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Complete Civil Engineering Design / Consultation Services
Lionville Professional Center
125 Dowlin Forge Road
Exton, PA 19341

December 2, 2013

Tredyffrin Township
Attn: Stephen Burgo, P.E., Township Engineer
1100 DuPortail Road
Berwyn, PA 19312

RE: Pennsylvania Turnpike Commission Mile Post 320 – 326 Total Reconstruction and Widening Project
Post Construction Stormwater Management Design Review #2
Tredyffrin Township, Chester County, PA

Dear Mr. Burgo:

Per the Township's request, Edward B. Walsh & Associates, Inc. (EBWA) has completed the initial review of the stormwater management design for the Pennsylvania Turnpike Commission Mile Post 320 – 326 Total Reconstruction Project. The below listed plans and calculations have been reviewed for compliance Ordinance No. HR-375, Chapter 174 - the Tredyffrin Township Stormwater Management Ordinance.

- Plans:
 - Commonwealth of Pennsylvania - Pennsylvania Turnpike Commission Post Construction Stormwater Management Plan, prepared by STV Incorporated, Douglasville PA, 95 sheets, no date.
- Reports:
 - Pennsylvania Turnpike Commission Post Construction Stormwater Management Plan – Volume 1 to 4, Roadway and Bridge Reconstruction Milepost 320 to Milepost 326, prepared by STV Incorporated, Douglasville, PA, STV Project No. 40-13059, dated April 2013
 - Drainage Report for Roadway and Bridge Reconstruction Milepost 320 to Milepost 326, prepared for Pennsylvania Turnpike Commission, prepared by STV Incorporated, dated April 2013

A second review of the Post Construction Stormwater Management (PCSM) improvements has been completed per the request of the Township. The comments and recommendation from my

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May 31, 2012 review letter are noted below with the status of comments listed below in **bold**. Items noted in **green**, have been adequately addressed and require no further action.

1. Section 11. Drainage Plan Contents.

- a. **Section 11.B.9 - Additional labels for proposed contours must be added to the plan.**

This item has been adequately addressed.

- b. Section 11.B.18 – In the areas of proposed stormwater infiltration facilities, the locations of all existing septic areas and wells must be shown. The locations must be clearly identified on the plan in order to assist with the evaluation of the proposed infiltration designs (and potential negative impacts to the septic systems or wells).

It is recommended that an analysis be provided of the immediate properties downslope of the proposed infiltration facilities to determine if any septic systems exist that may be impacted by the infiltration design.

Within Appendix A.11 is an Existing Well Location map (3 sheets). It is recommended that the Appendix O – Geotechnical Reports be revised to specifically address the Geotechnical Engineer’s opinion on the impacts the proposed infiltration on the wells within the vicinity of the infiltration facilities, in particular SWM facilities 1A-2, 2A, 3 & 3A and 6B.

- c. **Section 11.B.22.a&b – The PCSWM Plan must include a statement, signed by the applicant, acknowledging that any revision to the approved drainage plan must be submitted to and approved by the Township and a revised erosion and sediment control plan must be submitted to and approved by the Chester County Conservation District for a determination of adequacy.**

This item has been adequately addressed.

- d. Section 11.B.23 – The PCSWM plan must include the design engineer certification signature block per the ordinance requirements. In addition to the design engineer certification signature block, a certification block should be added for the geotechnical engineer to certify all stormwater management facilities proposed within the Karst/Carbonate Geology areas.

This item has not been adequately addressed. As noted in below comment 8.g and 8.h, a meeting must be held with the Township Engineer to review the geophysical surveys and the loading ratios. The proposed loading ratios do not meet ordinance recommendations. It is recommended that a written justification be provided in the form of a separate package for the all substandard design items including the proposed loading ratios and proposed improvements in karst areas. The justification should include an acknowledgement / certification from the geotechnical engineer and design engineer regarding their professional opinion regarding the risk level associated with the proposed substandard design elements. This information

should be in addition to the information noted in geotechnical reports included in Appendix O.

- e. Section 11.C.1.f – An Operation and Maintenance (O&M) plan in accordance with Section 174-28 must be submitted for review and approval. General notes regarding the O&M are included on drawing 2 of 98. Additional detailed information regarding O&M is required per Chapter 174, Section 28.

See comment 14 below for additional details.

- f. Section 11.C.4 – Due to the work along Yellow Springs Road (SR 1005), North Valley Road, and Valley Forge Road (SR 0252), a Declaration of Adequacy and Highway Occupancy Permit from the PennDOT District 6-0 is required for the utilization of a PennDOT storm drainage system.

The PennDOT permit is noted as required on the cover sheet.

- g. Identify and provide application for Road Opening Permit to Tredyffrin Township for any/all proposed impacts to Township owned roadways.

The PTC has submitted the Road Opening Permit application to the Township. Review and approval is pending.

- h. Identify and coordinate with Tredyffrin Township Public Works Department for any proposed grading, construction or impacts in vicinity of the Township's Sanitary Sewer System.

The PTC has indicated that coordination with the Township Municipal Authority is ongoing. It is recommended that copies of all correspondences between the Municipal Authority and the PTC regarding the project be provided to the Township Engineer for his files. The final letter of approval from the Authority must be provided upon receipt.

- i. The following data must be indicated on the plans for future submittals:
 - i. Township Boundary must be indicated and labeled on the PCSWM plans and all drainage plans.

This item has been adequately addressed.

- ii. Chester County Uniform Parcel Identifier (UPI) numbers, owner's names per the tax records and the street address must be indicated on the PCSWM, E&S Control and drainage area plans.

This item has been adequately addressed.

- iii. Inlet numbers must be indicated on the PCSWM, E&S Control and drainage area plans.

This item has been adequately addressed.

- iv. Woodland areas and limits of clearing should be clearly indicated on the PCSWM Plans.

Per discussions with the design engineer, the PTC proposes to clear all areas within the Limits of Disturbance (LOD). The LOD line is only shown on the E&S Plans for clarity purposes. The limits of clearing include all areas within the PTC right-of-way and the offsite stormwater management areas. It is strongly recommended that the PTC review the proposed clearing limits and in areas of no temporary or permanent earth disturbance, limit the tree removal. For example (not an all inclusive list):

Basin 1A-2. South of temporary sediment trap ST-1A.

Basin 2A. South of basin and west of parcel 26A.

Basin 3. Northeast corner of basin above stockpile area.

Basin 6B. Southeast of basin along stream corridor.

- v. All road names must be clearly labeled on the PCSWM plans and the drainage plans.

The design engineer must verify this requirement has been completed (reference plan sheets 54, 55, 56, 67 and 81 of 95 for example).

- vi. Proposed improvements (or portions thereof) should be indicated on the Worksheet No. 4 Site Area Plans – Post Developed Condition.

This item has been adequately addressed.

- vii. FEMA floodplain shall be indicated and labeled on all plans (drainage and PCSWM). In areas where detailed FEMA floodplains are not mapped, assumed floodplain limits, per Township Zoning Ordinance Chapter 208, shall be indicated on all plans.

The floodplain is label on the E&S Control plans and some of the PCSM Plans. The floodplain must be added to all PCSM plans. Impacts are proposed to various floodplain areas. Refer to review of Hydrologic and Hydraulic Report review for further comments regarding floodplain impacts.

- j. In order to properly evaluate the drainage patterns along the project corridor, roadway typical sections must be included as part of the PCSWM plans. It is understood that the structural design of the retaining walls / sound barrier walls will be detailed in separate construction improvement plans, but the PCSWM plans should have general details related to the stormwater inlets adjacent to the walls. In

many locations, the runoff from roadway will be forced to the shoulder areas and captured by the inlets. It is unclear if the runoff is proposed to flow against the wall or if a concrete barrier or equal will be installed at the wall toe.

This item has been adequately addressed.

2. Section 12. Plan Submission

- a. Section 12.A. Documentation of approval must be submitted from the following:
 - i. PA DEP NPDES Permit for Stormwater Discharges from Construction Activities
 - ii. Chester County Conservation District E&S Control approval.
 - iii. PennDOT Highway Occupancy Permit for all work within the State Highways
 - iv. Tredyffrin Township Road Opening Permit for all work within the Township roadway or rights of way.

The required permits are noted on the PCSWM Plan cover sheet. Proof of approvals must be supplied to the Township upon receipt.

3. Section 13. Drainage Plan Review

- a. Section 13.H. A note must be added to the plan indicating the applicant shall prepare as-built drawings of all stormwater management facilities along with an explanation of any discrepancies with the design plans within 60 days of completion. As-built plans should be supplied in both paper and electronic (PDF and ACAD) format. As-built plans shall be recorded at the Chester County Office of the Recorder of Deeds, within 60-days of completion of the project.

The required note has been added to the plans but based upon the design engineer's May 24, 2013 response letter, the PTC will submit the plans upon receipt (not within the 60 day time period) and they will not record the as-built plans. The PTC must coordinate this issue with the Township.

4. Section 16. General Requirements

- a. Section 16.E - Stormwater flows onto adjacent property shall not be created, increased, decreased, relocated, or otherwise altered without the permission of the adjacent property owner(s). Such stormwater flows shall be subject to the requirements of the Township Ordinance. Existing points of concentrated drainage that discharge onto adjacent property shall not be altered in any manner which could cause property damage without permission of the affected property owner(s) and shall be subject to any applicable discharge criteria specified in this chapter. Proof of permission from all affected property owners shall be submitted in writing to the Township prior to issuance of a permit. A detailed Easement table should be provided that clearly identifies all required easements, by location, stormwater facility and drainage area, property owner information, as well as easement status. All necessary easements for stormwater facilities must be provided to the Township for their files prior to the final permit being issued. Additional information must be provided, as detailed in this letter, to justify the design and determine if permission from affected property owners is required.

The design engineer has indicated a right-of-way clearance certificate will be issued to the Township and the PTC may not record all easements and rights-of-way for a “period of time”. Upon receipt of the clearance certificate, the final Township permit will be conditioned on all right-of-way / easements being recorded prior to the start of construction.

- b. Section 16.F - Areas of existing diffused drainage discharge, whether proposed to be concentrated or maintained as diffused drainage areas, shall be subject to any applicable discharge criteria in the general direction of existing discharge. If diffused drainage discharge is proposed to be concentrated and discharged onto adjacent property, the Applicant must document that adequate downstream conveyance facilities exist to safely transport the concentrated discharge or otherwise prove that no accelerated erosion, sedimentation, flooding, or other impacts will result from the concentrated discharge. Proof of permission from all affected property owners shall be submitted to the Township prior to issuance of a Stormwater and Grading Permit.

Again, additional information must be provided, as detailed in this letter, to justify the design and determine if permission from affected property owners is required. Based upon my review of the submitted information, further downstream impact analysis may be required.

The PTC design professional have analyzed all downstream discharge points and presented data that the proposed peak flow rates do not exceed the pre-developed peak flow rates. Required drainage right-of-ways and easements are noted on sheet 11 of 95 of the PCSM plans. Refer to comments 4a and 11f regarding drainage easements and level spreader flow modifications and sub-watershed specific review comments for additional issues to address.

- c. Section 16.G – The PTC should review with the Township if drainage easements shall be provided for all streams. Per the Ordinance, at a minimum the drainage easement shall include the streambed, banks, and 10 feet extending from the top of each bank. It is recommended that the drainage easement also includes the limits of the 100-year floodway.

This item is pending discussion between the PTC and the Township. I recommend a meeting be scheduled by the PTC to discuss this item.

- d. Section 16.I - All stormwater runoff shall be pretreated for water quality prior to discharge to surface or groundwater. Water quality inlets, forebays, bioretention areas appear to be proposed for all discharge areas which include runoff from the Turnpike road surface. Additional design information for the pretreatment devices must be provided (pollutant removal efficiency of the water quality inlets and other BMPS).

This item has been adequately addressed.

- e. Section 16.Q – All easements, agreements and permits for off-site areas being used for drainage purposes must be obtained and provided along with the stormwater plan submission to the Township for review and approval prior to the start of any construction activities. Furthermore, these agreements and plans will be recorded at the Office of the Recorder of Deeds for Chester County and two (2) copies of those dated/signed plans provided to the Township. It is recommended that a table detailing all required easements be added to the plan.

Refer to comment 4a above regarding right-of-way clearance certificate.

- f. With all future submittals, it is recommended that a master table be added to the PCSWM plan clearly indicating all applicable Township Stormwater Management Ordinance requirements and a compliance with those requirements. For example, the master table shall indicate the required verses the proposed volume/infiltration requirements, peak rate controls for all storm events, loading rations and pre / post outlet velocities. In sub-watersheds without 100% compliance, percentage compliance or change from existing shall also be provided in the table. The chart should also address floodplain impacts / zoning relief requirements.

The chart as submitted adequately addresses the tabulation of the stormwater management requirements. The plans must be revised to indicate a summary of floodplain impacts / zoning relief requirements.

- g. Detailed Section views should be provided for all Stormwater Management Facilities, Basins, Vaults, Beds, Bioretention areas, etc. with the design storm (1, 2, 5, 10, 25, 50, and 100 – year) water surface elevations showing line through outlet structure, and including the berm, top of bed, outlet structure, etc.

This item is not adequately addressed. Section views are not provided for all basins including but not limited to Basins 2A, 6A, 6B, and 7.

5. Section 17. Permit Requirements by Other Governmental Entities – Prior to commencement of the project, proof of permits for the following must be supplied to the Township:
 - a. Chester County Conservation District approval (regulated earth disturbance activities subject to PA DEP regulations at 25 Pennsylvania Code Chapter 102).
 - b. PA DEP approval Chapter 105 for work within drainageways / wetlands.
 - c. PennDOT permits for work within the state highways.
 - d. Chester County Health Department (septic system relocation at Basin 2A).
 - e. Tredyffrin Township Road Opening Permit for impacts to Township roadways and rights of way.

It is recommended that a list of all required permits be noted on the PCSWM plans. Upon receipt of the permits and prior to final plan issuance, the applicable permit numbers and approval dates should be referenced on the final plans.

This item has been adequately addressed. Final plans must note the approval date of the permits.

6. Section 18. Erosion and Sediment Control during Regulated Earth Disturbance Activities.
A review of the E&S Controls plans have not been completed to date as the plans have only been recently submitted to the Township by the Turnpike (May 2012).

No additional comment.

7. Section 19. Nonstructural Project Design.
a. Section 19.B – The Applicant is required to following the sequence per Section 19.B when preparing the stormwater management design. Documentation should be submitted with the stormwater report detailing the requirements of the Existing Resource and Site Analysis Map (ERSAM), stream buffers and other applicable requirements per this section. It is my recommendation that the pre-developed drainage area plans be modified to include the additional information to meet the requirements of the ERSAM.

This item has been adequately addressed. The E&S Controls Plans have sufficient data to meet the requirements of the ERSAM.

8. Section 20. Groundwater Recharge and Volume Control Standards.
a. A minimum depth of twenty-four (24) inches between the bottom of the BMP and the top of the limiting zone shall be provided for all infiltration facilities. It is recommended that a summary chart be provided indicating the top and bottom elevation of the infiltration facility and the elevations of the limiting zone for all facilities. It is also recommended that data for the non-infiltration facilities be included, if available, to evaluate the design.

This item has been adequately addressed.

- b. Infiltration facilities shall be capable of completely infiltrating the required volume within three (3) days (72 hours). Calculations and a summary chart for the stormwater facilities (basins, beds, vaults, bioretention, etc.) dewatering times must be provided.

All infiltration basins are proposed to infiltrate the Township required volume (net 2-year volume) within 72 hours. This item has been adequately addressed.

Two stormwater management facilities (bioretention basin 3A and 11-1 and an underground vault 10B) hold water (2-year storm event) for a period in excess of 72 hours. Although these facilities are not infiltration facilities it is recommended that an analysis be prepared by the design engineer to indicate the effects of the extended storage on the capacity of the facility for subsequent rain events.

- c. The retention (infiltration) volume (Rev) to be captured and infiltrated shall be the net 2-year 24-hour volume. The net volume is the difference between the post-

development runoff volume and predevelopment runoff volume. Per appendix A, Change in Runoff Summary Table, the infiltration requirements at each Points of Interest (POI) RD & RE, RG, RJ & RK within the Valley Creek Watershed are not met but the overall volume requirement within the watershed is met (see below chart). The infiltration requirement at POI RQ within the Trout Creek Watershed and the overall is not met. This must be reviewed with the Township to determine amount of additional sub-watershed controls required for compliance with Chapter 174 Stormwater Management Ordinance requirements.

May 31, 2012 summary table (old)

Watershed	Required Volume (CF)	Provided Volume (CF)	Difference (CF)
Valley Creek			
RA	25,007	35,832	-10,825
RB/RC	114,428	138,697	-24,269
RD/RE	84,611	55,321	29,290
RF	77,061	86,366	-9,305
RG	15,448	0	15,448
RH	48,491	65,814	-17,323
RI	56,728	76,790	-20,062
RJ/RK	119,509	76,978	42,531
RL	54,853	91,398	-36,545
RM	33,991	37,026	-3,035
Subtotal	630,127	664,222	-34,095
Trout Creek			
RN	190,411	209,193	-18,782
RQ	80,187	8,336	71,851

PCSM Plan sheet 12 of 95 includes a Stormwater Summary Table indicating the updated required infiltration volume requirements and the provide volume controls. The required volume controls per the Township Ordinance requirements have not been met for various sub-watersheds including the overall Valley Creek Watershed and the overall Trout Creek Watershed.

Summary table (new)

Watershed	Required Volume (CF)	Provided Volume (CF)	Difference (CF)	Compliance Twp. Ordinance Requirements (%)
<u>Valley Creek</u>				
RA	26,867	27,993	-1,126	104%
RB/RC	120,038	133,081	-13,043	111%
RD/RE	84,554	17,424	67,130	21%
RF	80,810	83,150	-2,340	103%
RG	13,771	0	13,771	0%
RH	51,491	68,145	-16,654	132%
RI	59,486	93,136	-33,650	157%
RJ	63,835	76,301	-12,466	120%
RK	53,646	0	53,646	0%
RL	35,614	91,385	-55,771	257%
RM	54,804	29,185	25,619	53%
Overall Valley Creek	644,916	619,800	25,116	96%
<u>Trout Creek</u>				
RN	175,934	218,814	-42,880	124%
RQ	86,046	22,831	63,215	27%
Overall Trout Creek	26,1980	24,1645	20,335	92%

Supporting calculations detailing the required and provided volume per Township Ordinance calculations are provided in Appendix N. The PCSM Report narrative discusses the limitation located in each sub-watershed area including but not limited to karst geology. The summary table also indicates the percent compliance based upon the actual site conditions (existing impervious coverage). The PTC must schedule a meeting with the Township to review this non-complaint issue.

- d. Supporting calculations must be included with Worksheet 5 in Appendix B detailing the provided volume at each BMP, including but not limited to the biofiltration areas and the infiltration basins, as well as the detention basins and vaults.

This item has been adequately addressed. Refer to below comments regarding specific watershed comments.

- e. The use of the volume within the biofiltration areas toward credit for the required retention (infiltration) volume (Rev) should be reviewed with the Township. Additional information related to the drawdown period of the volume within the biofiltration area will need to be provided in order to properly analyze the design.

Some bioretention areas are proposed to be constructed with a geosynthetic clay liner between the biofiltration backfill mix and the subsurface stone beds. Clarification must be provided regarding the dewatering process of the backfill mix during periods when evapotranspiration does not occur.

Bioretention basins include basins 3A, 8, 11-1, 11-2 and 15-2. The design includes approximately 6 to 8 inches of standing water and 3 to 3.5 feet of bioretention backfill mix. The project narrative indicates that wetland plants will be placed and spaced to support pollutant removal and transpiration. An impervious liner is proposed to be placed below and to the sides of the bioretention backfill mix. Additional data is requested to support the design in particular the transpiration process for this 3.5 to 4 foot depth of water that will remain in the bioretention basins following a storm event.

Additional comments regarding the biofiltration areas include:

- 1. Supporting calculations must be provided to indicate the 24" domed risers have sufficient capacity to convey the runoff to the subsurface stone bed. As designed, the bioretention basins have three or four domed risers to convey the runoff to the stone bed.**
 - 2. Additional access ports are recommended to be incorporated into the subsurface pipe system for inspection purposes and maintenance (flushing).**
 - 3. The pipe system in the biofiltration systems are proposed to be corrugated metal pipe (CMP). Additional specifications regarding the CMP must be provided. Consideration should be given to utilize a pipe material that is more corrosion resistant due to the application.**
 - 4. It is recommended to have additional pipes connecting the subsurface pipe systems to promote the migration of the runoff throughout the system. As designed there is only one header pipe connecting the various legs.**
- f. The proposed plans do not show volume compliance for a portion of the Trout Creek Watershed. Further details of proposed stormwater management facilities both onsite and offsite should be provided and/or discussed with the Township to address the proposed volume deficiency. Clarification must be provided if the PTC is proposing offsite stormwater controls in the Trout Creek Watershed. Proposed facilities were deficient and no offsite stormwater management facilities or controls were provided with the 10-24-12 plan submission for Trout Creek.

As currently designed, the project does not comply with the Township ordinance volume requirements for individual sub-watersheds within the Trout Creek and a few sub-watersheds in Valley Creek. This issue must be reviewed with the Township.

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- g. Section 20.B & C – Soils & Karst and/or Carbonate Geology. I recommend a meeting be held with the Township, PTC and the appropriate design professionals to review the soil testing, karst geology and the deep dynamic compaction procedures for the project, as well as submittal of geotechnical and geophysical data within the Karst and/or Carbonate Geology areas of the project.

A meeting with the PTC design professionals and the geotechnical engineer is still recommended to review the geotechnical design. The April 2013 GAI Consultants Stormwater Management Studies (Appendix O) for various basins, including but not limited to 4, 8 and 12 discusses the elevated risk for sinkholes within this area and makes recommendations for sinkhole remediation if they occur.

- i. It is recommended that a tabulation of the soil borings be added to the plan indicating, at the minimum, the boring number, the elevation of the test, elevation of the limiting zone (if applicable), elevation of the bottom of stormwater facility, any indication of karst geology, and any other pertinent notes.

The Stormwater Management Summary Table on sheet 12 of 95 indicates the tested infiltration rate. Appendix O of the PCSWM Report includes boring information and data regarding site observations. Although significant soil testing has been completed at the stormwater management facilities, the elevations of the test locations are not always at the basin bottoms. An additional chart must be provided indicating only those test areas which were used to calculate the recommended infiltration rate. The geotechnical engineer discusses in Appendix O the over-excavation of poor drainage soils under the presence of the Geotechnical Representative and consideration of these remediation efforts in establishing the recommended rates. It is recommended the PTC design professionals prepare the chart and review the results with the Township to determine if the testing performed is satisfactory or additional testing is required.

- ii. It is my understanding that the Township has received numerous inquiries from the residents surrounding Basin 2A regarding the karst geology in the vicinity of the basin. Upon consultation with the Township regarding the results of the existing borings, a geophysical survey of this area and other infiltration areas may be warranted, and should be provided with future plan resubmission for all stormwater facilities within the Karst/Carbonate portions of the project. These results should be summarized in a geotechnical report, and locations of testing shown at each stormwater management facility location.

A geophysical survey has not been completed for Basin 2A. According to the response letter from the design engineer, geophysical testing was not recommended by the geotechnical engineer in this area. According

to Section 20.C, in areas underlain by karst and/or carbonate geology, an evaluation of the site conditions shall include geophysical survey of the site to identify locations and extent of existing subsurface karst features. Dolomite bedrock is noted at boring 2A-12 and 2A-15 therefore a geophysical survey must be completed and submitted for review. Prior to completing the geophysical survey, it is recommended that the PTC design professionals review with the Township to ensure the location of the sections are acceptable.

- iii. The Township has serious reservations regarding the infiltration capacity of the stormwater management facilities following the deep dynamic compaction process. General note number 12 on the Deep Dynamic Compaction Plans indicates that infiltration testing shall be completed following the compaction process. The plan should detail what steps can be taken if the soil no longer allows for infiltration or the rate is reduced from the design rate.

Deep dynamic compaction is no longer proposed for this project therefore this issue is no longer applicable.

- iv. It is recommended that procedures for monitoring the infiltration within the facilities, especially those where deep dynamic compaction is proposed, for an extended period, minimum of 2 years or period to be determined by the Township, be incorporated into the Operation and Maintenance requirements of the project.

Deep dynamic compaction is no longer proposed for this project therefore this issue is no longer applicable.

- v. It is recommended that a geotechnical engineer certification be added to the plan indicating the engineer's professional opinion as to the suitability for infiltration as the various stormwater management facilities, and the rationale for those shown as detention and not suitable for infiltration.

The PTC has indicated that the Geotechnical Reports substantiating the design are included within the PCSM Report and certifications not required by Ordinance are not included. See above comments.

- vi. Submit full geotechnical report for the limits of the project, including but not limited to soils, boring, and geophysical data for all proposed stormwater management facility locations.

Appendix P of the PCSM Report includes geophysical surveys for a variety of basin including 1A, 4, 5, 7A, 8B, 7B, 8, 11, 12, 12A and 15-3. The basin numbering has changed since the time of the geophysical survey work making it difficult to cross reference the survey locations to the proposed basins. It is recommended that an overall map showing the locations of the geophysical surveys be included with Appendix P to

assist with cross referencing the locations of the surveys to the actual basin locations.

A summary sheet must be provided detailing each stormwater facility and the conclusion of the geophysical survey.

It appears additional geophysical surveys are necessary including but not limited to Basin 2A (as referenced is above comment) and Basin 6. As noted in Appendix O, Stormwater Management Study, Stormwater Shed RH, the site geology consists of dolomite.

The geotechnical report must also address the potential for sinkholes within conveyance channels. For example, Basin 15-2 outlet pipe discharges into a conveyance swale and as noted in Appendix O – Geotechnical Exploration Plan, there is a *backfilled sinkhole* located in this conveyance swale. It is recommended that a conveyance pipe be installed in this area rather than a swale.

- h. The PCSWM Report Appendix A includes a summary of the loading ratios for each infiltration facilities. The provided ratios exceed the ratios listed in Appendix B of the Township Ordinance for the impervious coverage, total area and impervious coverage in karst areas. These ratios should be reduced to meet the standards in Appendix B, or to the greatest extent feasible. Per Appendix B, if the loading ratios cannot be met, this must be reviewed with the Township Engineer, and the Turnpike will need to demonstrate reason for non-compliance, as well provide a statement on the plans signed by the design engineer and geotechnical engineer that certifies stormwater management design and addresses risk for sinkhole or solution formation development.

The proposed loading ratios exceed the ratios noted Appendix B of the Ordinance therefore a meeting must be held with the Township Engineer.

The recommended loading ratios are as follows:

- **Maximum impervious loading ratio of 5:1 relating impervious drainage area to infiltration area.**
- **Maximum total loading ratio of 8:1 relating total drainage area to infiltration area.**
- **Maximum impervious loading ratio of 3:1 relating impervious drainage area to infiltration area for karst areas.**

Some of the loading ratios including:

BMP	Impervious Area	Total Area
1A-2	7.39:1	11.61:1
2A	8.85:1	14.91:1
6B	12.89:1	25.17:1
7-1	6.07:1	11.58:1
12-4	22.00:1	32.80:1

It is recommended that the following items be addressed by the PTC design professionals:

- 1. Within the PCSM Report Narrative, the design engineer has generally noted *the basin footprint has been maximized within the available site area to minimize the loading ratio* as the justification regarding the inability to meet the loading ratio recommendations. Additional justification must be provided by the design engineer indicating why additional facilities cannot be provided and / or runoff diverted to reduce the loading ratios.**
 - 2. The geotechnical reports in Appendix O must specifically address the geotechnical engineer's professional opinion on the design loading ratio based upon the soil conditions and the geology. Refer to above comment 1.d regarding the justification summary for substandard design items. The geotechnical engineer must review and update the loading ratios detailed in their reports as some do not match the design ratios per STV reports.**
- i. The submitted construction details for all underground infiltration facilities must be revised to indicate additional design information for cleanouts and access ports for maintenance purposes.

Additional cleanouts and access ports are recommended for the subsurface elements of the infiltration facilities and bioretention basins.

- j. The Township requests the design engineer evaluate the proposed stormwater management design in conjunction with the Township's Trout Creek Watershed Study completed by Borton-Lawson and CH2MHill (CD/DVD previously provided to STV, Turnpike's Consultant Team, and copy enclosed with Township letter dated May 31, 2012) . In particular, the post developed peak rate analysis and volume reduction should be reviewed to see how the timing of the release impacts the lower watershed, especially given that the proposed plans do not meet the volume control requirements in Section 20 of the Township Stormwater Management Ordinance. Within the Township Study, there are at least three different points of interest below the PA Turnpike property. Copies of the study and HEC-HMS model have and will be provided to the PTC design engineer.

The design engineer has indicated that this analysis should be completed by the Township and is not a part of this Turnpike reconstruction project.

9. Section 21. Water Quality Requirements.

- a. Additional information must be provided within the stormwater management report to indicate compliance with the Water Quality Volume (WQv) requirements of the Township Ordinance, this information was not provided in the October 2011 plan submission.

The WQv calculation per Section 21 of the Ordinance must be completed for each watershed and supporting documentation must be submitted to indicate compliance.

- b. Stream buffers shall be created at all perennial or intermittent streams within the project area. The buffer shall extend a minimum of ten (10) feet to either side of the top-of-bank of the channel. The buffer shall be maintained with appropriate native vegetation

In areas of proposed disturbance along the stream which cannot be avoid, buffer plantings shall be installed at a minimum of ten (10) feet to either side of the top-of-bank.

10. Section 22. Stream Bank Erosion Requirements

- a. Further information shall be provided to demonstrate compliance with Section 22(A) and (B) for the 1-yr storm retention and release over a 24-hour period.

POI RQ3 does not comply with the Township Stream Bank Erosion requirements. The design must be modified.

11. Section 23. Stormwater Peak Rate Control and Management Standards.

- a. Based upon my review of the Worksheet No. 4 Site Area Plan set (13 sheets), it appears the design for the Groundwater Recharge and Volume Control Standards per the requirements of Section 20 of the Township Ordinance appear to account for all disturbed areas within the PTC right-of-way and the disturbed off-site areas (stormwater management basins). The drainage area boundaries indicated on the Drainage Map for Routing Analysis do not appear to account for the additional runoff generated from the conversion of the wooded area to the lawn (clearing limits within the right-of-way). Clarification must be provided as whether these areas have been addressed in the design. Clarification should also be provided if it is anticipated that rock will be encountered for any of the proposed slope areas. If so, the ground cover assumptions should address this (exposed rock face).

This item has been adequately addressed.

- b. As noted above, the calculations for the Groundwater Recharge and Volume Control Standards indicate the majority of the areas within the PTC right-of-way will be cleared of existing vegetation. As per discussions with the Township, this was not their understanding from the Round Table discussions. Clearing limits must be detailed on the plan and minimized to the greatest extent.

Refer to comment 1.i.iv above regarding discussion of clearing limits.

- c. In order to properly evaluate the Peak Rate Control requirements, clarification must be provided for all watersheds to indicate which sub-watershed areas are used in the model for the establishment of the pre-developed peak rate of runoff to each point of interest. The Drainage Map for Routing Analysis – Existing Conditions indicate drainage areas that do not discharge to the point of interest. The Appendix C Watershed Map Area Summaries for the pre-developed condition include all sub-watershed areas even if they do not discharge to the point of interest. Due to complexity of the various modeling methods (Township, PA DEP, Actual),

consideration should be given to separate the Pondpack reports in Appendix G. As submitted, I was unable to locate the pre-developed hydrograph which was used to determine the peak flow rate to each point of interest.

This item has been adequately addressed.

- d. Time of concentration flow paths must be indicated on the drainage area plans for all watersheds.

This item has been adequately addressed.

- e. An analysis of the sheet flow conditions for areas on the southside of the Turnpike must be provided to determine if the reduction in drainage area during the post developed condition reduces the flow more than the change in ground cover (woods to lawn) will increase the flow to the downstream property owners.

This item has been adequately addressed.

- f. In order to properly evaluate the proposed level spreaders, design information must be included in the PCSWM report, including flow data. Construction details for the culvert pipe connections to the level spreader must also be provided.

The design calculations and sizing of the proposed level spreaders appear adequate based upon the proposed flow. The construction details also appear adequate. The level spreaders are being proposed at locations of existing point discharges. The level spreader design will alter the flow to a sheet flow condition. While this is a positive improvement in most scenarios, it is an alteration to the existing flow patterns. PTC design professionals must review the individual level spreader locations and determine if drainage easements / approvals from the downstream property owner are required for the alteration.

- g. Clarification must be provided regarding if the concrete vaults are to be installed completely level or a slight grade pitch toward the outlet structure (to avoid trapped water along the bottom and behind the baffles).

This item has been adequately addressed. The design plans indicate the vault to be installed level.

12. Section 25. Other Requirements.

- a. Emergency spillway calculations must be provided for all stormwater management facilities per Section 25.C.

This item has been adequately addressed for all above ground stormwater management facilities except the bioretention facilities. The design must be modified to provide emergency spillways for all bioretention areas. One of the primary reasons for the spillway is to control the overflow location in case of a basin failure. For example, an overflow on the south side of Basin 3A would

have a large negative impact to the downslope home immediately adjacent to the basin. Refer to comment 18.d for additional requirements.

- b. The plans should demonstrate adequate erosion and sediment protection be provided along all open channels and points of discharge per Section 25.H.

This item has been adequately addressed.

- c. Per Section 25.I, areas of discharge from basins or direct shall ensure adequate downstream conveyance capacity to ensure not to create or aggravate an existing stormwater drainage or flooding problem. This is especially important in smaller tributaries in the Valley Creek portion of the project, as well as the eastern tributary of Trout Creek between Richards Road and the Glenhardie Golf Course.

The stormwater management report details the peak rate of discharge and the volume of runoff for the 2-year storm are not increased at all basin discharges per the ordinance requirements. Various watersheds have an increase in volume for the larger storm events. The stormwater report includes an Antidegradation Analysis for the areas downstream of the basins. This analysis appears to be based upon the actual site conditions and do not address the analysis based upon the Township design criteria. Revised information for this analysis must be provided and upon review of this information, additional downstream analysis may be required to justify the design engineers opinions that the various streams have sufficient capacity for larger storms therefore the streams will not be adversely impacted.

13. Section 26. Inspections. Notes must be added to the final construction plans detailing the requirements that the Township representatives shall inspect the construction of the stormwater management facilities and the contractor shall notify the Township Engineer prior to the start of work. In addition, notes shall be added to the plan requiring a pre-construction meeting be held with representatives of PADEP, CCCD, Tredyffrin Township and/or its designee, and PTC staff and contractors / subcontractors prior to the start of any construction. Notes on the plans shall provide provisions for full access by designated Township staff and/or designee inspectors, as well as representatives of the CCCD and PADEP, for the full duration of the construction, as well as a maintenance period following completion of the project.

This item has not been adequately addressed. Additional notes are required to address Section 26 requirements. Per the design engineer response letter, the Township will be required to request access to the Commission property for post construction inspection purposes. This must be reviewed with the Township.

14. Section 28. Responsibilities for Operations and Maintenance of Stormwater Controls and BMPs. An Operations and Maintenance Control Plan addressing the requirements of this section must be prepared and submitted for review and approval. Upon approval, the plan must be recorded at the offices of the Recorder of Deeds of Chester County. The O&M plan shall be a stand-alone plan set / document detailing operation and maintenance procedures for each BMP including the plan view and construction details for each facility.

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The O&M Plan shall comply with the requirements of Section 28. Specific details must include, but are not limited to, the responsible party and contact information, inspection and maintenance frequency standards for all stormwater management facilities and associated vegetated components of the project, as well as mowing frequency, plant maintenance and replacement, weed control, amended soil aeration, mulching frequency, and fence maintenance. Notes shall be added to the plans to comply with Section 28(B).4.

As submitted, the Stormwater Management Operation and Maintenance plan information has been incorporated into the Post Construction Stormwater Management Plan. As required by Section 28, a separate plan set must be prepared to be recorded at Chester County Recorder of Deeds. The plan must include the requirements from Section 28.B.

It is recommended that the Operation and Maintenance requirements detailed on sheet 2 of 95 be revised to detail the minimum inspection schedule (in lieu of the listed requirement of “establish a regular inspection schedule the first year of operation”). If needed, the O&M procedures can be revised at a later date (after construction) based upon the site conditions / needs.

15. Section 31. Operation and Maintenance Agreement for Privately Owned Stormwater Facilities. An O&M Agreement must be prepared and submitted to the Township for review and approval. The O&M Agreement & Plan must clearly identify who is responsible for the maintenance for all BMPs and stormwater conveyance systems within the Turnpike lands, private easements, Township right-of-way and PennDOT right-of-way.

This item is not adequately addressed. An agreement (separate from the plan) must be prepared and submitted for review and comment.

16. Section 32. Stormwater Management Easements. All required stormwater easements, per Section 32, shall be identified on the plans, and a copy of those easements must be provided to the Township prior to issuance of the permit.

Refer to above comment #4 regarding easement / right-of-way discussion. The PTC proposes to issue a right-of-way clearance certificate to be issued to the Township prior to construction.

17. Recording of an Approved Stormwater Control, BMP Operations and Maintenance Plan, and Related Agreements. Section 33 requirements shall be noted on the PCSWM Plans and recorded at the Chester County Recorder of Deeds Office, following final permit approval.

The design engineer has indicated the PTC will provide approved Stormwater Control, BMP Operations and Maintenance Plan, and related agreements but will not record the documents. The O&M Plan and agreement must be recorded prior to the start of construction.

18. Appendix B. Stormwater Best Management Practices (BMP) Design Standards.

- a. Detailed notes must be indicated on the plans for the construction requirements of the infiltration facilities per Section A.3 of the Appendix B.

This item has been adequately addressed.

- b. It is recommended that a technical report be provided from the geotechnical engineer summarizing the PCSWM Appendix D data and relevant information from Section 20 and Section A.5 of Appendix B. The report should, at the minimum, address the following initial concerns:
- i. Depth of the karst geology.
 - ii. Sinkhole potential below the deep dynamic compaction impact area.
 - iii. Noise and vibration impacts of the deep dynamic compaction process for surrounding residents.
 - iv. Impacts to the future infiltration capacity of the soil within the infiltration basins.
 - v. Geophysical Survey of proposed stormwater management facilities located within Karst and/or Carbonate Geology areas of the project.

Appendix O and P of the PCSM Report includes detailed information regarding soil information and karst geology, including recommendations from the geotechnical engineer regarding design infiltration rates. As noted in above comment 8.g, additional geophysical surveys are required to evaluate the proposed improvements.

- c. Anti-seep collar design information must be submitted for review.

This item is adequately addressed.

- d. A minimum of one (1) foot of freeboard must be provided between the 100-year design flow in the emergency spillway and the top of berm.

This item is not adequately addressed. Freeboard is the difference between the elevation of the 100-year design flow in the emergency spillway and the top elevation of the basin berm. As designed, less than one foot of freeboard has been provided.

- e. Per Section E.12, drainage easements that allow legal access and maintenance vehicle access by Township personnel if the need arises shall be provided to the Township. Details for these easements should be reviewed with the Township.

This item is not adequately addressed. The PTC must review this requirement with the Township Staff and Solicitor. An agreement must be prepared allowing the Township to access PTC property during construction and post construction.

- f. Section F of Appendix B – Landscaping of Stormwater Management Practices.
 - i. Landscape Plans shall be prepared by a professional Landscape Architect. The Landscape Architect seal must be added to the plans.

The design engineer has indicated a Landscape Architect seal will be added to the appropriate plans.

- ii. Proposed landscaping of the infiltration and bioretention basins consist of a variety of basin seed mixtures, plugs and shrubs. Generally the plant material specified for the facilities appear appropriate but a more detailed review of the material will be complete during future reviews. In order to fully evaluate the landscape design, final design information is required for the dewatering times of the infiltration and bioretention basins, to determine adequacy of the proposed vegetative plantings.

As indicated in the design engineer’s response letter, the plant species have been selected that can withstand periods of inundation and drought. The construction sequence must detail the procedures for establishing the basin ground cover, in particular within the infiltration and bioretention basins. Dewater of the basins may be necessary to the establishment of the seed mixtures.

- iii. The locations of the plantings around the stormwater management facilities must be coordinated with the proposed storm sewer. Various shrubs and tree whips are planted over top of the storm sewers and inlets.

This item has been adequately addressed.

19. Preliminary sub-watershed specific review comments are provided below for each point of interest. Additional review comments are anticipated upon receipt of the additional design information requested in this letter.

- a. SR 0029 Slip Ramp connection. Based upon discussions with the design engineer, they have indicated that the increase in impervious coverage from the start of work at station 1057+00 to station 1065+50 is addressed as part of the SR 0029 Slip Ramp project that is currently under construction. Documentation regarding this must be included in the Post Construction Stormwater Management Plan report.

This item has been adequately addressed.

- b. Point of Interest RA
 - i. Clarification must be provided for the sub-watershed area A-RA-6 (offsite area) discharging to POI RA. The western limits do not appear accurate.

This item has been adequately addressed.

- ii. Clarification regarding the grading along the shoulder between Station 1066+00 to 1068+00 right must be provided (swale or sheet flow condition).

This item has been adequately addressed.

- iii. Parking lot improvements for the future development of the area above Basin 1A-2 as indicated on sheet 24 of 98 should not be shown on the plan as they are not approved. Restoration details for the replacement of the existing gravel parking area should be provided.

This item has been adequately addressed.

- iv. Existing contour elevations over Infiltration Basin 1A-2 must be labeled and proposed grades (as per this project) should be indicated on the plan to verify if adequate cover will exist over the bed.

This item has been adequately addressed.

- v. Clarification should be provided if tree clearing is needed at Basin 1A-2.

Significant tree clearing is proposed for the area surrounding Basin 1A-2. Clarification must be provided regarding the stormwater impacts of tree removal area downslope of Basin 1A-2 (conversion of woods to grass).

- vi. It appears that additional right-of-way for Howell Road is being obtained just north of the Turnpike. Howell Road is a Township roadway and the final disposition of this right-of-way should be reviewed with the Township.

The design engineer has indicated that the right-of-way will be acquired in fee simple by the PTC in the name of Howell's Road. Coordination with the Township regarding the dedication of right-of-way to the Township must be completed by the PTC.

- vii. The 48" storm pipe that is located at approximate station 1076+50 is proposed to be diverted from the current location to POI RA (diverted around Basin 1A-2). This is located upslope of the current discharge location. An analysis of the downstream properties must be provided to indicate the ditch below POI RA can support this flow.

This item is adequately addressed.

- c. Point of Interest RB/RC

- i. As previously reviewed with the Township, it is recommended that the design engineer evaluate the drainage area that is proposed to discharge to POI RB/RC and if feasible, divert runoff from this POI to POI RA, or

provide additional Turnpike right-of-way stormwater facilities, or alternatives that would reduce the drainage area, and loading ratio of this POI.

The design engineer has noted in the PCSM Narrative that alternate design of diverting additional runoff to Basin 1A-2 was reviewed but was removed from consideration based upon the loading ratios of Basin 1A-2. As designed, 17.72-acres of additional drainage area discharges to the POI RB/RC downslope of Basin 2A. If diverting runoff from this POI is not feasible based upon the surrounding facilities, consideration should be given to providing additional stormwater management facilities within the watershed.

- ii. The plan must be revised to address any temporary grading requirements needed to construct the 48” storm pipe and the sound barrier / retaining wall within the steep embankment on the south side of the Turnpike between stations 1075+00 to 1084+00.

This item is adequately addressed.

- iii. A summary of the pre and post developed drainage area or flow to the point of interest for the 30” culvert at station 1095+50 must be provided to ensure there is no increase in flow to this point of interest.

This item is adequately addressed.

- iv. Clarification must be provided for the differences between the pre and post developed condition areas indicated on Worksheet No. 4 Site Area Plan. As indicated in the report, the post developed condition is 1.4-acreas larger.

This item is adequately addressed.

- v. The existing culvert at station 1100+50 must be shown on the plan. This information appears to have been inadvertently turned off this plan.

This item is adequately addressed.

- vi. Basin 2A is proposed to discharge to the southside of Salem Way. Due to the significant increase in drainage area that is proposed to discharge at this point of interest, an analysis of the downstream impact properties must be provided.

This item is adequately addressed. The post developed peak rate of runoff is proposed to be less than the pre-developed peak rate.

- vii. Clarification must be provided for limits of the proposed driveway to Basin 2A. It is unclear where the end of the driveway is located. Clarification is

also requested whether the volume analysis and peak rate control analysis accounted for the impervious coverage of this proposed driveway.

The design engineer has indicated the driveway will be unpaved. The drive must be label as such on the PCSM Plans.

viii. Culverts:

1. The existing 36” culvert at Station 1100+50 is proposed to discharge into a level spreader. Currently this pipe discharge outlets at a point discharge. Initially this change from a point discharge to a level spreader appears to be a positive modification but this should be reviewed further with the Township to ensure no negative affects will occur due to this change.

Refer to above comment 11.f regarding level spreaders.

2. The existing storm pipe at station 1105+45 is proposed to be hard piped through wetland F. This may have already been addressed by the Turnpike, and if so the plans should be updated to show the current proposed easement and storm sewer drainage configuration, and if not it should be reviewed with DEP as the removal of the base flow may negatively impact the wetland area.

This wetland crossing is part of the PA DEP Joint Permit application and approval is pending.

3. The configuration of the proposed level spreader at the station 1109+50 culvert should be reviewed with the Township to minimize the affect on wetland G.

This item is adequately addressed.

d. Point of Interest RD/RE

- i. A pre and post flow analysis for the level spreader / point discharge outlets must be provided for the outfall locations at approximate stations 1117+50, 1124+00, 1130+00, 1141+00. For the culvert at 1117+50, the change from the point discharge to a level spreader should be reviewed with the Township.

The pre / post flow analysis has been completed and appears adequate. Refer to above comment 11.f regarding level spreaders.

- ii. North Valley Road, including the state route number, must be labeled on drawing 32 and 33 of 98.

This item is adequately addressed.

- iii. Clarification as to the point of interest must be provided for this watershed (adjacent to Basin 3A or downstream at the basin outlet pipe).

This item is adequately addressed.

- iv. Within this sub-watershed area, the bio-retention basins do not meet the requirements for the Township Groundwater Recharge and Volume Control Standards. The Township volume control requirement is 84,641 cf. The proposed volume control is 55,321 cf. This proposed volume control is being provided via soil amendments. Calculations justifying this provided volume must be included in the report. The lack of volume control within the sub-watershed must be reviewed with the Township.

The proposed volume control is only 21% of the Township ordinance requirements. Refer to above comments 8.c and 8.e.

- e. Point of Interest RF

- i. The channel / drainage swale downslope of POI RF must be analyzed to determine if it has adequate capacity for the discharge of Basin 4. The drainage area A-RF-9 which consists of 4.53 acres of land and portions of A-RF-7 had not previously discharged to the channel directly downslope of POI RF. A-RF-9 flowed in a sheet flow condition to an area below the POI. The net increase in area per the volume calculations for this watershed is 3.0 acres.

This item is adequately addressed.

- ii. A pre and post flow analysis for discharge location at 1153+00 right must be provided.

This item is adequately addressed.

- f. Point of Interest RG

- i. Runoff to this point of interest is controlled via Underground Vault 5 (230' x 20' x 8.5'). Based upon the configuration of the Turnpike storm sewer conveyance system, the drainage area to this point of interest is proposed to decrease by 4.2-acres. No infiltration is proposed to occur within this watershed. Even with the decrease in area, the Township Groundwater Recharge and Volume Control Standards are not met. This must be reviewed with the Township.

The post developed drainage area to POI RG is proposed to be decreased by 3.04-acres. The post developed runoff volume will be decreased due to the reduction in drainage area but the Township volume control requirements (pre-developed meadow condition) are not proposed to be met since no infiltration is proposed within this sub-watershed area. Refer to above comment 8.c regarding volume control standards.

g. Point of Interest RH

- i. The loading ratios for Basins 6A and 6B are very high compared to the ratios per the Township Ordinance (39:1 and 26:1 for total area). The design engineer should evaluate the design and attempt to reduce the ratios to the greatest extent.

Refer to above comment 8h regarding loading ratios. The loading ratios have been decreased from the original design. The design engineer must verify the ratio noted in the summary table as it does not match the report ratio for Basin 6B.

- ii. The design engineer should review the pre-developed drainage area A-RI-2. It appears portions of this area discharges to POI RH during the pre-developed condition.

This item is adequately addressed.

h. Point of Interest RI

- i. A significant portion of the runoff from this watershed discharged to the channel / ditch between Main Street and Basin 7-1. The basin is proposed to discharge at the tributary to Valley Creek. The impacts to the upper reach of this tributary (above the point of conveyance) must be reviewed to ensure no negative effects from the flow adjustment.

This item is adequately addressed.

- ii. Easement documentation must be provided for Basin 7-1 & 7-2 (Chesterbrook Masters Association).

Final approval of this easement is pending.

i. Point of Interest RJ/RK

- i. Drainage plans and calculations must be revised so the drainage areas and subwatershed areas are consistently labeled (references to both RJ and RK).

This item is adequately addressed.

- ii. Within this sub-watershed area, the bio-retention basins, vaults and infiltration basin do not meet the requirements for the Township Groundwater Recharge and Volume Control Standards. The Township volume control requirement is 119,509 cf. The proposed volume control is 76,978 cf. This proposed volume control is being provided an infiltration basin and the bioretention basins. The lack of volume control within the sub-watershed must be reviewed with the Township.

POI RJ and RK have been separated in the new analysis. The volume control located in RJ exceeds the Township volume control

requirements. There is no volume control facilities located in RK subwatershed. As noted in the narrative, the combined flow to RJ and RK is only 65% of the total Township requirements. The PTC must review this non-complaint volume issue with the Township (refer to above comment 8c).

The design engineer must also provide clarification as to the impacts that the proposed earthen berm located upslope of the existing basin adjacent to Bioretention Basin Bio 8. It appears the berm will divert runoff away from the existing basin which may impact the overall watershed RJ.

- iii. The outlet structure for Basin 8 should be reviewed in relationship to the grading to ensure adequate cover is located over the outlet pipe and the anti-seep collars.

This item is adequately addressed.

- iv. The design engineer should verify the drainage area boundaries for Areas A-8-3 and A-Bio-8B2 indicated on the Drainage Map for Routing Analysis Proposed Condition.

This item is adequately addressed.

- v. Improvements are proposed within the Valley Creek floodplain area including the stream crossing, grading and Basin 8B. A review of the floodplain impacts (H&H Study) will be completed in subsequent reviews. The PTC should identify and coordinate all necessary zoning approvals required for work within the floodplain area. The limits of the floodplain, existing and proposed, should be clearly identified on the PCSWM plans.

Basin 8B has been removed from the Valley Creek floodplain. The limits of floodplain, both existing and proposed, must be clearly identified on the PCSM plans.

- j. Point of Interest RL
 - i. Stormwater management for this watershed consists of two concrete vaults and infiltration basin 10 (a modification to an existing offsite stormwater management basin). Ownership and maintenance of this offsite basin must be detailed in the O&M documentation.

Based upon the O&M notes, all basins are proposed to be owned and maintained by the PTC including Basin 10. This item is adequately addressed.

- ii. Basin 10 is proposed to control offsite stormwater management due to the inability to provide volume control at the proposed vaults. Clarification

should be provided if this basin is used to account for the peak rate control (compensatory).

This item is adequately addressed. No peak rate volume credit is provided for this basin.

- iii. Additional design information is requested for Basin 10 including the following:
1. Outlet structure detail (existing and proposed modifications, if any).
 2. Basin cross section (existing and proposed).
 3. A tabulation of the existing basin volume and the proposed basin volume.

The basin cross section has not been provided.

- iv. Clarification is requested for the following related to level spreader / infiltration trench LS-RL-1.
1. Assuming the top of stone elevation is proposed to be level, proposed grading must be added to the plan (drawing 65 of 98). The elevation of the top grade of the stone should be labeled on the plan.

This item is adequately addressed.

2. The infiltration trench is proposed to be approximately four (4) feet deep adjacent to the Wilson Run tributary. The design engineer should review area to ensure the trench will not be within the seasonal high water table.

The design engineer has noted that *the area has been reviewed and it is not within the seasonal high water table*. Clarification as to the justification for this is requested as the bottom elevation is proposed to be 119.75 and the edge of stream bank adjacent to the level spreader is elevation 120.

- k. Point of Interest RM
- i. On drawing 75 of 98, clarification must be provided for the improvements shown at approximately Station 1294+50 left (data ghosted out).

This item is adequately addressed. The information is a stormwater management facility constructed as part of the Valley Forge Road bridge reconstruction.

- l. Point of Interest RN
- i. As per the landscaping plans, it appears the rest stop parking area from Station 1297+00 right to 1306+00 is proposed to be removed and restored as a meadow area. The PCSWM plan (drawing 74 of 98) should note this information (asphalt removal).

This item is adequately addressed.

- ii. Clarification regarding the 24” pipe at Station 1318+00 must be provided. It appears this is the outlet pipe for the existing detention basin which discharges to the north side of the Turnpike. Based upon the storm sewer layout, it appears this basin discharge is proposed to connect to the 30” pipe from the inlet at 1317+50 right and outlet into the Basin 12-1 forebay. Information on how this existing basin was modeled should be noted in the PCSWM report.

This item is adequately addressed. The previous submission indicated an existing basin located at 1317+50 right. This basin does not exist but is part of a separate project for the service plaza. The PTC must coordinate the designs and update these plans if applicable. The service plaza improvements and stormwater management controls will be subject to Township review and approval.

- iii. The existing contours at Basins 12-1 to 12-3 must be clearly identified on the plans. It is unclear as to the impacts of the earthen berm (sound barrier) on the drainage patterns from the offsite areas. It appears the berm may restrict the flow of water from the offsite area creating a point discharge of runoff onto Thomas Road.

Existing contours within the proposed work limits, including Basins 12-1 to 12-4, are clipped and not shown on the PCSM Plans. Existing contours within the work limits are indicated on the existing conditions plans within the Erosion and Sedimentation Control Plans. For clarity purposes, I have no objections to this drafting standard.

Cross pipes have been added under the proposed berm to address the offsite drainage. This item is adequately addressed.

- iv. Design information for the proposed work in Thomas Road must be provided (area south of Station 9+00 does not appear to be indicated in the PCSWM plan set). Township Roadway Opening Permits are required for work within the Township road cartway and/or right-of-way. Amount of impact should be clearly identified on the plans and permits submitted to the Township.

Sheet 81 of 95 indicates the proposed stormwater improvements on Thomas Road. Pipe improvements include 14” x 23” storm sewer pipe located in Thomas Road. Material is not specified but it is anticipated to be RCP since metal pipe is not available in size. The use of corrugated metal storm pipe within Township public right-of-way is discouraged. The road opening permit approval is pending.

- v. An easement for the Detention Basin 14 outlet pipe appears to be required as it is partially outside the PTC right-of-way.

This item is adequately addressed.

- vi. Clarification related to the sanitary sewer located at approximate Station 1315+00 right must be provided. Fill is proposed to be installed in depths of excess of twenty (20) feet. The ownership and maintenance of the sewer main must be noted on the plans (PTC or Township). It is recommended that the condition of the main be evaluated prior to the placement of the fill to determine if the pipe should be replaced prior to the placement of the fill. The Turnpike should discuss the sanitary sewer line fill further with the Township Public Works Department.

The PTC has indicated they own the sewer line and will provide protection requirements for construction. Since the sewage from the PTC service area drains into the Township conveyance system, it is recommended that the method of protection be reviewed and approved with the Municipal Authority as damage to the private sewer line can create negative effect on the Township conveyance and treatment facilities.

- vii. Discharge from Basin facility 12-4 should be clearly identified to indicate the end discharge location on the proposed plans to Trout Creek. Discharge is not shown on the 10-24-12 plan submission package, and has changed from previous Design roundtable plans.

Basin 12-4 is proposed to discharge off of Thomas Road into the West Branch of Trout Creek. The drainage area to this point of interest (RN1) is increased by 30.28-acres. Based upon the Basins 12-1 to 12-4, the post developed peak rates are decreased to less than the pre-developed rates and the two-year volume controls are met. This 30.28-acre area previously discharged at various locations on the north side of the Turnpike (within Valley Forge National Park and the rear of Richard Road parcels) and eventually converged at the Turnpike crossing of Trout Creek (POI RN-2 – Station 1355+80 left). Although the peak discharge rates are controlled, it is recommended that the PTC review this configuration with the Township to discuss the existing problems along West Branch of the Trout Creek. The additional volume of runoff generated with this 30.28-acre drainage area may negatively impact the creek and adjoining properties. A more in-depth drainage impact analysis may be required.

- m. Point of Interest RQ
 - i. Clarification should be provided on how access to Basins 15-1 and 15-1A will be provided for future maintenance.

The PTC has indicated access is proposed from the Glenhardie community and is noted on the right-of-way plan set.

- ii. Specifications for the geomembrane should be noted on the construction details for Basins 15-1 and 15-1A (drawing 93 of 98).

This item is adequately addressed. The special provision (included within the electronic package submittal) has construction specifications for the geomembranes.

- iii. Channel capacity north of the existing Turnpike culvert on Trout Creek is a concern. Substantial debris is evident within the limits of the main channel between the Turnpike underpass and Richards Road which may affect discharge conveyance. The downstream channel capacity analysis should be performed below this POI.

The design engineer has acknowledged the history of flooding and debris accumulation at this location but has noted that the area is removed from the project site and not part of the PTC reconstruction project responsibility. The engineer has noted the post developed peak rates to this location will be reduced as a result of this project. The submitted calculations support this statement (reduction of post developed peak flow rates). The design engineer must review and provide clarification regarding the impacts of the increase volume of runoff from the proposed improvements.

- 20. Construction improvement plans that indicate the limits of roadway resurfacing for all Township owned roadways must be provided for review and approval.

The design engineer has indicated construction plans have been submitted in the Road Opening Permit application to the Township for review.

- 21. Zoning Ordinance Section 208-15.1.H - *Within the Flood Hazard District, all uses not allowed as permitted uses or authorized by grant of variance shall be prohibited. The following uses, when authorized as a conditional use, are subject to the general standards prescribed in §§ 208-105 and 208-117, provided that the applicant demonstrates to the reasonable satisfaction of the Planning Commission and Board of Supervisors that the grant thereof will not result in increasing the elevation of the one-hundred-year flood. No conditional use may be granted within the floodway if any increase in the one-hundred-year flood elevations would result.*

- 1. *Permeable improved parking areas and roads to serve other permitted uses in the Flood Hazard District or where required by the regulations for any contiguous district.*
- 2. *Roads, bridges and utility transmission lines.*
- 3. *A change in grade by either cut or fill, or a combination of both, may be permitted as a conditional use, but only upon the following conditions:*
 - a. *The effect is not to alter the cross-sectional area of the profile of the floodplain.*
 - b. *The effect is not to increase the elevation of the one-hundred-year flood.*
 - c. *The effect is not to increase the runoff characteristics of the area disturbed.*

The PTC should review the proposed impacts to the Flood Hazard District with the Township to determine the required zoning relief necessary.

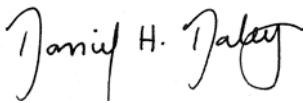
The design engineer has indicated that *the PTC is not subject to Tredyffrin Zoning Ordinances*. The PTC must supply written clarification regarding this interpretation which will be reviewed by the Township Zoning Officer and Township Solicitor.

New Comments – December 2, 2013

1. It is requested that the PTC comment on the use of road salt and other deicing products that are currently used and proposed to be used on the Turnpike and the affects of these products on the basin infiltration capacity, plant material within the basins and the overall soil profile.

If you should have any questions or require any additional information, please feel free to contact me.

Very truly yours,
EDWARD B. WALSH & ASSOCIATES, INC.

A handwritten signature in black ink that reads "Daniel H. Daley". The signature is written in a cursive style with a large, stylized 'D' and 'A'.

Daniel H. Daley, P.E.