

APPENDIX D PROBLEM AREAS AND OBSTRUCTIONS

GENERAL BACKGROUND

Development causes a wide range of adverse impacts on water resources. The urbanization of the land typically results in impervious areas being directly connected to stormwater conveyance systems, which then are discharged directly to streams, or through man-made channels. This results in stormwater runoff being conveyed as fast as possible to receiving waters, which decreases the opportunity for infiltration, water quality treatment, and evapotranspiration. It is now recognized that because stormwater runoff is discharged to streams in this manner, small storm events can result in increased stormwater runoff flows that significantly increase the frequency and duration of stream flows and cause accelerated erosion. Figure 1 depicts the impact of urbanization on stormwater runoff.

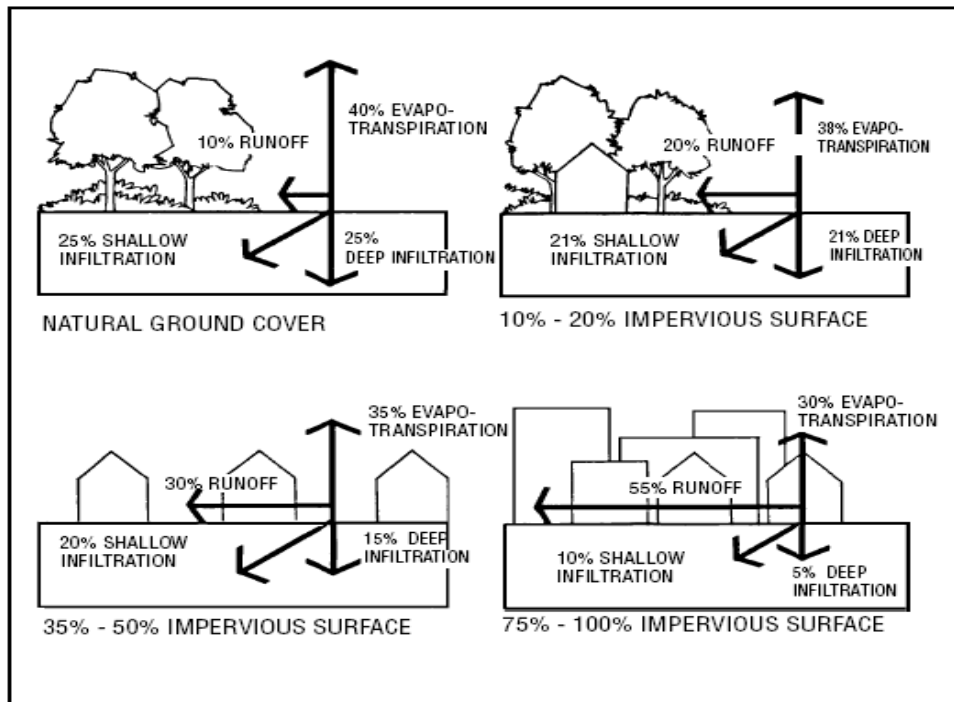


Figure 1: Impact of land urbanization on stormwater runoff
(Source: Center for Watershed Protection)

It is important for Dauphin County to have sound stormwater management planning, since this is critical in the areas already affected and currently unaffected by stormwater problems. For areas which are currently being affected, the occurrence of flooding has been mainly during larger storm events, but the frequency and severity of these events is increasing as development continues. The Act 167 Plan addresses future, more frequent flooding problems in these areas by managing runoff from newly developing areas. For areas currently unaffected by stormwater problems, the Act 167 Plan imposes peak rate and volume controls on future development to aid in preventing future stormwater runoff problems.

Some drainage problems occur on a yearly basis. Continued development within Dauphin County may amplify these problems. Remedial actions may be necessary to correct drainage problems. In the long term, a comprehensive approach is needed to address stormwater related problems. Any long term solution to these problems will have to incorporate regulations and development standards into local ordinances, consider both on-site and off-site drainage, provide a consistent approach between municipalities, use natural elements for the transport and storage of stormwater runoff, consider both quantity and quality of water, and treat the watershed as a whole.

DEVELOPMENT OF A SYSTEMATIC APPROACH FOR THE CORRECTION OF EXISTING PROBLEM AREAS

During this planning effort, correction of Dauphin County's existing problem areas has been given a new significance compared to the previously completed watershed-wide Act 167 plans. Section 5(b)(5) of the Act states that the Plan shall include "a survey of existing drainage problems and proposed solutions."

The following information provides a framework for how municipalities can use the information contained within this Plan as a guide to preventing new problem areas from occurring while striving to resolve existing problem areas:

- Existing drainage problems (in areas previously not covered under existing Act 167 plans) have been documented through interaction with WPAC.
- Refer to the five (5) previously completed watershed-wide Act 167 plans for problem areas contained within those areas.
- Implementation of the stormwater runoff control criteria specified in this Plan has been designed to prevent the existing drainage problems from becoming worse.
- Implementation of the stormwater runoff control criteria specified in this Plan has been designed to prevent the creation of new stormwater drainage problems.
- The hydrologic model developed to formulate the stormwater runoff control criteria may be used as an analytical tool for designing engineering solutions to existing drainage problems.

Based on the above, it is encouraged that each municipality take the following steps to implement solutions to the existing stormwater drainage problem areas:

- Review the list of known problem areas contained within their municipality and review the conceptual solutions as included in this Plan.
- Prioritize the list of stormwater drainage problems within their municipality based on frequency of occurrence, potential for injury to persons or property, damage history, public perception of the problems, estimated project costs, and other appropriate cost/benefit criteria.

- For the top priority stormwater drainage problems in the municipality, it is recommended that detailed engineering evaluations be conducted to determine the exact nature of the problems (if not known), alternative solutions be designed, cost estimates for the alternative solutions be provided, and a course of municipal action is encouraged. The number of stormwater drainage problems to be evaluated by a municipality should be based on a schedule compatible with completing engineering studies on all problem areas within approximately five years. The hydrologic models used in this Act 167 study are available to provide peak flow data as input to the engineering studies.
- On priority and cost basis, it is recommended to incorporate implementation of recommended solutions to the drainage problems in the annual municipal capital budget or the municipal maintenance budget as funds are available. Other options to assist in project implementation include applying for Federal and State financial assistance through either loans or grants.

It is important to emphasize that the above stated procedure for dealing with existing stormwater drainage problem areas is not a mandatory action placed on municipalities with the adoption of the Plan. Rather, it represents a systematic method to approach the problems uniformly throughout Dauphin County. The key elements involved in the success of this strategy will be the dedication of the municipalities to secure funding and construct the corrective measures. The final design of any solutions should be consistent with all stormwater runoff control criteria specified in the Plan. The latter element is essential to ensure that remedial measures do not become obsolete (under-designed) by increases in the volume of stormwater runoff with continued development. It is anticipated that the minimum objectives of this Plan and the minimum mandates of Act 167 can be accomplished without significant modification of existing municipal procedures.

PROBLEM AREA IDENTIFICATION

The purpose of this section is to identify the location and nature of existing drainage problems within Dauphin County, determine conceptual solutions for the most significant problems, and provide recommendations that may be implemented through the Dauphin County Act 167 Plan.

The Act 167 Questionnaire that was distributed during Phase II was the main source of information regarding the identification of problem areas and obstructions in Dauphin County. For this planning effort, Dauphin County was divided into three (3) Planning Regions. The largest effort was invested in the Southern Planning Region, because this is the first Act 167 planning effort in that region. Moreover, the Central and Northern Regions of Dauphin County are largely covered by existing Act 167 plans. Those plans, identified in Table 1, are incorporated into this planning effort by reference, and as such, problem areas and obstructions identified in previous Act 167 plans are not duplicated in this Plan. Therefore, only new problem areas and obstructions identified in areas where previous Act 167 plans were not in place are included herein.

Table 1: Previously Completed Act 167 Plans in Dauphin County

PLAN NAME	WATERSHEDS	MUNICIPALITIES	PLAN DATE
Mid-Dauphin Basins	Fishing Creek, Stony Creek, Clark Creek, Powell Creek, Armstrong Creek, and Gurdy Run	Dauphin Boro. Halifax Boro. E. Hanover Twp. Halifax Twp. Jackson Twp. Jefferson Twp. Middle Paxton Twp. Reed Twp. Rush Twp. Susquehanna Twp. Wayne Twp. W. Hanover Twp.	June 2003
Wiconisco Creek Watershed	Wiconisco Creek	Berrysburg Boro. Elizabethville Boro. Gratz Boro. Lykens Boro. Tower City Boro. Millersburg Boro. Williamstown Boro. Jackson Twp. Jefferson Twp. Lykens Twp. Mifflin Twp. Porter Twp. Rush Twp. Tremont Twp. Upper Paxton Twp. Washington Twp. Wiconisco Twp. Williams Twp.	July 2005
Spring Creek Watershed	Spring Creek (West)	Harrisburg City Paxtang Boro. Penbrook Boro. Lower Paxton Twp. Swatara Twp. Susquehanna Twp.	August 2005
Paxton Creek Watershed	Paxton Creek	Harrisburg City Penbrook Boro. Lower Paxton Twp. Susquehanna Twp.	September 2005
Multi-Creek Watersheds	Beaver Creek, Manada Creek, Bow Creek and Kellock Run	E. Hanover Twp. Lower Paxton Twp. Swatara Twp. S. Hanover Twp. W. Hanover Twp.	December 2005

After reviewing the Questionnaire, the basin characterization and problem area identification began with a review of existing information concerning Dauphin County's stormwater system, streams, and tributary drainage basins. Field reconnaissance was subsequently conducted to confirm existing conditions, assess problem locations, identify the general drainage patterns, and determine subwatershed divides for modeling purposes.

Northern Planning Region

Five (5) municipalities in this region returned the Questionnaire but only three (3) municipalities reported the problem areas and obstructions they experience during storm events. The three (3) municipalities that reported problems are: Halifax Township, Upper Paxton Township and Wiconisco Township. Wiconisco Township was addressed in the Wiconisco Creek Watershed Act 167 Plan. Halifax Township reported a total of seven (7) problem areas, however five (5) of the seven (7) were addressed in the Mid-Dauphin Basins Act 167 Plan, so those problem areas will not be addressed in this Plan. The remaining two (2) are tributary to the Susquehanna River, therefore will be included in this plan. Upper Paxton Township was included in the Wiconisco Creek Watershed Act 167 Plan, but the problem area they reported was on Mahantango Creek, so it has been addressed in this Plan.

The primary reason for the reported flooding problems within the Northern Planning Region of Dauphin County appears to be the insufficient capacity of the existing storm sewers or undersized roadway culverts. However, other problems occur in areas where there is only a partial storm sewer system. In addition, some problem areas are located in floodplain areas.

Central Planning Region

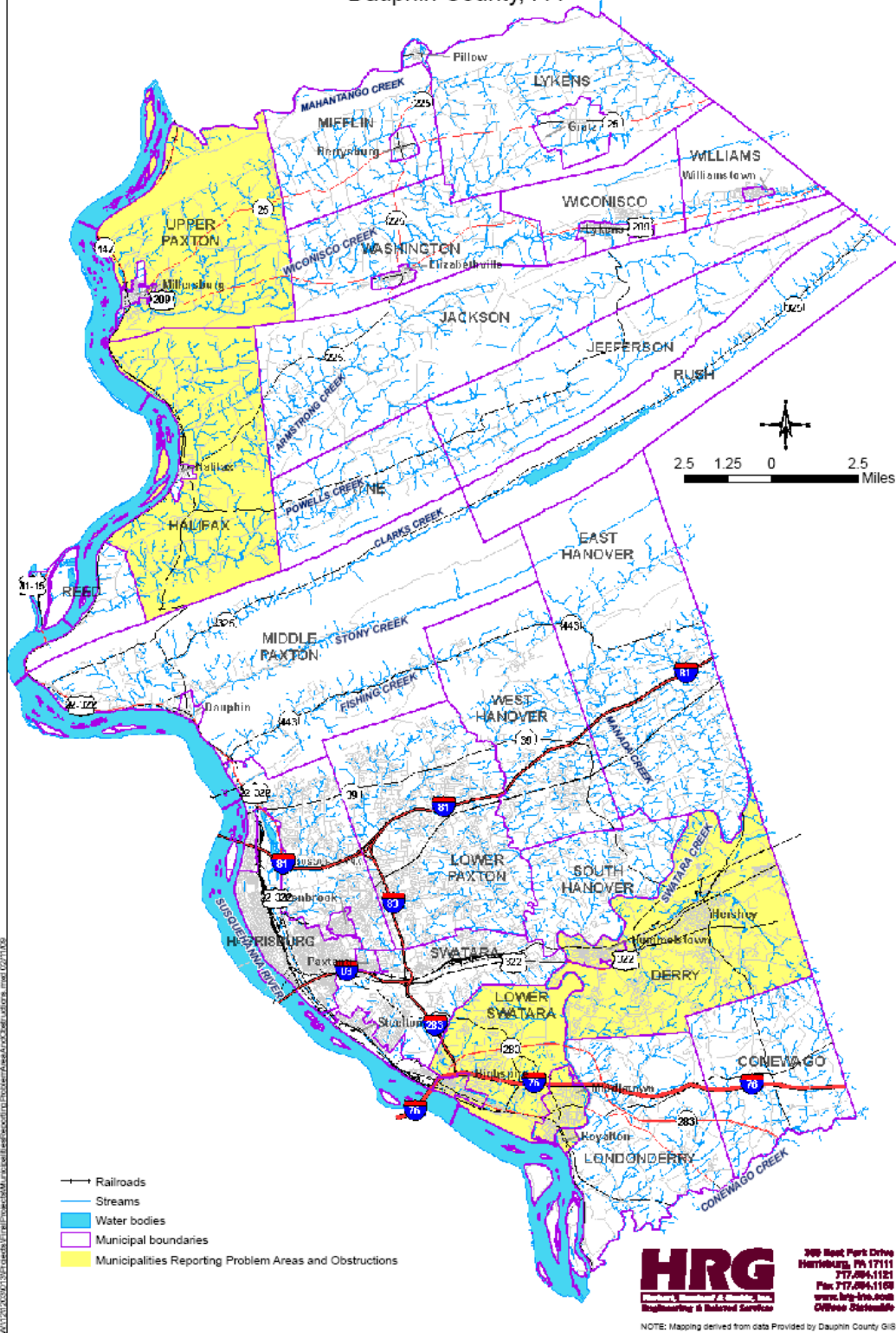
Only the City of Harrisburg and East Hanover Township in this Planning Region returned the Questionnaire and reported the problem areas and obstructions they experience during storm events. However, the City of Harrisburg was included in the Paxton Creek Watershed Act 167 Plan and East Hanover Township was included in the Mid-Dauphin Basins Act 167 Plan, so they have not been evaluated under this Plan.

Southern Planning Region

All ten (10) municipalities in Southern Planning Region returned the Questionnaire but only seven (7) municipalities reported the problem areas and obstructions they experience during storm events. The seven municipalities that reported problem areas include: Derry, Swatara, and Lower Swatara Townships, and Hummelstown, Middletown, Royalton, and Highspire Boroughs. Swatara Township was covered by the Spring Creek Watershed Act 167 Plan and has not been evaluated under this Plan.

The reported flooding problems within the Southern Planning Region are the result of several causes. Some problems occur in areas where the existing storm sewer system has insufficient capacity while others occur in areas where there is a lack of a comprehensive collection and conveyance system. Some problems occur due to lack of maintenance; for example, when catch basins become plugged, local flooding occurs. In addition, some problem areas are located within floodplain boundaries. It was found that the majority of the problem areas are more pronounced in denser populated areas. A number of these stormwater related problems have also been traced back to uncontrolled stormwater runoff from local and upstream areas.

Municipalities Reporting Problem Areas and Obstructions
 Dauphin County Act 167 Plan
 Dauphin County, PA



PROBLEM AREAS SOLUTION DEVELOPMENT

Field views were conducted on all the problem areas and obstructions submitted by the municipalities via the Questionnaire. Possible solutions were offered by either the municipality or the HRG project engineer, based on a field view of the area. It is important to note that these solutions are conceptual and additional in-depth analyses of system capacities associated with these problem areas and obstructions should be conducted to assess whether the existing stormwater runoff conveyance systems are undersized and contributing to the reported problems. Most importantly, public feedback through interviews with local residents who witnessed flooding events should also be considered in evaluating stormwater conveyance system capacities.

There are a number of municipalities in Dauphin County covered under this Plan, and the problem areas and obstructions have been assigned ID codes as indicated in Table 2 and used in Table 3 and Table 4 and Drawings 1 through 32. The reported problem areas and obstructions are listed in Table 3.

Table 2: Municipality Code Designations

REGION	MUNICIPALITY	MUNICIPAL CODE
Northern Dauphin County	Upper Paxton Township	UP
Central Dauphin County	N/A	
Southern Dauphin County	Derry Township	D
	Highspire Borough	HB
	Hummelstown Borough	H
	Lower Swatara Township	LS
	Middletown Borough	M
	Royalton Borough	R

Table 3: Problem Areas and Obstructions

ID	MUNICIPALITY	LOCATION	DESCRIPTION	POSSIBLE SOLUTION	DETAILED EVALUATION?
D1	Derry Township	500 Block Of East Chocolate Avenue	Culvert	Increase pipe size under route 422; add inlet at low point of route 422; relocate inlet on private property.	Y
D2	Derry Township	Between Governor Road & Fishburn Road	Flooding On Cocoa Avenue	Install larger storm sewers and enlarge channel.	Y
D3	Derry Township	Mill/Cherry Streets	Flooding	Install supplemental storm sewer.	Y
D4	Derry Township	West Chocolate Avenue	Roadway Intersection Flooding	Install additional storm sewer.	Y
D5	Derry Township	422/322 Cloverleaf	Highway Flooding	Enlarge culverts under roadways.	Y
D6	Derry Township	Intersection Of Wood And Bullfrog Valley Roads	Flooding On Wood Road	Enlarge roadway culvert and channelization upstream.	Y
D7	Derry Township	Sunset Drive	Street Flooding	Install a storm sewer and channelization.	Y
D8	Derry Township	Bindhagle Road	Street Flooding	Relocate roadway.	Y
D9	Derry Township	Cocoa Avenue	Street Flooding	Install storm sewer system.	Y
D10	Derry Township	Forest Avenue	Street And Property Flooding	Install larger storm sewer system.	Y
D11	Derry Township	Hershey Park Drive	Street And Property Flooding	Enlarge culverts under railroad and downstream roadways.	Y
D12	Derry Township	Lucy Avenue	Property Flooding	Install storm sewer.	Y
D13	Derry Township	Mill Road Underpass	Street Flooding	Install storm sewer.	Y
D14	Derry Township	Palmdale Park	Park Flooding	Construct detention basin upstream of park.	Y
D15	Derry Township	Norfolk Southern RR	Property Flooding	Install storm sewer.	Y
D16	Derry Township	Highmeadow Camp	Property Flooding	Install storm sewer and channelization.	Y
D17	Derry Township	West Mansion Road	Property And Roadway Flooding	Replace bridges.	Y
HA1	Halifax Township	38 & 67 Pawnee Lane	Property Flooding	Increase Pipe Size.	N
HA2	Halifax Township	Buffalo Park Road	Roadway Flooding	Relocate Roadway.	N
H1	Hummelstown Borough	East End Around Main/Walton Intersection	Flooding	Install storm sewer.	Y
H2	Hummelstown Borough	Hammond Property	Flooding	Install a Larger Storm Sewer Under Roadway and Widen Channel.	Y
H3	Hummelstown Borough	Kokomo Ave - from Hanover to Dock Street	Flooding	Remove Structures from Floodplain.	N

ID	MUNICIPALITY	LOCATION	DESCRIPTION	POSSIBLE SOLUTION	DETAILED EVALUATION?
H4	Hummelstown Borough	N. Alley & M.H. Railroad Tracks	Flooding	Install Storm Sewer from Main St. To 2 nd St.	N
H5	Hummelstown Borough	Circle Drive From Dock Street Eastward.	Flooding	Remove Structures from Floodplain.	N
H6	Hummelstown Borough	Railroad & Duke St (At Duke Street Bridge)	Flooding	Remove Debris and Sediment from Bridge Openings.	Y
H7	Hummelstown Borough	Sweet Arrow Drive	Flooding	Remove Structures from Floodplain.	N
H8	Hummelstown Borough	Dareen Drive	Flooding	Needs More Clarification and Investigation.	N
H9	Hummelstown Borough	Main Street At Railroad Crossing	Debris And Flooding	Replace pipe under main street with larger size.	N
H10	Hummelstown Borough	West Main Street - from John to Duke Street	Flooding	Evaluate Capacity Of Storm Sewer Pipe And Increase Size if Necessary.	N
H11	Hummelstown Borough	Sweet Arrow Drive	Flooding	Flood Proof, or Remove Structures From Floodplain.	N
H12	Hummelstown Borough	West Main Street & Village Lane	Flooding	Flood Proof, or Remove Structures From Floodplain.	N
H13	Hummelstown Borough	Handwerk Property	Flooding	Remove structures from floodplain.	N
H14	Hummelstown Borough	L.D.H.S. Band Field	Flooding	Place More Fill On The Field To Elevate It and Provide Additional Inlets.	N
HB1	Highspire Borough	Burd Run	Stream Bank Erosion	Continue channelization work.	Y
HB2	Highspire Borough	Burd Run	Stream Bank Erosion	See HB1	Y
HB3	Highspire Borough	Burd Run Outlet	Undersized Culvert	Replace culvert.	N
HB4	Highspire Borough	Burd Run	River Sedimentation And Street Flooding	Periodic Cleaning of Pipe Outfall. Possibly Extend Pipe Closer to Main Channel of River.	Y
LS1	Lower Swatara Township	Airport Connector	Flooding Due To Undersized Culverts	Construct Flood Detention Ponds and Pump Stations.	Y
LS2	Lower Swatara Township	Olmsted Plaza	Flooding Due To Undersized Culverts	See LS1	Y
LS3	Lower Swatara Township	HIA/PA Air National Guard Base	Flooding Due To Undersized Culverts	See LS1	Y

ID	MUNICIPALITY	LOCATION	DESCRIPTION	POSSIBLE SOLUTION	DETAILED EVALUATION?
LS4	Lower Swatara Township	Jednota Flats	Flooding Due To Undersized Culverts	See LS1	Y
M1	Middletown Borough	Emaus Street	Street Flooding	Investigate Storm Sewer System in the Area.	N
M2	Middletown Borough	Maple Road to Few Avenue	Flooding	Enforce Floodplain Rules. Flood Proof or Remove Structures Located in Floodplain.	N
M3	Middletown Borough	Caravan Court & Adelia Road	Flooding	Enforce Floodplain Rules. Flood Proof or Remove Structures Located in Floodplain.	N
M4	Middletown Borough	Hoffer Park	Flooding	Enforce Floodplain Rules. Consider Elevating the Road Higher Than a Design Flood Level.	N
M5	Middletown Borough	Wood Street, Emaus To Wilson	Flooding	Enforcing Floodplain Rules. Flood Proof or Remove Structures in Floodplain.	N
R1	Royalton Borough	400 Shippen Street	Flooding	Enforce Floodplain Regulations. Flood Proof or Remove Structures in Floodplain.	N
R2	Royalton Borough	500 Canal Street	Flooding	Enforce Floodplain Rules and Regulations. Flood Proof or Remove Structures in Floodplain.	N
UP1	Upper Paxton Township	Snyder Mill Road	Roadway Flooding	Elevate the Roadway Higher than Design Flood Elevation.	Y

The Act 167 stormwater problem area identification and solution development process involved a more detailed study of selected significant problem areas and obstructions in an effort to identify the nature of the problem and determine estimated cost of possible solutions. Of those problem areas identified, 31 were selected for further analysis based on the severity of the problem. The selected problem areas are identified in Table 3 with a “Y” in the Detailed Evaluation column. It is important to note that other smaller and less significant obstructions are also listed above in Table 3. The conceptual solutions to the problem areas and obstructions mentioned below were developed with these parameters in mind: cost, available area, and efficiency. Table 4 provides the page number reference for the detailed description of the selected problem areas and the recommended solutions.

Table 4: Problem Area Page References

PROBLEM AREA ID	MUNICIPALITY	LOCATION	PAGE REFERENCE
D1	Derry Township	500 Block of East Chocolate Avenue	12
D2	Derry Township	Between Governor Road & Fishburn Road	15
D3	Derry Township	Mill/Cherry Streets	19
D4	Derry Township	West Chocolate Ave	21
D5	Derry Township	422/322 Cloverleaf	23
D6	Derry Township	Intersection of Wood & Bullfrog Valley Roads	25
D7	Derry Township	Sunset Drive	28
D8	Derry Township	Bindnagle Road	31
D9	Derry Township	Cocoa Avenue	33
D10	Derry Township	Forest Avenue	35
D11	Derry Township	Hershey Park Drive	37
D12	Derry Township	Lucy Avenue	39
D13	Derry Township	Mill Road Underpass	42
D14	Derry Township	Palmdale Park	44
D15	Derry Township	Norfolk Southern RR	46
D16	Derry Township	Highmeadow Camp	48
D17	Derry Township	West Mansion Road	50
H1	Hummelstown Borough	East End around Main/Walton Intersection	52
H2	Hummelstown Borough	Hammond Property	54
H6	Hummelstown Borough	Railroad & Duke St (At Duke Street Bridge)	56
HB1	Highspire Borough	Burd Run	58
HB4	Highspire Borough	Burd Run	60
LS1 – LS4	Lower Swatara Township	Airport Connector	62
UP1	Upper Paxton Township	Snyder Mill Road	65

PROBLEM AREA D1- DERRY TOWNSHIP – 500 BLOCK OF EAST CHOCOLATE AVENUE

DESCRIPTION

- Flooding of Route 422 and the parking lot by the car dealership (Chevrolet of Hershey) have been reported (Photo 1 and Drawing No. 1). There is an existing catch basin in the vegetated area between the auto dealership and the Highmark building on the north side of Route 422 (Photo 2).
- Stormwater runoff that enters the existing catch basin is conveyed by an 18-inch diameter pipe under Route 422, where the flow is discharged to open ground on the Spring Creek Golf Course (Photo 3).
- The existing pipe does not have enough capacity to drain all the stormwater reaching the inlet efficiently during large storm events. In addition, the inlet is not located at the lowest point in the grassy swale area. Storm runoff ponds in the grassy area and the corner of the parking lot.
- Water also ponds on E. Chocolate Avenue at a low point just west of the inlet, creating a traffic hazard.



Photo 1 - Aerial View of Problem Area D1



E. CHOCOLATE AVE.

MANSION RD.

LEGEND

— S — PROPOSED STORM SEWER



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DAUPHIN COUNTY
 ACT 167 STORMWATER MANAGEMENT STUDY
 PROBLEM AREAS
 D1 - DERRY TOWNSHIP - EAST CHOCOLATE AVENUE
 DAUPHIN COUNTY PENNSYLVANIA

PROJ. MGR. - MSB
DESIGN- ATB
CADD-
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SCALE- 1" = 300'
DATE- 12-9-08

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OF
PROJECT 1203.0013



Photo 2 - View of the stormwater catch basin

CONCEPTUAL SOLUTION

- The drainage area that is contributing to this site is about 10-acres (0.02-square miles).
- A short term economical solution to alleviate some of the nuisance ponding of stormwater runoff would be the addition of another stormwater catch basin, and connection to the existing conveyance system.
- It will be necessary to add an additional inlet at the low point of E. Chocolate Avenue and replace the 18-inch pipe under Route 422 (Photo 3) to eliminate the ponding and flow of storm runoff along E. Chocolate Avenue. A preliminary analysis shows that a 30-inch pipe could pass the 50-year storm event.



Photo 3 - Existing 18-inch pipe under Route 422

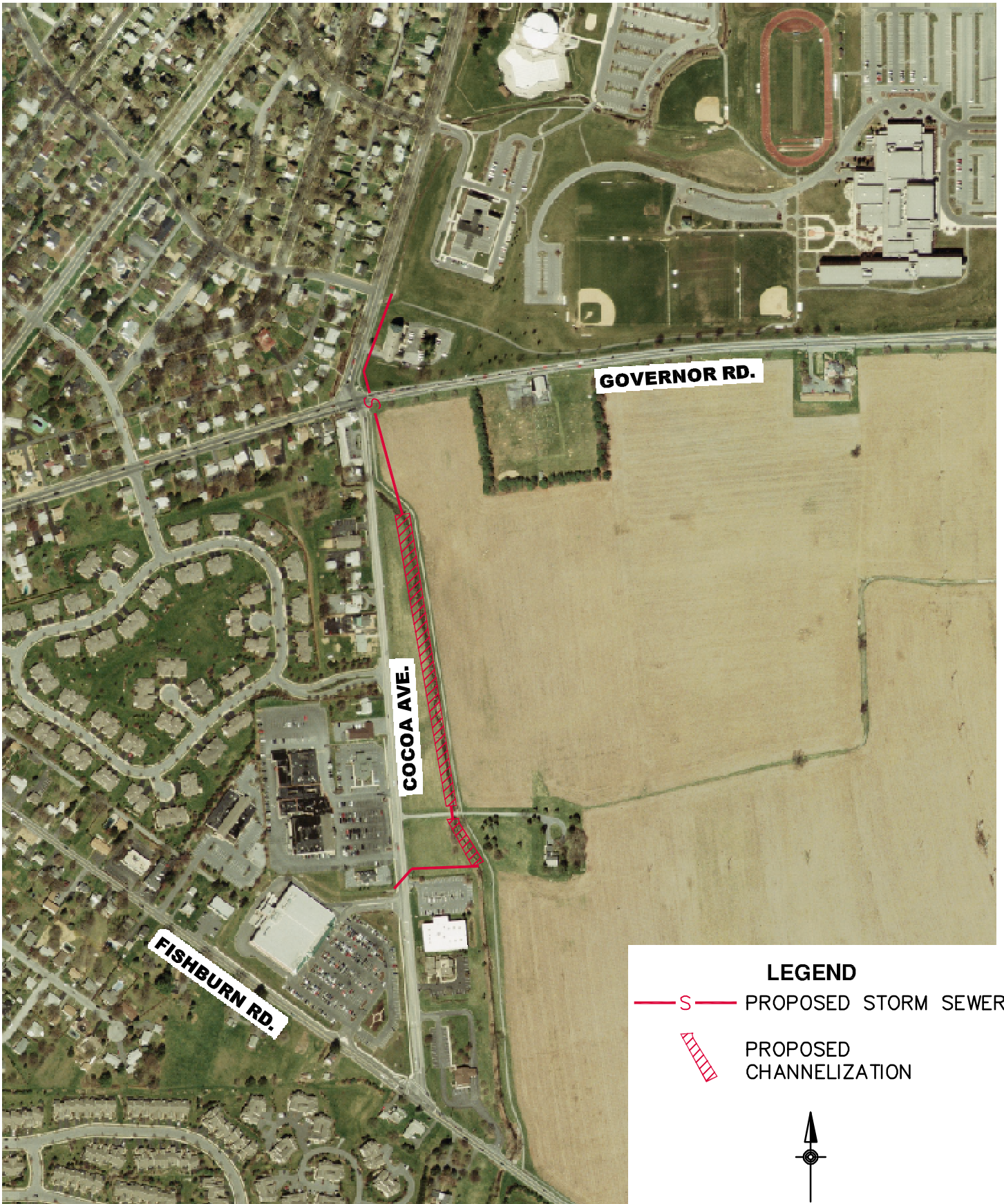
PROBLEM AREA D2 - DERRY TOWNSHIP – BETWEEN GOVERNOR ROAD AND FISHBURN ROAD

DESCRIPTION

- Flooding and channel erosion have been occurring along Cocoa Avenue, in the shopping center parking lot, and on several private properties near Governor Road. The primary cause of these problems is the lack of capacity in various roadway culverts and stream channels (Table 5 and Drawing No. 2). The other reason is due to flooding of the stormwater catch basins located along the roadway. The catch basins discharge to the east, via a box culvert under Cocoa Avenue, into an adjacent field where discharge is conveyed via a swale into a tributary of Spring Creek (East). The receiving swale, which carries stormwater runoff appears to be full of sediment, and does not function as intended. As a result, the drainage system does not operate properly.
- The culvert located under Cocoa Avenue does not have enough capacity; therefore, flooding of Cocoa Avenue between Governor Road and Fishburn Road has been reported. In addition, erosion (Photo 4) was observed in the swale adjacent to Fulton Bank (Photo 5).
- The series of pipes and box culverts near the intersection of Cocoa Avenue and Governor Road do not have sufficient capacity to convey the 10-year storm event. As a result, the intersection and private properties on the west side of Cocoa Avenue are subject to periodic flooding.

Table 5: Existing Stormwater Facilities of Cocoa Avenue

LOCATION AND PROPOSED IMPROVEMENT	DRAINAGE AREA (SQ.MI.)	EXISTING FACILITY
Culvert under Cocoa Avenue near Fulton Bank	0.05	18" RCP
Culvert under private driveway	1.41	5' X 3.5' Conc. Arch
Culvert under Cocoa Avenue just south of Governor Road	1.50	2 – 42" RCP
Culvert under Governor Road	1.53	6' x 5' Conc. Box
Culvert under Cocoa Avenue just south of Valley Road	1.54	11' x 3.5' Conc. Box



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DAUPHIN COUNTY
ACT 167 STORMWATER MANAGEMENT STUDY
PROBLEM AREAS
D2 - DERRY TOWNSHIP - GOVERNOR ROAD

DAUPHIN COUNTY

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Photo 4 - Looking south on Cocoa Avenue



Photo 5 - Eroded endwall by Fulton Bank west of Cocoa Avenue

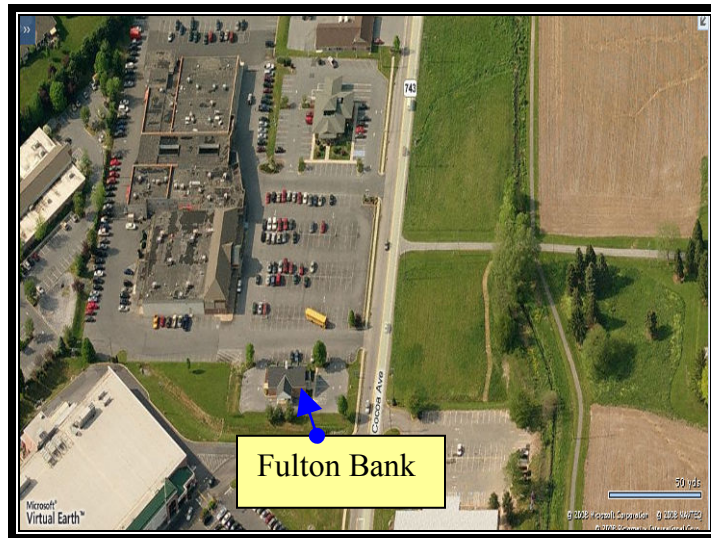


Photo 6 - Aerial view of Cocoa Avenue

CONCEPTUAL SOLUTION

- Clean the roadway stormwater catch basins.
- A preliminary analysis based on Manning's equation shows that a 48-inch pipe with a length of 275-feet should be constructed by Fulton Bank (Table 6).
- In addition, two (2) 66-inch pipes 20 feet long should be constructed under the private driveway (Table 6) east of Cocoa Avenue (Drawing No. 2).
- The channel downstream of the private driveway culvert should be widened in order to convey the increased amount of stormwater runoff (Drawing No. 2). However, further investigation must be conducted to evaluate the capacity of the channel downstream of Governor Road to ensure there will be no increase in flooding in the park, especially near the pool and ball fields. This will require detailed survey data.
- Two (2) 72-inch pipes should be constructed under Governor Road (Table 6), to eliminate the flooding problem at the Cocoa Avenue intersection with Governor Road.

Table 6: Proposed Stormwater Facilities for the Cocoa Avenue System

PROPOSED IMPROVEMENT	RECOMMENDED FACILITY
Culvert under Cocoa Avenue near Fulton Bank	One (1) - 48" CMP, 275' Long
Culvert under private driveway	Two (2) - 66" CMP, 20' Long
Culvert under Governor Road	Two (2) - 72" CMP, 800' Long

PROBLEM AREA D3 - DERRY TOWNSHIP – MILL/CHERRY STREETS

DESCRIPTION

- Flooding of buildings, streets and parking lots in the area of Mill Street and Cherry Drive has been reported (Photo 7 and Drawing No. 3).
- There is an existing storm sewer that runs northward under Mill Street and Cherry Street from Governor Road (Route 322) to a discharge point at the quarry ponds north of the railroad tracks.
- The contributing drainage area at the quarry discharge point is approximately 1.04-square miles, at Route 422 it is 0.95-square miles, and at the intersection of Governor Road and Cherry Street it is 0.51-square miles.
- The existing storm sewer system is undersized for the level of existing land development and the amount of impervious cover in the contributing watershed.

CONCEPTUAL SOLUTION

- Clean the sediment from the stormwater catch basins and pipes in the shopping center parking lot.
- Install a new storm sewer parallel to the existing storm sewer with inlets and pipes of sufficient supplemental capacity, so that together, the existing and proposed system can handle the 50-year return frequency storm event. Drawing No. 3 illustrates the approximate alignment of the new sewer system. Assuming an average proposed system slope of 1.0 percent, the proposed storm sewer ranges in size from 30-inches between Governor Road and Cedar Avenue, 48-inches between Cedar Avenue and Route 422, and 60-inches from Route 422 to the quarry outfall.



Photo 7 - Sedimentation and Flooding Problems at STAPLES



—S— PROPOSED STORM SEWER

LEGEND



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PROBLEM AREAS
D3 - DERRY TOWNSHIP - MILL / CHERRY STREETS

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PROBLEM AREA D4 - DERRY TOWNSHIP – WEST CHOCOLATE AVENUE

DESCRIPTION

- West Chocolate Avenue has experienced several flooding events at the intersection with Swatara Avenue.
- The intersection of West Chocolate and Swatara Avenues is a low spot of the roadway (Photo 8 and Drawing No. 4). There are no stormwater catch basins at the low point, so stormwater runoff ponds until it either infiltrates or evaporates. The drainage area contributing to this low spot is approximately 10-acres.



PHOTO 8 - Aerial View of the intersection of Swatara Avenue and West Chocolate Avenue


CONCEPTUAL SOLUTION

- Install stormwater catch basins, and a 30-inch storm sewer that would tie into the recommended storm sewer system of Problem Area D3 – Mill/Cherry Streets (Drawing No. 3).



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— S — PROPOSED STORM SEWER



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 ACT 167 STORMWATER MANAGEMENT STUDY
 PROBLEM AREAS
 D4 - DERRY TOWNSHIP - WEST CHOCOLATE AVENUE
 DAUPHIN COUNTY PENNSYLVANIA

PROJ. MGR. - MSB
DESIGN- ATB
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DATE- 12-9-08

DRAWING NO. 4
SHEET NO. OF
PROJECT 1203.0013

PROBLEM AREA D5 - DERRY TOWNSHIP – 422/322 CLOVERLEAF

DESCRIPTION

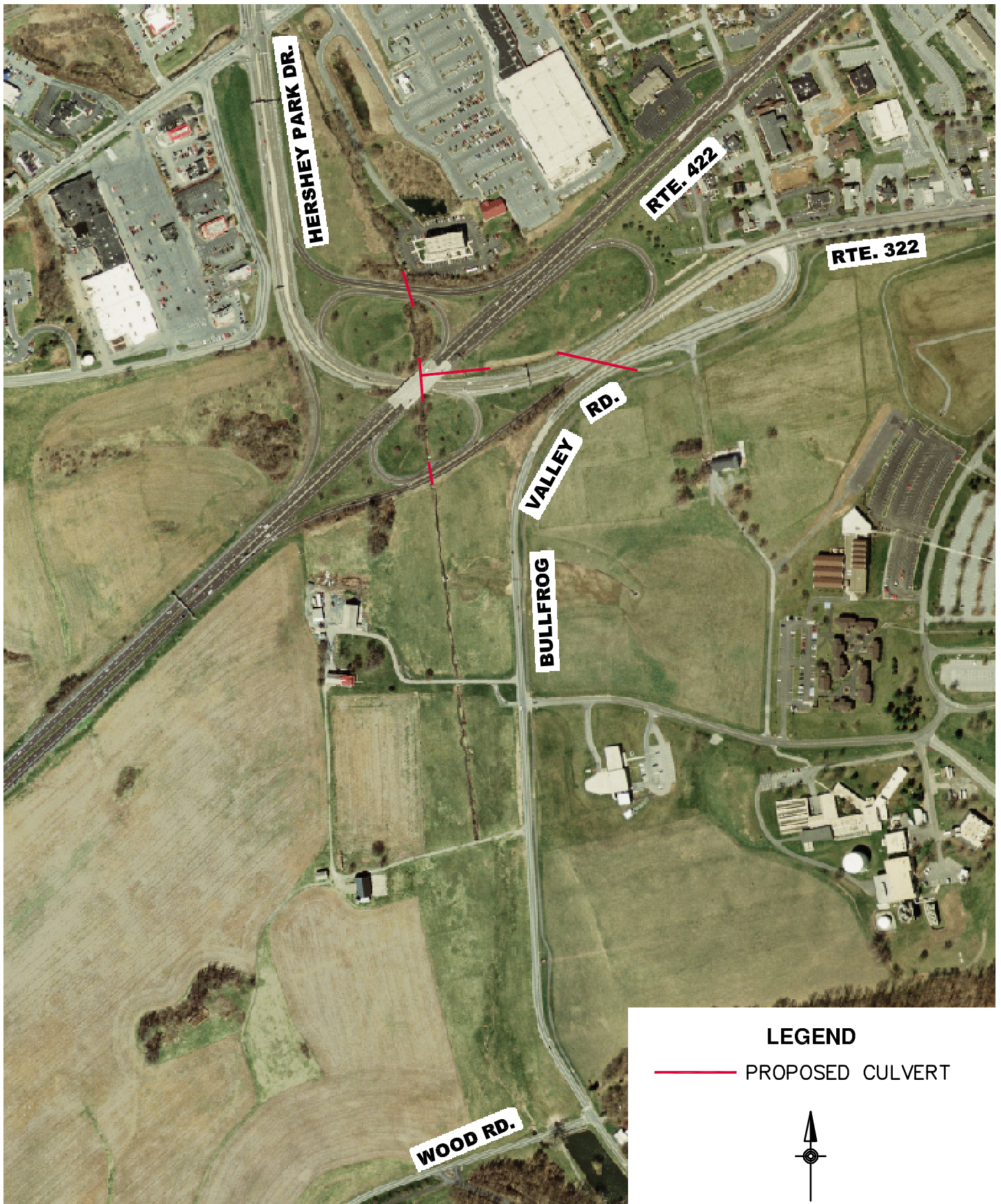
- A flooding problem has been reported along Bullfrog Valley Road at the Route 422/322 interchange.
- The drainage system is comprised of an unnamed tributary to Swatara Creek running south to north that roughly parallels Bullfrog Valley Road from south of Wood Road to the Route 322/422 interchange (Drawing No. 5).
- There is also another tributary that collects runoff from east of Bullfrog Valley road and enters the Route 422/322 system via a culvert under the roadway just downstream of the large stormwater detention pond on the Hershey Hospital grounds.
- There is a series of 48-inch pipes under the Route 422/322 interchange (Photo 9).



Photo 9 - Upstream end of the existing culvert under the Route 322 ramp

CONCEPTUAL SOLUTION

- The results of a preliminary analysis show conveying the 25-year event requires a total of three (3) 48-inch pipes under each ramp and the main roadway of the Route 322/422 intersection (Drawing No. 5) for the stream paralleling Bullfrog Valley Road and a single 48-inch pipe under Bullfrog Valley Road and Route 322 for the tributary.



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 ACT 167 STORMWATER MANAGEMENT STUDY
 PROBLEM AREAS
 D5 - DERRY TOWNSHIP - 422 / 322 INTERCHANGE
 DAUPHIN COUNTY PENNSYLVANIA

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SCALE- 1" = 500'
DATE- 12-9-08

DRAWING NO.
5
SHEET NO.
OF
PROJECT 1203.0013

PROBLEM AREA D6 - DERRY TOWNSHIP – INTERSECTION OF WOOD AND BULLFROG VALLEY ROADS

DESCRIPTION

- Flooding of Wood Road near the intersection with Bullfrog Valley Road has been reported (Photo 10 and Drawing No. 6).
- The right bank of the stream that flows under Wood Road has been significantly eroded just upstream of the pedestrian bridge. Gabion baskets placed in the stream have been eroded around at their tie-in location within the stream banks (Photo 11).
- During flood events, the pond located near the intersection of Wood Road and Bullfrog Valley Road has been inundated and stream flow has overtopped Wood Road. The standpipe installed in the pond appears to be undersized and does not function properly. The pond's emergency spillway elevation and width is inadequately sized to prevent the stream flow from overtopping the pond, eroding the embankment, and flooding Wood Road. The pipe carrying flow from the emergency spillway under Wood Road also has insufficient capacity.



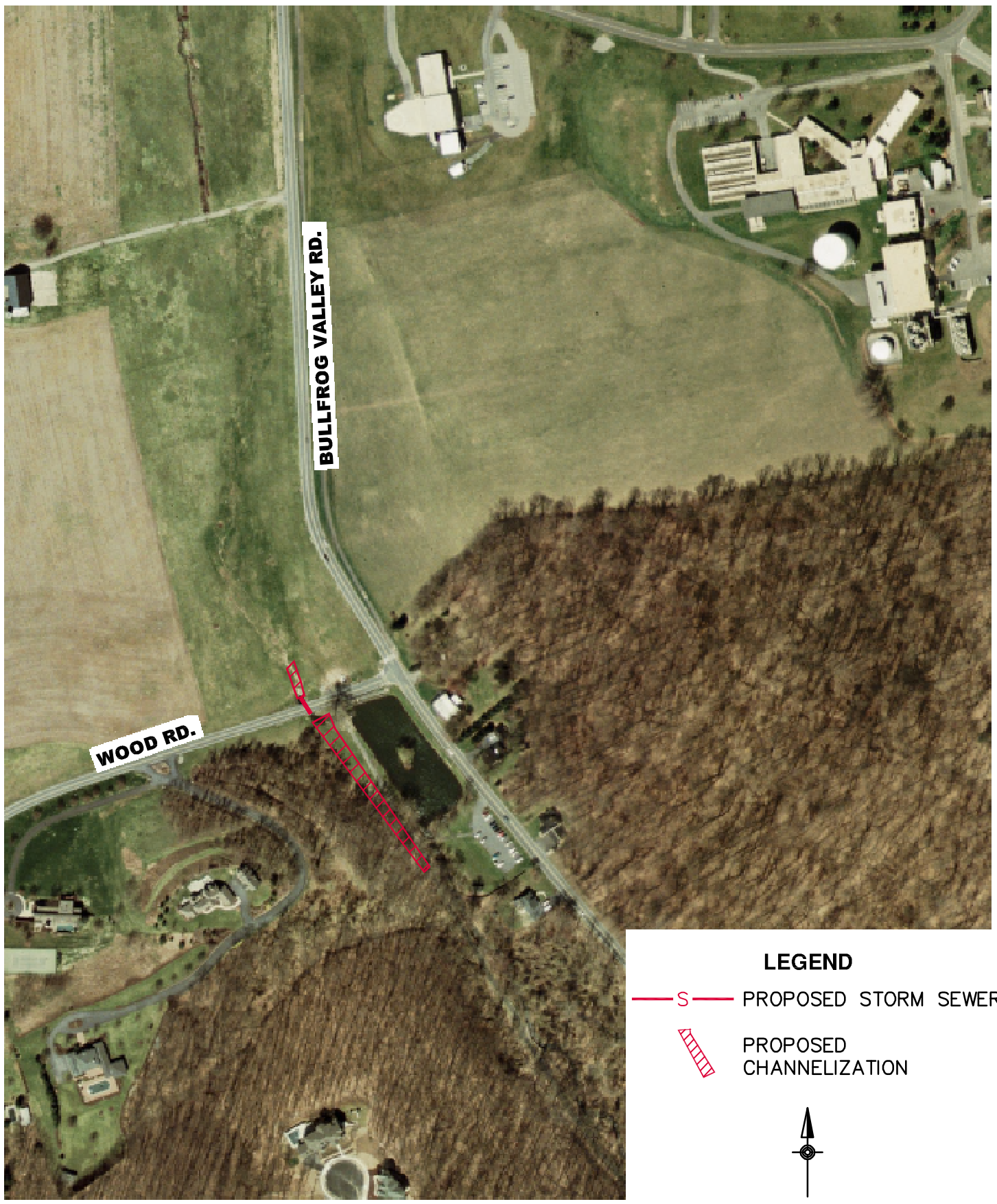
Photo 10 - Flooding of the Wood Road Pond





Photo 11 – Erosion at gabions upstream of pond

CONCEPTUAL SOLUTION

- To minimize the flooding conditions that have been experienced periodically, it is recommended that the culvert under Wood Road be replaced (Drawing No. 6), and the short segment of storm sewer just north of Wood Road be removed. This will require relocating a major water pipeline that parallels the north side of Wood Road. The existing gabion weirs upstream of the pond on the south side of Wood Road should be evaluated for their impacts on flooding and stream meandering and the eroded channel should be repaired.



LEGEND

-  PROPOSED STORM SEWER
-  PROPOSED CHANNELIZATION



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- Derry Township is considering replacing the footbridge upstream of the pond with a new bridge with greater capacity.
- Since the pond does not provide any flood protection benefit, a bypass channel should be constructed on the west side of the pond, so that high flows could bypass the pond, thereby protecting the embankment and outlet structure.
- The outlet structures of the pond (primary and emergency) should be replaced with a system that can handle higher flows without suffering from erosion.
- In addition to the culvert replacement at Wood Road, it will be necessary to improve the channel flood capacity downstream of Wood Road for the design storm event. The low flow channel was designed to handle the 2.33-year return period flow (often referred to as the annual average flow rate). The overbank flow area north of Wood Road should be designed to handle the 50 year return period flow once the storm sewer is removed (Table 7).



Photo 12: Aerial View of Wood Road

Table 7: Recommended Engineering Solutions for the Flooding Problem on Wood Road

LOCATION	EXISTING CULVERT	RECOMMENDED IMPROVEMENTS	NOTES
Upstream of Pond	-	Channelization	Widen and armor existing channel.
Under Wood Road	60"	2 – 60"	Add one (1) 60" pipe. Keep existing pipe.
Under Water Line	24"	Channelization	Remove existing pipe. Relocate water line and create an open channel.
Between Wood Road and Route 322 Ramp	--	Restore low-flow channel and enlarge flood channel near Wood Road	Re-grade flood channel as needed to protect pedestrian path.
Under entrance to Technical Center	24' Arch	No change	Existing culvert is adequate for 50 year event

PROBLEM AREA D7 - DERRY TOWNSHIP – SUNSET DRIVE

DESCRIPTION

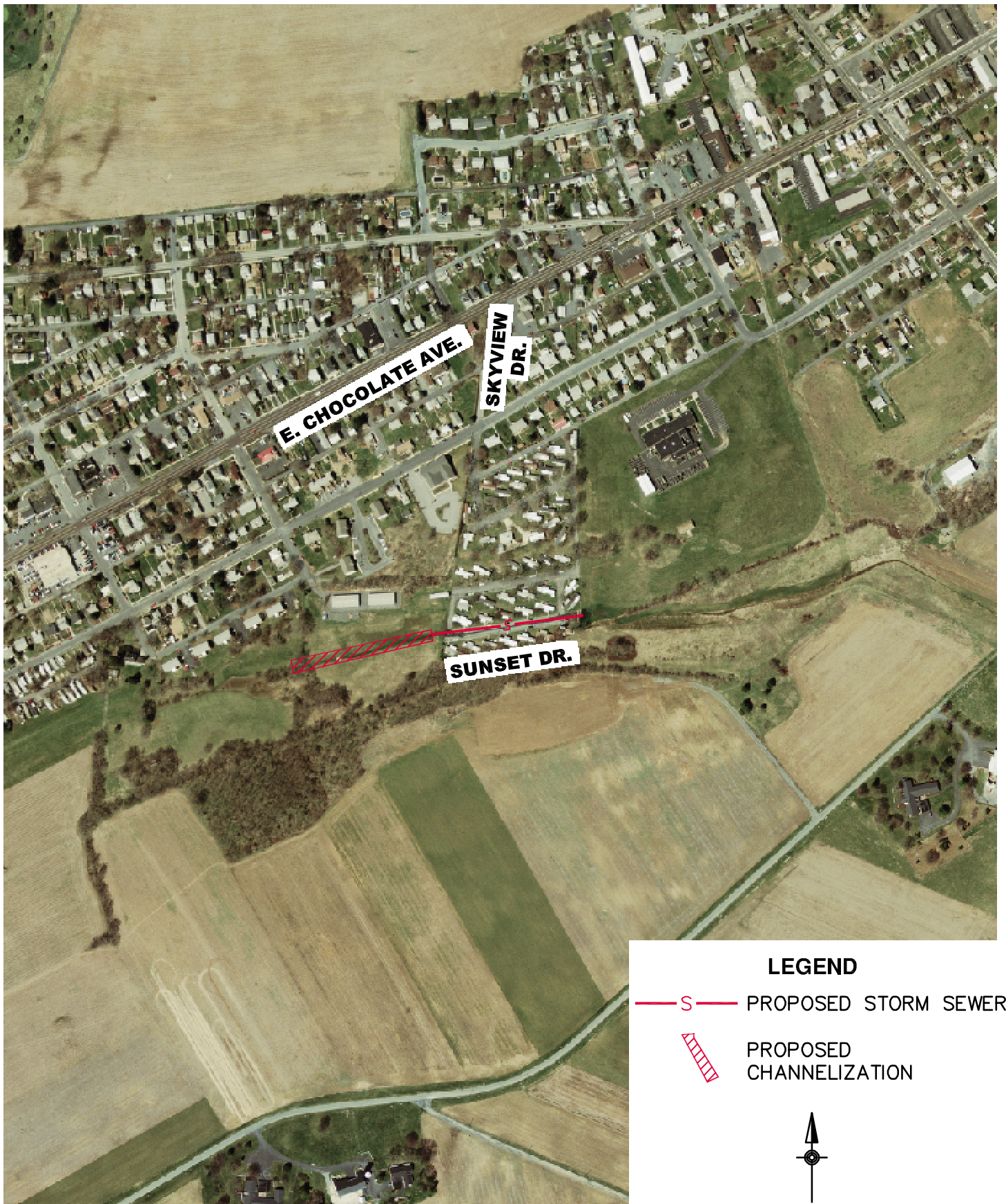
- Flooding of Sunset Drive and the mobile home park located south of Caracas Avenue (Drawing No. 7).
- According to the Township records, some sinkholes developed after 1949. This development may have altered the hydrology of Spring Creek (East) at this location. After large storms, the stream flows through its original route down Sunset Road. Since the capacity of the stormwater system is not large enough to deal with large storms, Spring Creek floods Sunset Drive and the mobile home park (Photos 13, and 14).





Photo 13 - The concrete wall that is supposed to protect the park from floods.



Photo 14 - Mobile Home Park and Sunset Drive



LEGEND

-  PROPOSED STORM SEWER
-  PROPOSED CHANNELIZATION



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D7 - DERRY TOWNSHIP - SUNSET DRIVE

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CONCEPTUAL SOLUTION

- The drainage area contributing to this site is about 3.66-square miles.
- As illustrated on Drawing No. 7, it is recommended to install a storm sewer that would have a headwall or stormwater catch basin at the east (upstream) end of Sunset Drive, and then run under Sunset Drive and through a farm field to discharge into Spring Creek, approximately 500-feet west of the west end of Sunset Road. The total system length of the main storm sewer would approximately be 1,200-feet. There would be four (4) stormwater catch basins along Sunset Drive to collect lateral inflow. The main storm sewer would require two (2) 60-inch HDPE pipes to convey the 50-year return frequency storm event peak discharge.

PROBLEM AREA D8 - DERRY TOWNSHIP – BINDNAGLE ROAD

DESCRIPTION

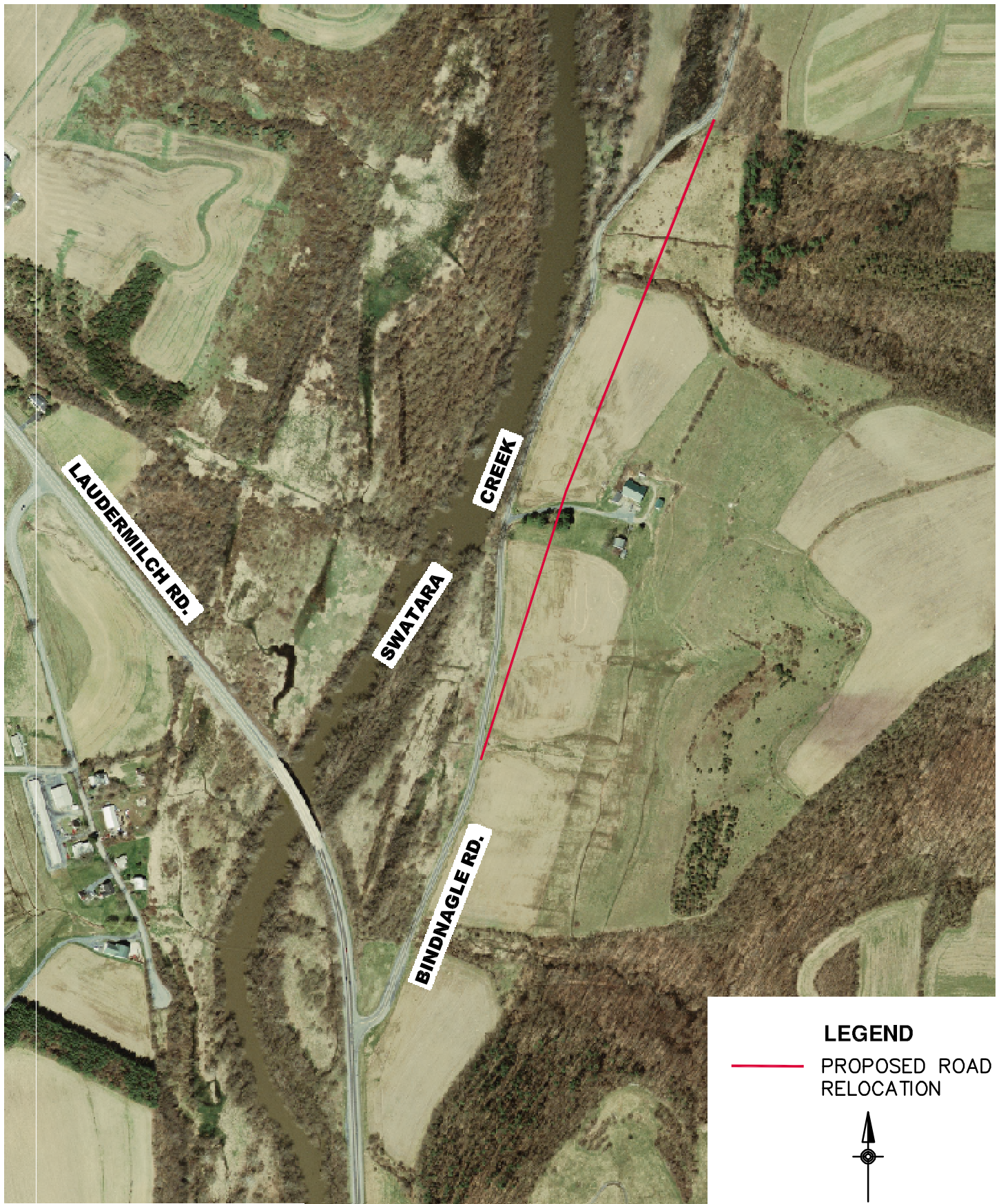
- Flooding of Bindnagle Road has been reported (Drawing No. 8 and Photo 15). A portion of Bindnagle Road is inundated periodically when Swatara Creek floods. The stretch of road that is primarily impacted starts approximately 2,100-feet north of the intersection of Bindnagle and Laudermilch Roads and runs for about 1,700-feet.



Photo 15 - Flooding at Bindnagle Road

CONCEPTUAL SOLUTION

- Relocate the affected portion of Bindnagle Road far enough east of the current alignment to raise it above flood levels. This would allow the road to be elevated several feet above the existing most frequent floodplain elevation of Swatara Creek.



LEGEND

— PROPOSED ROAD RELOCATION



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PROBLEM AREA D9 – DERRY TOWNSHIP – COCOA AVENUE

DESCRIPTION

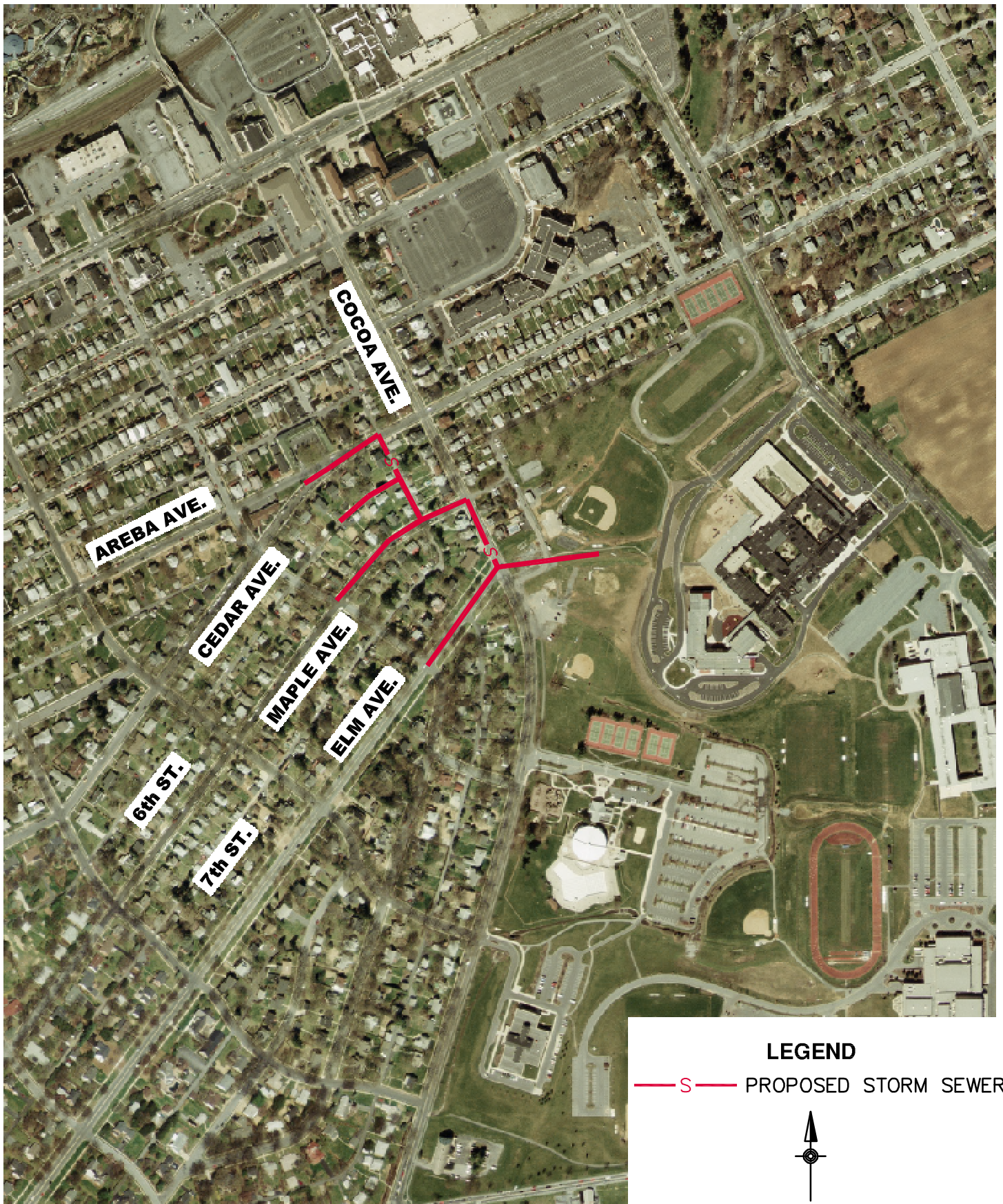
- Flooding occurs during large storm events along Cocoa Avenue at the intersection with Maple Avenue and along Maple Avenue and Elm Avenue and the local alleyways (6th and 7th Streets). The flooding has, on occasion, flooded garages and homes along the roadways (Photo 16).
- The cause of the flooding is the inadequate sizing of storm sewers and lack of sufficient inlets along the roadways.
- Also contributing to the flooding condition is backwater that can be generated due to surcharging of the major storm sewer system that runs under the Hershey School District's ball fields.



Photo 16 – Flooding on 6th Street during Hurricane Ivan, 2001

CONCEPTUAL SOLUTION

- A larger and extended storm sewer system is recommended following the alignment shown on Drawing No. 9.
- The storm sewer system would be comprised of 24-inch pipes and standard type "C" inlets.
- Additionally, a detailed study should be conducted of the capacity of the major sewer system that runs under the Hershey School District's ball fields to determine whether that system's capacity should also be upgraded.



LEGEND

— S — PROPOSED STORM SEWER



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DRAWING NO.
9
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PROBLEM AREA D10 – DERRY TOWNSHIP – FOREST AVENUE

DESCRIPTION

- Flooding occurs during large storm events at the intersection of Forest Avenue and Clark and Sand Hill Roads.
- Sand Hill Road south of the intersection is a steep hill and the runoff from this area concentrates at the intersection.
- The roadway intersection floods and then the yards also flood along the east side of Sand Hill Road, north of the intersection (Photo 17).



Photo 17 – Looking north at Sand Hill Road intersection

CONCEPTUAL SOLUTION

- A storm sewer should be constructed to collect the runoff from the three branch roads prior to reaching the intersection.
- The storm sewer would be extended north along Sand Hill Road as shown on Drawing No. 10 and would discharge into the storm sewer and pond system that connects to the Cherry Drive storm sewer.



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DRAWING NO.
10
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PROBLEM AREA D11 – DERRY TOWNSHIP – HERSHEY PARK DRIVE

DESCRIPTION

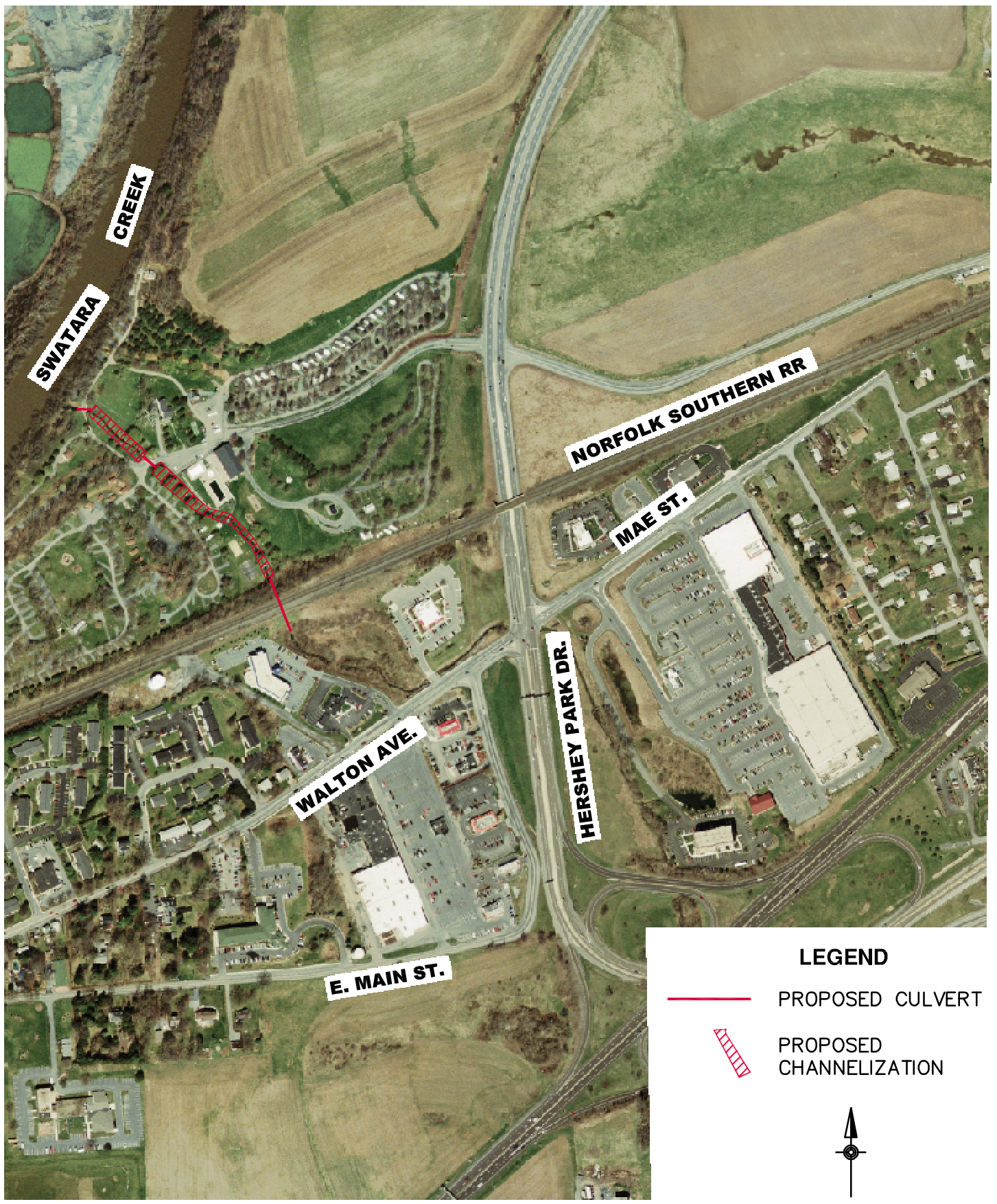
- There is an unnamed tributary to Swatara Creek that runs northward and parallel to the east side of Hershey Park Drive between Route 422 and Mae Street. The stream then turns under Hershey Park Drive (Photo 18), and flows westward for approximately 500 feet parallel to the north side of Walton Avenue before turning northward again to flow under the Norfolk Southern railroad embankment (Drawing No. 11).
- The culvert under the railroad embankment is 48 inches in diameter and becomes surcharged during medium to large storm events. When the water backs up at the culvert entrance, it eventually rises to flood portions of Walton Avenue, E. Main Street, and Hershey Park Drive, and portions of the shopping center on the west side of E. Main Street.



Photo 18 – Looking downstream at culvert under Hershey Park Drive

CONCEPTUAL SOLUTION

- First and foremost, the capacity of the culvert under the railroad embankment should be increased. This can be accomplished by boring two (2) 60-inch culverts through the embankment (existing 48-inch culvert to remain).
- If the capacity through the railroad embankment is increased, then the channel and two small driveway crossings in the Highmeadow Camp facility will have to be modified to handle the increased flows. Drawing No. 11 illustrates the locations of the culverts and channelization work.



LEGEND

— PROPOSED CULVERT

▨ PROPOSED CHANNELIZATION

↑

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DRAWING NO.
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PROBLEM AREA D12 - DERRY TOWNSHIP - LUCY AVENUE

DESCRIPTION

- There is a shallow detention pond on the east side of Lucy Avenue (Photo 19) that provides some control of the runoff from the heavily developed contributing watershed. However, during large storm events, the detention pond fills up and water flows over Lucy Avenue (Drawing No. 12).



Photo 19 – Looking at the detention pond on the east side of Lucy Avenue

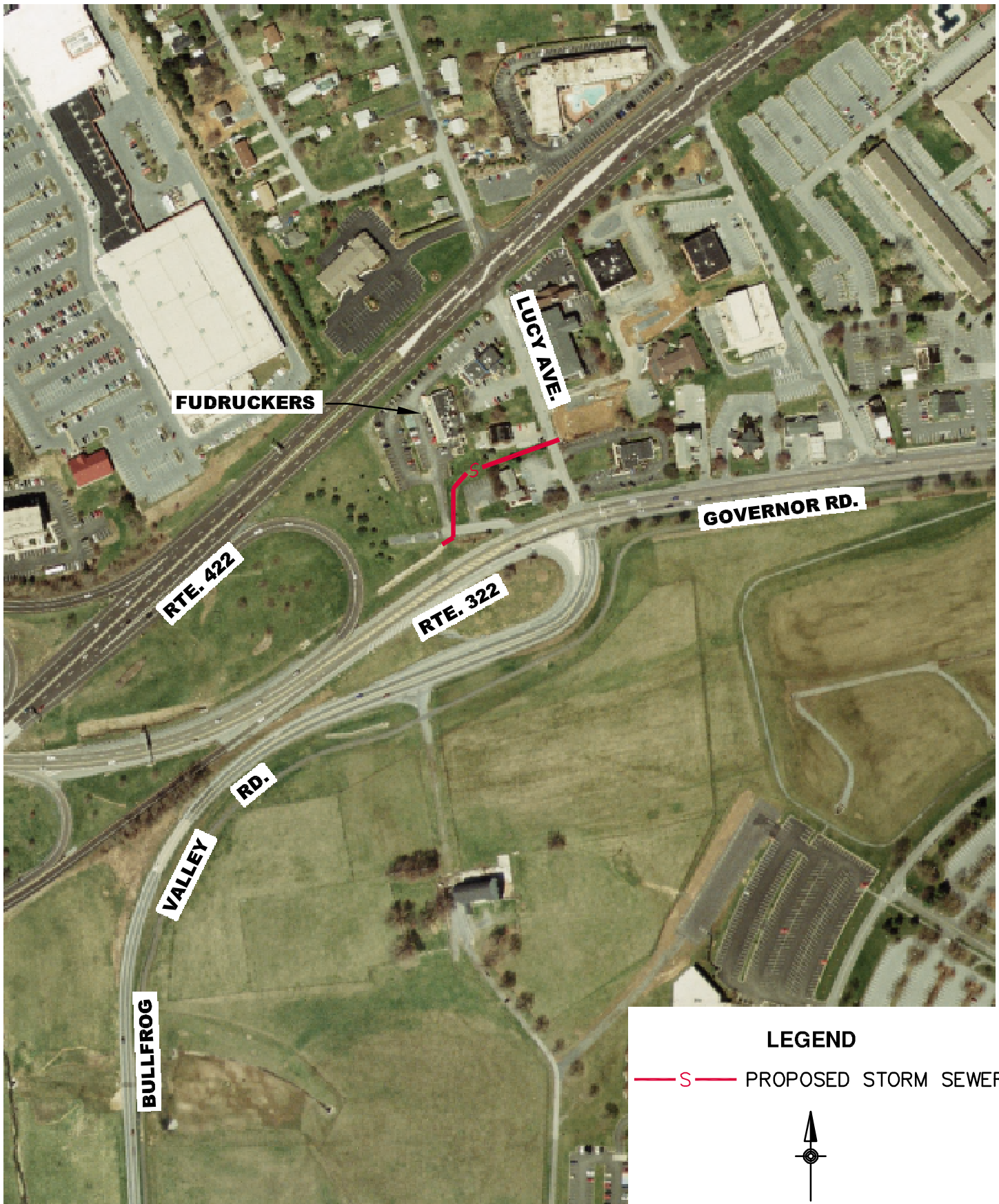
- On the west side of Lucy Avenue, there is an open channel that conveys water westward through a driveway culvert (Photo 20) and then to the culvert and open channel system serving the Route 422/322 intersection. The culvert under the driveway does not have capacity for large storm events and backwater causes flooding of the upstream property.



Photo 20 – Looking at the culvert under the driveway to Fudruckers Restaurant

CONCEPTUAL SOLUTION

- As illustrated on Drawing No. 12, it is recommended to install a 36-inch storm sewer system from the detention pond on the east side of Lucy Avenue westward past the driveway to Fudruckers Restaurant that has capacity for larger storm events.



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DRAWING NO.
12
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PROBLEM AREA D13 – DERRY TOWNSHIP – MILL ROAD UNDERPASS

DESCRIPTION

- The Mill Road underpass is the low point for a 60-acre drainage area that includes portions of Mill and Ridge Roads and W. Chocolate Avenue (Photo 21).
- In and around the underpass there are five (5) inlets, some of which appear to be partially clogged. The storm sewer that connects these inlets ultimately discharges to Swatara Creek.
- The storm sewers are under-sized for the drainage area and the underpass floods during large storm events, resulting in temporary road closures until the flooding subsides.



Photo 21 – Mill Road underpass


CONCEPTUAL SOLUTION

- Several of the inlets are quite small and difficult to keep clean. Replace those inlets with standard type “C” inlets.
- Replace the storm sewers with larger pipes (48-inch) to increase the capacity of the system.
- Replace the outlet pipe that runs from the underpass to Swatara Creek with a larger pipe (Drawing No. 13).



LEGEND

— S — PROPOSED STORM SEWER



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PROBLEM AREA D14 – DERRY TOWNSHIP – PALMDALE PARK

DESCRIPTION

- Spring Creek runs through Palmdale Park and has a drainage area of approximately four (4) square miles at the culverts under Route 422 (Chocolate Avenue). However, there is no defined bed and banks for the stream due to significant sinkhole activity upstream. Runoff from most storms enters small sinkholes and flows directly to the groundwater table.
- During larger storm events, the groundwater table rises to the surface level and runoff continues to follow the low ground down to Palmdale Park, where it floods the baseball and soccer fields.
- The culverts under Route 422 (Photo 22) would have enough capacity to handle the flows, but the ground both upstream and downstream of the highway is so flat that it does not drain well.



Photo 22 – Looking north at culverts under Route 422

CONCEPTUAL SOLUTION

- Just upstream of the Park's access road, the U.S. Army Corps of Engineers constructed a levee that parallels 2nd Street. The purpose of the levee was to prevent flood flows from running northward into the yards of the homes along 2nd Street.
- It would be possible to modify and extend the levee so that it created a detention pond on the east side of the Park access road (Drawing No. 14). An outlet structure could be installed that would control the discharge to a level that would not flood the ball fields.



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PROBLEM AREA D15 – DERRY TOWNSHIP – NORFOLK SOUTHERN RR

DESCRIPTION

- Water ponds on the south side of the Norfolk Southern railroad tracks near Sipe Avenue (Photo 23).

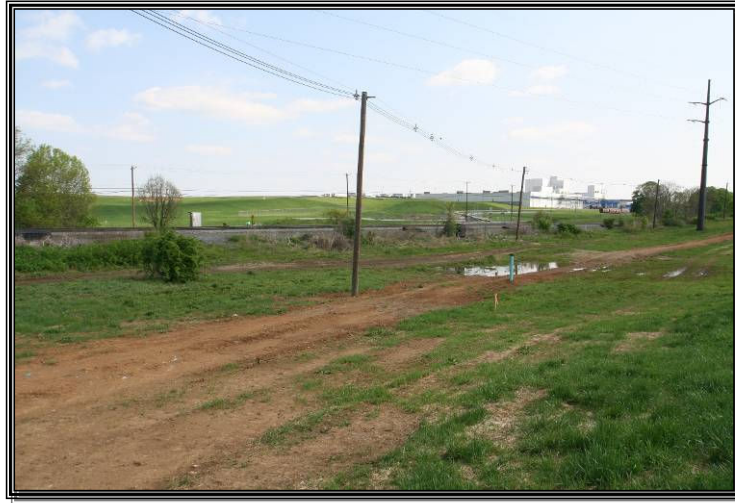


Photo 23 – Looking east at railroad embankment from Sipe Avenue

- The 177 acre watershed draining to this location includes several large-scale industrial and commercial developments. These developments all have stormwater detention ponds, but they discharge to the ground surface upstream of the railroad track embankment.

CONCEPTUAL SOLUTION

- Install a storm sewer that would have an inlet at the upstream end and a discharge to the existing stream channel on the north side of W. Chocolate Avenue (Drawing No. 15).



LEGEND

— S — PROPOSED STORM SEWER

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PROBLEM AREA D16 – DERRY TOWNSHIP – HIGHMEADOW CAMP

DESCRIPTION

- An unnamed tributary to Swatara Creek flows through the Highmeadow Camp parking lot just west of Hershey Park Drive. There is a storm sewer that carries the flow under the parking lot (Photo 24) and discharges to an open channel on the west side. This storm sewer is undersized for the six (6) square mile drainage area of this stream.

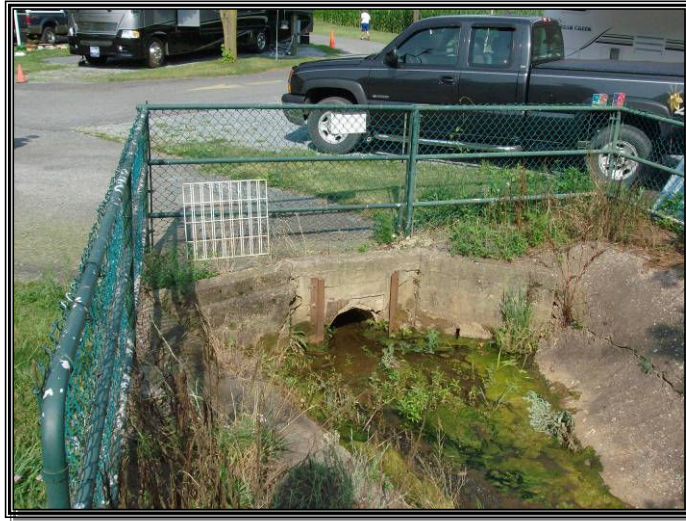
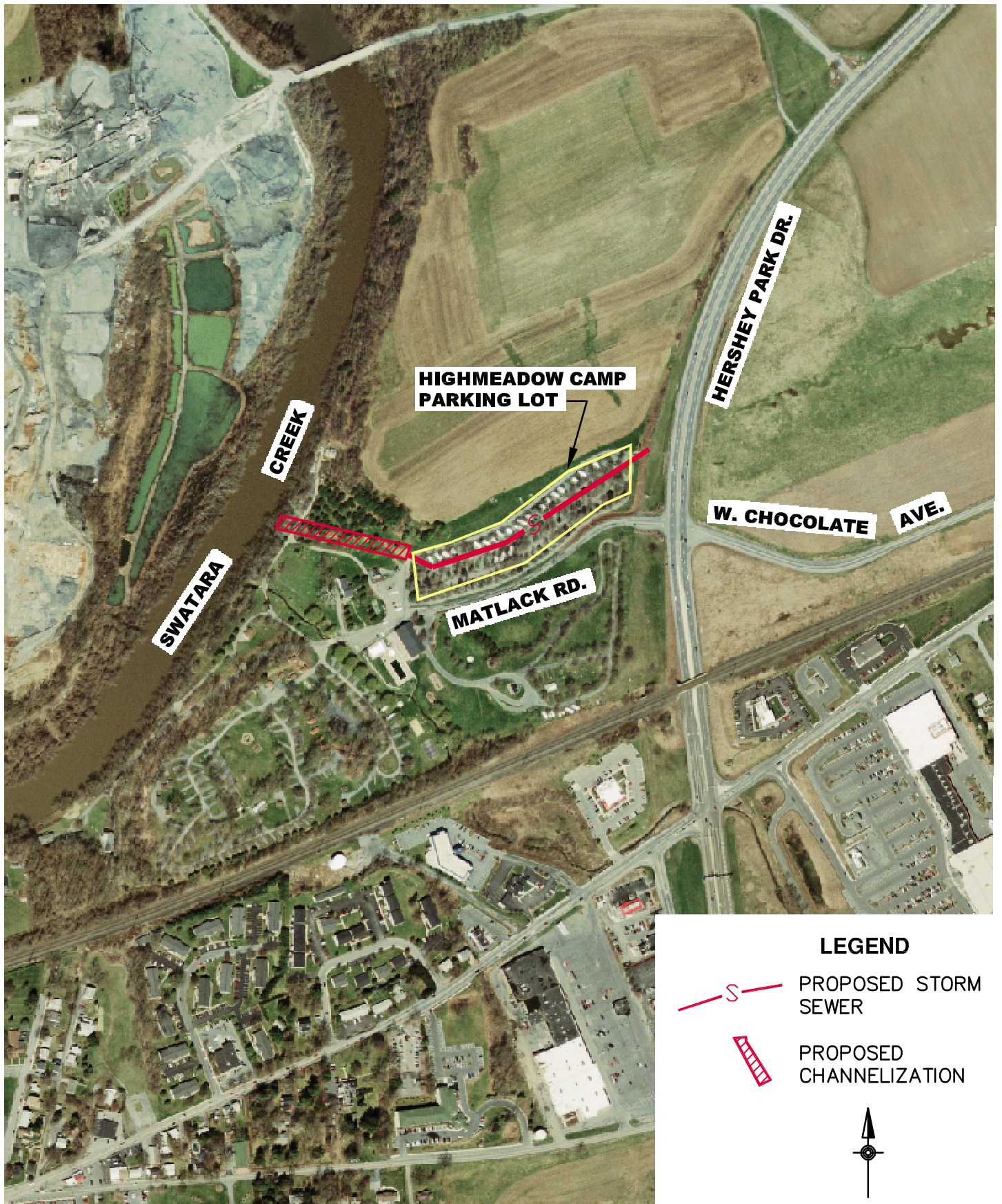


Photo 24 – Upstream end of pipe under Highmeadow Camp parking lot

CONCEPTUAL SOLUTION

- Replace the existing storm sewer with a 36-inch pipe and increase the size of the open channel at the downstream end of the pipe (Drawing No. 16).



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PROBLEM AREA D17 – DERRY TOWNSHIP – WEST MANSION ROAD

DESCRIPTION

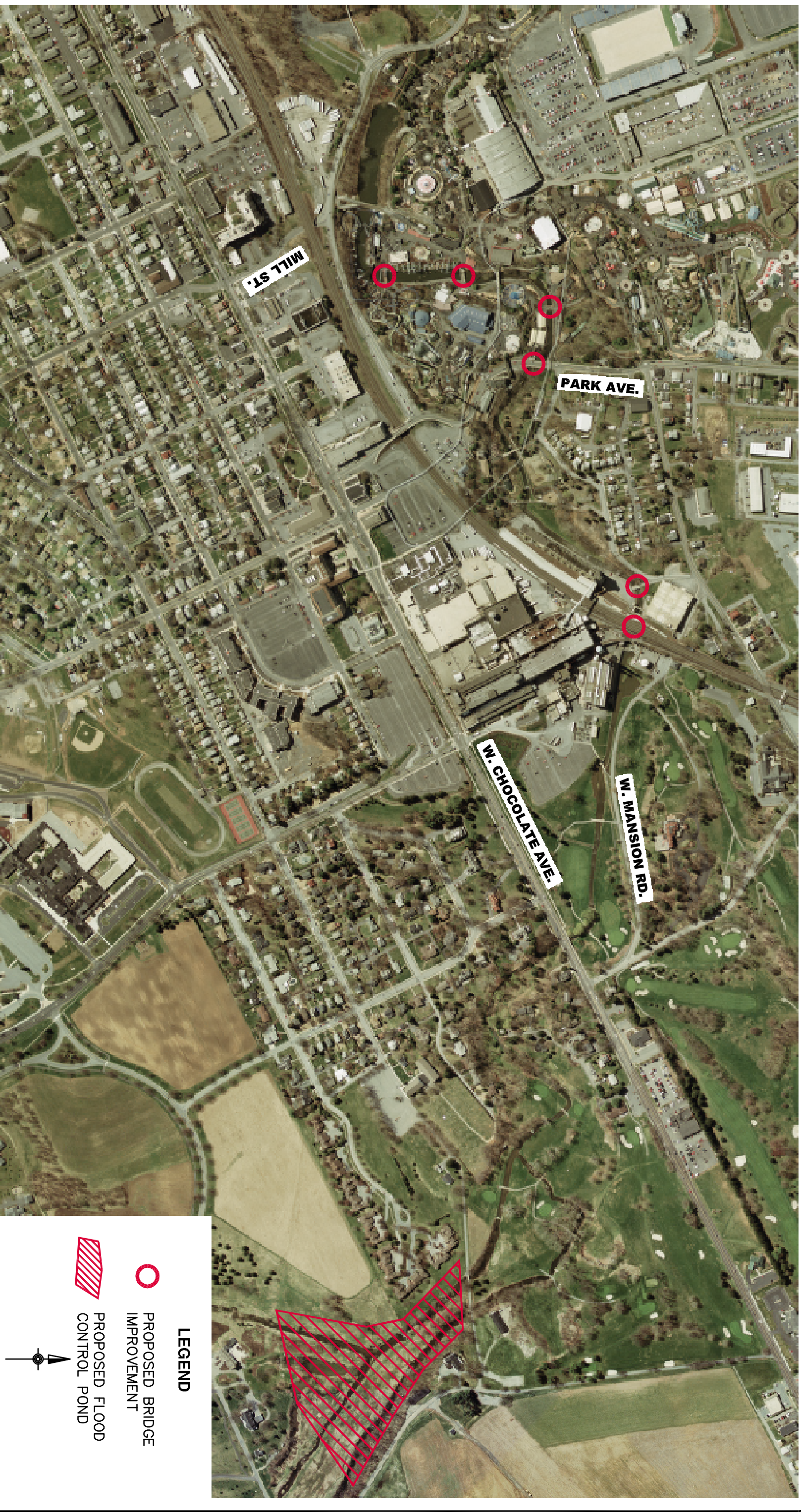
- Spring Creek flows past the Hershey Chocolate Plant and Hershey Park on its way to join with Swatara Creek. Along that stretch of stream there are a number of roadway, railroad, and pedestrian crossings that constrict the flow capacity of the stream channel. In addition, the stream has been channelized and portions of the floodplain were filled when the Chocolate Plant was built. As a result, large storm events cause backwater flooding along West Mansion Road upstream of the Norfolk Southern railroad culvert (Photo 25).





Photo 25 – Spring Creek looking north towards the railroad crossing – 3/5/08 storm


CONCEPTUAL SOLUTION

- The capacity of the stream crossings and channel between the Norfolk Southern railroad culvert and Swatara Creek must be evaluated and those crossings and channel segments that have insufficient capacity for a major storm event and should be enlarged. Based on a cursory analysis, there are at least six (6) crossings, shown on Drawing No. 17, which will probably have to be replaced. In addition, the channel and floodplain area will have to be enlarged to handle severe events.
- In lieu of replacing the crossings, it may be possible to construct a flood control (detention) pond upstream of W. Chocolate Avenue on property owned by Milton Hershey School. This area would have to be surveyed and a detailed hydrologic and hydraulic analysis would have to be conducted to evaluate the feasibility of this solution.



LEGEND

-  PROPOSED BRIDGE IMPROVEMENT
-  PROPOSED FLOOD CONTROL POND



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DAUPHIN COUNTY
 ACT 167 STORMWATER MANAGEMENT STUDY
 PROBLEM AREAS
 D17 - DERRY TOWNSHIP - WEST MANSION ROAD

PROJ. MGR. - MSB
 DESIGN - ATB
 CADD -
 CHECKED -
 SCALE - 1" = 500'
 DATE - 11-4-08

DRAWING NO.
17

SHEET NO.
 OF
 PROJECT 2484.0429

PROBLEM AREA H1 - HUMMELSTOWN BOROUGH – EAST END AROUND MAIN/WALTON INTERSECTION

DESCRIPTION

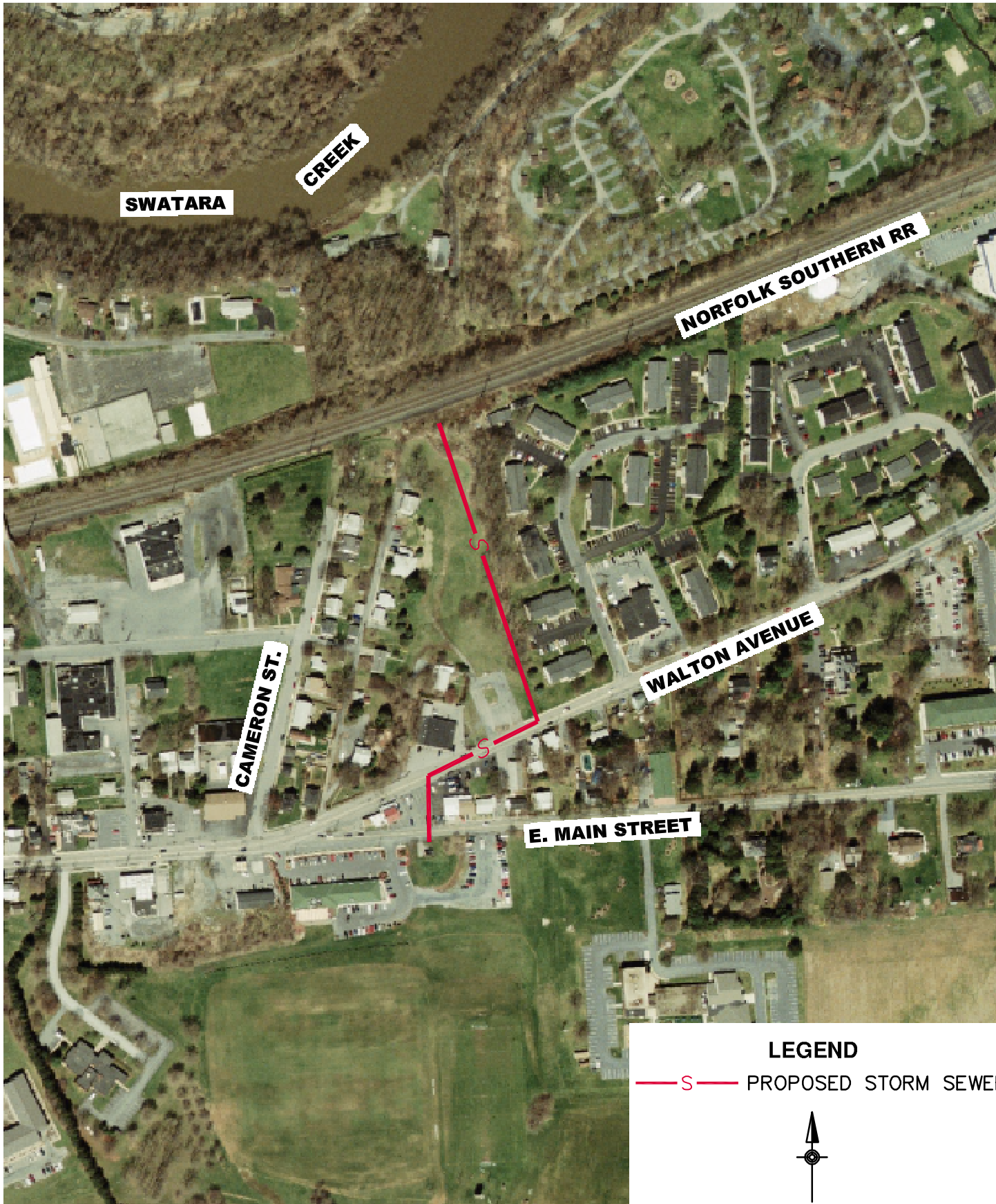
- The existing 36-inch storm sewer goes northward under a building between East Main Street and Walton Avenue and continues north under the Norfolk-Southern Railroad (Drawing No. 18).
- Recently, an additional 48-inch pipe was constructed under the railroad embankment. However, the upstream pipe was not improved.
- There have been reports that portions of the 36-inch pipe have partially collapsed. Prior to the collapse, the pipe was undersized and caused stormwater flooding at the intersection of East Main Street and Walton Avenue (Photo 26).



Photo 26 - Stormwater inlet under East Main Street

CONCEPTUAL SOLUTION

- It was determined that a 60-inch pipe should be constructed under East Main Street and Walton Avenue all the way to the railroad embankment to pass the 25-year storm event. The new stormwater system will replace the existing collapsed 36-inch pipe system for improved capacity to reduce flooding during larger rainfall events. Drawing No. 18 shows a plan view of the proposed engineering solution to the flooding problem at this site.



File name: \\V:\1203\1203013\1203013.dwg C:\Dauphin County Problem Areas - Hummelstown.dwg Layout: H1 May 21, 2008 - 2:44pm Jones



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DAUPHIN COUNTY
ACT 167 STORMWATER MANAGEMENT STUDY
PROBLEM AREAS
H1 - HUMMELSTOWN BOROUGH - MAIN / WALTON
DAUPHIN COUNTY PENNSYLVANIA

PROJ. MGR. - MSB
DESIGN - ATB
CADD -
CHECKED -
SCALE - 1" = 300'
DATE - 12-9-08

DRAWING NO.
18
SHEET NO.
OF
PROJECT 1203.0013

PROBLEM AREA H2 - HUMMELSTOWN BOROUGH - HAMMOND PROPERTY

DESCRIPTION

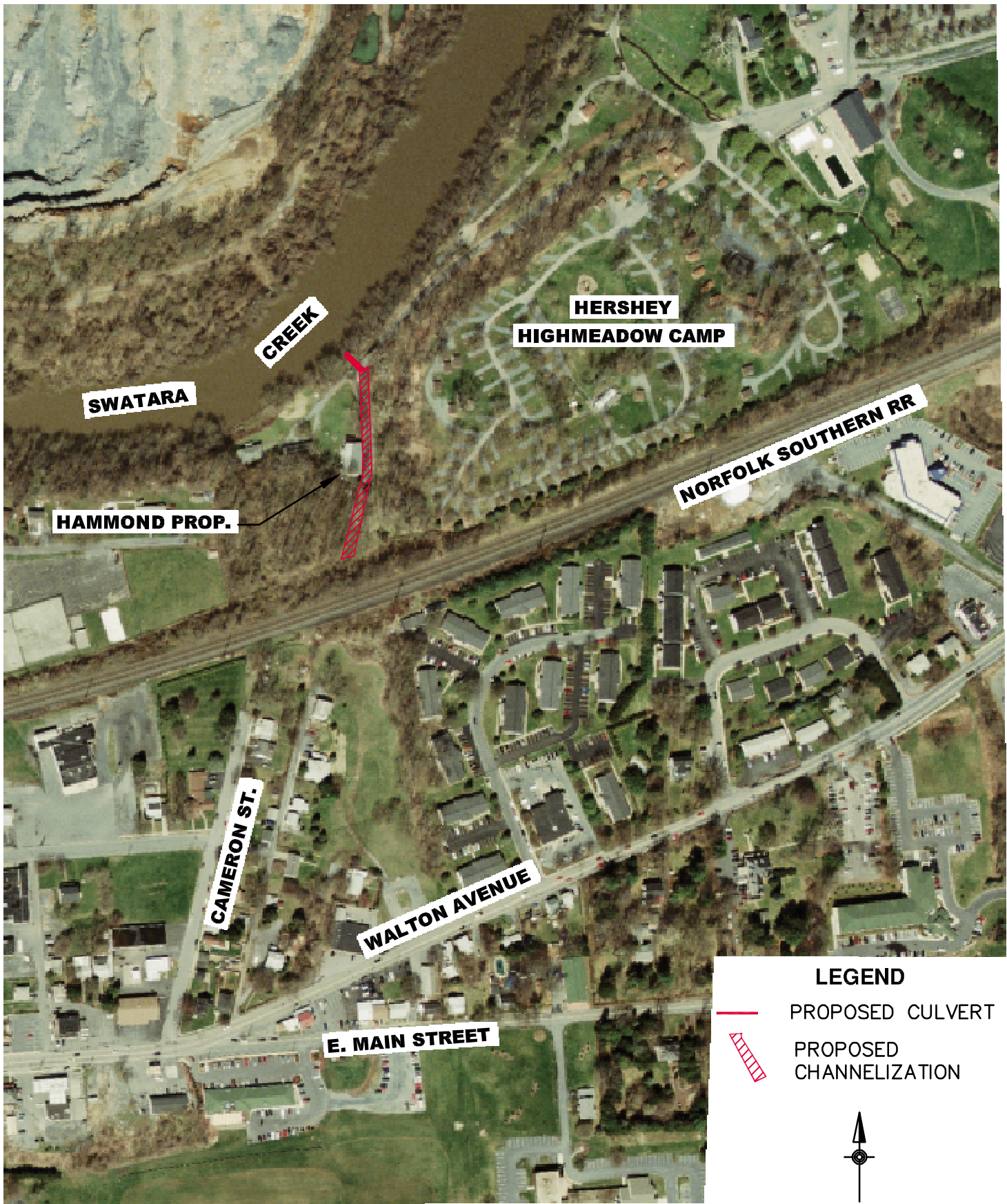
- Stormwater flooding occurs at the previous Hammond Property located west of Highmeadow Camp Ground (Photo 27 and Drawing No. 19). The land was sold to Hershey Entertainment & Resorts Company.
- Several homes at this area have yards in the 100-year floodplain of Swatara Creek. In addition, there is roadway flooding, west of Highmeadow Camp Ground.



Photo 27 - Road leading to Hammond Property

CONCEPTUAL SOLUTION

- Install a storm drain system under the road and widen the channel between the railroad embankment and road (Drawing No. 19). Two (2) 42-inch pipe culverts are needed to convey the 25-year event (596 cfs) under the roadway.
- This conceptual solution will not solve the problem of backwater flooding from Swatara Creek.



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LEGEND

— PROPOSED CULVERT

▨ PROPOSED CHANNELIZATION

↑



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PROBLEM AREAS
H2 - HUMMELSTOWN BORO - HAMMOND PROPERTY
DAUPHIN COUNTY PENNSYLVANIA

PROJ. MGR. - MSB
DESIGN- ATB
CADD-
CHECKED-
SCALE- 1" = 300'
DATE- 12-9-08

DRAWING NO.
19
SHEET NO.
OF
PROJECT 1203.0013

PROBLEM AREA H6 - HUMMELSTOWN BOROUGH – RAILROAD AND DUKE STREET

DESCRIPTION

- North Duke Street bridge over Swatara Creek causes flooding problems to the adjacent streets and properties (Drawing No. 20).
- Sediment and debris partially block part of the waterway opening (Photo 28).



Photo 28 - Debris blocking the waterway opening of North Duke Street Bridge

CONCEPTUAL SOLUTION

- Remove the debris and sediment from the bridge opening. Photos 28 and 29 show that most of the debris blocking the bridge opening is tree branches and accumulated sediment.
- The drainage area contributing to this site is 514-square miles. If the Borough plans to replace the bridge, any new hydraulic structure should be designed to pass FEMA's 100-year flood event (47,000-cfs).

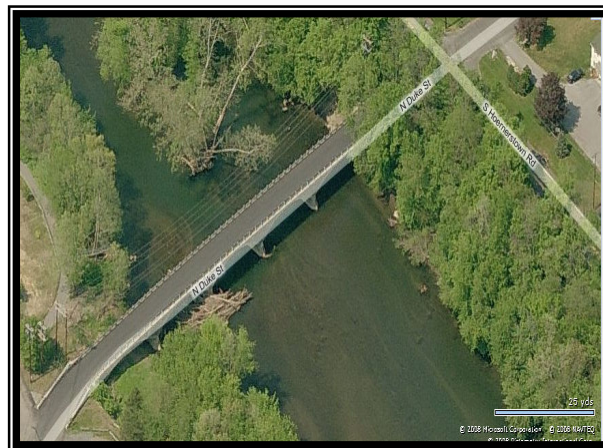
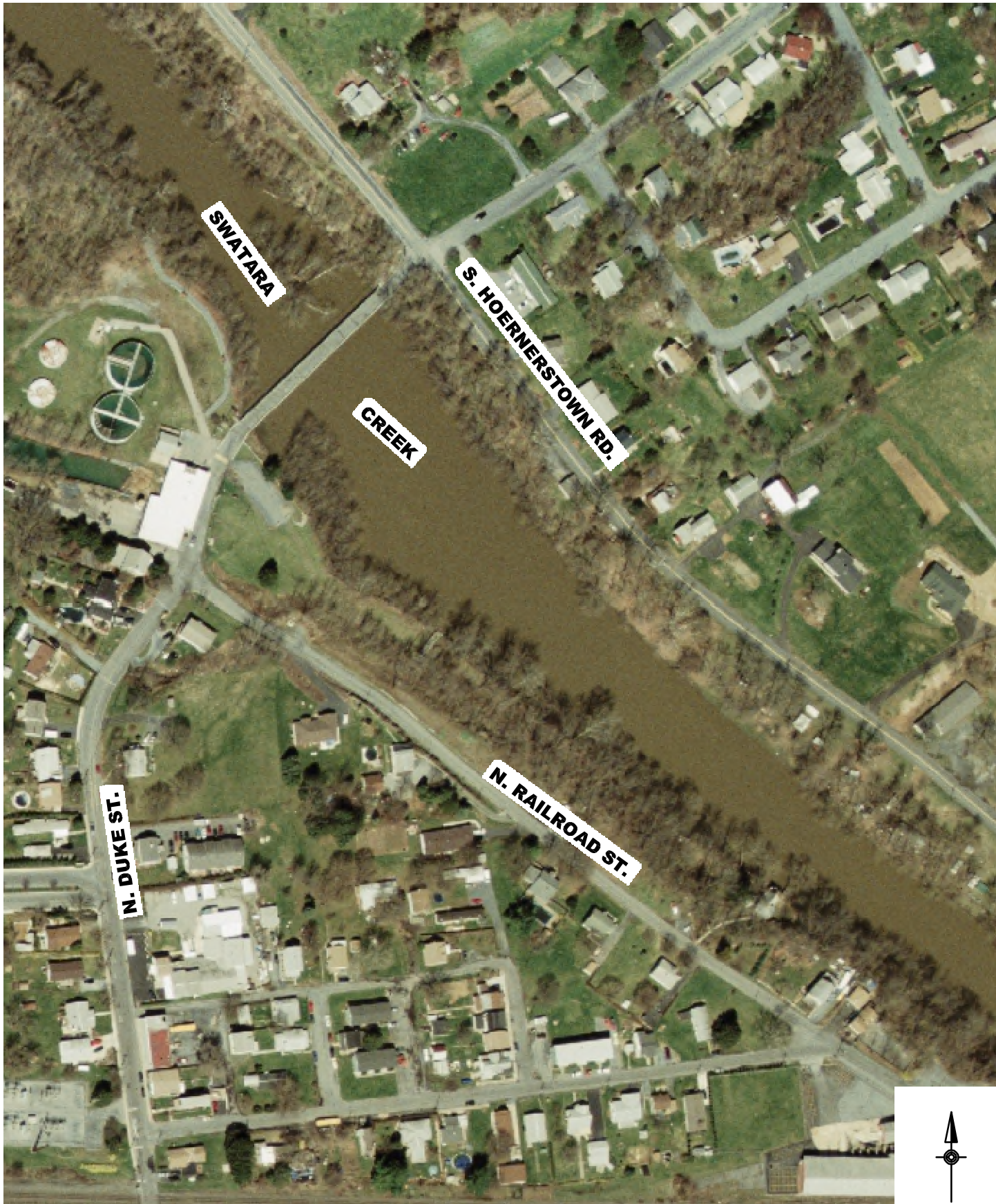


Photo 29 - Aerial View of North Duke Street Bridge



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DAUPHIN COUNTY
ACT 167 STORMWATER MANAGEMENT STUDY
PROBLEM AREAS
H6 - HUMMELSTOWN BOROUGH - RAILROAD & DUKE
 DAUPHIN COUNTY PENNSYLVANIA

PROJ. MGR. - MSB
DESIGN- ATB
CADD-
CHECKED-
SCALE- 1" = 200'
DATE- 12-9-08

DRAWING NO.
20
SHEET NO.
OF
PROJECT 1203.0013

PROBLEM AREA HB1 & HB2 - HIGHSPIRE BOROUGH – BURD RUN

DESCRIPTION

- Burd Run has been experiencing stream bank erosion near Memorial Park. There has been some stabilization work just upstream of 2nd Street (Photo 34).
- Most of the watershed is developed.



Photo 34 - Burd Run stream stabilization work

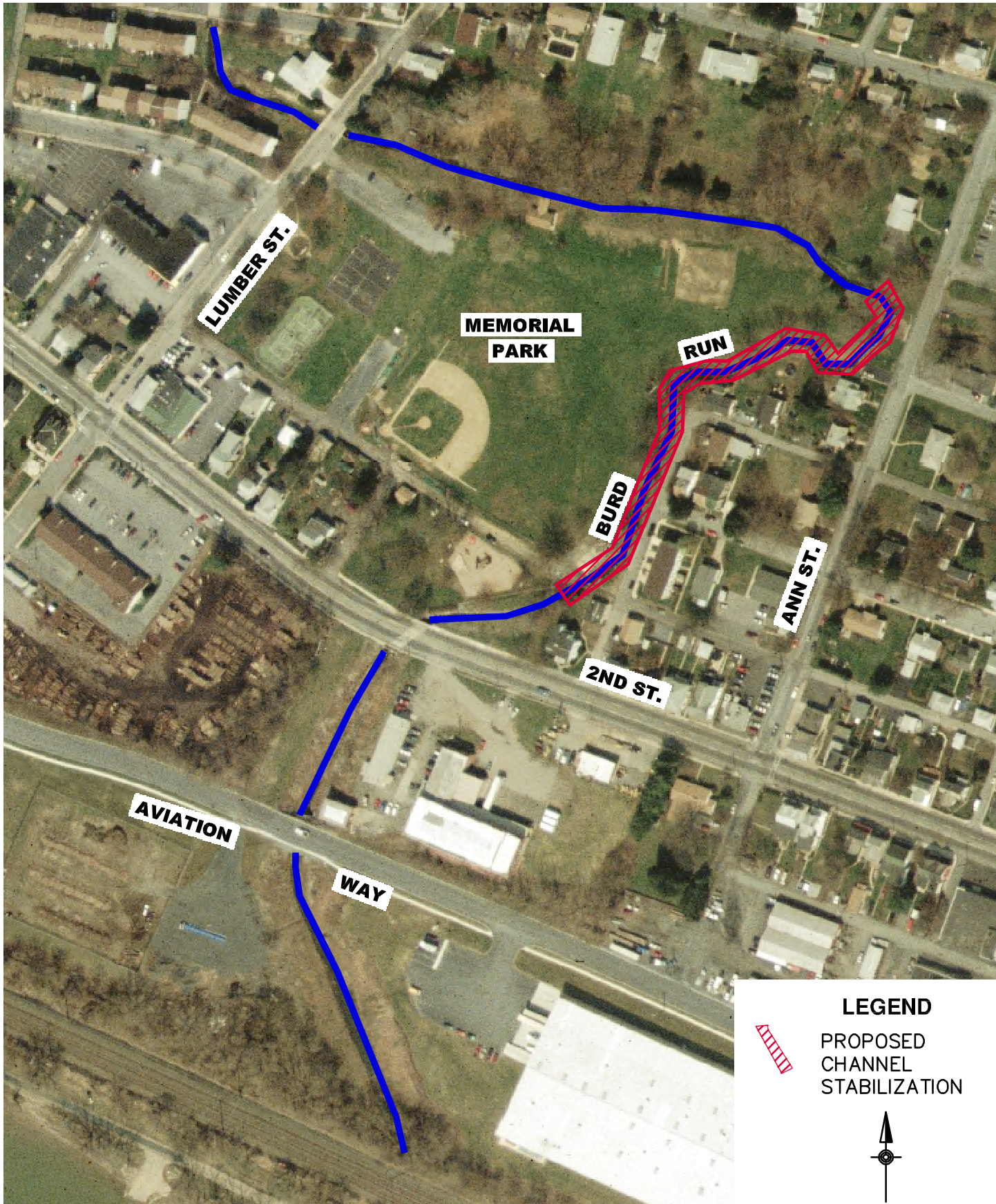
CONCEPTUAL SOLUTION

- Rosgen classification for Burd Run within Highspire Borough was conducted to check the erodability potential of Burd Run. The results are presented in Table 8.


Table 8: Rosgen Classification for Burd Run


STREAM	ROSGEN	SENSITIVITY TO DISTURBANCE	RECOVERY POTENTIAL	SEDIMENT SUPPLY	STREAM BANK EROSION POTENTIAL
B2	C5b	Very High	Fair	Very High	Very High
B3	G5c	Extreme	Very Poor	Very High	Very High
B4	B5c	Moderate	Excellent	Moderate	Moderate
B5	C5	Very High	Fair	Very High	Very High

- The results show that most of the stream has very high potential for stream bank erosion. Therefore, it is important to develop a solution that fits with the dominant environmental conditions.
- It is recommended that the channel stabilization work be continued with some adjustment to incorporate more vegetation into the bank stabilization measures (Drawing No. 21).



LEGEND

 PROPOSED CHANNEL STABILIZATION



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DAUPHIN COUNTY
 ACT 167 STORMWATER MANAGEMENT STUDY
 PROBLEM AREAS
 HB1 & HB2 - HIGHSPIRE BOROUGH - BURD RUN
 DAUPHIN COUNTY PENNSYLVANIA

PROJ. MGR. - MSB
DESIGN- ATB
CADD-
CHECKED-
SCALE- 1" = 200'
DATE- 12-9-08

DRAWING NO.
21
SHEET NO.
OF
PROJECT 1203.0013

PROBLEM AREA HB4 - HIGHSPIRE BOROUGH – BURD RUN

DESCRIPTION

- Susquehanna River sedimentation is causing a problem at the outfall of the Burd Run storm sewer system (Drawing No. 22 and Photo 35).
- The pipe outfall is being blocked by the accumulation of river sediment.
- When the Susquehanna River floods, the Burd Run outfall pipe is surcharged and river sediment accumulates in the outfall channel, restricting the discharge of Burd Run.



Photo 35 - Burd Run Watershed Outfall

CONCEPTUAL SOLUTION

- Clean the pipe and outflow channel periodically.
- If this does not solve the problem or becomes too costly, extend the pipe closer to the main channel of the Susquehanna River (Drawing No. 22).



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 ACT 167 STORMWATER MANAGEMENT STUDY
 PROBLEM AREAS
 HB4 - HIGHSPIRE BOROUGH - BURD RUN
 DAUPHIN COUNTY PENNSYLVANIA

PROJ. MGR. - MSB
DESIGN- ATB
CADD-
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SCALE- 1" = 400'
DATE- 12-9-08

DRAWING NO.
22
SHEET NO.
OF
PROJECT 1203.0013

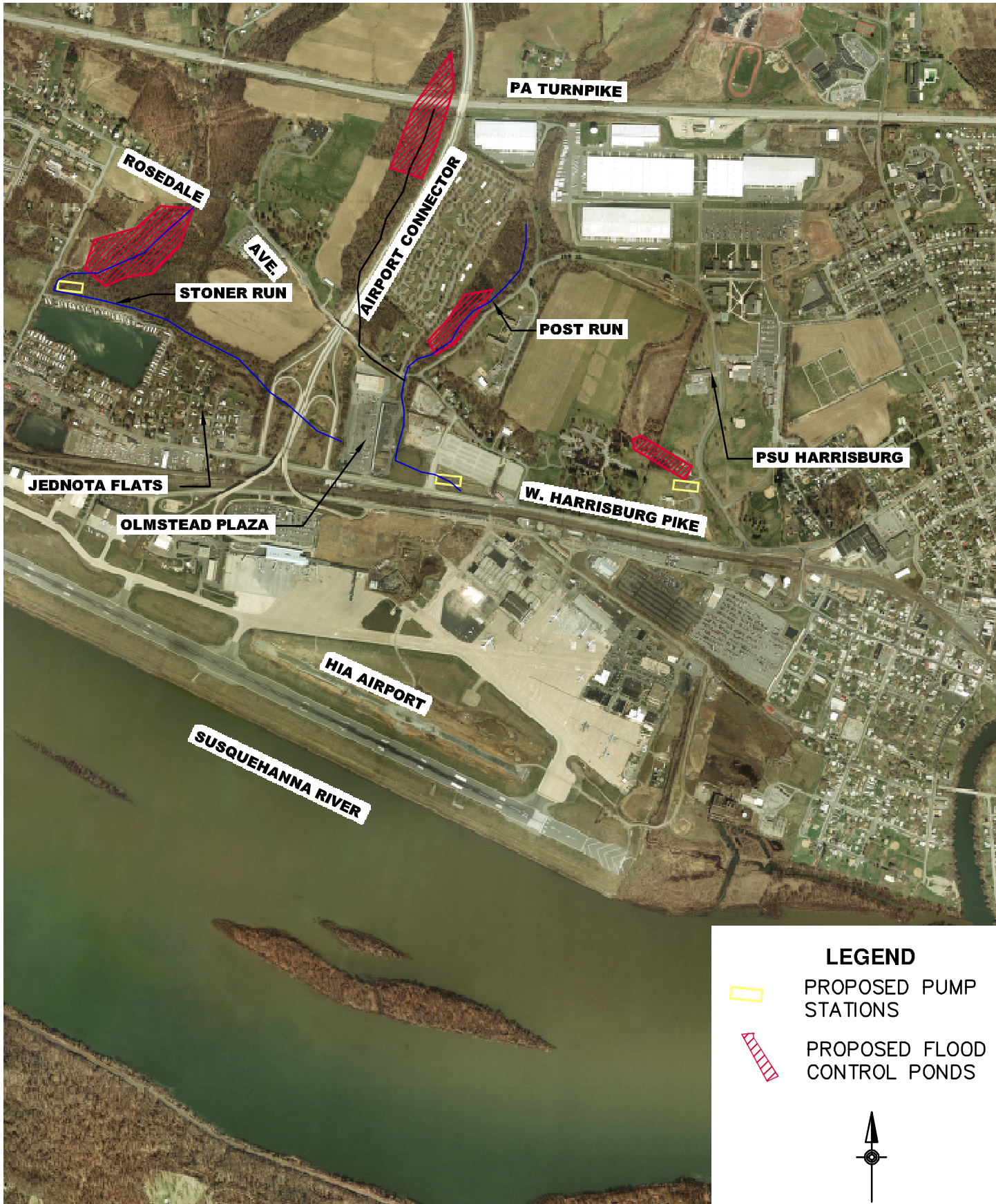
PROBLEM AREA LS1, LS2, LS3 & LS4 - LOWER SWATARA TOWNSHIP – AIRPORT CONNECTOR, OLMSTEAD PLAZA, HIA/PA AIR NATIONAL GUARD BASE, AND JEDNOTA FLATS



DESCRIPTION

- Flooding conditions have been reported at Jednota Flats, Olmested Plaza, Pennsylvania State University (PSU) at Harrisburg, Harrisburg International Airport (HIA), and the US Air Force National Guard Base. The general area is shown on Drawing No. 23.
- In 2004, Hurricane Ivan passed through the area and generated over 7-inches of rain in about a 12-hour period. This storm produced enough runoff to cause flooding several feet deep in the Jednota Flats area and temporarily closed Route 230.
- There are three main reasons for the flooding problem:
 1. The flatness of the terrain;
 2. The inadequate capacity of storm sewers and culverts that exist between Jednota Flats and the discharge point of Post Run on the Susquehanna River and between Route 230 (W. Harrisburg Pike) and Swatara Creek. These culverts and pipes do not have sufficient capacity to convey peak discharges from even a 2-year storm event and their capacity is severely reduced when Swatara Creek and the Susquehanna River flow levels rise enough to cause backwater conditions, and;
 3. The existence and operation of floodgates on the storm sewer serving the area upstream of the stone culvert that runs under Norfolk Southern's railroad lines. The gates are controlled by HIA personnel and are operated with the intent to prevent flooding of the airport runway and taxiway system when the water level of the Susquehanna River rises and the culverts through the levee are closed (Photo 36).



Photo 36 – Levee primary outlet culverts at HIA



- LEGEND**
-  PROPOSED PUMP STATIONS
 -  PROPOSED FLOOD CONTROL PONDS



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DAUPHIN COUNTY
ACT 167 STORMWATER MANAGEMENT STUDY
PROBLEM AREAS
LS1-4 - LOWER SWATARA TOWNSHIP

DAUPHIN COUNTY

PENNSYLVANIA

PROJ. MGR. - MSB
DESIGN- ATB
CADD-
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SCALE- 1" = 1,500'
DATE- 12-9-08

DRAWING NO.
23
SHEET NO.
OF
PROJECT 1203.0013

CONCEPTUAL SOLUTION

- The Airport currently has two (2) 30,000 gallon per minute stormwater pumping stations located at the levee (total capacity 134-cfs). According to a previous study conducted by HRG in response to the Jednota Flood Committee (Jednota Flood Study, 2007), these pumping stations are activated whenever the flow level on the upstream side of the levee reaches elevation 294.5- feet.
- Since the culvert and storm sewer systems that convey flows to the levee do not have the capacity to handle the 100-year storm event, it would not be effective to significantly increase the pumping capacity only at the levee.
- Therefore, three (3) additional pumping stations need to be installed at the following locations: at the old Smart Park Pond, upstream of Route 230; upstream of Jednota Flats, and; upstream of the entrance to PSU's Harrisburg Campus just upstream of the engineering lab roadway.
- These pump stations would be built in combination with four (4) flood detention ponds upstream of the stations and diversion pipes would also be constructed from Jednota Flats to the Susquehanna River and from the Capital Campus at Route 230 to Swatara Creek.
- The estimated cost of the water pumping system is \$12,500,000 (2007 dollars).
- The location of the recommended facilities are shown on Drawing No. 23.
- For more information on the flooding problems in this area, please refer to the Jedonta Flood Study of 2007.

PROBLEM AREA UP1 - UPPER PAXTON TOWNSHIP – SNYDER MILL ROAD

DESCRIPTION

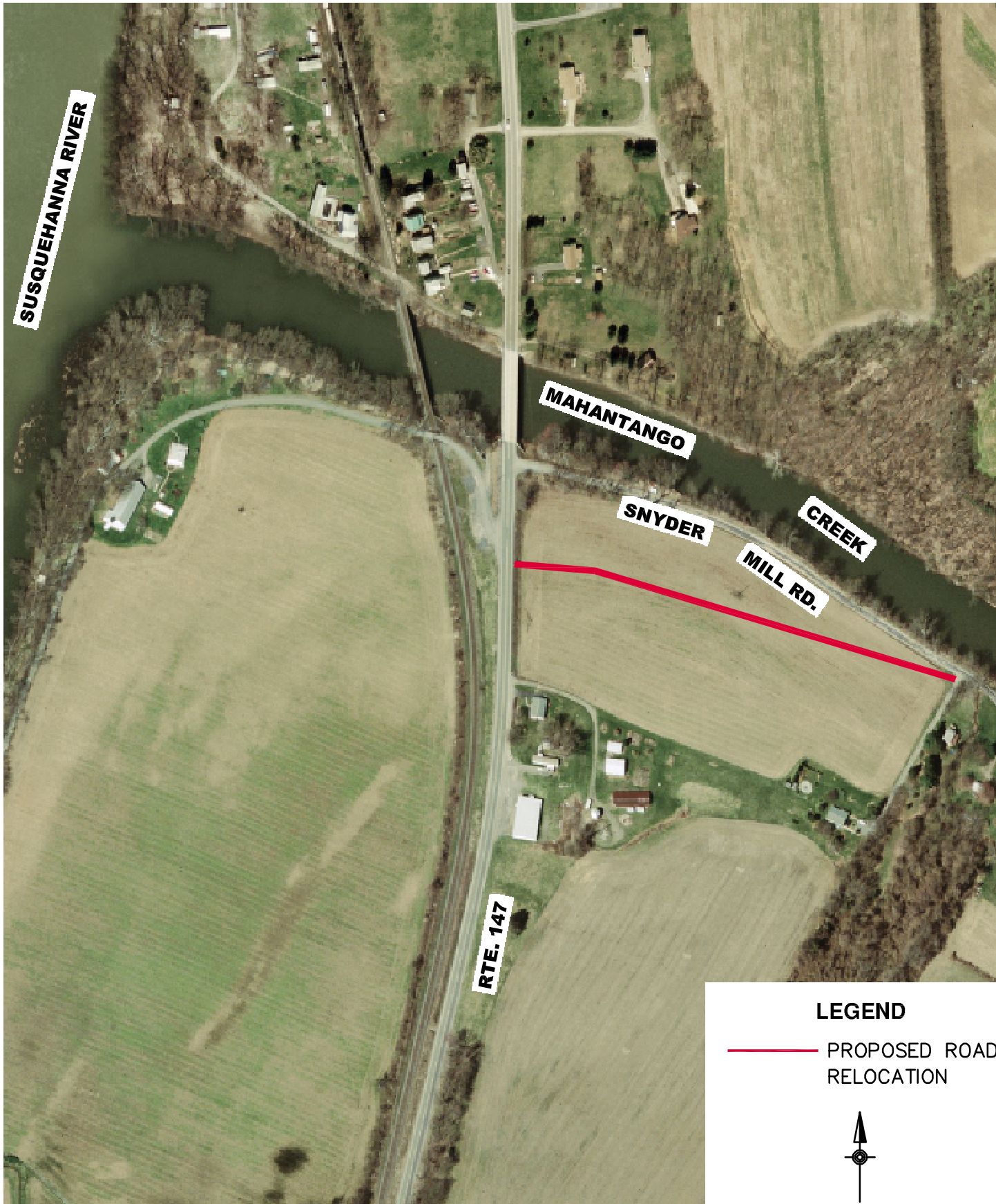
- A flooding problem has been reported along Snyder Mill Road just upstream of Route 147 (Drawing No. 24). In addition, some debris was observed at the Route 147 bridge opening.
- The road is located in the floodplain of Mahantango Creek (Photo 37).



Photo 37 - Standing on the left overbank of Mahantango Creek

CONCEPTUAL SOLUTION

- As illustrated on Drawing No. 24, relocate and elevate the roadway to be higher than a selected design flood elevation of Mahantango Creek. This will prevent future damage and keep the roadway in service during large flood events. However, further investigation needs to be conducted to ensure that raising the roadway elevation would not increase upstream flood elevations and create a backwater effect.



LEGEND

— PROPOSED ROAD RELOCATION



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 PROBLEM AREAS
 UP1 - UPPER PAXTON TOWNSHIP - SNYDER MILL RD.
 DAUPHIN COUNTY PENNSYLVANIA

PROJ. MGR. - MSB
DESIGN- ATB
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SCALE- 1" = 300'
DATE- 12-9-08

DRAWING NO.
24
SHEET NO.
OF
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