed:

3. The proposed basins have 3:1 (and in some cases only 2:1) interior slopes. The Applicant needs to revise the six infiltration basin designs to have 4:1 interior slopes.
4. The six proposed basins do not provide a 10-ft wide (min.) safety bench at the perimeter nor provide access for maintenance equipment. The Applicant needs to revise the basin designs to provide suitable access for maintenance and provide a 10-foot wide minimum



safety bench. As discussed in the Massachusetts SWH, maintenance access should typically be provided from a community right-of-way, using a minimum width of 15-feet and a maximum slope to the basin of 5:1, and the access should extend to the sediment forebay, the basin safety bench and the outflow structure (but not crossing the outflow structure).

The RSMR (item 6, page 4) requires: ***“Stormwater discharge shall not result in channelization of surface runoff offsite without the written consent of the owner of the land affected, in the form of a permanent grant of easement, recorded at the Registry of Deeds.”***

5. After re-design (following changes in design infiltration rate) the Applicant needs to check (a) the outflows from Infiltration Basins 1, 4 and 5 which are closest to the upgradient abutting properties, to be sure that any stormwater discharges will not result in flow or flooding onto the abutting properties, and (b) analyze the impact of the combination of basin outflows plus storm flows from upgradient abutting properties that would normally have flowed onto the Site land prior to the proposed development rise in grade to be sure that the post-development condition will not increase flooding on upgradient abutting lots.

The RSMR (item 7, page 4) requires: ***“Include hydrologic and hydraulic calculations and data to support the proposed design for the runoff drainage system. Both volume and flow rate of runoff, before and after development, must be clearly stated and shall be in accordance with the specifications previously designated herein. Calculations shall be performed using the most recent procedures of the U.S.D.A. Soil Conservation Service such as are described in National Engineering handbook - Section 4- Hydrology (SCS 1985., TR-20 "Computer Program for Project Formulation-Hydrology (SCS 1983), and Technical Release No. 55 "Urban Hydrology for Small Watersheds" (SCS 1986). Structure design shall comply with the standards of USDA SCS Publication TR-60 for containments for detention and retention areas or other designated references. Rainfall event amounts shall be as derived from the latest Atlases of Precipitation as published by the Northeast Regional Climate Center, Cornell University, Ithaca, N.Y.”*** The Applicant’s submittals generally demonstrate compliance with these requirements. However, as noted earlier, the *“hydrologic and hydraulic calculations and data to support the proposed design”* are flawed and need to be corrected before we can offer final comment on compliance.

Review per the RSMR Checklist of Design Regulations⁸

⁸ See pages 5 through 8 in Section II of the Regulations for Stormwater and Runoff Management



The Applicant's submittal does not include an evaluation of compliance with the Wrentham RSMR checklist of design regulations for stormwater and drainage designs. In our review, we have found the following items of non-compliance:

6. ***The Hydrologic Report shall be prepared which is stamped and signed by a Professional Engineer, Registered in the Commonwealth of Massachusetts.*** The Applicant needs to submit a stormwater management report that is stamped and dated by the Registered Professional Engineer for the Project.
7. The Applicant also needs to submit a copy of the *MassDEP Checklist for Stormwater Report* that is stamped and dated by the Registered Professional Engineer for the Project.
8. ***Separate overlays shall be included of pre- and post- development watershed catchment areas, including the soil types, hydrologic categories, CN values of the NRSCS, and the Time of Concentration flow paths and design points delineated.*** The Applicant needs to submit a revised post-development watershed plan that more clearly identifies the various sub-catchment areas, perhaps using shaded colors to distinguish the limits of each sub-area; and include all test pit documented levels of ESHGW on this plan. Also, the Applicant should explain the few instances in the HydroCAD submittals where CN values were determined based on Hydrologic Soils Group (HSG) A, since it does not appear that any clearly defined area of HSG-A soils exist at the Site.
9. ***Best Management Practices shall be provided for removal of contaminants from the peak runoff from the 2-inch storm. Specific calculations shall be prepared.*** The Applicant needs to submit revised Water Quality Volume calculations that are based on the 2-inch storm (instead of the 1-inch quantity that was used).
10. ***High groundwater determinations shall be made in the areas of any detention or infiltration basins based upon soil morphology or by use of an adjustment provided by or otherwise approved by the Board of Health based upon the methodology of Frimpter. The location of all test holes and monitor wells shall be shown, including elevation of top of monitor well, elevation of ground, date of water level readings (should usually be taken between the 22nd and 29th of the month), and groundwater adjustment used with supporting data, where applicable.*** The Applicant needs to obtain and submit additional field test data to adequately document high groundwater (ESHGW) conditions. See comment 2.
11. ***Hydrographs shall be printed out and show data and a 2D graphical representation for pre- and post- development conditions.*** The applicant needs to submit printed hydrographs, but in the interest of saving paper volume, we recommend that it would



most useful if the hydrographs printed by the Applicant only be for the final design point discharges for pre- and post-development conditions for required design storm events.

12. **20-scale Cross-Section view of basin showing detail of design features and underlying profiles of high groundwater, existing grade, proposed grade, soil strata, and impervious/bedrock layers. All test holes and borings also shown in appropriate perspective.** The Applicant should submit revised 20-scale cross-section views of the six infiltration basins (Sheets 33 to 35) that show the existing grade line (in the background) and include soil strata and actual field documented ESHGW levels below each basin.
13. The Applicant should also check and correct graphical errors on the Grading and Drainage Sheets 14 through 17, and on the the three detail sheets (Sheets 33 to 35), for example:
 - a. many contour lines are not labeled, and proposed stone armored areas are not shown in correct locations on the detail sheets;
 - b. OCS-1 at Infiltration Basin 5 needs to be detailed and explained with more clarity.
 - c. It appears that the outlet pipe for OCS-1 will not have adequate cover as it leaves the structure, and the outlet pipe invert elevation at point of discharge north of the basin is not listed. Inferring from the 0.5% slope assigned to this outlet pipe in the HydroCAD model, we calculate that the outlet elevation would be **248.93** which would be about 1-ft lower than the existing grade shown on Sheet 15 as **249.8±** and, extending this pipe in length would place it within the Town's wetlands buffer 50-foot no touch zone.
 - d. The curb cut inlet intended to allow street flow to enter Infiltration Basin 5 (shown on Sheet 16) needs to be detailed and explained better on plan view Sheet 16 and perhaps also on Detail Sheet 35 and there is no erosion protection feature at this curb cut. The elevation at the curb cut is unclear, and the surrounding proposed grades leading up to this inlet are not labeled. Also, because this flow to Infiltration Basin 5 is not passing through a deep sump catch basin, the calculated pretreatment prior to Basin 5 will be less than the 44% TSS removal⁹ that has been properly provided at the other infiltration basin locations. We recommend that the Applicant consider another type of inlet at this location that incorporates a deep sump catch basin structure to capture sediments from this entrance road to the Site off 20 Hancock Street.

⁹ We note that the Site is located within the *Potential Medium/High Yield* zone on the Town's *Aquifer Protection Districts map dated November 2006*, and as such, the 44% TSS removal is appropriate for pretreatment prior to any stormwater infiltration zones.



- e. The 256 contour is very close to SMH-12 Rim elev. 257.03 and does not appear to be reasonable. This grading should be revised.
 - f. On Sheet 14, the entrance road off West Street should have enough grade change at the curb cut to prevent West Street drainage from entering the Site. Also, the grades at the start of the entrance road off Hancock Street are not labeled on Sheet 16, and it is not possible to determine if a similar situation exists at this entrance where street flows might enter the Site. The Applicant should revise these designs; otherwise, the drainage tributary area(s) will need to be redefined to include the extra storm flows from West Street and/or Hancock Street.
 - g. The Applicant needs to add details to show proposed construction of the outflow spillways, including the exact lengths and widths (as used in HydroCAD), and show grading transitions to areas outside the basin, and materials and depths of materials to be used to armor these spillways for erosion protection. Calculations should be submitted to show that the proposed armoring is sufficient to withstand the exit velocities from these basins. Again, as noted in other comments, any such calculations should be prepared after the basins have been re-designed to account for field verified saturated hydraulic conductivity rates, any new ESHGW levels, and any mounding analysis adjustments, and any reshaping of basins per comments 3, 4 and 15.
14. **Geometric Design follows both Board of Health requirements and DEP Stormwater Handbook. Note that 4:1 side slopes are required on basin interiors and a 10' safety bench are required. The width of the top of the containment berm must be at least 10' wide.** The Applicant needs to revise the Grading and Drainage Plans (sheets 14 to 17) and the basin details (sheets 33 to 35) to meet the 4:1 interior side slope and 10-foot safety bench requirements. Also see comments 3 and 4.
15. **Minimum of 12 inches of freeboard provided.** The plans indicate adequate freeboard meeting this requirement at five of the six infiltration basins. Infiltration Basin 5 is proposed to have only 0.6-feet (7.2-inches) of freeboard above the outlet elevation. The Applicant should submit a revised design for Infiltration Basin 5.
16. **Maintenance access has been provided (for basins).** The Applicant needs to revise the six basin designs to meet this requirement. See comment 4.
17. **Soil hydraulic conductivity shall be based upon field borehole permeability tests.** The Applicant needs to conduct these field tests as recommended. See comment 1.



18. **Complete Boring Logs and Details of Calculations shall be submitted.** The Applicant needs to submit these data records after completing the field work recommended in comments 1 and 2.
19. **Elevation of high ground water, elevation of underlying impervious layer (ledge or clay), and saturated thickness of underlying aquifer has been determined.** The Applicant needs to conduct additional field testing as noted in comments 1 and 2. Regarding determining the “saturated thickness of underlying aquifer”, we recommend that the Applicant obtain this information during borehole investigations discussed in comment 1.
20. **Mounding of Groundwater shall be considered in the design.** Because the vertical separation from the bottom of the proposed infiltration basins is less than 4-feet from ESHGW and basins are used to control peak flows, per the Massachusetts SWH¹⁰, the Applicant should submit mounding analyses for the six infiltration basins.
21. **An infiltration structure for a 2-inch storm will have a minimum of 2 feet of vertical clearance (preferably 4 feet) to the high ground water with consideration of the groundwater mound.** The Applicant needs to demonstrate that this requirement is met after completing the work noted in comment 20.
22. Also, related to comment 21 above, the proposed wick drains within the six infiltration basins are not appropriate as they violate the 2-foot minimum and preferred 4-foot set back from ESHGW as established by the Massachusetts SWH and the Town RSRM. These wick drains will extend close to, or into and below ESHGW levels where such elevations have been determined to date. The Applicant needs to eliminate these features from the proposed infiltration basins; or alternatively, defend their use as justifiable engineering design in the face of the noted regulation restrictions.
23. **Ten-year storm will empty (infiltrate) in 24 hours maximum.** The Applicant should submit calculations to demonstrate that this condition is met at the six proposed basins after revising the basin designs based on an infiltration rates determined by the required field testing of comment 1; and after removal of proposed wick drains per comment 22.
24. **100-year storm will empty (infiltrate) in 72 hours maximum.** The Applicant should submit calculations to demonstrate that this condition is met at the six proposed basins after revising the basin designs based on an infiltration rates determined by the required field testing of comment 1; and after removal of proposed wick drains per comment 22.

¹⁰ Vol.3, Ch.1, p.32



25. ***The stormwater management system shall have an operation and maintenance plan satisfactory to the Board of Health in accordance with Mass DEP guidelines and good engineering practice to ensure that systems function as designed. For stormwater facilities that are not publicly owned or maintained, the Board of Health shall require that an agreement shall be executed, subject to the approval of the Board of Health, for perpetual maintenance and operation of the stormwater system in order to guarantee the regular maintenance, repair, and replacement of any or all components as necessary.*** Subject to some recommended additions, the Applicant has submitted a satisfactory Operation & Maintenance Plan for the proposed stormwater BMPs; however as noted, an agreement between the Board of Health and the Owner (and ultimately the Homeowner Association) will need to be executed. See comments 28 and 29.

MASSACHUSETTS STORMWATER MANAGEMENT STANDARDS

The Applicant's Stormwater Management Report includes an evaluation of compliance with the Stormwater Management Standards as presented in the Massachusetts Stormwater Handbook (SWH). The Project's compliance with Stormwater Management Standards are addressed for each standard below:

Standard 1: No New Untreated Discharges or Erosion to Wetlands. Compliance with this standard has been partially demonstrated. However, our concerns regarding additional field tests, and design revisions that will likely follow field testing, need to be addressed in order to be sure that uncontrolled releases or erosion potential does not exist.

Standard 2: Peak Rate Attenuation. Compliance with this standard has been partially demonstrated in that the current design proposal complies with Standard 2 and the current post-development peak flows do not exceed the pre-development runoff rates. However, several concerns have been raised in the prior sections of this report with requests for additional site testing design inputs, which depending on results will likely lead to a revised design of the six infiltration basins. These issues must be addressed first followed by a recheck of the HydroCAD model as revised to match design revisions.

Also, the proposed use of drip edge stone recharge systems located along the foundations of homes are potentially problematic for homeowners with full basements. These infiltration practices are proposed presumably to help meet SWH Standard 2 for control of peak discharges. However, they do not comply with the Massachusetts SWH for trench drains and drywells which require setbacks from building foundations of 20-feet and 10-feet respectively (and the 20-foot setback seems to be more appropriate in this instance). An architect's plan shows a bulkhead for basement access:



26. The Applicant should explain if the proposed homes will have full basements or not. If full basements are proposed, we recommend against the use of the proposed drip edge systems and suggest the Applicant consider collection of roof runoff to be directed either to the infiltration basin areas or to separate dry wells (perhaps serving multiple home sites) located 20-foot minimum from any foundations. Nevertheless, should the Applicant choose to defend the use of drip edge systems and/or propose mitigation, the design is still lacking in detailed presentation: The Applicant will need to show plan view locations of the drip edge underdrains, show underdrain connections to other systems or to any surface discharge points, and prove that pipe slopes and elevations will allow connections to other systems or to surface discharge; and, prove compliance with the required 2-foot minimum (4-foot preferred) setbacks of drip edge stone beds from ESHGW at the many proposed locations.

Standard 3: Stormwater Recharge. The intent of Standard 3 is to ensure that the infiltration volume of precipitation into the ground under post-development conditions is at least as much as the infiltration volume under pre-development conditions. Compliance with this standard has been generally demonstrated, but based on flawed infiltration inputs. The Applicant needs to address the issues discussed in comments 1 and 2 to demonstrate that the subsurface infiltration BMPs proposed are designed based on data obtained from on-site saturated hydraulic conductivity testing, and soils evaluations that confirm soil morphology and seasonal high groundwater elevations.

Standard 4: Water Quality. The Stormwater Report and design plans demonstrate that stormwater runoff from all paved areas will be collected and directed through adequate pre-treatment and contained infiltration with the exceptions noted in comments 9, 13.d and 13.g, which the Applicant must first address before this Standard can be stated as met.

Standard 5: Land Uses with Higher Potential Pollutant Loads (LUHPPLs). This standard is not applicable for the Project Site.

Standard 6: Critical Areas. The Project Site does not fall within a Critical Area and compliance with this standard is not required.

Standard 7: Redevelopment Project. This standard is not applicable for the Project Site.

Standard 8: Construction Period Pollution Prevention and Erosion and Sedimentation Controls: The Applicant has provided plans and instructions for controlling erosion and sedimentation and is generally in compliance with this standard. However, because site contractors often seek to utilize infiltration basin areas as a temporary stormwater detention basins during construction, we recommend that the Applicant add a note to the Site Plans to protect infiltration basin areas:



27. The Applicant needs to add a note to the Erosion Control Plan Notes, on Sheet 2, to specify procedures to follow if such areas are used as temporary drainage management basins during construction. For example, one approach is that excavation to finished grade should not be completed until site construction is completed. Then, any accumulated siltation can be removed along with the final 1-foot of excavation to the final basin bottom grade.

Standard 9: Operation and Maintenance Plan. A long-term Operation and Maintenance Plan has been submitted as part of the Stormwater Report. This plan should be amended as follows:

28. The O&M Plan should include recommendations for maintenance and inspection forms for the drip edge drains (if used, see comment 26).
29. The O&M Plan should include recommendations for maintenance, and inspection forms for the infiltration basin overflow sections and inflow receiving areas.

Standard 10: Prohibition of Illicit Discharges. An Illicit Discharge Compliance Statement has not been submitted and therefore this standard has not been met.

30. The Applicant should submit a signed Illicit Discharge Compliance Statement as discussed in the Massachusetts SWH.

**WRENTHAM RULES AND REGULATIONS GOVERNING THE SUBDIVISION OF LAND (SRR) –
DRAINAGE SECTIONS 5.2 AND 6.1**

The Applicant's submittal does not include an evaluation of compliance with Wrentham SRR Sections 5.2 and 6.1 that relate to drainage. We have reviewed the Project relative to SRR Drainage rules that are not already adequately addressed by the Town's Regulation for Storm Water and Runoff Management" (RSRM). Through this review, we have found the following items of Project non-compliance with specific relevant SRR provisions:

SRR Section 5.212 - Stormwater management, including detention, retention, and infiltration systems, must be designed to prevent any increase or decrease in peak and total flow rates for the two (2), 10, 50 and 100 - year Soil Conservation Service Type III design storms. In addition, drainage systems shall include water quality/settling basins or water quality inlets that treat and detain the first flush of stormwater. Its design shall be based on a 5/10 - inch rainstorm for an average of at least six (6) hours, unless within a critical area as defined by DEP, in which case a 1.0-inch rainstorm during the same time period shall be considered. Stormwater basins shall be



sized and designed for a 100 - year storm event. The Applicant's submittals are compliant with the requirements stated in the first and second sentences above, however, the requirements of the third sentence (5/10-inch first flush) have been superseded by more stringent requirements of the Town's Regulation for Storm Water and Runoff Management which requires that a 2-inch "first flush" rainfall be evaluated.

SRR Section 5.213 - *The average rainfall intensity in inches per hour shall be obtained from the Technical Paper No. 40 (TP-40) Atlas.* This requirement has been superseded by more stringent requirements of the Town's Regulation for Storm Water and Runoff Management which requires that storm event rainfall amounts be as derived from the latest Atlases of Precipitation published by the Northeast Regional Climate Center, Cornell University, Ithaca, N.Y.

SRR Section 5.215 - *The use of relatively small open drainage basins (e.g. "rain gardens") and unlined channels located within each sub-drainage area of a given subdivision shall normally serve as the method of treating and managing stormwater flows. Other methods may be allowed if the Board determines, based on submitted documentation by the Applicant, that it, as compared to the system design that will normally be required, would; 1) be more appropriate given site-specific environmental conditions; 2) offer at least the same level of managing and treating stormwater flows; and, 3) not present inordinate costs to maintain, repair and replace in the future. In such cases, the requirements imposed herein upon stormwater basins shall apply to any alternative drainage facility.*

31. In light of the above requirement, the Applicant's stormwater management report should discuss their evaluation of the feasibility of employing the Low Impact Development practices noted (rain gardens, etc.),

SRR Section 5.231 - *Capacity of drainage pipes, culverts and drainage channels shall be determined on the basis of 25 - year storm intensity. Computation shall be based on full development of all tributary areas upgradient of each system. Runoff analyses shall be calculated by using the "Rational Method". The runoff coefficients are shown on Table 2. All drains shall be sloped to provide for a minimum velocity of 2 feet per second and a maximum design velocity of 10 feet per second under full flow conditions. Where natural drainage courses would otherwise be obstructed, culverts or similar structures approved by the Board shall be installed to restore natural drainage. Capacity of these structures shall be determined on the basis of 50 - year storm intensity.*

32. The Applicant needs to provide design calculations for closed drainage systems being used to convey stormwater to the infiltration basins. The calculations should document the projected flows and design capacities of the proposed drainage lines as specified by



SRR Section 5.231 and also ensure that flow velocities will fall between the 2-feet/second minimum and 10-feet/second maximum.

33. We recommend that the Applicant check the capacity of the perimeter drainage areas and drainage channels that will exist after the proposed Site grades are raised by the imported fill and ensure that addition of post-development flows from the Site in combination with stormflow from upgradient abutting properties will not exceed such drainage area / drainage channel capacity or result in flooding of upgradient abutting lots. See comment 5.

SRR Section 5.246 - *Where existing drainage systems discharge onto the property being subdivided, provision shall be made for accepting that drainage into the proposed drainage system.*

34. As noted in other sections of this review, although there is no apparent drainage system draining to the Site, under the existing condition upgradient abutting properties are draining onto the Site and the Applicant needs to consider the impact of raising grade and preventing upgradient drainage from passing through the Site. See comments 5 and 33.

SRR Section 5.247 - *Private Drains: Perimeter drains, cellar drains or any other form of drainage collection system within a building lot shall neither be connected into manhole and catch basin structures within a street nor discharge within 20 feet of a street layout.*

35. The Applicant needs to present details on the proposed 4-inch diameter underdrains that will collect and discharge some of the stormwater collected in the roof runoff drip edge trenches, and prove compliance with SRR Section 5.247. Also, given the likely proximity of full basement floors to ESHGW (which the Applicant should check), any foundation underdrains that are proposed should be designed in compliance with SRR 5.247, and be shown on the Grading and Drainage Plans and detailed on the detail sheets. Also see comment 26.

SRR Section 5.248 - *Stormwater basins and other related or similar improvements that are designed to primarily manage drainage flows within certain lots (as opposed to primarily benefiting areas outside of said lots) shall be the sole responsibility of the current and future owners of said lots to properly maintain and replace, when necessary. The design of said improvements shall nonetheless be subject to approval by the Board in terms of its potential effect on drainage systems along proposed and existing roadways. Documents shall be recorded at the Norfolk County Registry of Deeds allowing the Town to enter upon said lots to make any necessary repairs to said drainage improvements therein should flows from said improvements exceed original design parameters and undermine the drainage system along nearby public ways.*



In such an event, a municipal lien shall be placed on the lot for the cost of such work performed by the Town unless the lot owner provides prior compensation to the Town.

36. It appears that the Project Site will remain as the existing two lots, possibly combined as one lot, which will be owned by a homeowner's association or other private entity. Regardless, the provisions of this section of the SRR may apply. The Applicant should discuss the requirements of this section with the Town and indicate their intended response.

SRR Sections 6.11 through 6.15 – These regulation sections discuss drainage system construction requirements including methods of construction and quality of materials used, and these shall conform with the details of the most recent edition of MHD Standard Spec. for Highways and Bridges unless specific exception is made by the Board.

37. It appears that the Project is proposed as a privately owned community, with roads that may not be accepted by the Town, nevertheless, we recommend that the Applicant discuss their details of construction for catch basins, drain manholes, drainage pipe, etc., with the Town's Department of Public Works or Town Engineer, and obtain their approval.

SRR Section 6.16 - *All open-ended pipes over 15 inches in diameter shall be provided with a vertical grate protection permanently attached to the end of the pipe. Horizontal distance between the vertical bars of the grate shall be approximately six (6) inches.*

38. The Applicant needs to present details to show compliance with the requirement of SRR Section 6.16 for the two larger open-ended pipes that are shown on the Site Plans: The 18-inch outfall to Infiltration Basin 4, and the 24-inch outfall to Infiltration Basin 6.