

November 9, 2017

Tredyffrin Township
Attn: Stephen Burgo, PE
Township Engineer
1100 Duportail Road
Berwyn, PA 19312-1079

*Scientists, Engineers &
Environmental Planners
Designing Innovative
Solutions for Water,
Wetland and Soil
Resource Management*

**Re: Station Square
Stormwater Review
Tredyffrin Township, Chester County, Pennsylvania
pH No. 1380.035**

Dear Steve,

Princeton Hydro is pleased to provide Tredyffrin Township with this letter report which summarizes our review of the stormwater management measures for the Station Square residential development. As requested, we have evaluated the project's compliance with the Township's stormwater management ordinance. Based on our review of the documentation, as submitted, we believe that the engineer has generally demonstrated that the proposed use of the site can be supported by the proposed stormwater management measures with respect to water quality, peak flow rate and volume control. However, based on the letter received from Michael Baker Int. on November 7, 2017, the proposed PennDOT improvements at the intersection present a conflict with the currently proposed location of the Station Square stormwater management system and reserve parking area. Furthermore, the letter states that a *minimum* of 1.4 acres will be required for the proposed PennDOT improvements. The Michael Baker Int. letter was generally consistent with the discussion of our October 24, 2017 conference call which was held with Michael Baker Int. (representing PennDOT), the applicant and engineer and the Township.

In order to demonstrate full compliance with the Township Stormwater Ordinance, the location of the proposed stormwater management system must be revised to accommodate the PennDOT improvements in compliance with the Settlement Agreement. Despite this substantial conflict we have reviewed the application materials and summarized our comments in the following sections.

□ 1108 Old York Road PO Box 720
■ 1200 Liberty Place
□ 203 Exton Commons
□ 20 Bayberry Road

Princeton Hydro, LLC
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Sicklerville, NJ 08081
Exton, PA 19341
Glastonbury, CT 06033

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Documents Reviewed

The following documents were provided to us by the Township for the purpose of our review:

- Preliminary/Final Subdivision and Land Development Plan for Station Square, Tredyffrin Township, Chester County, PA, prepared by Chester Valley Engineers, dated October 5, 2017.
- Stormwater Report, Preliminary/Final Land Development Plan, Tredyffrin Township, Chester County, PA, prepared by Chester Valley Engineering, dated October 5, 2017.
- Letter from Chris Stamford, P.E. on behalf of PennDOT, Re: SR 1005 Section PTC (MPMS #47979), Paoli Transportation Center – Phase 2 Roadway Improvements, dated November 7, 2017.

Introduction

The applicant is proposing to develop a 49,244+ square foot building with four levels of living space over an underground parking garage that will provide 135 parking spaces. The entire property is 7.6 acres with the site improvements limited to 5.41 acres. In the current submission 1.12 acres of the property has been dedicated to PennDOT for roadway improvement projects (ROW). A portion of the west side of the property has been reserved for an additional 82 (reserve) parking spaces if requested in the future by the Township. This additional reserve impervious area has not been represented in the stormwater calculations and therefore the sizing of the stormwater management measures does not reflect this additional impervious coverage.

The site drains to Little Valley Creek, an Exceptional Value stream. The site is not located within a portion of the Township which is underlain with carbonate geology. The existing conditions include four commercial buildings and associated parking lots that will be completely demolished. The development will result in a net reduction of impervious area under post development conditions.

Proposed stormwater infrastructure at the site includes four seepage beds, a green roof system and two vegetated swales. Under proposed conditions the ground level impervious cover drainage will be directed into 14 water quality inlets connected to the underground stormwater system. The green roof has a total footprint of 24,956 square feet. The project's proposed stormwater system is not designed to provide stormwater management for the reserve parking area per the Settlement Agreement.

Groundwater Recharge and Volume Control

The proposed seepage beds are comprised of StormTank Modules wrapped in nonwoven geotextile surrounded by a bed of crushed aggregate with nonwoven geotextile on the bottom and sides of the bed. In total, the positive storage volume (below the first stage outlet) provided by the all four of the seepage beds is 19,736 cubic feet.

Within the West POI portion of the site, seepage bed 1 is designed to have discharge controlled primarily by an elevated (1.32 ft) 8-inch orifice on the outlet structure, dictating the positive storage in the system, with the elevation of the 4-foot weir corresponding roughly with the elevation of the 100-year storm. It will provide approximately 9,120 cubic feet of positive storage. The overflow from the infiltration bed will discharge from the control structure to a proposed 18 inch pipe which will discharge to the existing stormwater sewer along North Valley Road. Similarly, Seepage bed 2 is designed to have discharge controlled primarily by an elevated (1.3 ft) 8-inch orifice on the outlet structure, dictating the positive storage in the system, with the elevation of the 3-foot weir corresponding roughly with the elevation of the 100-year storm. It will provide approximately 2,905 cubic feet of positive storage. The overflow from the infiltration bed will discharge from the control structure to a proposed 15 inch pipe which will discharge to the existing stormwater sewer along North Valley Road.

Within the East POI portion of the site, seepage bed 3 is designed to have discharge controlled primarily by an elevated (1.25 ft) 8-inch orifice on the outlet structure, dictating the positive storage in the system, with the elevation of the 3-foot weir also corresponding roughly with the elevation of the 100-year storm. It will provide approximately 4,773 cubic feet of positive storage. The overflow from the infiltration bed will discharge from the control structure to a proposed 18 inch pipe which will discharge to the existing stormwater sewer along the north side of the site on East Central Avenue. Generally similar in design, seepage bed 4 is designed to have discharge controlled primarily by an elevated (1.25 ft) 8-inch orifice on the outlet structure, dictating the positive storage in the system, with the elevation of the 3-foot weir corresponding roughly with the elevation of the 100-year storm. It will provide approximately 2,938 cubic feet of positive storage. The overflow from the infiltration bed will discharge from the control structure to a proposed 18 inch pipe which discharges to the downstream side of the outlet control structure for seepage bed 3.

The following comments are provided with respect to the application's compliance with the Groundwater Recharge and volume control requirements:

1. The engineer did apply the meadow condition for existing impervious areas and lawn areas in the predevelopment condition for generating the two-year runoff

- volume calculations in accordance with Township Ordinance §174-20 C(1)b[1]. The land in the ROW (48,764 square feet) has been included in the runoff volume calculations in the existing and proposed conditions. The resulting two-year volume is 19,669 cubic feet. However, the calculations include the PennDOT ROW area which the engineer assumes will be pervious under post development conditions. If this area is entirely excluded from the calculations the net volume requirement is increased to $\pm 25,000$ cubic feet. The engineer should revise the calculations to focus solely on the portion of the site where the proposed site improvements will be located; independent of and excluding any and all portions of the PennDOT ROW. The drainage area map and plan set should clearly reflect the portion of the site which is to be dedicated for the ROW and excluded from the calculations.
2. The engineer has provided loading ratio calculations which indicate that seepage bed 1 has a total loading ratio of 11.5 with a 5.2 to 1 impervious area loading ratio. Seepage bed 2 has a total loading ratio of 12.5 to 1 with a 5.1 to 1 impervious area loading ratio. Seepage bed 3 has a total loading ratio of 5.5 to 1 with a 4.8 to 1 impervious area loading ratio. Seepage bed 4 has a total loading ratio of 8.1 to 1 with a 4.9 to 1 impervious area loading ratio. The loading ratios are generally consistent the Township Ordinance. However, as noted in following comments, the footprint of the systems is also contingent on the anticipated infiltration rate of the beds which has not been adequately justified at this time.
 3. The applicant has completed infiltration testing on the site at the previously proposed seepage bed locations. However, the locations of the tests no longer correspond with the locations of the currently proposed seepage beds. Infiltration testing was not performed in the footprint of seepage bed 2. Infiltration testing was terminated in the borings in the locations of seepage beds 3 and 4 due to boring hole collapse during the investigation. Therefore, infiltration testing has only been performed in seepage bed 1. The observed infiltration test results ranged between 0.02 to 0.18 inches per hour in the tested locations. The applicant should conduct a more thorough investigation with additional infiltration testing to support the proposed locations and elevations of the seepage beds. Although somewhat preliminary and incomplete, currently the testing does not support the engineer's performance assumptions.
 4. The PCSM/OM Plan (Sheet 15A) indicates boring locations in the legend however, neither the seepage beds nor the boring locations appear to be provided on the plan. The boring hole locations and infiltration test locations were provided on a previous version of the plans as an attachment in the

Stormwater Report. However, the boring hole and infiltration test locations should be provided on the updated plans.

5. The plans specify that 24 inches of amended soil be applied beneath the seepage beds. The soils will be tested during installation to confirm a minimum infiltration rate of 1.5 inches per hour is achieved. The design infiltration rate is based a higher infiltration rate of 0.25 inches per hour. Once the locations of the seepage beds are finalized, the engineer should include details for each system indicating the soil amendment location and thickness. Additionally, the amended/replacement soil should have less than 10% fines.
6. Bedrock was encountered in each of the test borings. In their current locations, the systems have been separated into four smaller basins instead of two large basins to accommodate the bedrock. In their current locations, adequate separation has been provided between the bed bottom and the limiting zones. However, according to the PennDOT review letter (comment #12), the proposed seepage beds 1 and 2 and the swale must be relocated as they are currently proposed within the area of PennDOT's roadway improvements. It states that the seepage beds must be relocated to under the area of the proposed reserved parking. However, this area is also within PennDOT's drainage easement area. It is unclear if the seepage beds can be located under the reserve parking area, as the comment in the review letter is in disagreement with the boundaries of the drainage easement and preliminary required right of way areas shown in the attached map in the letter. Either way it is apparent that the seepage beds will likely have to be relocated below the proposed (not reserve) parking area to avoid conflict with PennDOT's drainage easement. This will require the beds to be redesigned with a shallower depth in order to accommodate the higher elevation of bedrock east of the reserve parking lot as is noted in Appendix B of the stormwater management report.
7. In accordance with item "k" of the Settlement Agreement, the plans indicate that a green roof will be constructed on to provide approximately 50% coverage over the building area. The engineer should provide construction details for the proposed system to ensure that it satisfies the condition of the Settlement Agreement.

Water Quality

The project proposes to provide water quality primarily through a combination of permanent oil/grit inlet filters and subsurface seepage beds. The proposed inlet filters are the "Inceptor" model manufactured by Stormdrain Solutions. The groundwater recharge volume requirement exceeds the required water quality volume and therefore

since the design has generally demonstrated compliance with the volume control requirements, the water quality requirements have also been met.

The following comment is provided and specifically relate to the project's compliance with the Water Quality requirements:

1. The functionality of the proposed inlet water quality filters is contingent on periodic/routine inspection and maintenance. As is detailed in a following section, the engineer must provide additional detail related to the operation and maintenance of the proposed stormwater management system.
2. Based on the aforementioned conflicts associated with the PennDOT ROW, the implementation of the currently proposed vegetated swale at the north western corner of the site is at question. The application also provides for a ± 75 foot long vegetation swale on the eastern portion of the property adjacent to Fennerton Road. The supporting calculations in the stormwater management report should be updated to reflect the proposed swale.

Peak Flow Rate Control

As was discussed during the August 15, 2017 meeting with the applicant and engineer, the engineer has attempted to maintain the site's existing drainage patterns and appropriately divided the site into two drainage areas, referred to as the East POI and West POI in the stormwater narrative. The engineer has used appropriate times of concentration in the calculations and the peak flow rate calculations use appropriate Curve Number (CN) values (meadow preconstruction assumption) and the proper separation of pervious and impervious areas. Similar to the volume control calculations, the engineer has made reasonable assumptions with respect to the Hydrologic Soil Group (HSG) of the existing soils.

The stormwater narrative does not make mention of the fact that a least a portion of runoff from the eastern half of the site may be currently managed by an underground stormwater management system with is presumed to have been constructed in the early 1990's. We do not believe that this should have any bearing on the application's current stormwater management design/compliance.

For peak flow rate control, the design relies primarily on the four proposed subsurface seepage/detention beds. The engineer has correctly represented the green roof portion of the building with a CN of 86. This also affords some level of peak flow rate control; although relatively small in comparison to that which is provided via the subsurface seepage/detention beds.

The application had generally demonstrated that the stormwater management features can meet the peak flow rate requirements of the Township Ordinance. However, the following comments are provided related to the project's compliance with the Peak Flow Rate Control requirements:

1. The engineer has completed calculations both with and without accounting for infiltration during the storm. The calculations indicate that with empty seepage beds at the beginning of the storm and without infiltration losses from the beds during the storm, both the East and West portions of the site will meet the 5yr post to 1yr pre- requirement. The engineer has demonstrated that the peak flow rate requirements up to and including the 50 year storm will be met without including infiltration losses from the seepage beds during the storm routings. However, the currently proposed systems will not quite meet the 100 year pre to post match as is currently designed unless the infiltration losses are included in the routing. The engineer must demonstrate compliance without relying on infiltration losses during the storm in their routings. This is especially relevant in this application since the initial infiltration test result were relatively slow and the infiltration loss rate assumed by the engineer is not fully supported by the preliminary test results.

Operation and Maintenance

Due to the initial stage of the application, the current submission contains little detail on the Operation and Maintenance (O&M) requirements for the proposed stormwater management system. The following comments are provided with respect to the stormwater considerations for the project.

8. The Post Construction Stormwater/Operation and Maintenance Plan, Sheet 15A currently reflects BMPS for an unrelated project site. The engineer should revise the plan set accordingly including detailed O&M procedures for the proposed BMPs.
9. The engineer should be aware that they must provide a detailed standalone O&M plan for review that includes all the necessary and relevant site specific information needed in order for the owner to maintain the proposed stormwater management measures.
10. The PCSM Stormwater Details and Grading and Utility Plans do not indicate cleanouts or inspection ports in the seepage beds. Cleanouts or inspection should be provided for inspection and maintenance purposes.

Summary and Conclusions

It is our professional opinion that the engineer should address the comments contained within this letter and revise the application materials accordingly prior to the issuance of a Stormwater and Grading Permit. The following list generally summarizes our primary comments:

- The location of the two western seepage beds (#1 and #2) presents a conflict with the proposed PennDOT improvements as is detailed in the November 7, 2017 letter from Michael Baker International.
- The location of boring holes and infiltration testing should be indicated in the updated plans.
- The engineer should revise the operation and maintenance information and create a site specific and comprehensive standalone manual.
- Cleanouts or inspection ports should be provided for maintenance access.
- The applicant should be aware that they must obtain a Township Stormwater and Grading Permit prior to any construction or disturbance at the site.

This concludes our review of the revised land development plans for Station Square development project. We reserve the right to make additional comments in the future as it becomes necessary. I look forward to meeting with you to discuss this report in detail and answer any questions you may have. Please do not hesitate to contact me with any questions. We appreciate the opportunity to provide Tredyffrin Township with these services.

Sincerely,



Clay Emerson, Ph.D. PE CFM
Princeton Hydro, LLC

Cc: None

Encl: (0)