

**Radnor Township**  
**Stormwater Management Advisory Committee (SWMAC)**  
**Agenda**  
**7:00pm, Thursday, February 11, 2016**



1. Call to Order.
2. Pledge of Allegiance.
3. Review / approve meeting minutes of January 14, 2016 SWMAC Meeting.  
**(5 minutes)**
4. Introduction of Timothy Sass, new SWMAC member.  
**(5 minutes)**
5. Public comment.  
**(10 minutes)**
6. Recap of February 8, 2016 Board of Commissioners meeting: SWMAC 2016 Budget and Presentation  
**(15 minutes)**
7. Discussion of repair budget prioritization.  
**(15 minutes)**
8. Possible action item for 2/22/2016 BoC Meeting: Proposal (CH2M) for Township Wide Assessment  
**(30 minutes)**
9. Old/New Business – Banbury Francis Draft RFP (CH2M), then (time permitting) update on current Repair Projects, Storm Sewer Inspection/TV, SWM Ordinance Revisions, Five Culvert Evaluation Report, RMS Connector  
**(40 minutes)**
10. Set the date and time for the next meeting and adjourn.

**ATTENDEES:** SWMAC: Heather Gill, Paige Maz, Regina Majercak, Charles Boschen,  
Paul Burgmayer, Joe Schanne  
CH2M: Daniel Wible

**PREPARED BY:** CH2M  
**MEETING DATE:** January 14, 2016  
**SUBJECT:** January 2016 meeting

**YouTube link:**

[https://www.youtube.com/watch?v=SGSJrdN9rSY&index=11&list=PLWSgQZEok8cWuk\\_of0zq2i9J-kzoKsYZx](https://www.youtube.com/watch?v=SGSJrdN9rSY&index=11&list=PLWSgQZEok8cWuk_of0zq2i9J-kzoKsYZx)

**Review of Previous Meeting Minutes**

- December 10, 2015 SWMAC meeting minutes – approved

**Public Comment**

- No public comment

**Election of Chair and Vice-Chair**

- Paige Maz elected new chair and Paul Burgmayer elected new vice-chair

**Action Items for 1/25/16 Board of Commissioners (BOC) Meeting**

- Single Family Residential (SFR) retroactive application – SWMAC voted in favor of making the SFR rebate program retroactive to 1/1/15
  - Paul to send recommendation memo to Steve on 1/15/16 so that it can be included in the 1/15/16 BOC meeting agenda
- CH2M proposal for Township Wide Assessment – Daniel presented slides summarizing the outline of the Township wide flood assessment
  - Daniel noted that the Township spans four watersheds (Darby Creek, Ithan Creek, Gulph Creek, and Meadowbrook Run) and that some of these, especially Darby Creek, extend well beyond the Township's borders
  - Daniel noted that the modeling effort will include a combination of hydrologic (areas with limited storm sewer data) and hydrologic/hydraulic modeling (areas with sufficient storm sewer data)
  - Joe noted that the flood assessment should also include those two relatively small areas that are not included in one of the four "main" watersheds
  - Daniel noted that the new study will be similar to the Ithan Creek assessment, but will entail more detailed modeling of somewhat larger areas such that the benefits of more than one conceptual solution could be analyzed for each priority problem area
  - Joe noted that this effort should include a comprehensive list of the known flooding locations throughout the Township from the various emergency services (fire departments, ambulance corps, police department, etc.); Daniel noted that this would be part of Task 1 of the new study
  - Daniel noted that several of the most significant known flood locations will require coordination/partnership with neighboring townships (Easttown and Newtown)
  - Daniel presented an outline of the Township wide flood assessment, in which the following six tasks are proposed:
    - Task 1 – Identification of Flood Risk Locations in Radnor Township

- Since this analysis was previously completed for Ithan Creek, that watershed will not be included in this task
- Task 2 – Data Gap Analysis and Data Collection
  - Daniel presented a table summarizing the type of information that is needed to build a hydraulic model, the potential sources for this information, and the relative cost for obtaining this information
  - Given the uncertainty associated with this task, the fee will be considered an “allowance” and CH2M will notify them the Township and SWMAC if additional fee is needed
  - SWMAC noted that the imminent storm sewer televising effort should be coordinated with this flood assessment in order to not duplicate efforts
  - *Post-meeting follow-up: the televising work will include storm sewer type, size, and condition*
- Task 3 – Enhanced Flood Modeling – Existing Conditions
- Task 4 – Identification of Site-Specific Conceptual Flood Mitigation Solutions
  - This task will include modeling of conceptual flood mitigation solutions in the priority problem areas
  - Daniel noted that identifying stormwater management / flood mitigation projects on private properties could be part of this task
- Task 5 – Prioritization of Township-Wide Conceptual Flood Mitigation Projects
  - Daniel presented examples of criteria ranking and prioritization of stormwater projects from a project in Philadelphia
- Task 6 - Development of Concept Plans
  - 6 concept plans were assumed
- The estimated fee range for this effort is from \$275,000 to \$300,000
- Joe suggested that Tasks 5 and 6 be considered optional tasks; Charles noted that Task 5 (prioritization) could be an important task and should be included
- SWMAC generally concerned about the anticipated price of flood assessment and requested CH2M explore ways for reducing it (e.g. eliminating Task 6)
  - Heather concerned about spending too much budget on detailed modeling when a higher level analysis closer to the Ithan Creek assessment might be sufficient
  - Regina/Charles noted that this effort, while expensive, would be a one-time study that would help guide future efforts
- CH2M will provide a detailed proposal to the Township and SWMAC to review prior to the February SWMAC meeting; it is anticipated that the SWMAC will make a final vote on the proposal at that meeting

#### BOC Discussion

- Commissioner Don Curley offered various thoughts on the direction of the SWMAC and the Township’s stormwater efforts in general
  - What has been done right according to Commissioner Curley:
    - Provided a public forum for discussing stormwater issues
    - The Banbury / Francis / Windsor project contained the elements (cost-benefit analysis, detailed modeling, etc.) that he has been looking for on other stormwater projects in the Township
  - What has been done wrong according to Commissioner Curley:
    - There has not been enough sensitivity and/or cost-benefit analysis conducted for projects such as. North Wayne basin, the Radnor Middle School pipe connection, and a recent dredging project

- Regina noted that the SWMAC was not involved in the decision-making process for most of those project examples
  - Misunderstanding between floodway and stormwater; the interventions for these issues are fundamentally different; interventions such as rain barrels are not the solution for flooding
  - Need to better define the problematic storm(s) for flood locations
  - Noted a trend toward resiliency with respect to floodways; trend is “to bend with it (the floodway) and safely pass the storm rather than fight the storm”
  - The link between the stormwater fee and the benefits it funds should be increased and more direct
  - Stormwater budget: there should be a comprehensive, parallel list of stormwater projects in each watershed; there needs to be clearer, more rational path between comprehensive and particular
  - The SWMAC should be more technically-oriented and less advocacy-oriented
    - For example, CARFAC provides clear technical guidance, while Planning is more advocacy-oriented; the SWMAC should act in a more similar way to CARFAC
- Recommended changes:
  - Commissioner Curley offered six recommendations for improving the SWMAC’s role:
    - Divide into geographic (or watershed) entities for budgeting purposes
    - More direct link between the stormwater fee and the intervention
    - Comprehensive, parallel list of projects that can provide a more analytical approach to decision-making; this would facilitate a more rational comparison of the options
    - Increase sensitivity analysis
    - SWMAC should be more technical
    - Stormwater fee should be going toward stormwater management / flood mitigation projects rather than emergency repairs and routine maintenance, which should come out of the general fund; Commissioner Curley plans to advance this notion with the BOC in the coming months
  - Conclusion: steps have been taken in both the right and wrong directions; the current direction is problematic, but it is not too late to “fix it”
  - Regina stated that stormwater projects should be prioritized / selected on a Township basis, not a watershed basis; Commissioner Curley suggested eliminating the fee or setting up an alternative fee structure
- Commissioner James Higgins urged the SWMAC to stay the course, be prudent and practical, and don’t get bogged down in theory; the majority of the BOC supports the SWMAC’s efforts to date

### Stormwater Budget Discussion

- Paul presented an overview of the updated stormwater budget
  - SWMAC recommends high-level 5-year budget based on annual % goals in 4 areas
    - Capital improvement – new projects / programs – transition to 67% per year
    - Repair / cleaning / MS4 – repair / replace / maintain infrastructure – transition to 20% per year
      - This budget allocation will be exceeded in 2016 and 2017 due to several previously approved culvert projects
    - Rebates / ODP incentives / grants – 5% per year
    - General engineering / administration – 8-10% per year
- Based on stormwater fee received each year (approximately \$1M)

- To date, nearly all stormwater dollars have been spent on repair projects
- Two areas (engineering / administration and rebates / incentives / grants) are well-defined and expected to be relatively consistent year-to-year
- Planned township-wide stormwater assessment will allow cost-benefit analysis (CBA) of capital projects and CBA of capital vs. repair
- Recommendations to BOC:
  - 5-year budget include large stormwater capital / repair programs *only* after BOC approval
    - Steve / Daniel to update budget monthly with specifics under major categories
  - Budget to be updated for BOC each time SWMAC presents BOC with new program
- Daniel to confirm that Mill Road and Malin Road culverts were approved; verify if “Malin Road” was supposed to be “Marlbridge Road”
- Daniel to confirm status of both storm sewer televising effort and culvert study
- General discussion regarding 20% annual allocation for repair / cleaning / MS4 category; Regina noted that the SWMAC encourages the BOC to consider shifting these expenses to the Township’s general fund
- SWMAC voted in favor of recommending to the BOC the budget allocations (%’s) listed above, for the 4 main categories

**Miscellaneous**

- Regina suggested open-forum work sessions to further discuss issues; this could expedite the decision-making process
- The March and April SWMAC meetings will likely be held in a different meeting room as the Radnorshire Room is booked

**Next SWMAC meeting: 2/11/16**

**Action Items**

- **CH2M** to provide Township with cost proposal to perform township-wide flood assessment
- **CH2M** to develop RFP for design of Banbury/Francis/Windsor flood mitigation project
- **CH2M** to work with Steve to clarify / confirm budget items noted above
- **Paul** to send Steve a memo recommending making the SFR rebate program retroactive to 1/15/16 (completed on 1/14/16)

Projected Radnor Township Stormwater Budget 2016-2020

Prepared by: PRB. Mods by JJS

Date: 12/29/15

= Target % of SW funding (year-to-year).

= Differing from target % of SW funding

YEAR (actual \$ and %)	2015\$	2015%	2016\$	2016%	2017\$	2017%	2018\$	2018%	2019\$	2019%	2020\$	2020%
<b>PLANNED REVENUES</b>												
Stormwater Fee Revenue	\$1,010,500		\$1,000,000		\$1,100,000		\$1,000,000		\$1,000,000		\$1,000,000	
Previous Year Balance	\$1,615,853		\$2,267,442		\$879,773		\$464,303		\$284,303		\$284,303	

<b>PLANNED EXPENDITURES</b>												
Repair/Maintenance/MS4	\$212,228	21.0%	\$657,669	66%	\$185,470	17%	\$200,000	20%	\$200,000	20%	\$200,000	20%
Culvert assessments (S)			\$41,500									
Replace Marlbridge Rd culvert			\$74,200									
Feasibility-Malin Rd culvert			\$11,313									
Repair Barley Cone Ln			\$12,029									
Marlbridge Rd replace + inspect			\$244,000									
Marlborough Rd pipe purchase			\$14,627									
Mill Rd culvert - GF			\$160,000									
Televised inspection			\$100,000		\$50,000		\$50,000		\$50,000		\$50,000	
Total committed R/M/MS4 \$\$			\$657,669		\$50,000		\$50,000		\$50,000		\$50,000	
Unused R/M/MS4 \$\$			\$0		\$135,470		\$150,000		\$150,000		\$150,000	
Capital Improvements	\$60,000	5.9%	\$1,600,000	160%	\$1,200,000	109%	\$850,000	85%	\$670,000	67%	\$670,000	67%
North Wayne Station			\$30,000		\$100,000							
Middle School Connection			\$150,000									
Banbury Francis Way			\$607,000		\$600,000							
Township-wide assessment			\$275,000									
Total committed Capital \$\$			\$1,062,000		\$700,000		\$0		\$0		\$0	
Unused Capital \$\$			\$538,000		\$500,000		\$850,000		\$670,000		\$670,000	
Admin/ General SW Engineering	\$84,683	8.4%	\$80,000	8%	\$80,000	8%	\$80,000	8%	\$80,000	8%	\$80,000	8%
Rebate/Credit/Grants	\$2,000	0.2%	\$50,000	5%	\$50,000	5%	\$50,000	5%	\$50,000	5%	\$50,000	5%
%/\$ of current year fees	\$358,911	35.5%	\$2,387,669	239%	\$1,515,470	139%	\$1,180,000	118%	\$1,000,000	100%	\$1,000,000	100%

<b>Year -End Balance</b>	\$2,267,442		\$879,773		\$464,303		\$284,303		\$284,303		\$284,303	
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*Stormwater Advisory  
Committee Budget  
Presentation*

2/8/16

Radnor Township

Board of Commissioners meeting

# Focus first on 2019 budget

Repair/Maintenance/MS4 20%  
 Capital Improvements 67%  
 Admin/Eng 8%  
 Rebate/Credit/Grants 5%

YEAR (actual \$ and %)	2015\$	2015%	2016\$	2016%	2017\$	2017%	2018\$	2018%	2019\$	2019%	2020\$	2020%
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Goal

Previous BoC-approved spending dominates spending in 2016-2017



# Why these percentages?

Repair/Maintenance/MS4	20%
Capital Improvements	67%
Admin/Eng	8%
Rebate/Credit/Grants	5%

- Capital Improvements
  - Belief that primary function of stormwater fee is to provide solutions to flooding
  - Bulk of \$\$ directed to capital improvements
- Repair/Maintenance/MS4
  - Ordinance specifies “maintain” which includes repair
  - 20% is less than % expended thru 2017 but is reasonable balance
- Rebate (SFR)/Credit-Incentive (ODP)/Grant
  - Current SFR rebate engages public in process in a more active way
  - Planned ODP credit/incentive can be useful tool in larger flood mitigation projects
- SW Engineering/Admin
  - Lubricant that keeps process moving – necessary cost

# Explaining 2016-2017

- Listed 2016-17 spending on capital and repairs determined by
  - prior BoC approval
  - Anticipated fixed costs (televised inspections)
- Admin/Eng and Rebates/Incentives fixed costs

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Unused Capital \$\$	\$538,000		\$500,000	
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\$/ of current year fees	\$2,387,669	239%	\$1,515,470	139%
Year -End Balance	\$879,773		\$464,303	

# Adding new projects to budget Proposal



- New **capital** and **repair** projects added to spreadsheet as BoC approves
  - Include expected future costs assuming project goes to completion
  - Impact on % yearly goals reflected in spreadsheet when presented to BoC for approval
- Prioritization process part of approval discussion
  - By mid-2016, capital spending to be based on township-wide prioritized list of capital improvements using township-wide engineering assessment
    - Banbury/Francis Way example of SWMAC capital project process
- SWMAC starting discussions on prioritizing repair projects

# *Asking BoC for approval of...*

- Stated percentage goals in the four categories
  - Repair/Maintenance/MS4 20%
  - Capital Improvements 67%
  - Admin/Eng 8%
  - Rebate/Credit/Grants 5%
- Proposed process for adding new projects



## *Proposed repair project prioritization and approval*

- *Meeting 1*
  - New projects introduced and justified by Steve/Dan
  - SWMAC asks follow-up questions and requests clarifications
    - Clarifying questions may continue after meeting as other info learned
- *Meeting 2*
  - If all questions answered, project formally voted on by SWMAC
    - If yes, ask for place on BoC agenda
      - May alter priority but assume go with Steve/Dan recommendation
    - If no, place on alternate list
- *BoC meeting*
  - Project presented to BoC
    - *Include impact of total project on budget goals*
- As project progresses, Steve/Dan update budget

**Radnor Township –  
Proposal for Radnor Township Watersheds  
Assessment**

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Submitted February 2016

Prepared by:



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# Purpose

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Radnor Township covers an area of approximately 13.8 square miles and spans four major watersheds (Ithan Creek, Darby Creek, Gulph Creek, and Meadowbrook Run), which are tributary to two regional watersheds (Ithan, Darby, and Meadowbrook Run contribute to the Delaware River, while Gulph contributes to the Schuylkill River). Contained within that Township is a wide variety of land uses, including high density residential, low density residential, transportation facilities, office building complexes, college/school campuses, commercial areas, historical areas, recreational facilities, and a major transportation corridor (I-476). As the Township developed over time, it became apparent that its drainage system was no longer adequate to effectively convey stormwater runoff in many areas and that, as a result, the Township experiences numerous areas of significant flooding, to a degree that homes, streets, driveways, and emergency services are frequently impacted.

The Radnor Township Stormwater Management Advisory Committee (SWMAC) has requested that their Stormwater Program Administrator, CH2M, conduct an assessment of flooding conditions throughout the Township. The purpose of the study is to assess the areas of existing flooding in the Township, the causes of the flooding, and potential solutions that can work both individually and collectively to best address (i.e. reduce if not eliminate) the identified areas of flooding. Such solutions could entail sustainable improvements in a variety of areas, such as streets, parking lots, schools, open space/undeveloped areas, and parks. The ultimate goal of this effort is to identify viable, cost-effective, and community-enhancing conceptual solutions that will lead to meaningful improvements in flooding conditions throughout Radnor Township.

## Scope of Work

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The following Scope of Work proposes the following five tasks:

- **Task 1:** Identification of Flood Risk Locations in Radnor Township (all 4 watersheds)
- **Task 2:** Data Gap Analysis and Collection
- **Task 3:** Enhanced Flood Modeling (Existing Conditions)
- **Task 4:** Identification and Modeling of Conceptual Flood Mitigation Solutions
- **Task 5:** Prioritization of Conceptual Flood Mitigation Projects.

It is anticipated that this Township-wide flood conditions assessment and the results developed based on the analysis, will both create a blueprint for future flood mitigation projects throughout the Township.

### Task 1 – Identification of Flood Risk Locations in Radnor Township

CH2M will perform a flooding analysis of all four watersheds in Radnor Township in order to better understand known flooding locations and to identify previously unknown flooding locations. Prior to commencing with this analysis, CH2M will familiarize itself with available information related to flooding problems in this watershed, including, but not limited to, previous studies, observations, complaint records, and anecdotal information provided by interviews with the SWMAC and/or the Township.

CH2M will develop a flood model of the Township in order to identify those areas with the greatest likelihood of flooding. Specifically, CH2M will use its own Flood Modeller two-dimensional rapid simplified hydraulic modeling software to yield a relatively quick representation of the location, extent, and severity of

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known flooding locations in the watershed and to identify additional areas that may be prone to flooding. CH2M will model the entire Township for up to three different storm scenarios and map the results alongside known problem areas, including those identified in the Darby and Cobbs Creeks Watershed Act 167 Stormwater Management Plan. This analysis will also facilitate the identification of locations where additional, more detailed data collection and modeling work may be required in Tasks 2 and 3. CH2M will perform site investigations, as necessary, to inform its investigation of the flooding causes. The following steps will be performed to complete Task 1:

- **Document Known Flood Problems**
  - Review a variety of sources/stakeholders (PennDOT, emergency services, etc.), in addition to Township staff to include a variety of experiences in the documentation effort. Up to three stakeholder meetings will be held with groups of stakeholders to:
    - Discuss the magnitude and history of known problem areas
    - Review potential additional problem areas as indicated by preliminary rapid inundation modeling results (from 2015 Ithan Creek watershed assessment) and obtain feedback on the magnitude of the problems and history of these locations as known by stakeholders
    - Collect any additional problem area locations identified by stakeholders, along with magnitude and historical information
- **Refine and Expand Flood Modeller Model**
  - Utilize existing Ithan Creek Watershed Flood Modeller FAST model with improved downstream boundary conditions and refine the previously developed 2D (Flood Modeller) model for the Gulph Creek, Darby Creek, and Meadowbrook Run watersheds, as well as the two areas of the Township not located in one of the four main watersheds, as needed to include more detailed representations of topographical obstructions such as bridges and culverts (see Figure 1)
- **Define Preliminary Problem Areas**
  - Define preliminary problem area locations within the entire Township (including areas outside the four main watersheds). Preliminary problem areas will be defined using model results developed in the previous step as well as known flood areas documented in the first step of Task 1 based on stakeholder meeting documentation, mapping information, and problem location information available from the Township.
- **Identify Priority Problem Areas for Detailed Study**
  - Identify flood risk locations from the list of preliminary problem areas defined in the previous step for more detailed study. Priority problem areas will be those which impact homes/streets/driveways/emergency services during the 25-year storm event. The following will be performed for identified priority problem areas:
    - Quantify flood extents/depths at identified locations
    - Develop a high-level ranking system
    - Apply the raking system to rank and prioritize flood risk locations in order of severity

Task 1 Assumptions:

- Up to 3 meetings with Township staff, stakeholders, and SWMAC representatives to review and discuss known flooding problems

Task 1 Milestones and Deliverables:

- Township-wide map illustrating all identified/catalogued flood problem areas, including rank for priority problem areas based on this task
- Technical presentation documenting known flooding areas, expanded flood model results, preliminary problem areas, and priority problem areas identified for further study



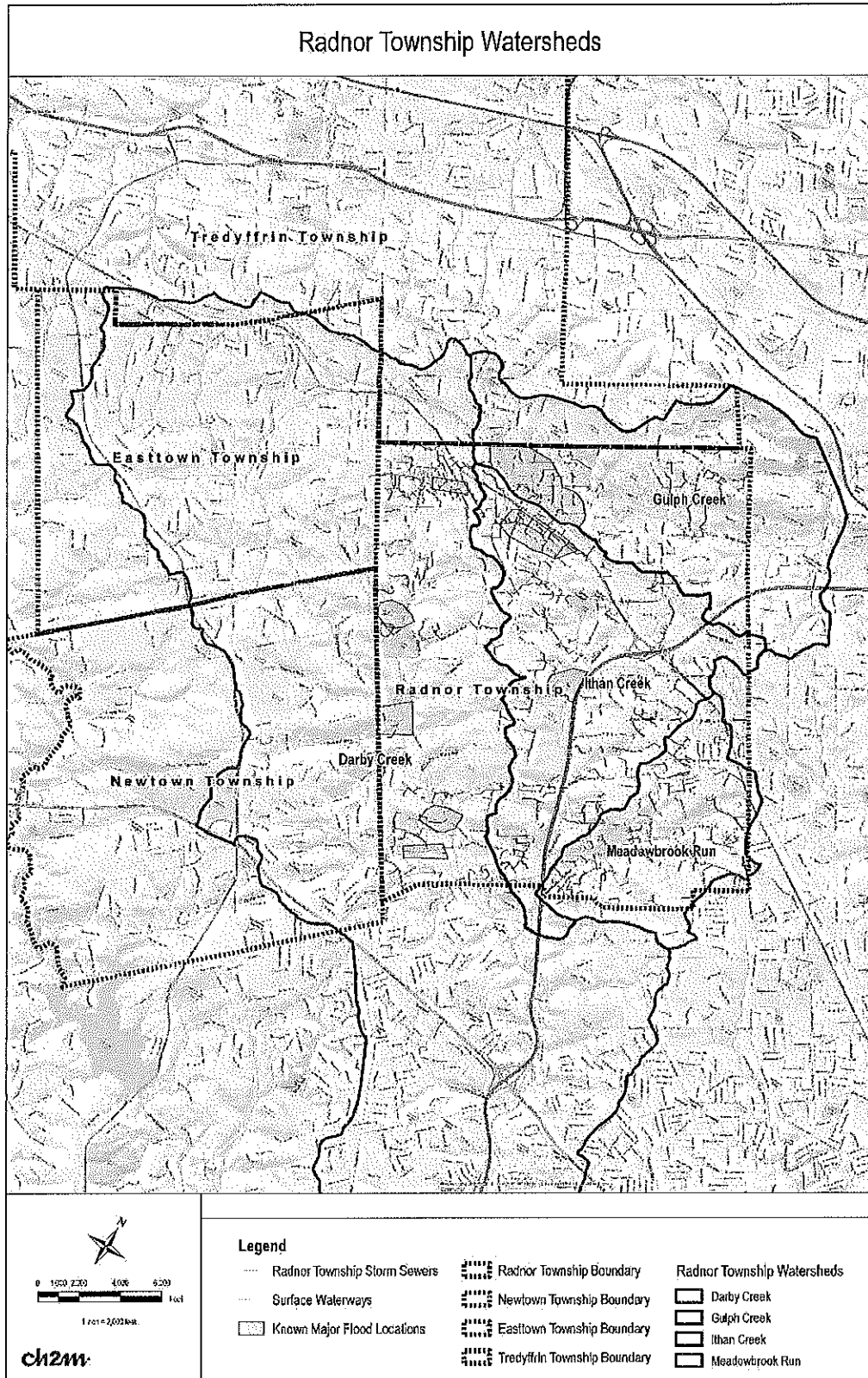


Figure 1: Radnor Township watersheds

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## **Task 2 – Data Gap Analysis and Collection**

The purpose of this task is to identify data gaps and collect the information required to develop enhanced flood models of the priority problem areas for use in Task 3. The following steps will be performed to complete Task 2:

- **Delineate Priority Problem Drainage Areas**
  - Delineate contributing watersheds upstream of priority problem areas identified in Task 1. Identify key model development locations and likely trunk sewer locations within the priority drainage areas. This will include the Radnor Middle School stormwater system, as well as the proposed N. Wayne basin.
- **Review Existing Information and Identify Data Gaps**
  - Review available information in priority problem area drainage areas, including existing hydraulic modeling, record drawings, etc.
  - Identify data gaps in the existing information that will need to be filled prior to Task 3. Data gaps may include missing connectivity, invert, or diameter information in the storm sewer system.
- **Collect Additional Data**
  - Collect needed information via records research and field investigation to facilitate the development a geodatabase for stormwater infrastructure. This geodatabase will only include information needed to build SWMM models of the priority problem areas identified in Task 1. Data will be collected for priority problem areas until the allocated budget for this task has been exhausted.

### **Task 2 Assumptions:**

- Radnor Township will provide access to electronic and hard copy record drawings and data on an as needed basis for the duration of this task
- Radnor Township will provide authorization for CH2M to open/access and inspect storm sewer structures located in open areas and the public ROW
- CH2M will make reasonable assumptions to fill out any data gaps (storm sewer connectivity, inverts, diameters, etc.) remaining at the conclusion of this task

### **Task 2 Milestones and Deliverables:**

- Organized electronic appendix of collected research and field data
- Geodatabase with storm sewer features updated based on records research and field investigations

## **Task 3 – Enhanced Flood Modeling – Existing Conditions**

The purpose of this task is to develop hydrologic and hydraulic models for the priority problem areas established in Task 1. Such detailed models will facilitate the modeling of conceptual flood mitigation solutions in Task 4, which will in turn facilitate a cost/benefit analysis for decision making purposes (Task 5). The following step will be performed to complete Task 3:

- 1D (SWMM) and 2D (Flood Modeller) modeling of contributory drainage areas and storm sewer networks upstream of priority problem areas that have adequate data available from Task 2 investigations to support modeling needs.

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### Task 3 Assumptions:

- Drainage areas outside Radnor Township will be modeled hydrologically only. Existing Flood Insurance Study models will be utilized for hydraulics where available.
- Results from each model will be compared to up to two historical validation data points, if available.
- Focus on modeling high risk areas identified in Task 2 and that have adequate data collected to support detailed hydraulic modeling.
- Detailed modeling will be limited to the extents needed to fully investigate priority problem areas and potential solutions.
- Model will include existing Radnor Middle School stormwater system, as well as proposed N. Wayne basis.
- CH2M assumes that detailed models will be developed for 7-8 priority problem areas

### Task 3 Milestones and Deliverables:

- Technical memorandum summarizing the assumptions, methodologies, limitations, and results of the analysis conducted
- Presentation on CH2M's findings at a regularly scheduled monthly SWMAC meeting

## Task 4 – Identification and Modeling of Conceptual Flood Mitigation Solutions

For this task, CH2M will establish a framework for identifying conceptual stormwater solutions for the most severe flooding locations as determined in the previous tasks that will not only reduce flooding but also achieve multiple other objectives, such as community enhancements, groundwater recharge, and water quality improvements. Specifically, CH2M will identify specific and/or high-level categories (or “programs”) of conceptual solutions for flooding locations throughout the Township watersheds meeting a minimum severity threshold as determined in the previous tasks. Examples of conceptual solution categories/programs include green infrastructure, detention, and conveyance.

CH2M will develop a watershed map indicating general locations for the various specific solutions or solution categories, noting potential linkages where planned capital improvements and partnering opportunities with other stakeholders, such as PennDOT and Villanova University, can be integrated. While our approach will emphasize low impact development / green infrastructure / sustainable storm water management solutions that address runoff at its source, we will also consider enhanced conveyance options or structural solutions when appropriate. In addition, we will identify potential functional relationships with other existing and/or proposed (as part of this study) stormwater solutions within the Township watersheds, recognizing that the most effective solutions will likely be those that enhance or are enhanced by other existing and/or proposed solutions.

The second part of this task will entail integrating the conceptual solutions into the model developed as part of Task 3. Specifically, CH2M will develop and model up to three alternative conceptual solutions for each problem location. In addition, CH2M will develop conceptual-level cost estimate (AACE Class 4: -30% to +50%) for each conceptual solution. The results of this task (high level benefits and costs) will facilitate a prioritization of the various conceptual solutions in Task 5.

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#### Task 4 Assumptions:

- CH2M assumes that this scope will entail modeling up to three alternative conceptual solutions for 7-8 priority problem areas, or up to 21-28 conceptual solutions.

#### Task 4 Milestones and Deliverables:

- Develop preliminary Township watersheds map depicting potential solutions and/or solution categories for flooding locations meeting a minimum severity threshold as determined in the previous tasks
- Review meeting with representatives of the Township and the SWMAC to discuss preliminary potential project solution map and matrix
- Final Township watersheds map with potential solution categories depicted
- Memorandum summarizing the assumptions, methodologies, and results of this task; the memorandum will include the final summary list of potential specific solutions and/or solution categories and their respective high-level benefits and costs
- Presentation on CH2M's findings at a regularly scheduled monthly SWMAC meeting

### **Task 5 – Prioritization of Conceptual Flood Mitigation Projects**

CH2M will meet with representatives of the Township, the SWMAC, and possibly other stakeholders (as determined by the Township) to conduct a prioritization workshop for the potential flood mitigation projects identified in the previous tasks. The result of this workshop will be a refined assessment of prioritization criteria that will allow CH2M to subsequently rank the identified potential flood mitigation projects. The workshop will include field visits of selected sites with representatives of the Township, the SWMAC, and possibly other stakeholders.

CH2M anticipates facilitating a multi-variable prioritization process to gain input on the relative importance of various criteria from the SWMAC, Township, and other stakeholders in attendance. The key potential ranking criteria may include the following: public safety, flooding frequency and severity, number of properties affected in a problem cluster, quality of life, environmental impacts, and economic impacts. Results will be used to rank potential flood mitigation projects based on the criteria, and can serve as a guide for the development of future Stormwater Fee Program investments.

#### Task 5 Milestones and Deliverables:

- Workshop with representatives of the Township and the SWMAC to review potential flood mitigation projects and establish prioritization criteria for ranking said projects
- Prioritized list of potential flood mitigation projects
- Memorandum summarizing the methodology, description of criteria, ranking results, and all key assumptions
- Presentation of summary findings at a regularly scheduled monthly SWMAC meeting

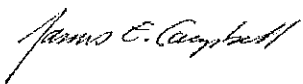
# Budget

Task	Fee
Task 1 – Identification of Flood Risk Locations in Radnor Township	\$22,169
Task 2 – Data Gap Analysis and Collection	\$43,834
Task 3 – Enhanced Flood Modeling (Existing Conditions)	\$70,876
Task 4 – Identification and Modeling of Conceptual Flood Mitigation Solutions	\$94,998
Task 5 – Prioritization of Conceptual Flood Mitigation Projects	\$16,526
Project Management / Administration	\$9,704
<b>TOTAL FEE</b>	<b>\$258,107</b>

# Schedule

This work will be completed in accordance with the following approximate schedule, which is partially dependent on several review periods and meetings with the SWMAC and Township:

Milestone	Weeks from Preceding Milestone NTP	Approximate Date
Task 1 – Identification of Flood Risk Locations in Radnor Township	4	TBD
Task 2 – Data Gap Analysis and Collection	4	TBD
Task 3 – Enhanced Flood Modeling (Existing Conditions)	4	TBD
Task 4 – Identification and Modeling of Conceptual Flood Mitigation Solutions	6	TBD
Task 5 – Prioritization of Conceptual Flood Mitigation Projects	2	TBD

	240-563-4220, Jed.Campbell@CH2M.com	2/2/16
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**AUTHORIZED SIGNATURE**

**PHONE & EMAIL**

**DATE**

**TO BE EXECUTED BY RADNOR TOWNSHIP IF APPROVED**

**Robert A. Zienkowski Manager/Secretary**

**DATE**