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August 23, 2013

Mr. Michael Kissinger, P.E.
Pennoni Associates, Inc.
One South Church Street, 2nd Floor
West Chester, PA 19382

RE: Wayne Glen (formerly Richter Tract)
Conditional Use Stormwater Management Review
***Stormwater Management Review Letter No. 2 and
Geotechnical Review Letter No.1***

Dear Mr. Kissinger:

Enclosed you will find the Township Stormwater Review Letter No. 2, and Geotechnical Review Letter No.1, generated by Princeton Hydro, LLC on behalf of Tredyffrin Township, for the Stormwater Management and supporting Geotechnical portion of the Conditional Use Application for the Wayne Glen Project. The attached review letters provide comments on the proposed stormwater management design and management facilities, last revised August 8, 2013, and Geotechnical Evaluation, dated August 2, 2013, for the Wayne Glen proposed development submitted by Pennoni Associates, Inc. for compliance with HR-375, Chapter 174 – the Tredyffrin Township Stormwater Management Ordinance, the Trout Creek Stormwater Overlay Ordinance, and the 2010 Trout Creek Study.

Tredyffrin Township along with our Princeton Hydro review staff are available for a conference call next week to review any comments with Pennoni Associates, Inc. design staff prior to next Thursday nights meeting. I can be reached at (610)-408-3616 or at EngineeringDept@tredyffrin.org with any questions or comments on the attached review letter.

Sincerely,



Stephen Burgo, P.E.
Township Engineer

cc: Mr. Burgo, P.E. – Township Engineer
Mr. Martin – Township Manager
Mr. Baumann – Director of Planning and Zoning
PC & BOS – Tredyffrin Township
Mr. Duckworth – Arcadia Land
Mr. Rich Wilson – Arcadia Land
Mr. Emerson, P.E., PhD. – Princeton Hydro, LLC
Mrs. Damerou – PADEP

August 22, 2013

Tredyffrin Township
Attn: Stephen Burgo, PE
Township Engineer
1100 Duportail Road
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*Scientists, Engineers &
Environmental Planners
Designing Innovative
Solutions for Water,
Wetland and Soil
Resource Management*

**Re: Wayne Glen Independent Carbonate Geology Study Review
Tredyffrin Township, Chester County, Pennsylvania
pH No. 1380.001**

Dear Steve,

Princeton Hydro is pleased to provide Tredyffrin Township with this letter report which summarizes our review of the carbonate geology study which was recently submitted by Pennoni in support of the Wayne Glen development.

Documents Reviewed

The following documents were provided to us by the applicant's engineer for the purpose of our review. These documents were received by our office on August 9th.

- Carbonate Geology Study Richter Tract, Arcadia Land Company, Tredyffrin Township, Chester County, PA, prepared for Arcadia Tredyffrin, LLC, prepared by Pennoni, dated August 2, 2013.
- Overall Karst Geology Test Plan, Wayne Glen Conditional Use Submission, Tredyffrin Township, Chester County, Pennsylvania, 1 Sheet, prepared for Arcadia Tredyffrin, LLC, prepared by Pennoni, dated May 29, 2013.

Introduction

We have formatted this letter with the intent of comparing the submitted carbonate study to the Tredyffrin Township Code. As you are aware we provided some commentary on the proposed testing techniques and measures prior to the field work. Some of the items we discussed prior to the field work appeared to have been completed. However, portions of that guidance were not addressed.

In general, there are outstanding items which the report does not address. These issues are detailed in the following sections. It is our opinion that the "Carbonate

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Geology Study” is a summation of additional field work and publically available background data, rather than a geotechnical engineering report of the geology in the specific context of the proposed high density development and the critical stormwater infrastructure. The report offers little to no information in context of the stormwater management plan. Our main comment is that the report does not provide interpretations or specific opinion on how the site’s geology is or is not compatible with the proposed use.

Township Code Compliance

The self-stated objective (section 1.2) of the provided report is to provide information in “general accordance with Tredyffrin Township Code 174 Attachment, Appendix B, Section A-5”. The report has been reviewed in the context of the code below (sections of the code are restated for clarity and presented in italics):

Tredyffrin Code 174 - Appendix B, Section A.5 - Karst/Carbonate Geology

a.(i) Soil thickness, gradation, anisotropy, and permeability (from existing soil data and soil borings) to determine the capacity and rate of infiltration of the soil and relative depth of soil necessary to protect against sinkhole formation.

Logs for test pits and borings are provided but, no discussion or summary of the soil thickness encountered is provided. Analysis or information on the gradation of the encountered soil is absent with no reported testing of the soils encountered in the test pits. The reported USDA soils mapping data presents a brief discussion of soil qualities, but additional discussion is needed in the context of sinkhole formation. Permeability/assessment of infiltration capacity of the soils are not addressed with no site specific testing completed during this effort. Sinkhole propensity in the context of the encountered soil deposits are not addressed.

a.(ii) Karst characteristics of geologic units underlying the site (from current publications, maps and information of U.S. Geological Survey, PA Geological Survey, PA Department of Transportation, etc.).

The report presents some information as to the bedrock under the site. Karst characteristics specific to the site conditions are not discussed. The report should include how the likelihood of sinkhole formation relates: to geologic formation contacts, mapped faulting, layering of subsurface geologic deposits, and adjacent geologic deposits.

a.(iii) Inventory of existing karst landforms, visual indications and/or surface manifestations of subsurface features or other karst features (from interviews with municipal representatives familiar with known problem areas, review of aerial photography, and site reconnaissance).

No comments.

a.(iv). Geophysical survey of the site to identify locations and extent of existing subsurface karst features.

No comments.

a.(v) Effectiveness of soil mantle to remove pollutants from infiltrating water to determine whether or not the need exists for removal of pollutants from stormwater runoff prior to infiltration (for example, soil thickness and soil cation exchange capacity, etc.).

This item is not addressed in the report.

a.(vi) Depth to ground water and vertical location of water table relative to carbonate geologic unit (from existing information and/or borings).

Depth to encountered groundwater is noted on the test pits logs and borings, however no summary or discussion is provided in the report.

(vii) Other appropriate site specific parameters affecting infiltration.

Infiltration information is not presented in the report.

b. Location of infiltration BMPs is critical and shall be considered early on in the site planning process. Where karst conditions exist, infiltration BMPs shall be located and designed based on the subsurface conditions identified in the site evaluation, to avoid formation of new karst features and to protect existing karst features from accelerated development. Infiltration BMPs shall be located at least 100 feet away from existing karst features and sited away from buildings, roadways or other structures where subsidence could damage the structure and create an unsafe condition. Where underlying geologic units are prone to formation of karst features, but no karst features are identified on the site, infiltration BMPs shall be designed to avoid formation of new karst features.

The table presented in Section 5.1 of the report provides an overview of the investigated site conditions and the proximity to the proposed site improvements. In particular, line items 1 and 2 of the table present the proposed location of a basin at a mapped sinkhole feature. The proposed condition inferred by the table, a basin to be located at a mapped sinkhole, is in conflict with this section of the Code. Further the report does not discuss how the site has been designed to reduce the exacerbation or formation of karst features inventoried on the site.

c. Ground water quality of the carbonate aquifer shall be protected from infiltration of pollutants. At a minimum, stormwater runoff from hotspots shall first be discharged through a water quality BMP(s) to remove pollutants prior to infiltration. Where soil characteristics are insufficient to provide removal of pollutants from sources other than hotspots, stormwater

runoff shall first be discharged through a water quality BMP(s) to remove pollutants prior to infiltration.

This item is not addressed in the report.

General Comments

1. The section of the Township Code that this report intends to address requests a thorough assessment of the nature of the karst activity on site and how it will interact with the proposed development. The ordinance recommends avoidance of known or established karst activity for infiltration facilities and prudence in the siting of these facilities based on sound Engineering and Science. The conclusion presented in the report addresses sinkhole mitigation, in conflict with the intent of this section of the Code. This report needs to thoroughly address the karst features on site and discuss how the design is cognizant of the site conditions.
2. The report presents general site information from public resources including soil and geology. Available groundwater information needs to be presented and interpreted for the site.
3. The documentation lacks discussion of the consistency of the mapped data and encountered site conditions. This is particularly an issue when the USDA has mapped areas of the site as urban land.
4. Test pit logs and boring logs are presented in appendices to the report but do not provide suitable geologic descriptions of the materials. Suspect descriptions that recur in the presented logs include “Gray rock fragments” and “potential mottling”. As has been discussed previously, the logs should use USDA descriptions for encountered soils and the USBR Engineering Geology Field Manual Volume 1 description methodology for encountered rock.
5. The test pit and boring logs need to be reviewed for consistency. A recurring inconsistency on the logs is the nature of a boring or test pit termination, e.g. refusal, caving, etc.
6. Methodology and references as to how the soils and rock were logged in the field (e.g. ASTM D2488, USDA Field Manual Techniques).
7. The investigation lacks soil and rock testing to confirm the nature and consistency of the encountered materials.
8. The surface and groundwater hydrology section of the report does not present information specific to the site with exception to stating that the unnamed tributary to Trout Creek is ephemeral. Site specific groundwater flow conditions are specifically requested in this section of the Code.
9. The documentation presents a reasonable catalogue of observed surface manifestation of possible karst activities. However, the nature of possible karst activity is not discussed in the report. Specifically, what types of activity

- would be expected, where on the site is activity assessed to be most prevalent, what size of activity would be expected, etc.
10. Dynamic compaction - as a method to improve soils for sinkhole activity must be considered carefully. Discussion as to the suitability in the context of the fine-grained site materials present in the logs and USDA mapping must be discussed. Discussion of how dynamic compaction will impact infiltration and groundwater needs to be presented.
 11. Compaction grouting - methodology is crucially important in the adequate mitigation of sinkholes. The report must discuss the particulars of where compaction grouting will be used and what methodologies need to be utilized. Discussion of how compaction grouting will impact infiltration and groundwater needs to be presented.
 12. A map of site specific soil depth should be presented.
 13. A map of site specific soil interpretation should be presented.
 14. A map of site specific geologic formation interpretation should be presented.
 15. Test trench test information should be presented.
 16. Photographic representation of the trenches is common so that detailed soil and geologic mapping can be drawn in the profile.
 17. The report indicates: “the proposed development will not likely pose a significant threat on groundwater quality or the stability of surface structures, if proper remedial actions are implemented and preventative measures are used during and after construction.” The report continues without any indication as to what the specific “preventative measures” or “remedial actions” should or will be and how those measures and actions will protect the groundwater and structures. Appendix E of the report includes what appear to be generic recommendations for preventative measures. These measures include the avoidance of “deep cuts” (regional basin) and the prevention of “infiltration of runoff into foundation areas” (permeable paver driveways). Neither of these preventative measures appears to have been written in the context of the proposed plans.

Summary and Conclusions

In general the report does not fully address the issues required in the Township Code. The report lacks interpretation of the presented findings as has been detailed above. It was our understanding that the purpose of the report was to frame the structural and stormwater infrastructure components in context of the site geology in an effort to document the site’s potential suitability for the proposed use. It is our opinion that the recently submitted Carbonate Geology Study has not accomplished this.

This concludes our review of the Carbonate Geology Study for the proposed Wayne Glen development. We would like to reserve the right to make additional comments in the future as it may become necessary. Please do not hesitate to contact me with any questions. We appreciate the opportunity to provide Tredyffrin Township with these services.

Sincerely,



Keith Merl, PE CPESC
Princeton Hydro, LLC

Cc: Clay Emerson, PhD PE, Princeton Hydro
John Miller, PE CFM, Princeton Hydro
Steve Souza PhD, President

Encl: (0)

August 22, 2013

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Solutions for Water,
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Resource Management*

**Re: Wayne Glen Independent Stormwater Review
Tredyffrin Township, Chester County, Pennsylvania
pH No. 1380.001**

Dear Steve,

Princeton Hydro is pleased to provide Tredyffrin Township with this letter report which summarizes our review of the proposed stormwater management for the Wayne Glen development. As you are aware, our original review letter dated July 15th was provided to Pennoni and was the subject of a meeting held at the Township building on July 30th. The contents of that letter were discussed with Mr. Duckworth and representatives from Pennoni at the meeting. The plans and supporting calculations for the Wayne Glen project have been revised based on the discussions during the July 30th meeting.

Our review of the revised materials suggests that while substantial progress and improvements have been made consequent to our initial review letter, there remain some major items related to the proposed project's compliance with the Trout Creek Stormwater Overlay.

Documents Reviewed

The following documents were provided to us by the applicant's engineer for the purpose of our review. This material was received by our office on August 8th.

- Post-Construction Stormwater Management Report, Wayne Glen Tredyffrin Township, Chester County, PA, prepared by Pennoni, dated April 22, 2013, latest revision August 8, 2013.
- Wayne Glen Conditional Use Submission, Tredyffrin Township, Chester County, Pennsylvania, 50 Sheets, prepared for Arcadia Tredyffrin, LLC, prepared by Pennoni, dated April 22, 2013, latest revision August 8, 2013.

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■ 1200 Liberty Place
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- Post-Construction Stormwater Management Operations & Maintenance Document Wayne Glen, Tredyffrin Township, Chester County, Pennsylvania, prepared for Arcadia Tredyffrin, LLC, prepared by Pennoni, dated April 22, 2013.
- HEC-RAS Study of the Trout Run Tributary through the Richter Property, Tredyffrin Township, Chester County, PA, prepared by Herbert E. MacCombie, Jr., PE Consulting Engineers & Surveyors, dated March 19, 2012.

General Comments

In general, the revisions have largely addressed the issues and concerns outlined in our original July 15th review letter. This letter provides comment on the contents of the recently submitted revised material which was received by our office on August 8th. In an effort to maintain continuity with the original review letter we have maintained the same general outline as the July 15th letter and have provided our response to the revised material in each relevant section. Comments related to any new material are provided at the end of this letter.

Rainfall Data

Based on the discussions during the July 30th meeting, the engineer has revised the on-site development calculations. Both the runoff rate and volume calculations under both pre- and post-development conditions now use a depth of 3.21 inches. In effort to be consistent with the original Trout Creek Study, the watershed-wide calculations still use 3.16 inches. No further action is necessary.

Curve Number Methodology

The calculations have been revised to use a separate, non-composite, CN analysis. The one and two-year final outflow rates under post-construction conditions are not increased due to there being adequate storage provided in the proposed SCMs. The largest increases are found for the five and ten-year storms. However, the peak flow rates are still within the allowable rates from both a Chapter 174 and TCO perspective. No further action is necessary.

Peak Flow Rate Control Compliance

As discussed in the previous section, the engineer has revised the calculations to provide a separate, non-composite, CN analysis consistent with the Township Ordinance. With respect to potential discrepancies between the SCM storage capacities listed in the calculations and shown on the plans, during the July 30th meeting Pennoni explained that depending on how the geometric data is entered, the software can provide erroneous data output which was not actually used in the

calculations. The revised calculations provide geometric data for the SCMs (stage storage relationship) that are directly consistent with the Appendix C calculations which are consistent with the proposed dimensions as shown on the design plans.

The applicant should justify how the proposed development is in compliance with the peak flow rate control requirements in light of the reported bypass area peak flow rates for the three POI locations. More discussion of these bypass areas is provided in the following section.

Volume Control Compliance

The concept of effective storage was one of the primary comments in our original review letter. In an effort to address this comment the engineer has revised both the calculations and the proposed plans. These modifications include incorporation of the proposed surface infiltration basins into the volume control calculations, the reconsideration of the permeable pavers, and the incorporation of an additional subsurface infiltration basin in the POI#3 drainage area. The engineer has also provided a flowchart which quantifies the design's reliance on SCMs arranged in series to meet the volume control requirements. In some situations the flow must pass through three levels of SCMs before the required storage is provided. The interconnected nature of the proposed SCMs makes it imperative that the design provide for adequate secondary conveyance to downstream SCMs when pipe capacities are exceeded (>25 year storm). The plans and narrative currently do not demonstrate this.

It should be understood that the incorporation of the surface infiltration basins into the volume control calculations removes a level of redundancy which was previously assumed in the original submission.

The engineer should address how offsite contributory drainage area will impact the performance of the proposed SCMs. Most notably is the contribution from the existing residential area north west of Surface Infiltration Basin #1.

The revised calculation summary includes the bypass volumes. These are the areas of the proposed development which are not captured by one of the proposed on-site SCMs, but rather drain directly to the proposed regional basin. The vast majority of these proposed bypass areas do not contain proposed impervious coverage, however, in contrast to what is stated in the narrative, there are some proposed areas of impervious cover, including 7,300 sf, 0.17 ac near the stream crossing, that are not treated by an SCM prior to discharge into the proposed regional basin. At a minimum, some level of water quality treatment should be provided for runoff originating from these proposed impervious surfaces prior to discharge to the stream. In general, the majority of the total bypass area is proposed to be turf grass and is represented as such in the calculations. This area is primarily perimeter area

and slope along the regional basin. It is suggested that converting as much of this proposed turf grass area to meadow conditions would further reduce the bypass volume and flow rate.

Bioretention Basins

Appendix C has been revised to remove any reference to infiltration volumes accounted for during the storm through active infiltration in accordance with the Township Ordinance.

It is again reiterated that the volume control performance assumptions of the Bioretention Basins are contingent on the site having underlying soil which is capable of adequately dewatering the basins between storm events. It is understood that the Bioretention Basins will not have underdrains and will rely on infiltration alone to dewater. More discussion on the anticipated infiltration capability of the site is provided in a later section of this report.

Permeable Pavers

The original submission explicitly accounted for the storage provided in the permeable pavers and represented the permeable paver areas as impervious coverage. However, in the revised submission the calculations represent the pavers with a CN value of 70 (Type B soils) and 79 (Type C soils) and therefore the storage is no longer directly accounted for. Under these conditions the pavers are predicted to produce 0.83 inches of runoff in Type B soils and 1.34 inches in Type C soils during the two-year, 3.21 inch storm. As the narrative states, these assumptions are consistent with the Philadelphia Water Department's guidelines (see Appendix K) and in our opinion can be reasonable estimates. However, if the permeable pavers are going to be represented with reduced CN values, it is our opinion that the crushed stone storage beds should have a minimum effective storage depth (depth below the overflow) of 24 inches. More discussion on this is provided in a later section regarding loading ratio calculations.

Sheet CS9503 of the plan set has been revised to indicate that the permeable pavers will be constructed with flat bottoms, in accordance with the Township Ordinance. In addition the driveway detail has been revised to show a flat bottom and an elevated underdrain pipe. The dimension, specific elevation, material, perforation status, and other details are not provided for the pipe. It is also not clear where the pipe is intended to be directed. The narrative indicates that areas with large slopes including Alley A, will be constructed with a stepped flat bottom slope. However, Sheet CS9503 does not appear to contain any details which give guidance on the construction techniques or materials for a proposed stepped system.

The applicant should also provide justification for the proximity of the proposed permeable pavers to the residential structures in accordance with Appendix B of the Township Ordinance.

Subsurface Infiltration Basins

The revised plans include an additional Subsurface Infiltration Basin (#4) located in the POI#3 watershed (Professional). As it should, the volume control flow chart only accounts for the effective storage volume in the SCMs. The effective storage is the volume that would actually be used in the two-year storm.

SCM Loading Ratio Compliance

The loading ratio calculations were discussed in the July 30th meeting. The methodology used by the engineer was further clarified during the meeting. The calculations essentially group the infiltration surface area of either the Infiltration Basin or Bioretention Basin with the total area of proposed permeable pavers in the drainage area to that SCM. This methodology under-represents the loading ratios to the SCMs since they consistently have a higher loading ratio than the permeable paver driveways and other areas. Furthermore, this methodology treats the permeable paver areas as distinct SCMs which implies that they will have enough storage to contain the two-year runoff volume from their individual drainage area. While the delineation of numerous micro-drainage areas is not warranted, it is our opinion that since the permeable pavers are represented with a reduced CN, that some basic area averaged calculations should be completed to justify a minimum effective depth for all permeable paver areas.

Without the inclusion of the permeable paver areas the loading ratios for the SCMs would be much higher. For example the calculations for Bioretention Basin #7 indicate a total area loading ratio of 3:1. If the surface area of the permeable pavers were not included in the infiltration surface area (denominator) this would increase to 17:1. If just the permeable paver areas were removed from the drainage area *and* from the “infiltration facilities surface area” (denominator) the loading ratio would be 13:1. However, if the engineer could justify that the permeable paver areas will have at least an average of a 2:1 ratio themselves, for Bioretention Basin #7 the loading ratio would then be reduced to 9:1.

In other words, we agree that the engineer should take credit for the permeable pavers in the loading ratio calculations, but we believe this should be accomplished by justifying the reduction in the drainage area rather than increasing the infiltration surface area (denominator in loading ratio calculation). This is much more consistent with the manner that the “in series” configuration of the SCM has been represented in the rest of the calculations.

Infiltration Testing and Anticipated SCM Performance

The concerns expressed in our original review letter are reiterated. The Carbonate Geology Study does not provide any additional substantial information with respect to the site's general suitability for infiltration. The provided narrative does not provide any further justification or information regarding our previously stated concerns on this topic. We agree that maintaining a distributed approach to infiltration is key; however this alone does not imply that the site will function as designed.

It is our opinion that the applicant should provide a geotechnical engineering report which relates the site's soil and geology to the proposed stormwater infrastructure. Our review of the "Carbonate Geology Study" indicates that the findings and interpretations of the study do not provide this critical link.

Regional Detention Basin

In our initial review letter stated that the smaller storm peak flow reduction capability of the proposed regional basin was likely overestimated. Under the proposed conditions the Walker Road crossing will have a 4x6 foot box culvert and two three foot diameter circular pipes. This increases the conveyance (outflow) of the basin for all depths prior to overtopping (stage discharge relationship). Based on information contained in the floodplain mapping report this would include all storms up to and including the 10-year storm with a reported peak elevation of 137.2 feet. The only situation where this would not *increase* the peak flow rate of a routed hydrograph (non-overtopping) would be if the proposed basin geometry had more storage at these lower elevations.

As requested, Pennoni has supplied the stage storage curves for the existing and proposed regional basin. A graphical comparison of the existing and proposed conditions is provided below in Figure 1.

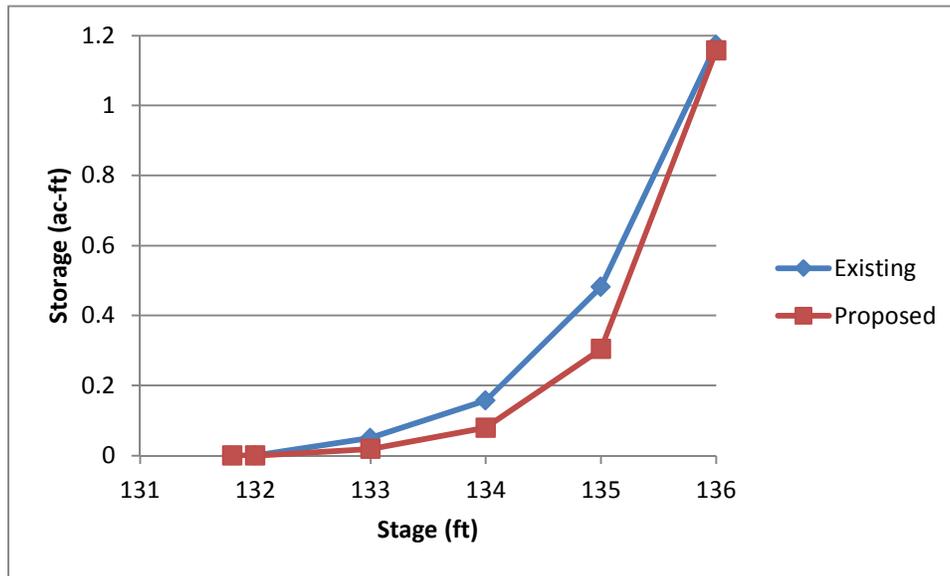


Figure 1. Comparison of the stage storage curves for the regional basin; note that the two-year peak elevation (stage) under proposed conditions is 135.5.

Contrary to the provided narrative, the comparison indicates that under proposed conditions the basin will actually have *less* storage available for the smaller (1 to 10-year) storms. Without actually routing storms through the existing and proposed regional basin we are confident that the modifications will *increase* peak outflow rates for these storms. These modifications will decrease the frequency and extent of overtopping at Walker Road but as a result, they will increase downstream peak flow rates for smaller more frequent storms.

In our original report we recommended that the existing calculations be completed with the existing “basin” explicitly represented. The engineer has not done this and offered the following statement in the narrative “The overlay ordinance specifically relates the performance of this basin to the Trout Creek Study. Our model utilizes the Trout Creek Study Model, which has been provided to us by the Township from that study; therefore, the existing flow data exactly matches that report.”

We do not agree with this interpretation and reiterate that, the original Trout Creek Study stated that any potential development in this area should “ensure that any modification of the existing Walker Road Culvert maintains, at a minimum, the same amount of storage or ponding upstream of the culvert as presently occurs so as to not reduce any attenuation that the existing culvert provides.”

The regional basin is a critical element of the proposed development. As such the peak flow rate control capabilities of the regional basin should be fully quantified so the Township has a clear understanding of how the proposed basin will function and can only then understand and weigh the trade-off between the frequency and severity of Walker Road overtopping and potentially *increased* peak flow rates.

We understand that discussions with the Army Corps of Engineers and PADEP have already been initiated. We reiterate that the Township and their consultants should continue to be involved with this process so that they are fully aware of the potential implications a regional basin.

We also would add that the plan should fully consider and address any potential impacts and any necessary modifications to the existing sanitary sewer which traverses the proposed regional detention basin. It is our recommendation that the sewer line should be fully inspected and any and all modifications be completed to ensure that the system remains isolated from the basin even during periods of high flow and when the sewer and manholes may have a surcharge of water due to the impounded water in the basin.

Operation and Maintenance

We have reviewed the operations and maintenance manual for the project with a focus on the operation and maintenance aspects of the proposed regional basin. The report includes a list of only eight (8) items of note for the long-term operation and maintenance of the five acre in-stream stormwater management facility. We believe that operations and maintenance requirements for the proposed regional basin are grossly underestimated in the operation and maintenance manual. We do not believe that the currently outlined operation and maintenance items satisfy Section 208-150 (11)(e) which states that the applicant shall “Present a long-term operations and maintenance plan that includes ownership, maintenance and funding responsibilities of all applicable parties for the public stormwater improvements and that is consistent with the requirements of Chapter 174, Stormwater Management”.

It is our current understanding that the proposed basin will be a regulated dam. Therefore depending on the Hazard Potential Classification, the structure will likely be required to have routine inspections performed by a professional engineer in compliance with Pennsylvania Code §105.53. The cost for these inspection services alone could be on the order of \$3,000 per year.

A comprehensive operation and maintenance manual should fully address all aspects of the upkeep of the structure. The document should have sections devoted to the maintenance of an PADEP approved Emergency Action Plan (EAP) in accordance with Pennsylvania Code §105.134, inspections, sediment removal, sinkhole remediation, basin access from both the east and west sides of the stream channel, and vegetation management (short term and long-term). The plan should also address the existence of the sanitary sewer main which traverses the proposed basin.

In summary, we believe that the application has not fully considered the operation and maintenance considerations for the proposed regional basin.

Floodplain Mapping

Since the previous submission a flood study of the property was submitted. The study is dated March 19, 2012 and was therefore completed prior to the previous submission. The results of the floodplain mapping are provided on the revised “by-right” plan (CS0402). The subtraction of the floodplain area from the gross lot area results in the reduction of the by-right plan from 26 to 25 lots. The table on this sheet incorrectly still states 26 lots, however the proposed number of units has been reduced from 113 to 112.

The floodplain analysis itself lacks a substantial amount of information. The report contains no narrative to describe the methods and assumptions of the analysis. The report does not provide a profile plot of the results, nor does it provide a cross section location map. No explanations are given for any potential notes and warnings reported by HEC-RAS. These are critical pieces of information that should always be provided with any inundation study. Furthermore, some of the cross sections appear to be suspect with flow not being contained within the cross section. A cross section location map would help troubleshoot some of these issues. The station labeling alone is not sufficient to determine how each cross section was cut from the topographic data. The results themselves appear to be reasonable and are generally consistent with observations of the property during periods of high flow. However, more background information is necessary to qualify the resulting floodplain map and its potential impact on the by-right plan.

Summary and Conclusions

This concludes our review of the revised material for the proposed Wayne Glen development. We would like to reserve the right to make additional comments in the future as it may become 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: Keith Merl, PE CPESC, Princeton Hydro
John Miller, PE CFM, Princeton Hydro
Steve Souza PhD, President

Encl: (0)