D. Geology

Geology plays a direct role in surface runoff in the Sacony Creek due to limestone and plays a major role in soil types through parent material breakdown. The geologic map of the watershed can be found in Figure II-4. Below is a description of geologic formations in the watershed.

1. **Allentown Formation (Cal)** – Medium-gray dolomite and impure limestone; dark-gray chert stringers and nodules; laminated; some oolite and sharpstone conglomerate; maximum thickness is about 2,000 feet; good subsurface drainage; poor surface drainage; sinkholes are common.

2. **Epler Formation (Oe)** - Very finely crystalline, medium-gray limestone interbedded with gray dolomite; coarsely crystalline limestone lenses present; approximately 1,000 feet thick; good subsurface drainage; sinkholes and caves are characteristic.

3. **Felsic to mafic gneiss (gn)** – Light buff to light pink; fine to medium grained; most mineral grains are about 1mm in diameter; primary minerals are quartz, microcline, hornblende, and occasional biotite; good surface drainage.

4. **Graphitic felsic gneiss (gg)** – Light to medium gray; includes the minerals quarts, orthoclase, hornblende, biotite, and graphite; graphite occurs as flakes 1 to 2 mm in diameter, somewhat larger than the usual grain size of the rock, and is disseminated throughout the gneiss; graphite shows a glistening luster; includes Pickering Gneiss; good surface drainage.

5. **Graywacke and shale of Martinsburg Formation (Omgs)** – Gray to dark gray, buff-weathering shale; abundant impure sandstone (greywacke) interbeds.

6. **Hamburg sequence rocks (Oh)** – Transported rocks of the Hamburg overthrust; gray, greenish-gray, and maroon shale, silty and siliceous in many places; dark-gray impure sandstone; medium- to light-gray, finely crystalline limestone and shaly limestone; total thickness is about 3,000 feet; good surface drainage.

7. **Hardyston Formation (Cha)** – Light-gray quartzite; weathers yellow brown; porous and limontic in many places; quartz-pebble conglomerate occurs at base; maximum thickness is 800 feet; good surface drainage.

8. **Hornblende gneiss (hg)** – Dark-gray to black; horneblende makes up about 50 percent of the rock; the other 50 percent is labradorite (feldspar); rock is extremely resistant to abrasion and very resistant to rupture, but may be susceptible to crumbling; good surface drainage.

9. **Jacksonburg Formation (Ojk)** – Medium- to dray-gray limestone, coarsely crystalline; thin silty layers; fossiliferous; commonly called "cement limestone";

maximum thickness is 375 feet; "cement rock" portion of formation is composed of silty limestone, dark-gray to black, fine-grained; thin pyrite seams; fossiliferous; 830 feet thick; good surface drainage; minor subsurface drainage.

10. **Leithsville Formation (Clv)** – Dark-gray to medium-gray dolomite; some calcareous shale and sandy dolomite; cherty; 1,500 feet thick; good surface drainage; little subsurface drainage.

11. **Limestone of Hamburg sequence (Ohl)** – Hamburg sequence rocks (Oh) with conspicuous limestone.

12. **Martinsburg Formation (Om)** – Buff-weathering, dark-gray shale, and thin interbeds of siltstone, metabentonite, and fine-grained sandstone; brown-weathering, medium-grained sandstone containing shale and siltstone interbeds occurs in the middle of the formation; basal part grades into limy shale and platy-weathering, silty limestone; may be 12,800 feet thick; good surface drainage.

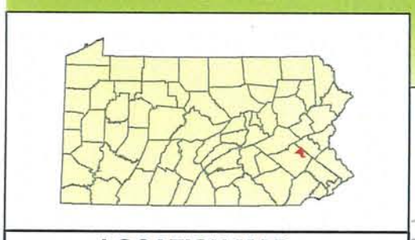
13. **Ontelaunee Formation (Oo)** – Light- to dark- gray, very fine to medium-crystalline dolomite; interbedded and nodular dark-gray chert at base; average thickness is about 750 feet; good subsurface drainage; minor surface drainage.

14. **Rickenbach Formation (Ori)** - Gray, very finely to coarsely crystalline, laminated dolomite; dark-gray chert in irregular beds, stringers, and nodules; bands of quartz-sand grains in lower half; thickness of at least 350 feet is present; good subsurface drainage; minor surface drainage.

15. **Shale and graywacke of Hamburg sequence (Ohsg)** – Hamburg sequence rock (Oh); shale containing zones of conspicuous greywacke (sandstone).

16. **Stonehenge Formation (Os)** - Gray, finely crystalline limestone and dark-gray silty laminated limestone; contains numerous flat-pebble breccia beds and shaly interbeds; maximum thickness is 1,500 feet; good subsurface drainage; sinkholes are characteristic.

SACONY CREEK
ACT 167 STORMWATER MANAGEMENT PLAN



LOCATION MAP

N

LOWHILL

WEISENBERG

ALBANY

LEHIGH COUNTY

BERKS COUNTY

MAIDEN CREEK WATERSHED

LENHARTSVILLE

GREENWICH

UPPER MACUNGIE

MAXATAWNY

KUTZTOWN

TOPTON

LONGSWAMP

LYONS

ROCKLAND

DISTRICT

Mill Creek

Sacony Creek

Little Sacony Creek

MAIDEN CREEK

Om Ohsg Oh Ohl Omgs Ojk Oo Oe Os Ori Cal Clv Cha gn hg gg

0.5 0.25 0 0.5 1 1.5 Miles

GEOLOGY

- SINKHOLES
- AREAS OF CARBONATE LITHOLOGY (LIMESTONE)

FORMATION

- Cal - Allentown Formation
- Cha - Hardyston Formation
- Clv - Leithsville Formation
- Oe - Epler Formation
- Oh - Hamburg sequence rocks
- Ohl - Limestone of Hamburg sequence
- Ohsg - Shale and graywacke of Hamburg sequence
- Ojb - Juniata and Bald Eagle Formations, undivided
- Ojk - Jacksonburg Formation
- Om - Martinsburg Formation
- Omgs - Graywacke and shale of Martinsburg Formation
- Oo - Ontelaunee Formation
- Ori - Rickenbach Formation
- Os - Stonehenge Formation
- Ss - Shawangunk Formation
- gg - Graphitic felsic gneiss
- ggd - Felsic and intermediate gneiss
- gn - Felsic to mafic gneiss
- hg - Hornblende gneiss

Figure II-4
GEOLOGY AND LIMESTONE

Prepared For:
Berks County
Planning Commission
County Services Center
633 Court Street
Reading, PA 19601
610-476-6300

Map Legend

- WATERSHED BOUNDARY
- STREAMS
- WATER BODIES
- COUNTY BOUNDARIES
- MUNICIPAL BOUNDARIES
- HIGHWAYS
- OTHER ROADS
- RAILROADS

NOTE:
Portions of this map were generated from existing data sources as listed below. These data are shown on the map for spatial reference only. These data did not enter into any computations or affect the reliability of the hydrologic analysis. Borton-Lawson Engineering has found some inaccuracies in some of these data and has corrected the data in locations where discrepancies were obvious, however, it was not a part of this ACT 167 Plan to correct all of the mapping data.

DATA SOURCES:
Watershed Boundary - RKR Hess Act 167 Plan for Sacony Creek
Streams - RKR Hess Act 167 Plan for Sacony Creek
Water Bodies - RKR Hess Act 167 Plan for Sacony Creek (Devided from Streams data)
Roads - Berks Co. & Lehigh Valley Planning Commissions, PennDOT
Railroads - Berks Co. & Lehigh Valley Planning Commissions
Counties - Berks County Planning Commission
Municipalities - Berks Co. & Lehigh Valley Planning Commissions, PennDOT
Geology, Limestone and Sinkholes - PA DCNR

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PREPARED BY: WSB CHECKED BY:

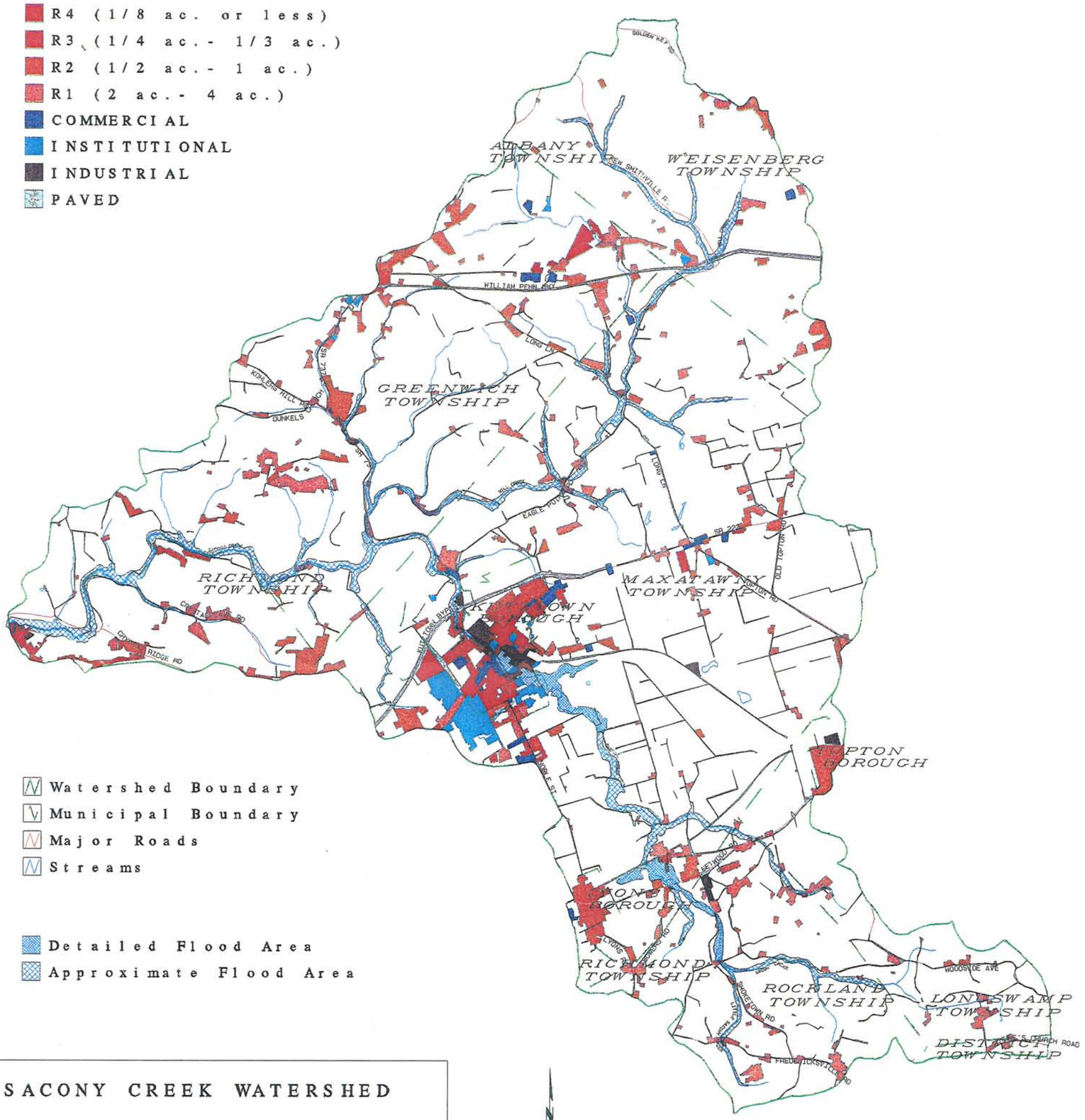
DATE: 12/22/2004 PROJECT #: 2003-1349-02

FILE: \\WBData\Projects\2003\1349\02\DATA\GIS\ArcMap\FINAL MAPS\Figureiii-4_Geology(Sacony).mxd

SACONY CREEK WATERSHED

LAND COVERAGE:

- R4 (1/8 ac. or less)
- R3 (1/4 ac.- 1/3 ac.)
- R2 (1/2 ac.- 1 ac.)
- R1 (2 ac.- 4 ac.)
- COMMERCIAL
- INSTITUTIONAL
- INDUSTRIAL
- PAVED



- Watershed Boundary
- Municipal Boundary
- Major Roads
- Streams

- Detailed Flood Area
- Approximate Flood Area

SCALE IN FEET

0 2000 4000 6000

SACONY CREEK WATERSHED

WATERSHED FLOODPLAINS & DEVELOPMENT MAP

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Paul A. DeBarry, Project Manager
Michael L. Mellinger, Map Designer

05/05/97, FLOODMS

PLATE III-6

Township/Borough	Stream	Land Use* Which Infringes on Flood Boundary	General Location
	Sacony Creek	Industrial (1)	North of Kutztown Bypass
	Sacony Creek	Commercial (9)	along Fleetwood Road
	Sacony Creek	Residential 2 (13)	North and South of Fleetwood Road
	Sacony Creek	Residential 4 (3)	East of Noble Street
	unnamed	Residential 2 (2)	East of Noble Street
Richmond Township	Sacony Creek	Residential 2 (1)	South of Crystal Cave
Rockland Township	Sacony Creek	Residential 2 (4)	South of Fleetwood Road and west of Smoketown Road
	Little Sacony Creek	Residential 4 (2)	South of Fredericksville Road
	unnamed	Residential 1 (2)	South of Fleetwood Road
Topton Borough	N/A/	N/A	N/A
Weisenberg Township	Mill Creek	Commercial (2)	South of William Penn Highway

* - See Plate III-3 for definitions of land use. The number in () represents the number of infringements.

2. Future Conditions

As can be seen from the projected Future Land Use Map, Plate III-4, the potential for development in the floodplains is great. The 100-year flood elevation was determined on the land use characteristics at the time of the FIS study and does not account for increased runoff due to developmental pressures. Therefore, the potential for future flooding would increase as development continues if this Watershed Storm Water Management Plan were not adopted. The trend would be that flood elevations would not rise significantly on broad, level floodplains but the floodplains would expand considerably in width, whereas in streams with steep embankments, the flood elevation would most likely increase significantly with little increase in the floodplain width. Increased flows from developing watershed conditions would also expand the current floodway widths in many instances, thus allowing the potential for existing development to infringe on the floodway. Allowing buildings in the flood plain is discouraged.

J. Survey Existing Drainage Problems and Proposed Solutions

Information on drainage problems and proposed solutions was obtained by providing forms to the Watershed Plan Advisory Committee (WPAC) and requesting that they solicit people in their local areas for input.

Table III-6 is a compilation of the problems. Plate III-7 (storm water problem areas, flooding, and storm water control facilities) and Appendix VIII of the Technical Appendix (Form A - storm water

problem areas) should be used to further identify these areas. Solutions have been proposed both formally and informally as a result of agency involvement.

Thirty-six (36) problem areas were identified in this study. Identification numbers correspond to the areas indicated on Plate III-7. The categories selected in Table III-6 typically have similar causes and solutions which are discussed below.

TABLE III-6
SACONY CREEK WATERSHED PROBLEM AREAS

Number of Problem Areas	Municipality	Erosion & Sediment	Runoff	Groundwater	Pollution	Flooding
0	Albany Township	-	-	-	-	-
0	District Township	-	-	-	-	-
1	Greenwich Township	-	-	-	-	A-1
16	Kutztown Borough	A-6	-	-	A-13	A-1 to A-16
4	Longswamp Township	A-1, A-3, A-4	-	-	-	A-1 to A-4
2	Lyons Borough	-	-	-	-	A-1, A-2
12	Maxatawny Township	A-3	-	-	-	A-1 to A-12
0	Richmond Township	-	-	-	-	-
0	Rockland Township	-	-	-	-	-
0	Topton Borough	-	-	-	-	-
1	Weisenberg Township	-	-	-	-	A-1

Erosion and Sedimentation (E & S)

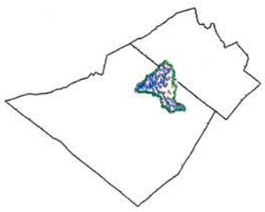
The Berks County Conservation District is responsible for administering Title 25, Chapter 102 (Erosion Control Regulations). These regulations address accelerated erosion and the resulting sedimentation from earthmoving activities. Permanent stabilization of exposed areas and proper stabilization of channels of conveyance will reduce these problems.

It should be noted that the many streambank erosion problems under the "Erosion and Sediment" heading in Table III-6 contribute tons of sediment pollution each year. With a streambank erosion included, a total of 5 sites have been identified.

Culverts and Outlets

The problems identified in Table III-6 are the result of inadequately sized culverts and/or unstable outlets which traverse state roads, township roads or private access roads. The typical solution involves performing a hydrologic study to determine pipe size and replacing the pipe with a properly sized unit. Costs are typically borne by the owner of the road.

SACONY CREEK WATERSHED



Watershed Location Map

LEGEND :

- Watershed Boundary
- Municipal Boundary
- Major Roads
- Streams

SCALE IN FEET

0 2000 4000 6000

SACONY CREEK WATERSHED

PROBLEM AREA MAP

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Paul A. DeBarry, Project Manager
T.J.O. & M.L.M., Map Designers 05/08/97: wshed_probarea

PLATE III-7

Bridges

Many bridges reach capacity on an annual basis. The proposed solutions all involve performing hydrologic studies and increasing the hydraulic capacity underneath the roadway.

Because of the high bedloads of streams within the watershed, gravel deposits threaten capacity in addition to bridge design.

Streams

The problems listed in Table III-6 include eroding streambanks that affect adjacent properties. A proposed solution consists of stabilizing the banks using rock rip-rap or cribbing. Private funding is the only avenue available at this time and the cost may be prohibitive.

As discussed in the erosion and sedimentation portion of this subtask, numerous streambank erosion problems exist. It should be noted that many of these areas are typical of stream characteristics within the watershed. While some pose a threat to personal property, most actually contribute to the unique habitats that make the streams in the watershed outstanding fisheries.

Concerned was raised during the WPAC meeting on the proper procedure for removing debris in streams which are acting as an obstruction and causing problems. Appendix 5 - "Standards for Channel Cleaning at Bridges and Culverts" establishes the guidelines for which to follow in this matter.

Flooding

Flooding in the watershed can be classified into two categories: 1) local flooding caused by inadequately sized culverts or conveyance systems; and 2) location of structures within the floodplain of the major tributaries. Of the sites identified in Table III-6, most of these are caused by inadequate conveyance systems in developed areas.

Sacony Creek has caused flooding conditions in the Borough of Kutztown. The areas within the borough immediately adjacent to Sacony Creek are generally low lying areas and are subject to minor flooding after even moderate rain or thaw conditions. The major storms along the Sacony Creek in the Borough of Kutztown occurred in 1902, May 1942, August 1955 and June 1972.

Based on the historic data and information from the July 12, 1995 Flood Insurance Study (FIS), the Sacony Creek in the Township of Maxatawny has caused flood problems. In 1972, Tropical Storm Agnes caused a major flooding event. Based on USGS gage data on the Schuylkill River near Berne, Agnes-related flooding had a 70-year recurrence interval. Based on USGS gage data on Maiden Creek where it crosses Interstate Route 78 at Gebartsville, the Tropical Storm Agnes flood had a recurrence interval of 20 years in the Township of Greenwich. According to the USGS, the Agnes flood had a recurrence interval of 33 years at the Blue Marsh dam site on Tulpehocken Creek. Near the community of Bowers, the Sacony Creek is contained within its channel by natural and man-made levees. During flood conditions, the creek overflows and floods Bowers following the channel of an abandoned mill race. Flood damage has also occurred in the Township of Rockland from the

Little Sacony Creek, in the Township of Greenwich from the Sacony Creek, and from tributaries to Mill Creek.

K. Existing and Proposed Storm Water Collection Systems

Both Kutztown and Lyons Borough have storm sewers. Since both systems are relatively old, design data is not currently available on the design storm for which they were sized. There are no known proposed storm water collection systems at this time.

L. Existing and Proposed State, Federal and Local Flood Control Projects

The July 12, 1995 FIS references man-made flood control levees along the Sacony Creek near Bowers, however, design data was unavailable. Kutztown Borough has also had the Sacony Creek channeled, however, minimum flood protection is provided.