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Lisa Hayes, City Planner
Department of Community Development
70 Allen Street
Pittsfield, MA 01201

Re: Churchill Estates

Dear Ms. Hayes:

As requested by the City of Pittsfield Community Development Department, Geosyntec Consultants (Geosyntec) has conducted a peer review of the Application of Definitive Plan for Residential Subdivision known as Churchill Estates – Churchill Street Pittsfield, MA and associated materials for the above-referenced project. The plans and supporting materials were submitted by White Engineering of Pittsfield, MA on behalf of the developer known as Berkshire Central Land Development, LLC. 308 Barker Road, Pittsfield, MA.

Geosyntec has reviewed the proposed project with regard to regulatory requirements pursuant to the City of Pittsfield Subdivision Regulations (Sections 4.3 and 5.5 specifically) and the Massachusetts Stormwater Policy.

The Definitive Subdivision Plan was submitted as a Low Impact Development (LID) design with a request for several waivers including:

- Length of dead end road
- Pavement width (24' wide paved)
- Elimination of curbing
- Elimination of one of the sidewalks.

The proposed approach to use LID techniques to improve water quality and to better manage stormwater should be supported by the City of Pittsfield. The Churchill Estates site is ideally suited for the use of LID techniques and it is anticipated that a well designed system can provide effective management of stormwater. However, this set of plans and supporting materials still does not indicate that the developer has a strong understanding of the principles of LID other than selecting specific LID elements without an overall plan or approach for this development. In addition, Geosyntec does not believe that the applicant has met the requirements and intent of the City's Subdivision regulations. We recommend that the definitive plans for the Churchill Estates Subdivision as submitted and reviewed by Geosyntec be disapproved.

The following is a summary of Geosyntec's review of the proposed project. Section 1 presents comments on the Stormwater Management Plan, Section 2 presents comments on the Definitive Plans, and Section 3 provides comments on the Hydrogeologic Conditions Study.

Section 1 - Comments on the Stormwater Management Plan:

The Stormwater Management Plan is generally incomplete and lacking detail and supporting information.

Massachusetts Stormwater Management Standards (MA SMS):

1. Untreated Stormwater:
   a. The applicant indicates that "there are no discharges to either wetlands or waterway of the Commonwealth within this subcatchment" for each subcatchment in the development. It appears that Subcatchment 3 has a discharge from the detention pond which outfalls via overland flow east towards Bordering Vegetated Wetlands and Daniels Brook. Additionally, Subcatchments 4 has an outfall which appears to discharge into a swale in Subcatchment 6. The discharge from this swale appears to ultimately flow into the detention pond in Subcatchment 3.
   b. However, it appears that according to the MA SMP Standard 4 that this stormwater is treated and therefore complies with the standard. It is recommended that this text be revised to reflect this.
2. Post Development Peak Discharge Rates:
   a. Post development discharge rates cannot exceed predevelopment discharge rates (for the 2 and 10 year storms). The following is an excerpt from the Stormwater Management Plan (SMP) for the Churchill Estates Subdivision:

"The final major design criterion that was used to size the infiltration basins is the amount of time the basins will actually be absorbing water. Since the peak flow does not occur until 12 hours into the storm duration, the detention time used for sizing the basins was only twelve hours. The basins will be available to absorb stormwater runoff for all 24 hours, but to conservatively be able to manage the storm during peak flow times, it has been designed to manage the rain disbursed over 24 hours in 12 meaning they are twice the size they would be required to be to maintain off-site run-off conditions at the completion of construction."

Following this methodology White Engineering applied a "depth of storage over a 12 hour period" of 30 feet for all infiltration beds in the subdivision. Essentially, White Engineering is assuming that the storage facilities can infiltrate 30 feet of runoff over the area of each Quick4 High Capacity Chamber (31.72 square feet) from Infiltrator Systems, Inc.

The percolation rate of the soil, as documented in the Hydrogeologic Conditions study conducted by Gifford Engineering, is approximately 2 minutes per inch or less. This corresponds to an infiltration rate of 30 inches per hour or less. Therefore, if the infiltration rate is multiplied by the soil surface area beneath the Quick4 High Capacity Chambers for each of the infiltration beds (11.33 square feet as calculated from the schematic in Appendix B of the SMP versus the 31.72 square feet used in

White's calculations), a peak discharge for infiltration from the system can be calculated. The results have been calculated for the six infiltration beds in the subdivision and are shown in the Table 1.

Table 1. Peak Discharge through Infiltration

Subcatchment No.	Peak $Q_{2\text{-YR}}$ (cfs)	Peak $Q_{10\text{-YR}}$ (cfs)	Peak $Q_{100\text{-YR}}$ (cfs)	Infiltraiton Bed No.	Soil Infiltration Rate (in/hr)	No. of Chambers Used	Exposed Soil Surface Area (ft^2)	Peak Discharge through Infiltration (cfs)
1	1.56	5.59	12.54	1	30	26	295	0.20
2	0.61	6.48	17.46	4	30	26	295	0.20
				5	30	13	147	0.10
4	1.11	8.38	15.45	2	30	48	544	0.38
5	0.1	2.71	7.97	3	30	12	136	0.09
6A	0.05	3.07	10.46					
6B	2.18	8.11	17.68	6	30	250	2833	1.97
6C	0.78	4.28	10.32					

The results in Table 1 are based on a constant infiltration rate of 30 in/hr in the vicinity of all infiltration beds in the subdivision. It is recommended that a percolation test be conducted in the vicinity of each infiltration bed to accurately estimate the infiltration rate in that area. The following excerpt is from the MA SMS:

"Soil infiltration rates should be determined by specific samples at the location of the basin. One soil boring for every 5,000 feet of basin area is recommended, with a minimum of three borings for each infiltration basin. Borings should be taken at the actual location of the proposed infiltration basin so that any localized soil conditions are detected. The design of the infiltration basin should be based on the slowest rates obtained from the infiltration tests performed at the site. The minimum acceptable final soil infiltration rate is 0.5 inches per hour."

It does not appear that this investigation has been conducted.

As can be seen in Table 1, the peak discharge through infiltration in every case is less than the peak runoff (Q) for every storm modeled. Therefore, there will be outflow from each of the infiltration beds during small storm events (e.g., 2-year, 24 hour storm event).

In order to comply with this MA SMP Standard, White Engineering must calculate the peak post-development runoff, which they have not yet completed, in order to ensure that it does not exceed pre-development peak flows. This can be done by using HydroCAD or TR-55 to route each design storm through the subcatchments, swales, and infiltration beds to determine if the combined outflow from the systems exceeds pre-development peaks.

Routing must also be completed to determine the size of all pipes in the subdivision. Without routing flows between subcatchments in the subdivision it is unknown how much flow a pipe is expected to discharge. It appears that many of the pipes in the subdivision are undersized and that no formal calculations have been done to demonstrate their capacities. The catch basins should also be modeled to ensure that they have sufficient capacity to accept all flows being routed to them.

It is also important to note that infiltration bed #6 is located down gradient of the wetland in the designated open space area. It appears that this infiltration bed is in the flow path between the wetland and Daniels Brook. This location of the subdivision may have a high groundwater elevation. According to the MA SMS "infiltration basins must have a minimum separation from seasonal high groundwater or bedrock of 2 feet." This has not been specifically stated for each infiltration basin, but a general statement was included in the Hydrogeologic Conditions study conducted by Gifford Engineering, which stated that the "depth to groundwater or mottling is 5 to 7 feet." It is unclear if Gifford conducted testing to verify this estimate of high groundwater.

Subcatchment 3 is not included in Table 1 because it does not have an infiltration basin in the subcatchment. Instead of an infiltration basin, White Engineering proposed a detention basin due to the conditions of the soil (HSG B rather than HSG A). It appears that the detention basin was sized for the minimum volume to maintain outflow equal to pre-construction conditions for the 10-year storm. These calculations were not provided in the SMP. There are many design requirements for detention basins in the MA SMS that have not been included in the submittal.

It is also unclear if the detention pond is intended to have a permanent pool or if it is intended to infiltrate. The outlet is raised, but HSG B soils will infiltrate if no liner is installed, or the basin is not installed in the groundwater table.

Also, in the same way as the infiltration beds, site specific borings should be conducted in the area of this BMP to determine the depth to the seasonally high groundwater table.

3. Recharge to Groundwater:
   a. White Engineering did not accurately model the amount of runoff infiltrated through the infiltration basins in the subdivision. Therefore, this requirement is not satisfied.
   b. Additionally, for Subcatchment 3, the text in the report of the submittal indicates that the required volume of recharge was fully infiltrated, whereas the Appendix H indicates that there is no recharge in Subcatchment 3.

4. 80% TSS Removal:
   a. It appears that through the use of a combination of BMPs, that White Engineering achieved 80% of TSS from the subdivisions runoff, based on percent removals from the MA SMS.
   b. However, calculations were not included in the submission indicating that the sediment forebays and deep sump catch basins were sized according to the MA SMS, and minimal calculations were submitted to justify that the swales were sized according to the MA SMS. According to the MA SMS sediment forebays should be sized for a minimum volume of 0.1 inch per contributing acre. In addition, "volume sizing should be for the prescribed water quality volume, at a minimum, and can accommodate the 2 and 10 year storms." Additionally, the MA SMS require that "the contributing drainage area to any individual inlet or sump should be one acre or less of impervious area." Appendix E to the SMP includes calculations for two different swale designs at maximum capacity. However, White Engineering did not convey through their calculation package that peak rates in the swales remain below these maximum capacity values (see comments to Standard 2). Additionally, the spacing of the check dams is not described.

c. The discussion in Item 2 above discussing the sizing of infiltration beds is also in Item 4. The infiltration beds must be properly sized in order to perform at the required level.

5. Higher Potential Pollutant Loads:

   a. It appears that the site does not contain land uses with Higher Potential Pollutant Loads, as White Engineering indicated.

   b. An additional requirement to this MA SMS indicates that "the use of infiltration practices without pretreatment is prohibited." White Engineering indicates in Standard 4 (above) that the following BMPs are proposed for the subdivision: "vegetated swales" (or drainage channels as they are described in the MA SMS), sediment forebays, deep sump catch basins, and infiltration basins. It is clear by reviewing the drawings that the swales, sediment forebays, and deep sump catch basins are being used as pretreatment for the infiltration basins. However, calculations were not included in the submission indicating that the sediment forebays and deep sump catch basins were sized according to the MA SMS, and minimal calculations were submitted to justify that the swales were sized according to the MA SMS (see comments to Standard 4).

6. Protection of Critical Areas:

   a. Acceptable

7. Redevelopment Projects:

   a. Acceptable

8. Erosion and Sedimentation Controls:

   a. Acceptable

9. Operation & Maintenance Plans:

   a. O&M Plans were included for the deep sump catch basins, drainage swales, and infiltration basins at the end of the SWPPP. O&M plans were not provided for review for the sediment forebays. Plans should be provided for review to determine if they are acceptable for all BMPs proposed for the subdivision.

Section 2 - Comments on the Definitive Plans:

The applicant did not obtain or request approval from the Development Board for Preliminary Plans. As a result, there are several important items missing from the Definitive Plan set and supporting documents. The most important elements missing are related to Section 4.205 (b) changes in surface drainage and 4.302 (h) contents. The plans do not accurately show proposed finished grading of the lots which would result in changes to the drainage and sizing of swales, pipes and culverts. The changes to the surface drainage are not accurately calculated for the use of the infiltration systems which could lead to a backup in the system and possible surface discharge and flooding of some of the lots and public roadways. Specific comments are presented below.

1. The plans are missing soils information including the location of test pits conducted.
2. The design of infiltration bed's 3, 4 and 5 are dead-ended (unless the catch basin is intended as an inlet and outlet to the system). If the catch basins are used as both an inlet and outlet then sediment could be resuspended in the catch basin sumps and move into the infiltrators. A by-pass for high flow events should be included in the design.
3. There is no legend on the E&S Plan, and overall the legends on each sheet do not appear to be complete.
4. The swales on the plans are shown as contours and not specifically identified as swales. Additionally, there are two different swale flow calculations; however, it is hard to determine what size swales are proposed where on the plans.
5. Overall grading is unclear in places, (Subcatchments 4, 6A, 6B (ID in wrong location), etc). If the lots are not developed upfront then that the grading in each lot could be changed by the final builder. It is agreed that the subcatchments would drain to the same overall locations, but in some cases the swales would be collecting more water than intended if the lots are graded towards the street rather than laterally, as shown in some of the subcatchments. Lot level drainage is essential for effective LID design.
6. The location of driveway culverts should be shown on the plan. If this is not possible then there should be a written agreement ensuring that a culvert gets placed below driveways. Additionally requirements should be stated as to the work in each lot regarding grading, compaction, work in swales, etc.

<u>Sheet Specific Findings:</u>

Sheet 06-02-07-2A

1. There is no edging/guard rail around the depressed island between the North/South Boulevard. This could be a hazard for a main entrance/exit, especially with the slopes as steep as proposed.

Sheet 06-02-07-3A

1. There are no check dams in the swales on either side of Alice Way.

Sheet 06-02-07-5A

1. Infiltration Bed #3 does not appear to have an outlet.

Sheet 06-02-07-6A

1. It is unclear if the swales extend around the cul-de-sac due to the very shallow grading.
2. Infiltration Beds #4 and #5 do not appear to have outlets.

Sheet 06-02-07-7A

1. There do not appear to be any check dams in the swales on Michelle Renee Lane.
2. Sediment forbay in cul-de-sac seems large for the contributing area.
3. Swale on eastern boarder of site, leading towards detention pond, does not have check dams.
4. Sediment forebay at the outlet of the swale appears to be small for the contributing area draining to that location.
5. There is no information for the outlet to the detention pond. This information was found on the detail.

Sheet 06-02-07-8A

1. It appears that the swale on the eastern border of the site flows directly above the Infiltration Bed #6. Is it intended that this water will infiltrate through the surface and into the system? Is the surface of the infiltration bed depressed to allow for surface storage prior to infiltration?
2. There is pipe connecting the cul-de-sac and the northern swale on Marisa Lane, this pipe is not labeled (inv in/out/rim). Does this cul-de-sac have a stormwater purpose?
3. There does not appear to be an outlet from the Infiltration Bed #6. Does overflow from this flow to the swale and into the detention pond (this should be shown on the plans).

Sheet 06-02-07-10A

1. Infiltration Chamber System:
    a. There does not appear to be any geotextile below the infiltration system. Geotextile is usually specified to prevent upward migration of fines into the infiltration basin.
    b. The detail states to "compact base to a min. of 95% of the modified proctor density". Soils beneath infiltration systems are not usually compacted, because this may lower the infiltration rate of the soils. Since the infiltration beds are not under pavement, there does not appear to be a reason for compaction.
    c. The soil above the infiltration bed is specified in the detail. Infiltration through the finished surface into the infiltration bed is not intended (only input is from the catch basin) then specifying the soil above the system does not appear to be necessary. The engineer may want to specify the soil beneath the infiltration system to provide enhanced pollutant removal.
2. Splash Apron Detail:
    a. It is unclear what the 4" inch pipe is connected to in the detail.
    b. Drywells are specified in the submitted SMP, but no detail was included in the permitting plans.
3. Drainage Channel Detail:
    a. Two different swale flow calculations were presented in the SMP; however, only one detail is shown in the permitting plans. The plans should be edited to include a second

detail or a table indicating that there are two cross-sections and indicate which locations each should be installed.

Sheet 06-02-07-11A

1. Check Dam Detail:

   a. The V-notch weir in the check dam is not a standard design. Instead, the check dam cross-section should have a gradual dip in center of dam, not a defined off-centered V-notch. The detail, as shown, is not easily constructed or maintained unless grouting is proposed. Additionally, it may cause erosion issues in the swales if constructed as designed.

Sheet 06-02-07-13A

1. Detention Basin:

   a. It is not standard practice to include manure in the soil mix on the bottom of the detention pond, especially if the pond is unlined and stormwater will be infiltrating through the bottom.

   b. The riprap apron should have a separate detail or specification.

2. Sediment Forebay:

   a. The sediment forebay detail needs more detail and/or rock and soil specifications.

Section 3 – Comments on the Hydrogeologic Study

This study lacks detail and technical basis. Elements that were missing included:

1. Water table map/direction of groundwater flow
2. Location of percolation tests
3. Loading calculations and mounding from stormwater infiltration systems and nearby septic systems.

Section 4 – Conclusions

The proposed Churchill Estates development continues to lack the demonstration of a complete understanding of LID and how it can be a powerful design and stormwater management tool to reduce or minimize impacts from development. The Definitive Plans and supporting documents as submitted do not

meet the City of Pittsfield Subdivision Regulations and requirements. We recommend that the Definitive Plans for the Churchill Estates Subdivision as submitted and reviewed by Geosyntec be disapproved

The site however does present a very good location for an LID development if the design was improved. We look forward to the applicant improving on their design and providing the appropriate calculations and sizing for their stormwater system.

If you would like to discuss the information presented above, please contact Steve Roy or Marcus Quigley at 978-263-9588.

Sincerely,

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