ACT 537 UPDATE/WASTEWATER MANAGEMENT PLAN

FOR

SPRINGFIELD TOWNSHIP, BUCKS COUNTY, PA

Submitted to:

MARCH 24, 2009

Springfield Township
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Quakertown, PA 18951
Attn: Richard Schilling,
Township Manager

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Supervisors:

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Karen	Bedics	
Chuck	Halderman	
Barb	Lindter	
Rob	Zisko	

Town Officials:

Scott	MacNair	Solicitor
Sandy	Everitt	Secretary/Treasurer
Mark	Laudenslag	Chief of Police
Richard	Schilling	Township Manager

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Executive Summary

The Springfield Township Act 537 Wastewater Management Plan update builds upon the following:

- Act 537 Wastewater Management Plan (WWMP) of 1994
- Springfield Township Comprehensive Plan of 2002
- Listing of the Positive Elements of the 1994 WWMP that have not been implemented, with state-of-the-art information
- Listing of the Deficiencies of the 1994 WWMP
- Cooks Creek Watershed Plan
- Springtown Source Water Protection Plan

and consists of the following components:

1. Updated community profile and natural resources information and integration of GIS and parcel information to develop a digital and spatial profile for each lot. The integration of the data is not seamless due to source data quality and completeness, as described herein.
2. Defining wastewater management needs of Springfield Township considering environmental, public health, engineering and regulatory factors. Specifically addressing the needs on a lot-by-lot basis in the sub areas of:
   - Springtown
   - Zion Hill
   - Passer
   - Pleasant Valley
   - Designated Development Area
   - Route 309
   - Remainder of Township entitled "Outlying Areas"

   The Management Program needs of Springfield Township were also defined
3. Facilities Plans to address the needs of the sub-areas including Management Program, with budgets, implementation schedules and financing program

A key element of the 2008 Act 537 Wastewater Management Plan update has been the integration of the latest GIS information with Parcel Assessor's data and with Buck's County Board of Health Septic System data that enables the lot by lot analysis and provides the parcel owner and township:

- A centralized location for information relevant to wastewater management
- A mechanism to review and comment on information affecting wastewater management decisions

- A basis for parcel owners to understand the proper and optimal wastewater management technique(s) for the parcel and community areas of interest

The GIS-database integration efforts require the following activities for it to be seamless:

1. There is a discrepancy between the number of total parcels within the Assessor's Real Estate Database and the corresponding GIS information which requires resolution.
2. GIS parcel information is missing for lots along the western boundary of the Township.

These activities are included in the proposed Management component of the Facilities Plan.

Acknowledgements

The following documents were used as part of the community profile and regulatory structure for Springfield Township:

- Springfield Township Comprehensive Plan 1986
- Springfield Township Comprehensive Plan 2002 located online at the following URL:

  http://www.springfieldbucks.org/comp_plan.html

- Cooks Creek Watershed Study located online at the following URL:

  http://www.cookscreekpa.org/watershed.htm

- Springfield Township- Springtown Source Water Protection Plan, January 2006

Portions of the above documents were used "as-is". LAI wishes to thank the authors of the above documents for their excellent work and to acknowledge the use of text, tables and figures as background information in this Plan. Portions of text that were used are located throughout this Plan and are not cited in each case. Important tables and figures do contain citations.

Lombardo Associates, Inc. would also like to acknowledge the following individuals, who provided invaluable support and insight in the creation of the Springfield Township Act 537 Wastewater Management Plan update:

- Mr. Richard Schilling, Township Manager, Springfield Township
- Bob Wynn, Township Engineer, C. Robert Wynn Associates, Inc.
- Bobb Carson, Chairperson, Springfield Township/Bucks County Planning Commission

1. INTRODUCTION

The Springfield Township Comprehensive Plan seeks "to nurture sound land use planning and growth management principles that seek to manage natural, economic, and social systems and resources in a fashion that enhances the residents' quality of life." Part of that quality of life relates to adequate wastewater systems that both protect the natural resources of the Township and service future growth patterns. In conjunction with provisions of the existing zoning ordinances, wastewater management in the Township shall have to accommodate concentrated development along Route 309, aggregations of small parcels (<1 acre) in existing villages (Springtown, Pleasant Valley, Passer, and Zion Hill) and in future cluster developments, and development on larger lots. This distributed development pattern is best served by a decentralized wastewater management plan that integrates centralized, community, and on-lot wastewater systems and protects both public health and surface water and groundwater.

An updated Act 537 Sewage Facilities Plan has been prepared, based on a lot-by-lot assessment of salient environmental and parcel/building characteristics, to develop a comprehensive strategy for decentralized wastewater treatment and management. Lombardo Associates, Inc. (LAI) submits this report as an updated Act 537 Plan.

2. COMMUNITY PROFILE

Township History from the Springfield Township Historical Society as compiled by Betty Gross Riter as described on the Town's website is as follows:

First Settler of Springfield Township

In 1728, the first recorded white man to arrive in the area now called Springtown was an Englishman named George Wilson. He came into the area by way of Cook's Creek. He built a crude log hut on a portion of land along Silver Creek, a tributary branch of the larger Cook's Creek. He was an innkeeper, storekeeper, and a retailer of rum. He traded goods with the Indians. George Wilson lived on the land as a squatter. A squatter was a settler who selected a tract of land, built a log house upon it, and began to clear and cultivate the soil as though he owned the land. Years later his widow secured patent deeds for the land and paid from ten to fifty pounds per hundred acres to the proprietors, the sons of William Penn.

The usual method of purchasing land was to locate a tract, secure a warrant for its survey, and then obtain a patent deed. Original deeds to many properties in this area are traceable to land grants from William Penn in the late 1600s and early 1700s.

Lottery Lands in Springfield Township

In 1735, the sons of William Penn decided to sell a tract of about 4,000 acres of their best land in southeastern Pennsylvania by lottery. The area was over 3 miles long and 2 miles wide. 7,750 lottery tickets were issued at 40 shillings each (1 shilling was equal to 12 pennies). 1,293 lottery tickets were marked as award prizes of 25 to 3,000 acres. Holders of the tickets were allowed to locate the land indicated as the prize on the lottery ticket. Eventually, holders of lottery tickets were allowed to secure the deed to the land. These acres became known as the Lottery Lands of Springfield Township. German immigrants obtained most of the land involved in the lottery ticket sale.

Environmental Setting

Cooks Creek Watershed is a 30 square mile watershed in northern Bucks County, Pennsylvania. The main stem of Cooks Creek flows in a northeasterly direction into the Delaware River. The watershed drainage consists of a number of small, mostly unnamed tributaries covering approximately 24 square miles in Springfield Township, 5.5 square miles in Durham Township, and a few additional areas within Lehigh and Northhampton Counties.

The Watershed has been designated as an Exceptional Value (EV) Cold Water Fishery under the PA Chapter 93 regulations and is the only native brook trout fishery in Bucks County. The watershed is home to numerous rare and endangered species including several rare reptiles and amphibians. The watershed was rated priority 1 in the 1999 Bucks County Natural Areas Inventory.

The Cooks Creek watershed has a number of unique geologic, scenic, and natural resources, including the following:

- The Cooks Creek Watershed has been designated as an Exceptional Value waters in accordance with the Pennsylvania Code Chapter 93;
- The entire Cooks Creek has been designated as a 1-A priority for consideration as a state scenic river;
- The watershed supports threatened and endangered species, both federal and state-listed species;
- Cooks Creek is a wild brown trout stream;
- The watershed contains some unusual geologic conditions, such as karst-prone areas and a Triassic basin. The local geology, particularly karst areas, makes the stream and groundwater vulnerable to contamination.

2.1. PLANNING AREA

The planning area for this study is Springfield Township in Bucks County, PA. Figure 2.1.1 shows the location of the study area. The predominant watershed is the Cook's Creek Watershed, to which approximately 67% of the Township drains. Cook's Creek is classified as an Exceptional Value Stream, the highest quality stream classification and it supports one of two naturally occurring trout populations in the state.

2.1.1 Aerial Photography

Figures 2.1.2 presents an aerial of Springfield Township. Figures 2.1.3 through 2.1.5, respectively, provide a trilogy of aerial photographs of Springfield Township with increased detail.

2.1.2 Township Population

According to the 2000 census, Springfield Township has a population of 4,963 people. A medium projection estimates 2010 population at 5,406. Historical population and 2000 population by age data for Springfield Township are presented in Table 2.1.1. Population projections by age group for 2010 are presented in Table 2.1.2. and Table 2.1.3., respectively.

Figure 2.1.1. Springfield Township within Bucks County

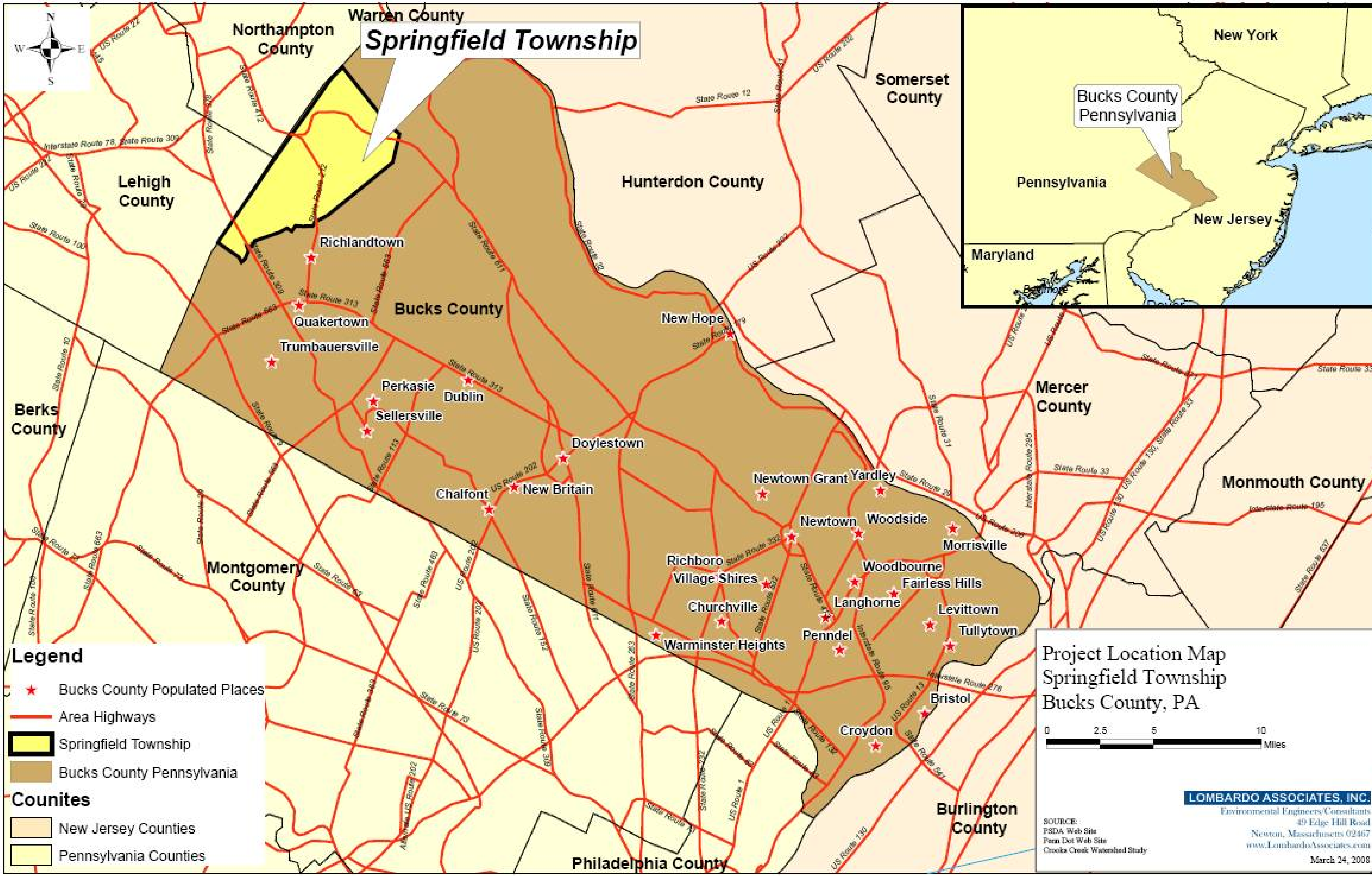


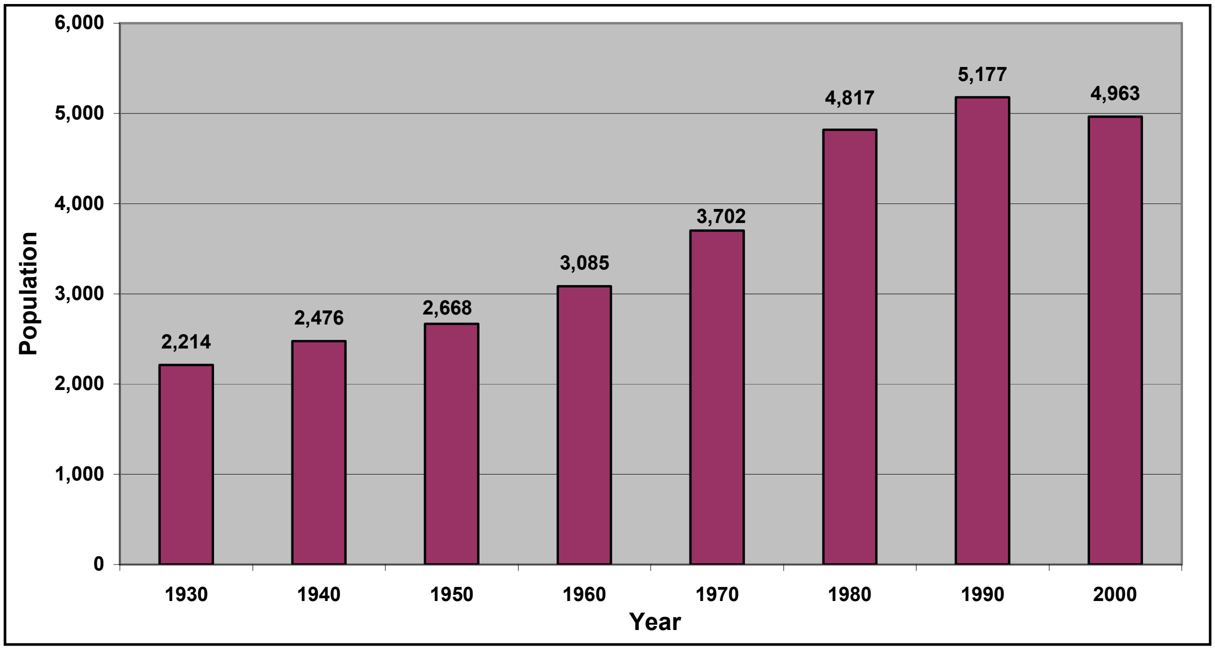
Figure 2.1.2. Aerial Photography of Springfield Township (2005)

Figure 2.1.3. Aerial Photography of Springfield Township (2005)

Figure 2.1.4. Aerial Photography of Springfield Township (2005)

Figure 2.1.5. Aerial Photography of Springfield Township (2005)

Table 2.1.1: Historical Population Data for Springfield Township



Source: 1994 Sewage Facilities Plan and 2002 Comprehensive Plan

Table 2.1.2. Population by Age for Springfield Township

Age	2000	
	Population	Percentage
Under 5	219	4.4%
5 to 9	297	6.0%
10 to 14	378	7.6%
15 to 19	319	6.4%
20 to 24	182	3.7%
25 to 34	477	9.6%
35 to 44	931	18.8%
45 to 54	878	17.7%
55 to 64	641	12.9%
65 to 74	367	7.4%
75 and over	274	5.5%
Total	**4,963**	**100.0%**
Under 18	1,110	22.4%
18-64	3,212	64.7%
65 and over	641	12.9%
Total	**4,963**	**100.0%**

Table 2.1.3. Population Projections by Age for Springfield Township

Age	2000 Census		2010 Projections					
			Low		Medium		High	
	Male	Female	Male	Female	Male	Female	Male	Female
0-4	101	118	111	125	118	132	130	143
5-9	163	134	148	121	154	126	162	134
10-14	178	200	139	171	145	177	154	186
15-19	171	148	193	137	198	142	206	150
20-24	96	86	142	129	149	369	161	148
25-29	101	97	164	140	175	151	193	169
30-34	133	146	151	147	161	157	177	173
35-39	206	228	144	176	149	181	157	189
40-44	254	243	166	184	170	188	177	195
45-49	201	216	197	235	199	237	202	240
50-54	240	221	272	232	274	234	278	238
55-59	190	171	208	213	210	215	213	218
60-64	151	129	222	206	223	207	225	209
65-69	97	95	170	142	171	144	173	147
70-74	88	87	114	96	115	97	116	99
75-79	63	78	66	63	67	64	68	66
80-84	33	50	40	45	40	46	40	47
85+	19	31	18	35	18	36	18	37
Total Male/Female	**2,485**	**2,478**	**2,665**	**2,597**	**2,736**	**2,670**	**2,850**	**2,788**
Total	**4,963**		**5,262**		**5,406**		**5,638**	
Migration Rate*	**-1.37%**		**-2.74%**		**0%**		**4.33%**	

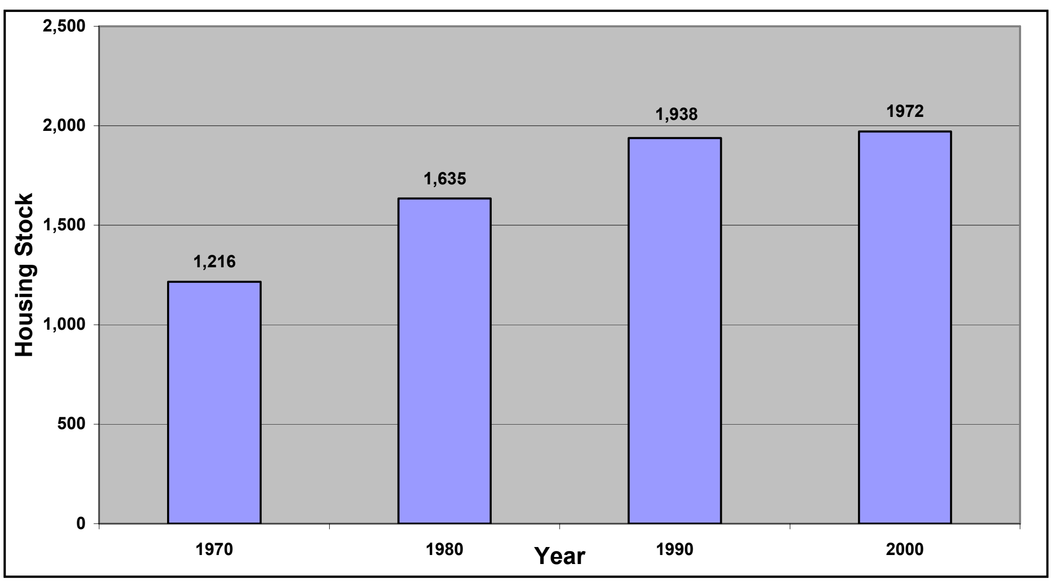
*Migration is determined by subtracting the change in population due to births and deaths from the change in population. Migration rates are calculated by dividing migration by the total population. The low projection uses a migration rate twice that seen in the 1990's, the medium projection assumes no migration in or out of the township, and the high projection uses a migration rate seen during the 1980s.

Source: 2002 Comprehensive Plan

2.1.3 Demographics, Housing Data & Lot Sizes

Figure 2.1.6 and Table 2.1.4 present the housing data by decade from 1970 – 2000.

Figure 2.1.6. Historical Housing Data for Springfield Township



Source: 1994 Sewage Facilities Plan and 2002 Comprehensive Plan

Table 2.1.4. Calculated Age of Housing Data for Springfield Township

Age of House	#	% Total	Cumulative %	Springtown	% Total	Zion Hill	% Total	Passer	% Total	Pleasant Valley	% Total	Development District	% Total	On-Site Study Area	% Total	Route 309 Study Area	% Total
<8	179	8.66%	8.66%	27	11.20%	3	3.57%	1	2.33%	4	6.06%	2	3.39%	142	9.19%	0	0.00%
9-13	72	3.48%	12.14%	2	0.83%	0	0.00%	0	0.00%	1	1.52%	0	0.00%	69	4.47%	0	0.00%
14-18	67	3.24%	15.38%	3	1.24%	1	1.19%	4	9.30%	0	0.00%	1	1.69%	58	3.75%	0	0.00%
19-28	295	14.26%	26.40%	11	4.56%	9	10.71%	2	4.65%	1	1.52%	6	10.17%	266	17.22%	0	0.00%
29-38	383	18.52%	44.92%	28	11.62%	22	26.19%	8	18.60%	2	3.03%	13	22.03%	307	19.87%	3	10.00%
39-48	200	9.67%	54.59%	31	12.86%	12	14.29%	1	2.33%	5	7.58%	15	25.42%	132	8.54%	4	13.33%
49-58	146	7.06%	61.65%	23	9.54%	4	4.76%	12	27.91%	9	13.64%	4	6.78%	92	5.95%	2	6.67%
59-68	95	4.59%	66.25%	13	5.39%	5	5.95%	9	20.93%	7	10.61%	6	10.17%	55	3.56%	0	0.00%
69+	506	24.47%	90.72%	86	35.68%	23	27.38%	6	13.95%	27	40.91%	9	15.25%	353	22.85%	2	6.67%
No Data	125	6.04%	96.76%	17	7.05%	5	5.95%	0	0.00%	10	15.15%	3	5.08%	71	4.60%	19	63.33%
Total:	**2,068**	**100.00%**	**100.00%**	**241**	**100.00%**	**84**	**100.00%**	**43**	**100.00%**	**66**	**100.00%**	**59**	**100.00%**	**1,545**	**100.00%**	**30**	**100.00%**

Springfield Township has an estimated 1,972 housing units which results in 34 additional units since 1990 as shown in Table 2.1.5 Because Springfield is a rural, relatively undeveloped area, most of the housing units are single-family detached houses on lots of one acre or more. The 2000 U.S. Census estimates that, of the total number of units, 1,693 are single-family detached, 54 are single-family attached, 111 are multifamily units, 91 are mobile homes, and 22 are seasonal units as shown in Table 2.1.6. About 1,900 units in the Township are occupied. Almost 88 percent of the occupied units are owner-occupied. Tables 2.1.7 and 2.1.8 summarize the Springfield Township Housing and Population statistics and Demographic information from 1990-2000, respectively. Table 2.1.9 demonstrates the Springfield Township parcels with buildings separated by Study Area. Table 2.1.10 shows the distribution of lot sizes within Springfield Township.

The age of the housing stock in the Township varies greatly. About 25.3 percent of the housing units in Springfield Township were built before 1939. Another 27.5 percent were built between 1940 and 1969 and 47.1 percent were built between 1970 and 2000. Roughly 592 units were built in the 1970s and 303 units were built during the 1980s. According to census figures, only 34 houses were built during the 1990s.

Table 2.1.5 Springfield Township Housing Units, 1980-2000

Age	1980	1990	2000	1980-1990	1990-2000	1980-2000
Total Units	1,635	1,938	1,972	303	34	337
% Total Units				15.63%	1.72%	17.09%

Table 2.1.6 Springfield Township Housing Units by Type, 1990-2000

Housing Type	1990		2000	
	Number of Units	Percentage of Total	Number of Units	Percentage of Total
Single-Family Detached	1,659	85.6	1,693	85.9
Single-Family Attached	54	2.8	54	2.7
Multifamily	111	5.7	111	5.6
Mobile Homes	91	4.7	91	4.6
Seasonal Units	22	1.1	22	1.1
Totals	**1,938**	**100**	**1,972**	**100**

Table 2.1.7 Springfield Township Region Housing & Population, 1990-2000

Municipality	Housing	Population
	2000	2000
Springfield	1,972	4,963
Durham	525	1,313
Nockamixon	1,411	3,517
Haycock	841	2,191
Richland	3,877	9,920
Milford	3,161	8,810
Lower Saucon	3,195	9,884
Upper Saucon	4,117	11,939
Williams	1,738	4,470
	21,557	**57,007**

Table 2.1.8 Springfield Township Demographic Characteristics, 1990-2000

Characterestic	1990	2000
Median Age	38.1	41.8
Households*	1,856	1,900
Family household**	1,485	1,471
Married Couple Families	1,310	1,279
Nonfamily Households***	371	429
Householders Living Alone	301	338
Average Household Size	2.7	2.61
Average Family Size	3.04	2.96

*A household is an occupied housing unit.

**A family household is a household with two or more individuals related by marriage, birth, or adoption.

***A nonfamily household is a household with a group of unrelated individuals or a person living alone.

Table 2.1.9 Springfield Township Parcels with Buildings by Study Area

Date Erected Category	Age of House	Development District	On-Site Study Area	Passer	Pleasant Valley	Route 309 Study Area	Springtown	Zion Hill	Township-Wide Total	Cum. Total	% Total Dev.	Cum. % Total Dev.	Age of House
2000-2008	<8	2	142	1	4	0	27	3	179	179	8.7%	8.7%	<8
1995-1999	9-13	0	69	0	1	0	2	0	72	251	3.5%	12.1%	9-13
1990-1994	14-18	1	58	4	0	0	3	1	67	318	3.2%	15.4%	14-18
1980-1989	19-28	6	266	2	1	0	11	9	295	613	14.3%	29.6%	19-28
1970-1979	29-38	13	307	8	2	3	28	22	383	996	18.5%	48.2%	29-38
1960-1969	39-48	15	132	1	5	4	31	12	200	1,196	9.7%	57.8%	39-48
1950-1959	49-58	4	92	12	9	2	23	4	146	1,342	7.1%	64.9%	49-58
1940-1949	59-68	6	55	9	7	0	13	5	95	1,437	4.6%	69.5%	59-68
pre-1940	69+	9	353	6	27	2	86	23	506	1,943	24.5%	94.0%	69+
No Data	No Data	3	71	0	10	19	17	5	125	2,068	6.0%	100.0%	No Data
	Subtotal:	**59**	**1,545**	**43**	**66**	**30**	**241**	**84**	**2,068**		**100.0%**		
Undeveloped		22	500	9	9	26	65	19	650	2,718			
Total Parcels										2,718			

Table 2.1.10 Springfield Township Lot Sizes by Study Area

Study_Area	<10,000	10,001-15,000	15,001-20,000	20,001-40,000	40,001-60,000	60,001-80,000	>80,000	No Data	Total
Development District	0	0	4	19	7	**4**	44	3	**81**
On Site	33	23	30	131	156	**92**	1,539	41	**2,045**
Passer Village	0	1	14	16	9	**1**	9	2	**52**
Pleasant Valley Village	7	6	11	20	7	**6**	17	1	**75**
Route 309	5	4	4	9	7	**4**	22	1	**56**
Springtown Village	57	51	46	38	34	**7**	52	21	**306**
Zion Hill Village	5	6	8	14	28	**11**	29	2	**103**
Grand Total	**107**	**91**	**117**	**247**	**248**	**125**	**1,712**	**71**	**2,718**

2.1.4 Other Township Information

2.1.4.1 Town Finances

Tables 2.1.11 through 2.1.13 define the sources of revenue and expenditure for the Township. The average developed parcel paid an annual property tax of approximately $100.00.

Table 2.1.11 Sources of Revenue, Springfield Township, 2000

Revenue Source	Amount	Percentage
Earned Income Tax	$547,623	50%
Property Tax	$184,704	16.90%
Real Estate Transfer Tax	$87,726	8.00%
Other Taxes	$73,642	6.70%
Licenses and Permits	$88,706	8.10%
Fines and Fees	$55,964	5.10%
Miscellaneous Revenue	$56,385	5.20%
Total Revenue	**$1,094,750**	**100%**

Table 2.1.12 Expenditures, Springfield Township, 2000

Expenditure	Amount	Percentage
General Administration	$200,179	19.10%
Building Maintenance	$20,770	2.00%
Public Safety	$468,544	44.80%
Zoning and Subdivision Administration	$114,945	11.00%
Public Works	$239,377	22.90%
Miscellaneous	$2,062	0.20%
Total	**$1,045,877**	**100%**

Table 2.1.13 Revenues & Expenditures, Springfield Township, 1994-2000

	1994	1995	1996	1997	1998	1999	2000
Total Operating Receipts	$795,333	$833,154	$949,298	$953,802	$1,362,312	$1,071,005	$1,904,750
Carry Over	$397,887	$407,325	$465,505	$418,838	$418,838	$276,898	$413,099
Total Revenues	$1,193,220	$1,240,479	$1,414,803	$1,372,640	$1,781,150	$1,347,903	$1,507,849
Total Expenditure	$718,968	$800,806	$907,198	$986,965	$1,390,715	$1,149,193	$1,045,877
Surplus/(Deficit)	$474,252	$439,673	$507,605	$385,675	$390,435	$198,710	$461,972

2.1.4.2 Recreational Facilities

Springfield Township has several private recreational facilities, but until recently, lacked a township land to provide public park and recreational facilities. In February of 2002, the Township acquired the Kurtesan Farm which is a 45.3-acre tract located on Peppermint Road. The property was purchased through the County's Open Space Program and is intended for future park use. The Township also has an option to purchase an additional 25 acres of land on the opposite side of Peppermint Road. The property is suitable to satisfy a wide-range of active and passive recreational opportunities. Responses from the Township survey mailed out at the beginning of the comprehensive planning process will allow township officials to identify the specific park and recreational activities requested by residents.

In 1991 Springfield Township developed a park and recreation plan to enable the Township to acquire or develop (via fees in lieu of dedication) park and recreation facilities through the subdivision and land development process as permitted by Section 503 (11) of the municipalities planning code. The plan was also intended to provide guidelines to the Supervisors as to the size, location, design, and types of park and recreation facilities that are appropriate to the Township. The plan was completed but never adopted. The plan analyzed five different park types: tot lots and miniparks, neighborhood parks, community parks, regional parks, and linear park and provided an inventory of available facilities.

The park and recreation plan recommends that neighborhood parks be placed in or near the villages of Zion Hill, Springtown, and Pleasant Valley or future high-density areas. The plan suggests a need to further study whether a community park is appropriate for the Township and where such a park should be located. Although the Township has no regional facilities, the plan identifies 12 regional parks in Bucks, Lehigh, and

Northampton counties that are within one hour's drive. As with community parks, the plan suggests the need to further study whether a regional park is needed within the Township.

Table 2.1.14 lists the recreational facilities in the Township.

Table 2.1.14 Springfield Township Recreational Facilities

Name	Park Type	Facilities	Acreage	Ownership
Springfield Elementarty School	Neighborhood	Baseball Field, Basketball Courts, Playground Equipment	0.43	Public
Passer Community Center	Neighborhood	Basketball Court, Swing	3.75	Private
Zion Church	Neighborhood	Baseball Field, Basketball Courts, Playground Equipment	3.74	Private
Ridge and Valley Rod and Gun Club	Community	Archery Shooting Range	11.38	Private
Springtown Rod and Gun Club	Community	Picnic Area, Shooting Range	30.7	Private
Silver Creek Athletic Association	Community	Baseball Fields , Basketball & Tennis Courts, Picnic & Playground Facilities	31.82	Private

2.1.4.3 Conservation Area

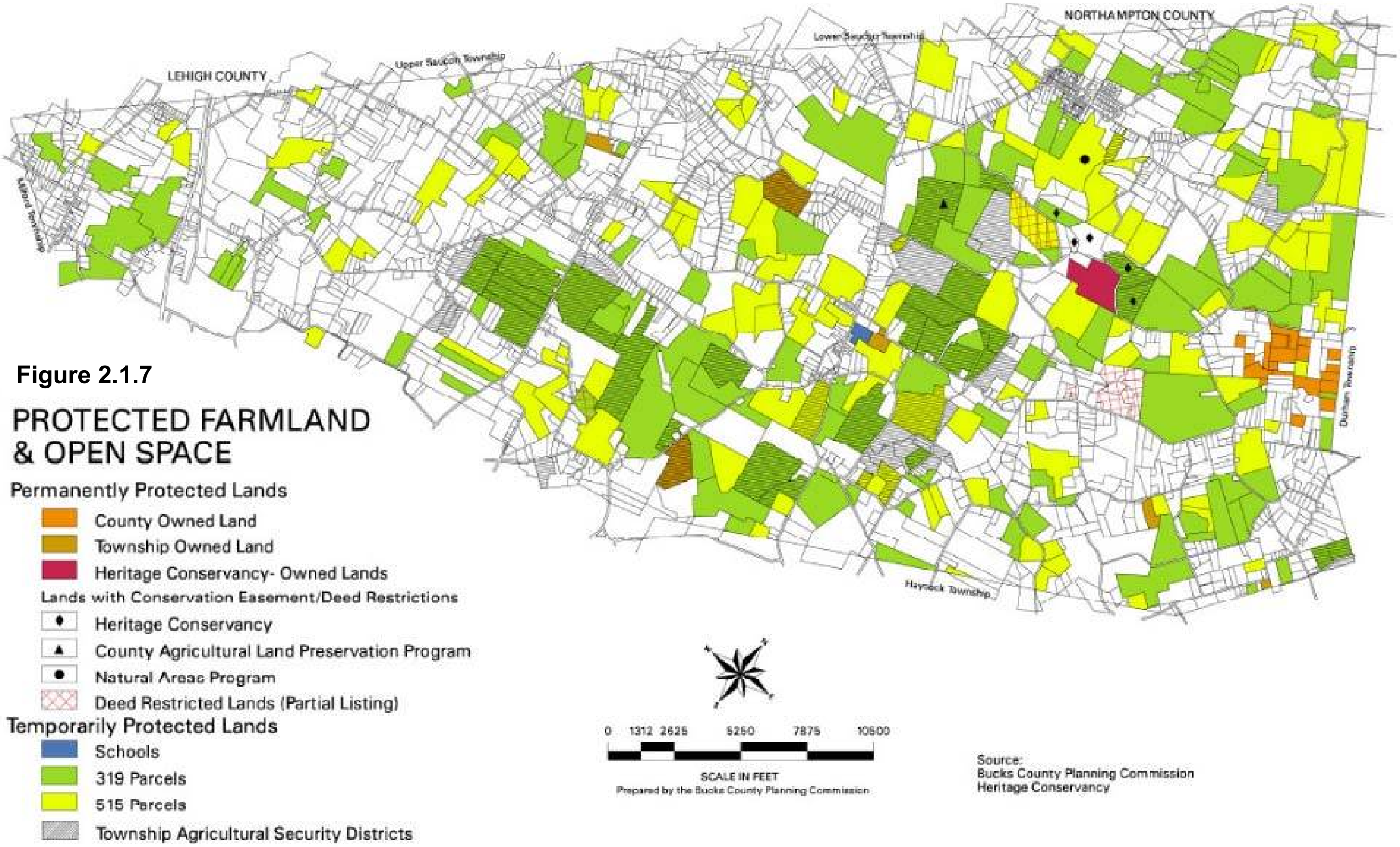
Open Space preservation is a priority for the residents of Springfield Township. In 2000, the residents approved by Referendum a .25% Earned Income Tax to be set aside for preservation of open space. At the end of 2007, Springfield Township had preserved 1,522 acres. Whenever possible, the Township matches funding sources to ensure that the residents get the most for their tax money.

Figure 2.1.7 illustrates the protected Township land and open space according to the Bucks County Planning Commission Heritage Conservancy, as stated in the 2002 Comprehensive Plan, with the following definitions of some of the categories:

Act 319 - Pennsylvania Farmland and Forest Land Assessment Act (***Clean and Green***) is a state law passed in 1974, and amended in 1998 by Act 156 that allows land parcels which are 10 acres or more in size and which are devoted to agricultural and forest land use, to be assessed at value for *that use* rather than Fair Market Value. The intent of the act is to encourage property owners to retain their land in agricultural or forestland use, and to provide some tax relief to land owners.

Act 515 - of 1996 enables Pennsylvania counties to covenant with landowners to voluntarily preserve land in farm, forest, water supply or open space by taxing land according to its use value rather than the prevailing market value.

Figure 2.1.7. Bucks County Planning Protected Farmland & Open Space, 2002



2.1.5 Historic Resources

Established in 1743, Springfield Township has an abundance of historic resources, and their recognition is important in maintaining the Township's cultural heritage and identity. Residential and nonresidential development proposals often pose a potential threat to historic and archeological sites. The Springfield Township Historic Commission and Springfield Township Historic Society have been instrumental in the identification and prompting the protection of historic properties. The Township Historic Commission has identified and documented various historic sites and has compiled the Township Historic Registry. The Historic Registry contains a listing of properties that possess architectural integrity and local significance and participation is entirely voluntary. The Historic Commission and Historic Society have also identified other significant historic properties, including sites that have received a 250th Springfield Township Anniversary commemorative plate due to their historic value.

The Township's historic resource sites are listed in Table 2.1.15 below. The Table also identifies sites that are listed on the National Register of Historic Places and the Heritage Conservancy Register of Historic Places.

Figure 2.1.8 identifies the location of these historic sites within the context of the Township.

Table 2.1.15 Summary of Springfield Township Historic Resource Sites

Map Number/Historic Resource Sites (Refer to Figure 2.1.8 for Map Number locations)

1. Knight Property*
2. Gunster Residence*
3. Buckwampum Farm*
4. Opp's Tavern*
5. Passer Schoolhouse*
6. Knecht's Covered Bridge* t
7. Smith-Leith House
8. Nusbickle House
9. Pleasant Valley Schoolhouse
10. Passer Creamery
11. Ritter House
12. Boyer House
13. Church School
14. Funk's Mill
15. Kockert's Tavern
16. Slifer's Log House
17. Springfield Meeting House
18. Post Office and Henry Mill's General Store
19. Springfield High School
20. Blacksmith Shop

21. Zion Hill Lutheran Church
22. Walking Purchase Monument
23. Meyer-Moyer/Kirkland/Meyer
24. White Horse Inn/Hess/Strock
25. Times Building-Funk
26. Johannes Cyphert/George Seifert/Homer Strock
27. Springtown Hotel
28. Frankenfield Homestead
29. Pleasant Valley Three Stone Arch Bridge
30. Milestone 1793 "43 m to P"
31. Weierbach's Store
32. Pleasant Valley Inn
33. Pleasant Valley Feed Mill-Yost Mill
34. Schuckenhausen Evangelical and Reformed Church
35. Passer Hotel

Notes:
t Listed on the National Register of Historic Places
* Listed on the Heritage Conservancy Registry of Historic Places

Figure 2.1.8 also identifies four historic villages in the Township-Springtown, Pleasant Valley, Passer, and Zion Hill. Other villages or hamlets that do not contain an existing village zoning district are not shown.

2.1.6 Development Status

Tables 2.1.16 and 2.1.17 summarize the current development within the Township.

Table 2.1.16 Parcels & Development Status by Study Area

Study_Area	Developed Parcels	Undeveloped Parcels	Grand Total Parcels
Development District	59	22	81
Outlying Areas	1,545	500	2,045
Passer Village	43	9	52
Pleasant Valley Village	66	9	75
Route 309	30	26	56
Springtown Village	241	65	306
Zion Hill Village	84	19	103
Grand Total	**2,068**	**650**	**2,718**

Figure 2.1.8. Springfield Township Historic Resource Sites

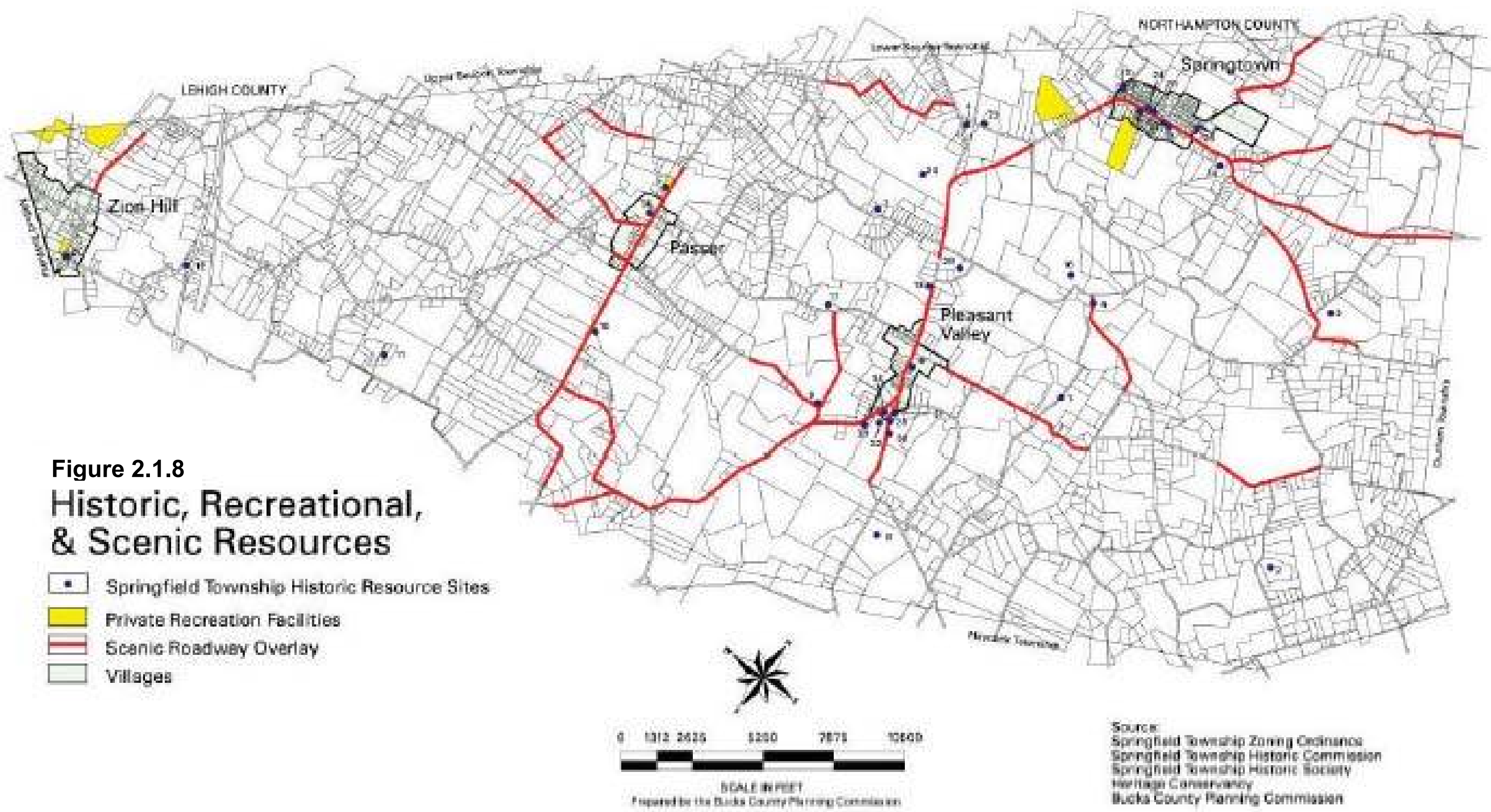


Table 2.1.17: Distribution of Development in Springfield Township

Study_Area	# of Parcels	Total Area (acres)	% of Township	% of Parcels
Developed	2,068	14,284	**74.1%**	**76.1%**
Undeveloped	650	5,001	**25.9%**	**23.9%**
Undevelopeable	0		**0.0%**	**0.0%**
Grand Total	**2,718**	**19,285**	**100.0%**	**100.0%**

2.1.7 Buildout Discussion

The housing data presented in Table 2.1.5 shows highly variable growth rates. Over the period 1980-2000, the approximate growth rate was 1% per year. Applying this rate to the 2,068 existing developed parcels, the approximate number of additional dwelling units anticipated over the 20-year period of this plan is 414. There are 680 undeveloped lots covering 5,001 acres. Buildout is not anticipated to occur during the period of this Plan. Furthermore, for the growth that is anticipated, there is no basis for assigning it to individual study areas discussed in the following sections.

2.2. PHYSICAL CHARACTERISTICS

Figure 2.2.1 illustrates the physical characteristics of the study area, including streams, lakes, impoundments, natural conveyance, channels, and drainage basins in the planning area. Figure 2.2.2 shows the surface topography contours.

Figure 2.2.1. 10 Meter Digital Elevation Model of Springfield Township

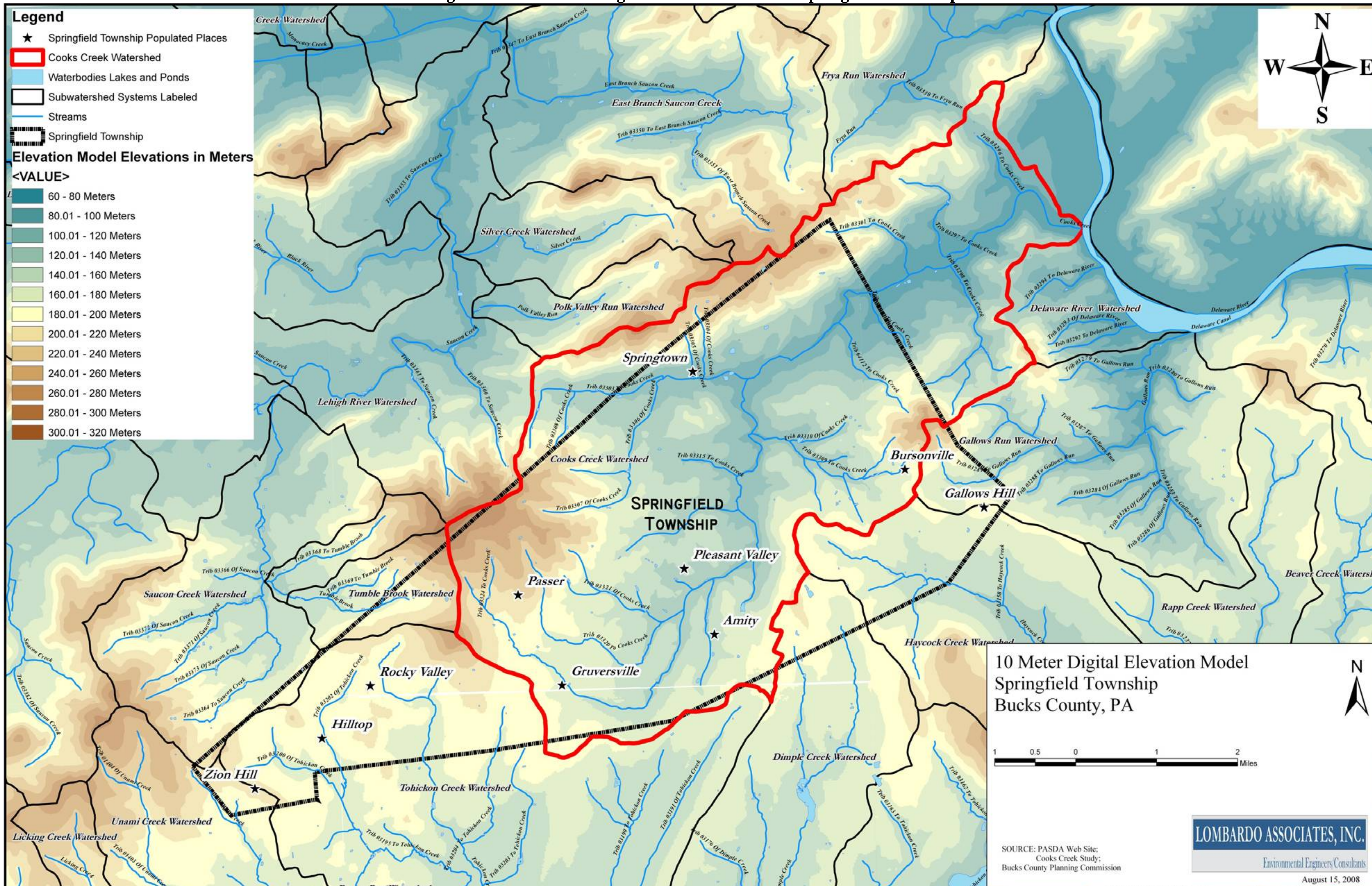
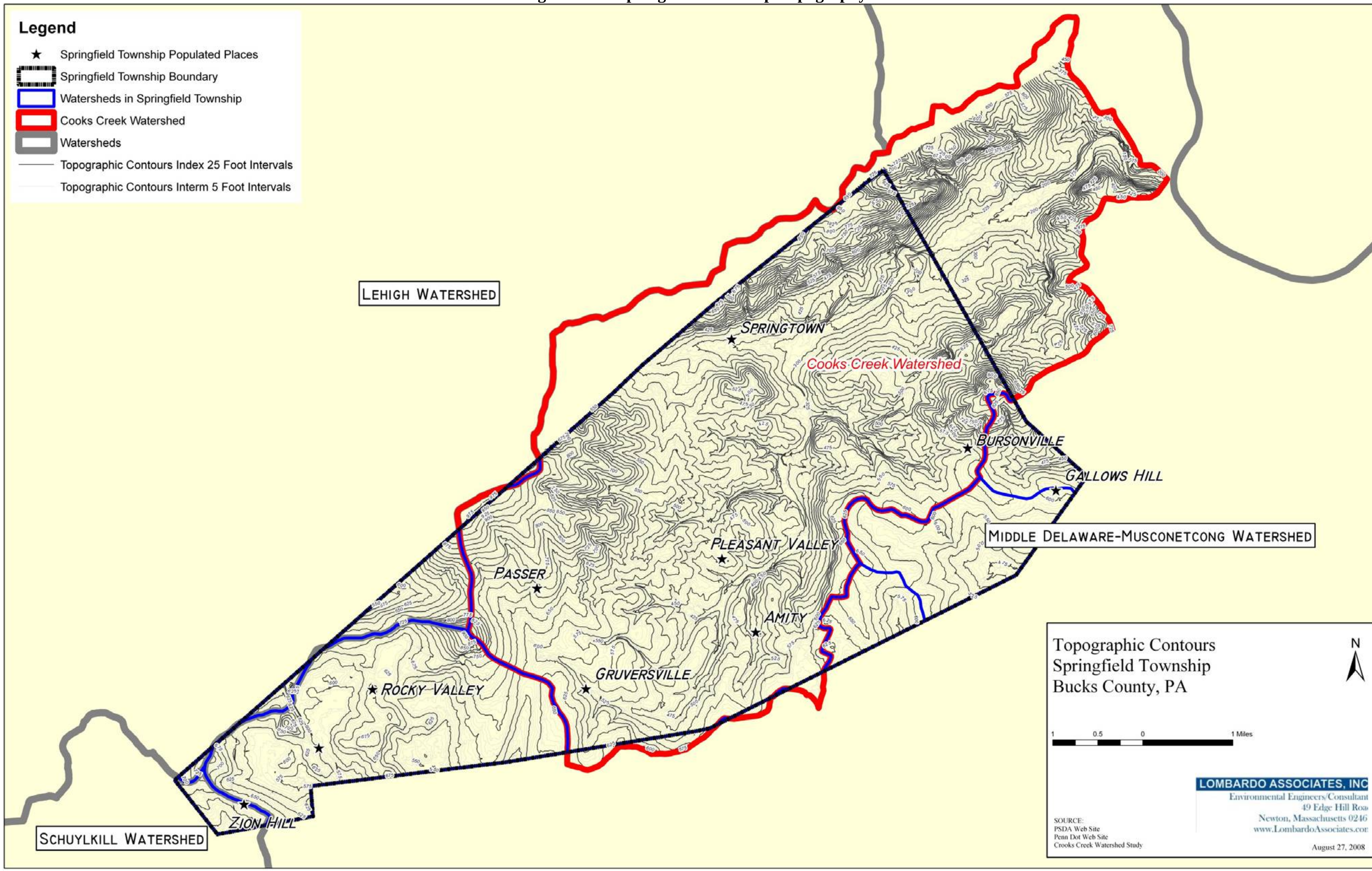


Figure 2.2.2. Springfield Township Topography



2.3. SOILS

Table 2.3.1 presents the soils that are listed as occurring within Springfield Township, according to the USDA Natural Resource Conservation Service. Figure 2.3.1 presents the soils sorted by suitability to sustain septic systems. The suitability of the soils in a given area for in-ground on-lot systems or elevated sand mounds and areas unsuitable for soil dependent systems can be determined from this map. Figure 2.3.2 presents the USDA interpretation of soils slopes. Figure 2.3.3 illustrates the soil types in Springfield.

Figure 2.3.4 presents the locations of the watershed boundaries in and around Springfield Township.

In the opinion of the Bucks County Sewage Enforcement Officer, the soils listed on Table 2.3.1 are problematic for drainfields.

Table 2.3.1: Problematic Soils in Springfield Township

Soil Symbols	Soil Location
AbA, AbB, AbC	Abbottstown
AmA, AmB, AmC	Amwell
Bo	Bowmansville
CwxB	Croton
DdA, DdB	Doylestown
LmA, LmB, LmC, LnB, LnD	Lehigh
RIA, RIB, RIC	Reaville
ToA, ToB, TpB	Towhee

The Cooks Creek Watershed Plan stated that three main generalized soil groups exist within the watershed. These groups are:

- Deep soils that have a medium-textured surface layer and a medium-textured or moderately fine-textured subsoil (Associations: Allenwood Chester, Duffield-Washington, and Towhee-Neshaminy-Mount Lucas)
- Deep soils that have a medium-textured surface layer and a firm friable, but mainly firm and compact, subsoil; shallow to deep over shake and sandstone. (Associations: Abbotstoewn-Readington-Reaville and Penn-Klinesville)
- Deep soils that have a medium-textured surface layer and a medium-textured or moderately coarse-textured subsoil (Association: Alton-Pope)

The area near the Delaware River is comprised of Alton-Pope soils. These are nearly level to gently sloping, well-drained soils on terraces or floodplains. The central portion of the watershed consists of Duffield, Washington and Allenwood soils. These are gently sloping, well-drained upland soils. On either side of Duffield andWashington association soils are the Chester soils. Chester soils contain nearly level to moderately steep, well-drained upland soils. On either side of the Allenwood soils are the Penn-Klinesville soils. Penn-Klinesville soils are comprised of nearly level to moderately steep, shallow and moderately deep, well-drained upland soils.

Soils data for all soil types in Springfield Township are presented in Table 2.3.2.

Figure 2.3.5 presents the Agricultural Soils of the Township.

Table 2.3.2: Soils Classifications within Springfield Township

Soil Type		Depth (in)	USDA Texture	Suitability for septic disposal	Suitability for sand mounds	Suitability for spray irrigation	Hydric Soils	Alluvial soil	Permeability (Ksat) (in/hour)	Percolation Rate (min/in)	Percolation Rate (min/in)	Depth to Bedrock (ft)	Hydrologic Group	Water Table Upper Limit	Water Table Lower Limit	% Town	% Study Area: % Springtown	% Zion Hill	% Passer	% Pleasant Valley	% Development District	% Outlying Study Area
AbA	Abbotstown	0-10	Silt loam						.6 - 2	100 - 30	0.6 - 2	54	C	0.5-1.5	1.3-2.6	0.459%						0.48%
		10-20	Silt loam, loam silty clay loam						.6 - 2	100 - 30												
		20-39	Channery silt loam, loam silty clay loam						.06 - .2	1000 - 300												
		39-48	Channery silt loam, loam silty clay loam						.06 - .6	1000 - 100												
		48-58	bedrock						.06 - .6	1000 - 100												
AbB	Abbotstown	0-10	Silt loam						.6 - 2	100 - 30	0.6 - 2	54	C	0.5-1.5	1.3-2.6	2.899%		3.35%	7.26%			3.01%
		10-20	Silt loam, loam silty clay loam						.6 - 2	100 - 30												
		20-39	Channery silt loam, loam silty clay loam						.06 - .2	1000 - 300												
		39-48	Channery silt loam, loam silty clay loam						.06 - .6	1000 - 100												
		48-58	bedrock						.06 - .6	1000 - 100												
AbC	Abbotstown	0-10	Silt loam						.6 - 2	100 - 30	0.6 - 2	54	C	0.5-1.5	1.3-2.6	0.138%						0.14%
		10-20	Silt loam, loam silty clay loam						.6 - 2	100 - 30												
		20-39	Channery silt loam, loam silty clay loam						.06 - .2	1000 - 300												
		39-48	Channery silt loam, loam silty clay loam						.06 - .6	1000 - 100												
		48-58	bedrock						.06 - .6	1000 - 100												
AmB	Amwell	0-10	Silt loam						0.20 - 2	300 - 30	0.2 - 2	84	C	1.0-2.5	1.3-2.9	0.062%						0.07%
		10-21	Clay loam, silty clay loam, gravelly silty clay loam						0.20 - 2	300 - 30												
		21-57	Loam, silt loam, gravelly silty clay loam						0.06 - 0.2	1000 - 300												
		57-75	Fine sandy loam, very channery loam, gravelly silt loam						2.00 - 6	30 - 10												
ArB	Arendtsville	0-10	Gravelly Silt Loam						0.60 - 6	100 - 10	0.6 - 6	84	B	---	---	4.373%		6.52%	53.62%		2.02%	4.29%
		10-52	Gravelly Sandy Loam, Clay						0.60 - 6	100 - 10												
		52-81	Gravelly loam, very gravellly sandy loam, very gravelly loam						0.60 - 6	100 - 10												
ArC	Arendtsville	0-10	Gravelly Silt Loam						0.60 - 6	100 - 10	0.6 - 6	84	B	---	---	5.331%		5.85%	26.95%		1.89%	
		10-52	Gravelly Sandy Loam, Clay						0.60 - 6	100 - 10												
		52-81	Gravelly loam, very gravellly sandy loam, very gravelly loam						0.60 - 6	100 - 10												
ArD	Arendtsville	0-10	Gravelly Silt Loam						0.60 - 6	100 - 10	0.6 - 6	84	B	---	---	2.011%						2.11%
		10-52	Gravelly Sandy Loam, Clay						0.60 - 6	100 - 10												
		52-81	Gravelly loam, very gravellly sandy loam, very gravelly loam						0.60 - 6	100 - 10												
Bo	Bowmansville	0-7	Silt loam	No			Yes	Yes	0.60 - 2	100 - 30	0.6 - 2	84	B/D	0.5-1.5	>6	3.042%	0.51%			2.06%		3.20%
		7-26	Silt loam, clay loam, sandy clay loam						0.20 - 0.6	300 - 100												
		26-43	silty clay loam, fine sandy loam, gravelly silt loam						0.20 - 2	300 - 30												
		43-65	gravelly sandy loam, stratified gravel to sand						2.00 - 6.00	30 - 10												
BrB	Brecknock	0-10	Channery silt loam						0.60 - 2	100 - 30	0.6 - 2	48	B	---	---	0.401%		17.06%				0.25%
		10-32	Silt loam, clay loam, channery silt loam						0.60 - 2	100 - 30												
		32-41	Very channery silt loam, channery loam, very channery clay loam						0.60 - 2	100 - 30												
		41-51	bedrock						0.60 - 6	100 - 10												
BrC	Brecknock	0-10	Channery silt loam						0.60 - 2	100 - 30	0.6 - 2	48	B	---	---	0.093%						0.10%
		10-32	Silt loam, clay loam, channery silt loam						0.60 - 2	100 - 30												
		32-41	Channery silt losm, very channery silt loam, channery loam, very channery clay loam						0.60 - 2	100 - 30												
		41-51	bedrock						0.60 - 6	100 - 10												
BwB	Buckingham	0-7	Silt loam						0.60 - 2	100 - 30	0.6 - 2	84	C	0.5-1.5	1.8-3.4	2.246%		3.42%		7.54%	1.08%	2.27%
		7-30	Silt loam, loam, silty clay loam						0.60 - 2	100 - 30												
		30-44	silt loam, loam, silty clay loam						0.06 - 0.6	1000 - 100												
		44-70	Gravelly silt loam, gravelly loam						0.06 - 0.6	1000 - 100												
CmB	Clarksburg	0-8	silt loam	No					0.60 - 2	100 - 30	0.6 - 2	84	C	1.5-3.0	1.8-3.0	0.723%	1.23%					0.73%
		8-27	loam, silty clay loam, gravelly silt loam						0.60 - 2	100 - 30												
		27-51	silty clay loam, channery loam, silt loam						0.06 - 0.6	1000 - 100												
		51-84	silt loam, clay, channery loam, silty clay loam						0.06 - 0.6	1000 - 100												
CwA	Croton	0-6	Silt loam						0.20 - 2	300 - 30	0.2 - 2	80	D	0.0-0.5	1.3-2.1	1.752%		2.89%				1.82%
		6-19	Silt loam, silty clay loam, channery silt loam						0.20 - 0.6	300 - 100												
		19-49	Silt loam, silty clay loam, channery silt loam						0.06 - 0.2	1000 - 300												
		49-78	Silt loam, channery silty clay loam, channery clay loam						0.06 - 0.2	1000 - 300												
		78-90	bedrock						0.00 - 0.2	#DIV/0! - 300												
CwB	Croton	0-6	Silt loam						0.20 - 2	300 - 30	0.2 - 2	84	D	0.0-0.5	1.3-2.1	1.935%		2.51%				2.02%
		6-19	Silt loam, silty clay loam, channery silt loam						0.20 - 0.6	300 - 100												
		19-49	Silt loam, silty clay loam, channery silt loam						0.06 - 0.2	1000 - 300												
		49-78	Silt loam, channery silty clay loam, channery clay loam						0.06 - 0.2	1000 - 300												
		78-90	Extremely channery loam						0.20 - 0.6	300 - 100												
CwxB	Croton, Extremely Stony	0-6	Silt loam						0.20 - 2	300 - 30	0.2 - 2	84	D	0.0-0.5	1.3-2.1	0.042%						0.04%
		6-19	Silt loam, silty clay loam, channery silt loam						0.20 - 0.6	300 - 100												
		19-78	Silt loam, silty clay loam, channery silty clay loam						0.00 - 0.2	#DIV/0! - 300												
		78-90	Extremely channery loam						0.00 - 0.2	#DIV/0! - 300												
CyB	Culleoka	0-10	Channery silt loam						2.00 - 6	30 - 10	2 - 6	54	B	---	---	0.125%						0.13%
		10-31	Channery silt loam, flaggy loam, silty clay loam						0.60 - 6	100 - 10												
		31-38	Very channery silt loam, very flaggy silty clay loam, flaggy loam						0.60 - 6	100 - 10												
		38-48	bedrock						0.00 - 2	#DIV/0! - 30												
CyC	Culleoka	0-10	Channery silt loam						2.00 - 6	30 - 10	2 - 6	54	B	---	---	0.084%						0.09%
		10-31	Channery silt loam, flaggy loam, silty clay loam						0.60 - 6	100 - 10												
		31-38	Very channery silt loam, very flaggy silty clay loam, flaggy loam						0.60 - 6	100 - 10												
		38-48	bedrock						0.00 - 2	#DIV/0! - 30												
DgC	Duffield	0-10	silt loam	Moderate					0.60 - 2	100 - 30	0.6 - 2	84	B	---	---	0.655%	6.31%					0.59%
		10-53	silty clay loam, silty clay, channery loam						0.60 - 2	100 - 30												
		53-72	channery silt loam, silt loam, clay						0.60 - 2	100 - 30												
EcC	Edgemont	0-8	Channery loam						0.60 - 6	100 - 10	0.6 - 6	84	B	---	---	0.373%						0.40%
		8-36	Fine sandy loam, channery sandy clay loam, channery sandy loam, gravelly clay loam						0.60 - 6	100 - 10												
		36-60	Sandy loam, channery loamy sand, channery sandy loam, very gravelly clay loam						0.60 - 6	100 - 10												
EdD	Edgemont	0-8	Channery sandy loam						0.60 - 6	100 - 10	0.6 - 6	84	B	---	---	0.882%						0.94%
		8-36	Fine sandy loam, channery sandy clay loam, channery sandy loam, gravelly clay loam						0.60 - 6	100 - 10												
		36-60	Sandy loam, channery loamy sand, channery sandy loam, very gravelly clay loam						0.60 - 6	100 - 10												
EdF	Edgemont	0-8	Channery sandy loam						0.60 - 6	100 - 10	0.6 - 6	84	B	---	---	0.548%						0.58%
		8-36	Fine sandy loam, channery sandy clay loam, channery sandy loam, gravelly clay loam						0.60 - 6	100 - 10												
		36-60	Sandy loam, channery loamy sand, channery sandy loam, very gravelly clay loam						0.60 - 6	100 - 10												

	Soil Type	Depth (in)	USDA Texture	Suitability for septic disposal	Suitability for sand mounds	Suitability for spray irrigation	Hydric Soils	Alluvial soil	Permeability (Ksat) (in/hour)	Percolation Rate (min/in)	Percolation Rate (min/in)	Depth to Bedrock (ft)	Hydrologic Group	Water Table Upper Limit	Water Table Lower Limit	% Town	% Study Area: % Springtown	% Zion Hill	% Passer	% Pleasant Valley	% Development District	% Outlying Study Area
Fl	Fluvaquents	0-6	Silt loam						0.20 - 6	300 - 10	0.2 - 6	84	C	0.0-0.5	>6	0.186%						0.20%
		6-62	Silty clay loam, gravelly sand, clay						0.06 - 0.6	1000 - 100												
GlB	Gladstone	0-10	Gravelly silt loam						0.60 - 6	100 - 10	0.6 - 6	84	B	---	---	3.948%	15.77%					3.89%
		10-42	Gravelly sandy clay loam, gravelly silt loam, gravelly clay loam						0.20 - 0.6	300 - 100												
		42-68	Gravelly clay loam, gravelly fine sandy loam, gravelly loam						2.00 - 6	30 - 10												
GlC	Gladstone	0-10	Gravelly silt loam						0.60 - 6	100 - 10	0.6 - 6	84	B	---	---	3.102%	13.83%					3.05%
		10-42	Gravelly sandy clay loam, gravelly silt loam, gravelly clay loam						0.20 - 0.6	300 - 100												
		42-68	Gravelly clay loam, gravelly fine sandy loam, gravelly loam						2.00 - 6	30 - 10												
GlD	Gladstone	0-10	Gravelly silt loam						0.60 - 6	100 - 10	0.6 - 6	84	B	---	---	1.000%	3.82%					0.99%
		10-42	Gravelly sandy clay loam, gravelly loam, gravelly silt loam, gravelly clay loam						0.20 - 0.6	300 - 100												
		42-68	Gravelly clay loam, gravelly fine sandy loam, gravelly loam						2.00 - 6	30 - 10												
GmB	Gladstone, Very Bouldery	0-10	Silt loam						0.60 - 6	100 - 10	0.6 - 6	84	B	---	---	0.047%						0.05%
		10-42	Gravelly clay loam, gravelly silt loam, gravelly sandy clay loam						0.60 - 6	100 - 10												
		42-68	Gravelly clay loam, gravelly sandy loam, gravelly fine sandy loam						0.60 - 2	100 - 30												
GmD	Gladstone, Very Bouldery	0-10	Silt loam						0.60 - 6	100 - 10	0.6 - 6	84	B	---	---	2.766%	3.07%					2.85%
		10-42	Gravelly clay loam, gravelly silt loam, gravelly sandy clay loam						0.60 - 6	100 - 10												
		42-68	Gravelly clay loam, gravelly sandy loam, gravelly loam						0.60 - 2	100 - 30												
GmF	Gladstone, Very Bouldery	0-10	Silt loam						0.60 - 6	100 - 10	0.6 - 6	84	B	---	---	0.146%	0.25%					0.12%
		10-42	Gravelly loam, gravelly silt loam, gravelly sandy clay loam						0.60 - 6	100 - 10												
		42-68	Gravelly loam, gravelly sandy loam, gravelly fine sandy loam						0.60 - 2	100 - 30												
GrA	Glenville	0-9	Silt loam						0.60 - 2	100 - 30	0.6 - 2	84	C	1.5-3.0	1.8-1.9	0.966%	2.87%					0.98%
		9-17	Silt loam, channery loam, channery silty clay loam						0.60 - 2	100 - 30												
		17-39	Silt loam, channery loam, silty clay loam						0.06 - 0.6	1000 - 100												
		39-82	Channery fine sandy loam, channery loam, very channery sandy loam						0.20 - 0.6	300 - 100												
GrB	Glenville	0-9	Silt loam						0.60 - 2	100 - 30	2	84	C	1.5-3.0	1.8-1.9	1.514%	2.16%					1.55%
		9-17	Silt loam, channery loam, channery silty clay loam						0.60 - 2	100 - 30	2											
		17-39	Silt loam, channery loam, silty clay loam						0.06 - 0.6	1000 - 100	0.6 - 0.6											
		39-82	Channery fine sandy loam, channery loam, very channery sandy loam						0.20 - 0.6	300 - 100	0.6											
Ha	Hatboro	0-9	silt loam	No			Yes		0.60 - 2	100 - 30	0.6 - 2	84	D	0.0-0.5	>6.0	1.798%	8.64%	2.51%			6.78%	1.59%
		9-44	silt loam, silty clay loam, sandy clay loam						0.60 - 2	100 - 30												
		44-56	sandy clay loam, sandy loam, silt loam						0.60 - 2	100 - 30												
		56-70	stratified gravelly sand to clay						2.00 - 6	30 - 10												
KlB	Klinesville	0-8	very channery silt loam	No	Yes				2.00 - 6	30 - 10	2 - 6	22	C	---	---	1.661%						1.76%
		8-14	channery silt loam, very channery silt loam						2.00 - 6	30 - 10												
		14-18	channery silt loam, extremely channery silt loam						2.00 - 6	30 - 10												
		18-28	bedrock						0.20 - 2	300 - 30												
KlC	Klinesville	0-8	very channery silt loam	No	Yes				2.00 - 6	30 - 10	2 - 6	22	C	---	---	1.885%						2.00%
		8-14	channery silt loam, very channery silt loam						2.00 - 6	30 - 10												
		14-18	channery silt loam, very channery silt loam, extremely channery silt loam						2.00 - 6	30 - 10												
		18-28	bedrock						0.20 - 2	300 - 30												
KlD	Klinesville	0-8	very channery silt loam						2.00 - 6	30 - 10	2 - 6	22	C	---	---	1.522%				6.65%		1.57%
		8-14	channery silt loam, very channery silt loam						2.00 - 6	30 - 10												
		14-18	channery silt loam, very channery silt loam, extremely channery silt loam						2.00 - 6	30 - 10												
		18-28	bedrock						0.20 - 2	300 - 30												
LfA	Lamington	0-7	Silt loam						0.60 - 2	100 - 30	0.6 - 2	84	D	0.0-0.5	>6	0.168%						0.18%
		7-21	Silt loam, loam, silty clay loam						0.60 - 2	100 - 30												
		21-41	Clay loam, cobbly loam, gravelly clay loam						0.06 - 0.2	1000 - 300												
		41-62	Very gravelly sandy loam, stratified gravelly silty clay loam						0.60 - 20	100 - 3												
LhE	Lansdale, Extremely Stony	0-6	Loam						0.60 - 2	100 - 30	0.6 - 2	61	B	---	---	0.028%						0.03%
		6-38	Sandy loam, sandy clay loam, loam, channery sandy loam						0.60 - 6	100 - 10												
		38-60	Loamy sand, channery sandy loam, very channery sandy loam						2.00 - 6	30 - 10												
		60-61	bedrock						0.20 - 0.6	300 - 100												
LmB	Lehigh	0-6	Channery silt loam	No	Yes				0.60 - 2	100 - 30	0.6 - 2	61	C	1.0-2.0	1.8-3.4	1.646%		10.03%				1.62%
		6-38	Channery silt loam, channery silty clay loam						0.06 - 0.2	1000 - 300												
		38-60	Channery silty clay loam, very channery silt loam, extremely channery silt loam						0.06 - 0.2	1000 - 300												
		60-61	bedrock						0.60 - 6	100 - 10												
LmC	Lehigh	0-6	Channery silt loam						0.60 - 2	100 - 30	0.6 - 2	61	C	1.0-2.0	1.8-3.4	0.193%						0.20%
		6-38	Channery silt loam, channery silty clay loam						0.06 - 0.2	1000 - 300												
		38-60	Channery silty clay loam, very channery silt loam, extremely channery silt loam						0.06 - 0.2	1000 - 300												
		60-61	bedrock						0.60 - 6	100 - 10												
LnB	Lehigh, Extremely Stony	0-6	Silt loam						0.60 - 2	100 - 30	0.6 - 2	61	C	1.0-2.0	1.8-3.4	0.029%						0.03%
		6-38	Channery silt loam, channery silty clay loam						0.06 - 0.2	1000 - 300												
		38-60	Channery silty clay loam, very channery silt loam						0.06 - 0.2	1000 - 300												
		60-61	bedrock						0.60 - 6	100 - 10												
LnD	Lehigh, Extremely Stony	0-6	Channery silt loam						0.60 - 2	100 - 30	0.6 - 2	61	C	1.0-2.0	1.8-3.4	0.114%						0.12%
		6-38	Channery silt loam, channery silty clay loam						0.06 - 0.2	1000 - 300												
		38-60	Channery silty clay loam, very channery silt loam						0.06 - 0.2	1000 - 300												
		60-61	bedrock						0.60 - 6	100 - 10												
Lt	Linden	0-10	Loam						2.00 - 6	30 - 10	2 - 6	84	B	3.0-6.0	>6	0.005%						
		10-42	Loam, silt loam, gravelly loam, sandy loam						2.00 - 6	30 - 10												
		42-63	Loam, gravelly loam, very gravelly sand						6.00 - 20	10 - 3												
MaB	Manor	0-8	loam	Yes		Yes			0.60 - 2	100 - 30	0.6 - 2	84	B	---	---	0.122%						0.13%
		8-22	loam, silt loam, channery loam						0.60 - 2	100 - 30												
		22-73	loam, sandy loam, channery sandy loam						0.60 - 6	100 - 10												
MaC	Manor	0-8	loam						0.60 - 2	100 - 30	0.6 - 2	84	B	---	---	0.054%						0.06%
		8-22	loam, silt loam, channery loam						0.60 - 2	100 - 30												
		22-73	loam, sandy loam, channery sandy loam						0.60 - 6	100 - 10												
MaD	Manor	0-8	loam						0.60 - 2	100 - 30	0.6 - 2	84	B	---	---	0.034%						0.04%
		8-22	loam, silt loam, channery loam						0.60 - 2	100 - 30												
		22-73	loam, sandy loam, channery sandy loam						0.60 - 6	100 - 10												

Soil Type		Depth (in)	USDA Texture	Suitability for septic disposal	Suitability for sand mounds	Suitability for spray irrigation	Hydric Soils	Alluvial soil	Permeability (Ksat) (in/hour)	Percolation Rate (min/in)	Percolation Rate (min/in)	Depth to Bedrock (ft)	Hydrologic Group	Water Table Upper Limit	Water Table Lower Limit	% Town	% Study Area					
																	% Springtown	% Zion Hill	% Passer	% Pleasant Valley	% Development District	% Outlying Study Area
MbD	Manor	0-8	loam						0.60 - 2	100 - 30	0.6 - 2	84	B	---	---	0.237%						0.25%
		8-22	loam, silt loam, channery loam						0.60 - 2	100 - 30												
		22-73	loam, sandy loam, channery sandy loam						0.60 - 6	100 - 10												
MbF	Manor	0-8	loam						0.60 - 2	100 - 30	0.6 - 2	84	B	---	---	0.017%						0.02%
		8-22	loam, silt loam, channery loam						0.60 - 2	100 - 30												
		22-73	loam, sandy loam, channery sandy loam						0.60 - 6	100 - 10												
MlA	Mt. Lucas	0-9	silt loam			Yes			0.60 - 2	100 - 30	0.6 - 2	84	C	0.5-3.0	1.8-2.9	0.328%		0.53%			1.50%	0.32%
		9-38	Silt loam, gravelly silty clay loam, clay loam						0.06 - 0.6	1000 - 100												
		38-60	Gravelly sandy loam, gravelly loam, gravelly loamy sand						0.06 - 6	1000 - 10												
MlB	Mt. Lucas	0-9	silt loam			Yes			0.60 - 2	100 - 30	0.6 - 2	84	C	0.5-3.0	1.8-2.9	2.056%		9.63%			10.50%	1.87%
		9-38	Silt loam, gravelly silty clay loam, clay loam						0.06 - 0.6	1000 - 100												
		38-60	Gravelly sandy loam, gravelly loam, gravelly loamy sand						0.06 - 6	1000 - 10												
MlC	Mt. Lucas	0-9	silt loam						0.60 - 2	100 - 30	0.6 - 2	84	C	0.5-3.0	1.8-2.9	0.350%						0.37%
		9-38	Silt loam, gravelly silty clay loam, sandy clay loam, clay loam						0.06 - 0.6	1000 - 100												
		38-60	Gravelly clay loam, gravelly sandy loam, gravelly loam, gravelly loamy sand						0.06 - 6	1000 - 10												
MmB	Mt. Lucas, Extremely Stony	0-9	silt loam						0.60 - 2	100 - 30	0.6 - 2	84	C	0.5-3.0	1.8-2.9	6.674%					2.99%	7.03%
		9-38	Silt loam, gravelly silty clay loam, sandy clay loam, clay loam						0.06 - 0.6	1000 - 100												
		38-60	Gravelly sandy loam, gravelly loam, gravelly loamy sand						0.06 - 6	1000 - 10												
MmD	Mt. Lucas, Extremely Stony	0-9	silt loam						0.60 - 2	100 - 30	0.6 - 2	84	C	0.5-3.0	1.8-2.9	1.073%					6.36%	1.01%
		9-38	Silt loam, gravelly silty clay loam, sandy clay loam, clay loam						0.06 - 0.6	1000 - 100												
		38-60	Gravelly clay loam, gravelly sandy loam, gravelly loam, gravelly loamy sand						0.06 - 6	1000 - 10												
NbB	Neshaminy	0-9	Silt Loam						0.60 - 2	100 - 30	0.6 - 2	61	B	---	---	0.827%					12.04%	0.62%
		9-52	Silt loam, gravelly clay loam, gravelly sandy clay loam						0.20 - 0.6	300 - 100												
		52-54	Silt loam, very gravelly clay loam, gravelly sandy clay loam						0.20 - 0.6	300 - 100												
		54-64	bedrock						0.20 - 2	300 - 30												
NbC	Neshaminy	0-9	Silt Loam						0.60 - 2	100 - 30	0.6 - 2	61	B	---	---	0.487%		1.24%			10.45%	0.29%
		9-52	Silt loam, gravelly clay loam, gravelly sandy clay loam						0.20 - 0.6	300 - 100												
		52-54	Silt loam, very gravelly clay loam, gravelly sandy clay loam						0.20 - 0.6	300 - 100												
		54-64	bedrock						0.20 - 2	300 - 30												
NhB	Neshaminy, Extremely Bouldery	0-9	Silt Loam	Moderate		Yes			0.60 - 2	100 - 30	0.6 - 2	61	B	---	---	3.437%		0.59%			3.07%	3.58%
		9-52	Silt loam, gravelly clay loam, gravelly sandy clay loam						0.20 - 0.6	300 - 100												
		52-54	Silt loam, very gravelly clay loam, gravelly sandy clay loam						0.20 - 0.6	300 - 100												
		54-64	bedrock						0.20 - 2	300 - 30												
NhD	Neshaminy, Extremely Bouldery	0-5	silt loam	No					0.60 - 2	100 - 30	0.6 - 2	61	B	---	---	1.680%					8.31%	1.62%
		5-52	silt loam, gravelly clay loam, gravelly sandy clay loam						0.20 - 0.6	300 - 100												
		52-54	silt loam, very gravelly sandy loam, gravelly sandy clay loam						0.20 - 0.6	300 - 100												
		54-64	bedrock						0.20 - 2	300 - 30												
NhF	Neshaminy, Extremely Bouldery	0-5	silt loam						0.60 - 2	100 - 30	0.6 - 2	61	B	---	---	0.678%						0.72%
		5-52	silt loam, gravelly clay loam, gravelly sandy clay loam						0.20 - 0.6	300 - 100												
		52-54	silt loam, very gravelly sandy loam, gravelly sandy clay loam						0.20 - 0.6	300 - 100												
		54-64	bedrock						0.20 - 2	300 - 30												
PeA	Penn	0-8	channery silt loam	No	Yes	Yes			0.60 - 6	100 - 10	0.6 - 6	40	C	---	---	0.235%						0.25%
		8-21	channery silt loam, channery loam, channery silty clay loam						0.60 - 6	100 - 10												
		21-34	very channery silt loam, very channery loam						0.60 - 6	100 - 10												
		34-44	bedrock						0.20 - 6	300 - 10												
PeB	Penn	0-8	channery silt loam	No	Yes	Yes			0.60 - 6	100 - 10	0.6 - 6	40	C	---	---	4.245%				19.91%		4.37%
		8-21	channery silt loam, channery loam, channery silty clay loam						0.60 - 6	100 - 10												
		21-34	very channery silt loam, very channery loam						0.60 - 6	100 - 10												
		34-44	bedrock						0.20 - 6	300 - 10												
PeC	Penn	0-8	channery silt loam						0.60 - 6	100 - 10	0.6 - 6	40	C	---	---	0.724%						0.77%
		8-21	channery silt loam, channery loam, channery silty clay loam						0.60 - 6	100 - 10												
		21-34	very channery silt loam, very channery loam						0.60 - 6	100 - 10												
		34-44	bedrock						0.20 - 6	300 - 10												
PeD	Penn	0-8	channery silt loam						0.60 - 6	100 - 10	0.6 - 6	40	C	---	---	0.047%						0.05%
		8-21	channery silt loam, channery loam, channery silty clay loam						0.60 - 6	100 - 10												
		21-34	very channery silt loam, very channery loam						0.60 - 6	100 - 10												
		34-44	bedrock						0.20 - 6	300 - 10												
PkB	Penn	0-8	channery silt loam						0.60 - 6	100 - 10	0.6 - 6	40	C	---	---	2.463%				0.13%		2.61%
		8-21	channery silt loam, channery loam, channery silty clay loam						0.60 - 6	100 - 10												
		21-34	very channery silt loam, very channery loam						0.60 - 6	100 - 10												
		34-44	bedrock						0.20 - 6	300 - 10												
PkC	Penn	0-8	channery silt loam						0.60 - 6	100 - 10	0.6 - 6	40	C	---	---	1.917%				5.58%		2.00%
		8-21	channery silt loam, channery loam, channery silty clay loam						0.60 - 6	100 - 10												
		21-34	very channery silt loam, very channery loam						0.60 - 6	100 - 10												
		34-44	bedrock						0.20 - 6	300 - 10												
PlE	Penn, Extremely Stony	0-5	silt loam						0.60 - 6	100 - 10	0.6 - 6	40	C	---	---	0.746%						0.79%
		5-21	Channery silt loam, channery loam						0.60 - 6	100 - 10												
		21-34	Very channery silt loam, very channery loam						0.60 - 6	100 - 10												
		34-44	bedrock						0.20 - 6	300 - 10												
PnD	Penn	0-8	Silt loam						0.60 - 6	100 - 10	0.6 - 6	40	C	---	---	0.556%						0.59%
		8-21	channery silt loam, channery loam, channery silty clay loam						0.60 - 6	100 - 10												
		21-34	very channery silt loam, very channery loam						0.60 - 6	100 - 10												
		34-44	bedrock						0.20 - 6	300 - 10												
RaA	Raritan	0-09	Silt loam						0.60 - 2	100 - 30	0.6 - 2	84	C	0.5-3.0	1.8-2.6	0.120%						0.13%
		9-27	Clay loam, loam, silt loam						0.60 - 2	100 - 30												
		27-43	Clay loam, loam, silt loam						0.20 - 0.6	300 - 100												
		43-60	Stratified gravelly sand to silt loam						0.60 - 6	100 - 10												

	Soil Type	Depth (in)	USDA Texture	Suitability for septic disposal	Suitability for sand mounds	Suitability for spray irrigation	Hydric Soils	Alluvial soil	Permeability (Ksat) (in/hour)	Percolation Rate (min/in)	Percolation Rate (min/in)	Depth to Bedrock (ft)	Hydrologic Group	Water Table Upper Limit	Water Table Lower Limit	% Town	% Study Area					
																	% Springtown	% Zion Hill	% Passer	% Pleasant Valley	% Development District	% Outlying Study Area
RaB	Raritan	0-09	Silt loam						0.60 - 2	100 - 30	0.6 - 2	84	C	0.5-3.0	1.8-2.6	0.127%						0.13%
		9-27	Clay loam, loam, silt loam						0.60 - 2	100 - 30												
		27-43	Clay loam, loam, silt loam						0.20 - 0.6	300 - 100												
		43-60	Stratified gravelly sand to silt loam						0.60 - 6	100 - 10												
ReA	Readington	0-11	silt loam	No	Yes	Yes			0.60 - 2	100 - 30	0.6 - 2	65	C	1.5-3.0	1.8-3.0	0.397%		0.96%				0.41%
		11-29	loam, channery silt loam, silty clay loam						0.60 - 2	100 - 30												
		29-58	silt loam, channery loam, channery silt loam						0.20 - 0.6	300 - 100												
		58-68	bedrock						0.60 - 6	100 - 10												
ReB	Readington	0-11	silt loam						0.60 - 2	100 - 30	0.6 - 2	65	C	1.5-3.0	1.8-3.4	4.051%		3.96%	12.17%	4.58%		4.14%
		11-29	loam, channery silt loam, silty clay loam						0.60 - 2	100 - 30												
		29-58	silt loam, channery loam, channery silt loam						0.20 - 0.6	300 - 100												
		58-68	bedrock						0.60 - 6	100 - 10												
ReC	Readington	0-11	silt loam						0.60 - 2	100 - 30	0.6 - 2	65	C	1.5-3.0	1.8-3.0	0.177%						0.19%
		11-29	loam, channery silt loam, silty clay loam						0.60 - 2	100 - 30												
		29-58	silt loam, channery loam, channery silt loam						0.20 - 0.6	300 - 100												
		58-68	bedrock						0.60 - 6	100 - 10												
RlA	Reaville	0-8	Channery silt loam						0.60 - 2	100 - 30	0.6 - 2	38	C	0.5-3.0	>6.0	0.039%						0.04%
		8-19	silt loam, channery silt loam, channery silty clay loam						0.06 - 0.2	1000 - 300												
		19-32	channery silt loam, very channery silt loam, very channery loam						0.06 - 0.2	1000 - 300												
		32-42	bedrock						0.06 - 2	1000 - 30												
RlB	Reaville	0-8	channery silt loam	No					0.60 - 2	100 - 30	0.6 - 2	38	C	0.5-3.0	>6.0	1.553%				11.56%		1.57%
		8-19	silt loam, channery silt loam, channery silty clay loam						0.06 - 0.2	1000 - 300												
		19-32	channery silt loam, very channery silt loam, very channery loam						0.06 - 0.2	1000 - 300												
		32-42	bedrock						0.06 - 2	1000 - 30												
RlC	Reaville	0-8	channery silt loam						0.60 - 2	100 - 30	0.6 - 2	38	C	0.5-3.0	>6.0	0.384%						0.41%
		8-19	silt loam, channery silt loam, channery silty clay loam						0.06 - 0.2	1000 - 300												
		19-32	channery silt loam, very channery silt loam, very channery loam						0.06 - 0.2	1000 - 300												
		32-42	bedrock						0.06 - 2	1000 - 30												
Ro	Rowland	0-12	Silt loam						0.20 - 2	300 - 30	0.2 - 2	84	C	1.0-3.0	>6	0.390%	4.83%			0.52%		0.33%
		12-34	silt loam, channery silt loam, channery silty clay loam						0.20 - 2	300 - 30												
		34-46	Sandy clay, silt loam, gravelly silty clay loam						0.20 - 2	300 - 30												
		46-61	Stratified gravel to sand loam						2.00 - 6	30 - 10												
ToA	Towhee	0-8	silt loam						0.60 - 2	100 - 30	0.6 - 2	84	D	0.0-0.5	1.0-2.6	1.983%					13.20%	1.84%
		8-28	silt loam, gravelly silt loam, silty clay loam						0.60 - 2	100 - 30												
		28-63	silt loam, silty clay loam, gravelly silty clay loam						0.06 - 0.2	1000 - 300												
		63-76	clay loam, sandy loam, gravelly sandy loam						0.06 - 0.6	1000 - 100												
ToB	Towhee	0-8	silt loam	No			Yes		0.60 - 2	100 - 30	0.6 - 2	84	D	0.0-0.5	1.0-2.6	1.916%		7.13%			0.04%	1.96%
		8-28	silt loam, gravelly silt loam, silty clay loam						0.60 - 2	100 - 30												
		28-63	silt loam, silty clay loam, gravelly silty clay loam						0.06 - 0.2	1000 - 300												
		63-76	clay loam, sandy loam, gravelly sandy loam						0.06 - 0.6	1000 - 100												
TpB	Towhee, Extremely Stony	0-7	silt loam						0.60 - 2	100 - 30	0.6 - 2	84	D	0.0-0.5	1.8-2.6	4.721%		0.10%			7.13%	4.87%
		7-28	silt loam, gravelly silt loam, silty clay loam						0.60 - 2	100 - 30												
		28-63	silt loam, silty clay loam, gravelly silty clay loam						0.06 - 0.2	1000 - 300												
		63-76	clay loam, sandy loam, gravelly sandy loam						0.06 - 0.6	1000 - 100												
Ub	Udorthents	0-5	Loam						0.06 - 20	1000 - 3	0.06 - 20	84	B	6	>6	0.124%						0.13%
		5-40	Loam, very gravelly loam						0.06 - 20	1000 - 3												
		40-70	Very gravelly sandy loam, loam, silty clay loam						0.06 - 6	1000 - 10												
UfuB	Urban Land	0-6	variable						-							0.324%	0.05%				4.82%	0.25%
UgB	Urban Land	0-6	variable						-							0.085%						0.09%
UkB	Urban Land	0-6	variable						-							0.588%	27.11%					1.80%
UkD	Urban Land	0-6	variable						-							0.067%	3.69%					0.01%
UnB	Urban Land	0-6	variable						-							0.072%						0.08%
UrB	Urban Land	0-6	variable						-							0.201%						
UvB	Urban Land	0-6	variable						-							0.227%					8.06%	0.07%
UvD	Urban Land	0-6	variable						-							0.104%					0.01%	0.11%
UxB	Urban Land	0-6	variable						-							0.329%				41.46%		0.05%
UxD	Urban Land	0-6	variable						-							0.179%						0.19%
W	Water								-							0.242%	1.13%					0.24%
WaB	Washington	0-9	silt loam	Yes*					0.60 - 2	100 - 30	0.6 - 2	84	B	---	---	1.535%	4.73%					1.51%
		9-42	clay loam, silty clay loam, loam						0.60 - 2	100 - 30												
		42-61	clay loam, silt loam, gravelly silt loam						0.60 - 6	100 - 10												
WfD	Weikert	0-8	channery silt loam						2.00 - 6	30 - 10	2 - 6	19	B/D	---	---	0.181%						0.19%
		8-15	Channery loam, very channery silt loam, gravelly loam						2.00 - 6	30 - 10												
		15-18	Channery loam, very channery silt loam, extremely channery silt loam						2.00 - 6	30 - 10												
		18-20	bedrock						0.60 - 20	100 - 3												

* Limitation may be severe for septic systems in areas where the soils are carbonate-derived and there is a danger of groundwater contamination.

Figure 2.3.2. USDA Soils and Representative Slope

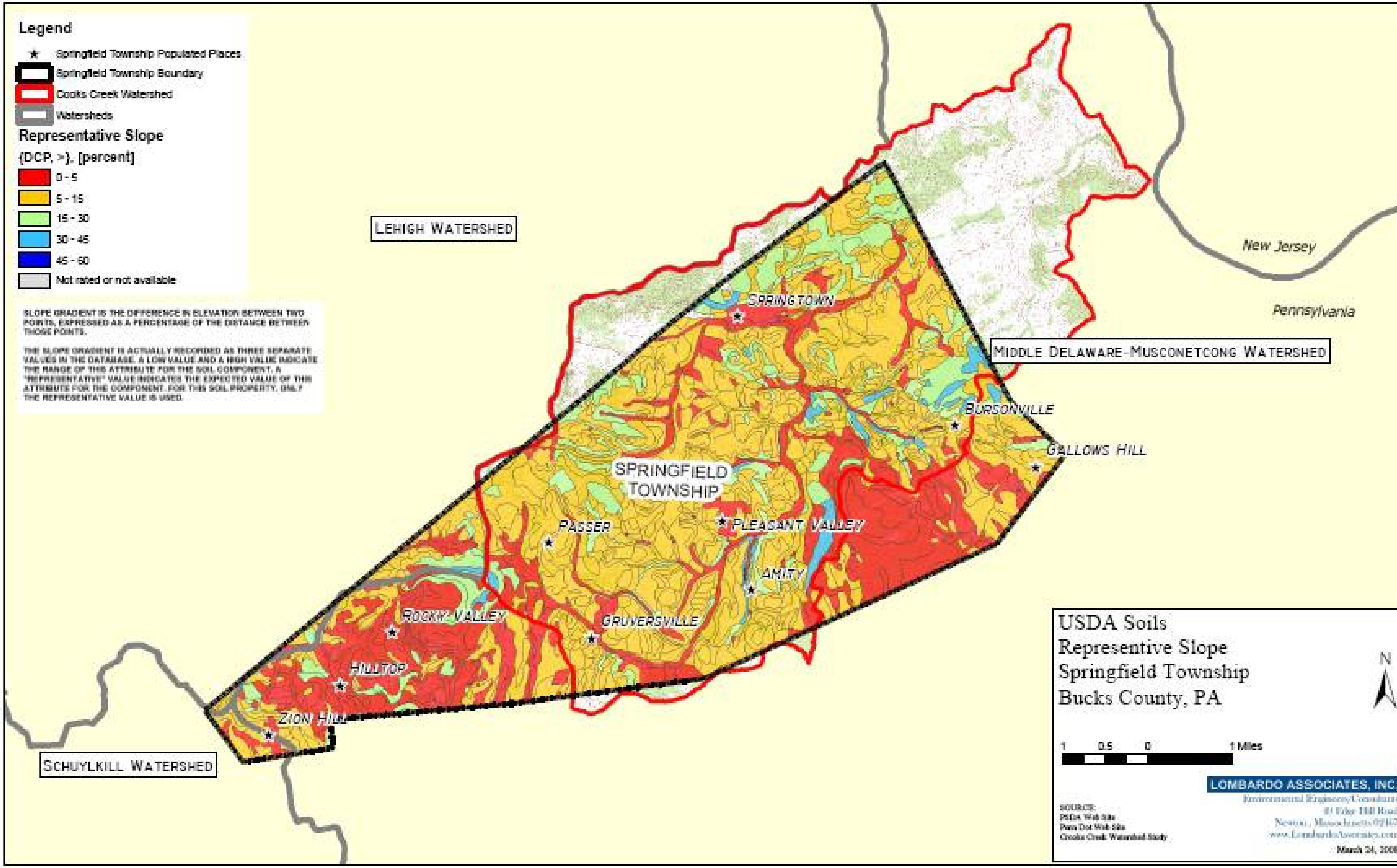


Figure 2.3.3. USDA Soils in Springfield Township

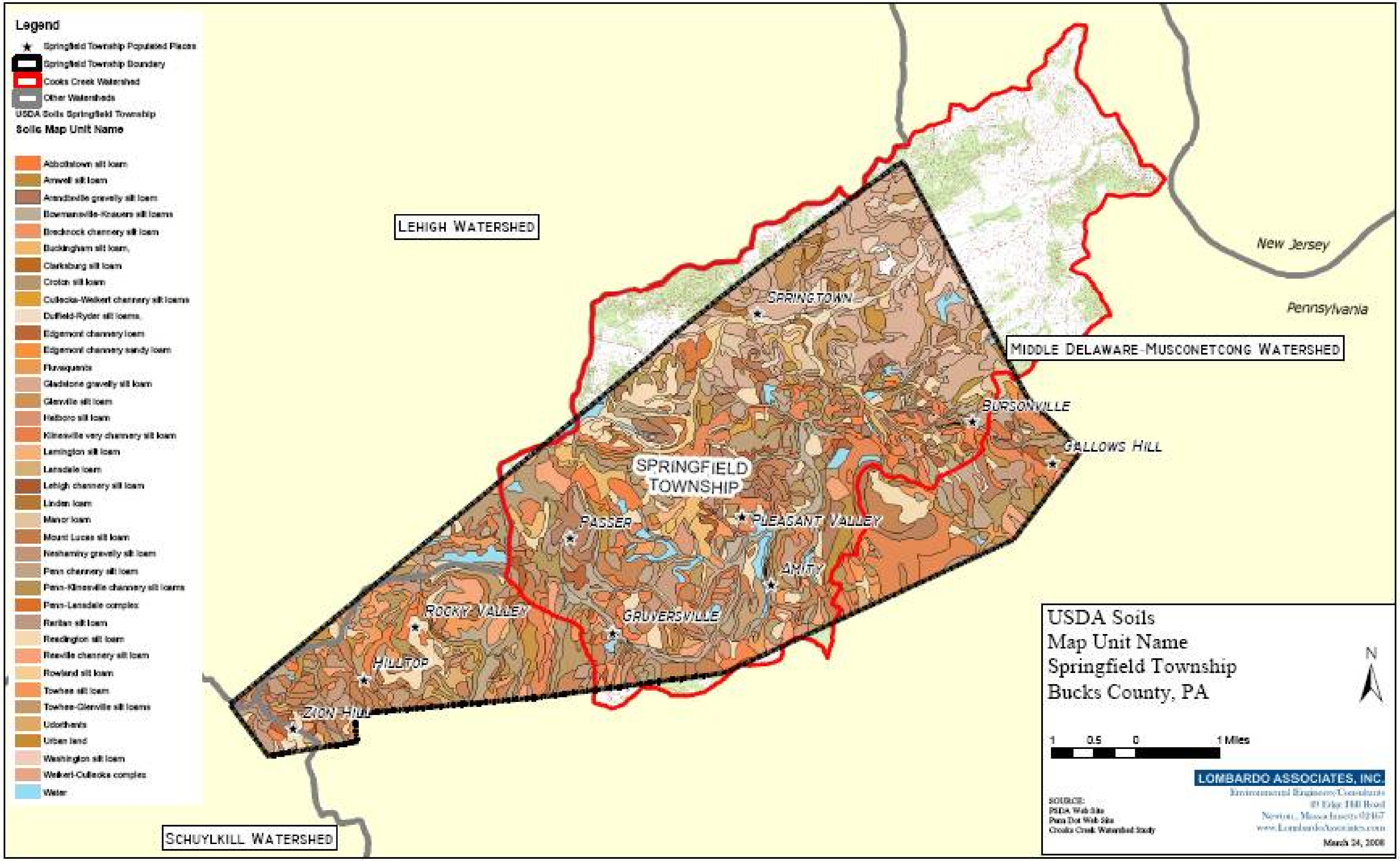


Figure 2.3.4. Springfield Township Watershed Boundaries

Subwatersheds within Springfield Township	Size of Sub-Watershed (acres)	Size of Sub-Watershed in Springfield Township (acres)	Percent of Sub-Watershed within Township	Percent of Springfield Township Acreage
Lehigh Watershed				
Tumble Brook	1,859	519	27.9%	2.6%
Saucon Creek	15,146	79	0.5%	0.4%
Lehigh River	42,888	19	0.0%	0.1%
East Branch Saucon Creek	6,621	2	0.0%	0.0%
Subtotal	*66,513*	*618*	*0.9%*	*3.1%*
Middle Delaware - Musconetcong Watershed				
Cooks Creek	18,895	13,674	72.4%	67.7%
Tohickon Creek	31,444	3,299	10.5%	16.3%
Haycock Creek	6,325	1,456	23.0%	7.2%
Gallows Run	5,588	621	11.1%	3.1%
Dimple Creek	4,691	534	11.4%	2.6%
Subtotal	*66,943*	*19,584*	*29.3%*	*96.9%*
Schuylkill Watershed				
Unami Creek	8,190	1	0.0%	0.0%
Subtotal	*8,190*	*1*	*0.0%*	*0.0%*
Grand Total	**141,847**	**20,203**	**14.3%**	**100%**

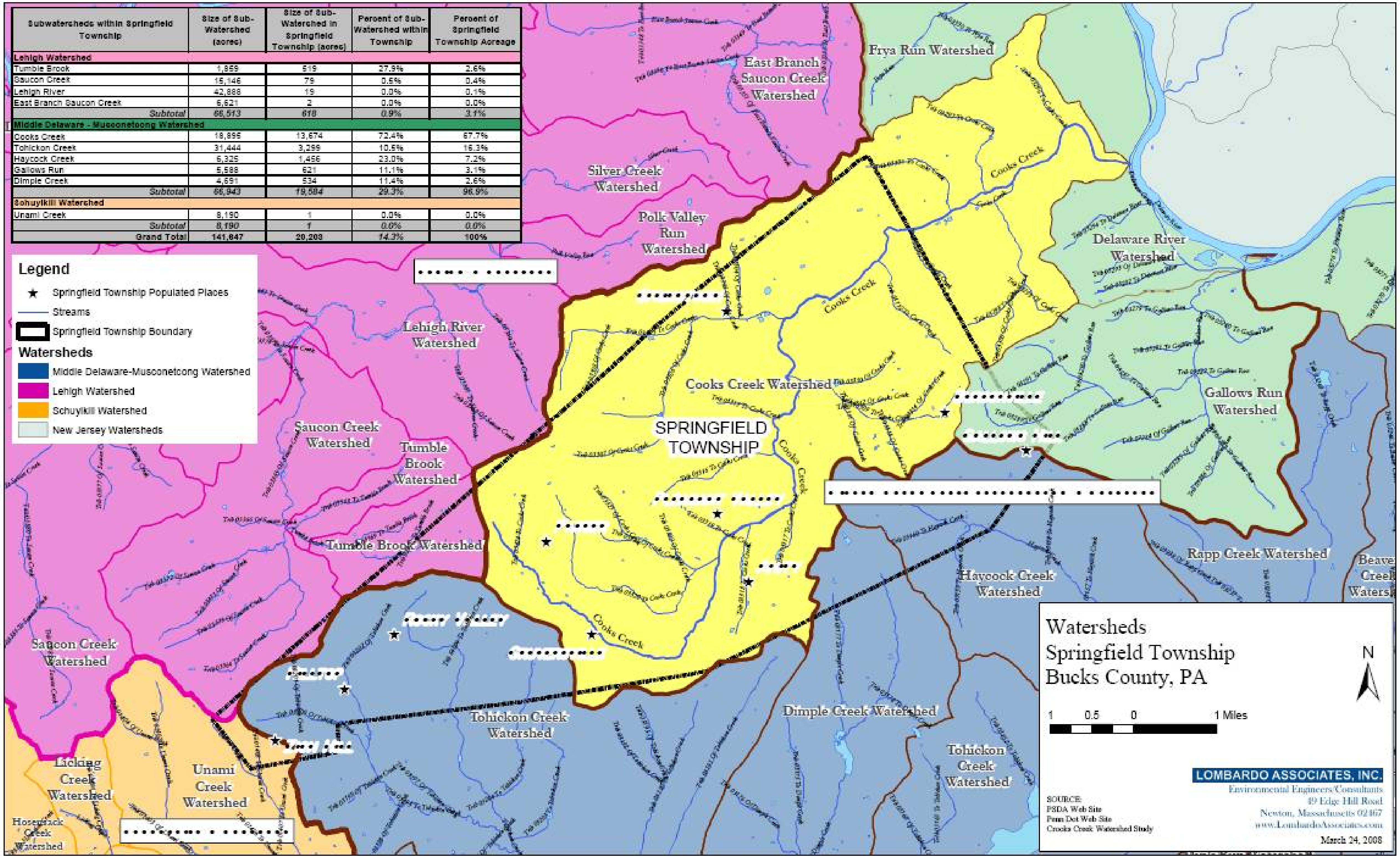
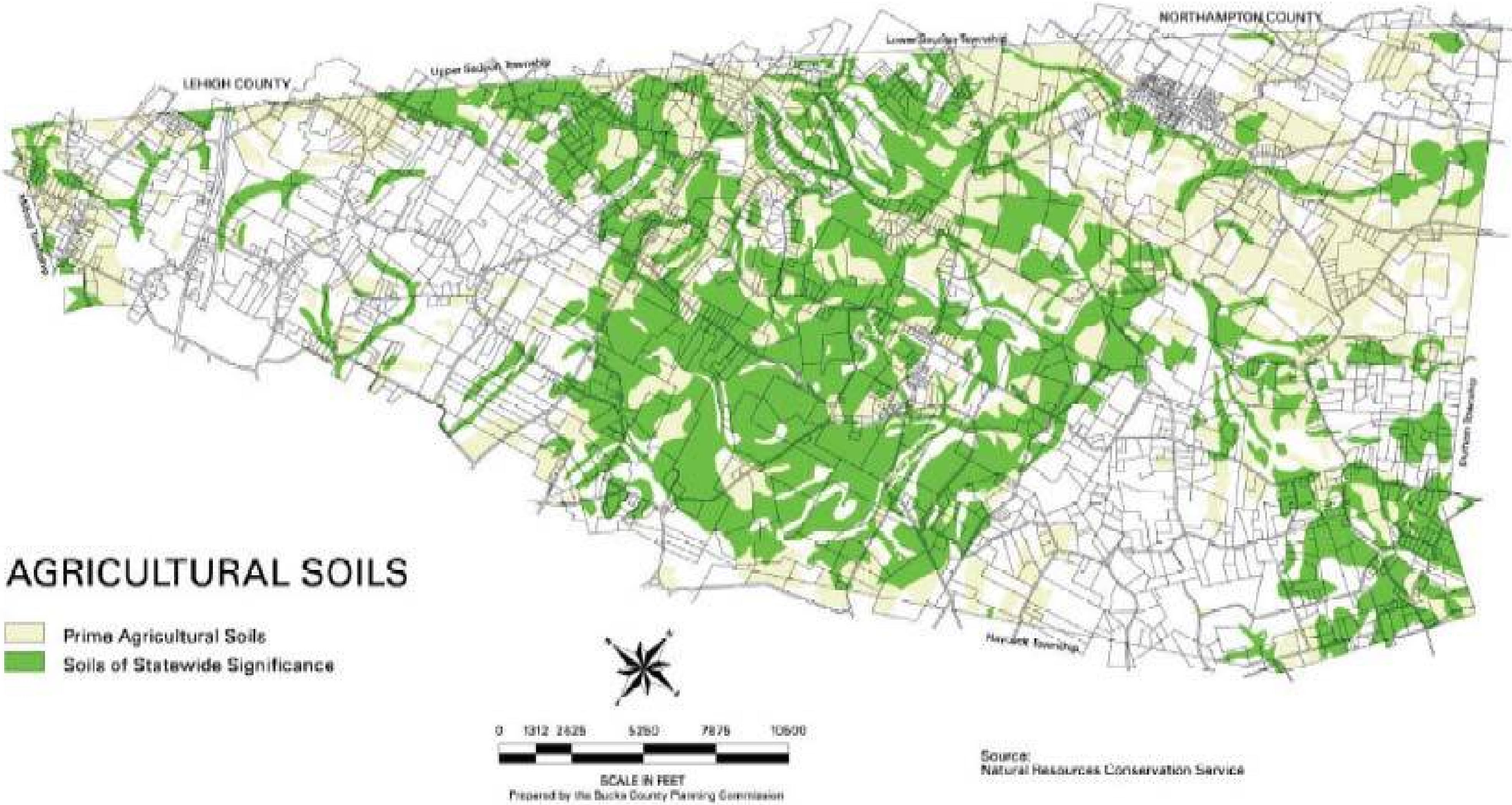


Figure 2.3.5 Springfield Township Agricultural Soils



2.4. GEOLOGIC FEATURES

Springfield Township lies within the physiographic provinces of the Triassic lowlands of the Piedmont province and the Reading prong of the New England province. The Township is characterized by large rocky hills cut by stream valleys. The rock types in the Township consist of gneiss, Lockatong lithofacies, red shales and sandstones, diabase, limestone, and quartzite. Figure 2.4.1 illustrates the Surficial Geology of Springfield Township.

Rock types determine groundwater supplies. By identifying rock types, the Township can plan for the water supply needs for its residents. Quartzite and gneiss, located in the north corner of the Township, provide small to moderate supplies of groundwater. Red shales and sandstones, which are rocks of the Brunswick formation, represent significant supplies of water to the Township. These rocks are located in the Township's south-central region and also extend in a band from this area toward the Township's eastern portion. The Lockatong lithofacies, which are generally a poor source of water, are located in a small area at the eastern corner of the Township. Diabase, which makes up most of the western portion as well as areas in the eastern portion of the Township, has among the poorest water supply yields in the County. Figure 2.4.2 illustrates the Bedrock Geology of Springfield Township.

The limestone areas of the Township are part of the Durham Carbonate Valley, which is an area that stretches from Riegelsville, PA, across the northern half of Durham Township, to the northern corner of Springfield Township. Limestone varies greatly in its supply of water and is susceptible to groundwater contamination, sinkholes, and solution channels. Groundwater contamination is a particular problem because contaminated water can move rapidly through solution channels, threatening an extensive area in a short period of time. Other carbonate valley phenomena include disappearing and influent streams, ghost lakes, land surface mottling, and cave formation.

For areas underlain by carbonate geology, the Springfield Township Zoning Ordinance requires subdivision and land development applicants to identify all carbonate geologic features. The mapping and identification of these features must be based on a field survey and published data and the qualifications of the individual performing the survey must be listed. Stormwater management facilities are required to meet specific design standards. Proposed buildings, sewage disposal facilities, and utilities must meet setback requirements from susceptible areas. Uses such as landfills, junkyards, fuel storage and distribution, and truck terminals are prohibited in these areas.

The Cooks Creek Watershed Conservation Plan (CCWP) (located at www.cookscreekpa.org/watershed.htm) has prepared an extensive analysis of the geology in the Cooks Creek watershed.

Figure 2.4.1. Surficial Geology

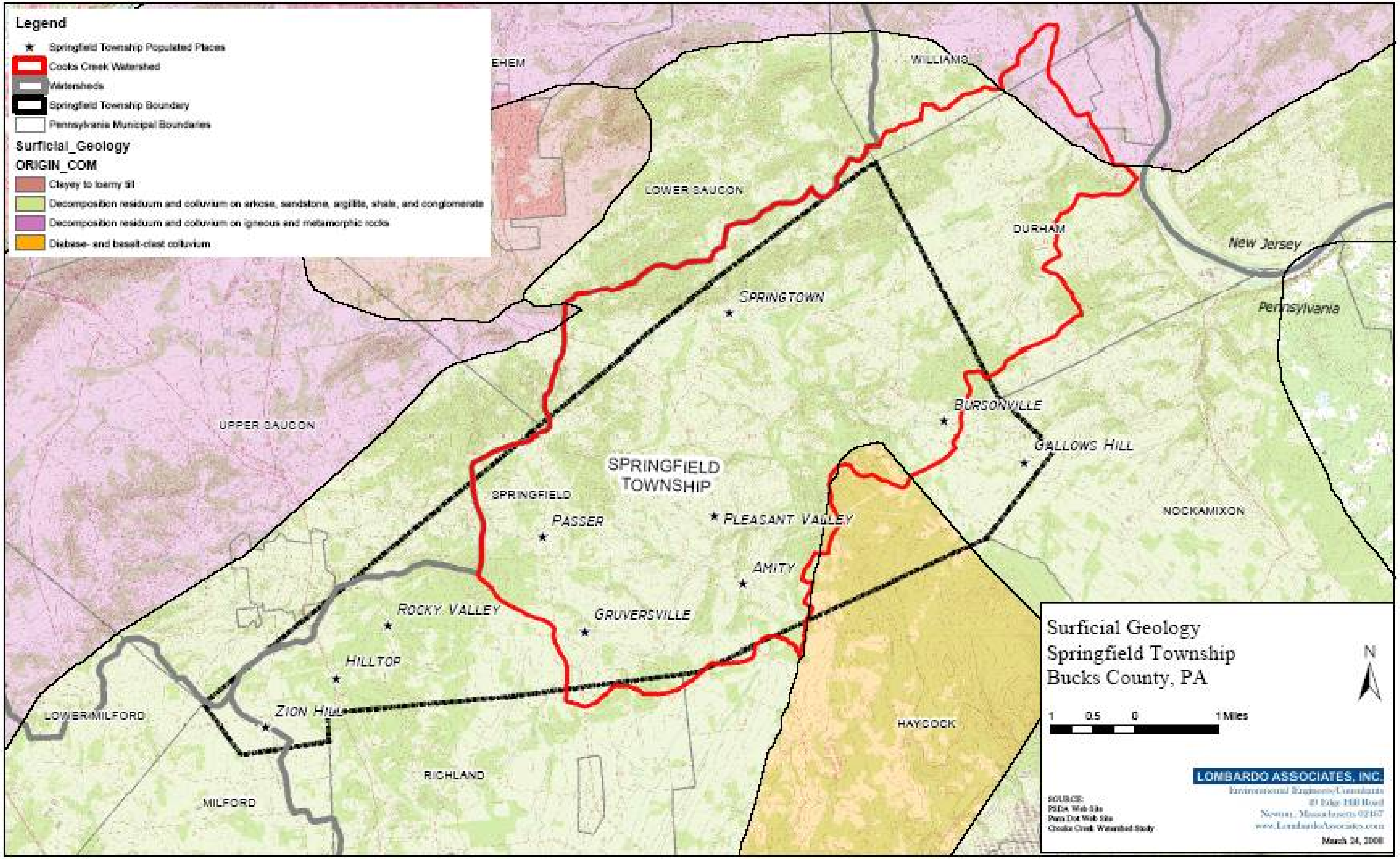
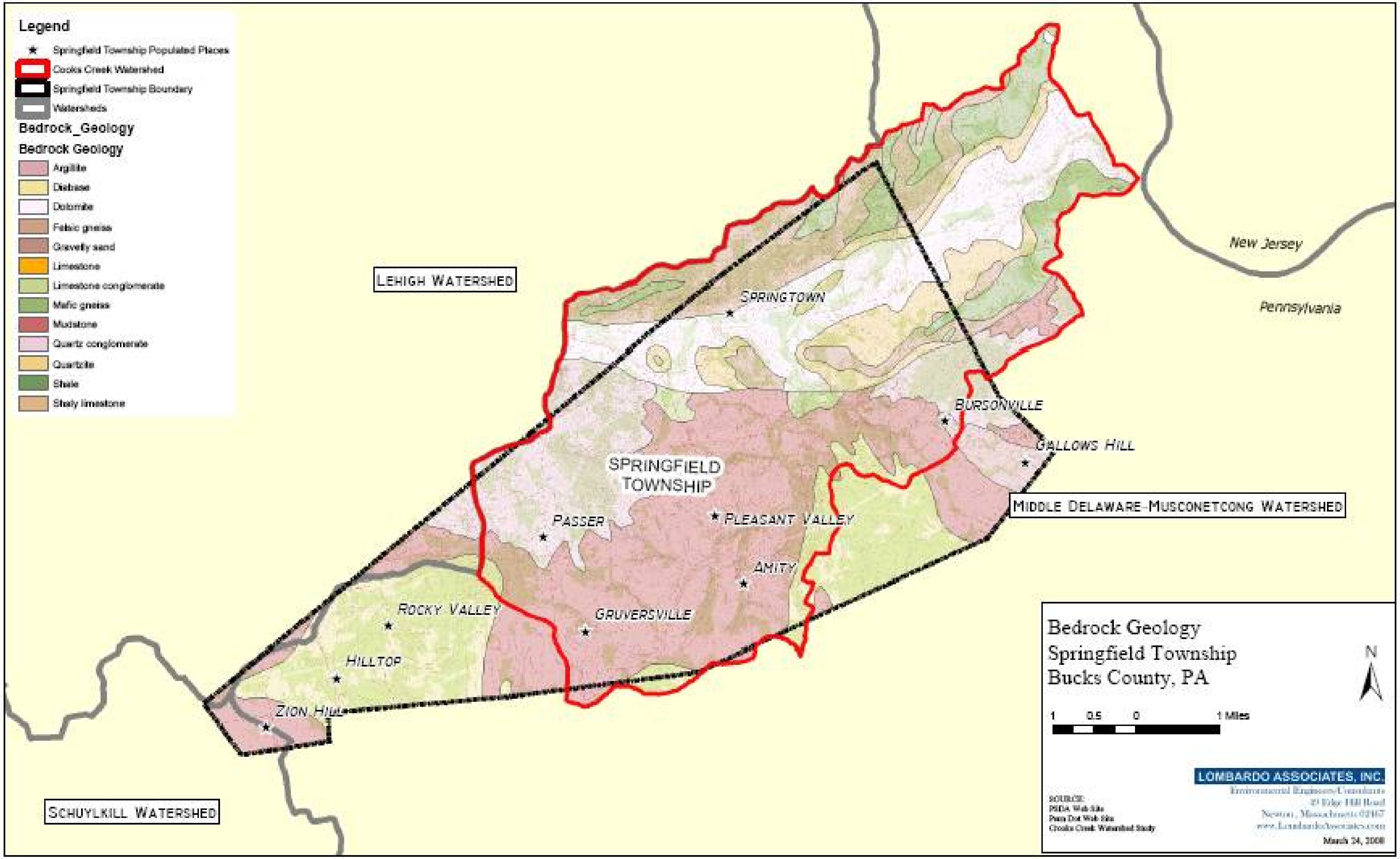


Figure 2.4.2. Bedrock Geology



In the CCWP, the geologic units of the entire watershed were grouped into four geologic categories:

- Category I: Diabase
- Category II: Brunswick and Lockatong Formations; and Quartz Fanoglomerates
- Category III: Carbonate Rocks including Allentown and Leithsville Formations and Limestone Fanoglomerates
- Category IV: Crystalline Rocks including Hardyston Formation and Gneiss Formations

These classifications were used in determining groundwater contributions to the base flow of the basins and/or sub-basins within the watershed.

The general lack of many active sinkholes, the presence of mostly mantled sinkholes (i.e. sinkholes formed by collapse of a mantle of soil above bedrock), and the general absence of exposed bedrock in the topographically lowest portions of the valley, suggest that the Cooks Creek karst is a mature system. Mature karst systems of limestone bedrock within the watershed are masked by extensive soil coverage

Geologic Block Diagrams of the Cooks Creek Watershed as illustrated in Figures 2.4.3 through 2.4.5

Figure 2.4.3. Block Diagram of the areas Northern Basin- Crystalline Rocks and Durham Valley- Karst

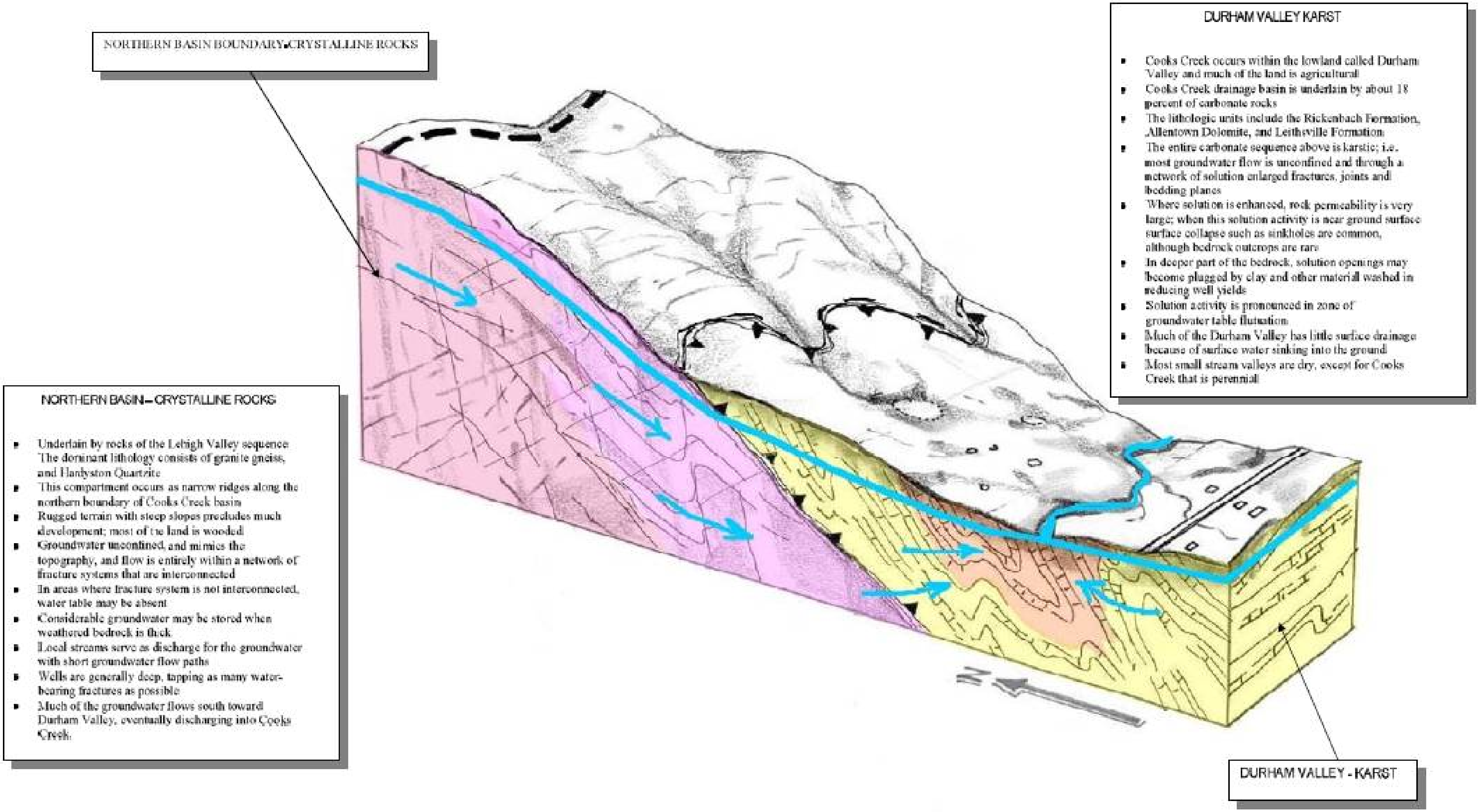


Figure 2.4.4. Block Diagram of the areas Musconetong- Bitts Hill Rocks and Buckampum Hill

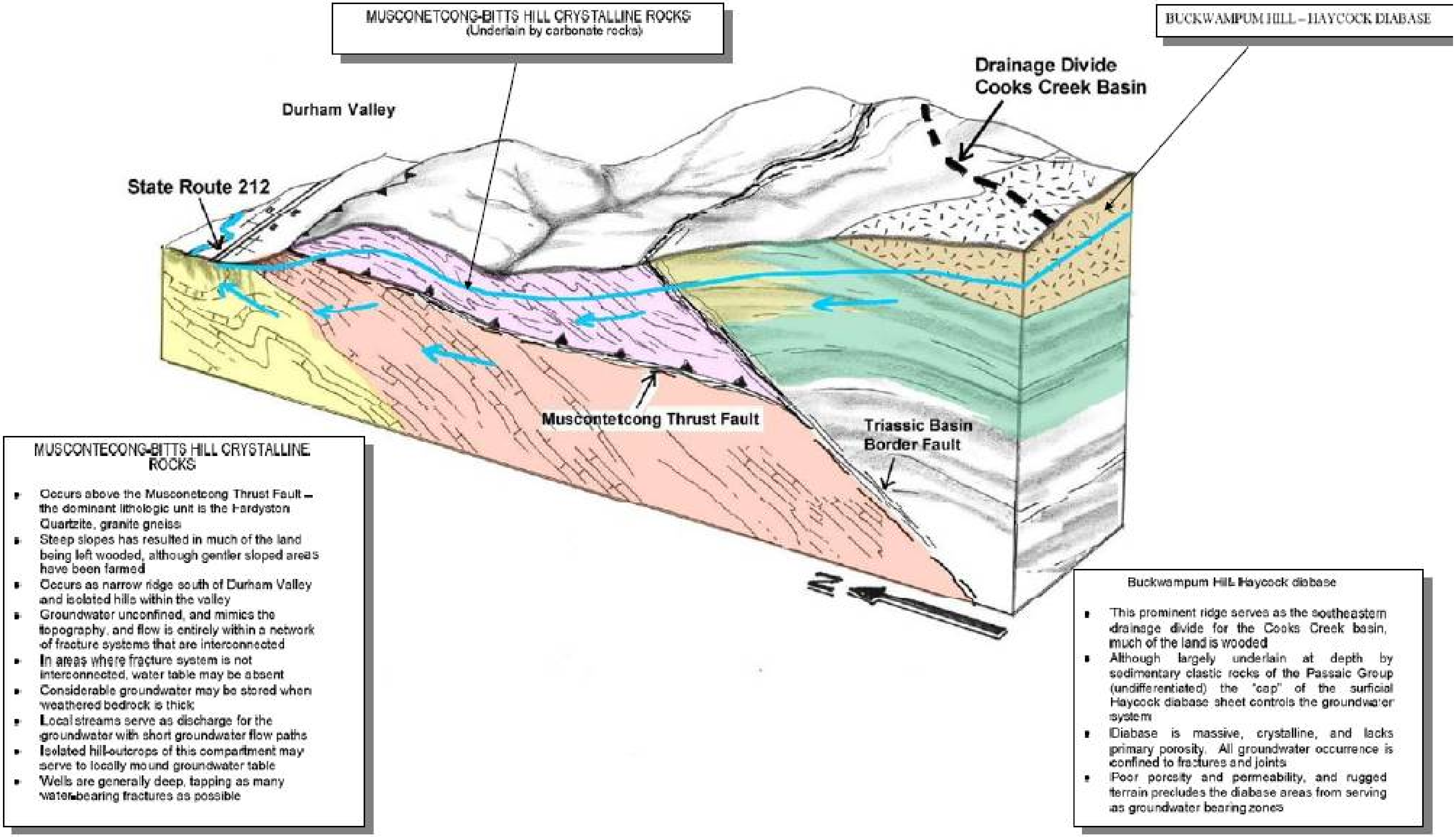
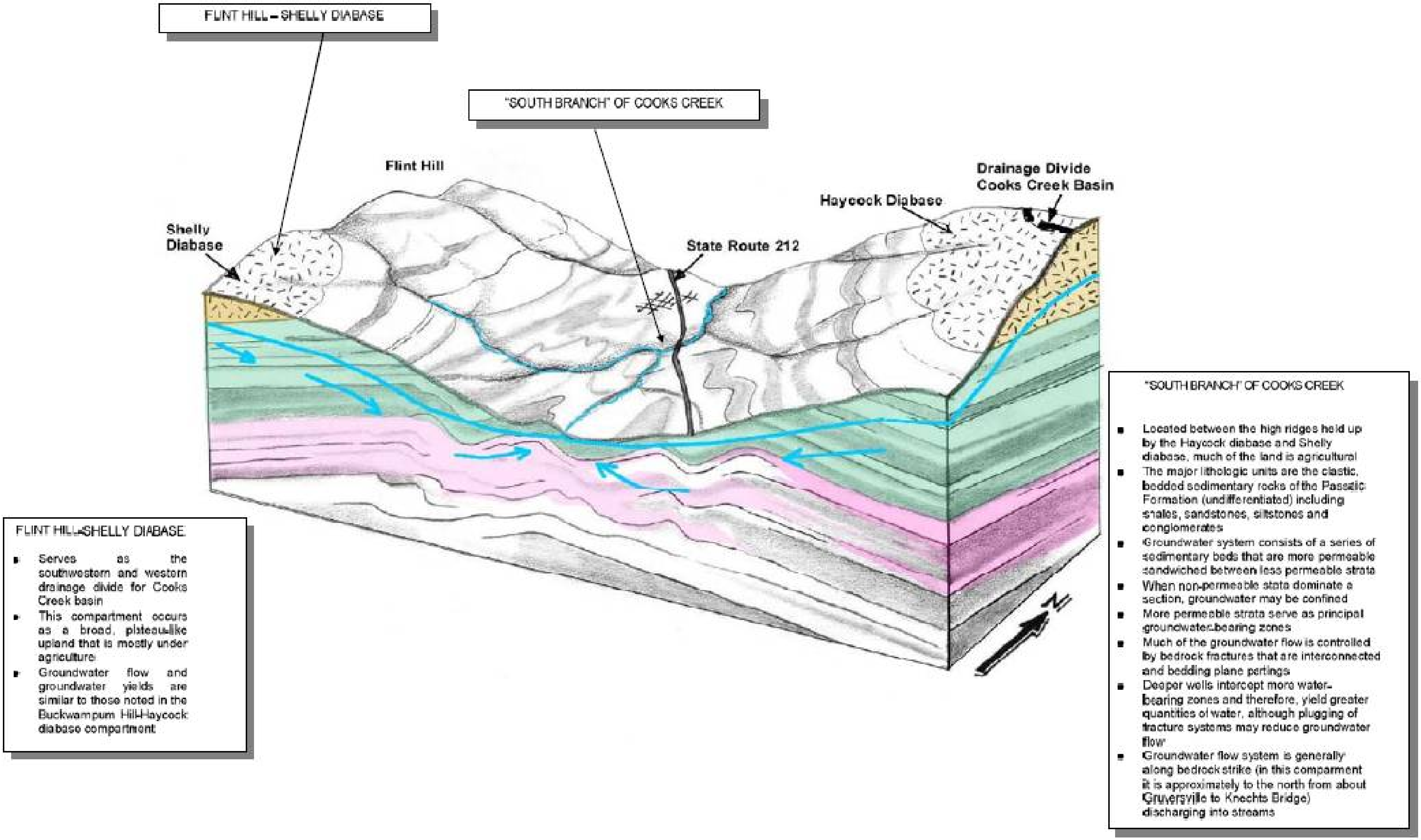


Figure 2.4.5. Block Diagram of the areas South Branch of Cooks Creek and Flint Hill – Shelly Diabase



2.5. GROUNDWATER ELEVATIONS & PERCOLATION RATES

Based upon soils data, Figures 2.5.1 and 2.5.2 illustrate the depth to groundwater and groundwater contours for the Township, respectively, based on mapping provided by the USDA Soil Data Viewer for Bucks County soils. Table 2.5.1 shows the distribution of percolation rates based on BOH records where available and data associated with the soils types.

Table 2.5.1. Percolation Rates

Soil Type		% Township	Perc. Rate
MmB	Mt. Lucas, Extremely Stony	6.7%	69
ArC	Arendtsville	5.3%	46
TpB	Towhee, Extremely Stony	4.7%	100
ArB	Arendtsville	4.4%	45
PeB	Penn	4.2%	41
ReB	Readington	4.1%	51
GlB	Gladstone	3.9%	50
NhB	Neshaminy, Extremely Bouldery	3.4%	22
GlC	Gladstone	3.1%	50
Bo	Bowmansville	3.0%	85
AbB	Abbotstown	2.9%	38
GmD	Gladstone, Very Bouldery	2.8%	50
PkB	Penn	2.5%	40
BwB	Buckingham	2.2%	85
MlB	Mt. Lucas	2.1%	46
ArD	Arendtsville	2.0%	45
ToA	Towhee	2.0%	100
CwB	Croton	1.9%	85
PkC	Penn	1.9%	40
ToB	Towhee	1.9%	100
KlC	Klinesville	1.9%	20
Ha	Hatboro	1.8%	50
CwA	Croton	1.8%	85
NhD	Neshaminy, Extremely Bouldery	1.7%	50
KlB	Klinesville	1.7%	20
LmB	Lehigh	1.6%	24
RlB	Reaville	1.6%	100
WaB	Washington	1.5%	34
KlD	Klinesville	1.5%	10
GrB	Glenville	1.5%	100
MmD	Mt. Lucas, Extremely Stony	1.1%	70
GlD	Gladstone	1.0%	50
GrA	Glenville	1.0%	100

Figure 2.5.1. Depth to Groundwater

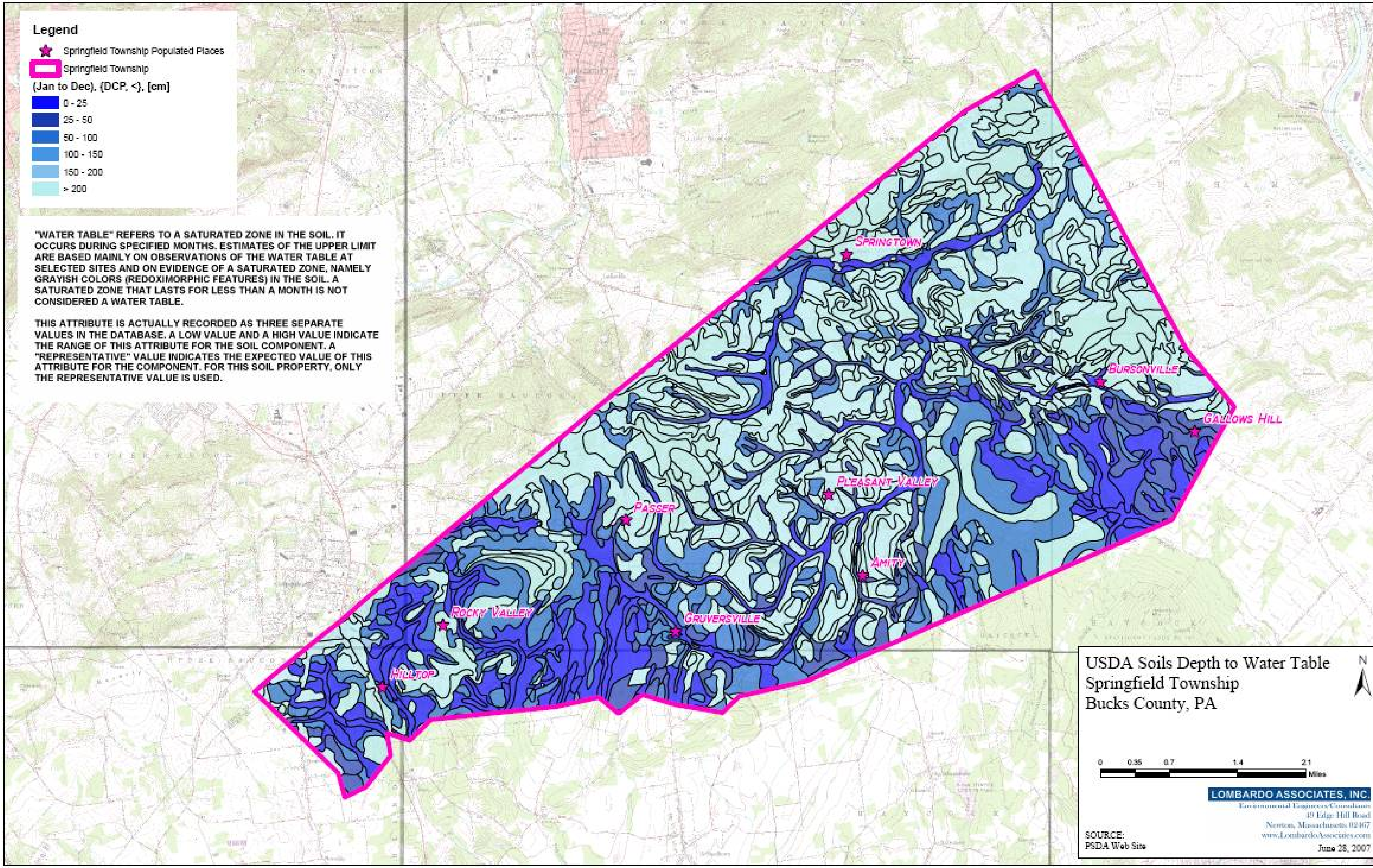
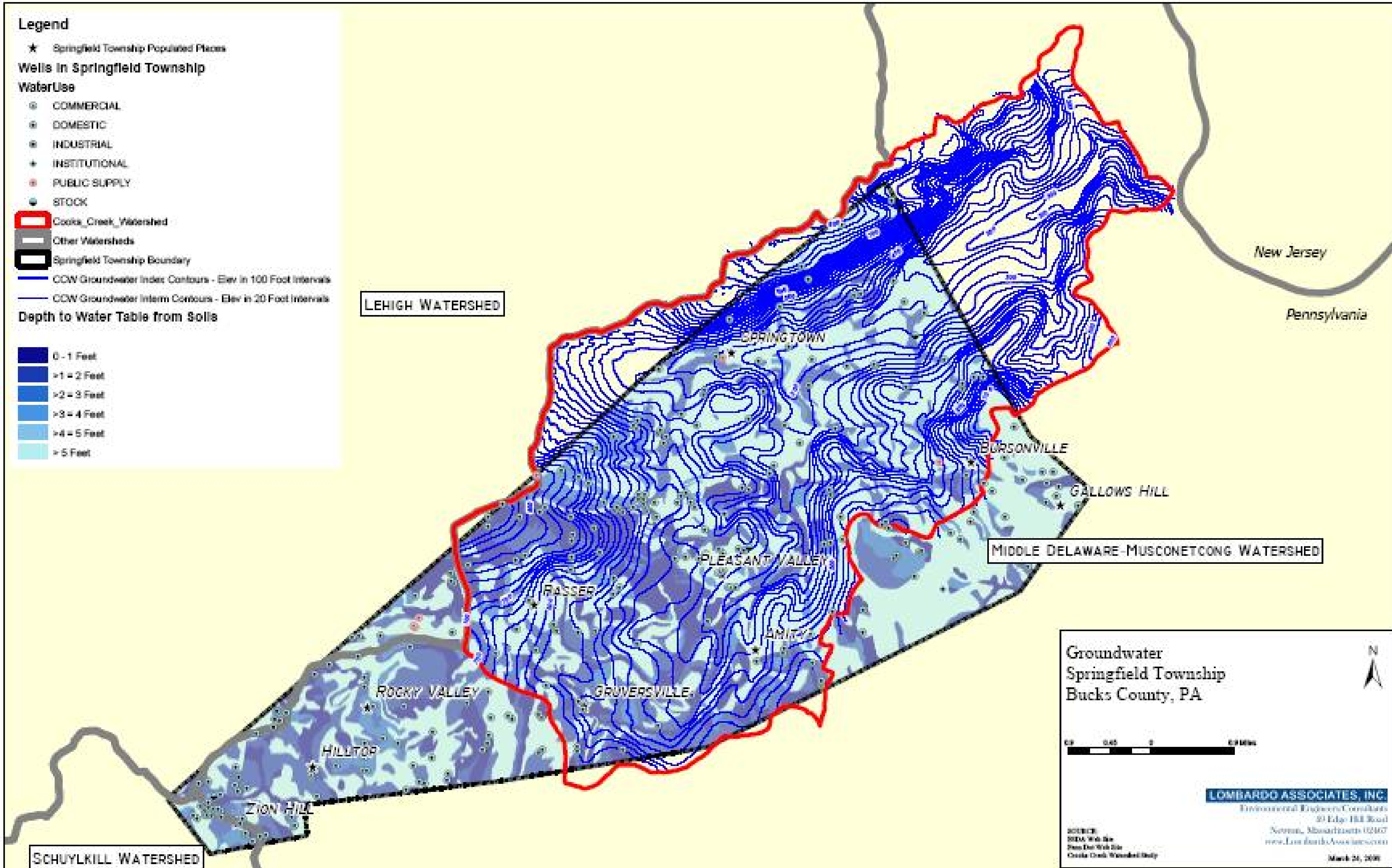


Figure 2.5.2. Groundwater Contours



2.6. TOPOGRAPHY

As seen in Figure 2.3.2 there are numerous areas with steep slopes in the Township. Approximately 27 percent of the Township is covered by slopes of 15 percent or greater. Development on steep slopes, if not regulated and designed properly, can lead to accelerated erosion, instability of structures, limited access, and screening of scenic views.

The Springfield Township Zoning Ordinance restricts the development of areas with slopes of 15 percent or greater. For areas with slopes of 15 to 24 percent, 70 percent of the area shall be protected; for areas with slopes of 25 to 30 percent, 85 percent of the area shall be protected; and for areas with slopes of greater than 30 percent, 100 percent of the area shall be protected. These standards apply to all zoning districts except the AD Agriculture district, where the steep slope protection standards are 20, 30, and 50 percent respectively. The reduced standards are intended to allow more agricultural development on steep slopes and greater protection of agricultural soils on sites located in the AD district with both natural resources.

As stated in the CCWP, the topography of Cooks Creek drainage basin is defined by geologic characteristics of harder, more resistant rocks, which occupy highlands. These highlands may rise to elevations as high as 300 feet above the lowlands. The softer, less-resistant rocks tend to erode easily and occupy the lowlands as broad open valleys, valley bottoms, or gentle stream gradients. With harder, more resistant rocks, the valleys are narrower and steeper. Many of the streams draining the ridges surrounding the valley of Cooks Creek flow down more resistant rocks that underlie the ridge crest and mid slopes. These streams occupy steeper and narrower valleys. Cooks Creek occupies the broad, open, lowland valley bottomlands called the Durham Carbonate Valley. Much of this land is currently under agricultural use. The natural diversity of Cooks Creek basin is due largely to the fact that the watershed spans two physiographic provinces: the Reading Prong and the Piedmont.

2.7. POTABLE WATER SUPPLIES

The Cooks Creek Watershed Plan indicated that relatively good drinking water quality exists throughout the watershed. The total number of private residential wells is approximately 1,700 in Springfield Township.

There are two public community wells located in the Township. A public well is operated by Scenic View Apartment (located in Lower Saucon and Springfield Townships) and serves a total of 49 connections. There are about 24 connections in Springfield Township.

The other public well is operated by the Springfield Township Authority (STA) and serves Springtown residents. The water supply for the STA system comes from two sources. The primary source consists of springs located on a 2-acre tract owned by

Springfield Township but located in Lower Saucon Township, Northampton County. Water from the springs flows into two separate reservoirs-one located off New Hill Way and a buried tank located off Lower Saucon Road. The secondary water source is a well located adjacent to the Springtown Firehouse and is only used when the reservoirs are running low. The STA water supply system provides 171 domestic and approximately 15 commercial connections. The total average daily water use was 33,300 gallons per day (gpd). The safe yield is 1,920,000 gpd. Based upon future water quantity projections, the projected daily withdrawals are not expected to exceed the permitted safe yield in the foreseeable future.

As stated in the 2006 Springtown Source Water Protection Plan, the Springtown Village Well (Well 2) is located on the Springtown Community Volunteer Fire Company Number 1 property. The well is 158 feet deep and constructed with 95 feet of eight-inch diameter steel casing. The producing formation is the Leithsville Formation. Currently, the well system is capable of providing a flow rate of between 100 and 150 gallons per minute. Based on the year 2004 production volumes, the well contributed an average of 12,900 gallons per day with a maximum daily production of 61,800 gallons (July 2, 2004). In addition to the village well, the Springtown water system is fed by three springs located in Lower Saucon Township. The spring boxes are named Main Spring 1, Spring 2, and Spring 4. Spring 3 has not been operational for many years, and there are no plans to bring Spring 3 online at this time. Spring 4 was disconnected in 2003 at the request of DEP due to data suggesting that the source was being influenced by surface water. When it was connected to the system, Spring 4 provided 10 to 15 gallons per minute. The remaining two springs produce an average flow rate of 20 to 25 gallons per minute. All three springs produce groundwater from a crystalline rock aquifer (felsic to mafic gneiss). Based on the year 2004 production volumes, the spring system contributed an average of 44,600 gallons per day with a maximum daily production of 67,200 gallons (August 18, 2004).

A hydrogeologic model was created in the Source Water Protection Plan using US Department of Defense Groundwater Modeling System (GMS) Version 5.0. GMS is an industry-recognized groundwater flow software that utilizes MODFLOW (A Modular Three-Dimensional Finite-Difference Ground-Water Flow Model), PEST (Model-Independent Parameter Estimation), and MODPATH (a particle tracking post-processing program) program codes. The model-generated water budget can serve as an approximation of the groundwater budget for the Cooks Creek study area. The volumetric flow budget, as presented in Table 2.7.1, describes the volume of groundwater that moves through the modeled area – direct precipitation, storm water runoff, and evapotranspiration does not enter the groundwater system and are therefore excluded from the flow budget numbers. Through the parameter estimation process, hydraulic conductivity values for the modeled area were estimated to be between 0.0001 and 2.3 meters per day (0.00033 to 7.5 feet per day) with a mean value of 0.085 meters per day (0.28 feet per day), as shown on Figure 2.7.1.

Figure 2.7.1. Hydraulic Conductivity Map- Village of Springtown

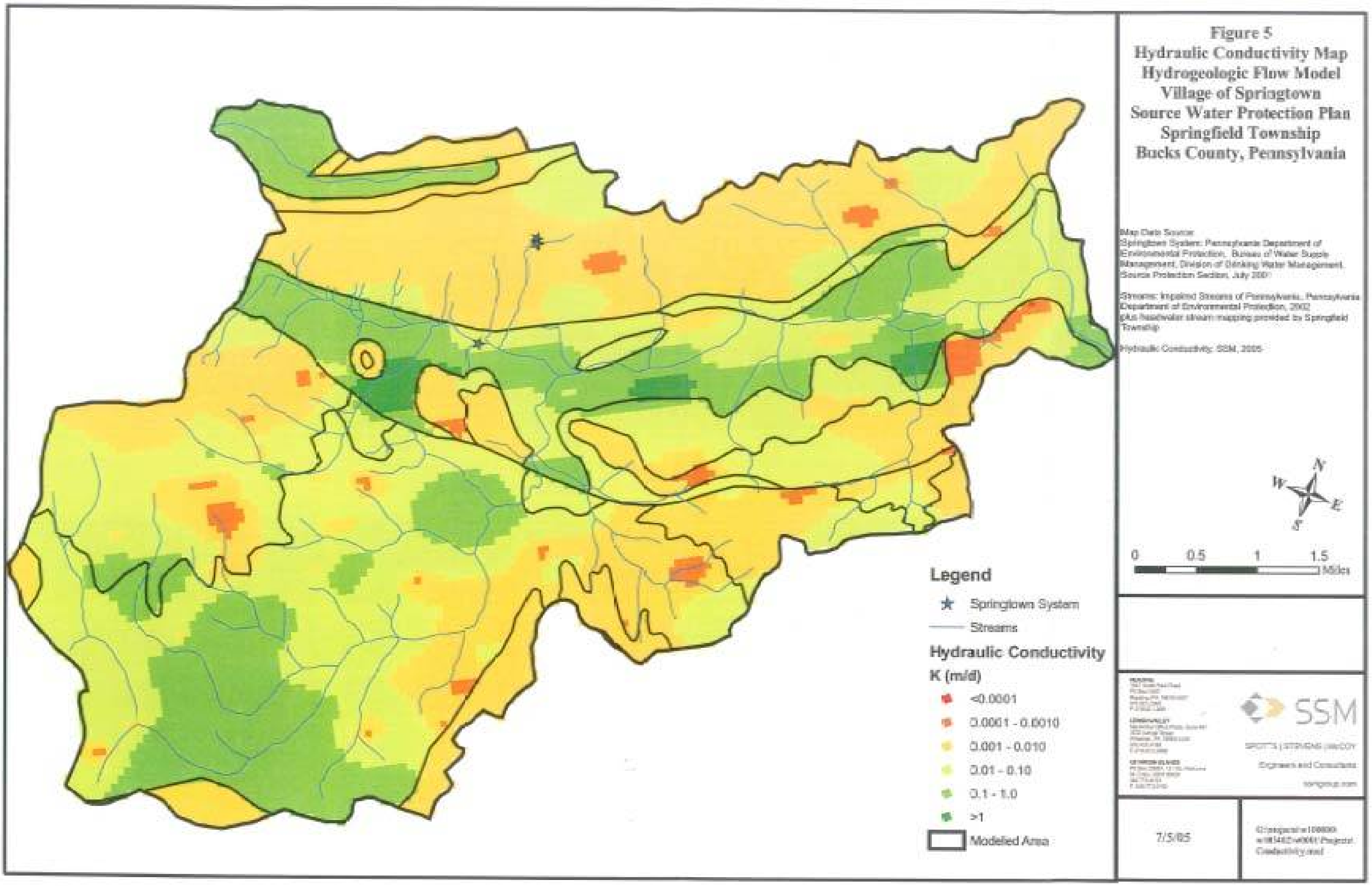


Table 2.7.1 Volumetric Water Flow Budget

Feature	INFLOW (gallons per day)	OUTFLOW (gallons per day)
Wells	0	62,000
Seeps, Springs, Drains	0	2,694,000
Streams	1,990,000	3,540,000
Recharge	4,306,000	0
TOTAL	**6,296,000**	**6,296,000**

Source Water Protection Area Delineations

The source water protection area calculations and delineations were based on well/spring information, groundwater flow patterns and watershed configuration. The delineated zones for each of the Springtown sources are presented in Figure 2.7.2**.**

Source Water Protection Zone I

The Source Water Protection (SWP) Zone I is the smallest of the three SWP zones and also the most stringent from a protection standpoint. The SWP Zone I radius for the Springtown Village Well is 100 feet. For springs with flows of less than 100,000 gallons per day, Zone I is a circle extending upgradient from the spring with a 200-foot radius that is arranged such that the spring is set back 50 feet from the downslope point on the circumference of the circle.

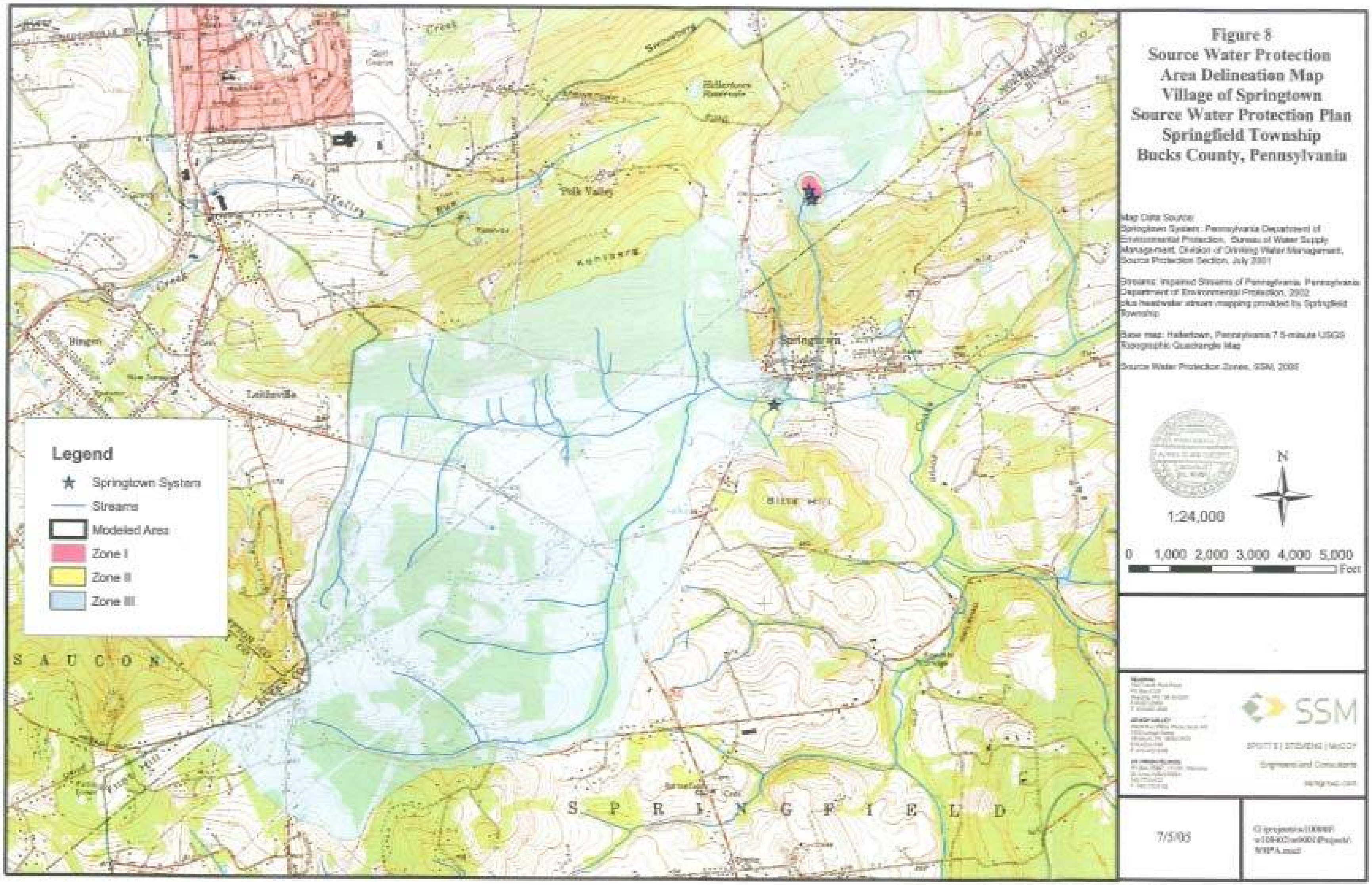
Source Water Protection Zone II

The volume of water in an aquifer that migrates towards a pumping well or flowing spring is referred to as the capture zone, or the zone of diversion. SWP Zone II area is the geographical representation of the zone of diversion. The Zone II area delineations shown in Figure 2.7.2 were derived from the hydrogeologic flow model. Using a particle-tracking algorithm, the volume of water entering the sources in a 10- year time of travel formed the basis for the Zone II area delineation. In other words, groundwater that resides below the area identified as Zone II area has a high probability of reaching the corresponding source in less than ten years. The capture zone for the Springtown spring sources combine for approximately 10 acres, while the Springtown well has a capture zone of approximately 11 acres.

Source Water Protection Zone III

The SWP Zone III area, or zone of contribution, is the upgradient extent of the subbasin that can contribute water to the zone of diversion. Using a particle-tracking algorithm, the volume of water that enters the Zone II area is determined to be the zone of contribution. The groundwater that enters the well's Zone III area is derived, in part, by water entering the groundwater system through losing reaches of Silver Creek (Figure 2.7.3) which also illustrates groundwater flow direction. For this reason the entire upgradient extent of

Figure 2.7.2. Source Water Protection Area Delineation Map- Village of Springtown



Silver Creek is included in the well's Zone III area. The SWP Zone III area for the production well encompasses an area of 3.9 square miles, and the springs' Zone III area is 0.3 square miles.

Figure 2.7.4 illustrates potential sources of contamination in the water supply well recharge area. Table 2.7.2 lists all the properties located in Zones I and II.

Table 2.7.2 Properties located in Zones I and II

Spring/ Well	Zone	Tax Map ID	Owner Name	Street Address	City & Zip Code	Parcel Area (acres)
Springs	1	4565-00-9820-8427	Rafferty Bernard & Audrey	2545 Martins Lane	Hellertown PA 18055	2.79
Springs	1	4565-00-0426-8892	Vierzbicki Joseph	2583 Martins Lane	Hellertown PA 18056	43.91
Springs	1	4565-00-9424-9948	Springfield Township Authority	So Martins Lane	Hellertown PA 18057	2.50
Springs	1	4565-00-9429-6090	Riddle William & Elsie	2558 Martins Lane	Hellertown PA 18058	15.03
Springs	2	4565-00-9820-8427	Rafferty Bernard & Audrey	2545 Martins Lane	Hellertown PA 18059	2.79
Springs	2	4565-00-0426-8892	Vierzbicki Joseph	2583 Martins Lane	Hellertown PA 18060	43.91
Springs	2	4565-00-9424-9948	Springfield Township Authority	So Martins Lane	Hellertown PA 18061	2.50
Springs	2	4565-00-8923-3378	Seifert David	Martins Lane	Hellertown PA 18062	37.50
Springs	2	4565-00-9429-6090	Riddle William & Elsie	2558 Martins Lane	Hellertown PA 18063	15.03
Springs	2	42012134	Koder Gladys F	3074 Route 212	Coopersburg PA 18036	5.06
Wells	1	42012128	Rutherford James W	2984 Route 212	Springtown PA 18081	3.25
Wells	1	42012127	Springtown Comm Vol Fire Co 1	3010 Route 212	Coopersburg PA 18036	2.45
Wells	1	42012136	Gawronski Michael & Cheryl	2094 Route 212	Coopersburg PA 18036	2.12
Wells	2	42012060	Hunt John & Marjorie B	2916 Springtown Hill Road	Coopersburg PA 18036	42.04
Wells	2	42012134	Koder Gladys F	3074 Route 212	Coopersburg PA 18036	5.06
Wells	2	42012130	Broadhecker Donald & Thelma	3070 Route 212	Coopersburg PA 18036	0.20
Wells	2	42012128	Rutherford James W	2984 Route 212	Springtown PA 18081	3.25
Wells	2	42012129	C D Hldg LLC	3050 Route 212	Coopersburg PA 18036	0.60
Wells	2	42012157	Rosso John & Sunny	Route 212	Coopersburg PA 18036	28.71
Wells	2	42012127	Springtown Comm Vol Fire Co 1	3010 Route 212	Coopersburg PA 18036	2.45
Wells	2	42012128	Rutherford James W	2984 Route 212	Springtown PA 18081	3.25
Wells	2	42012126	Carver Robert & Susan	3006 Route 212	Coopersburg PA 18036	0.56
Wells	2	42012126-001	Roth John & Vicki	3004 Route 212	Coopersburg PA 18036	0.26
Wells	2	42012125	Bove Anthony & Nina Marie	3000 Route 212	Coopersburg PA 18036	4.04

The supply of public water to serve the designated Development Areas of Zion Hill and Pleasant Valley is a concern. The feasibility of options, such as a connection into adjacent sources of public water located in Coopersburg Borough, Upper Saucon Township, or Richland Township is under consideration.

Rock types and geologic formations determine groundwater supplies. Springfield Township is underlain with red shales and sandstones associated with the Brunswick Formation, Lockatong lithofacies, Diabase, and Limestone areas. The Brunswick Formation is considered to be a reliable source of water with an average yield of 60 gallons per minute. The Lockatong lithofacies are generally poor sources of water with an average yield of 7 gallons per minute, while the Diabase is among the poorest water supplies in the County with an average yield of 5 gallons per minute. The Limestone area associated with the Durham Carbonate Valley varies greatly in its supply of water and is also susceptible to groundwater contamination, sinkholes, and solution channels.

Private on-lot wells function as the primary source of drinking water for over 90 percent of the Township's population. Recent reports to the Township indicate that there been only a few private on-lot wells that have dried up, predominately located on older properties. This is probably due to the shallow wells that were drilled to reach the aquifer. At this time, there appears to be an adequate supply of water from private wells to satisfy the demands for immediate future.

Water for fire fighting purposes is primarily obtained from private ponds or outside municipal water sources such as hydrants from Coopersburg and Richlandtown boroughs, and the City of Hellertown. Water from these sources is pumped into water tanker trucks, and then transported to the site of the fire. There is a dry hydrant located at a pond in Springtown (near the intersection of Drifting Drive and Greenwood Road). A second pond, located off Winding Road near Woodcock Lane has a stone access drive that allows tanker trucks to withdraw water through the use of hoses. An agreement between the Township and the respective property owners allows the Township to obtain water from these two ponds on an as needed basis. Currently, the total storage capacity of STA is about 28,000 gallons, and is inadequate to satisfy both the supply of water for domestic use and firefighting purposes. To address this issue, the STA is considering the construction of a back-up reservoir off Lower Saucon Road. This additional reservoir will not only provide an additional source of public drinking water but also enhance the fire fighting capacity in the future.

The Delaware River Basin Commission (DRBC) monitors groundwater withdrawals in excess of 100,000 gallons per day (gpd) for municipalities in the Delaware River Basin located outside the designated groundwater protection area, including Springfield Township. These withdrawals must not interfere with the performance of existing supply wells, or exceed the safe yield of the source aquifer. DRBC encourages municipalities to monitor public and private water use to determine the community's sustainable groundwater yields. To satisfy future water demands, there may be a need to supplement groundwater supplies with public water supply options, especially in communities with poor underlying aquifers.

The subdivision and land development ordinance requires a water impact study for major subdivisions (5 lots or more) and for all land developments in Springfield Township. The study is to be prepared by a qualified hydrogeologist and professional engineer registered in Pennsylvania. The purpose of the study is to determine if there is adequate water supply to serve the proposed use and to estimate the impact of the additional water use on the existing nearby wells, underlying aquifers, and surface water bodies. Any proposed water system or on-lot water supply for a major subdivision or land development that does not provide adequate supply for use, or which adversely affects nearby wells or streams shall not be approved by the Township and shall be cause for denial.

Figure 2.7.3. Groundwater Flow Direction Map- Village of Springtown

Figure 2.7.4. Potential Sources of Contamination- Village of Springtown

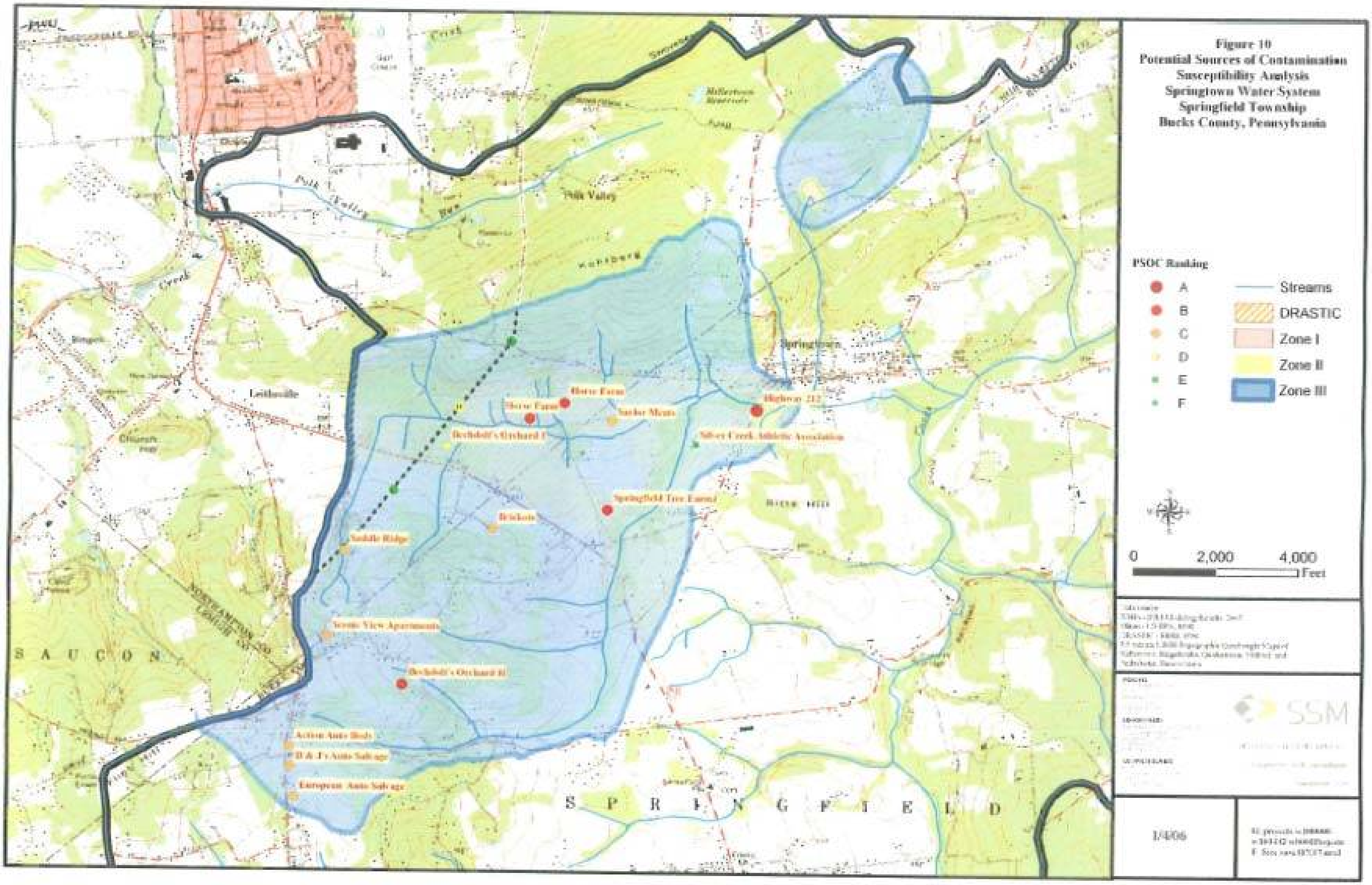


Table 2.7.3. Potential Sources of Contamination Inventory

NAME	ADDRESS	ACTIVITY	POTENTIAL CONTAMINATION TYPES	DISTANCE TO WELL (miles)	RANKING
Routes 412 and 212	---	Major roads	Gasoline, oil, metals, etc.	0.10	A
Bechdolf's Orchard II	Leithsville Road (Route 412)	Peach/apple orchard	Pesticides, herbicides	2.16	B
Horse Farms	Orchard Road	Horse farms	Pathogens, nutrients	0.98	B
Brickole	2200 Route 412	Construction supplies	General chemicals	1.44	C
Springfield Tree Farm	3018 Mayer Road	Tree nursery	Pesticides, herbicides	0.92	B
Scenic View Apartments	Scenic View Lane off of Flint Hill Rd	Apartment complex	Pathogens, lawn chemicals	2.34	C
Saddle Ridge	Off Flint Hill Rd	Housing development	Pathogens, lawn chemicals	2.10	C
Action Auto Body	2899 Richlandtown Pike	Auto body shop	Gasoline, oil, paint, etc.	0.74	C
D & J's Auto Salvage	2875 Richlandtown Pike	Auto salvage	Gasoline, oil, paint, etc.	2.79	C
European Auto Salvage	2785 Richlandtown Pike	Auto salvage	Gasoline, oil, paint, etc.	2.80	C
Saylor Meats	3226 Mayer Road	Butcher's shop	Organic matter, Bacteria	0.79	C
Bechdolf's Orchard I	Leithsville Road (Route 412)	Peach/apple orchard	Pesticides, herbicides	1.32	D
Silver Creek Athletic Association	2843 Route 212, PO Box 392, Springtown PA 18081	Athletic fields/club	Lawn chemicals	5.42	F

Note: all PSOCs listed in this table have the possibility of contaminating Well 2. No PSOC's were identified for Springs 1 and 2.

Over concerns of increasing water demands for public supply, individual residential use, industrial, and commercial uses, residents in several upper and central Bucks municipalities formed the Groundwater Management Committee (GWMC). In May 1994, GWMC prepared the Municipal Groundwater Resources Management, Northern Bucks Co.-Position Paper based upon the results of a U.S. Geological Survey titled, Hydrogeology and Groundwater Quality of Northern Bucks County, Pennsylvania (1994). The committee disbanded in the mid-90s and the each municipality has pursued implementation of the individual plan recommendations as deemed appropriate. Many of the recommendations of this study have been incorporated into subsequent studies.

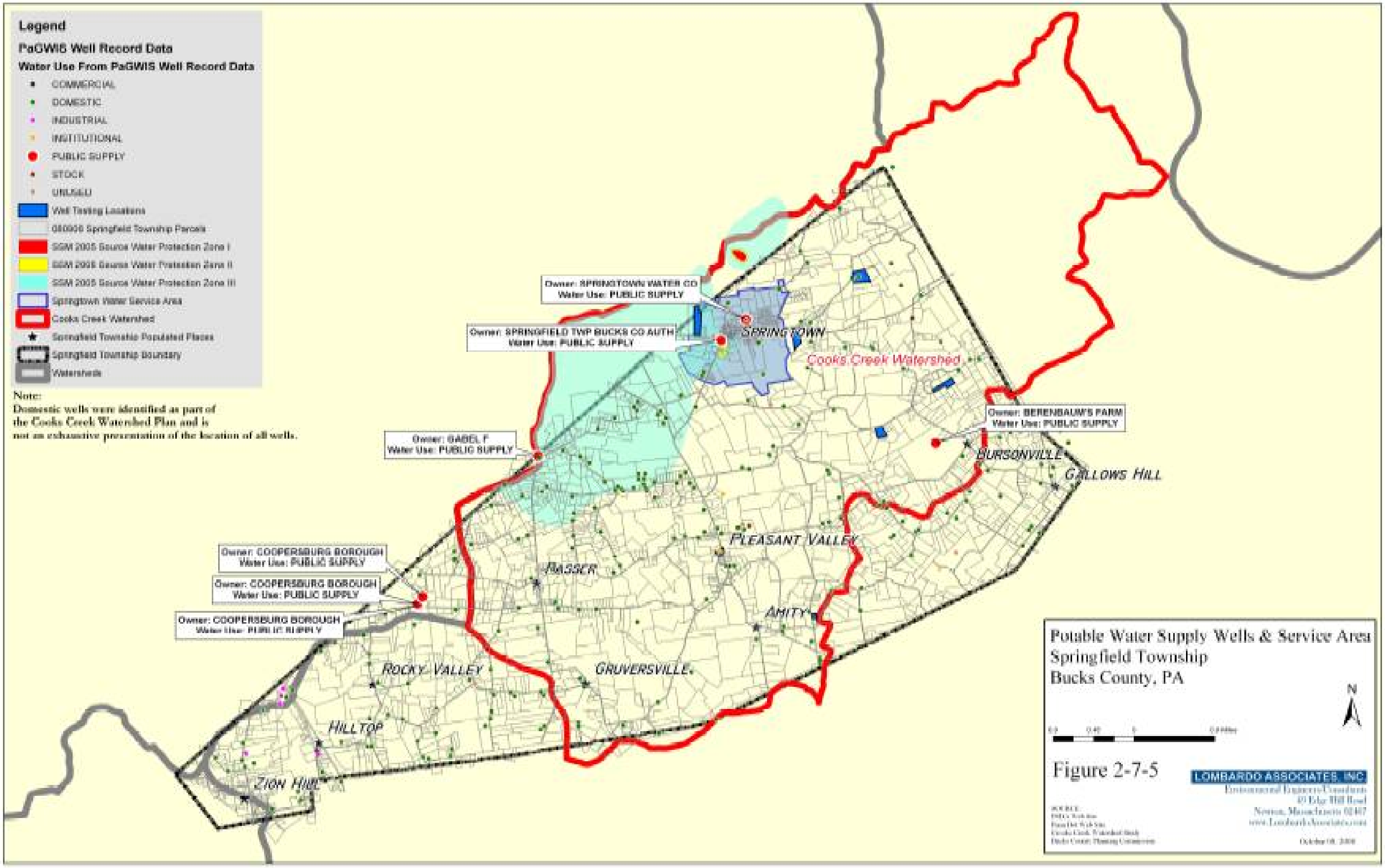
2.7.1 Springtown Public Water Supply

The Source Water Protection Area Map for Springtown water supply system is presented on Figure 2.7.5. The location of water supply wells and the service areas of the Springtown water supply system are also illustrated on Figure 2.7.5.

2.7.2 On-Lot wells

Individual potable water supply wells that were located, as part of the Cooks Creek Watershed Plan, are presented on Figure 2.7.5.

Figure 2.7.5. Potable Water Supply Wells & Springtown Service Areas



2.8. WETLANDS AND FLOODPLAINS

Wetlands are not predominant in the Township, comprising a little over 2 percent of the Township, as shown in Figure 2.8.1. These wetland are defined by the National Wetlands Inventory (NWI) maps. While not covering a large area, wetlands are located throughout the Township, mostly along stream corridors and in isolated, low-lying areas. The Township zoning ordinance requires 100 percent protection of all wetlands and wetland buffers. The current zoning ordinance establishes a 75-foot margin around (all but small or isolated) wetlands.

The areas within the Township that are adjacent to the Township's streams and watercourses are susceptible to flooding. Areas within the 100-year floodplain are also shown on Figure 2.8.1.

The Township zoning ordinance contains provisions for the protection of floodplain areas that comply with the National Flood Insurance Program and the Pennsylvania Floodplain Management Act. The ordinance contains provisions that limit the expansion and enlargement of existing structures that would cause an increase in the elevation of the 100-year flood heights, provisions that deny the granting of any variance for any construction, development, use, or activity that would cause an increase in the elevation of the 100-year flood heights, and provisions that set out elevation and flood-proofing requirements for residential and nonresidential structures built in the floodplain.

As part of the Cooks Creek Wetlands Plan (CCWetP) field reconnaissance reviewed the NWI wetlands areas and identified other wetlands and incorrectly classified or delineated wetlands on the NWI maps. Figure 2.8.2 illustrates the field identified wetlands, areas incorrectly identified by NWI as wetland and wetland study areas.

The wetland types that were identified within the Cooks Creek watershed include:

- palustrine forested
- palustrine scrub shrub
- palustrine emergent
- palustrine open-water
- palustrine unconsolidated bottom
- palustrine flat-bottom
- riverine perennial
- riverine intermittent
- riverine unknown perennial

Figure 2.8.1. Springfield Township 100-Year Floodplain and NWI Wetlands

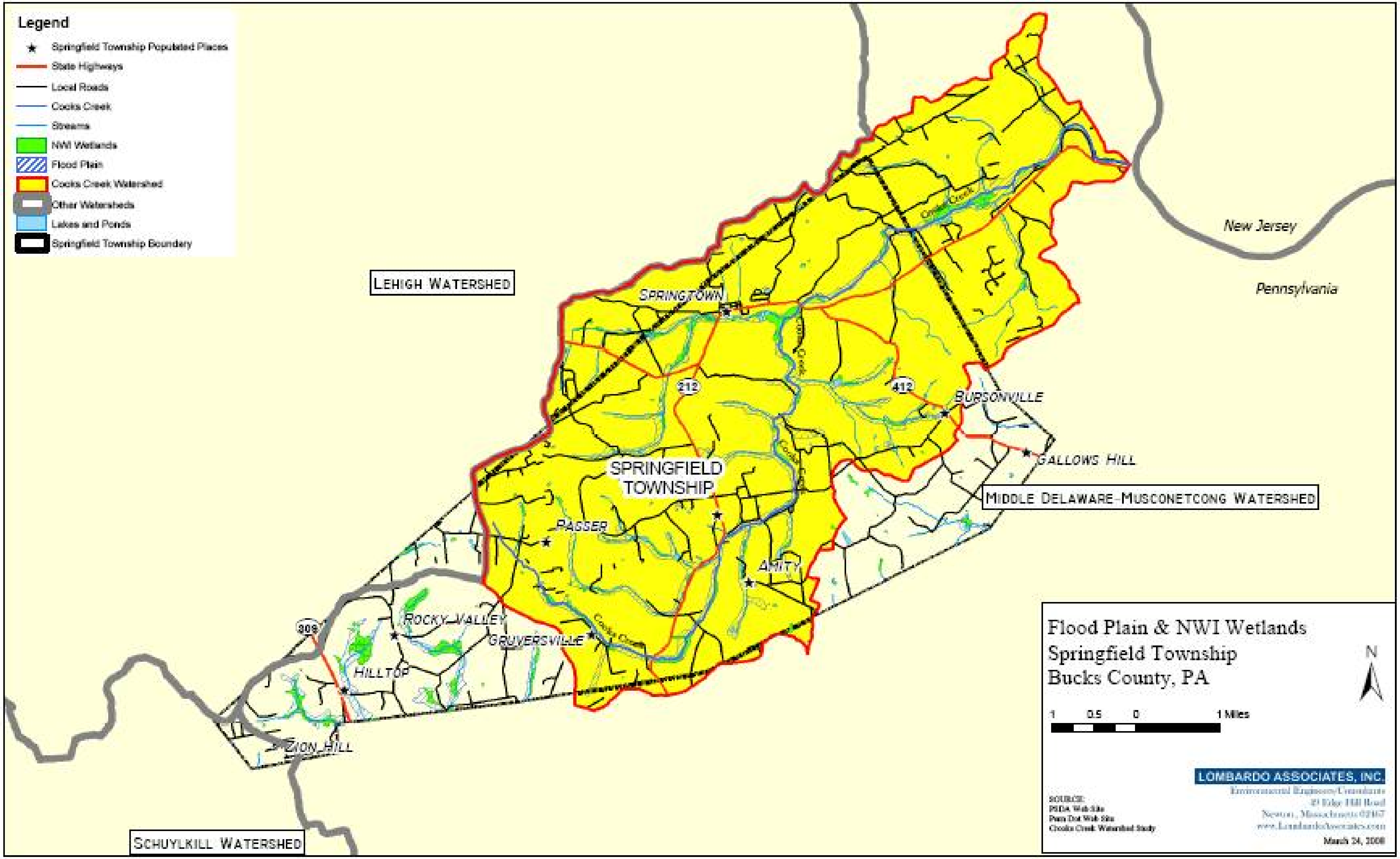


Figure 2.8.2. Field Identified Wetlands & NWI Incorrectly Designated Wetlands

2.9. HYDROLOGY & WATERSHEDS

Figure 2.9.1 illustrates the watersheds in Springfield Township. Table 2.9.1 presents the amount of Springfield land in the various watersheds and subwatersheds. Figure 2.9.2 illustrates the water bodies, streams and watersheds within Springfield Township.

Figure 2.9.1. Springfield Township Watersheds

Table 2.9.1: Subwatersheds within Springfield Township

Subwatersheds within Springfield Township	Size of Subwatershed (acres)	Size of Subwatershed in Springfield Township (acres)	Percent of Subwatershed in Springfield Township	Percent of Springfield Township Acreage
Lehigh Watershed				
Tumble Brook	1,859	519	27.9%	2.6%
Saucon Creek	15,146	79	0.5%	0.4%
Lehigh River	42,888	19	0.0%	0.1%
East Branch Saucon Cree	6,621	2	0.0%	0.0%
Subtotal	**66,514**	**619**	**0.9%**	**3.1%**
Middle Delaware - Musconetcong Watershed				
Cooks Creek	18,895	13,674	72.4%	67.7%
Tohickon Creek	31,444	3,299	10.5%	16.3%
Haycock Creek	6,325	1,456	23.0%	7.2%
Gallows Run	5,588	621	11.1%	3.1%
Dimple Creek	4,691	534	11.4%	2.6%
Subtotal	**66,943**	**19,584**	**29.3%**	**96.9%**
Schuylkill Watershed				
Unami Creek	8,190	1	0.0%	0.0%
Subtotal	**8,190**	**1**	**0.0%**	**0.0%**
Grand Total	**141,647**	**20,204**	**14.3%**	**100.0%**

Figure 2.9.2. Water Bodies, Streams & Watersheds within Springfield Township

The Cooks Creek Wetlands Plan provided the following Table 2.9.2 water budget information for Cooks Creek.

Average water budgets for the Cooks Creek watershed for 1991 –1992 periods calculations were referenced in the Cooks Creek Watershed Plan. Average annual precipitation (P) was 42.5 inches; average annual evapotranspiration (ET) and other losses were 23.8 inches or 56 percent of precipitation; average annual stream flow was 19.0 inches or 45 percent of the average precipitation; and the average annual change in ground-water storage was a decrease of 0.2in., or less than 1 percent of the average annual precipitation.

Table 2.9.2 Annual Water budget for Cooks Creek for 1991-1992

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

* Average annual precipitation is 45.2”. Data presented in this table reflects below average rainfall.

Cooks Creek Stream flow gauges have been installed as part of the Cooks Creek Watershed plan at the Brunswick Stream Gauge Station and Red Bridge Stream Gauge Station. The Red Bridge Gauging Station is located approximately one-half mile up stream from the confluence of the main stem of the Cooks Creek with the Delaware River. This gauging station was installed and utilized by the USGS between 1990 and 1993. The station was re-equipped in 1999 and provides data for the entire Cook Creek drainage area.

The Brunswick Aquifer Stream Gauge was installed on the eastern edge of the watershed, just upstream of the confluence of Silver Creek with the Cooks Creek main stem, near the village of Springtown. This gauging station monitors the Triassic/Diabase area of the watershed and allows comparison between the Carbonate/Crystalline and Triassic/Diabase aquifer features within the watershed.

As part of the Cooks Creek Watershed Plan, short-term pumping tests were performed on nine (9) private wells throughout the watershed, providing valuable information regarding various aquifers. In addition, long-term pumping test results from one (1) public well for the Springtown Firehouse Well #4 were obtained for interpretation. Therefore, a total of ten (10) hydraulic pumping tests were compared. Wells for pumping tests were carefully selected to obtain permeability values within representative aquifer geologic formations of the watershed.

Five (5) pumping tests were completed on May 19, 2002. Four (4) pumping tests were conducted on June 2, 2002 and the Springtown Firehouse Well #4 pumping test was performed in December of 1968. Out of ten (10) hydraulic tests, four (4) were performed in the Limestone Aquifers, four (4) were performed in the Brunswick Aquifers and two (2) in the Crystalline Aquifers. Table 2.9.3 presents the pumping tests results.

Table 2.9.3 Summary of Aquifer Properties- Water Well Hydraulic Test Results

Test Date	Owner	Parcel ID	Address	Hydrogeologic Unit	Transmissivity (gpd/ft)	Transmissivity (ft²/day)	Storativity	Hydraulic Conductivity (ft/day)	Hydraulic Conductivity (cm/sec)
May 19, 2002	[illegible]	[illegible]	[illegible] Springfield PA	Limestone	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
May 19, 2002	[illegible]	[illegible]	[illegible] Durham PA	Limestone	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible] 1968	Springtown Village	[illegible]	Firehouse Well No. 4 [illegible] Springtown Village, Springtown PA	Limestone	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
June 2, 2002	[illegible]	[illegible]	[illegible] Durham PA	Limestone	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
				Average	[illegible]	[illegible]		[illegible]	[illegible]
June 2, 2002	[illegible]	[illegible]	[illegible] Rd., Springtown Village, Springfield PA	Crystalline	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
June 2, 2002	[illegible]	[illegible]	[illegible] Rd., Springfield PA	Crystalline	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
				Average	[illegible]	[illegible]		[illegible]	[illegible]
May 19, 2002	[illegible]	[illegible]	[illegible] Rd., Springfield PA	Brunswick	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
May 19, 2002	[illegible]	[illegible]	[illegible] Springfield PA	Brunswick	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
June 2, 2002	[illegible]	[illegible]	[illegible] Valley Rd., Springfield PA	Brunswick	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
June 2, 2002	[illegible]	[illegible]	[illegible] Rd., Springfield PA	Brunswick	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
				Average	[illegible]	[illegible]		[illegible]	[illegible]

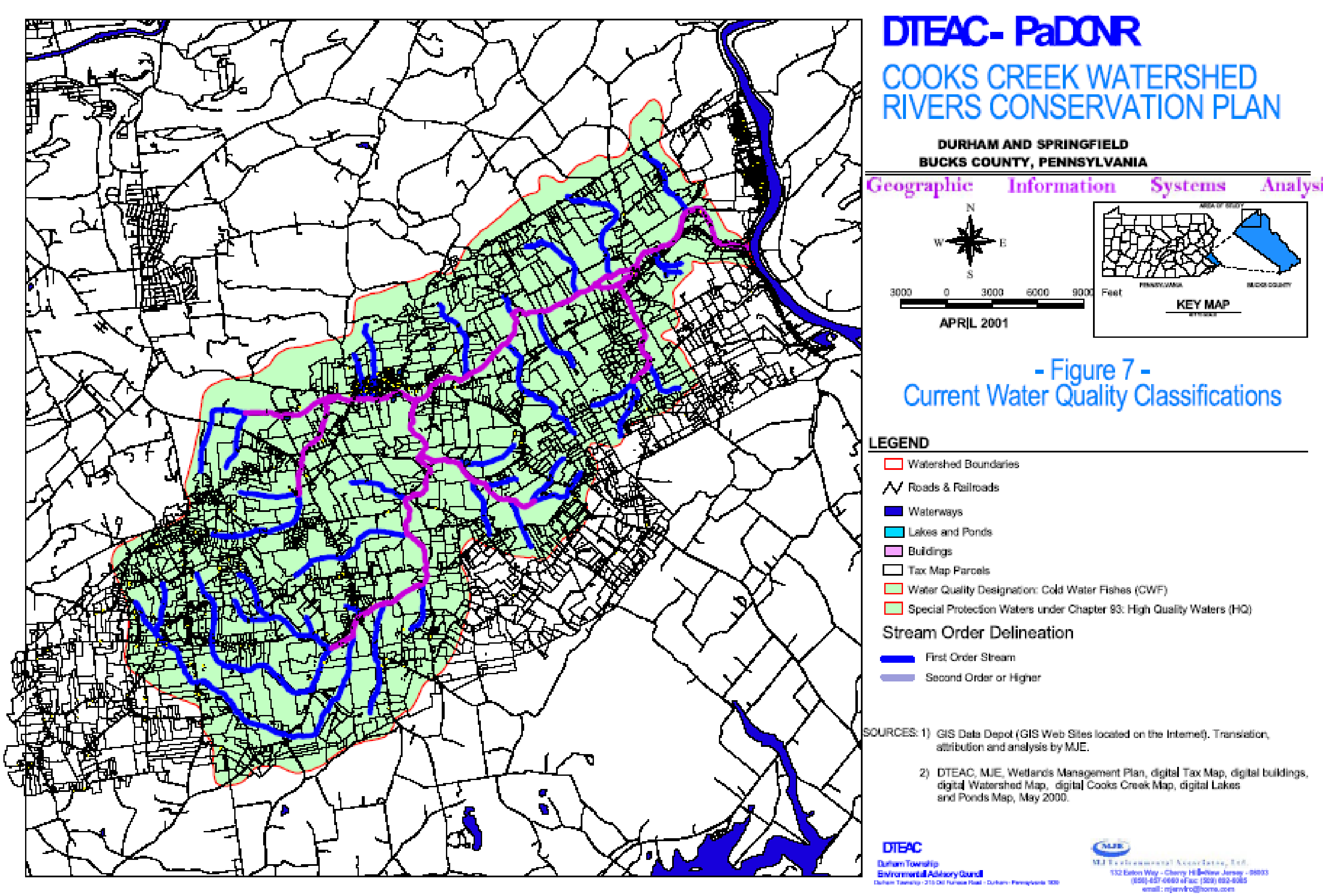
The water quality classifications for Cooks Creek Watershed streams are illustrated on Figure 2.9.3. and listed on Table 2.9.4.

Table 2.9.4 Water Quality Classifications- Cooks Creek Watershed

Waterway	Segment	Chapter 93 Designation
Cooks Creek	Basin	EV-CWF
Hollow Run	Basin	TSF
Rodgers Run		
Gallows Run	Basin	CWF
Hickon Creek		
Tohickon Creek	Basin- Source to Nockamixon Dam	TSF

EV = Exceptional Value Waters
CWF = Cold Water Fishing
TSF = Trout Stocking

Figure 2.9.3. Water Quality Classifications for Cooks Creek Watershed



2.10. THREATENED AND ENDANGERED SPECIES AND OTHER LIVING RESOURCES

According to the Cooks Creek Wetlands Plan, the watershed supports a diverse range of living resources and provides habitat for a number of special status species. According to the USFWS, the Cooks Creek supports several populations of bog turtles (Clemmys muhlenbergii), which is listed as a federally threatened species. Bog turtles inhabit shallow, spring-fed fens, sphagnum bogs, swamps and pastures that have an open-canopy and are characterized by soft muddy bottoms and clear cool water that is usually ground-water fed. According to the USFWS, occasional transient species that are federally threatened or endangered may visit the Cooks Creek watershed as well. The Pennsylvania Department of Conservation and Natural Resources database showed that the following state threatened or endangered species have been recorded within or near the watershed:

Species	Status
• Spreading Globe flower (Trolliustaxus Salisb.)	State endangered
• Red-bellied turtle (pseudemys rubriventris)	State threatened
• Least bittern (Ixobrychus exilis)	State threatened
• Peregrine falcon (Falco peregrinus)	State endangered
• Sedge wren (Cistothorus platensis)	State threatened
• Bog turtle (Clemmys muhlenbergii)	State endangered

According to the Nature Conservancy, the bog-turtle and other special status species including the red-bellied turtle and the eastern mud salamander have been documented at 1 site within the watershed (Bureau of Water Quality Management, 1991). Fish surveys have collected a diverse population of primarily cold-water fish species including brown trout, brook trout, rainbow trout, rock bass, redbreast sunfish, bluegill, green sunfish, pumpkinseed, large mouth bass, small mouth bass, long nose dace, white sucker, blacknose dace, common shiner, swallowtail shiner, spotfin shiner, silvery minnow, bluntnose minnow, cutlips minnow, creek chub, margined madtom, tesselerated darter, and slimy sculpin.

The Audubon Society has completed a number of bird surveys within the Cooks Creek basin. At least 196 avian species have been recorded, of which approximately 39 are directly dependent on water resources for their survival. According to the Bureau of Water Quality Management (1991), the Cooks Creek watershed is also important to the migratory birds that use the Delaware River as an important stop-over point during spring and fall migrations.

2.11. WATER QUALITY

As part of the Cooks Creek Watershed Plan, water quality sampling of Cooks Creek and its tributaries was conducted on February 18, March 20, and April 7, 2002. Historical data from 2000. As stated in the Cooks Creek Watershed Plan, none of the water quality results reflect serious water quality issues for the Feb 18, 2002 sampling event. However, during the April 7, 2002 sampling event high levels of nitrate and phosphates were detected.

Nitrogen levels up to 1 mg/L and elevated phosphorous concentrations suggest a concern within the watershed. Evidence of blue-green algae in Silver Creek, near the firehouse on the south side of Route 412, reflects the results of such water quality issues.

The CCWP indicated that low level, chronic nutrient pollution has been observed in the watershed and has been shown to impact water and habitat quality, and recommended a comprehensive nutrient balance to determine the sources and causes of nutrient enrichment in the Cooks Creek Watershed and use this information to pinpoint appropriate management actions.

It is understood that there are water quality concerns in the Cooks Creek Watershed, including nutrient and thermal pollution.

2.12. LAND USE AND ZONING

2.12.1 Land Use

Table 2.12.1 (same as Table 2.1.16) shows the distribution of developed and undeveloped parcels and total area. Table 2.12.2 presents the distribution of land use in 1990 and 2001. Figures 2.12.1 and 2.12.2 illustrate Existing and Future Land Use in Springfield Township.

Table 2.12.1 Distribution of Developed and Undeveloped Parcels by Study Area

Study_Area	Developed Parcels	Undeveloped Parcels	Undevelopeable Parcels	Grand Total Parcels
Development District	59	22		81
On-Site	1,545	500		2,045
Passer Village	43	9		52
Pleasant Valley Village	66	9		75
Route 309	30	26		56
Springtown Village	241	65		306
Zion Hill Village	84	19		103
Grand Total	**2,068**	**650**		**2,718**

Table 2.12.2 Comparison of Land Use Distribution in 1990 and 2001.

Land Use Category	1990		2001		1999-2001	
	Acreage	% of Total	Acreage	% of Total	Amt. Chg.	% Chg.
Single Family Residential	1,930	9.8	2,271	11.5	341	15
Multi Family Residential	62	0.3	19	0.1	-43	-226
Rural Residential	6,013	30.5	6,627	33.6	614	9
Agricultural	6,625	33.6	6,057	30.7	-568	-9
Minig & Manufacturing	28	0.2	51	0.3	23	45
Commercial	220	1.1	252	1.3	32	13
Transportation & Utilities	581	3	593	3	12	2
Governmental & Institutional	117	0.6	148	0.8	31	21
Park & Recreation	22	0.1	22	0.1	0	0
Vacant	4,101	20.8	3,659	18.6	-442	-12
Total	**19,699**	**100%**	**19,699**	**100%**		

Source: 2002 Comprehensive Plan

Single-Family Residential category contains single-family detached dwellings on lots less than 5 acres. Rural Residential land use contains a single-family detached dwelling but is located on lots that are 5 acres or greater. The purpose of Rural Residential land use category is to identify large residential lots that may have future development potential for future subdivision or development. This category will be useful for identifying potential areas for future development in the Township as discussed in the Future Land Use and Growth Management section.

Multifamily Residential land uses are generally limited to the Route 309 corridor and within or adjacent to the villages Zion Hill, Pleasant Valley, and Springtown corresponding to the Highway Commercial, Village Commercial, or Village Residential Zoning District where this is a permitted use. Multifamily Residential consist of 19 acres or 0.1 percent of the total land area. The current Development District is intended to accommodate a variety of residential and nonresidential uses, including higher density housing types. The provision of public infrastructure may provide incentives for the provision of multifamily residential uses within this area (as discussed in the Future Land Use and Growth Management section).

Mining & Manufacturing land uses (51 acres or 0.3 percent of the total land area) are limited to the Route 309 corridor which corresponds to the Planned Industrial zoning district. Other nonresidential land uses (i.e., Commercial and Government & Institutional) consisting of approximately 400 acres or 2 percent of the total land area, are scattered around the Township.

Private recreational facilities (fraternal organizations/clubs) are considered Government & Institutional for the purposes of identifying land use characteristics. The Township has purchased land on Peppermint Road for recreational use.

2.12.2 Zoning

Figures 2.12.3, 2.12.4 and 2.12.5, illustrate zoning for Springfield Township. The following are descriptions of the zoning districts within the Township.

Development District (DD)

The Development District was established to accommodate the anticipated residential growth of the Township for the target year of 2010. In order to provide a variety of different uses including higher density housing types, public water and sewer is to be pursued within the DD. The purpose of this area is to concentrate residential and nonresidential growth and to coordinate this growth with the provisions of public services.

According to the 2002 Comprehensive Plan, there is only one development district, which is adjacent to Zion Hill. The Zion Hill Development District was previously deemed adequate in size to accommodate future growth demands given the objective to pursue public water and sewer to the Development Area. The zoning ordinance allows for a reduction of the minimum lot size in the DD, VC district, and VR district for various uses (e.g., Single-Family Detached, Village House, Twin House, and Duplex House) based upon the provision of centralized water and/or sewer. This will result in more efficient, compact development within the Zion Hill Development District.

Figure 2.12.1. Existing Land Use within Springfield Township

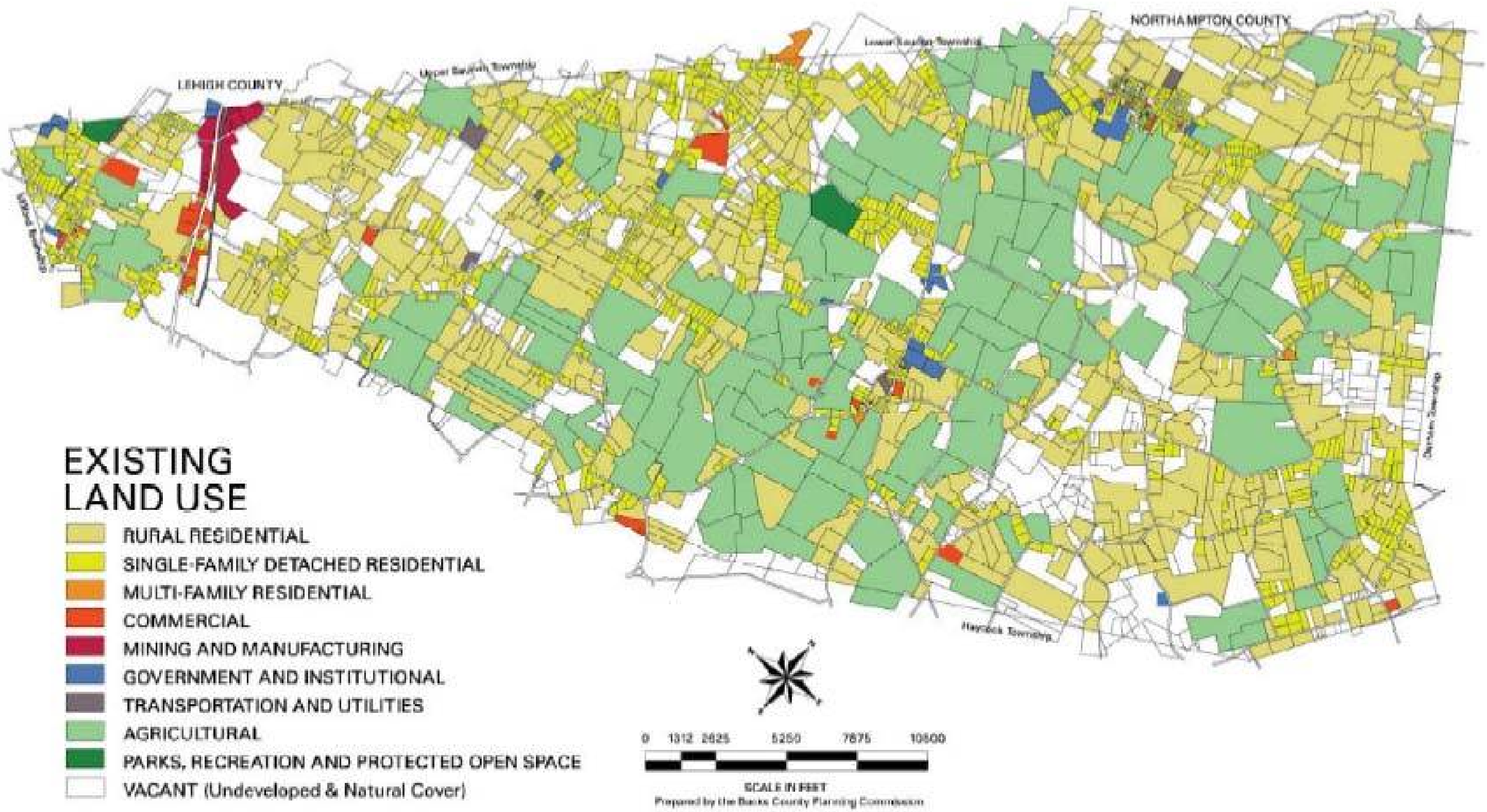
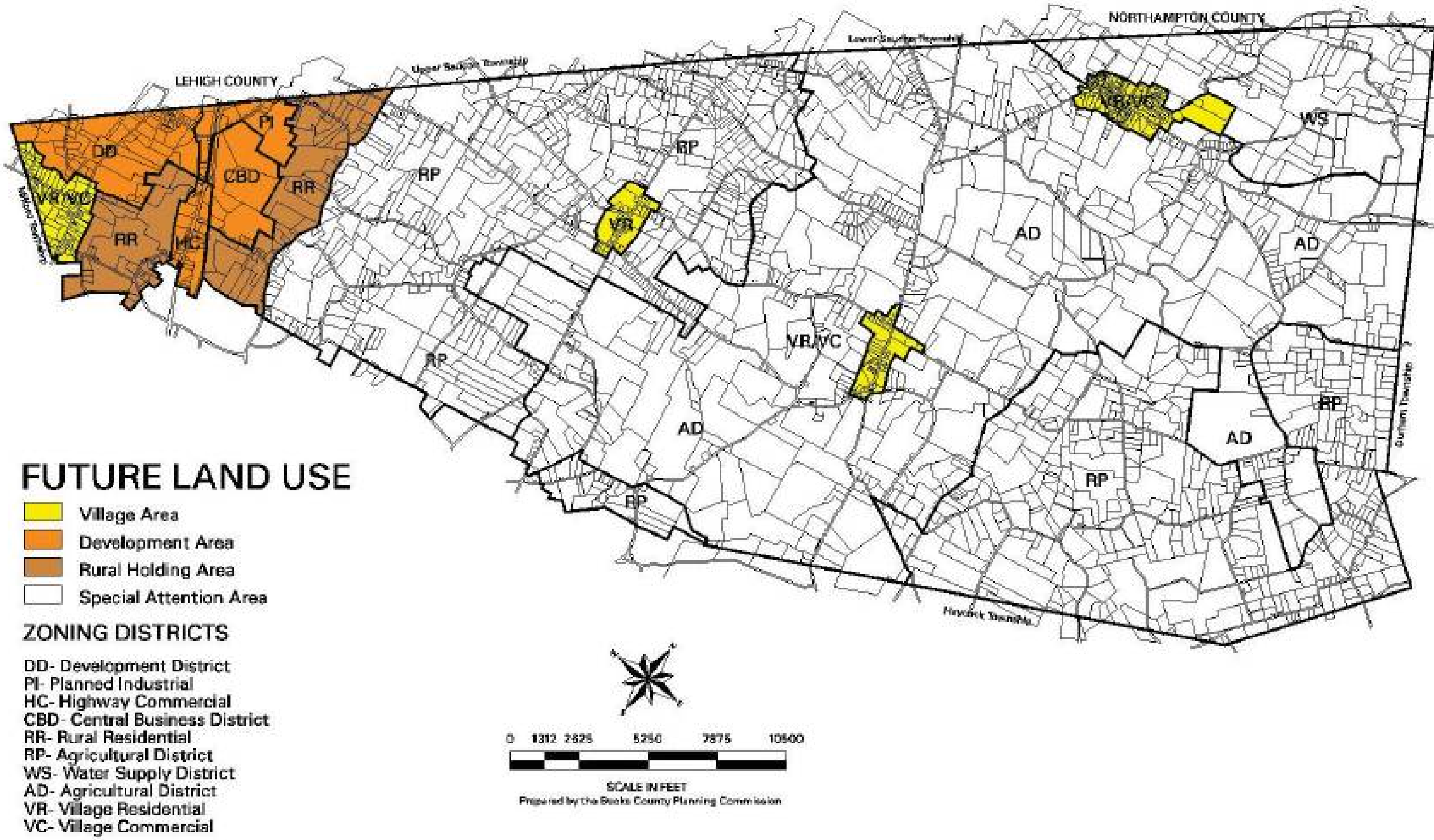


Figure 2.12.2. Future Land Use within Springfield Township



* Future land use based on 2002 Comprehensive Plan, not current Zoning ordinance.

Highway Commercial District (HC)

The purpose of this district is to provide highway commercial uses along the Route 309 corridor, to be served by adequate service roads and traffic controls. While there is limited land remaining in the HC district, there are still opportunities for infill development. There are several vacant lots dispersed throughout the district but three vacant lots located to the northeast of Route 309, and a rural residential lot on the southwest side of Route 309 that is large enough to further subdivide and be developed in the future.

Planned Industrial District (PI)

The purpose of this district is to encourage planned industrial and heavy commercial uses in an appropriate area. Such development shall be planned as a whole with all uses fronting on an internal street. This intent is to encourage high quality industrial and commercial development, which enhances the employment opportunities in the Township and is designed with adequate road access and public utilities to minimize adverse impacts on the natural systems and residential uses in the surrounding area.

The PI district has been reduced in size as compared to the previous comprehensive plan. As a result there is about 58 acres of vacant or potentially developable land. The reason was twofold-there was more than ample vacant land that has not been proposed for development, and a portion of the PI district is to be used for the creation of the new CBD-Central Business District.

Rural Residential District (RR)

The purpose of this district is to preserve the rural character of the Township and to provide a reserve area for future development. It is intended that this district provide a place for residential growth and minimize health risks from on-lot sewage failure. Residential uses are permitted on large lots or where they are clustered with large areas of open space and provisions for off-site sewage disposal. This residential development will relate to the natural physical characteristics such as waterways, woodlands, topography, and soils so as to protect and preserve these natural features and the open character of the countryside.

The RR district has been changed since the previous comprehensive plan in order to eliminate those areas that are not located adjacent to the Development Area. Since this zoning district corresponds to the Rural Holding Area, it functions as a reserve area for the future expansion of the Development Area when deemed appropriate.

Agricultural District (AD)

The purpose of this district is to recognize and protect the area designated as a significant agricultural area by Bucks County in its Natural Resources Plan and the areas of the Township where farming predominates. Within the district, areas with Class I and II agricultural soils, as defined by the Natural Resources and Conservation Service (NRCS) shall be protected in accordance with the protection standards herein established. This district recognizes that farmland must be considered to be developed land being used to produce a product. It is not a holding zone but an area having a positive purpose in utilizing the prime agricultural soils for benefit of the entire community. It is therefore the intent of the district to protect the area from interference by incompatible uses. Agricultural activities within this district may have associated with them noise, odors, and other disturbances that are considered part of normal farming operations. Residents of the AD district are advised that there may be noise, odors, dust, fumes, or other disturbances associated with agricultural practices considered to be acceptable effects of farming and shall not be regulated by township nuisance laws. Development on large lots or in clusters where open space is preserved shall be permitted.

The AD district was altered in various areas of the Township in order to more accurately reflect those areas that are being actively farmed. There have been changes in the status of agricultural land since the adoption of the previous comprehensive plan in 1988, and the proposed AD district boundary line reflect those changes. Additional AD district boundary changes may be warranted as a result of water supply study associated with the WS district.

Resource Protection District (RP)

The purpose of this district is to protect areas consisting largely of natural resources such as forests, steep slopes, scenic areas, wetlands, streams, floodplains, and ponds including those identified in the Bucks County Natural Resources Plan (1999), Natural Areas Inventory (1999), and Cooks Creek Watershed Conservation Plan (2002). Intensities are such as to ensure that these resources are preserved, while providing for residential development with suitable sewage disposal.

Many of the areas that were designated RR district in the previous comprehensive plan that are not located adjacent to the present Development Area were changed to either RP or AD district, depending on the context and nature of the area.

Water Supply District (WS)

This district contains natural resources such as forests, steep slopes, scenic areas, wetlands, streams, floodplains, and springs including those identified in the Bucks County Natural Resources Plan (1999), Natural Areas Inventory (1999), and Cooks Creek Watershed Conservation Plan (2002). However, this district contains a higher concentration of steep slopes and underground springs. The purpose of this district is to protect these extraordinary natural and scenic resources while protecting the aquifer that supplies the public wells in Springtown.

Formerly the Watershed District (WS), the name has been changed to more accurately reflect the district's purpose, since the WS district encompasses only a fraction of the overall Cooks Creek Watershed. Currently, a draft of the Cooks Creek Watershed Conservation Plan has been issued. The plan is intended to formulate a management program that truly sustains water resource through utilization of Best Management Practices (BMPs) and to highlight those characteristics or critical issues in the watershed that require further study.

The plan may provide the empirical data necessary to quantify the potential impacts of development on the aquifer and the water supply of Cooks Creek watershed. The study may provide support for establishing the area and dimensional requirements of the WS district and additional regulations intended to enhance the protection of the water supply to Springtown. Additionally, the boundaries of the WS and the adjacent AD district may need to be adjusted increase or decrease the area of the respective districts based upon the results of the study.

Village Commercial District (VC)

This district is established and specifically structured to accommodate retail sales and services and municipal and institutional uses that are considered necessary to the functions of the Village Residential neighborhoods. Commercial facilities permitted in this district are generally required by a family at intervals of a week or less. This district recognizes existing commercial development within the existing villages of the Township.
Based upon the need to reflect a more focused district purpose, the Springtown Village Study (2000) recommended the following revision to the VC district purpose as follows:
This district is established and specifically structured to accommodate retail sales and services as well as municipal and institutional uses that are considered necessary to the function of the Village Residential neighborhoods. This district is intended to function as the commercial core or focal point for the adjacent residential districts. Commercial facilities in this district are intended to service the immediate residents within the village as well as residents of the immediate region.

There is a minor VC district boundary change since the previous comprehensive plan as described in the VR district below.

Village Residential District (VR)

This district is established and specifically structured to accommodate higher density residential uses, recognizing existing areas of development of greater intensity in the Township. The zoning standards are designed to preserve the village character.

Based upon the established goals and objectives, the Springtown Village Study (2000) recommends revising the district purpose as follows:

This district is established and specifically structured around the original residential uses within the village. The purpose of this district is to provide zoning standards that are responsive to the existing conditions within the village while maintaining the village character. A limited number of nonresidential uses are permitted, but this district is intended to be primarily residential in character.

In the Springtown Village Study, several lots that are currently located in the former WS-Watershed District and the AD-Agricultural District are recommended for inclusion into the VR-Village Residential District. This recommendation has been incorporated into the VR/VC district boundary for Springtown.

Floodplain Protection Overlay District

This district recognizes that streams represent a significant natural resource to the citizens of Springfield Township. These areas are important to the protection of the water supply, indigenous wildlife, and scenic beauty of the Township and therefore must be protected from all development. FP is an overlay district and, as such, it adds to the existing regulations in the district affected. It does not replace those regulations.

Scenic Overlay District

The purpose of this district is to protect the unique visual character of the Township by setting standards for the visual impact of development on views from the roads. The district does not affect the overall permitted density within the underlying zoning district, but it does require that proposed development go through special site plan review procedures as defined herein, designed to minimize adverse impacts on the scenic character of the Township.

Cooks Creek Watershed Overlay District

The purpose of this new district is to provide additional preservation measures for this significant resource that covers a majority of the Township. The overlay district regulations apply only to those properties located within the Cooks Creek Watershed, and activities and uses are limited to those which will not degrade or pose a negative impact to the water quality and inherent natural and scenic resources of this area. (See Watershed Overlay District description below.)

2.12.3 Zoning and Land Use Distribution

While the Township's housing stock is composed mostly of single-family detached homes, the Township's zoning ordinance does permit a reasonable range of housing types in a reasonable range of districts, as mandated by the Pennsylvania Municipalities Planning Code (MPC).

To provide for the use of land within the municipality for residential housing of various dwelling types encompassing all basic forms of housing, including single-family and two-family dwellings, and a reasonable range of multifamily dwellings in various arrangements, mobile homes and mobile home parks, provided, however, that no zoning ordinance shall be deemed invalid for the failure to provide for any other specific dwelling types. Table 2.12.3 presents housing types and the zoning district they are permitted within Springfield Township Zoning Districts.

Single-Family Detached and Accessory Apartments for Family Members are permitted in all zoning districts. Duplex, Multifamily, Senior Citizen Housing, Townhouse, Twin, and Village House are permitted in the Development District, Village Commercial District, and Village Residential District. These zoning districts are located in or adjacent to the Township's villages. Single-Family Detached Cluster is permitted in the Agricultural, Resource Protection, and Rural Residential zoning districts. These districts cover significant portions of the Township. Mobile Home Park is permitted in the Highway Commercial District and is a conditional use in the Development District. Dwelling in Combination with a Business is permitted in the Village Commercial District and is a conditional use in the Development District. Boarding House is permitted by special exception in the Village Commercial District. Halfway House is permitted by special exception in the Rural Residential District. Finally, Group Home is permitted by special exception in all districts except Highway Commercial and Planned Industrial, zoning districts that are located adjacent to Route 309.

Table 2.12.3: Housing Types Permitted Within Zoning Districts

House Type	Zoning District								
	WS	AD	RP	RR	DD	VC	VR	HC	PI
Boarding House						S			
Group Home	S	S	S	S	S	S	S		
Halfway House				S					
Duplex					P	P	P		
Moble Home Park					C			P	
Multifamily					P	P	P		
Residential Conversion		S	S	S	S	S	S		
Senior Citizen Housing					P	P	P		
Single-Family Detached	P	P	P	P	P	P	P	P	P
Single-Family Detached, Cluster		P	P	P					
Townhouse					P	P	P		
Twin					P	P	P		
Village House					P	P	P		
Accessory Apartments for Family Members	P	P	P	P	P	P	P	P	P
Dwelling in Combination w/ Business					C	P			

Source: 2002 Comprehensive Plan

*Not inclusive of all housing uses permitted by the zoning ordinance, only those uses that fit into a "house type."

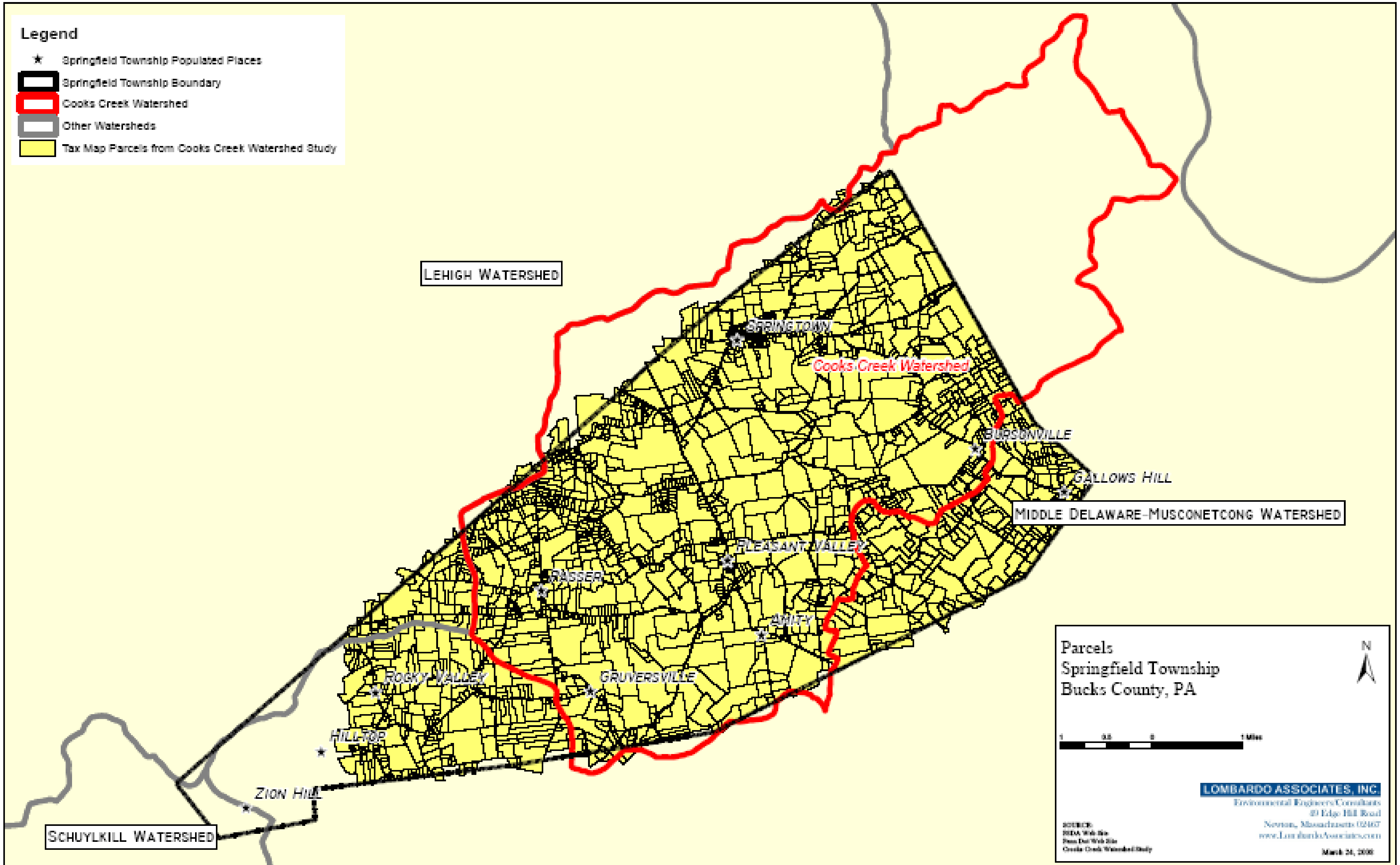
Key:

WS Watershed District	DD Development District	P Permitted
AD Agricultural District	VC Village Commercial District	C Permitted by Conditional Use
RP Resource Protection District	VR Village Residential District	S Permitted by Special Exception
RR Rural Residential District	HC Highway Commercial District	PI Planned Industrial District

Figure 2.12.3. Delineation of Zoning Districts within the Township

Figure 2.12.4. Springfield Township Zoning

Figure 2.12.5 Springfield Township Parcel and Building Layout



2.13. CURRENT WASTEWATER MANAGEMENT OVERVIEW

Springfield Township is served exclusively by individual systems with the exception of 65 residences within Zion Hill that are sewered and serviced by the Milford Trumbauersville Area Sewer Authority (MTASA). A total of approximate 2,200 septic systems exist within the Cooks Creek watershed (Springfield & Durham). The locations of the septic systems within the Cooks Creek Watershed were mapped by the CCWP. Figure 2.13.1 illustrates the location of the MTASA treatment facility.

Individual systems largely consist of traditional septic tank- drain field systems. There are 4 systems permitted for direct discharge listed in Table 2.13.1, and 136 parcels classified as rural residences. There are 8 spray irrigation systems. Rural residences are properties in excess of 10 acres, for which no permit is required. There are no available records for systems on these properties. Rural residences and direct discharges within Springfield Township are shown on Figure 2.13.2. Other facilities in surrounding Townships are shown on Figure 2.13.3. All other developed parcels within Springfield Township are various types of individual on-lot systems.

Table 2.13.1: Bucks County Data Files - Permits and Direct Discharge Properties

PID	No.	Owner Last Name	Owner First Name	Address	City	NPDES Permit Number	Water Management Permit No.	Permit Issued	Permit Expired	Septic Tank	Aerobic Tank	Subsurface Sand Filter (bured with no access)	Free Access Sand Filter	Recirculation Sand Filter	Lagoon	Spray Irr	Stream / Dry Swale Discharge	Flow (gpd)
42-008-053-002	1	Fisher	Andrea	1748 Wuarny Road	Coopersburg					x	0	x	0	0	0	x	0	400
42-021-160-001	2	Fitton	Robert	3260 Mink Road	Kintnewsville	0056316	0994416	11/23/99	11/23/04	x	0	x	0	0	0	0	x	1000
42-021-160	3	Thompson	Gregory	1550 Maple Road	Kintnewsville	0058513	0902403	9/6/02	9/30/07	x	0	x	0	0	0	0	x	
42-021-160-002	4	Helder	Thomas	1586 Maple Road	Kintnewsville	0058611	0902404	9/4/02	9/30/07	x	0	x	0	0	0	0	x	400
42-008-069	5	Hurkleroad	Dawn	1531 Richlandtown Pike	Quakertown	0994307-T1	0993407	10/1/03	9/30/04	0	x	0	x	0	0	x	0	400
42-023-010-003	6	Nekoranik	Francis	2315 Nekoranik Way	Kintnewsville		0994418	10/1/03	9/30/04	x	0	x	0	0	0	x	0	400
42-023-010-002	7	Nekoranik	Mark	1330 Maple Road	Kintnewsville		0995420	11/14/95		x	0			0	0	x	0	
42-023-004	8	Nekoranik	Michael	1330 Maple Road	Kintnewsville		0996403	4/30/96		x	0			0	0	x	0	500
42-021-102	9	Ryker	Richard	3233 Mink Road	Kintnewsville	0992419-T1				x	x	0	0	0	0	x	0	400
42-008-037-001	10	Schaefer	Mark	1731 Quary Road	Coopersburg		0983403-T2			0	x	0	0	0	0	x	0	400
42-001-048	11	Schlosser	Paul	148 W. Cherry Road	Quakertown	0989448	0989448	1991		0	0	0	x	0	0	x	0	400
42-004-055	12	Schueck	Glendora	1512 Route 309	Quakertown	0057321	0998-401			0	0	0	x	0	0	0	0	500
42-015-014-001	13	Stangil	Sherry	3176 Walnut Street	Springtown	0054313	0991415	10/28/02	10/31/07	0	x	0	x	0	0	0	x	800
									Totals	***8***	***4***	***5***	***4***	***0***	***0***	***8***	***4***	***5600***

Figure 2.13.1. MTASA Facility that Serves a portion of Zion Hill

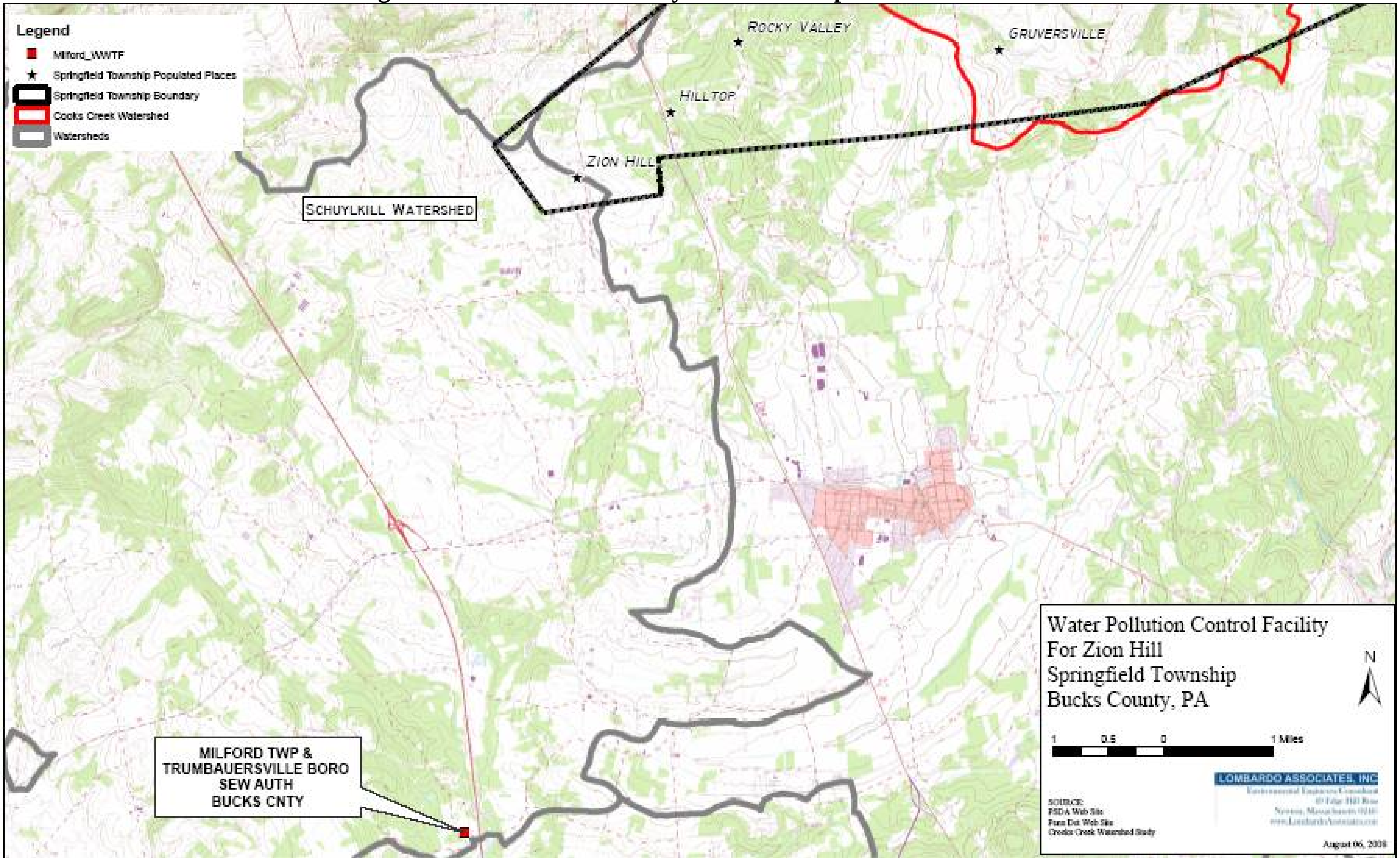
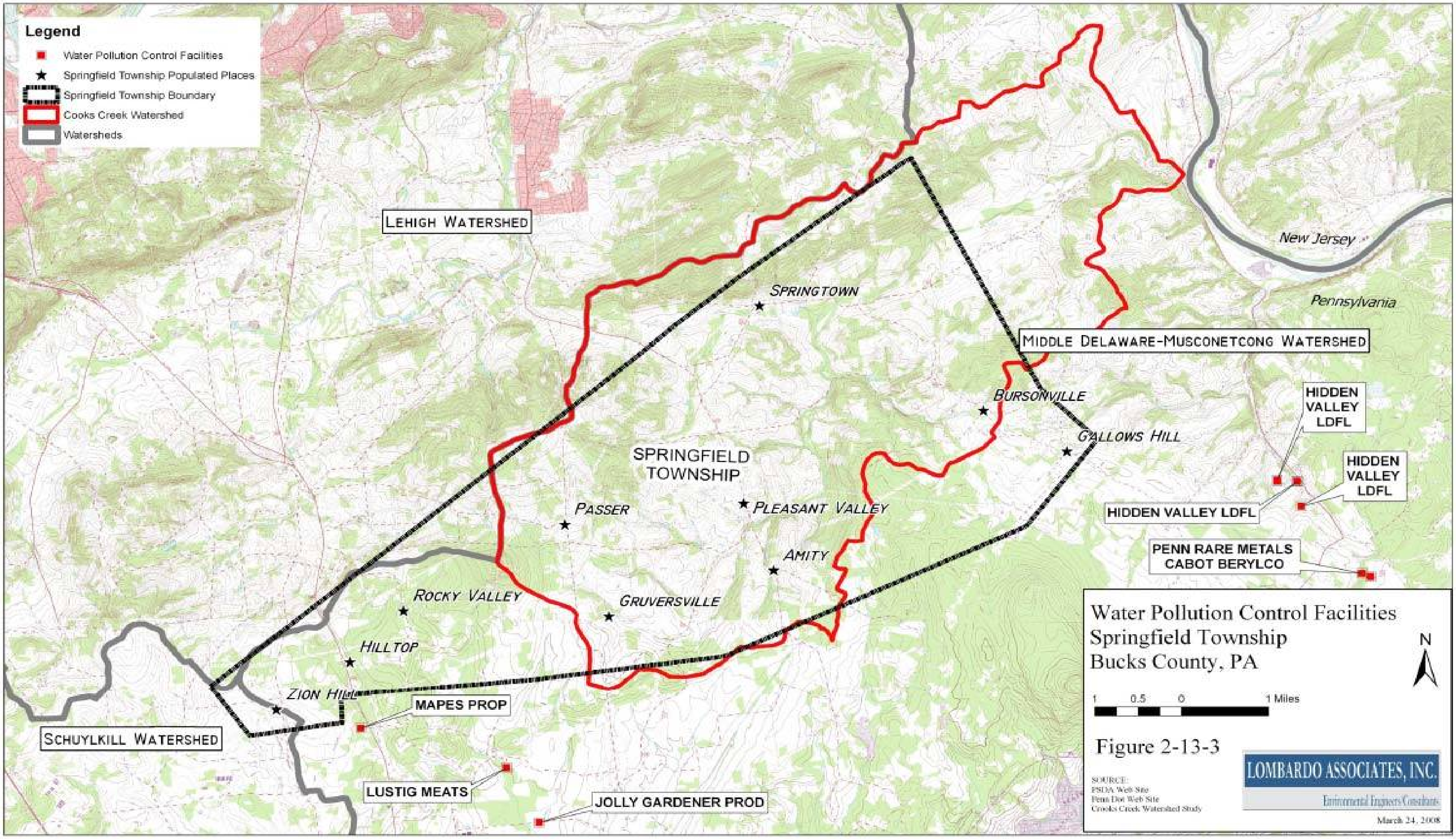


Figure 2.13.2. Rural Residences & Di rect Discharges within Springfield Township

Figure 2.13.3. Water Pollution Control Facilities Near Springfield Township



Existing wastewater treatment information for developed property was located in the following sources:

Number of Parcels (DEV)	Source
• 1,244	Bucks County Health Department-Septic system computer files
• 13	Bucks County Health Department-Septic system permit files
• 135	Rural Residential Properties
2,092	**TOTAL**

2.13.1 Existing Wastewater Systems

2.13.1.1 Zion Hill Sewer System – Connection to the Milford Trumbauersville Area Sewer Authority (MTASA)

An extension of public sewer from the Milford Trumbauersville Area Sewer Authority into Zion Hill was implemented in 1999. This extension provided 65 existing connections with a potential for 5 additional connections in the future. The Milford Trumbauersville Area Sewer Authority owns and operates the sewer system and Springfield Township Authority is responsible for collecting tapping fees (i.e., cost of connectin to the existing sewer system). It is understood that the capacity of the MTASA will not accommodate any future flows from Springfield, specifically Zion Hill. There are to be no additional connections to the MTASA system.

Milford Township adopted Resolution 2008-9 on February 5, 2008 which adopted the Quakerstown Area Sewer Authority with the following revision which addresses capacity at the MTASA treatment plant: "However, because the Authority's sewage treatment plant discharges into Unami Creek, a high quality stream, Milford Township's policy is not to approve any expansion."

2.13.2 Performance of Existing Facilities

2.13.2.1 Background

Problems with existing individual systems include septic system failures that are typically due to one or more of the following issues:

1. Insufficient lot size
2. Insufficient septic tank volume
3. Poorly draining soils
4. High water table
5. Short circuiting of effluent due to porous soils
6. Organic and/or hydraulic overloading of wastewater system
7. Inadequate purification by soils

All the above issues result in insufficient treatment by the on-lot systems, which contribute to degradation of water quality within receiving watersheds. The following sections will detail the existing wastewater management practices and the needs analysis for the six study areas.

2.13.2.2 Inventory of Existing Systems

Tables B.2.5 and B.2.6 illustrate the types of existing individual systems existing in Springfield according to the Bucks County Health Department database.

Table B.2.5 Primary Treatment Summary

PRIMARY TREATMENT	Number of	% Total
NO DESCRIPTION AVAILABLE	487	39.1%
AEROBIC TANK	12	1.0%
SEPTIC TANK	745	59.9%
Grand Total	**1,244**	**100%**

Table B.2.6 Secondary Treatment Summary

SECONDARY TREATMENT	Number of	% Total
NO DESCRIPTION AVAILABLE	467	37.5%
ALT/EXP	35	2.8%
COMPONENT REPL	75	6.0%
ELEVATED SAND BED	263	21.1%
ELEVATED SAND TRENCH	2	0.2%
GRAVEL MOUND	25	2.0%
HOLDING TANK	27	2.2%
SEEPAGE BED	78	6.3%
STANDARD TRENCH	258	20.7%
SUBSURFACE SAND	9	0.7%
TRENCH/BED PRESS DOSE	5	0.4%
Grand Total	**1,244**	**100%**

2.13.2.3 Repair Rates

A history of system repairs across the Township was compiled from BOH data. Tables 2.13.2 and 2.13.3 show the septic system repair history from 1997 to present. The annual average repair rate of 0.7% is low and indicative of a good (if legacy problems are not increasing) septic system performance from a limited, albeit important perspective. Legacy problems are those problems that do not get repaired in a reasonable time and thereby increase the inventory of systems requiring repair. Information on systems requiring repair is usually obtained with a homeowner's questionnaire. Information on systems in malfunction needs to be developed to have a complete understanding of the efficacy of existing wastewater management practices.

Table 2.13.2: Septic System Repair & Replacement Data 1998-2007

Total Onsite Sewage Systems:	1,244

YEAR	COMPONENT (*)	FULL	Grand Total
1998	1	9	10
1999	1	8	9
2000	5	8	13
2001	5	14	19
2002	4	6	10
2003	2	6	8
2004	4	10	14
2005	7	9	16
2006	4	7	11
2007	3	14	17
Grand Total	**36**	**91**	**127**
Average/ Year	**4**	**9**	**13**

All Repairs as % Total Onsite Sewage Systems	
10	**0.8%**
9	**0.7%**
13	**1.0%**
19	**1.5%**
10	**0.8%**
8	**0.6%**
14	**1.1%**
16	**1.3%**
11	**0.9%**
17	**1.4%**
Average/ Year	**1.0%**

Full Repairs as % Total Onsite Sewage Systems	
9	**0.7%**
8	**0.6%**
8	**0.6%**
14	**1.1%**
6	**0.5%**
6	**0.5%**
10	**0.8%**
9	**0.7%**
7	**0.6%**
14	**1.1%**
Average/Y ear	**0.7%**

(*) Component Repairs May Include Septic Tank Repairs and/or Broken Pipes

Septic System Replacement Detail 1998-2007

YEAR	ALT. ESM (*)	AT-GRADE	AT-GRADE/ PEAT	DRIP	ESM (**)	HOLDING TANK	IRSIS (***)	SEEPAGE BED	TRENCHES	Grand Total
1998	1				4				4	**9**
1999					6		1		1	**8**
2000		1			3			1	3	**8**
2001				1	9				4	**14**
2002		1			2	1			2	**6**
2003					3				3	**6**
2004			1		6				3	**10**
2005		2	1		3			1	2	**9**
2006					6				1	**7**
2007		3			9	1			1	**14**
Grand Total	**1**	**7**	**2**	**1**	**51**	**2**	**1**	**2**	**24**	**91**
% of Total	**1.1%**	**7.7%**	**2.2%**	**1.1%**	**56.0%**	**2.2%**	**1.1%**	**2.2%**	**26.4%**	**100.0%**

(*) ALT. ESM: Alternate At-Grade Sewage System
(**) ESM: Elevated Sand Mound
(***) IRSIS: Individual Residential Spray Irrigation System

Table 2.13.3: Septic System Repair Data

REASON FOR APPL	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
EXPIRED/REISSUE		1				1											1	
NEW	4	6	11	11	13	10	6	10	13	11	14	18	8	12	15	16	13	9
REPAIRS			1	4	7	12	6	4	1	4	5	5	3	7	9	9	9	13
RURAL RESIDENCE			5	2	3	12	6	1	6	18	11	10	5	1	1			
TRANSFER		1	3	10	1	1	3	1	2	4	2	6	2	3	2	1	2	4
(BLANK)																		
Grand Total	**4**	**8**	**20**	**27**	**24**	**36**	**21**	**16**	**22**	**37**	**32**	**39**	**18**	**23**	**27**	**26**	**25**	**26**

REPAIRS AS % OF TOTAL SYSTEMS (~1900)	0.00%	0.00%	0.05%	0.21%	0.37%	0.63%	0.32%	0.21%	0.05%	0.21%	0.26%	0.26%	0.16%	0.37%	0.47%	0.47%	0.47%	0.68%

REASON FOR APPL	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	blank	Grand Total
EXPIRED/REISSUE		1	1				1								2	2		10
NEW	7	8	8	6	12	22	19	21	14	17	10	21	15	27	12	3	**1**	423
REPAIRS	9	19	12	7	11	7	8	9	17	9	8	12	11	9	16	6	**1**	270
RURAL RESIDENCE																	**8**	89
TRANSFER	6	2	2	2			2	3	4	2	2	3			2			78
(BLANK)																	**374**	374
Grand Total	**22**	**30**	**23**	**15**	**23**	**29**	**30**	**33**	**35**	**28**	**20**	**36**	**26**	**36**	**32**	**11**	**384**	**1244**

REPAIRS AS % OF TOTAL SYSTEMS (~1900)	0.47%	1.00%	0.63%	0.37%	0.58%	0.37%	0.42%	0.47%	0.89%	0.47%	0.42%	0.63%	0.58%	0.47%	0.84%	0.32%	0.05%	**0.41%**	**AVERAGE REPAIRS AS % OF TOTAL SYSTEMS**

2.13.3 Wastewater Sludge and Septage Generation

Septage in Springfield Township comes from periodic pumping of septic tanks located on individual properties. The following assumptions were made concerning septic tank sizing:

1. Properties with 3 or less bedrooms have a 1,000 gallon septic tank
2. Properties with 4-8 bedrooms have a 1,500 gallon septic tank
3. Properties with greater than 8 bedrooms have a septic tank equal to 1.5 x Design Flow, where design flow is [900 + (# of bedrooms - 3)x100]

This results in the following estimated septage generation:

Total Septic Tank Volume	**2,011,450**
Pumping Frequency (years)	**5**
Annual Septage Volume (gal)	**403,000**
Daily Septage Volume* (gal)	**2,000**

*200 days per year

Septic tank sizes were calculated based on flows that were calculated based on the number of bedrooms. The following table shows the distribution houses, grouped by the number of bedrooms.

	Dev, no BR.	1-3 BR	4-8 BR	9+ BR
# of Parcels	93	1,246	507	3

2.13.4 Management

Ordinance No.107, attached as Appendix G, from the Springfield Township Board of Supervisors established standards for managing on-lot sewage systems, including required maintenance agreements and financial security, and relates to the use of Holding Tanks, individual spray irrigation systems, small flow treatment facilities, conventional sewage systems and sewage maintenance agreements.

Appendix J presents the five (5) Ownership/Management Options as developed by the USEPA which include:

Table 2.13.4 illustrates the management responsibility for individual wastewater systems in Springfield. Tables 2.13.5 and 2.13.6 demonstrate the USEPA Management Models for Decentralized Wastewater Systems, respectively.

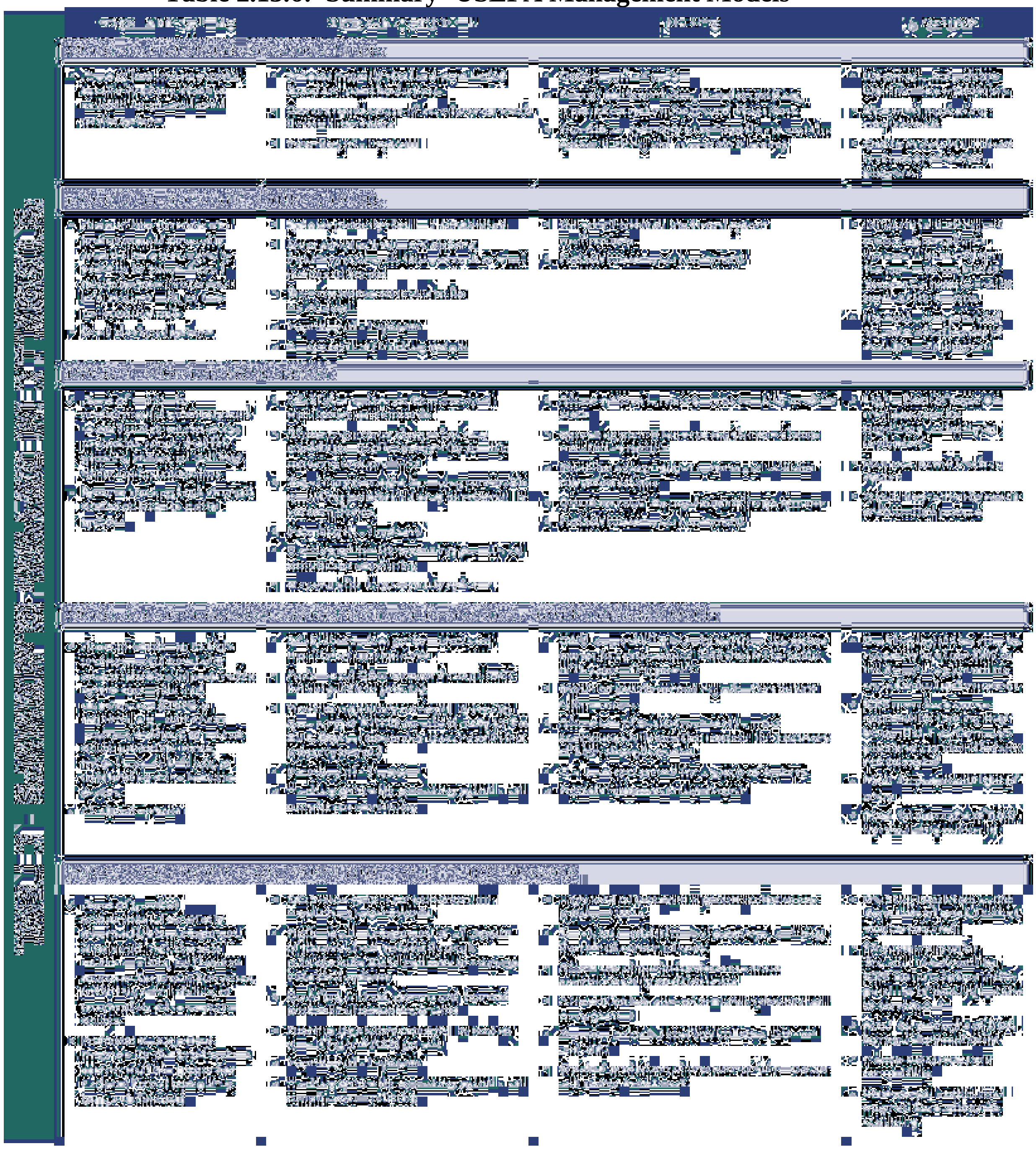
Table 2.13.4: Existing Individual Sewage System Management Program

Management Function	PA DER	BUCKS CO. HEALTH DEPT.	SPRINGFIELD TOWNSHIP	SYSTEM OWNER AND/OR USER
PLANNING			X	
SITE EVALUATION		X		
DESIGN REVIEW		X		
CONSTRUCTION REVIEW		X		
MONITORING		X		
MAINTENANCE & OWNERSHIP				X

Table 2.13.5: USEPA Management Models Decentralized Wastewater Systems

Model	EPA Description	Alternate Description
1	Homeowner's Awareness	Private Ownership/Private Operation & Maintenance
2	Maintenance Contracts	Private Ownership/Private Operation & Maintenance with proof of routine Maintenance
3	Operating Permits	Private Ownership/Private Operation & Maintenance with Public Assurance Program
4	Responsible Management Entity (RME) Operation & Maintenance	Private Ownership/Public Operation & Maintenance
5	RME Ownership	Public Ownership/Public Operation & Maintenance

Table 2.13.6: Summary- USEPA Management Models



2.14. REGULATORY STRUCTURE

On-lot sewage treatment facilities are governed by Title 25, Chapters 71, 72 and 73 of the Pennsylvania Code. In addition to these regulations, the following documents relate to wastewater treatment systems in Springfield Township:

1. Bucks County Department of Health Rules and Regulation Governing Individual and Community On-Lot Sewage Disposal Systems
2. PADEP's "Domestic Wastewater Facilities Manual"
3. PADEP's "Alternate Systems Guidance" document
4. PADEP's "Experimental Systems Guidance" document
5. PADEP's "Small Flow Treatment Facilities Manual"

The Bucks County Department of Public Health oversees the permitting of individual and community systems within all of Bucks County. Mr. Art Carlson is the Sewage Enforcement Officer. Appendix E illustrates the Bucks County Health Department website.

PADEP oversees permitting of all wastewater systems within the State of Pennsylvania. The Southeast Regional Office (Region 1), located in Norristown, oversees permitting of wastewater systems within Bucks County. Appendix F illustrates the PADEP website.

Assessors information will be used along with county and state design criteria to determine the design flow for each parcel. Soils data will be used to estimate the percolation rate that will be used to assign a design loading rate. The design flow and the design loading rate will be used to calculate the minimum required drainfield area. Each lot must have the capacity to site a new drainfield in the event that the existing drainfield fails. This area is known as reserve area. For planning purposes, the required area for any parcel will be double the drainfield area plus an allowance for siting the septic tank and any other necessary treatment units.

Table 2.14.1 shows the regulatory design criteria for assigning flow to property use types.

The PADEP approved wastewater management technologies are:

Standard Systems

1. Filtration System
    a. Subsurface Sand Filter
    b. Recirculating Subsurface Sand Filter
    c. CO-OP RFS III Recirculating Filter
    d. Accessible Sand Filter System
2. Disinfection
    a. Chlorination
    b. Ultraviolet (UV) Radiation

Alternate Systems

1. Alternate Individually Designed Composting Toilet
2. Flow Equalization
3. Alternate Peat Based System Options
4. Free Access Gravity Sand Filter System Option
5. CO-OP RFS III System Option

6. Leaching Chambers
7. Alternate Coarse Aggregate
8. Greywater System
9. At-Grade Bed Sytems
10. Modified Subsurface Sand Filter for Fast Percolation/Shallow Bedrock Sites
11. Shallow Placement Pressure Dosed System
12. Drip Irrigation System
13. Steep Slope Elevated Sand Mound (slopes 12-15%, 3 to 30 min/in.)
14. A/B Soil System
15. Non-Infiltration, Evapotranspiration Bed Contained Within a Greenhouse

Experimental Systems

1. Experimental Peat-Based System Options
2. Eljen Type B In-Drain
3. Drip Irrigation on Sites Not Suitable for Use Under the Alternate Drip Irrigation Listing
4. Elevated Sand Mounds (slopes 12-15%, 31 to 90 min/in.)
5. Elevated Sand Mound on Shallow Limiting Zones Sites (<20")
6. Controlled Fill

Table 2.14.1: Design Flow Criteria for Property Use Types*

Type of Establishment	***gpd***	***BOD/day***
Residential		
Hotels and Motels	100	0.3
Multiple family dwellings and apartments, including townhouses, duplexes and condominiums	400	1.13
Rooming houses (per unit)	200	0.6
Single family residences*	400	0.9
Commercial		
Airline catering (per meal served)	3	0.03
Airports (per passenger—not including food)	5	0.02
Airports (per employee)	10	0.06
One licensed operator Beauty shops	200	—
Bus service areas not including food (per patron and employee)	5	0.02
Country clubs not including food (per patron and employee)	30	0.02
Drive-in theaters (not including food—per space)	10	0.06
Factories and plants exclusive of industrial wastes (per employee)	35	0.08
Laundries, self-service (gallons/washer)	400	2
Mobile home parks, independent (per space)	400	1
Movie theaters (not including food, per auditorium seat)	5	0.03
Offices (per employee)	10	0.06
Restaurants (toilet and kitchen wastes per patron)	10	0.06
(Additional for bars and cocktail lounges)	2	0.02
Restaurants (kitchen and toilet wastes, single-service utensils/person)	8.5	0.03
Restaurants (kitchen waste only, single-service utensils/patron)	3	0.01
Stores (per public toilet)	400	2
Warehouses (per employee)	35	—
Work or construction camps (semipermanent) with flush toilets (per employee)	50	0.17
Work or construction camps (semipermanent) without flush toilets (per employee)	35	0.02

*For units of 3 bedrooms or less; for each bedroom over 3, add 100 gallons.

*Source: Chapter 73 of the Pennsylvania Code

Type of Establishment Institutional	gpd	BOD/day
Churches (per seat)	3	—
Churches (additional kitchen waste per meal served)	3	—
Churches (additional with paper service per meal served)	1.5	—
Hospitals (per bed space, with laundry)	300	0.2
Hospitals (per bed space, without laundry)	220	—
Institutional food service (per meal)	20	—
Institutions other than hospitals (per bed space)	125	0.17
Schools, boarding (per resident)	100	0.17
Schools, day (without cafeterias, gyms or showers per student and employee)	15	0.04
Schools, day (with cafeterias, but no gym or showers per student and employee)	20	0.08
Schools, day (with cafeterias, gym and showers per student and employee)	25	0.1
Recreational and Seasonal		
Camps, day (no meals served)	10	0.12
Camps, hunting and summer residential (night and day) with limited plumbing including water-carried toilet wastes (per person)	50	0.12
Campgrounds, with individual sewer and water hookup (per space)	100	0.5
Campgrounds with water hookup only and/or central comfort station which includes water-carried toilet wastes (per space)	50	0.5
Fairgrounds and parks, picnic—with bathhouses, showers, and flush toilets (per person)	15	0.06
Fairgrounds and parks, picnic (toilet wastes only, per person)	5	0.06
Swimming pools and bathhouses (per person)	10	0.06

*Source: Chapter 73 of the Pennsylvania Code

2.14.1 Required Area

To properly define the appropriate wastewater management approach for on-lot systems within each study area, the required area for treatment must be determined. The required area is a function of the following soil and property features and resulting design parameters:

1. Percolation rate – design drainfield loading rate
2. Depth to groundwater/bedrock/impermeable layer
3. Property size and usage - design flow and septic tank size

The percolation rate is used to determine the loading rate for the drainfield, measured in ft^2/ gpd. The relationship between percolation rate and loading rate is presented in Table 2.14.3 and Figure 2.14.2. The design flow of a property is a function of the use category and the size of the structure. Table 2.14.2 shows the required septic tank sizing as a function of design flow.

Table 2.14.2: Septic Tank Sizing*

Design flow (gpd)	*Minimum Tank Capacity (gal.)*
0—500	(3.5 x flow exceeding 400 gpd) + (900)
500—5,000	(1.50 x flow exceeding 500 gpd) + (1,250)
5,000—7,500	(1.45 x flow exceeding 5,000 gpd) + (8,000)
7,500—10,000	(1.35 x flow exceeding 7,500 gpd) + (11,625)
over 10,000	(1.50 x the daily flow)

*Source: Chapter 73 of the Pennsylvania Code

Table 2.14.3: Drainfield Loading Rate as a Function of Percolation Rate*

Average Percolation Rate Expressed as Minute per Inch	**Square Feet of Aggregate Area Per Gallon Per Day**	
	All Systems Except Elevated Sand Mounds (ESM) and Subsurface Sand Filters	**Elevated Sand Mounds (ESM) and Subsurface Sand Filters**
Less than 3.0[D]	Unsuitable	Unsuitable
3 - 5[C]	Unsuitable	1.50[AB]
6 - 15[C]	1.19[B]	1.50[AB]
16 - 30[C]	(Avg. Perc Rate - 15) x (0.040) + 1.19[B]	1.50[AB]
31 - 45[C]	(Avg. Perc Rate - 30) x (0.030) + 1.79[B]	(Avg. Perc Rate - 30) x (0.026) + 1.50[AB]
46 - 60[C]	(Avg. Perc Rate - 45) x (0.028) + 2.24[B]	(Avg. Perc Rate - 45) x (0.022) + 1.89[A]
61 - 90[C]	(Avg. Perc Rate - 60) x (0.023) + 2.66[A]	(Avg. Perc Rate - 60) x (0.020) + 2.22[A]
91 - 120[ACD]	Unsuitable	(Avg. Perc Rate - 90) x (0.017) + 2.82[A]
121 - 150[CD]	Unsuitable	((Avg. Perc Rate - 120) x (0.015) + 3.33) (1.05)[A]
151 - 180[CD]	Unsuitable	((Avg. Perc Rate - 150) x (0.014) + 3.78) (1.10)[A]
Greater than 181[CD]	Unsuitable	Unsuitable

[A]Pressure dosing required.
[B]One third reduction may be permitted for use of an aerobic tank.
[C]May be considered for experimental or alternate proposals.
[D]Unsuitable for subsurface sand filters.

*Source: Chapter 73 of the Pennsylvania Code

In addition, the **depth to limiting zone, in this case largely the high groundwater level**, affects the required area. Elevated sand mounds (ESM) are required in cases where:

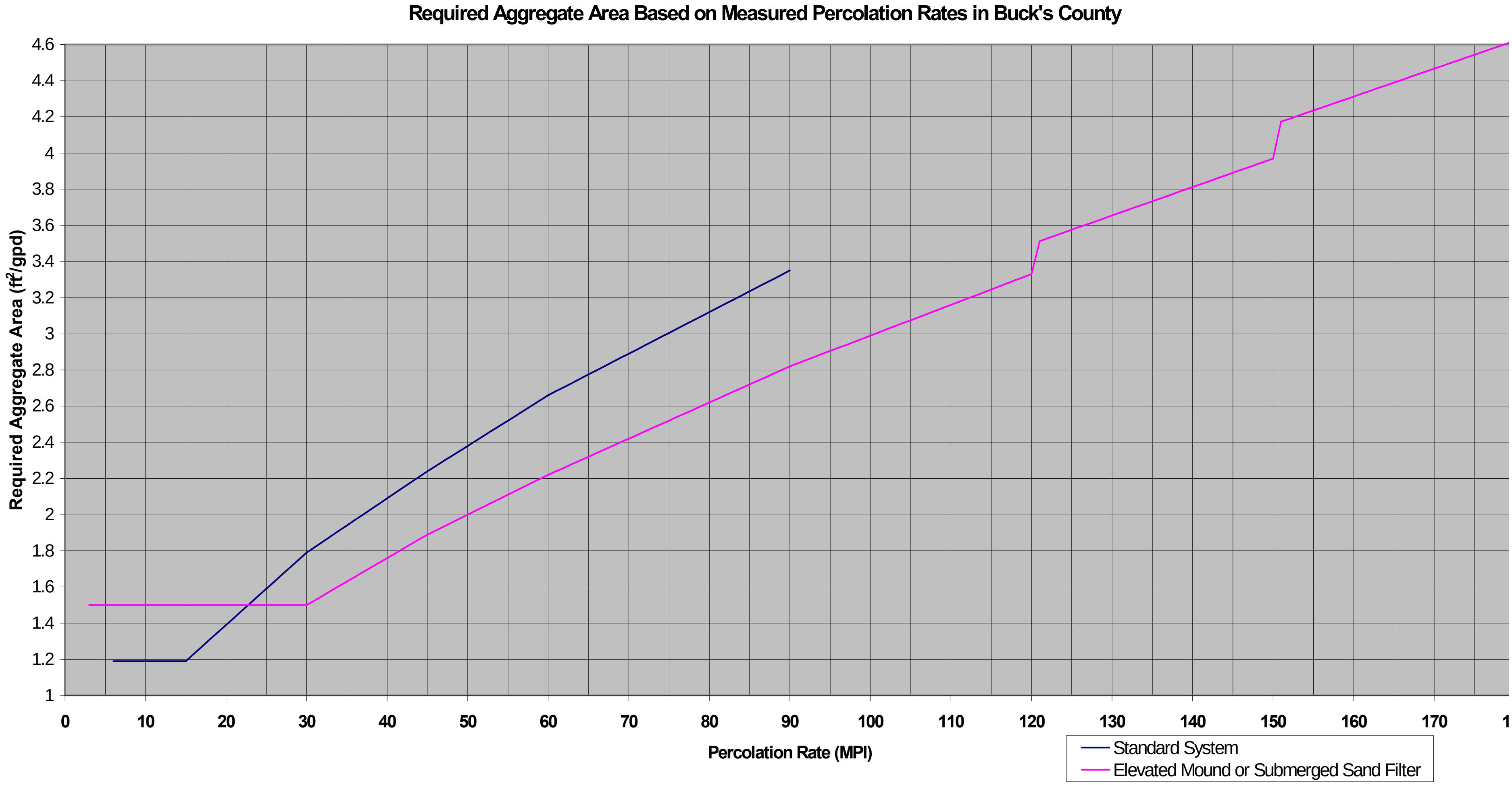
- the limiting layer is less than 5 feet of the natural surface. The minimum mound height is 1-foot, and
- no mound can be placed in an area where there is less than 20" of native soil between the bottom of the mound and the limiting layer.

In addition, for **percolation rates between 3-6 MPI and greater than 90 MPI**,

- standard systems cannot be used. In these cases, a subsurface sand filter will be required.

Table 2.14.4 shows representative sizes of systems, based on the flows, depth to groundwater, percolation rates and the formulas shown in Table 2.14.3 above.

Figure 2.14.2: Drainfield Loading Rate as a Function of Percolation Rate*



*Source: Chapter 73 of the Pennsylvania Code

Table 2.14.5: Regulatory Setback Requirements*

Bed rooms	Flow	Perc Rate	Min. Req. System	Minimum Drainfield Footprint	Bed rooms	Flow	Perc Rate	Min. Req. System	Minimum Drainfield Footprint	Bed rooms	Flow	Perc Rate	Min. Req. System	Minimum Drainfield Footprint
Depth to Groundwater > or = 5 ft.					Depth to Groundwater 4 ft.					Depth to Groundwater 2 ft.				
1-15	400 - 1,600	< 3	No system currently permittable		1-15	400 - 1,600	< 3	No system currently permittable		1-15	400 - 1,600	< 3	No system currently permittable	
1-3	400	3-6	SS Sand Filter	578 - 493	1-3	400	3-6	ESM Only	1,050 - 1,100	1-3	400	3-6	ESM Only	1,334 - 1,392
		6-15	Standard	493 - 697			6-15	ESM Only	1,100 - 1,250			6-15	ESM Only	1,392 - 1,566
		15-45	Standard	697 - 1,309			15-45	ESM Only	1,250 - 1,775			15-45	ESM Only	1,566 - 2,175
		45-90	Standard	1,309 - 2,240			45-90	ESM Only	1,775 - 2,550			45-90	ESM Only	2,175 - 3,074
		90-180	SS Sand Filter	2,240 - 3,042			90-180	ESM Only	2,550 - 4,042			90-180	ESM Only	3,074 - 4,590
4-8	500 - 900	3-6	SS Sand Filter	731 - 1,122	4-8	500 - 900	3-6	ESM Only	1,275 - 2,225	4-8	500 - 900	3-6	ESM Only	1,595 - 2,697
		6-15	Standard	629 - 1,581			6-15	ESM Only	1,325 - 2,575			6-15	ESM Only	1,653 - 3,103
		15-45	Standard	884 - 3,393			15-45	ESM Only	1,525 - 3,672			15-45	ESM Only	1,885 - 4,240
		45-90	Standard	1,632 - 5,490			45-90	ESM Only	2,175 - 5,394			45-90	ESM Only	2,639 - 6,014
		90-180	SS Sand Filter	2,800 - 7,304			90-180	ESM Only	3,096 - 8,736			90-180	ESM Only	3,600 - 9,500
9-15	1,000 - 1,600	3-6	SS Sand Filter	1,445 - 2,184	9-15	1,000 - 1,600	3-6	ESM Only	2,325 - 3,744	9-15	1,000 - 1,600	3-6	ESM Only	2,813 - 4,320
		6-15	Standard	1,241 - 3,198			6-15	ESM Only	2,450 - 4,324			6-15	ESM Only	2,958 - 4,896
		15-45	Standard	1,932 - 6,336			15-45	ESM Only	2,808 - 6,348			15-45	ESM Only	3,280 - 7,008
		45-90	Standard	3,744 - 10,080			45-90	ESM Only	4,089 - 9,282			45-90	ESM Only	4,641 - 10,070
		90-180	SS Sand Filter	6,100 - 13,248			90-180	ESM Only	5,916 - 15,184			90-180	ESM Only	6,572 - 16,200

Table 2.14.5 summarizes the setback requirements for treatment tanks, drainfields and spray irrigation areas. The following sections will detail the wastewater needs analysis for each of the six study area spray irrigation areas.

Table 2.14.5: Regulatory Setback Requirements*

Feature	Treatment Tank Setback Distance (ft)
Property line, easement or right of way	10
Occupied buildings, swimming pools and driveways	10
Individual water supply or water supply suction line	50
Water supply line under pressure	10
Streams, lakes, or other surface waters	25
Cistern used as a water supply	25

Feature	Drainfield Setback Distance (ft)
Property line, easement or right of way	10
Occupied buildings, swimming pools and driveways	10
Individual water supply or water supply suction line	100
Water supply line under pressure	10
Streams, water courses, lakes, ponds or other surface waters	50
Other active onlot systems	5
Surface drainageways	10
Mine subsidence areas- bore holes or sink holes	100
Rock outcrop or identified shwllow pinnacle	10
Natural or manmade slope greater than 25%	10
Cistern used as a water supply	25
Detention basins, retention basins & stormwater seepage beds	10

Feature	Spray Irrigation Setback Distance (ft)
Property line, easement or right of way	25
Occupied buildings and swimming pools	100
Individual water supply or water supply suction line	100
Cistern used as a water supply	25
Water supply line under pressure	10
Streams, water courses, lakes, ponds or other surface waters	50
Mine subsidence areas- bore holes or sink holes	100
Roads or driveways	25
Unoccupied buildings	25
Rock outcrop	25

* Source: Chapter 73 of the Pennsylvania Code

2.14.2 System Sizing, Buffer Zones and Available Areas

Physical characteristics will determine the suitability of individual lots to sustain a compliant septic system. If the soils are suitable for siting a septic system, the type of soil will determine the maximum loading rate for subsurface discharge of treated wastewater. This loading rate will define the required area for subsurface discharge.

The available area of an individual lot is the total area of a lot minus areas within building and property line setbacks and environmentally sensitive areas and their associated buffer zones. For lots within buffer zones, some or all of the available area may also be restricted. As a preliminary screening criteria, the available area of an individual lot will be compared to the required area for the existing or proposed use.

Lots that are located wholly within the following zones cannot have on-lot solutions per current regulations:

1. Inside or within 75 feet of a wetland
2. Within 125 feet of a stream or other water body
3. Within the 100 year floodplain
4. Within 10' of areas that have slopes in excess of 25%
5. Within 100' of a water supply well
6. Within Zone I and/or within Zone II of a public water supply well
7. For areas with slopes of:
   - 15 to 24 percent, 70 percent of the area shall be protected;
   - 25 to 30 percent, 85 percent of the area shall be protected;
   - greater than 30 percent, 100 percent of the area shall be protected.
8. For areas with Soil Percolation Rate > 180 mpi
9. For areas with Depth to Groundwater < 20 in.

These properties will be identified from available lot by lot GIS and assessors information that includes the following:

- Parcel Boundary
- Wetlands and 100 Year Floodplain Designation
- Streams and Water Bodies
- Soils Slope Data
- Delineation of parcels within Zone I and Zone II of a public water supply well

A lot by lot analysis of the above data will identify properties that may have insufficient area to site treatment facilities. These properties may require an offsite solution, pending additional study.

Parcels that are located partially within one or more of the above zones will be evaluated to determine if sufficient parcel area remains outside of these buffer zones. In addition to the above zones, there are a number of other setback requirements described in Chapter 73 of the Pennsylvania Code. The available area on each parcel is the sum of all areas not within any of the 6 zones listed above or within any other regulatory setback area. Table 2.14.5 summarizes the setback requirements for treatment tanks, drainfields and spray irrigation areas.

For the purposes of this Plan, available area will be simplified and defined as the area outside the wetland, water body, floodplain, water supply, Zone I and II, building and property line buffer zones. Lots with enough available area may still lack sufficient area when setbacks from the remaining features are taken into consideration.

2.15. PLANNING SUB-AREAS

There are five areas of concentrated development that are focused study areas due to density of development and/or expected future growth. The sixth "area" consists of the remaining land within the Township. These areas are as follows:

1. Springtown
2. Passer
3. Pleasant Valley
4. Zion Hill
5. Designated Development Area
6. Route 309
7. All township lands not within areas 1-6

The following section presents profiles of each of the Study Areas. Specific physical limiting properties, such as soils, depth to groundwater and subsurface geology will be discussed in greater detail in Section 3.

2.15.1 Springtown

Location

The Springtown study area is located in the northeastern portion of the Township near the border with Northampton County and is located within the Cooks Creek watershed. Springtown Road (PA Route 212/412) travels in an east/west direction through the center of the village. Cooks Creek and its tributaries are found flowing at various locations through out the village. The presence of Cooks Creek is important to this study area as the protection of the "exceptional value" waters of this stream will be an important factor in evaluating the wastewater alternatives for this study area. Figure 2.15.1 illustrates the Springtown Village.

Existing Land Use

Single family homes on lots less than 20,000 square feet in size are the most common type of parcel in this area. In addition to the approximately 200 homes, a few non-residential uses are located along Springtown Road. These uses include a tavern, gas station, post office, fire station, and two churches. Table 2.15.1 shows the distribution of lot sizes within Springtown. Table 2.15.2 presents the age of existing properties in Springtown.

Table 2.15.1: Distribution of Lot Sizes Within Springtown

Lot Size	Tax Assessors Database- Springtown					
	# Parcels	% of Total	Dev. Parcels	% of Total	Undev. Parcels	% of Total
<10,000	57	18.6%	45	18.7%	12	18.5%
10,001-15,000	51	16.7%	40	16.6%	11	16.9%
15,001-20,000	46	15.0%	41	17.0%	5	7.7%
20,001-40,000	38	12.4%	30	12.4%	8	12.3%
40,001-60,000	34	11.1%	32	13.3%	2	3.1%
60,001-80,000	7	2.3%	5	2.1%	2	3.1%
>80,000	52	17.0%	46	19.1%	6	9.2%
No Data	21	6.9%	2	0.8%	19	29.2%
Grand Total	**306**	100.0%	**241**	100.0%	**65**	100.0%

Table 2.15.2: Housing Age Distribution Within Springtown

Age of House	Springtown	% Total	Cumulative %
<8	27	11.20%	11.20%
9-13	2	0.83%	12.03%
14-18	3	1.24%	13.28%
19-28	11	4.56%	17.84%
29-38	28	11.62%	29.46%
39-48	31	12.86%	42.32%
49-58	23	9.54%	51.87%
59-68	13	5.39%	57.26%
69+	86	35.68%	92.95%
No Data	17	7.05%	100.00%
Total:	**241**	**100.00%**	

Existing Water Service

A public water system operated by the Springtown Water Authority provides water supply to homes and businesses in this study area. The boundaries of the water service district are the same as the boundary for this study area.

Existing Wastewater Management Practices

This study area relies entirely on individual on-lot systems to treat and dispose of all wastewater generated in this area. This area was the subject of two separate field investigations during the Fall of 1977 and 1978.

The Bucks County Health Department conducted a survey of home in November of 1977 to document the rate of sewage systems malfunctions in the village. Of the 154 surveys conducted, 69 responses were received. A total of 3 sewage malfunctions were identified which resulted in a 4.34% malfunction rate of properties surveyed.

In November of 1978, another survey of the Springtown area was conducted as part of the Township's Act 537 Plan Update. A random sampling of 37 homes was conducted for the purpose of verifying the data collected by the County Health Department in the previous year. A total of seven failures were observed during this investigation which resulted in a 19% failure rate.

A comparison of this area against the "Suitability for On-Site Disposal Systems" Map prepared by the Bucks County Planning Commission reveals that the majority of this study area is underlain by soils that are classified as being feasible for conventional systems. However, the use of on-lot systems may not be compatible with the development density of this area.

Wastewater Planning Needs

1. Determine the feasibility of continued use of on-lot systems
2. Identify and evaluate wastewater alternatives which can provide a comprehensive solution while protecting the quality of the Cooks Creek Watershed
3. Identify and evaluate the institutional arrangements available for the adequate long-term operation and maintenance of the proposed alternative.

Figure 2.15.1 Springtown Village

2.15.2 Zion Hill

Location

The Zion Hill study area is located in the extreme western end of the Township bordering Milford and Richland Townships in Bucks County and Upper Saucon Township, Lehigh County to the north and is located within the Unami Creek and Towhickson Creek watersheds. Old Bethlehem Pike travels in a north/south direction through the center of the village. Portions of Trolley Bridge Road and Cherry Road are also included within this study area. Unami Creek, located just over the Township line in Milford Township, is on the western edge of the study area and intersects with Trolley Bridge Road as an intermittent stream. An unnamed tributary to the Tohickon Creek is located on the northern edge of the study area and flows under old Bethlehem Pike. Neither stream has special water quality designations. Figure 2.15.2 illustrates the Zion Hill Village.

Existing Land Use

The study area is comprised primarily of single family detached homes and a small number of twin family units. There are also a few non-residential uses in the village including a post office and a church. Lot sizes along Old Bethlehem Pike are primarily less than 20,000 sq. ft. while lots on Cherry Road and Trolley Bridge Road are three-quarters of an acre and larger. There are approximately 95 existing homes/businesses in this study area. Table 2.15.3 shows the distribution of lot sizes within Zion Hill. Table 2.15.4 presents the age of existing properties in Zion Hill.

Table 2.15.3: Distribution of Lot Sizes Within Zion Hill

Lot Size	Tax Assessors Database- Zion Hill					
	# Parcels	% of Total	Dev. Parcels	% of Total	Undev. Parcels	% of Total
<10,000	5	4.9%	4	4.8%	1	5.3%
10,001-15,000	6	5.8%	6	7.1%	0	0.0%
15,001-20,000	8	7.8%	8	9.5%	0	0.0%
20,001-40,000	14	13.6%	10	11.9%	4	21.1%
40,001-60,000	28	27.2%	23	27.4%	5	26.3%
60,001-80,000	11	10.7%	10	11.9%	1	5.3%
>80,000	29	28.2%	22	26.2%	7	36.8%
No Data	2	1.9%	1	1.2%	1	5.3%
Grand Total	**103**	100.0%	**84**	100.0%	**19**	100.0%

Table 2.15.4: Housing Age Distribution Within Zion Hill

Age of House	Zion Hill	% Total	Cumulative %
<8	3	3.57%	3.57%
9-13	0	0.00%	3.57%
14-18	1	1.19%	4.76%
19-28	9	10.71%	15.48%
29-38	22	26.19%	41.67%
39-48	12	14.29%	55.95%
49-58	4	4.76%	60.71%
59-68	5	5.95%	66.67%
69+	23	27.38%	94.05%
No Data	5	5.95%	100.00%
Total:	**84**	**100.00%**	

Existing Water Service

Residents in this area rely on individual on-lot wells for their domestic water supply.

Existing Sewer Service

Sewage treatment and disposal in this study area is provided by individual on-lot systems and a sewer extension from the Milford Trumbauersville Area Sewer Authority (MTASA) sewer system.

An extension of public sewer from the MTASA into Zion Hill was implemented in 1999. This extension provided 65 existing connections with a potential for 5 additional connections in the future. The MTASA owns and operates the sewer system and Springfield Township Authority is responsible for collecting tapping fees. No future connections will be allowed to the MTASA facility.

From a wastewater planning perspective, there is no evaluation or solution generation needed for the properties that are currently connected to sewer. These properties are omitted from the study area.

Wastewater Planning Needs

1. Determine the feasibility for continued use of on-lot systems
2. Identify and evaluate wastewater management alternatives that can provide a comprehensive solution

Figure 2.15.2. Zion Hill Village

2.15.3 Passer

Location

The Passer study area is located in the north central portion of the Township near the border with Northampton County and is located within the Cooks Creek watershed. Richlandtown Pike travels in a north/south direction through the middle of the study area. Tributaries of Cooks Creek are found on the east and west sides of the village. Figure 2.15.3 illustrates the Passer Village

Existing Land Use

This study area is comprised of approximately 45 single family residential homes on lots ranging from 20,000 sq. ft. to 12 acres. Table 2.15.5 shows the distribution of lot sizes within Passer. Table 2.15.6 presents the age of existing properties in Passer.

Existing Water Service

Residents in this area rely on individual on-lot wells for their domestic water supply.

Table 2.15.5: Distribution of Lot Sizes Within Passer

Lot Size	Tax Assessors Database- Passer					
	# Parcels	% of Total	Dev. Parcels	% of Total	Undev. Parcels	% of Total
<10,000	0	0.0%	0	0.0%	0	0.0%
10,001-15,000	1	1.9%	0	0.0%	1	11.1%
15,001-20,000	14	26.9%	10	23.3%	4	44.4%
20,001-40,000	16	30.8%	15	34.9%	1	11.1%
40,001-60,000	9	17.3%	9	20.9%	0	0.0%
60,001-80,000	1	1.9%	1	2.3%	0	0.0%
>80,000	9	17.3%	8	18.6%	1	11.1%
No Data	2	3.8%	0	0.0%	2	22.2%
Grand Total	**52**	100.0%	**43**	100.0%	**9**	100.0%

Table 2.15.6: Housing Age Distribution Within Passer

Age of House	Passer	% Total	Cumulative %
<8	1	2.33%	2.33%
9-13	0	0.00%	2.33%
14-18	4	9.30%	11.63%
19-28	2	4.65%	16.28%
29-38	8	18.60%	34.88%
39-48	1	2.33%	37.21%
49-58	12	27.91%	65.12%
59-68	9	20.93%	86.05%
69+	6	13.95%	100.00%
No Data	0	0.00%	100.00%
Total:	**43**	**100.00%**	

Existing Sewer Service

Sewage treatment and disposal in this study area is provided by individual on-lot systems.

A comparison of this area against the "Suitability for On-Site Disposal Systems" Map prepared by the Bucks County Planning Commission reveals that the majority of this study area is underlain by soils that are classified as being feasible for conventional systems. These systems should be carefully managed to ensure that they continue to operate properly.

Wastewater Planning Needs

1. Determine feasibility of continued use of on-lot systems.
2. Identify and evaluate wastewater management alternatives that can provide a comprehensive solution.

Figure 2.15.3 Passer Village

2.15.4 Pleasant Valley

Location

This study area is located in the south-central portion of the Township near the border with Haycock Township and is located within the Cooks Creek watershed. Route 212 travels through the center of this study area. Cooks Creek and Durham Creek flow through this study area at various locations. Figure 2.15.4 illustrates the Pleasant Valley Village.

Existing Land Use

Land use in this study area is primarily residential, but there are a few commercial uses among the approximately 85 dwelling units. Lot sizes in this study area vary, with the smallest lots found along Route 212 and Old Bethlehem Road. Table 2.15.7 shows the distribution of lot sizes within Pleasant Valley. Table 2.15.8 presents the age of existing properties in Pleasant Valley.

Table 2.15.7: Distribution of Lot Sizes Within Pleasant Valley

Lot Size	Tax Assessors Database- Pleasant Valley					
	# Parcels	% of Total	Dev. Parcels	% of Total	Undev. Parcels	% of Total
<10,000	7	9.3%	3	4.5%	4	44.4%
10,001-15,000	6	8.0%	5	7.6%	1	11.1%
15,001-20,000	11	14.7%	9	13.6%	2	22.2%
20,001-40,000	20	26.7%	19	28.8%	1	11.1%
40,001-60,000	7	9.3%	7	10.6%	0	0.0%
60,001-80,000	6	8.0%	6	9.1%	0	0.0%
>80,000	17	22.7%	16	24.2%	1	11.1%
No Data	1	1.3%	1	1.5%	0	0.0%
Grand Total	**75**	100.0%	**66**	100.0%	**9**	100.0%

Existing Water Service

Residents in this area rely on individual on-lot wells for their domestic water supply.

Table 2.15.8: Housing Age Distribution Within Pleasant Valley

Age of House	Pleasant Valley	% Total	Cumulative %
<8	4	6.06%	6.06%
9-13	1	1.52%	7.58%
14-18	0	0.00%	7.58%
19-28	1	1.52%	9.09%
29-38	2	3.03%	12.12%
39-48	5	7.58%	19.70%
49-58	9	13.64%	33.33%
59-68	7	10.61%	43.94%
69+	27	40.91%	84.85%
No Data	10	15.15%	100.00%
Total:	**66**	**100.00%**	

Existing Sewer Service

Sewage treatment and disposal in this study area is provided by individual on-lot systems.

In September of 1992, the Springfield Elementary School was issued a permit to install two (2) 5,000 sq. ft. elevated sand mounds to repair the existing on-lot system that was malfunctioning. The system was designed for a flow of 3,589.5 gpd and the permit states that "no additional flows will be allowed into the system".

A comparison of this area against the "Suitability for On-Site Disposal Systems" Map prepared by the Bucks County Planning Commission reveals that the majority of this study area is underlain by soils that are classified as being feasible for conventional systems. Depth to groundwater, proximity to Cooks Creek and the existence of developed, small lots may necessitate offsite solutions for some of the properties in this study area, as failing systems are remediated or new systems are installed.

Wastewater Planning Needs

1. Determine feasibility of continued use of on-lot systems.
2. Identify and evaluate wastewater management alternatives that can provide a comprehensive solution.

Figure 2.15.4. Pleasant Valley Village

2.15.5 Designated Development Area

The Designated Development Area is located within the Tohickon Creek and Schuylkill watershed in the southeastern portion of the Township. This area is designed and sized to accommodate projected future growth and development, including infill and adaptive reuse opportunities. Its location adjacent to the Route 309 corridor provides good access and is a prime area for future development. Public sewer was identified as an important consideration for the Development Area in the 2002 Comprehensive Plan. The goal is to facilitate more concentrated development while maximizing the protection of Springfield Township's resources in other areas of the Township. This area is generally conducive to development, although there are areas of steep slopes, wetlands, and streams (tributaries of Tohickon Creek), that should be avoided during the development process. Figure 2.15.5 illustrates the Designated Development Area.

Table 2.15.9 shows the distribution of lot sizes within the Designated Development Area. Table 2.15.10 presents the age of existing properties in the Designated Development Area.

Table 2.15.9: Distribution of Lot Sizes- Designated Development Area

Lot Size	Tax Assessors Database- Development District					
	# Parcels	% of Total	Dev. Parcels	% of Total	Undev. Parcels	% of Total
<10,000	0	0.0%	0	0.0%	0	0.0%
10,001-15,000	0	0.0%	0	0.0%	0	0.0%
15,001-20,000	4	4.9%	3	5.1%	1	4.5%
20,001-40,000	19	23.5%	19	32.2%	0	0.0%
40,001-60,000	7	8.6%	5	8.5%	2	9.1%
60,001-80,000	4	4.9%	2	3.4%	2	9.1%
>80,000	44	54.3%	30	50.8%	14	63.6%
No Data	3	3.7%	0	0.0%	3	13.6%
Grand Total	**81**	100.0%	**59**	100.0%	**22**	100.0%

Table 2.15.10: Housing Age Distribution- Designated Development Area

Age of House	Development District	% Total	Cumulative %
<8	2	3.39%	3.39%
9-13	0	0.00%	3.39%
14-18	1	1.69%	5.08%
19-28	6	10.17%	15.25%
29-38	13	22.03%	37.29%
39-48	15	25.42%	62.71%
49-58	4	6.78%	69.49%
59-68	6	10.17%	79.66%
69+	9	15.25%	94.92%
No Data	3	5.08%	100.00%
Total:	**59**	**100.00%**	

Development Capacity

The capacity of Development District, according to the 2002 Comprehensive Plan was calculated as follows:

High-range (Use B6-Multifamily)
188.00 Acreage of vacant or potentially developable land
x 0.55 Minimum required open space ratio (40 % plus 5 %)(45%)
= 103.40 Net buildable acreage
x 6.00 Maximum permitted density (centralized water and sewer)
= 620.40 (620) Maximum number of potential dwelling units

Low-range (Use B11b-Single-Family Detached Dwelling)
188.00 Acreage of vacant or potentially developable land
x 0.80 Infrastructure and resource protection area (20%)
= 150.40 Net buildable area
x 1.00 Maximum permitted density (min. lot size = 1 acre)
= 150.40 (150) Maximum number of potential dwelling units

Using 225 gpd/EDU, wastewater flows under the high and low projections are 140,000 gpd and 34,000 respectively.

Figure 2.15.5 Designated Development Area

2.15.6 Route 309 Study Area

Location

The Route 309 Study Area consists of the length of Route 309 within the boundaries of the Township. This area is confined to lots having frontage on Route 309. Figure 2.15.6 illustrates the Route 309 Study Area.

Existing Land Use

Land use in this study area is primarily commercial. Table 2.15.11 shows the distribution of lot sizes within the Route 309 Study Area. Table 2.15.12 presents the age of existing properties in the Route 309 Study Area.

Table 2.15.11: Distribution of Lot Sizes- Route 309 Study Area

Lot Size	Tax Assessors Database- Route 309					
	# Parcels	% of Total	Dev. Parcels	% of Total	Undev. Parcels	% of Total
<10,000	5	8.9%	0	0.0%	5	19.2%
10,001-15,000	4	7.1%	1	3.3%	3	11.5%
15,001-20,000	4	7.1%	3	10.0%	1	3.8%
20,001-40,000	9	16.1%	4	13.3%	5	19.2%
40,001-60,000	7	12.5%	3	10.0%	4	15.4%
60,001-80,000	4	7.1%	2	6.7%	2	7.7%
>80,000	22	39.3%	17	56.7%	5	19.2%
No Data	1	1.8%	0	0.0%	1	3.8%
Grand Total	**56**	100.0%	**30**	100.0%	**26**	100.0%

Table 2.15.12: Housing Age Distribution Within the Route 309 Study Area

Age of House	Route 309 Study Area	% Total	Cumulative %
<8	0	0.00%	0.00%
9-13	0	0.00%	0.00%
14-18	0	0.00%	0.00%
19-28	0	0.00%	0.00%
29-38	3	10.00%	10.00%
39-48	4	13.33%	23.33%
49-58	2	6.67%	30.00%
59-68	0	0.00%	30.00%
69+	2	6.67%	36.67%
No Data	19	63.33%	100.00%
Total:	**30**	**100.00%**	

Figure 2.15.6. Route 309 Study Area

2.15.7 Outlying Areas

Location

The Outlying Areas consist of all remaining lots within the Township that are not within any of the other six study areas as defined in the previous descriptions.

Existing Land Use

Land use in the Outlying Areas is primarily agricultural and residential, with a few commercial uses throughout. Lot sizes in this study area are very large, with a few smaller, residential and undeveloped lots. Table 2.15.13 shows the distribution of lot sizes within the Outlying Areas. Table 2.15.14 presents the age of existing properties in the Outlying Areas.

Table 2.15.13: Distribution of Lot Sizes- Outlying Areas

Lot Size	Tax Assessors Database- On-Site Study Area					
	# Parcels	% of Total	Dev. Parcels	% of Total	Undev. Parcels	% of Total
<10,000	33	1.6%	3	0.2%	30	6.0%
10,001-15,000	23	1.1%	10	0.6%	13	2.6%
15,001-20,000	30	1.5%	21	1.4%	9	1.8%
20,001-40,000	131	6.4%	106	6.9%	25	5.0%
40,001-60,000	156	7.6%	124	8.0%	32	6.4%
60,001-80,000	92	4.5%	74	4.8%	18	3.6%
>80,000	1,539	75.3%	1,184	76.6%	355	71.0%
No Data	41	2.0%	23	1.5%	18	3.6%
Grand Total	**2045**	100.0%	**1545**	100.0%	**500**	100.0%

Table 2.15.14: Housing Age Distribution- Outlying Areas

Age of House	On-Site Study Area	% Total	Cumulative %
<8	142	9.19%	9.19%
9-13	69	4.47%	13.66%
14-18	58	3.75%	17.41%
19-28	266	17.22%	34.63%
29-38	307	19.87%	54.50%
39-48	132	8.54%	63.04%
49-58	92	5.95%	69.00%
59-68	55	3.56%	72.56%
69+	353	22.85%	95.40%
No Data	71	4.60%	100.00%
Total:	**1,545**	**100.00%**	

2.16. GIS & ORTHO PHOTOGRAPHY

Table 2.16.1 lists the ARC View GIS information that has been provided. ARC View files of the information are included on the attached CD.

Figure 2.16.1 illustrates the Springfield Township Parcels and Buildings on Ortho Photography.

Table 2.16.1: ARC View GIS Information

Datasets		Description	Source
Base Map	Pennsylvania Municipal Boundaries	Pa Municipalities 2007	Pennsylvania Department of Transportation website
	Major Roads	DOT Roadways 2006	Pennsylvania Department of Transportation website
	State Highways	DOT Roadways 2006	Pennsylvania Department of Transportation website
	Local Roads	DOT Roadways 2006	Pennsylvania Department of Transportation website
	Area Highways	Major Roads of the United States	U.S. Geological Survey
	Roadway Centerline with Names	Received from Bucks County	Bucks County Planning Commission
	Edge Pavement	Received from Bucks County	Bucks County Planning Commission
	Springfield Township	Springfield Township Clipped from Pennsylvania Minicipal Boundaries	Created by LAI
	Springfield Township	Received from Bucks County	Bucks County Planning Commission
	Bucks County Populated Places	Populated Places within Bucks County > 1,000	USGS Geographic Names Information System (GNIS)
	Counties	Pennsylvania County Boundaries	Pennsylvania Spatial Data Access (PASDA)
	Springfield Township Populated Places	Populated Places for Springfield Township	Pennsylvania Spatial Data Access (PASDA)
Hydro	Watersheds Major	Watersheds from PA Major Watershed Coverage	Pennsylvania Spatial Data Access (PASDA)
	Watersheds Small	Project Watersheds Clipped from PA Small Watershed Coverage	Pennsylvania Spatial Data Access (PASDA)
	Subwatershed	Subwatersheds used in Cooks Creek Watershed Managemant Plan	Cooks Creek Watershed Association (CCWA)
	Streams	Streams with no Name Labels	Bucks County Planning Commission
	NHD Waterbodies (w/ swamp)	National Hydrography Dataset (NHD)	USGS
	Wetlands - NWI	Pennsylvania National Wetlands Inventory	Pennsylvania Spatial Data Access (PASDA)
	Flood Plain	Floodplains of Pennsylvania	Pennsylvania Spatial Data Access (PASDA)
WQ	Impaired Streams 2004 303(d)	Impaired Streams from DEP	Pennsylvania Spatial Data Access (PASDA)
Soils	USDA soils	Bucks County Soils Cropped to Springfield Township	USDA
	Bedrock Geology	Statewide Bedrock Geology	Pennsylvania Spatial Data Access (PASDA)
	Surficial Geology	Statewide Surficial Geology	Pennsylvania Spatial Data Access (PASDA)
	Surficial Geology - karst		Cooks Creek Watershed Association (CCWA)
Water	Springtown Water Service Area	Water Service Area as taken from Cooks Creek Watershed Data	Cooks Creek Watershed Association (CCWA)
Wastewater	WWTFs treatment location	Bucks County WWTF	Pennsylvania Spatial Data Access (PASDA)
	WWTFs discharge locations	None Received	
	WWTF service areas	None Received	
	WWTF collection systems	None Received	
	Septic Systems	Septic Systems located for Cooks Creek Watershed Managemant Plan	Cooks Creek Watershed Association (CCWA)

Datasets		Description	Source
Parcels	Parcels (CCW)	Tax Map Parcels used in Cooks Creek Watershed Managemant Plan	Cooks Creek Watershed Association (CCWA)
	Parcels Bucks County	Parcels from Bucks County Planning Commission	Bucks County Planning Commission
	Bucks County Tax Acessor Database	Bucks County Tax Acessor Database	Bucks County Tax Acessor
	Public Lands		
Images	Aerial Photograpgy	Aerials Photography Dated 2005 (Total of 61 Aerial Panels)	Delware Valley Regional Planning Commission
	Aerial photo Index	Index of Aerial Photography in Eastern Pennsylvania	Pennsylvania Spatial Data Access (PASDA)
	DEM Image	Digital Elevation Model	Pennsylvania Spatial Data Access (PASDA)
	DRGs of topos (USGS Quads)	USGS Digital Raster Graphics	United States Geological Society
Misc.	Land use	None Received	
	National Park	None Received	
	State Parks	None Received	
	Wildlife management areas	None Received	
	Buildings	Good Quality Building Outlines	Bucks County Planning Commission
	Zoning	Zoning Springfield Township	Bucks County Planning Commission
	Buildings	Buildings Locations for Cooks Creek Watershed Study poor quality	Cooks Creek Watershed Association (CCWA)
Index	USGS quads	Index of Digital Raster Graphics USUS Topo Quads	Pennsylvania Spatial Data Access (PASDA)
	Aerial Sheet Layout	Aerial Sheet Layout Key Plan for Aerial coverage in 3 Sheets	Created by LAI
	Digital ortho quads	Index of 2005 Aerial Coverage Panels	Delware Valley Regional Planning Commission
Groundwater	Groundwater	Ambient and Fixed Station Network (FSN) Groundwater Monitoring Point Data (1985 - 1998)	Pennsylvania Spatial Data Access (PASDA)
	Groundwater Contours	Groundwater Contours shown at 20 Intervals within the boundaries of the Cooks Creek Watershed	Cooks Creek Watershed Association (CCWA)
	Groundwater Flow Arrows	Groundwater Flow arrows shown within the boundaries of the Cooks Creek Watershed	Cooks Creek Watershed Association (CCWA)
	PAGWIS_Well_Listing	Pennsylvania Groundwater Information System (PaGWIS)	Pennsylvania Department of Conservation and Naturan Resources
Topography	Topographic Contours	Land Contours at 25 foot Intervals clipped from Bucks County coverage to the Springfield Township Boundary	Delware Valley Regional Planning Commission
	Topographic Contours	Land Contours at 5 foot Intervals clipped from Bucks County coverage to the Springfield Township Boundary	Delware Valley Regional Planning Commission
	Topographic Spot Elevations	Spot Elevations clipped from Bucks County coverage to the Springfield Township Boundary	Delware Valley Regional Planning Commission

Figure 2.16.1. Springfield Township Parcels and Buildings on Ortho Photography

3. SEWAGE NEEDS DEFINITION

3.1.1 Methodology

LAI has used available information to identify, map and describe areas that utilize individual and community on-lot sewage systems. The information used includes:

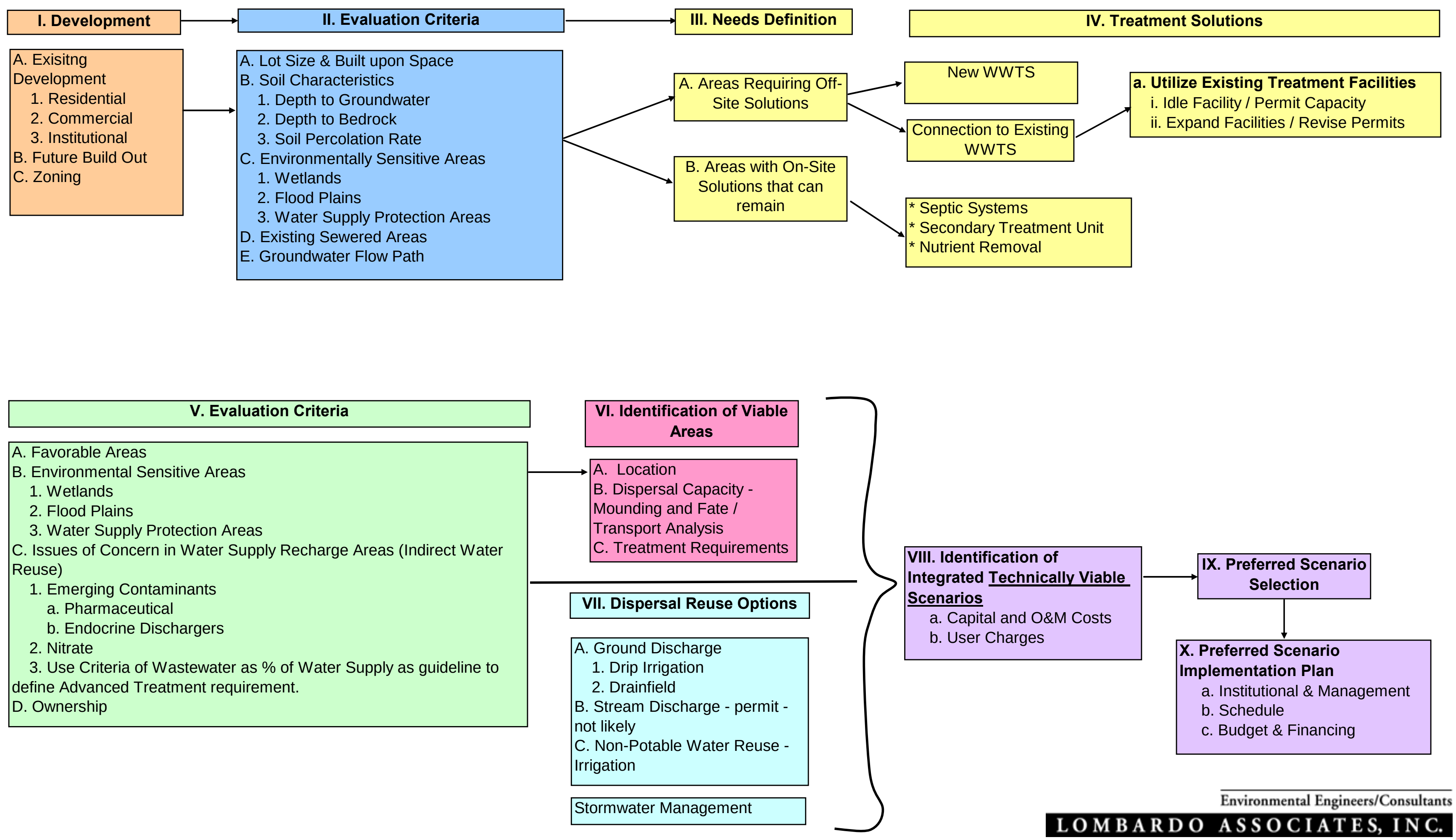
1. Tax Assessors and Board of Health On-lot Sewage Disposal records information on the types of on-lot systems in use.
2. Copies of Septic System Installation Permits have been reviewed for information on existing wastewater systems and to correlate actual soil investigation data with permitted/measured site conditions of:
    - Percolation rate
    - Depth to groundwater, bedrock, or other limiting layer
3. A comparison of the types of on-lot sewage systems installed in an area with the types of systems which are appropriate for the area according to soil, geologic conditions, topographic limitations, environmental conditions, sewage flows, and Title 25, Chapter 73 setback requirements.
4. Operation and maintenance requirements of the municipality for individual and small volume community on-lot systems, including the status of past and present compliance with these requirements and any other requirements.

To accomplish the development of the Springfield Township decentralized wastewater management plan, LAI is utilizing a lot-by-lot analytical technique as shown in Figure 3.1.1.

LAI has integrated GIS and parcel information for the following that are integral to developing a decentralized wastewater management plan:

- Parcel Map
- Assessor's lot information
- Environmentally Sensitive Areas
    - Wetlands
    - Flood Plains
    - Streams and Ponds
    - Steep Slopes
    - Limestone Geology Areas
- Topography
- Soils
    - Depth to Groundwater
    - Depth to Rock
    - Perc Rates

Figure 3.1.1: Decentralized Wastewater Facilities Plan Development Process



The lot-by-lot wastewater needs definition provides a firmly grounded engineering analysis that becomes the basis for analysis of cost-effective, long-term, sustainable wastewater solutions. The result is definition of parcels that may require off-site (sewer) solutions and those that may remain on-lot, pending further field studies. The needs analysis is examined by Study Areas in the following sections.

3.1.2 System Sizing, Buffer Zones and Available Areas

Physical characteristics were used to determine the suitability of individual lots to sustain a compliant septic system. If the soils are suitable for siting a septic system, the type of soil was used to estimate the maximum loading rate for subsurface discharge of treated wastewater. The loading rate was used to define the required area for subsurface discharge.

The available area of an individual lot is the total area of a lot minus areas within building and property line setbacks and environmentally sensitive areas and their setbacks. For lots within buffer zones, some or all of the available area may also be restricted. As a preliminary screening criteria, the available area of an individual lot was compared to the required area for the existing or proposed use.

Lots that are located wholly within the following zones cannot have compliant on-lot solutions per current regulations:

1. Inside or within 75 feet of a wetland
2. Within 125 feet of a stream or other water body
3. Within the 100 year floodplain
4. Within 10' of areas that have slopes in excess of 25%
5. Within 100' of a water supply well
6. Within Zone I and/or within Zone II of a public water supply well
7. For areas with slopes of:
    - 15 to 24 percent, 70 percent of the area shall be protected;
    - 25 to 30 percent, 85 percent of the area shall be protected;
    - greater than 30 percent, 100 percent of the area shall be protected.
8. For areas with Soil Percolation Rate > 180 mpi
9. For areas with Depth to limiting zone < 20 in.

Properties in this category were identified from available lot by lot GIS and assessors information that include the following:

- Parcel Boundary
- Wetlands and 100 Year Floodplain Designation
- Streams and Water Bodies

A lot by lot analysis of the above data has identified properties that have no apparent available area to site treatment facilities. These properties may require an offsite solution, upon further study or malfunction.

Parcels that are located partially within one or more of these zones were evaluated to determine if sufficient available area remains outside of all buffer zones. In addition to the above zones, there are a number of other setback requirements described in Chapter 73 of the Pennsylvania Code. The available area on each parcel is the sum of all areas not within any of the 4 zones listed above or within any other regulatory setback area. Table 2.14.4 summarizes the setback requirements for treatment tanks, drainfields and spray irrigation areas. Information on the location of the various features, with the exception of buildings and pubic water supply wells, is not readily available in GIS format.

For the purposes of this Plan, available area was simplified and defined as the area outside the wetland, water body, floodplain, steep slopes, building and property line buffer zones. Lots with enough available area may still lack sufficient area when setbacks from the remaining features, such as water supply wells, are taken into consideration.

In addition, the **depth to limiting zone, in this case largely the high groundwater level**, affects the required area. Elevated sand mounds (ESM) are required in cases where:

- the limiting layer is less than 5 feet below the natural surface. The minimum mound height is 1-foot, and
- no mound can be placed in an area where there is less than 20” of native soil between the bottom of the mound and the limiting layer.

The required area for a mounded system depends on the height of the mound and the slope of the soil the mound is constructed on. The simplifying assumption was made that mounds will be constructed on a relatively flat slope. The height of the mound is incorporated into the total required area calculation for properties requiring a mounded system.

In addition, for **percolation rates between 3-6 MPI and greater than 90 MPI**,

- standard systems cannot be used. In these cases, a subsurface sand filter or elevated sand mound is required, depending on the depth to limiting zone.

3.1.3 Required Area for Siting a Compliant On-Lot Wastewater System

The required area for an on-lot system is a function of the percolation rate and depth to limiting zone. Figure 3.1.2 shows how these two soils properties determine what type, if any, on-lot system is required. Figure 3.1.3 shows how the RA/AA is calculated and how this effects the feasibility of siting an on-lot system. Depending on the type of system and the percolation rate, these systems can range between 800 – 4,000 ft^2. The typical 400 gpd system, with no mound and an average percolation rate will require approximately 1,200 ft^2. This represents a relatively small fraction of the total area for most parcels in the township. Even parcels that are partially environmentally constrained typically have enough remaining area to site a compliant on-lot system, provided the depth to limiting zone and percolation rates are not prohibitive. The following needs analyses will separate out parcels that are constrained by the required area to available area ratio (RA/AA) such that they cannot feasibly site a compliant on-lot system. The standard chosen was if the RA/AA was less than or equal to 1.5. These properties will be termed “environmentally constrained”.

Figure 3.1.2: Feasibility and Type of On-Lot System Based on Percolation Rate and Depth to limiting zone

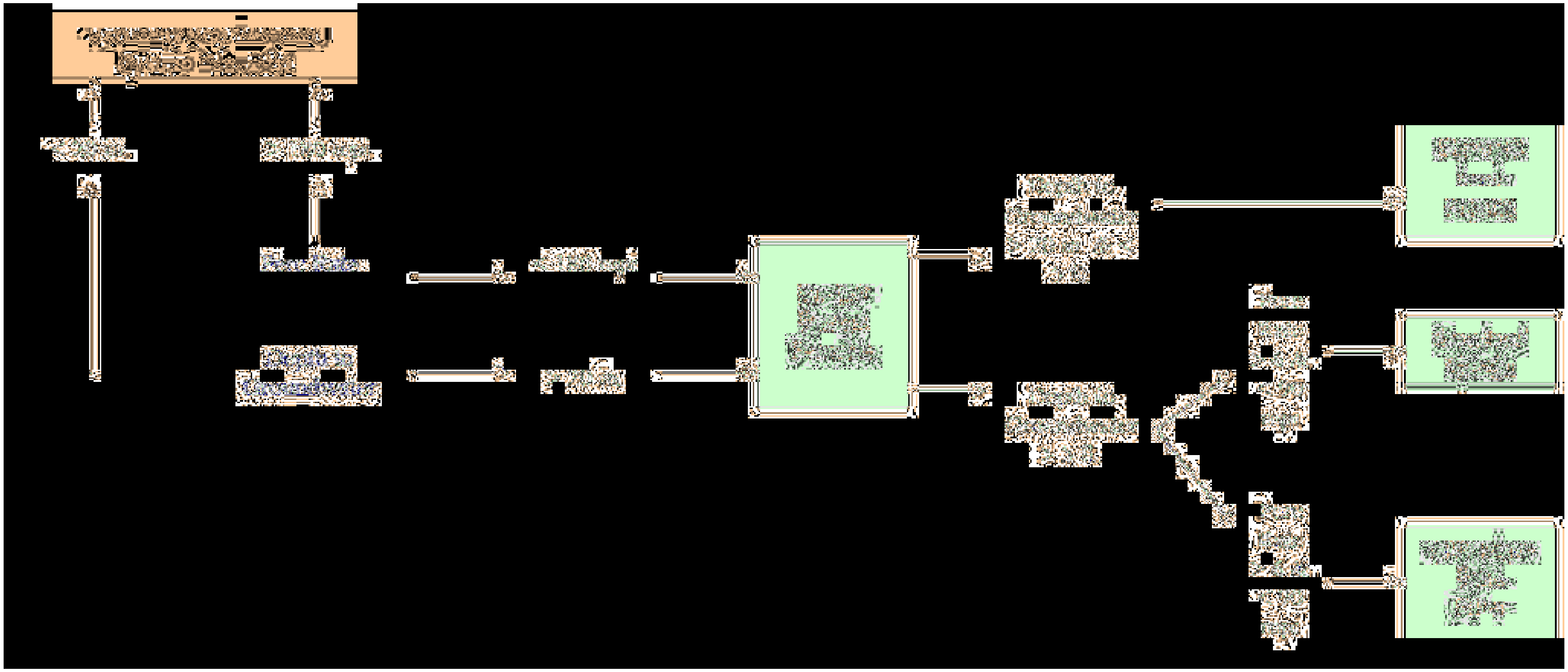
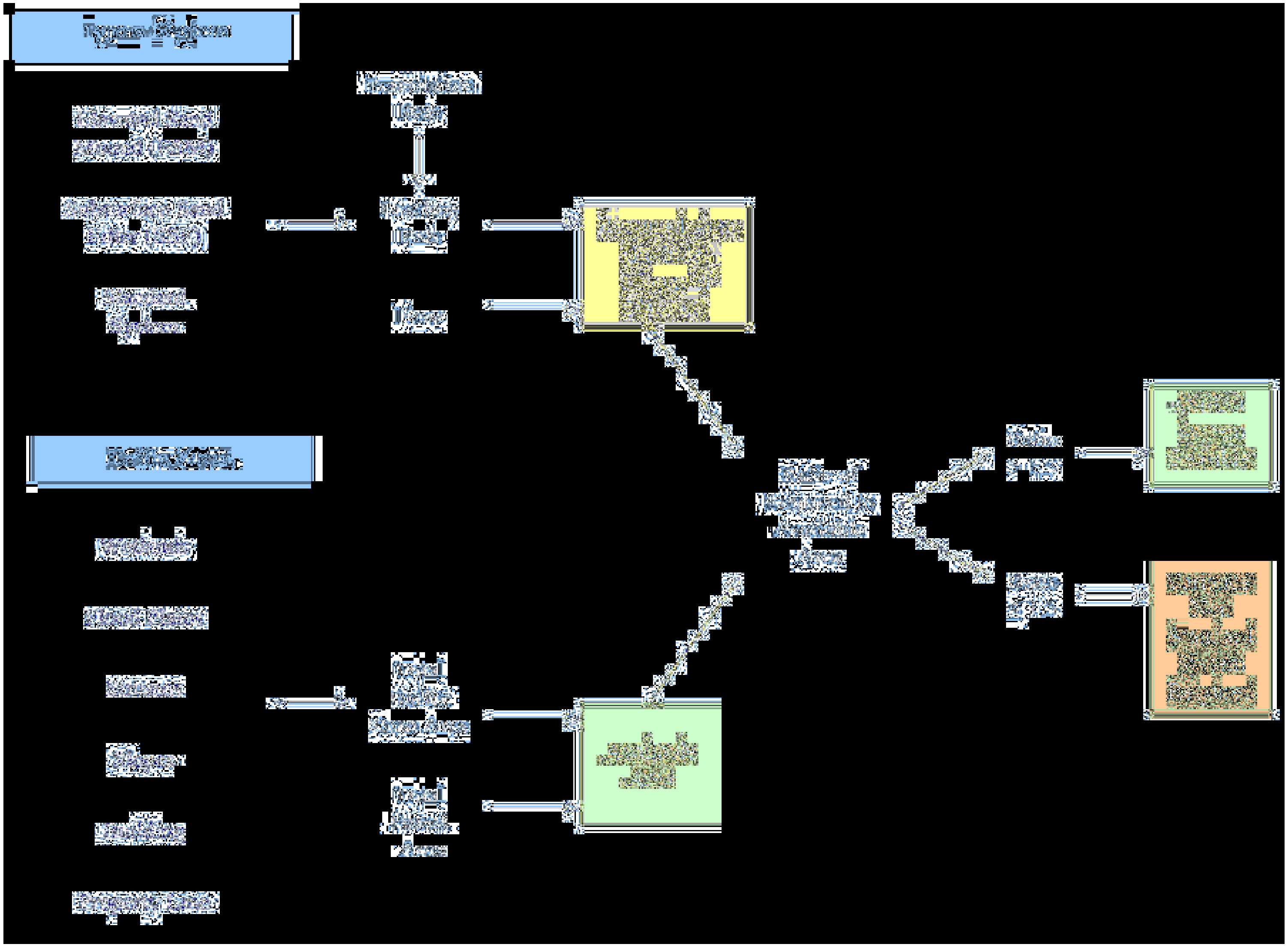


Figure 3.1.3: Feasibility and Type of On-Lot System Based on Required to Available Area Ratio



3.1.4 Water Supply Wells and Potential Water Supply Solution

There is a 100' buffer around a water supply well in which no part of a septic system can be sited. Depending on the location of the well, this can take up as much as 31,400 ft^2 of available area. In reality, wells tend to be located such that a portion of that buffer zone extends beyond their property line or into one of the other buffer zones. LAI made efforts to locate individual wells using existing data. The Durham Township Environmental Advisory Council provided well location data that was used in the Cooks Creek Watershed Study. This data provided locations for 419 wells within Springfield Township. Visual inspection of these well locations showed that well buffer zones do typically cross over parcel boundaries. There was insufficient information to create an actual well buffer zone for each property, so LAI made the simplifying assumption that half of the well buffer zone, or 15,700 ft^2, encroaches on the available area. This assumption is the difference in a significant number of lots with respect to the RA/AA. Parcels that are determined to need an offsite solution solely because of the water supply well buffer zone will be differentiated in the following needs analyses. For these parcels, there is not enough information to determine if there are any needs. If further analysis reveals that well setbacks are an issue, a water supply solution may be favored. More information is needed on well and septic system locations to perform this analysis. For this report, areas that may have a well separation issue are merely identified.

3.2. STUDY AREA NEEDS

Each study area was examined to determine the feasibility of maintaining on-lot systems. The following maps were generated for each study area, and are shown in this order in the Appendix:

1. Aerial Photography
2. PID and Wastewater Flows
3. Parcel Lot and Size
4. Soils
5. Depth to Groundwater
6. Depth to Bedrock
7. Slopes
8. Bedrock Geology
9. Septic System Age
10. Environmental Constraints
11. Needs Analysis

3.2.1 Springtown Needs Analysis

A summary of the Springtown needs analysis is presented in Table 3.2.1.

Table 3.2.1: Summary of Needs Analysis Information

	Characteristic		Study Area: Springtown
1	Development	Existing	241 Developed of 306 Total parcels
1	Flow	Existing(1)	approximately 56,925 gpd
2	Lot Sizes		50.3% of lots under 20,000 ft^2 & 17% over 80,000 ft^2
2	Zoning		106 parcels classified as VR, or 34.6%
3	Wetlands		Cooks Creek flows outside the southeast edge of the Springtown study area
4	Soil & Geology		Urban & Gladstone soils, Limestone derived bedrock is prevalent
5	Perc Rates		10 – 100 mpi
6	Depth to Groundwater		Shallow groundwater (< 5') exists in the NE and near streams and ponds within the study area
7	Slope		16 parcels with slope restriction (>15%), or 5.2% of Total parcels
8	Water Supply		Springtown Water Authority
9	Required & Available Area		Significant number of lots that are environmentally constrained
10	Needs Definition		99 parcels, or 34.7%, are environmentally constrained

(1) Calculated using 225 gpd per residential property

1. Development Status and Flow Data

Table 3.2.2 shows the development status of parcels in Springtown as well as the existing and buildout flows. This study area is large enough to where individual Title 25 flows do not apply. For commercial properties, the permitted flow is used. For all other properties, 225 gpd per EDU (defined as 3 bedrooms) was used.

Table 3.2.2: Development Status and Wastewater Flows

Springtown Study Area	# Parcels	# EDU[2]	% Study Area	Total Area (acres)	% Study Area	Existing WW Flow (gpd)[1]	Total Future WW Flow (gpd)[1, 2]
Developed	241	253.0	78.8%	633	87.3%	56,925	56,925
Undeveloped	65	TBD	21.2%	92	12.7%	n/a	TBD
Grand Total	306	253.0	100.0%	725	100.0%	56,925	56,925

(1) Using 225 gpd/residential unit
(2) Future flows have not been established for individual study areas.

2. Lot Size & Zoning

Table 2.15.2 is repeated here to illustrate the lot size distribution and the zoning distribution in Springtown.

Table 2.15.2: Distribution of Lot Sizes Within Springtown

Lot Size	Tax Assessors Database- Springtown					
	# Parcels	% of Total	Dev. Parcels	% of Total	Undev. Parcels	% of Total
<10,000	57	18.6%	45	18.7%	12	18.5%
10,001-15,000	51	16.7%	40	16.6%	11	16.9%
15,001-20,000	46	15.0%	41	17.0%	5	7.7%
20,001-40,000	38	12.4%	30	12.4%	8	12.3%
40,001-60,000	34	11.1%	32	13.3%	2	3.1%
60,001-80,000	7	2.3%	5	2.1%	2	3.1%
>80,000	52	17.0%	46	19.1%	6	9.2%
No Data	21	6.9%	2	0.8%	19	29.2%
Grand Total	306	100.0%	241	100.0%	65	100.0%

As can be seen from the above tables, roughly 50% of the parcels in Springtown are less than 20,000 square feet. In addition, there are 49 developed properties that are located in either Resource Protection or Water Supply Districts.

3. Wetlands, Streams and Floodplains

Figure 3.2.1 shows the delineation of wetlands and floodplains within Springtown, with streams and ponds also shown. Cooks Creek flows outside the southeast edge of the Springtown study area. There are several streams that flow through developed lots within the study area that are tributary to Cooks Creek.

4. Soils and Geology

The predominant soil types in Springtown are the Urban and Gladstone series. The Urban series covers 180 (73.4%) of the developed parcels, as can be seen in Tables 3.2.3 and 3.2.4, respectively. This soil type has no depth to groundwater or percolation data associated with it. The Gladstone series is associated with 26 (10.6%) of the developed parcels. This soil type is characterized by low groundwater and percolation rates that are generally between 10 – 100 mpi, with a restrictive layer in the 10" – 42" horizon that has percolation rates between 100 – 300 mpi.

In addition to the soils, limestone derived bedrock underlies 143 of the 245, or 58.4% of the developed parcels within Springtown. Limestone covers 50.7% of the study area as illustrated in Table 3.2.5.

Table 3.2.3: Distribution of Soils in Springtown

USDA Soil Type	USDA Soil Type Description	Soil Type Percentage of Township	Soil Type Percentage of Study Area	Cumulative %	# Dev Parcels w/ Predominant Soil	% Developed Springtown Parcels	Cumulati ve %
UkB	Urban land-Chester complex, 0 to 8 percent slopes	0.7%	27.1%	27.1%	164	66.9%	66.9%
GlB	Gladstone gravelly silt loam, 3 to 8 percent slopes	3.9%	15.8%	42.9%	7	2.9%	69.8%
GlC	Gladstone gravelly silt loam, 8 to 15 percent slopes	3.1%	13.8%	56.7%	12	4.9%	74.7%
Ha	Hatboro silt loam	1.8%	8.6%	65.4%	3	1.2%	75.9%
DgC	Duffield-Ryder silt loams, 8 to 15 percent slopes	0.6%	6.3%	71.7%	5	2.0%	78.0%
Ro	Rowland silt loam	0.4%	4.8%	76.5%		0.0%	78.0%
WaB	Washington silt loam, 3 to 8 percent slopes	1.5%	4.7%	81.2%	5	2.0%	80.0%
GlD	Gladstone gravelly silt loam, 15 to 25 percent slopes	1.0%	3.8%	85.0%		0.0%	80.0%
UkD	Urban land-Chester complex, 8 to 25 percent slopes	0.1%	3.7%	88.7%	14	5.7%	85.7%
GmD	Gladstone gravelly silt loam, 8 to 25 percent slopes, very bouldery	2.7%	3.1%	91.8%	5	2.0%	87.8%
GrA	Glenville silt loam, 0 to 3 percent slopes	1.0%	2.9%	94.7%	8	3.3%	91.0%
GrB	Glenville silt loam, 3 to 8 percent slopes	1.5%	2.2%	96.8%	6	2.4%	93.5%
CmB	Clarksburg silt loam, 3 to 8 percent slopes	0.7%	1.2%	98.1%	7	2.9%	96.3%
W	Water	0.2%	1.1%	99.2%		0.0%	96.3%
Bo	Bowmansville-Knauers silt loams	3.0%	0.5%	99.7%	5	2.0%	98.4%
GmF	Gladstone gravelly silt loam, 25 to 55 percent slopes, very bouldery	0.1%	0.2%	99.9%	2	0.8%	99.2%
UfuB	Urban land, 0 to 8 percent slopes	0.4%	0.1%	100.0%	2	0.8%	100.0%

4.1. Validation of Soils Attributes in Springtown

Soil testing data was taken from the BOH records from representative parcels in the area. Of the records pulled, none were found to have the Gladstone soils present. It appears that the Urban-Chester series covers many of the areas that are mapped as Gladstone.

5. Percolation Rates

Percolation rates were found to be in the 10 – 100 mpi range within Springtown. The Urban-Chester soil series appears to have acceptable properties with respect to percolation rate.

Table 3.2.4: Properties of Common Soils in Springtown

#	USDA Soil Type	USDA Soil Type Description	Soil Type Percentage of Study Area	Cumulative %	Depth (in)	USDA Texture	Suitability for septic disposal	Hydric Soils	Permeability (Ksat) (in/hour)	Percolation Rate (min/in)	Hydrologic Group	Water Table Upper Limit	Water Table Lower Limit
1	UkB	Urban land-Chester complex, 0 to 8 percent slopes	27.11%	27.11%	0-6	variable							
2	GlB	Gladstone gravelly silt loam, 3 to 8 percent slopes	15.77%	42.88%	0-10	Gravelly silt loam			0.6 - 6	100 - 10	B	---	---
					10-42	Gravelly sandy clay loam, gravelly silt loam, gravelly clay loam			0.2 - 0.6	300 - 100			
					42-68	Gravelly clay loam, gravelly fine sandy loam, gravelly loam			2 - 6	30 - 10			
3	GlC	Gladstone gravelly silt loam, 8 to 15 percent slopes	13.83%	56.71%	0-10	Gravelly silt loam			0.6 - 6	100 - 10	B	---	---
					10-42	Gravelly sandy clay loam, gravelly silt loam, gravelly clay loam			0.2 - 0.6	300 - 100			
					42-68	Gravelly clay loam, gravelly fine sandy loam, gravelly loam			2 - 6	30 - 10			
4	Ha	Hatboro silt loam	8.64%	65.35%	0-9	silt loam	No	Yes	0.6 - 2	100 - 30	D	0.0-0.5	>6.0
					9-44	silt loam, silty clay loam, sandy clay loam			0.6 - 2	100 - 30			
					44-56	sandy clay loam, sandy loam, silt loam			0.6 - 2	100 - 30			
					56-70	stratified gravelly sand to clay			2 - 6	30 - 10			
5	DgC	Duffield-Ryder silt loams, 8 to 15 percent slopes	6.31%	71.66%	0-10	silt loam	Moderate		0.6 - 2	100 - 30	B	---	---
					10-53	silty clay loam, silty clay, channery loam			0.6 - 2	100 - 30			
					53-72	channery silt loam, silt loam, clay			0.6 - 2	100 - 30			
6	Ro	Rowland silt loam	4.83%	76.49%	0-12	Silt loam			0.2 - 2	300 - 30	C	1.0-3.0	>6
					12-34	silt loam, channery silt loam, channery silty clay loam			0.2 - 2	300 - 30			
					34-46	Sandy clay, silt loam, gravelly silty clay loam			0.2 - 2	300 - 30			
					46-61	Stratified gravel to sand loam			2 - 6	30 - 10			
7	WaB	Washington silt loam, 3 to 8 percent slopes	4.73%	81.22%	0-9	silt loam	Yes*		0.6 - 2	100 - 30	B	---	---
					9-42	clay loam, silty clay loam, loam			0.6 - 2	100 - 30			
					42-61	clay loam, silt loam, gravelly silt loam			0.6 - 6	100 - 10			

Table 3.2.5: Limestone- Springtown

Study_Area	Total Study Area (acres)	Limestone Area (acres)	Limestone % Study Area
Springtown Village	725	367	50.7%

6. Depth to limiting zone

Depth to groundwater data information was taken from soils data available from the USDA soil data viewer. Data taken from the BOH records correlated well with the mapping data.

Depth to bedrock was taken from the USDA attributes table for the soil type assigned to each parcel within the study area. As can be seen from Table 3.2.4, bedrock does not appear to be an issue for the soils types found in Springtown.

7. Slope

Any parcel that has soil slopes in excess of 15% is subject to use restrictions. The number of developed parcels subject to slope restrictions is 16. This represents 5.2% of the study area.

The relative slopes covering Springtown are shown in the Appendix.

8. Water Supply

The Springtown Water Authority serves the Springtown study area. There are two public service wells located within the study area, both of which are shown in the Appendix, along with the associated Zone I and Zone II boundaries. These zones are included in the environmental constraints buffer areas affecting nearby parcels. The remaining lots are assumed to be free from setback requirements associated with water supply wells.

9. Individual Wastewater System Required Area vs. Available Area

The Springtown study area has a significant number of lots that appear to have insufficient available area to feasibly site a fully compliant on-lot system. These parcels are either too small or environmentally constrained.

10. Needs Definition

Table 3.2.5 shows the result of the lot-by-lot wastewater needs analysis, using the process outlined in Figures 3.1.2 and 3.2.3. The results are graphically shown in the Appendix. The results show that 74 existing lots within the study area are likely to not have fully compliant on-lot systems. For these properties, variances and/or non standard systems may be needed, as failing systems are remediated or new systems installed.

Table 3.2.5: Needs Definition- Springtown

	Springtown Study Area Parcels	Variance or Advanced Treatment System Required[1]						Conventional On-Lot System Feasible				
		Enviro. Constraint	Potential Water Supply Solution	Perc Rate	Depth to Limiting Zone	Total	% Study Area Parcels	Standard System	Elevated Sand Mound	Sub-surface Sand Filter	Total On-Lot	% Study Area Parcels
Developed	241	72	0	0	2	74	24.2%	121	44	0	165	53.9%
Undeveloped	65	25	0	0	0	25	8.2%	17	4	0	21	6.9%
Total	306	97	0	0	2	99	32.4%	138	48	0	186	60.8%

[1] For repairs or new construction. Does not apply to existing systems that are not identified as failing.
[2] The Sum of the two "% of Study Area Parcels" columns does not equal 100% as a result of parcels with Tax Assessors records and no corresponding GIS shape files.

3.2.2 Zion Hill Needs Analysis

A summary of the Zion Hill needs analysis is presented in Table 3.2.6.

Table 3.2.6: Summary of Needs Analysis Information

	Characteristic		Study Area
			Zion Hill
1	Development	Existing	84 Developed of 103 Total parcels
	Flow	Existing(1)	approximately 36,590 gpd
2	Lot Sizes		18.5% of lots under 20,000 ft^2 & 28.2% over 80,000 ft^2
	Zoning		59 parcels classified as VC, or 57.3%
3	Wetlands		Two ponds and a tributary to Towhickson Creek
4	Soil & Geology		Urban landsdale & Brecknock channery soils & Mudstone bedrock
5	Perc Rates		10 – 100 mpi range
6	Depth to Groundwater		Groundwater is not an issue in Arendtsville and Brecknock soil series
7	Slope		3% - 8% slope range
8	Water Supply		No public service wells serving the Zion Hill area
9	Required & Available Area		The Zion Hill study area has a significant number of parcels that appear to have insufficient available area to feasibly site an on-lot system.
10	Needs Definition		45 parcels, or 44.6%, are environmentally constrained

(1) Existing flows are calculated using code flow of 400 gpd for 3 or less bedrooms, and 100 gpd for each additonal bedroom over 3.

The Zion Hill area is partially sewered and serviced by the MTASA. The remaining lots have on-lot systems. The sewer layout and corresponding sewered parcels within Zion Hill are shown in the Appendix.

1. Development Status and Flow Data

This study area is not sufficient in size to allow for a reduction in flow to a more representative number. The flows are calculated based on Title 25 code requirements.

Table 3.2.7: Development Status and Wastewater Flows

Zion Hill Study Area	# Parcels	# EDU[2]	% Study Area	Total Area (acres)	% Study Area	Existing WW Flow (gpd)[1]	Total Future WW Flow (gpd)[1, 2]
Developed	84	91.5	81.6%	145	76.7%	36,590	36,590
Undeveloped	19	TBD	18.4%	44	23.3%	n/a	TBD
Grand Total	103	91.5	100.0%	190	100.0%	36,590	36,590

(1) Existing flows are calculated using code flow of 400 gpd for 3 or less bedrooms, and 100 gpd for each additonal bedroom over 3.
(2) Future flows have not been established for individual study areas.

2. Lot Size & Zoning

Table 2.15.5 shows the lot size distribution for Zion Hill.

Table 2.15.5: Distribution of Lot Sizes Within Zion Hill

Lot Size	Tax Assessors Database- Zion Hill					
	# Parcels	% of Total	Dev. Parcels	% of Total	Undev. Parcels	% of Total
<10,000	5	4.9%	4	4.8%	1	5.3%
10,001-15,000	6	5.8%	6	7.1%	0	0.0%
15,001-20,000	8	7.8%	8	9.5%	0	0.0%
20,001-40,000	14	13.6%	10	11.9%	4	21.1%
40,001-60,000	28	27.2%	23	27.4%	5	26.3%
60,001-80,000	11	10.7%	10	11.9%	1	5.3%
>80,000	29	28.2%	22	26.2%	7	36.8%
No Data	2	1.9%	1	1.2%	1	5.3%
Grand Total	103	100.0%	84	100.0%	19	100.0%

3. Wetlands, Streams and Floodplains

The delineation of wetlands and floodplains within Zion Hill, with streams and ponds is shown in the Appendix. There are two ponds in the study area. One is located off of Trolley Bridge Road and the other to the east of Old Bethlehem Pike. A tributary to Towhickson Creek flows across Old Bethlehem Pike between Trolley Bridge Road and Blue Church Road. The wetlands and floodplains in the area are associated with these water features.

4. Soils and Geology

The majority of developed parcels are located on the Urban soils. These soils are predominantly located in the sewered portion of Zion Hill. The remaining soils are classified as Arendtsville (ArB and ArC), Brecknock (BrB), Lehigh (LmB), Mount Lucas (MlB), Towhee (ToB), and Readington (ReB). Table 3.2.8 shows the properties of these soils as they effect siting of septic systems.

The Zion Hill study area is located above mudstone. There does not appear to be any limestone bedrock beneath the study area.

4.1. Validation of Soils Attributes in Zion Hill

Soil testing data was taken from the BOH records from representative parcels in the area. Data collected correlated well with the USDA soil survey data for the predominant soil types in the area.

5. Percolation Rates

Soils data from Table 3.2.8 shows percolation rates mostly in the 10 – 100 mpi range. However, many of the common soils types have restrictive layers that would prevent proper drainfield function. The Arendtsville and Brecknock soils do not have restrictive layers and do not appear to have groundwater issues associated with them.

6. Depth to Groundwater

No data is available on depth to groundwater associated with the Urban soil series. The Arendtsville and Brecknock soil series have no reported upper or lower limit, which indicates that groundwater is not an issue. The Mount Lucas, Towee and Readington soils have high groundwater that effects the ability to site a compliant on-lot system. The groundwater data is based on the predominant soil type covering each parcel. For lots with more than one significant soil type where the lesser type has a lower water table, this analysis may falsely indicate the need for an offsite solution due to depth to groundwater. Figure 3.2.1 shows the depth to groundwater derived from soils data.

7. Slope

The majority of the Zion Hill area is within the 3% - 8% slope range. There are seven parcels, all along Trolley Bridge Circle, that have slopes that may restrict the area available for siting a septic system.

The relative slopes covering Zion Hill are shown in the Appendix.

8. Water Supply

There are no public service wells serving the Zion Hill area. All lots in this study area are assumed to be serviced by individual water supply wells and therefore subject to the water supply well setback requirements.

9. Individual Wastewater System Required Area vs. Available Area

The Zion Hill study area has a significant number of parcels that appear to have insufficient available area to feasibly site an on-lot system. These parcels are either too small, have poor soils or are environmentally constrained.

10. Needs Definition

Table 3.2.9 shows the result of the lot-by-lot wastewater needs analysis, using the process outlined in Figures 3.1.2 and 3.2.3. The results are graphically shown in the Appendix. The public sewer has addressed the majority of the issues in this study area. Of the remaining non-sewered lots, there are six lots that appear to require variances and/or non standard systems, as failing systems are remediated or new systems installed. Of these, five are due to depth to groundwater and one appears to be in the sewered area, however records indicate that it is not connected. As mentioned above, the depth to groundwater limited properties may in fact have enough available area outside the predominant soil type to site a compliant system. These lots should be managed on a case by case basis.

Table 3.2.9: Needs Definition- Zion Hill

	Zion Hill Study Area Parcels	Variance or Advanced Treatment System Required[1]						Conventional On-Lot System Feasible				
		Enviro. Constraint	Potential Water Supply Solution	Perc Rate	Depth to Limiting Zone	Total	% Study Area Parcels	Standard System	Elevated Sand Mound	Sub-surface Sand Filter	Total On-Lot	% Study Area Parcels
Developed	84	4	20	0	11	35	34.0%	27	18	3	48	46.6%
Undeveloped	19	2	3	0	5	10	9.7%	2	6	0	8	7.8%
Total	103	6	23	0	16	45	43.7%	29	24	3	56	54.4%

[1] For repairs or new construction. Does not apply to existing systems that are not identified as failing.

[2] The Sum of the two "% of Study Area Parcels" columns does not equal 100% as a result of parcels with Tax Assessors records and no corresponding GIS shape files.

[3] Public sewer has addressed constraints on 30 of the 35 developed parcels identified as needing variances and/or non standard system

Table 3.2.8: Properties of Common Soils in the Zion Hill Study Area

#	USDA Soil Type	USDA Soil Type Description	Soil Type Percentage of Study Area	Cumulative %	Depth (in)	USDA Texture	Suitability for septic disposal	Suitability for sand mounds	Suitability for spray irrigation	Hydric Soils	Permeability (Ksat) (in/hour)	Percolation Rate (min/in)	Hydrologic Group	Water Table Upper Limit	Water Table Lower Limit
1	UrB	Urban land-Lansdale complex, 0 to 8 percent slopes	20.35%	20.35%	0-6	variable									
2	BrB	Brecknock channery silt loam, 3 to 8 percent slopes	17.06%	37.41%	0-10	Channery silt loam					0.6 - 2	100 - 30	B	---	---
					10-32	Silt loam, clay loam, channery silt loam					0.6 - 2	100 - 30			
					32-41	Very channery silt loam, channery loam, very channery clay loam					0.6 - 2	100 - 30			
					41-51	bedrock					0.6 - 6	100 - 10			
3	LmB	Lehigh channery silt loam, 3 to 8 percent slopes	10.03%	47.44%	0-6	Channery silt loam	No	Yes			0.6 - 2	100 - 30	C	1.0-2.0	1.8-3.4
					6-38	Channery silt loam, channery silty clay loam					0.06 - 0.2	1000 - 300			
					38-60	Channery silty clay loam, very channery silt loam, extremely channery silt loam					0.06 - 0.2	1000 - 300			
					60-61	bedrock					0.6 - 6	100 - 10			
4	MlB	Mount Lucas silt loam, 3 to 8 percent slopes	9.63%	57.07%	0-9	silt loam			Yes		0.6 - 2	100 - 30	C	0.5-3.0	1.8-2.9
					9-38	Silt loam, gravelly silty clay loam, clay loam					0.06 - 0.6	1000 - 100			
					38-60	Gravelly sandy loam, gravelly loam, gravelly loamy sand					0.06 - 6	1000 - 10			
5	ToB	Towhee silt loam, 3 to 8 percent slopes	7.13%	64.19%	0-8	silt loam	No			Yes	0.6 - 2	100 - 30	D	0.0-0.5	1.0-2.6
					8-28	silt loam, gravelly silt loam, silty clay loam					0.6 - 2	100 - 30			
					28-63	silt loam, silty clay loam, gravelly silty clay loam					0.06 - 0.2	1000 - 300			
					63-76	clay loam, sandy loam, gravelly sandy loam					0.06 - 0.6	1000 - 100			
6	ArB	Arendtsville gravelly silt loam, 3 to 8 percent slopes	6.52%	70.71%	0-10	Gravelly Silt Loam					0.6 - 6	100 - 10	B	---	---
					10-52	Gravelly Sandy Loam, Clay					0.6 - 6	100 - 10			
					52-81	Gravelly loam, very gravellly sandy loam, very gravelly loam					0.6 - 6	100 - 10			
7	ArC	Arendtsville gravelly silt loam, 8 to 15 percent slopes	5.85%	76.56%	0-10	Gravelly Silt Loam					0.6 - 6	100 - 10	B	---	---
					10-52	Gravelly Sandy Loam, Clay					0.6 - 6	100 - 10			
					52-81	Gravelly loam, very gravellly sandy loam, very gravelly loam					0.6 - 6	100 - 10			
8	ReB	Readington silt loam, 3 to 8 percent slopes	3.96%	80.52%	0-11	silt loam					0.6 - 2	100 - 30	C	1.5-3.0	1.8-3.4
					11-29	loam, channery silt loam, silty clay loam					0.6 - 2	100 - 30			
					29-58	silt loam, channery loam, channery silt loam					0.2 - 0.6	300 - 100			
					58-68	bedrock					0.6 - 6	100 - 10			
9	Ha	Hatboro silt loam	3.89%	84.42%	0-9	silt loam	No			Yes	0.6 - 2	100 - 30	D	0.0-0.5	>6.0
					9-44	silt loam, silty clay loam, sandy clay loam					0.6 - 2	100 - 30			
					44-56	sandy clay loam, sandy loam, silt loam					0.6 - 2	100 - 30			
					56-70	stratified gravelly sand to clay					2 - 6	30 - 10			
10	BwB	Buckingham silt loam, 3 to 8 percent slopes	3.42%	87.83%	0-7	Silt loam					0.6 - 2	100 - 30	C	0.5-1.5	1.8-3.4
					7-30	Silt loam, loam, silty clay loam					0.6 - 2	100 - 30			
					30-44	silt loam, loam, silty clay loam					0.06 - 0.6	1000 - 100			
					44-70	Gravelly silt loam, gravelly loam					0.06 - 0.6	1000 - 100			
11	AbB	Abbottstown silt loam, 3 to 8 percent slopes	3.35%	91.18%	0-10	Silt loam					.6 - 2	100 - 30	C	0.5-1.5	1.3-2.6
					10-20	Silt loam, loam silty clay loam					.6 - 2	100 - 30			
					20-39	Channery silt loam, loam silty clay loam					.06 - .2	1000 - 300			
					39-48	Channery silt loam, loam silty clay loam					.06 - .6	1000 - 100			
					48-58	bedrock					.06 - .6	1000 - 100			

3.2.3 Passer Needs Analysis

A summary of the Passer needs analysis is presented in Table 3.2.10.

Table 3.2.10: Summary of Needs Analysis Information

	Characteristic		Study Area
			Passer
1	Development	Existing	43 Developed of 52 Total parcels
	Flow	Existing(1)	approximately 18,200 gpd
2	Lot Sizes		28.8% of lots under 20,000 ft^2 & 17.3% over 80,000 ft^2
	Zoning		43 parcels classified as VR, or 82.7%
3	Wetlands		No water features or associated wetlands and floodplains within the study area
4	Soil & Geology		Arendtsville soils & Quartz Congolmerate Bedrock
5	Perc Rates		10 – 100 mpi range
6	Depth to Groundwater		Arendtsville soil series has no reported upper or lower limit, which indicates that groundwater is not an issue
7	Slope		The majority of the Passer area has slopes less than 15%
8	Water Supply		There are no public service wells serving the Passer area
9	Required & Available Area		Environmental constraints and poor soils do not appear to be an issue in Passer
10	Needs Definition		18 parcels may have well/septic separation issues

(1) Existing flows are calculated using code flow of 400 gpd for 3 or less bedrooms, and 100 gpd for each additonal bedroom over 3.

1. Development Status and Flow Data

This study area is not sufficient in size to allow for the same reduction in design flow per EDU that is associated with larger systems. The flows for this study area are calculated based on Title 25 code requirements and are presented in Table 3.2.11.

Table 3.2.11: Development Status and Wastewater Flows

Passer Study Area	# Parcels	# EDU[2]	% Study Area	Total Area (acres)	% Study Area	Existing WW Flow (gpd)[1]	Total Future WW Flow (gpd)[1, 2]
Developed	43	45.5	82.7%	63	78.3%	18,200	18,200
Undeveloped	9	TBD	17.3%	18	21.7%	n/a	TBD
Grand Total	52	45.5	100.0%	81	100.0%	18,200	18,200

(1) Existing flows are calculated using code flow of 400 gpd for 3 or less bedrooms, and 100 gpd for each additonal bedroom over 3.
(2) Future flows have not been established for individual study areas.

2. Lot Size and Zoning

Table 2.15.8 shows the lot size distribution for Passer.

Table 2.15.8: Distribution of Lot Sizes Within Passer

Lot Size	Tax Assessors Database- Passer					
	# Parcels	% of Total	Dev. Parcels	% of Total	Undev. Parcels	% of Total
<10,000	0	0.0%	0	0.0%	0	0.0%
10,001-15,000	1	1.9%	0	0.0%	1	11.1%
15,001-20,000	14	26.9%	10	23.3%	4	44.4%
20,001-40,000	16	30.8%	15	34.9%	1	11.1%
40,001-60,000	9	17.3%	9	20.9%	0	0.0%
60,001-80,000	1	1.9%	1	2.3%	0	0.0%
>80,000	9	17.3%	8	18.6%	1	11.1%
No Data	2	3.8%	0	0.0%	2	22.2%
Grand Total	52	100.0%	43	100.0%	9	100.0%

3. Wetlands, Streams and Floodplains

The delineation of wetlands and floodplains in the Passer area, with streams and ponds are shown in the Appendix. There are no water features or associated wetlands and floodplains within the study area. Towhickson Creek is nearby and located to the east of the study area. Cooks Creek flows to the west and south of the study area.

4. Soils and Geology

The predominant soil types in Passer belong to the Arendtsville gravelly silt loam series. There are six lots that contain the Readington soils. Table 3.2.12 shows the properties of the Passer Study Area soils as they effect siting of septic systems.

The underlying geology is a Quartz Conglomerate, as shown in the Appendix. There is no limestone derived bedrock underlying this study area.

Table 3.2.12: Properties of Common Soils in the Passer Study Area

#	USDA Soil Type	USDA Soil Type Description	Soil Type Percentage of Study Area	Cumulative %	Depth (in)	USDA Texture	Permeability (Ksat) (in/hour)	Percolation Rate (min/in)	Hydrologic Group	Water Table Upper Limit	Water Table Lower Limit
1	ArB	Arendtsville gravelly silt loam, 3 to 8 percent slopes	53.62%	53.62%	0-10	Gravelly Silt Loam	0.6 - 6	100 - 10	B	---	---
					10-52	Gravelly Sandy Loam, Clay	0.6 - 6	100 - 10			
					52-81	Gravelly loam, very gravellly sandy loam, very gravelly loam	0.6 - 6	100 - 10			
2	ArC	Arendtsville gravelly silt loam, 8 to 15 percent slopes	26.95%	80.57%	0-10	Gravelly Silt Loam	0.6 - 6	100 - 10	B	---	---
					10-52	Gravelly Sandy Loam, Clay	0.6 - 6	100 - 10			
					52-81	Gravelly loam, very gravellly sandy loam, very gravelly loam	0.6 - 6	100 - 10			
3	ReB	Readington silt loam, 3 to 8 percent slopes	12.17%	92.74%	0-11	silt loam	0.6 - 2	100 - 30	C	1.5-3.0	1.8-3.4
					11-29	loam, channery silt loam, silty clay loam	0.6 - 2	100 - 30			
					29-58	silt loam, channery loam, channery silt loam	0.2 - 0.6	300 - 100			
					58-68	bedrock	0.6 - 6	100 - 10			
4	AbB	Abbottstown silt loam, 3 to 8 percent slopes	7.26%	100.00%	0-10	Silt loam	.6 - 2	100 - 30	C	0.5-1.5	1.3-2.6
					10-20	Silt loam, loam silty clay loam	.6 - 2	100 - 30			
					20-39	Channery silt loam, loam silty clay loam	.06 - .2	1000 - 300			
					39-48	Channery silt loam, loam silty clay loam	.06 - .6	1000 - 100			
					48-58	bedrock	.06 - .6	1000 - 100			
		TOTAL:	**100.00%**								

4.1. Validation of Soils Attributes in Passer

Soil testing data was taken from the BOH records for representative parcels in the area. The percolation and depth to groundwater data from the files correlated well with the USDA soil survey data for the Arendstville and Readington soil types.

5. Percolation Rates

The Arendtsville soils have percolation rates in the 10 – 100 mpi range. There are 6 lots that have the Readington soils. These soils have a potentially restrictive layer that may complicate siting a compliant drainfield.

6. Depth to Groundwater

The Arendtsville soil series has no reported upper or lower limit, which indicates that groundwater is not an issue. The Readington soils have high groundwater conditions that will likely require an elevated sand mound system, however do not appear to prohibit an on-lot solution. The depth to groundwater derived from soils data is shown in the Appendix.

7. Slope

The majority of the Passer area has slopes less than 15%. There are ten lots that have slopes that may restrict the area available for siting a septic system, and no lots with slopes in excess of 15%.

The relative slopes covering Passer are shown in the Appendix.

8. Water Supply

There are no public service wells serving the Passer area. Individual water supply wells are assumed to supply water to the homes in this study area. There are a significant number of lots that are potentially affected by the water supply well buffer zones.

9. Individual Wastewater System Required Area vs. Available Area

Environmental constraints and poor soils do not appear to be an issue in Passer, with the exception of a limited number of parcels likely requiring a mounded system. The most significant potential impact on the available area in Passer is the water supply well buffer area.

10. Need Definition

Table 3.2.13 summarizes the needs for the Passer area. There are 18 parcels that appear to be too small as a result of the water supply well buffer area. There are eight parcels that will likely require mounded systems due to shallow, but not prohibitive depth to groundwater. There are no parcels that appear to require variances, and/or non standard systems, as failing systems are remediated or new systems installed, for any other reason than potential encroachment on the water supply well buffer area. A water supply solution may be the most cost effective solution to the needs in the Passer Study Area, should well/septic separation prove to be an issue.

Table 3.2.13: Needs Definition- Passer

	Passer Study Area Parcels	Variance or Advanced Treatment System Required[1]						Conventional On-Lot System Feasible				
		Enviro. Constraint	Potential Water Supply Solution	Perc Rate	Depth to Limiting Zone	Total	% Study Area Parcels	Standard System	Elevated Sand Mound	Sub-surface Sand Filter	Total On-Lot	% Study Area Parcels
Developed	43	0	18	0	0	18	34.6%	17	8	0	25	48.1%
Undeveloped	9	1	4	0	0	5	9.6%	2	0	0	2	3.8%
Total	52	1	22	0	0	23	44.2%	19	8	0	27	51.9%

[1] For repairs or new construction. Does not apply to existing systems that are not identified as failing.

[2] The Sum of the two "% of Study Area Parcels" columns does not equal 100% as a result of parcels with Tax Assessors records and no corresponding GIS shape files.

3.2.4 Pleasant Valley Needs Analysis

A summary of the Pleasant Valley needs analysis is presented in Table 3.2.14.

Table 3.2.14: Summary of Needs Analysis Information

	Characteristic		Study Area
			Pleasant Valley
1	Development	Existing	66 Developed of 75 Total parcels
	Flow	Existing(1)	approximately 25,400 gpd
2	Lot Sizes		36% of lots under 20,000 ft^2 & 22.7% over 80,000 ft^2
	Zoning		39 parcels classified as VR, or 52%
3	Wetlands		Cooks Creek flows through the southeast edge of the study area
4	Soil & Geology		Urban, Penn channery & Reaville
5	Perc Rates		10 – 100 mpi
6	Depth to Groundwater		The majority of Pleasant Valley had a depth to groundwater greater than 5 feet
7	Slope		Slopes in excess of 25% cover approximately 8 of the developed lots
8	Water Supply		There are no public service wells serving the Pleasant Valley area
9	Required & Available Area		Environmental constraints and the water supply well buffer area & Depth to Limiting Layer
10	Needs Definition		44 parcels, or 59.5%, are environmentally constrained

(1) Existing flows are calculated using code flow of 400 gpd for 3 or less bedrooms, and 100 gpd for each additonal bedroom over 3.

1. Development Status and Flow Data

This study area is not sufficient in size to allow for the reduction in design flow associated with larger systems. The flows are calculated based on Title 25 code requirements.

Table 3.2.15: Development Status and Wastewater Flows

Pleasant Valley Study Area	# Parcels	# EDU[2]	% Study Area	Total Area (acres)	% Study Area	Existing WW Flow (gpd)[1]	Total Future WW Flow (gpd)[1, 2]
Developed	**66**	**63.5**	**88.0%**	**124**	**96.9%**	**25,400**	**25,400**
Undeveloped	**9**	**TBD**	**12.0%**	**4**	**3.1%**	**n/a**	**TBD**
Grand Total	**75**	**63.5**	**100.0%**	**128**	**100.0%**	**25,400**	**25,400**

(1) Existing flows are calculated using code flow of 400 gpd for 3 or less bedrooms, and 100 gpd for each additional bedroom over 3.
(2) Future flows have not been established for individual study areas.

2. Lot Size and Zoning

Table 2.15.11 shows the lot size distribution for Pleasant Valley. There are 13 parcels with total area less than 15,000 ft^2 and an additional 11 with less than 20,000 ft^2.

Table 2.15.11: Distribution of Lot Sizes Within Pleasant Valley

Lot Size	Tax Assessors Database- Pleasant Valley					
	# Parcels	% of Total	Dev. Parcels	% of Total	Undev. Parcels	% of Total
<10,000	7	9.3%	3	4.5%	4	44.4%
10,001-15,000	6	8.0%	5	7.6%	1	11.1%
15,001-20,000	11	14.7%	9	13.6%	2	22.2%
20,001-40,000	20	26.7%	19	28.8%	1	11.1%
40,001-60,000	7	9.3%	7	10.6%	0	0.0%
60,001-80,000	6	8.0%	6	9.1%	0	0.0%
>80,000	17	22.7%	16	24.2%	1	11.1%
No Data	1	1.3%	1	1.5%	0	0.0%
Grand Total	**75**	100.0%	**66**	100.0%	**9**	100.0%

3. Wetlands, Streams and Floodplains

The delineation of wetlands and floodplains in the Pleasant Valley area, with streams and ponds are shown in the Appendix. Cooks Creek flows through the southeast edge of the study area. There is one tributary to Cooks Creek that flows through developed lots in the study area. The wetlands and floodplains in and around the area are associated with these two streams.

4. Soils and Geology

The predominant soil type for developed properties in Pleasant Valley is Urban-Penn (UxB). Penn channery silt loam (PeB), and Klinesville very channery silt loam (KlD). Table 3.2.16 shows the properties of the Pleasant Valley Study Area soils as they effect siting of septic systems.

The bedrock beneath Pleasant Valley is Mudstone. For the PeB and KlD soil types, the bedrock is very shallow, with soils survey data indicating depths between 32”- 42” and 18”- 28” respectively, from the surface.

4.1. Validation of Soils Attributes in Pleasant Valley

Soil testing data was taken from the BOH records from representative parcels in the area. The data collected correlated well with the USDA soil survey data for the predominant soil types in the study area.

5. Percolation Rates

There is no data for the percolation rates associated with the Urban soils. For the PeB and KlD soil types, the USDA reported percolation rates are between 10 – 100 mpi.

6. Depth to Groundwater

No data is available on depth to groundwater associated with the Urban soil series. The depth to groundwater mapping data, taken from the USDA Soil Data Viewer is shown in the Appendix. The majority of Pleasant Valley had a depth to groundwater greater than 5 feet. Areas close to the streams and one parcel located in the northeast of the study area have reported depths to groundwater less than 5 feet.

7. Slope

Slopes in excess of 25% cover approximately 8 of the developed lots. These lots are located in the south end of the study area. The remaining lots have reported slopes of less than 8%.

The relative slopes covering Pleasant Valley are shown in the Appendix.

8. Water Supply

There are no public service wells serving the Pleasant Valley area. All lots in this study area are assumed to be serviced by individual water supply wells. There is a 100’ setback requirement for water supply wells. This translates to 31,400 ft^2 of area that would not be available for siting a septic system.

9. Individual Wastewater System Required Area vs. Available Area

The most significant impacts on the available area in Pleasant Valley are environmental constraints and the water supply well buffer area. Lots appear to have sufficient size when not constrained by one or both of these issues.

10. Need Definition

Table 3.2.17 summarizes the needs analysis for the Pleasant Valley study area. There are 25 developed lots that do not appear to have sufficient available area due to water supply well buffer areas. There are eight developed lots that appear to be environmentally constrained. Three developed lots appear to have issues with depth to limiting zone. As potential water supply contamination appears to be the biggest issue in Pleasant Valley, a water supply solution may be the best alternative.

Table 3.2.17: Needs Definition- Pleasant Valley

	Pleasant Valley Study Area Parcels	Variance or Advanced Treatment System Required[1]						Conventional On-Lot System Feasible				
		Enviro. Constraint	Potential Water Supply Solution	Perc Rate	Depth to Limiting Zone	Total	% Study Area Parcels	Standard System	Elevated Sand Mound	Sub-surface Sand Filter	Total On-Lot	% Study Area Parcels
Developed	66	8	25	0	3	36	48.0%	1	28	0	29	38.7%
Undeveloped	9	7	1	0	0	8	10.7%	0	1	0	1	1.3%
Total	75	15	26	0	3	44	58.7%	1	29	0	30	40.0%

[1] For repairs or new construction. Does not apply to existing systems that are not identified as failing.

[2] The Sum of the two "% of Study Area Parcels" columns does not equal 100% as a result of parcels with Tax Assessors records and no corresponding GIS shape files.

Table 3.2.16: Properties of Common Soils in the Pleasant Valley Study Area

#	USDA Soil Type	USDA Soil Type Description	Soil Type Percentage of Study Area	Cumulative %	Depth (in)	USDA Texture	Suitability for septic disposal	Suitability for sand mounds	Suitability for spray irrigation	Hydric Soils	Alluvial soil	Permeability (Ksat) (in/hour)	Percolation Rate (min/in)	Hydrologic Group	Water Table Upper Limit	Water Table Lower Limit
1	UxB	Urban land-Penn complex, 0 to 8 percent slopes	41.46%	41.46%	0-6	variable										
2	PeB	Penn channery silt loam, 3 to 8 percent slopes	19.91%	61.37%	0-8	channery silt loam	No	Yes	Yes			0.6 - 6	100 - 10	C	---	---
					8-21	channery silt loam, channery loam, channery silty clay loam						0.6 - 6	100 - 10			
					21-34	very channery silt loam, very channery loam						0.6 - 6	100 - 10			
					34-44	bedrock						0.2 - 6	300 - 10			
3	RlB	Reaville channery silt loam, 3 to 8 percent slopes	11.56%	72.93%	0-8	channery silt loam	No					0.6 - 2	100 - 30	C	0.5-3.0	>6.0
					8-19	silt loam, channery silt loam, channery silty clay loam						0.06 - 0.2	1000 - 300			
					19-32	channery silt loam, very channery silt loam, very channery loam						0.06 - 0.2	1000 - 300			
					32-42	bedrock						0.06 - 2	1000 - 30			
4	BwB	Buckingham silt loam, 3 to 8 percent slopes	7.54%	80.47%	0-7	Silt loam						0.6 - 2	100 - 30	C	0.5-1.5	1.8-3.4
					7-30	Silt loam, loam, silty clay loam						0.6 - 2	100 - 30			
					30-44	silt loam, loam, silty clay loam						0.06 - 0.6	1000 - 100			
					44-70	Gravelly silt loam, gravelly loam						0.06 - 0.6	1000 - 100			
5	KlD	Klinesville very channery silt loam, 15 to 25 percent slopes	6.65%	87.12%	0-8	very channery silt loam						2 - 6	30 - 10	C	---	---
					8-14	channery silt loam, very channery silt loam						2 - 6	30 - 10			
					14-18	channery silt loam, very channery silt loam, extremely channery silt loam						2 - 6	30 - 10			
					18-28	bedrock						0.2 - 2	300 - 30			
6	PkC	Penn-Klinesville channery silt loams, 8 to 15 percent slopes	5.58%	92.70%	0-8	channery silt loam						0.6 - 6	100 - 10	C	---	---
					8-21	channery silt loam, channery loam, channery silty clay loam						0.6 - 6	100 - 10			
					21-34	very channery silt loam, very channery loam						0.6 - 6	100 - 10			
					34-44	bedrock						0.2 - 6	300 - 10			
7	ReB	Readington silt loam, 3 to 8 percent slopes	4.58%	97.28%	0-11	silt loam						0.6 - 2	100 - 30	C	1.5-3.0	1.8-3.4
					11-29	loam, channery silt loam, silty clay loam						0.6 - 2	100 - 30			
					29-58	silt loam, channery loam, channery silt loam						0.2 - 0.6	300 - 100			
					58-68	bedrock						0.6 - 6	100 - 10			
8	Bo	Bowmansville-Knauers silt loams	2.06%	99.34%	0-7	Silt loam	No			Yes	Yes	0.6 - 2	100 - 30	B/D	0.5-1.5	>6
					7-26	Silt loam, clay loam, sandy clay loam						0.2 - 0.6	300 - 100			
					26-43	silty clay loam, fine sandy loam, gravelly silt loam						0.2 - 2	300 - 30			
					43-65	gravelly sandy loam, stratified gravel to sand						2 - 6	30 - 10			
9	Ro	Rowland silt loam	0.52%	99.87%	0-12	Silt loam						0.2 - 2	300 - 30	C	1.0-3.0	>6
					12-34	silt loam, channery silt loam, channery silty clay loam						0.2 - 2	300 - 30			
					34-46	Sandy clay, silt loam, gravelly silty clay loam						0.2 - 2	300 - 30			
					46-61	Stratified gravel to sand loam						2 - 6	30 - 10			
10	PkB	Penn-Klinesville channery silt loams, 3 to 8 percent slopes	0.13%	100.00%	0-8	channery silt loam						0.6 - 6	100 - 10	C	---	---
					8-21	channery silt loam, channery loam, channery silty clay loam						0.6 - 6	100 - 10			
					21-34	very channery silt loam, very channery loam						0.6 - 6	100 - 10			
					34-44	bedrock						0.2 - 6	300 - 10			
		TOTAL:	**100.00%**													

3.2.5 Development District Needs Analysis

A summary of the Development District needs analysis is presented in Table 3.2.18.

Table 3.2.18: Summary of Needs Analysis Information

	Characteristic		Study Area: Development District
1	Development	Existing	59 Developed of 81 Total parcels
1	Flow	Existing(1)	approximately 25,305 gpd
2	Lot Sizes		28.4% of lots under 20,000 ft^2 & 54.3% over 80,000 ft^2
2	Zoning		42 parcels classified as DD, or 51.9%
3	Wetlands		There are two tributaries to Towhickson Creek that flow through the study area
4	Soil & Geology		Urban, Towhee, Neshaminy & Mt. Lucas soils; Diabase & Mudstone bedrock
5	Perc Rates		10 - 100 mpi; potential for shallow bedrock
6	Depth to Groundwater		Depth to groundwater is a significant issue throughout the Development District
7	Slope		Many of the parcels that lie outside the high groundwater areas are subject to potentially prohibitive slopes
8	Water Supply		There are no public service wells serving the Development District area
9	Required & Available Area		There are not many developed parcels in the Development District
10	Needs Definition		15 parcels appear to have issues with depth to limiting layer; 14 parcels have possible well/septic separation issues

(1) Existing flows are calculated using code flow of 400 gpd for 3 or less bedrooms, and 100 gpd for each additonal bedroom over 3.

Development Status and Flow Data

This study area is not sufficient in size to allow for the reduction in design flow associated with larger systems. Table 3.2.19 shows the flows calculated based on Title 25 code requirements.

Table 3.2.19: Development Status and Wastewater Flows

Development District Study Area	# Parcels	# EDU[2]	% Study Area	Total Area (acres)	% Study Area	Existing WW Flow (gpd)[1]	Total Future WW Flow (gpd)[1, 2]
Developed	59	63.3	72.8%	263	68.5%	25,305	25,305
Undeveloped	22	TBD	27.2%	121	31.5%	n/a	TBD
Grand Total	81	63.3	100.0%	384	100.0%	25,305	25,305

(1) Existing flows are calculated using code flow of 400 gpd for 3 or less bedrooms, and 100 gpd for each additional bedroom over 3.

(2) Future flows have not been established for individual study areas.

2. Lot Size

Table 2.15.14 shows the distribution of lot sizes in the Development District. There are only 4 lots with less than 20,000 ft^2 of total area, of which 3 are developed.

Table 2.15.14: Distribution of Lot Sizes- Development District

Lot Size	Tax Assessors Database- Development District					
	# Parcels	% of Total	Dev. Parcels	% of Total	Undev. Parcels	% of Total
<10,000	0	0.0%	0	0.0%	0	0.0%
10,001-15,000	0	0.0%	0	0.0%	0	0.0%
15,001-20,000	4	4.9%	3	5.1%	1	4.5%
20,001-40,000	19	23.5%	19	32.2%	0	0.0%
40,001-60,000	7	8.6%	5	8.5%	2	9.1%
60,001-80,000	4	4.9%	2	3.4%	2	9.1%
>80,000	44	54.3%	30	50.8%	14	63.6%
No Data	3	3.7%	0	0.0%	3	13.6%
Grand Total	81	100.0%	59	100.0%	22	100.0%

3. Wetlands, Streams and Floodplains

The delineation of wetlands and floodplains in the Development District area, with streams and ponds are shown in the Appendix. There are two tributaries to Towhickson Creek that flow through the study area. The one hundred year floodplain and wetland buffer areas corresponding to these tributaries are prevalent in the Development District.

4. Soils and Geology

The predominant soil types in the Development District Study Area belong to the Towhee, Urban, Neshaminy and Mount Lucas series. Table 3.2.20 shows the properties of the Development District Study Area soils as they effect siting of septic systems.

The underlying geology of the study area is Diabase and Mudstone. There is no limestone derived bedrock underlying parcels in this study area.

4.1. Validation of Soils Attributes in Development District

There majority of developed parcels within the Development District are on Urban soils, for which there is no USDA reported data for percolation rates or depth to groundwater. Soil testing data was taken from the BOH records from representative parcels in the area. The percolation and depth to groundwater data from the files were used to assign representative percolation rates and depth to groundwater associated with soils in this area.

5. Percolation Rates

There is no data for the percolation rates associated with the Urban soils. The remaining soils show the potential for shallow bedrock. The depth of soil above the bedrock has reported percolation rates between 10 – 100 mpi.

6. Depth to Groundwater

The predominant soil types in the Development District have high groundwater. Depth to groundwater is a significant issue throughout the Development District. Parcels on the outer edges of the study area have greater depths to groundwater, making wastewater dispersal more viable in this area.

7. Slope

The majority of the parcels that lie outside the high groundwater areas are subject to potentially prohibitive slopes.

The relative slopes covering the Development District are shown in the Appendix.

8. Water Supply

There are no public service wells serving the Development District area. All lots in this study area are assumed to be serviced by individual water supply wells and therefore subject to the water supply well buffer area.

9. Individual Wastewater System Required Area vs. Available Area

There are not many developed parcels in the Development District. The ones that are appear to have insufficient available area when water supply well buffer area are taken into account.

10. Need Definition

Table 3.2.21 summarizes the needs analysis for the Development District. The existing needs of this study area are confined to the parcels along Hilltop Road, with one parcel along Old Bethlehem Pike appearing to require an offsite solution, upon failure or installation of a new system. However, this area has been targeted for future growth. As such, public water and sewer are desired, according to the 2002 Comprehensive Plan. The projected buildout for this area will require a treatment system and disposal site. There are very few candidate parcels for siting a treatment and dispersal system. Of the properties outside the high groundwater areas, only two appear to have slopes that are below the 8-15% range. These are located in the southeastern corner of the study area. 15 developed parcels appear to have insufficient depth to limiting zone. In addition, 14 developed lots may have difficulty maintaining the 100 ft. buffer zone around their water supply wells.

Table 3.2.21: Needs Definition- Development District

	Development District Study Area Parcels	Variance or Advanced Treatment System Required[1]						Conventional On-Lot System Feasible				
		Enviro. Constraint	Potential Water Supply Solution	Perc Rate	Depth to Limiting Zone	Total	% Study Area Parcels	Standard System	Elevated Sand Mound	Sub-surface Sand Filter	Total On-Lot	% Study Area Parcels
Developed	59	0	14	0	15	29	35.8%	28	2	0	30	37.0%
Undeveloped	22	0	1	0	7	8	9.9%	8	1	2	11	13.6%
Total	81	0	15	0	22	37	45.7%	36	3	2	41	50.6%

[1] For repairs or new construction. Does not apply to existing systems that are not identified as failing.

[2] The Sum of the two "% of Study Area Parcels" columns does not equal 100% as a result of parcels with Tax Assessors records and no corresponding GIS shape files.

Table 3.2.20: Properties of Common Soils in the Designated Development Study Area

#	USDA Soil Type	USDA Soil Type Description	Soil Type Percentage of Study Area	Cumulative %	Depth (in)	USDA Texture	Suitability for septic disposal	Suitability for sand mounds	Suitability for spray irrigation	Hydric Soils	Alluvial soil	Permeability (Ksat) (in/hour)	Percolation Rate (min/in)	Hydrologic Group	Water Table Upper Limit	Water Table Lower Limit
1	**ToA**	Towhee silt loam, 0 to 3 percent slopes	13.20%	13.20%	0-8	silt loam						0.6 - 2	100 - 30	D	0.0-0.5	1.0-2.6
					8-28	silt loam, gravelly silt loam, silty clay loam						0.6 - 2	100 - 30			
					28-63	silt loam, silty clay loam, gravelly silty clay loam						0.06 - 0.2	1000 - 300			
					63-76	clay loam, sandy loam, gravelly sandy loam						0.06 - 0.6	1000 - 100			
2	**NbB**	Neshaminy silt loam, 3 to 8 percent slopes	12.04%	25.24%	0-9	Silt Loam						0.6 - 2	100 - 30	B	---	---
					9-52	Silt loam, gravelly clay loam, gravelly sandy clay loam						0.2 - 0.6	300 - 100			
					52-54	Silt loam, very gravelly clay loam, gravelly sandy clay loam						0.2 - 0.6	300 - 100			
					54-64	bedrock						0.2 - 2	300 - 30			
3	**MlB**	Mount Lucas silt loam, 3 to 8 percent slopes	10.50%	35.74%	0-9	silt loam			Yes			0.6 - 2	100 - 30	C	0.5-3.0	1.8-2.9
					9-38	Silt loam, gravelly silty clay loam, clay loam						0.06 - 0.6	1000 - 100			
					38-60	Gravelly sandy loam, gravelly loam, gravelly loamy sand						0.06 - 6	1000 - 10			
4	**NbC**	Neshaminy silt loam, 8 to 15 percent slopes	10.45%	46.19%	0-9	Silt Loam						0.6 - 2	100 - 30	B	---	---
					9-52	Silt loam, gravelly clay loam, gravelly sandy clay loam						0.2 - 0.6	300 - 100			
					52-54	Silt loam, very gravelly clay loam, gravelly sandy clay loam						0.2 - 0.6	300 - 100			
					54-64	bedrock						0.2 - 2	300 - 30			
5	**NhD**	Neshaminy gravelly silt loam, 8 to 25 percent slopes, extremely bouldery	8.31%	54.50%	0-5	silt loam	No					0.6 - 2	100 - 30	B	---	---
					5-52	silt loam, gravelly clay loam, gravelly sandy clay loam						0.2 - 0.6	300 - 100			
					52-54	silt loam, very gravelly sandy loam, gravelly sandy clay loam						0.2 - 0.6	300 - 100			
					54-64	bedrock						0.2 - 2	300 - 30			
6	**UvB**	Urban land-Neshaminy complex, 0 to 8 percent slopes	8.06%	62.56%	0-6	variable										
7	**TpB**	Towhee-Glenville silt loams, 0 to 8 percent slopes, extremely stony	7.13%	69.69%	0-7	silt loam						0.6 - 2	100 - 30	D	0.0-0.5	1.8-2.6
					7-28	silt loam, gravelly silt loam, silty clay loam						0.6 - 2	100 - 30			
					28-63	silt loam, silty clay loam, gravelly silty clay loam						0.06 - 0.2	1000 - 300			
					63-76	clay loam, sandy loam, gravelly sandy loam						0.06 - 0.6	1000 - 100			
8	**Ha**	Hatboro silt loam	6.78%	76.47%	0-9	silt loam	No			Yes		0.6 - 2	100 - 30	D	0.0-0.5	>6.0
					9-44	silt loam, silty clay loam, sandy clay loam						0.6 - 2	100 - 30			
					44-56	sandy clay loam, sandy loam, silt loam						0.6 - 2	100 - 30			
					56-70	stratified gravelly sand to clay						2 - 6	30 - 10			
9	**MmD**	Mount Lucas silt loam, 8 to 25 percent slopes, extremely stony	6.36%	82.83%	0-9	silt loam						0.6 - 2	100 - 30	C	0.5-3.0	1.8-2.9
					9-38	Silt loam, gravelly silty clay loam, sandy clay loam, clay loam						0.06 - 0.6	1000 - 100			
					38-60	Gravelly clay loam, gravelly sandy loam, gravelly loam, gravelly loamy sand						0.06 - 6	1000 - 10			
10	**UfuB**	Urban land, 0 to 8 percent slopes	4.82%	87.65%	0-6	variable										
11	**NhB**	Neshaminy gravelly silt loam, 0 to 8 percent slopes, extremely bouldery	3.07%	90.72%	0-9	Silt Loam	Moderate		Yes			0.6 - 2	100 - 30	B	---	---
					9-52	Silt loam, gravelly clay loam, gravelly sandy clay loam						0.2 - 0.6	300 - 100			
					52-54	Silt loam, very gravelly clay loam, gravelly sandy clay loam						0.2 - 0.6	300 - 100			
					54-64	bedrock						0.2 - 2	300 - 30			
12	**MmB**	Mount Lucas silt loam, 0 to 8 percent slopes, extremely stony	2.99%	93.71%	0-9	silt loam						0.6 - 2	100 - 30	C	0.5-3.0	1.8-2.9
					9-38	Silt loam, gravelly silty clay loam, sandy clay loam, clay loam						0.06 - 0.6	1000 - 100			
					38-60	Gravelly sandy loam, gravelly loam, gravelly loamy sand						0.06 - 6	1000 - 10			
13	**ArB**	Arendtsville gravelly silt loam, 3 to 8 percent slopes	2.02%	95.73%	0-10	Gravelly Silt Loam						0.6 - 6	100 - 10	B	---	---
					10-52	Gravelly Sandy Loam, Clay						0.6 - 6	100 - 10			
					52-81	Gravelly loam, very gravellly sandy loam, very gravelly loam						0.6 - 6	100 - 10			
14	**ArC**	Arendtsville gravelly silt loam, 8 to 15 percent slopes	1.89%	97.62%	0-10	Gravelly Silt Loam						0.6 - 6	100 - 10	B	---	---
					10-52	Gravelly Sandy Loam, Clay						0.6 - 6	100 - 10			
					52-81	Gravelly loam, very gravellly sandy loam, very gravelly loam						0.6 - 6	100 - 10			
15	**MlA**	Mount Lucas silt loam, 0 to 3 percent slopes	1.25%	98.87%	0-9	silt loam			Yes			0.6 - 2	100 - 30	C	0.5-3.0	1.8-2.9
					9-38	Silt loam, gravelly silty clay loam, clay loam						0.06 - 0.6	1000 - 100			
					38-60	Gravelly sandy loam, gravelly loam, gravelly loamy sand						0.06 - 6	1000 - 10			
16	**BwB**	Buckingham silt loam, 3 to 8 percent slopes	1.08%	99.95%	0-7	Silt loam						0.6 - 2	100 - 30	C	0.5-1.5	1.8-3.4
					7-30	Silt loam, loam, silty clay loam						0.6 - 2	100 - 30			
					30-44	silt loam, loam, silty clay loam						0.06 - 0.6	1000 - 100			
					44-70	Gravelly silt loam, gravelly loam						0.06 - 0.6	1000 - 100			
17	**ToB**	Towhee silt loam, 3 to 8 percent slopes	0.04%	99.99%	0-8	silt loam	No			Yes		0.6 - 2	100 - 30	D	0.0-0.5	1.0-2.6
					8-28	silt loam, gravelly silt loam, silty clay loam						0.6 - 2	100 - 30			
					28-63	silt loam, silty clay loam, gravelly silty clay loam						0.06 - 0.2	1000 - 300			
					63-76	clay loam, sandy loam, gravelly sandy loam						0.06 - 0.6	1000 - 100			
18	**UvD**	Urban land-Neshaminy complex, 8 to 25 percent slopes	0.01%	100.00%	0-6	variable										
		TOTAL:	**100.00%**													

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3.2.6 Route 309 Area Needs Analysis

A summary of the Route 309 Study Area needs analysis is presented in Table 3.2.22.

Table 3.2.22: Summary of Needs Analysis Information

	Characteristic		Study Area Route 309
1	Development	Existing	30 Developed of 56 Total parcels
	Flow	Existing(1)	approximately 17,205 gpd
2	Lot Sizes		23.1% of lots under 20,000 ft^2 & 39.3% over 80,000 ft^2
	Zoning		32 parcels classified as HC, or 57.1%
3	Wetlands		The majority of this area is low-lying and within wetland and floodplain buffer areas
4	Soil & Geology		Towhee, Urban & Neshaminy soils
5	Perc Rates		10 – 100 mpi
6	Depth to Groundwater		The majority of Pleasant Valley had a depth to groundwater greater than 5 feet
7	Slope		The 309 study area is relatively flat
8	Water Supply		There are no public service wells serving the Route 309 area
9	Required & Available Area		
10	Needs Definition		31 parcels, or 56.4%, are environmentally constrained

(1) Existing flows are calculated using code flow of 400 gpd for 3 or less bedrooms, and 100 gpd for each additonal bedroom over 3.

1. Development Status and Flow Data

This study area is predominantly made up of commercial properties. For these properties, the permit flows from the Township files were used.

Table 3.2.23: Development Status and Wastewater Flows

Route 309 Study Area	# Parcels	# EDU[2]	% Study Area	Total Area (acres)	% Study Area	Existing WW Flow (gpd)[1]	Total Future WW Flow (gpd)[1, 2]
Developed	30	43.0	53.6%	107	61.0%	17,205	17,205
Undeveloped	26	TBD	46.4%	69	39.0%	n/a	TBD
Grand Total	56	43.0	100.0%	176	100.0%	17,205	17,205

(1) Existing flows are calculated using code flow of 400 gpd for 3 or less bedrooms, and 100 gpd for each additional bedroom over 3.
(2) Future flows have not been established for individual study areas.

2. Lot Size

Table 2.15.17: Distribution of Lot Sizes- Route 309 Study Area

Lot Size	Tax Assessors Database- Route 309					
	# Parcels	% of Total	Dev. Parcels	% of Total	Undev. Parcels	% of Total
<10,000	5	8.9%	0	0.0%	5	19.2%
10,001-15,000	4	7.1%	1	3.3%	3	11.5%
15,001-20,000	4	7.1%	3	10.0%	1	3.8%
20,001-40,000	9	16.1%	4	13.3%	5	19.2%
40,001-60,000	7	12.5%	3	10.0%	4	15.4%
60,001-80,000	4	7.1%	2	6.7%	2	7.7%
>80,000	22	39.3%	17	56.7%	5	19.2%
No Data	1	1.8%	0	0.0%	1	3.8%
Grand Total	56	100.0%	30	100.0%	26	100.0%

3. Wetlands, Streams and Floodplains

The delineation of wetlands and floodplains in the Route 309 area, with streams and ponds are shown in the Appendix. The majority of this area is low-lying and within wetland and floodplain buffer areas. There is a tributary to Towhickson Creek that flows through the east side of the study area.

4. Soils and Geology

The predominant soil types in the Route 309 Study Area belong to the Urban, Towhee, Neshaminy and Mount Lucas series. Figure 3.2.24 shows the properties of the Route 309 Study Area soils as they effect siting of septic systems.

The underlying bedrock for the study area is Diabase with a very small portion in the northeast corner of the study area being Mudstone. There is no limestone derived bedrock underlying this study area.

4.1. Validation of Soils Attributes in Route 309

Soil testing data was taken from the BOH records from representative parcels in the area.

5. Percolation Rates

There is no data for the percolation rates associated with the Urban soils. For the limited depth of soil above the bedrock in the developed parcels, the percolation rates, as observed in a limited sampling of BOH files, are between 10 – 100 mpi.

6. Depth to Groundwater

No data is available on depth to groundwater associated with the Urban soil series. Depth to groundwater data, derived from the USDA Soil Data Viewer data, is shown in the Appendix. The majority of the Route 309 Study Area had a depth to groundwater greater than 5 feet. Areas close to the streams and one parcel located in the northeast of the study area have reported depths to groundwater less than 5 feet.

7. Slope

The 309 study area is relatively flat, with the exception being the northern edge of the study area, which has slopes in excess of 25%. The relative slopes covering the Route 309 study area are shown in the Appendix.

8. Water Supply

There are no public service wells serving the Route 309 area. All lots in this study area are assumed to be serviced by individual water supply wells, and therefore subject to the water supply well buffer area.

9. Individual Wastewater System Required Area vs. Available Area

Environmental constraints cover a significant number of properties in this study area. The majority of the parcels are large lots that, even when partially constrained, have an excess of available area.

10. Need Definition

There are five developed parcels within this study area that are environmentally constrained and may require variances and/or non-standard treatment systems, as failing systems are remediated or new systems installed. An additional two parcels appear to have issues with depth to limiting zone, in this case groundwater. There are seven developed parcels that may have issues with separation of drinking water wells and septic systems. Nearly half of the currently developed parcels in this study area will require greater than average oversight for proper management.

Table 3.2.25: Needs Definition- Route 309

	Route 309 Study Area Parcels	Variance or Advanced Treatment System Required[1]						Conventional On-Lot System Feasible				
		Enviro. Constraint	Potential Water Supply Solution	Perc Rate	Depth to Limiting Zone	Total	% Study Area Parcels	Standard System	Elevated Sand Mound	Sub-surface Sand Filter	Total On-Lot	% Study Area Parcels
Developed	30	5	7	0	2	14	25.0%	8	8	0	16	28.6%
Undeveloped	26	8	6	0	3	17	30.4%	2	6	0	8	14.3%
Total	56	13	13	0	5	31	55.4%	10	14	0	24	42.9%

[1] For repairs or new construction. Does not apply to existing systems that are not identified as failing.

[2] The Sum of the two "% of Study Area Parcels" columns does not equal 100% as a result of parcels with Tax Assessors records and no corresponding GIS shape files.

Table 3.2.24: Properties of Common Soils in the Route 309 Study Area

#	USDA Soil Type	USDA Soil Type Description	Soil Type Percentage of Study Area	Cumulative %	Depth (in)	USDA Texture	Suitability for septic disposal	Suitability for spray irrigation	Permeability (Ksat) (in/hour)	Percolation Rate (min/in)	Hydrologic Group	Water Table Upper Limit	Water Table Lower Limit
1	**TpB**	Towhee-Glenville silt loams, 0 to 8 percent slopes, extremely stony	28.66%	28.66%	0-7	silt loam			0.6 - 2	100 - 30	D	0.0-0.5	1.8-2.6
					7-28	silt loam, gravelly silt loam, silty clay loam			0.6 - 2	100 - 30			
					28-63	silt loam, silty clay loam, gravelly silty clay loam			0.06 - 0.2	1000 - 300			
					63-76	clay loam, sandy loam, gravelly sandy loam			0.06 - 0.6	1000 - 100			
2	**UfuB**	Urban land, 0 to 8 percent slopes	16.88%	45.55%	0-6	variable							
3	**NhB**	Neshaminy gravelly silt loam, 0 to 8 percent slopes, extremely bouldery	15.63%	61.17%	0-9	Silt Loam	Moderate	Yes	0.6 - 2	100 - 30	B	---	---
					9-52	Silt loam, gravelly clay loam, gravelly sandy clay loam			0.2 - 0.6	300 - 100			
					52-54	Silt loam, very gravelly clay loam, gravelly sandy clay loam			0.2 - 0.6	300 - 100			
					54-64	bedrock			0.2 - 2	300 - 30			
4	**MmB**	Mount Lucas silt loam, 0 to 8 percent slopes, extremely stony	14.97%	76.15%	0-9	silt loam			0.6 - 2	100 - 30	C	0.5-3.0	1.8-2.9
					9-38	Silt loam, gravelly silty clay loam, sandy clay loam, clay loam			0.06 - 0.6	1000 - 100			
					38-60	Gravelly sandy loam, gravelly loam, gravelly loamy sand			0.06 - 6	1000 - 10			
5	**MIB**	Mount Lucas silt loam, 3 to 8 percent slopes	6.96%	83.10%	0-9	silt loam		Yes	0.6 - 2	100 - 30	C	0.5-3.0	1.8-2.9
					9-38	Silt loam, gravelly silty clay loam, clay loam			0.06 - 0.6	1000 - 100			
					38-60	Gravelly sandy loam, gravelly loam, gravelly loamy sand			0.06 - 6	1000 - 10			
6	**NbB**	Neshaminy silt loam, 3 to 8 percent slopes	5.94%	89.05%	0-9	Silt Loam			0.6 - 2	100 - 30	B	---	---
					9-52	Silt loam, gravelly clay loam, gravelly sandy clay loam			0.2 - 0.6	300 - 100			
					52-54	Silt loam, very gravelly clay loam, gravelly sandy clay loam			0.2 - 0.6	300 - 100			
					54-64	bedrock			0.2 - 2	300 - 30			
7	**UvD**	Urban land-Neshaminy complex, 8 to 25 percent slopes	3.90%	92.95%	0-6	variable							
8	**NbC**	Neshaminy silt loam, 8 to 15 percent slopes	3.67%	96.62%	0-9	Silt Loam			0.6 - 2	100 - 30	B	---	---
					9-52	Silt loam, gravelly clay loam, gravelly sandy clay loam			0.2 - 0.6	300 - 100			
					52-54	Silt loam, very gravelly clay loam, gravelly sandy clay loam			0.2 - 0.6	300 - 100			
					54-64	bedrock			0.2 - 2	300 - 30			
9	**NhD**	Neshaminy gravelly silt loam, 8 to 25 percent slopes, extremely bouldery	1.50%	98.13%	0-5	silt loam	No		0.6 - 2	100 - 30	B	---	---
					5-52	silt loam, gravelly clay loam, gravelly sandy clay loam			0.2 - 0.6	300 - 100			
					52-54	silt loam, very gravelly sandy loam, gravelly sandy clay loam			0.2 - 0.6	300 - 100			
					54-64	bedrock			0.2 - 2	300 - 30			
10	**MoB**	Urban land, 0 to 8 percent slopes	1.20%	99.33%									
11	**ToA**	Towhee silt loam, 0 to 3 percent slopes	0.67%	100.00%	0-8	silt loam			0.6 - 2	100 - 30	D	0.0-0.5	1.0-2.6
					8-28	silt loam, gravelly silt loam, silty clay loam			0.6 - 2	100 - 30			
					28-63	silt loam, silty clay loam, gravelly silty clay loam			0.06 - 0.2	1000 - 300			
					63-76	clay loam, sandy loam, gravelly sandy loam			0.06 - 0.6	1000 - 100			
		TOTAL:	**100.00%**										

3.2.7 Outlying Areas Needs Analysis

The Outlying Areas comprise the majority of the parcels in the Township. Each of the previous study areas had somewhat unique characteristics with respect to soils, depth to groundwater, environmental constraints, percolation rates and lot size distribution. This area has some of every lot and constraint type. Housing in this area is typically low density and on large lots.

There are 35 parcels that have environmental constraints and may require variances and/or non-standard systems, as failing systems are remediated or new systems installed. Percolation rates are difficult to establish due to a large range in USDA reported values for most soil types. Only a few soil types have ranges that do not include percolation rates that could be suitable for a compliant septic system. Only two developed parcels have these soils on them and therefore are not likely to be able to site a compliant septic system. 166 parcels have issues with depth to limiting zone, which includes both bedrock and groundwater across the Outlying Areas. There area 104 parcels that may have issues with drinking water well and septic system separation.

Table 3.2.29: Needs Definition- Outlying Areas

	Outlying Areas Parcels	Variance or Advanced Treatment System Required[1]						Conventional On-Lot System Feasible				
		Enviro. Constraint	Potential Water Supply Solution	Perc Rate	Depth to Limiting Zone	Total	% Study Area Parcels	Standard System	Elevated Sand Mound	Sub-surface Sand Filter	Total On-Lot	% Study Area Parcels
Developed	1,545	35	104	2	166	307	15.0%	853	335	27	1,215	59.4%
Undeveloped	500	54	33	1	48	136	6.7%	260	80	6	346	16.9%
Total	2,045	89	137	3	214	443	21.7%	1,113	415	33	1,561	76.3%

[1] For repairs or new construction. Does not apply to existing systems that are not identified as failing.

[2] The Sum of the two "% of Study Area Parcels" columns does not equal 100% as a result of parcels with Tax Assessors records and no corresponding GIS shape files.

Table 3.2.28: Properties of Common Soils in the Outlying Areas

#	USDA Soil Type	USDA Soil Type Description	Soil Type Percentage of Study Area	Cumulative %	Depth (in)	USDA Texture	Suitability for septic disposal	Suitability for spray irrigation	Permeability (Ksat) (in/hour)	Percolation Rate (min/in)	Hydrologic Group	Water Table Upper Limit	Water Table Lower Limit
1	**MmB**	Mount Lucas silt loam, 0 to 8 percent slopes, extremely stony	7.03%	7.03%	0-9	silt loam			0.6 - 2	100 - 30	C	0.5-3.0	1.8-2.9
					9-38	Silt loam, gravelly silty clay loam, sandy clay loam, clay loam			0.06 - 0.6	1000 - 100			
					38-60	Gravelly sandy loam, gravelly loam, gravelly loamy sand			0.06 - 6	1000 - 10			
2	**ArC**	Arendtsville gravelly silt loam, 8 to 15 percent slopes	5.43%	12.45%	0-10	Gravelly Silt Loam			0.6 - 6	100 - 10	B	---	---
					10-52	Gravelly Sandy Loam, Clay			0.6 - 6	100 - 10			
					52-81	Gravelly loam, very gravellly sandy loam, very gravelly loam			0.6 - 6	100 - 10			
3	**TpB**	Towhee-Glenville silt loams, 0 to 8 percent slopes, extremely stony	4.87%	17.32%	0-7	silt loam			0.6 - 2	100 - 30	D	0.0-0.5	1.8-2.6
					7-28	silt loam, gravelly silt loam, silty clay loam			0.6 - 2	100 - 30			
					28-63	silt loam, silty clay loam, gravelly silty clay loam			0.06 - 0.2	1000 - 300			
					63-76	clay loam, sandy loam, gravelly sandy loam			0.06 - 0.6	1000 - 100			
4	**PeB**	Penn channery silt loam, 3 to 8 percent slopes	4.37%	21.69%	0-8	channery silt loam	No	Yes	0.6 - 6	100 - 10	C	---	---
					8-21	channery silt loam, channery loam, channery silty clay loam			0.6 - 6	100 - 10			
					21-34	very channery silt loam, very channery loam			0.6 - 6	100 - 10			
					34-44	bedrock			0.2 - 6	300 - 10			
5	**ArB**	Arendtsville gravelly silt loam, 3 to 8 percent slopes	4.29%	25.97%	0-10	Gravelly Silt Loam			0.6 - 6	100 - 10	B	---	---
					10-52	Gravelly Sandy Loam, Clay			0.6 - 6	100 - 10			
					52-81	Gravelly loam, very gravellly sandy loam, very gravelly loam			0.6 - 6	100 - 10			
6	**ReB**	Readington silt loam, 3 to 8 percent slopes	4.14%	30.12%	0-11	silt loam			0.6 - 2	100 - 30	C	1.5-3.0	1.8-3.4
					11-29	loam, channery silt loam, silty clay loam			0.6 - 2	100 - 30			
					29-58	silt loam, channery loam, channery silt loam			0.2 - 0.6	300 - 100			
					58-68	bedrock			0.6 - 6	100 - 10			
7	**GlB**	Gladstone gravelly silt loam, 3 to 8 percent slopes	3.89%	34.01%	0-10	Gravelly silt loam			0.6 - 6	100 - 10	B	---	---
					10-42	Gravelly sandy clay loam, gravelly silt loam, gravelly clay loam			0.2 - 0.6	300 - 100			
					42-68	Gravelly clay loam, gravelly fine sandy loam, gravelly loam			2 - 6	30 - 10			
8	**NhB**	Neshaminy gravelly silt loam, 0 to 8 percent slopes, extremely bouldery	3.58%	37.59%	0-9	Silt Loam	Moderate	Yes	0.6 - 2	100 - 30	B	---	---
					9-52	Silt loam, gravelly clay loam, gravelly sandy clay loam			0.2 - 0.6	300 - 100			
					52-54	Silt loam, very gravelly clay loam, gravelly sandy clay loam			0.2 - 0.6	300 - 100			
					54-64	bedrock			0.2 - 2	300 - 30			
9	**Bo**	Bowmansville-Knauers silt loams	**3.20%**	**40.79%**	0-7	Silt loam	No		0.6 - 2	100 - 30	B/D	0.5-1.5	>6
					7-26	Silt loam, clay loam, sandy clay loam			0.2 - 0.6	300 - 100			
					26-43	silty clay loam, fine sandy loam, gravelly silt loam			0.2 - 2	300 - 30			
					43-65	gravelly sandy loam, stratified gravel to sand			2 - 6	30 - 10			
10	**GlC**	Gladstone gravelly silt loam, 8 to 15 percent slopes	**3.05%**	**43.83%**	0-10	Gravelly silt loam			0.6 - 6	100 - 10	B	---	---
					10-42	Gravelly sandy clay loam, gravelly silt loam, gravelly clay loam			0.2 - 0.6	300 - 100			
					42-68	Gravelly clay loam, gravelly fine sandy loam, gravelly loam			2 - 6	30 - 10			

3.3. WATER QUALITY PROTECTION CONSIDERATIONS

The water quality issues of concern associated with wastewater management are:

1. Bacterial
2. Nitrogen
3. Phosphorous
4. Emerging Contaminants – pharmaceuticals and personal care products

It is proposed that the synthetic hormone, 17α – Ethenyl estradiol (EE2) be used as the constituent for No-Effect from the emerging contaminants category- pharmaceuticals and personal care products. EE2 affects fish reproduction. Recent scientific findings have concluded that a No-Effect of EE2 of 0.35 mg/l is appropriate. No data on the concentration of EE2 in the waters of Cooks Creek are known to exist.

3.4. MANAGEMENT CONSIDERATIONS AND APPLICABLE SECTIONS OF THE PENNSYLVANIA ADMINISTRATIVE CODE

A management program is needed to ensure proper inspection, operations and maintenance of on-log systems. Several locally applicable legal references have been included in the Appendix detailing the authority under which such a program can be instituted.

The Milford Township 1998 On-Lot Wastewater Management Ordinance is attached as Appendix G, for reference purposes.

From the PADEP draft document 362-2206-002, Appendix H contains the "Existing Authority and Requirements Relating to Assurance of Long Term Operation and Maintenance of Sewage Facilities" and Appendix I contains the "Minimum Operation and Maintenance Needs for Sewage Facilities Treatment Components When Used With Conventional On-lot Treatment Systems.

Recommendations for management plans associated with on-lot systems will be covered in Section 9. The following are excerpts from the Pennsylvania Administrative Code, Chapter 71 that are applicable to Management Plans for small flow and locally permitted facilities:

1. Establish specific responsibilities for operation and maintenance of wastewater systems including documentation that an effective implementation of one or a combination of the following operation and maintenance requirements (taken from 71.64(c)(5)(i-vii)) have been established:

    (i) A maintenance agreement between the property owner and an individual, firm or corporation experienced in the operation and maintenance of sewage treatment systems.

(ii) A maintenance agreement between the property owner and municipality or its designated local agency which establishes the property owner's responsibility for operating and maintaining the system and the responsibility of the municipality or local agency for oversight of the system.
(iii) A municipal ordinance which requires that the small flow treatment facilities be operated and maintained through a maintenance agreement between the property owner and an individual, firm or corporation experienced in the operation and maintenance of sewage treatment systems.
(iv) Municipal ownership of the system.
(v) Inclusion of the system under a sewage management agency developed in accordance with § 71.73 (relating to sewage management programs for sewage facilities permitted by local agencies) operated by the municipality.
(vi) A properly chartered association, trust or other private entity which is structured to manage the system.
(vii) Establishment of bonding, escrow or other security prior to planning approval. The bonding, escrow or other security shall be forfeited to the municipality upon notice of continuing noncompliance of the system with the operation, maintenance and monitoring standards contained in the permit or noncompliance with the municipal assurances for management of the operation and maintenance requirements established through this section. The municipality shall use the forfeited security to cover the costs of repair or future operation and maintenance of the system over its design life. The bonding, escrow or other security shall be for an amount up to a maximum of 50% for each of the first 2 years of operation. After 2 years of operation, the bond agreement must provide for a refund of a portion of the original bond so that only 10% of the cost of the equipment and installation is retained by the bond-holder. The remaining bond totaling 10% of the cost of the equipment and installation shall be maintained for the life of the system.

2. Sewage management programs for sewage facilities permitted by the local agency (Bucks County Health Department) include as a minimum the provisions required in 71.73(b)(1-8) as follows:

(1) Identification of the specific legal authority to be used by municipal officials and their designated employees to enter lands and make inspections of on-lot sewage facilities. The policy concerning a schedule of inspections and methods of notification of landowners of this policy shall be included.
(2) Standards consistent with section 8(b)(9) of the act (35 P. S. § 750.8(b)(9)) for operation, maintenance, repair or replacement of sewage facilities which include:

(i) Removal of septage or other solids from treatment tanks once every 3 years or whenever an inspection program reveals that the treatment tanks are filled with solids in excess of 1/3 of the liquid depth of the tank or with scum in excess of 1/3 of the liquid depth of the tank.
(ii) Maintenance of surface contouring and other measures, consistent with Chapter 73 (relating to standards for on-lot sewage treatment facilities) to divert stormwater away from the treatment facilities and absorption areas and protection of the absorption areas from physical damage.
(iii) Requirements for the use of water conservation devices to reduce hydraulic loading to the sewage system.
(iv) Requirements for the operation and maintenance of electrical, mechanical and chemical components of the sewage facilities; collection and conveyance piping, pressure lines and manholes; alarm and flow recorder devices; pumps; disinfection equipment and related safety items.
(v) Requirements for septage pumpers/haulers which are consistent with the Solid Waste Management Act (35 P. S. § § 6018.101— 6018.1003).
(vi) Requirements for holding tank maintenance.

3) A discussion of the specific requirements of the sewage management program and administrative or legal functions needed to carry out the program.
(4) Establishment of a fee schedule for the cost of municipal services related to implementing the provision of the sewage management program.
(5) Identification of the authority to be used to enforce the requirements of the sewage management program or restrain violations of the program.
(6) Identification of penalty provisions for violations of the program requirements.
(7) Draft ordinances, regulations or policies which relate to the sewage management program.
(8) Other requirements consistent with the act and The Clean Streams Law.

4. FUTURE GROWTH & LAND DEVELOPMENT

4.1. MUNICIPAL PLANNING DOCUMENTS

This Act 537 Update has relied upon the 2002 Springfield Township Comprehensive Plan. Figure 2.12.3 and 2.12.4 illustrate zoning for Springfield Township. Section 4.2 discusses Development in Springfield.

4.2. DEVELOPMENT

4.2.1 Existing

Existing development is described in Sections 2.1.2, 2.1.3 and 2.1.6.

4.2.2 Currently Planned Subdivisions

Table 4.3 lists the recently approved development programs in Springfield as provided by Township Engineer, C. Robert Wynn Associates, Inc. A summary is provided below in Table 4.2 and shown on Figure 4.1:

Table 4.2. Summary- Recently Approved Development Proposals

Date	Approved Subdivided Lots	% Total
Active	105	32.4%
2008	24	7.4%
2007	26	8.0%
2006	15	4.6%
2005	40	12.3%
2004	26	8.0%
2003	28	8.6%
2002	19	5.9%
2001	8	2.5%
2000	14	4.3%
1999	10	3.1%
1998	5	1.5%
1997	4	1.2%
TOTAL:	**324**	**100.00%**

4.2.3 Future Growth and Build-Out Estimates

Assuming the 2000-2010 medium growth rate of approximately 1% per year is equivalent to approximately 20 residential units per year being built, or 400 over a 20 year period. This is comparable to the 400 to 540 units projected for a 20 year period in the Cooks Creek Watershed Plan. The build-out capacity, based upon the amount of undeveloped land, is described in section 2.1.6.

Table 4.3. Recently Approved Development Proposals

FILE NO.	SUBDIVISION NAME	STATUS	ACTION LETTER DATE	NO. LOTS	Parent Tract TMP NO.	LOCATION BY STREET
21-289	Metzger Subdivision	Active	—————	99	42-9-131, 129, 12	RT 212
21-296	Mcardle Subdivision	Active	—————	2	42-9-128	RT 212
21-310	Herman Subdivision	Active	—————	4	42-9-172-4	HOTTLE RD/STATE RD
21-227	Pawar Subdivision	Approved Prel.	6/17/2008	5	-21-17, 15-1, 15-2, 1	WINDING ROAD/SHALE ROAD/OAK LANE
21-286	Gross Tract	Approved Prel.	4/29/2008	4	42-21-119	WINDING ROAD & WOODCOCK LANE
21-224	ossetti (Daniel) Subdivisio	Approved Prel.	11/27/2007	4	2-9-172, 172-2, 172-	SIDELINE ROAD
21-248	Prime Building Group	Approved Prel.	8/14/2007	5	42-3-36	CHERRY ROAD
21-228	ossetti (Michael) Subdivisi	Approved Prel.	1/10/2006	3	42-22-103	DURHAM ROAD (S.R. 412)
21-155	Roher Subdivision	Approved Prel.	4/15/2004	3	42-20-25-2	OLD BETHLEHEM ROAD
21-230	Balik Subdivision	Approved Prel.	1/13/2004	2	42-9-64-3	PLEASANT VIEW ROAD
21-216	Penn Meadows Subdivisio	Approved Prel.	11/11/2003	10	42-1-17 & 42-1-37	CHERRY ROAD & OLD BETHLEHEM PIKE
21-259	Cuff Subdivision	Approved	8/14/2008	3	42-5-27	PASSER ROAD
21-287	WC Land Investments	Approved	6/17/2008	2	42-1-33	CLAY AVE. & CHERRY ROAD
21-293	Joseph Subdivision	Approved	6/10/2008	2	42-20-14	OLD BETHLEHEM ROAD (S.R. 4101)
21-237	Rufe Subdivisin	Approved	3/25/2008	3	42-9-15	RICHLANDTOWN PIKE (S.R. 4047)
21-292	Rennie Subdivision	Approved	3/25/2008	2	42-21-82	WINDING ROAD
21-266	Sartori Subdivision	Approved	1/23/2008	3	42-22-96	HUNTER ROAD & RT 412
21-297	Curry Subdivision	Approved	11/27/2007	2	42-5-88 & 88-1	EBERT ROAD
21-175	Hall/Kucher Subdivision	Approved	10/25/2007	2	42-20-42	ROUNDHOUSE ROAD/WINDING RD.
21-290	Bilger/Sauer Subdivision	Approved	6/12/2007	2	42-9-121-1	STATE ROAD
21-291	Cory Minor Subdivision	Approved	4/24/2007	2	42-12-88	SLIFER VALLEY ROAD
21-272	Estates at State Road	Approved	2/7/2007	3	42-5-35	STATE ROAD
21-255	CrossRoads Subdivision	Approved	1/23/2007	6	42-1-1	TROLLEY BRIDGE ROAD
21-274	Duke, (Josh) Subdivision	Approved	12/19/2006	2	42-12-42	OLD BETHLEHEM PIKE (RT 212)
21-281	Kramer Subdivision	Approved	12/19/2006	2	42-9-71	DEER TRAIL ROAD
21-282	Duke (Carl) Subdivision	Approved	12/19/2006	2	42-9-144	GRUVERSVILLE RD/RICHLANDTOWN PIKE
21-270	ornwood Builders Subdivis	Approved	9/26/2006	3	42-9-4	QUARRY ROAD
21-199	Reese SWM	Approved	6/13/2006	3	42-5-16	NEMETH ROAD
21-251	Reed Lane Subdivision	Approved	12/13/2005	3	42-21-130	REED LANE/WINDING ROAD
21-176	Springtown Knoll	Approved	9/13/2005	20	42-17-59	DRIFTING DRIVE
21-239	Newman Subdivision	Approved	8/9/2005	3	2-24-4-1 & 42-22-11	SCHOOL ROAD
21-240	Asser Subdivision	Approved	6/14/2005	3	42-22-19	LEHNENBERG ROAD
21-238	Glazier Subdivision	Approved	4/12/2005	2	42-12-16-2	PEPPERMINT VALLEY ROAD
21-252	Lloyd Subdivision	Approved	3/10/2005	3	42-4-93	SALEM ROAD
21-188	Christ Subdivision	Approved	2/8/2005	4	42-1-8	BLUE CHURCH RD/OLD BETHLEHEM PIKE
21-249	Duke Subdivision	Approved	2/8/2005	2	42-9-144	WRESCICS RD/RICHLANDTOWN PK
21-059	Evergreen Estates	Approved	12/22/2004	10	42-17-89-1	BODDER ROAD
21-226	Cummings Subdivision	Approved	12/14/2004	4	42-12-48 & 48-3	RT 412
21-243	Haney Subdivision	Approved	11/9/2004	3	42-9-112-5	STATE ROAD
21-241	Solteck Subdivision	Approved	9/14/2004	4	42-21-72	WINDING ROAD
21-231	Grant Subdivision	Approved	12/17/2003	3	42-4-5	OLD BETHLEHEM PIKE
21-211	Summit Farm Subdivision	Approved	10/14/2003	4	42-6-25, 42-6-24-1	MOYER ROAD
21-222	Schlemmer Subdivision	Approved	9/9/2003	2	42-5-38	STATE ROAD
21-223	Walentine Subdivision	Approved	9/9/2003	2	42-9-91	DEER TRAIL ROAD & CHESTNUT ROAD
21-191	Yourtee Subdivision	Approved	4/8/2003	5	42-12-116	HICKORY LANE & RT 212/412
21-206	Mahl Subdivision	Approved	1/28/2003	2	42-21-80	WINDING ROAD
21-205	Hickon Terrace Subdivisio	Approved	12/17/2002	3	42-8-48	HICKON ROAD
21-184	hompson Minor Subdivisio	Approved	10/22/2002	2	42-21-160	MINK RD/MAPLE RD
21-186	High Meadow Farm	Approved	10/22/2002	10	42-12-27	PEPPERMINT VALLEY/OLD BETHLEHEM RD
21-198	Hickory Lane Subdivision	Approved	3/12/2002	4	42-12-110	HICKORY LANE
21-182	Berezny Subdivision	Approved	10/30/2001	2	42-9-17, 42-9-17-3	PASSER RD/RICHLANDTOWN PIKE
21-193	Olsson Subdivision	Approved	8/14/2001	2	42-22-19	LEHNENBERG ROAD
21-187	Platt Subdivision	Approved	4/10/2001	2	42-17-49 & 50	FUNKS MILL ROAD
21-276	Starr Subdivision	Approved	4/10/2001	2	42-17-50	FUNKS MILL ROAD
21-180	Nocket Subdivision	Approved	11/14/2000	2	42-5-3	PASSER RD/CUTOFF RD
21-181	Zisko Subdivision	Approved	11/14/2000	2	42-11-8	KUNSMAN RD/TOWNSHIP RD
21-137	Atherholt Subdivision	Approved	10/2/2000	2	42-20-70	ROUTE 212
21-144	Franklin Subdivision	Approved	8/9/2000	3	42-21-6	TOWNSHIP ROAD
21-178	Cross Creek Subdivision	Approved	7/11/2000	2	42-17-13	DRIFTING DRIVE
21-179	Kim Subdivision	Approved	7/11/2000	3	42-21-125	WOODCOCK LANE
21-163	Hidden Pond Subdivision	Approved	11/29/1999	4	42-20-32-1 & 33-1	OLD BETHLEHEM ROAD
21-124	Silver Creek	Approved	2/10/1999	6	42-12-57	ROUTE 212-412
21-128	Gehman Subdivision	Approved	12/22/1998	2	42-9-134.1	GRUVERSVILLE ROAD
21-136	Saddle Ridge	Approved	10/21/1998	3	42-6-3	HIGH POINT ROAD
21-130	Tumblebrook Subdivision	Approved	12/22/1997	2	42-4-192 & 193	TUMBLEBROOK ROAD/STATE ROAD
21-126	Litzenberger Subdivision	Approved	8/18/1997	2	42-17-88-2	DURHAM ROAD (S.R. 212)
21-254	Rapp (Rolling Hills Estates	Denied	10/23/2007	18	42-12-105	RT 212/SLIFER VALLEY ROAD
21-280	Mcardle Subdivision	Denied	4/24/2007	10	42-20-27	ROUNDHOUSE RD/OLD BETHLEHEM RD
21-253	Cohen Subdivision	Denied	8/8/2006	3	42-22-20	BODDER ROAD
21-260	Debrigida Tract	Denied	1/10/2006	16	42-9-151 & 42-9-153	GRUVERSVILLE RD/RICHLANDTOWN PIKE
21-268	Debrigida Tract	Denied	1/10/2006	2	42-9-150	RICHLANDTOWN PIKE/GRUVERSVILLE RD

Figure 4.1. Approved Subdivisions

5. TECHNOLOGY OVERVIEW

5.1. ON-LOT TECHNOLOGY OPTIONS

Figure 5.1 shows the range of technology options available for on-lot systems. Treatment, disinfection where necessary, and dispersal options that may be applicable to Springfield Township are discussed further in the following sections.

5.1.1 Treatment

Septic Tank

Septic tanks may have one or two compartments. Two-compartment tanks perform better at settling solids and are the only recommended option. When the wastewater flows into the tank, the heavy solids settle to the bottom to form a layer of sludge. Lighter materials (grease, fats, small food particles, etc.) float on the surface forming a layer of scum. Between these two layers is a liquid of suspended materials and water-soluble chemicals. Figure 5.1.1 shows a typical two-compartment septic tank. The division into two compartments increases the efficiency of the system at removing suspended solids, which increases the life of the drainfield. When the wastewater flows to the second compartment it is already substantially clarified (much of the solid material has settled out of the liquid). Moreover, there is little turbulence in the second chamber because the wastewater enters more slowly. Settling of finer suspended solids can occur in the second compartment as well.

Figure 5.1.1. Two-Compartment Septic Tank

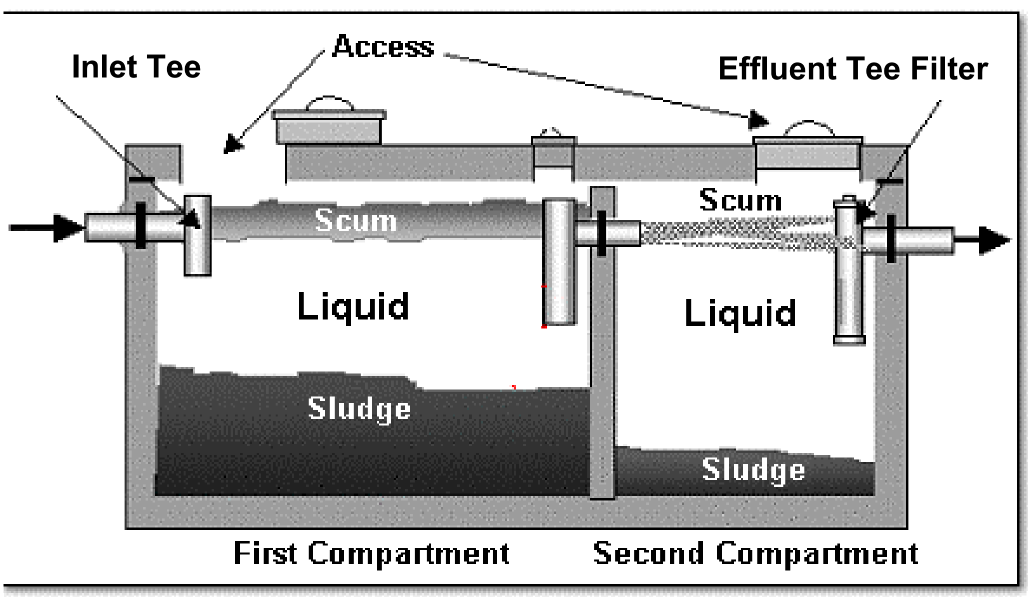
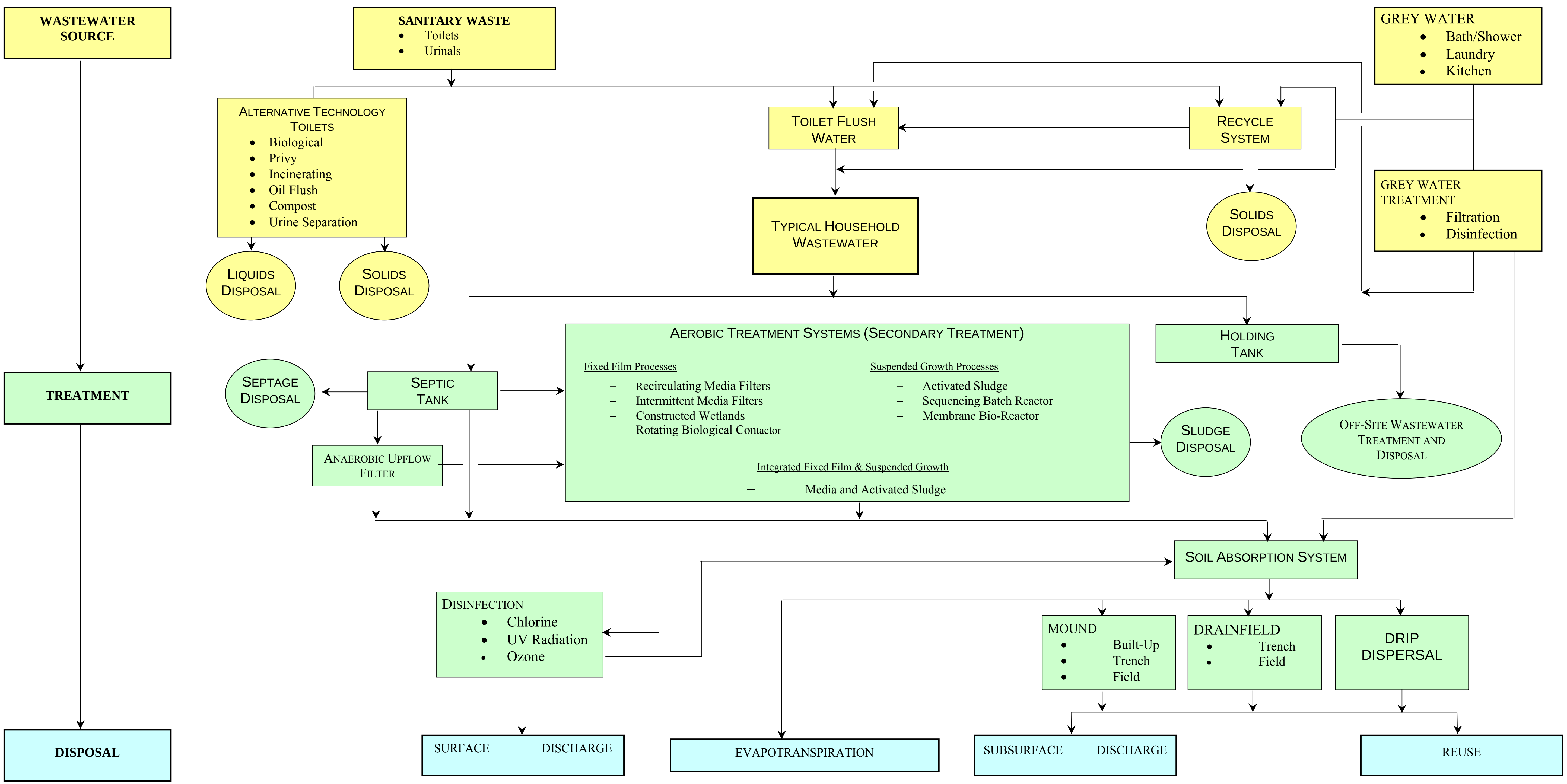


Figure 5.1. On-Lot Wastewater Management Systems - Options



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LOMBARDO ASSOCIATES, INC.

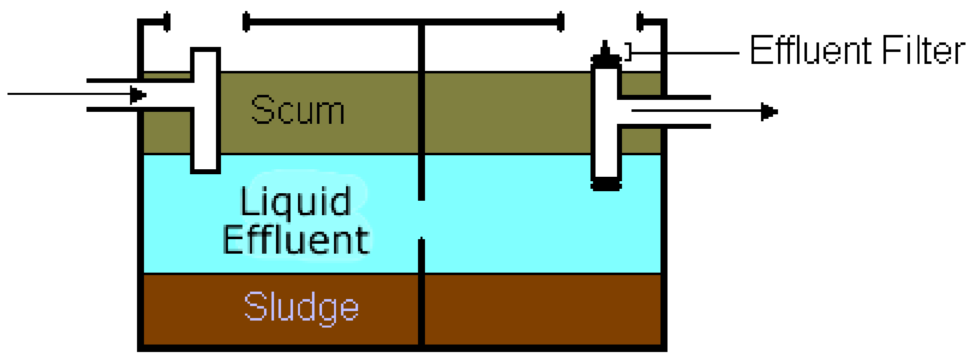
Effluent Tee Filter

Excessive discharge of solids to the drain field can cause it to plug and lose efficiency in treatment and dispersal of the normal liquid flow. If the problem persists, the drainfield may need to be replaced. Septic tank effluent filters provide a relatively inexpensive means of preventing solids discharge.

Effluent filters are devices that can be affixed to outlets of septic tanks and grease traps as shown on Figure 5.1.2. New tanks can easily accommodate the filter installation, while previously installed tanks can often be easily retrofitted. The filter is a primary screening barrier designed to reduce the volume of solids passing out of the tank to the disposal area.

Until recently, most of the information on the effectiveness of effluent filters has been intuitive and anecdotal. Orenco Systems Incorporated reports that the average TSS from their filter is less than 30 mg/L. TSS levels in unfiltered effluent range from 60-120 mg/L. Zabel Environmental Technology's model A100 (a larger residential unit) in tests performed by Tennessee Technological University averaged a 49 percent reduction in TSS and a 32 percent reduction in BOD. The actual performance in any particular situation will depend on a number of factors, the most important of which is daily flow. Importantly, the filters prevent high solids concentrations from being discharged to the drainfield.

Figure 5.1.2. Placement of Effluent Filter



Anaerobic Upflow Filter (AUF)

Advanced primary treatment can be provided by the addition of an AUF after the septic tank and prior to the drainfield. AUFs reduce BOD and TSS and extend the life of the drainfield. AUF units may require periodic (approximately every 10 years) flushing of accumulated solids and inspection of inlet and outlet systems. There would be no operation and maintenance costs until solids removal, if and when necessary.

Alternative Secondary Treatment Systems

There are a number of alternative secondary treatment systems available that provide at least secondary treatment. By producing a higher level of treated effluent compared to a conventional system using only a septic tank, these systems can be used on sites with poor percolating soils and other limiting site conditions, high groundwater or shallow depth to impermeable layer. In addition, many states allow a higher hydraulic application rate to the drainfield for systems using secondary treatment units. A higher hydraulic application rate results in a smaller required drainfield.

As discussed in Section 5.4, secondary treatment technologies include:

- Fixed Film Processes
- Suspended Growth Processes
- Integrated Fixed Film and Suspended Growth Processes

5.1.2 Disinfection Options

The potential disinfection options for on-lot systems are:

- Ozone
- Chlorine
- Ultraviolet (UV)

These disinfection processes are discussed in Section 5.5.

5.1.3 Dispersal Options

The potential dispersal options for on-lot systems are:

- Subsurface drainfield (gravity and pressure)
- Chamber systems
- Bottomless sand filters
- Mound systems
- Drip irrigation
- Low pressure pipe
- Alternative drainfield systems

Holding tanks are not considered a sustainable solution to disposal of treated wastewater.

Subsurface Drainfield

<u>Gravity</u>
A conventional system relies upon gravity to deliver the wastewater to the drainfield and this tends to do a poor job of evenly distributing the effluent throughout the drain field.

With a gravity-fed system, every time water is used in the house, the soil receives another dose of effluent. During periods of high water use by the household, the soil in the drain field may become saturated, which reduces its capacity to treat the effluent. If the soil is continuously oversaturated, it will become clogged and eventually cease to act as an effective filter for the wastewater.

Pressure Distribution

In a pressure distribution system a pump chamber is added that delivers septic tank effluent to the drainfield in controlled timed doses. The goal of a pressure distribution system is to create unsaturated flow in the soil absorption system. Delivering septic tank effluent in controlled pressurized doses ensures that the wastewater is equally distributed across the soil absorption bed, thus reducing the potential for the localized clogging that often occurs in conventional gravity dosed systems. Research has also shown that discharging effluent in controlled, properly timed doses gives the absorption bed a drying period between doses that can result in enhanced treatment with regard to pathogen and nutrient removal.

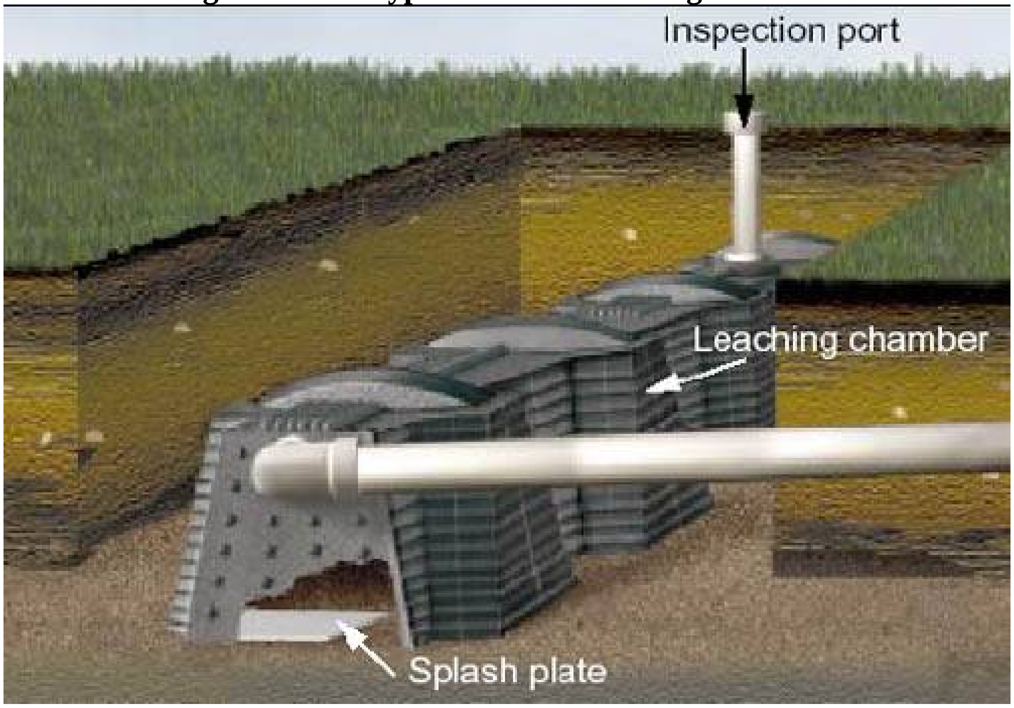
Chamber Systems

Leaching chambers may be used in place of perforated pipe and gravel for the distribution and storage of wastewater. Leaching chambers may be constructed of concrete, plastic or other material, with the bottom open for infiltration of the wastewater into the soil. The shape of leaching chambers and their layout on sites may vary. The roof of the chamber may be equipped with a vent and access hole(s) for inspection and maintenance as necessary as shown in Figure 5.1.3. Leaching chambers are typically placed over either native soil or specified fill soil in the disposal trench(es), and are not underlain by gravel as with distribution piping in a conventional disposal trench.

Effluent from a septic tank or other pretreatment process(es) flows by gravity to the leaching chamber and percolates in the natural soil. Evapotranspiration and infiltration into the natural soil are mechanisms by which water is removed from the subsurface on-lot disposal system. As with conventional subsurface disposal systems, septic tanks are the most common pretreatment unit used, but other processes may be used instead of or in addition to a septic tank.

As with conventional subsurface trench and bed absorption systems, the use of leaching chambers is limited by site conditions including soil type and depth, permeability, depth to bedrock or ground water, and topography. If properly sited, designed, constructed and maintained, leaching chambers should be an efficient and cost-effective method for on-lot wastewater treatment and disposal, and should have long service lives.

Figure 5.1.3. Typical Plastic Leaching Chamber



Source: Texas Agricultural Cooperative Extension

Bottomless Sand Filters

Bottomless sand filters are a type of intermittent sand filter (ISF). ISFs are set up so water only passes through the filter once. Water is introduced intermittently, to prevent overloading of the filter. A bottomless sand filter is not lined with an impermeable liner, has a small layer of gravel at the bottom, a large fill of sand in the middle, and another small layer of gravel on top. The distribution line is run through the top layer of gravel and the effluent trickles through the sand. The gravel at the top aids in dispersing the water to maximize exposure to the sand. A bottomless system will have a permeable liner to allow the filtered effluent to absorb into the soil underneath.

Mound Systems

A mound system, like a conventional system, consists of a septic tank and a soil absorption bed. In the mound system, however, sand is added where suitable native soil is insufficient. Figure 5.1.4 shows a typical mound system. Clarified effluent from the septic tank is pumped, in controlled pressurized doses, to an aboveground, freestanding sand layer. The sand layer, placed upon a specially prepared area of native soil, serves as the medium on which the biogeochemistry activities of secondary treatment occur.

Mound systems are generally utilized to overcome site restrictions of shallow soil cover over impermeable layers (bedrock, shale, etc.), and/or a high water condition.

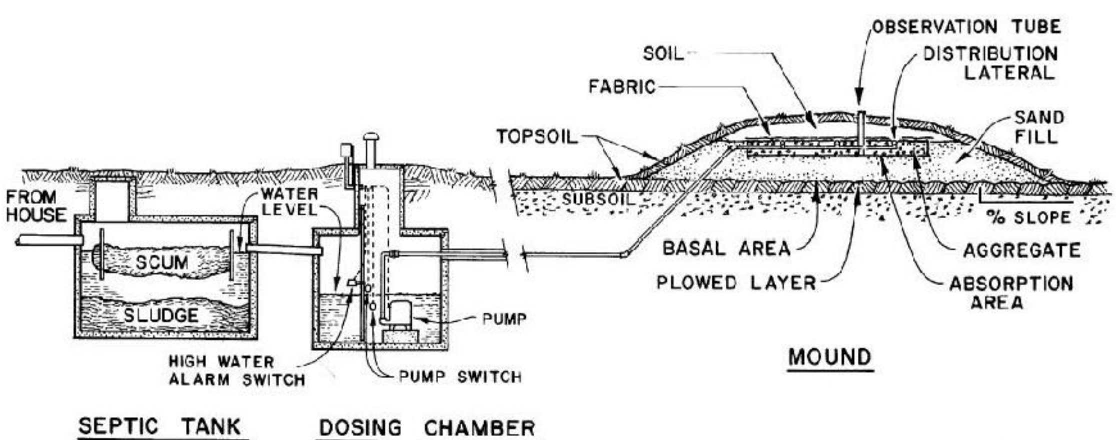
Some advantages of a mound system are as follows:

- They enable the use of some sites that otherwise would be unsuitable for other type systems
- The natural soil utilized in a mound system is usually the top layer (generally the most permeable)
- There is no direct point discharge to a ditch, stream, or other body of water
- Construction damage is minimized since little excavation is required in the mound area.

Some disadvantages of a mound system are as follows:

- Construction costs are typically much higher than those of conventional systems.
- Since there is usually limited permeable topsoil available at mound system sites, extreme care must be taken not to damage this layer with construction equipment.
- The location of the mound may affect drainage patterns and limit land use options.
- All systems require pumps or siphons.
- Mounds may not be aesthetically pleasing in some cases.

Figure 5.1.4. Typical Mound System



Source: Converse and Tyler (1987a),

Drip Irrigation

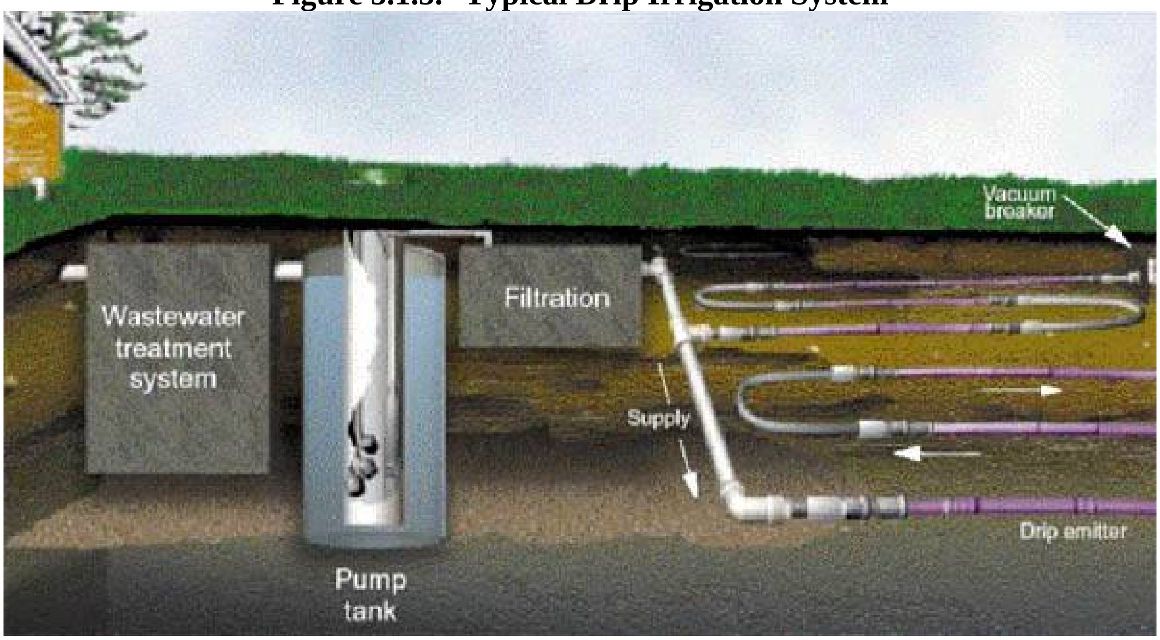
Drip subsurface soil disposal is a shallow slow rate pressure-dosed system used for land application of pretreated wastewater. Subsurface drip disposal systems have three basic design principles, which are different from conventional subsurface disposal systems. They are uniform distribution of effluent, dosing and resting cycles and very shallow placement of trenches. This type of system uses small diameter piping with underground drip emitters, and must be preceded by pretreatment, usually secondary levels which conforms to the manufacturer's specifications for the particular emitter used. Effluent must be adequately filtered before distribution through the underground emitter system. Figure 5.1.5 shows the layout of a typical drip irrigation system.

Subsurface drip irrigation systems have the capability of equally distributing effluent at a relatively low application rate over the entire absorption field to prevent saturation of the soil. Wastewater is applied at a controlled rate in the plant root zone, which tends to minimize percolation of the effluent.

Subsurface drip irrigation systems are often used for sites with adverse conditions such as: soils that are unsuitable for conventional absorption systems; insufficient depth to a restrictive horizon or ground water; and steep slopes.

Drip irrigation systems require a reliable source of power. An additional pretreatment process(es) is necessary after the septic tank and prior to final subsurface disposal. Routine maintenance is necessary to ensure the proper functioning of these systems.

Figure 5.1.5. Typical Drip Irrigation System



Source: Texas Agricultural Cooperative Extension

Alternative Drainfield Systems

Alternative Systems include the following:

- EZ Flow Drainfields
- Chipped Tire Aggregate
- Multiple Pipe Systems

EZ Flow Drainfields

EZ Flow drainfields consist of expanded polystyrene aggregate either by itself in a trench or surrounding a corrugated plastic pipe. The aggregate media is held in place by high density polystyrene netting. The principle advantage of this system is shallower depth, smaller required area and a higher resistance to clogging.

Chipped Tire Aggregate

Chipped tires are used in place of gravel as an aggregate material. Chipped tires have the advantage of being less expensive and available in areas where stone is not readily available. Studies have shown that leaching of contaminants is minimal, however there are still some concerns over potential contamination.

Multiple Pipe Systems

Multiple pipe systems consist of corrugated perforated pipes that maximize contact surface area with the surrounding soils. These systems have the advantage of reducing the required area of the potential drainfields.

Stream Discharge

Stream discharge, particularly in the Cooks Creek Watershed, should be avoided wherever possible and only used as a last resort. Should stream discharge be necessary, the following effluent limits, at a minimum, should be imposed and the appropriate treatment technologies will be selected accordingly:

- Total Nitrogen < 5 mg/L
- Total Phosphorus < 1 mg/L
- BOD < 10
- TSS < 10
- Total Coliform < 200 CFU / 100 mL

5.2. Community On-Lot Technology Options

Commnunity solutions may be used by more than one parcel and require a collection system to transmit wastewater from the parcel(s) to the treatment and/or dispersal site. The size of the system is dependent on the number of parcels that will be connected. Due to the predominance of low density development within the Township, a large, centralized township-wide facility will not be considered and evaluated.

Community on-lot systems can take many forms, small and large. In some instances, they may be simply a group of parcels served by one common septic system. In others, they resemble miniature conventional wastewater systems, with connecting sewers, a treatment plant and a large, common dispersal area. Under certain circumstances, cluster systems can be less costly than a series of on-lot systems. Also, they can be designed to serve the properties in need, and thereby allow the other properties to remain with on-lot systems. Cluster systems can be adapted to low or high-density areas. A flowchart providing an overview of the wastewater management options for cluster systems is presented in Figure 5.2.1.

A cluster system is one that includes transport of wastewater from more than one parcel to a common area for treatment and dispersal. This is in contrast to a centralized system where one facility serves a large area or the entire community. Wastewater conveyance systems often represent up to 70 percent of the total capital cost associated with wastewater management and should be given considerable emphasis in the alternatives analysis and technology selection.

Each alternative must be evaluated for a given site, in terms of its appropriateness in solving the problem, its costs, and its environmental impacts. This section presents an initial screening of alternatives for Collection, Treatment, Disinfection and Dispersal.

5.3. Collection

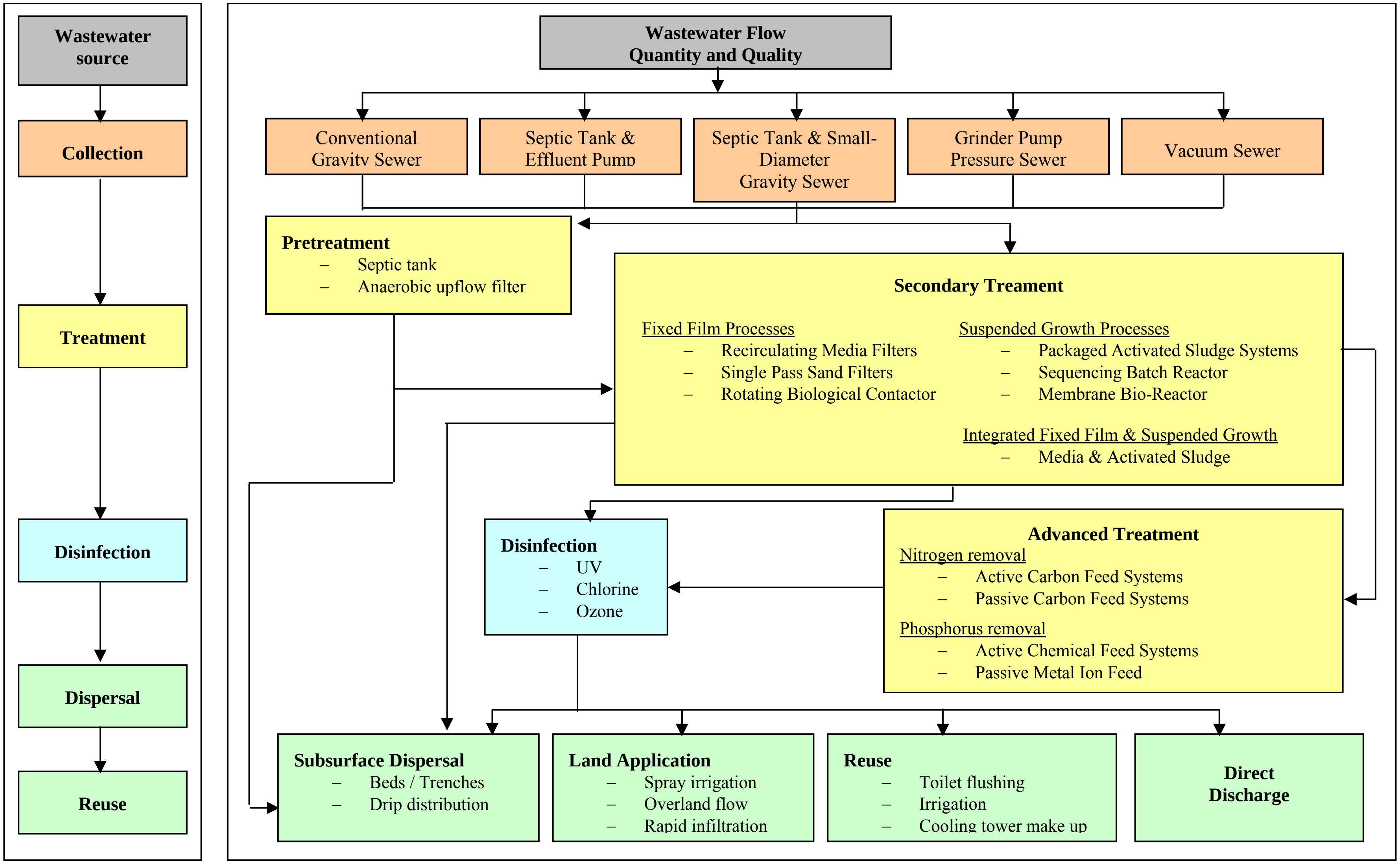
As discussed earlier, because the transport (collection) component costs represent a large percentage (up to 70 percent) of a total wastewater management system's cost, considerable attention needs to be placed on:

1. Route optimization, and
2. Collection technology choice when off-site solutions are examined.

The key factors that must be considered in the selection of an appropriate wastewater collection system are:

- Local topography
- Depth to bedrock and groundwater
- Development Density

Figure 5.2.1. Overview of Collection, Treatment & Dispersal Technologies Suitable for Springfield Cluster Wastewater Systems

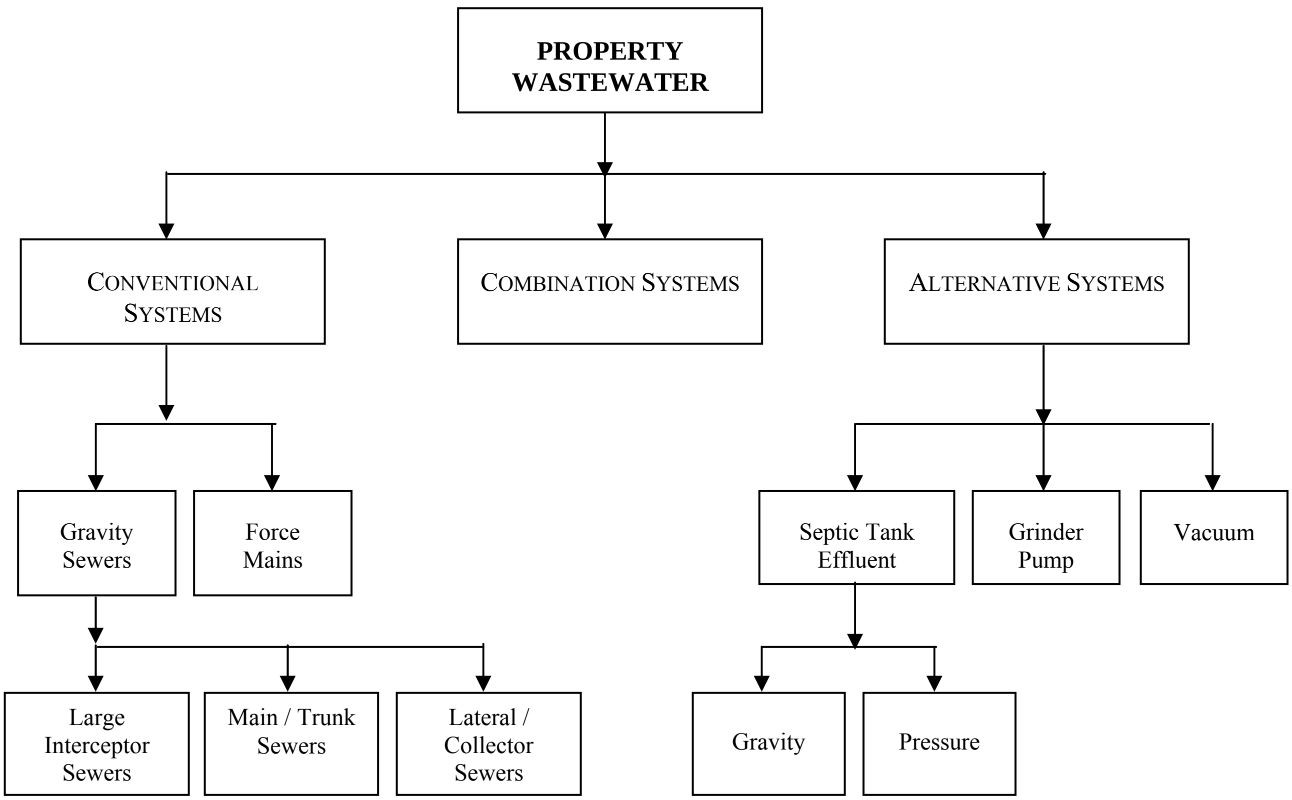


Collection system alternatives include:

- Conventional Gravity
- Septic Tank Effluent, both gravity (STEG) and pumped (STEP)
- Grinder Pump- pressure sewer
- Vacuum

A flowchart detailing the options for wastewater conveyance is presented in Figure 5.2.2.

Figure 5.2.2. Alternative Wastewater Conveyance Systems



5.3.1 Conventional Gravity Systems

Conventional gravity systems collect untreated wastewater directly from properties and convey it to treatment facilities. The collection mains are a minimum of 8 inches in diameter with manholes every 200 feet. Because the wastewater contains solids, conventional collection mains must always be constructed at a slope that maintains a scouring velocity within the pipe. In areas where it is not possible for wastewater to reach the treatment plant solely by gravitational flow, pump stations and force mains are installed to lift the wastewater to a part of the collection system that can reach the treatment facility. Deep excavation may be necessary to attain self-cleansing velocity (minimum of 2 feet per second) in the sewer under gravity flow. Alternatively, low lying properties may have individual pumps.

Conventional gravity sewers have the following advantages:

- Low maintenance
- No on-lot equipment needed for individual properties

Conventional gravity systems have the following disadvantages:

- High inflow/infiltration potential
- Deep cuts are needed when grade is not favorable
- Larger pipes with steeper slopes compared to STEG systems
- Manholes are needed, adding cost

Conventional gravity systems are most applicable to areas where the grade allows the sewer to remain relatively shallow and multiple pump stations are not necessary.

5.3.2 Grinder Pump (GP) Pressure Sewers

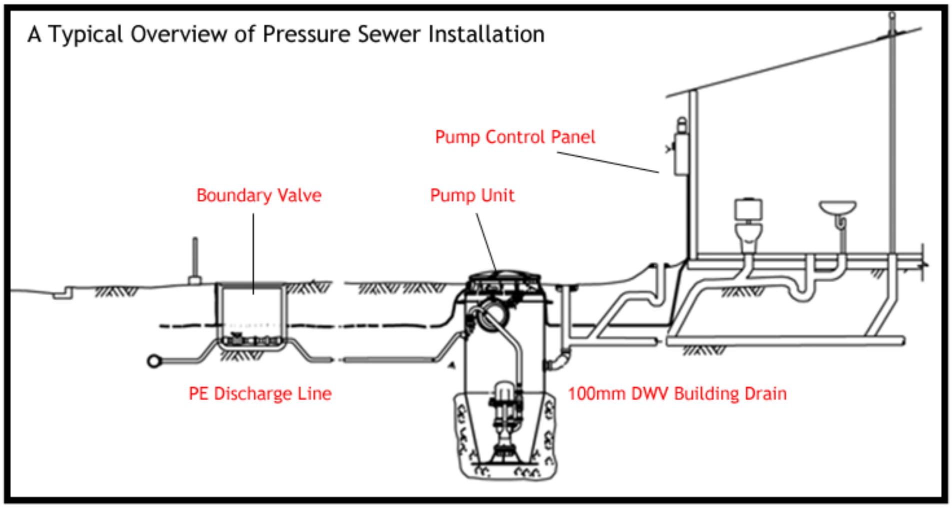
In Grinder Pump (GP) pressure sewer systems, small-diameter sewers are used in conjunction with on-lot grinder pumps located at each property. The grinder pump shreds solids and discharges the wastewater into the pressurized collection system. Wastewater is conveyed by the collection system either to a treatment facility or to a pump station/gravity sewer, and then ultimate transport to a treatment facility. Deep cuts are not necessary due to this being a pressurized system.

Grinder Pump Pressure Sewers are most applicable under the following conditions:

- Long sewer runs in flat areas where excavation is complicated by rock, bad soils and/or high groundwater
- Areas that have multiple low spots where many pump stations would be required for gravity systems
- Individual properties located in low spots where the number of properties is too low to make a pump station cost effective

Grinder Pump Pressure Sewers have the following disadvantages:

- Operations and maintenance requirements at each property
- Higher capital cost associated with pumps and electric connections
- Emergency storage or back-up power needed
- Higher pump costs as compared to STEP systems



5.3.3 Septic Tank Effluent by Gravity (STEG)

Small-diameter sewers are used in conjunction with an on-lot septic tank in septic tank effluent collection systems. For gravity systems, the septic tank effluent is transported through a 4-inch minimum diameter to the treatment/dispersal site. Small diameter pipes are permitted because large solids are retained in the septic tank.

STEG systems have the following advantages:

- Small diameter pipes and less slope required
- Lower potential for infiltration compared to larger gravity sewers
- Potential for variable grade sewers, eliminating the need for pump stations
- Less expensive cleanouts are generally used in place of manholes
- Eliminates the need for a Primary Settling Tank at the treatment facility

STEG systems have the following disadvantages:

- Installation or replacement of septic tank
- Pumping and general maintenance of septic tank required

5.3.4 Septic Tank Effluent Pressure (STEP) Systems

STEP systems work like STEG systems, with the difference being that the effluent is pumped with a STEP system. Wastewater from a home first flows into a septic tank, then effluent from the septic tank is pumped through 1.5 to 2 inch minimum diameter pipe to the treatment/dispersal site.

This technology is most applicable under the following conditions:

- Long sewer runs in flat areas where excavation for sewer is complicated by rock, bad soils and/or high groundwater
- Areas that have multiple low spots where many pump stations would be required for gravity systems
- Individual properties located in low spots where the number of properties is too low to make a pump station cost effective

STEP systems have the following disadvantages:

- Septic tank installation required
- Additional operations and maintenance requirements at each property
- Capital cost associated with pumps and electric connections
- Emergency storage or back-up power needed

5.3.5 Vacuum Collection System

Vacuum sewer systems operate through a central vacuum source constantly maintaining a vacuum on small – mid size diameter collection mains. Every home is provided with a vacuum unit that is equipped with a valve connecting the unit to the vacuum line. Sewage from the home unit is drawn into the line by the pressure differential created by the vacuum source. The sewage is then drawn into a central station and then pumped either into a pressurized main or into a gravity sewer for conveyance to a treatment facility. Vacuum systems centralize the power requirements, thereby eliminating the need for emergency storage or back-up power at each property.

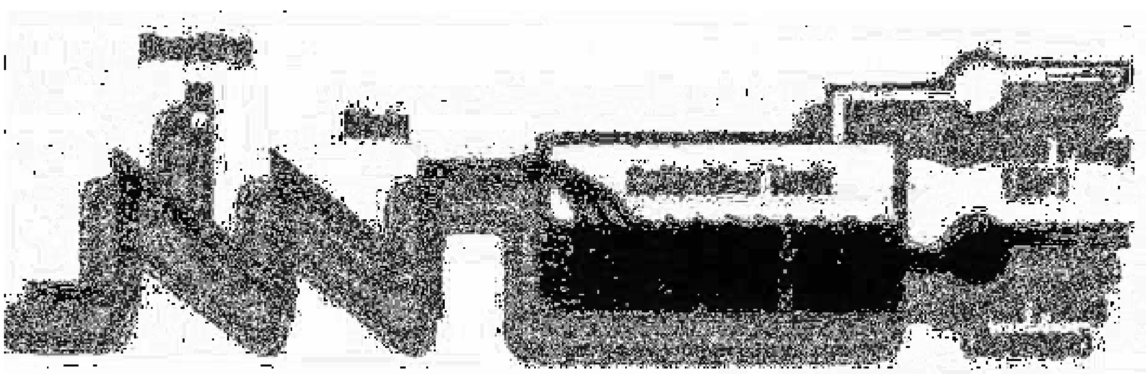
Vacuum systems are most applicable under the following conditions:

- Long sewer runs in flat areas where excavation is complicated by rock, bad soils and/or high groundwater
- Variable grade areas that would require multiple pumps stations for a gravity system

Vacuum systems have the following disadvantages:

- Highest capital cost for smaller systems
- Installation and maintenance of valves at each connection is necessary
- More complex system

The economies of scale do not generally favor vacuum systems when less than 100 to 200 connections exist. None of the study areas under consideration have more than 140 connections. In addition, as with STEP and Pressure Sewer systems, it is not applicable in areas with steep grades that allow for gravity collection. For these reasons, vacuum systems will not be considered as a collection system alternative.



5.3.6 Combination Systems

Grinder pumps and STEP/STEG systems are generally not mixed, however combination STEP and STEG systems are relatively common. Use of STEG and/or STEP systems with conventional sewers is not recommended when the conventional sewer is concrete due to corrosion concerns. Grinder pump systems discharging to conventional gravity sewers are relatively common. In general, when conditions favor gravity systems and there are a small number of low-lying properties, pumped systems will be installed on those properties. For conventional gravity systems, the low-lying properties will be fitted with grinder pumps and for STEG systems, the low-lying properties will be fitted with STEP systems.

5.4. TREATMENT

Treatment technologies for the Wastewater Treatment Facilities (WWTF) serving community on-lot systems can be the same as on-lot systems. As the wastewater management systems get larger, more sophisticated mechanical systems may become preferable to the land-intensive systems typical of on-lot technologies. The generic options for components of a WWTF are:

- Septic Tanks or Primary Clarifiers
- Flow Equalization Tanks
- Anaerobic Upflow Filter (AUF) or Vegetated Submerged Beds (VSB)
- Secondary Treatment using:
  - Fixed Film Processes, most commonly variations of recirculating media filters (RMF)
  - Suspended Growth / Activated Sludge
  - Integrated Fixed Film & Activated Sludge (IFAS)

Table 5.4.1 shows the treatment technologies applicable for the range of flows likely to be served in Springfield Township. These technologies have varying application depending on design flows, and are merely listed according to the flow ranges in which they are marketed to. Section 5.4 will discuss reliability as a function of design flow and process type. These are the options to be considered for use in on-lot systems and WWTFs.

5.4.1 Septic Tanks and Primary Clarifiers

A primary clarifier is a physical separation process that utilizes retention time and settling velocity of sediment and other suspended solids to reduce BOD and TSS at the influent of a treatment facility. Septic tanks act as primary clarifiers, with the difference being location, size and quantity.

5.4.2 Flow Equalization Tanks

One common issue in smaller, highly residential communities is a high peaking factor on the average daily flow. This is due to the heavy water usage during morning and evening hours, as people prepare for and wind down from the typical workday. Pump stations and sewers can inexpensively be designed with enough capacity to accommodate this temporary, high flow rate. However, the capital cost of adding capacity to a treatment system is considerably larger. In addition, treatment facilities work better when wastewater flows remain relatively constant. For this reason, flow equalization tanks are used to store excess flow from the high flow periods and supplement flow during low flow periods. Flow equalization tanks save considerable capital cost and improve the performance of wastewater treatment systems.

Table 5.4.1. Wastewater Treatment System Alternatives

Pre-treatment Needed	Technology*	Design Flows (gpd)			
		< 2,000	2,000 - 10,000	10,000 - 20,000	20,000 - 50,000
	Pre-treatment				
--	Septic Tank++	√	√	√	+++
--	Anaerobic Upflow Filter	√	√	√	√
	Secondary Treatment				
	Fixed Film Growth				
	Rotating Biological Contractor		√	√	√
	Trickling Filter		√	√	√
√	Vegetated Submerged Beds	√	√	√	√
√	Constructed Wetlands			√	√
√	Recirculating Media Filters	√	√	√	√
√	Intermittent Media Filters	√	√	√	
	Suspended Film Growth				
	Oxidation Ditch				√
	Activated Sludge Systems	√	√	√	√
	Sequencing Batch Reactor	√	√	√	√
	Membrane Bioreactor			√	√
	Integrated Fixed Film- Activated Sludge (IFAS)	√	√	√	√
	Tertiary Treatment				
√	Nitrogen Removal	Site Dependent			
√	Phosphorous Removal	Site Dependent			
√	Emerging Contaminants	Site Dependent			

5.4.3 Anaerobic Upflow Filters (AUF) and Vegetated Submerged Beds (VSB)

AUFs and VSBs provide treatment through anaerobic biological transformations of organic and inorganic contaminants. Organic material is converted to gasses and simpler forms, more readily available organic molecules that are easier to treat in downstream aerobic processes. Denitrification can occur as nitrates get reduced to nitrogen gas in the anaerobic environment.

AUFs may be used as a pretreatment step or as a denitrification step. Performance is reliable. Environmental risk is dependent upon how the system is employed. Typically it would not be a stand-alone process and would be followed by additional polishing unit operations. The major drawbacks include temperature sensitivity and potential media clogging. Gravity flow can be used and operator attention is low.

The VSB system is suitable for on-lot and small community applications. The performance is reliable and at low loading is suitable for subsurface dispersal. It is sensitive to seasonal climate changes. The major drawbacks include the need for odor control and the potential for system clogging. Energy consumption is negligible and operator attention is low. The aesthetic benefits of vegetative cover are a plus.

5.4.4 Aerobic Processes

Aerobic processes utilize microbial uptake to remove BOD and TSS, and to convert ammonia to nitrate. These processes come in three basic configurations, as discussed below.

5.4.4.1 Fixed Film Processes

Fixed Film processes are most applicable to the smaller flows and corresponding high variation in loading that occurs in small, residential developments. These technologies include:

- Single Pass Sand Filters
- Recirculating Media Filters (RMF), where the media is either sand, gravel, foam, peat or textile
- Rotating Biological Contactors (RBC)

Single pass sand filters represent the simplest type of treatment. However, they are limited when it comes to nutrient removal beyond the basic levels of treatment for BOD and TSS.

Recirculating Media Filters (RMF) utilize media with a high surface to volume ratio as a substrate for a biofilm to grow on. Wastewater and air are mixed, using fans and/or spray heads, and contacted with the biofilm that grows on the media. The media effluent is split between recirculating and discharging to the next stage of the treatment process. Recirculation flows are partially directed to the recirculation tank where denitrification and proper dilution of the influent flow occurs.

RBCs use an engineered surface is rotated through the wastewater stream. A biofilm grows on the surface and uses the nutrients in the wastewater as an energy source to fuel growth.

Recirculating media filters have the advantage of not producing large quantities of sludge and not needing energy intensive aeration and mixing. In addition, secondary clarifiers and return sludge pumps are not necessary, simplifying the process. Fixed film processes are also more resistant to varying flows and loads than suspended growth systems. This is due to the stability of the biofilm during periods of varying loading. These systems are more reliable and require less operator involvement than processes that utilize the suspended growth technology. Sludge production is also much lower for these systems, when compared to systems that utilize suspended growth technology. The result is simplicity and lower O&M costs.

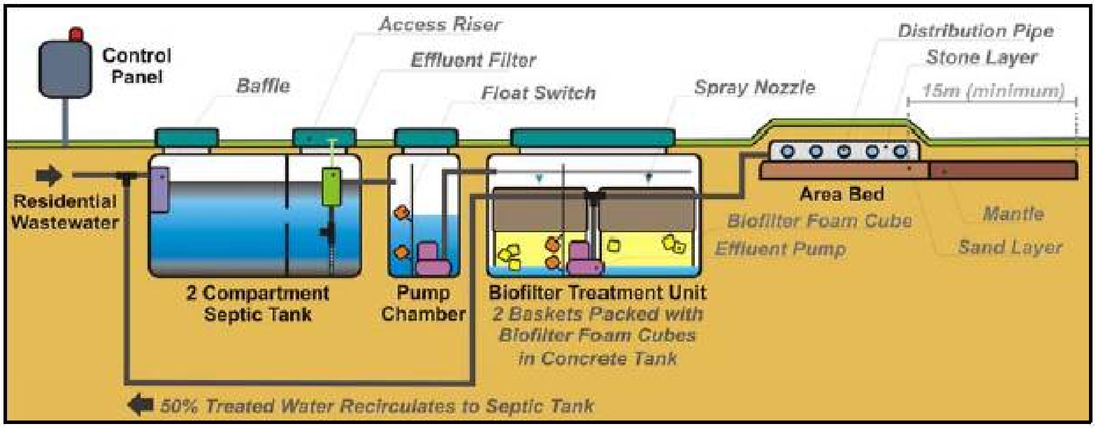
Recirculating media filters are not ideal for larger flows. Due to the reliance on surface area, the footprint of these systems becomes large as the flow increases. In general, for flows at or below 50,000 gpd, the recirculating media filters will provide a more reliable process with lower life-cycle costs than any of the other technologies. Once flows exceed 100,000 gpd, the economies of scale tend to favor other, more compact technologies. Plants that will operated in the 50,000 – 100,000 gpd flow range should be evaluated on a case by case basis to determine the most efficient and reliable technology option.

The following subsections outline the most commonly available recirculating media systems. These technologies represent the most reliable and cost effective treatment options for the potential design flows expected in the Township.

5.4.4.2 Waterloo Biofilter System

The Waterloo Biofilter system is an absorbent trickling filter in which dissolved organic matter and suspended solids are degraded by microbial action in an oxygenated environment. This unit is designed to treat septic tank effluent. The media in the trickling filter is comprised of 2-inch open-cell foam cubes that allows for microbial growth on the interior surfaces as well as the exterior surface of the foam blocks. The cubes are piled randomly into self-contained baskets that are placed in a suitable enclosure. The sides and top of the baskets are exposed to air circulation through an open meshwork. The baskets can be placed in enclosures that are above and below grade. The wastewater is sprayed over the media through spray heads controlled by a timer and floats in the pump chamber. The wastewater percolates down through the foam cubes and out the bottom of the filter. Biomat discoloration occurs in the upper 15 inches of the medium where most of the solids and organic matter are degraded, with the lower section of the filter attenuating bacteria and ammonia. Figure 5.4.1 presents the Waterloo System schematic.

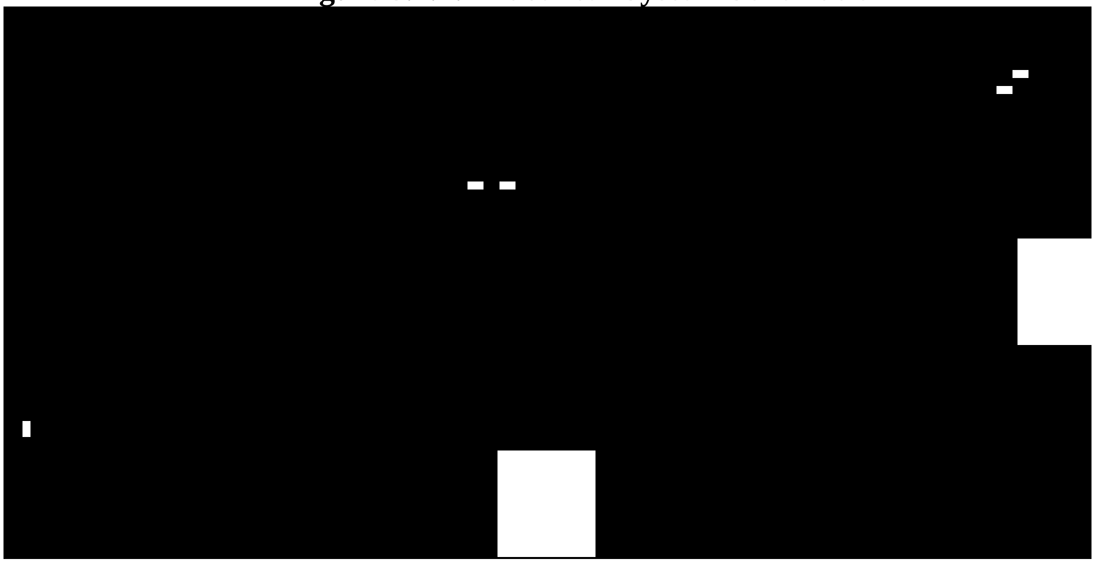
Figure 5.4.1: Waterloo System Schematic



5.4.4.3 AdvanTex System

The AdvanTex system is a recirculating, packed bed aerobic wastewater treatment system designed to treat septic tank effluent. The system is comprised of a pre-assembled, UV-protected fiberglass reinforced plastic (FRP) module that contains a textile media and spray heads to distribute the wastewater evenly over the media. A recirculation tank is used to blend influent wastewater with recirculated flow from the treatment units. This ensures sufficient biomass to treat the incoming wastewater and it provides an anoxic zone for denitrification of the nitrified recirculation flow. A Biotube Pump Package installed in the second compartment of the Processing Tank pumps effluent to a pressure distribution manifold located on top of the textile media in the filter module. The effluent is applied at a preset recirculation ratio of between 3:1 to 5:1, controlled by a timer. Timer settings can be recalibrated if flows vary significantly from projected flows. Effluent from the filter module flows in part or totally to the Processing Tank (where applicable) or to an external pump chamber or distribution box. During extended periods of low flow, all of the treated effluent is returned to the Processing Tank or external pump chamber. Figure 5.4.2 presents the Advantex System schematic.

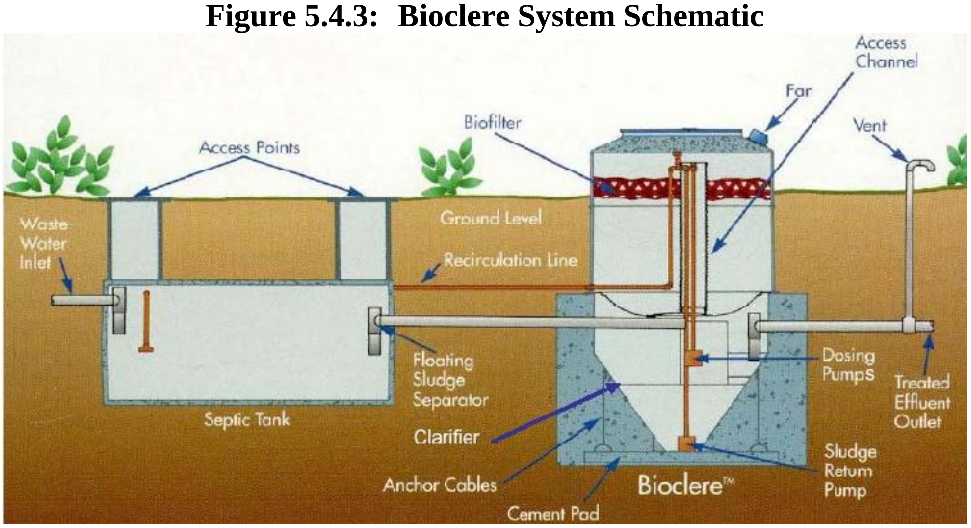
Figure 5.4.2: Advantex System Schematic



5.4.4.4 Bioclere System

The Bioclere system, is a fixed film reactor that consists of one or more fiberglass tanks containing a trickling filter section with inert plastic media, a clarifier and sump, a fan for supplying sufficient air to the biofilm and dosing and recirculating pumps. Effluent from the septic tank is sprayed over the plastic media and then enters the clarifier that separates solids from the liquid. The liquid effluent is discharged utilizing pressure distribution. A recycle pump returns settled solids to the recirculation tank. Figure 5.4.3 presents the Bioclere System schematic.

Figure 5.4.3: Bioclere System Schematic



5.4.4.5 Recirculating Sand Filter (RSF)

A typical RSF system consists of a septic tank, a recirculation tank and a sand filter. Effluent from the sand filter is recirculated to the recirculation tank, the septic tank or both.

In time controlled small doses, the mixed flow from the recirculation tank is applied to a sand filter bed. The wastewater is evenly distributed over the media bed by a pressure distribution system. As the wastewater trickles downward through the media, biological treatment on the surface of the media particles reduces BOD_5 and TSS, as well as nitrifying the filtrate. The filtrate is than collected at the bottom of the sand filter, and is split so that a portion is returned by gravity to the recirculation tank and the remaining flow goes to the next stage of the treatment process.

5.4.5 Suspended Growth Processes

The extended aeration package plant is the most simple suspended growth system. However, it is also the most unreliable and least adaptable for nutrient removal applications. This process is not considered a viable option for these study areas, as their performance suffers in cold weather. The generic options for suspended growth technologies on the market for the anticipated flows include the following:

- Packaged Conventional and Modified Activated Sludge Processes
- Sequencing Batch Reactors (SBR)
- Membrane Bioreactors (MBR)

Suspended growth processes treat wastewater using similar bacteria as the fixed film processes. The difference is that in this process, bacteria and solids are maintained in suspension within an aeration tank. These bacteria grow as they absorb nutrients. A secondary clarifier is needed following the aeration tank to settle the biosolids into what is then called activated sludge. A portion of the activated sludge is returned to the aeration tank where it is blended with influent wastewater to ensure that sufficient active bacteria are available to uptake the available nutrients. Packaged conventional and modified activated sludge processes all have similar process flows, with different configurations and appurtenances. SBRs are unique in that they utilize a batch process to combine treatment stages in a single tank. These units have great treatment potential, however, they are highly reliant on the close supervision of skilled operators. For this reason, they are not recommended for lower flows where full time specialized operations will not be feasible.

MBRs utilize the same suspended growth technology, replacing the secondary clarifiers with membranes. These processes have a range of treatment options, depending on the type of membranes used. Specialized operations and high life-cycle costs limits the feasibility of MBRs to areas with space constraints and/or a higher required treatment levels. These systems operate at a high MLSS level and a long sludge age, thereby reducing the amount of sludge production and adding stability to the process during varying flows and loads. The major concern with activated sludge processes is washout of the solids in the clarifier. MBRs offer an added measure of protection against this type of failure.

The major drawbacks of suspended growth systems are as follows:

- Higher sludge production and associated disposal issues
- High energy consumption
- High degree of operator involvement/skill required
- More sensitive to varying loading rates and process upsets

Suspended growth systems tend to be costly on a dollars per gpd basis at lower flows. As flows increase, the construction costs decrease on a dollars per gpd basis. The economies of scale must reach a point where the higher O&M costs are offset by the lower construction costs. Typically, flows must exceed 75,000 – 100,000 gpd (depending on the type of suspended growth system) before they start to become feasible on a total life cycle cost basis. The reliability of these systems is highly dependent on the operations staff. With full-time skilled operations, adjustments can be made as potential upsets occur. Aeration cycle time, recirculation ratios, return activated sludge (RAS) rates and waste activated sludge (WAS) rates all have an effect on the settleability of the mixed liquor.

Without full time, skilled operations staff, the suspended growth processes are not recommended for use in the study areas.

5.4.6 Integrated Fixed Film and Suspended Growth Processes

Integrated Fixed Film and Suspended Growth processes combine the fixed film and suspended growth technologies in one treatment process. Examples of these processes include the following:

- FAST
- AccuWeb
- LOTUS

These processes tend to require less space and are often more applicable to lower flows than the traditional suspended growth processes. In addition, by combining both processes, resistance to process upsets is increased over the suspended growth process alone. The addition of a fixed film media to the aeration tank in these processes increases the treatment capacity and reduces the footprint of the aeration tank. Despite the incorporation of the fixed film process, this technology has the same dependencies on operator attention and skill. For this reason, the integrated fixed film and suspended growth processes are not recommended for use in the study areas.

5.5. NUTRIENT REMOVAL

Additional nutrient removal may be required, and will be evaluated as an alternative. Nutrient removal normally requires the addition of carbon or heavy metals for nitrate and phosphorus respectively.

5.5.1 Active and Passive Carbon Feed

Nitrogen removal is achieved in an anoxic zone where denitrifying bacteria thrive. The anoxic zone follows the nitrification process, as for practical purposes, only nitrified wastewater can be denitrified. In typical wastewater, there is not a sufficient carbon source following the nitrification process.

An active carbon feed system utilizes a chemical feed system to dose methanol or some other carbon source to the anoxic zone where denitrification occurs. These systems require the storage and delivery of chemicals, and proper process control must be installed to prevent over or under dosing.

A passive carbon feed system utilizes a media that acts as a carbon source in an anoxic tank. Nitrified wastewater enters the tank and slowly flows around and through the media. The media supplies the necessary carbon to facilitate the denitrification process.

5.5.2 Active and Passive Chemical Feed Systems

Phosphorus removal is achieved by chemical precipitation during which dissolved multivalent metals (typically iron and aluminum) bond with the dissolved phosphorus to form a solid. This solid then precipitates out of solution and settles into the sludge.

An active chemical feed system doses metal salts (typically ferric or ferrous chloride or alum) to initiate the precipitation reaction. These systems produce excessive sludge and must also be monitored to prevent over or under dosing.

A passive chemical feed system utilized an iron rich media that releases the iron ion into solution. By only adding the metal ion and not the metal salts used in active chemical feed systems, the volume of sludge produce by the precipitation reaction is minimal.

5.6. DISINFECTION

The potential disinfection options for the wastewater systems are:

- Ozone
- Chlorine
- Ultraviolet (UV)

5.6.1 Ozone

Ozone disinfection operates by bubbling ozone through the wastewater. Ozone (O_3) is a strong oxidant and is highly toxic to microorganisms. The process by which ozone disinfects also destroys the ozone molecule, leaving only molecular oxygen (O_2) and inert organics in the disinfected wastewater. Ozone disinfection is also subject to concerns over the lack of disinfectant residuals to deter bacterial regrowth. Bromate, a known carcinogen, is a potential disinfection by-product for water that contains bromide. Ozone disinfection also has the highest energy costs of the three disinfection systems considered. Ozone treats for the emerging contaminants – pharmaceuticals and personal care products.

Ozone has the following advantages:

- Strong disinfecting power
- No hazardous material storage necessary
- No need to remove prior to discharge
- No THM or HAA formation

Ozone has the following disadvantages:

- No residual to prevent bacterial regrowth
- High capital cost
- High operating cost
- Potential bromate formation for bromide-containing water

5.6.2 Chlorine

The use of chlorine for wastewater disinfection has been practiced for the past century. A variety of technologies are used including tablets, gas, and chlorine dioxide. Due to its deleterious environmental effects, dechlorination may be required. Chlorination of waters containing organic materials, such as treated wastewater, has a strong potential to form THM and HAA acids. Both are known carcinogenic disinfection by-products.

Chlorine has the following advantage:

- Maintenance of residual to prevent bacterial regrowth

Chlorine has the following disadvantages

- THM and HAA formation potential is high for treated wastewater
- Hazardous chemical delivery and storage is necessary
- Dechlorination is normally necessary

5.6.3 Ultraviolet Disinfection (UV)

UV disinfection operates by exposing the wastewater to a UV light source of sufficient intensity to kill infectious organisms in the wastewater. UV does not maintain a residual to prevent bacterial regrowth. This lack of residual disinfectant and the potential for bacterial regrowth has been a concern with this method.

UV has the following advantages:

- No hazardous material storage necessary
- No need to remove prior to discharge
- No THM, HAA or bromate formation
- Mechanically simple system
- Low operating and maintenance costs

UV has the following disadvantages:

- No residual to prevent bacterial regrowth

UV disinfection is the most simple and lowest cost option for disinfection.

6. NEED BASED TECHNOLOGY SCREENING FOR ON-LOT SYSTEMS

LAI identified feasible technology options for areas where on-lot solutions are selected as the preferred approach. The needs identified in Section 4 were used as a guideline for selection of potential treatment/dispersal technologies.

6.1. TYPICAL STUDY AREA NEEDS

The following limitations to on-lot systems were identified within the Township:

1. Insufficient depth to limiting zone – either rock or groundwater
2. Environmental constraints – slopes, wetlands, floodplains, streams, ponds other regulatory setback requirements
3. Inadequate separation from drinking water wells, where a possible water supply solution may be preferred
4. Soils with potential for high percolation rates

Table 6.1.1 summarizes the results of the needs analysis in terms of the four categories listed above.

6.2. NEEDS AND RECOMMENDED TREATMENT AND DISPERSAL OPTIONS

For each of the four needs categories, there are unique considerations. The following is a brief discussion of what the concerns are with each identified need and the corresponding requirements these have on any proposed treatment/dispersal system.

6.2.1 Depth to Limiting Zone

The concern in areas where there is insufficient depth to limiting zone is that there will not be enough naturally occurring pervious material between the bottom of the drainfield and ultimate contact with groundwater. Bedrock is a concern since it offers no additional treatment beyond the soils above it. Water will flow along or through the bedrock until it reaches a body of water or other groundwater.

Insufficient depth to limiting zone reduces and in extreme cases eliminates the ability of the drainfield to perform its function. Therefore it is necessary to provide treatment beyond a standard septic tank prior to sending effluent to the drainfield. Secondary treatment is recommended. In this case, the septic tank and drainfield are still used, however a secondary treatment unit is place in the middle to substantially reduce the BOD, TSS, ammonia and total nitrogen sent to the drainfield.

Drip irrigation can be used to reduce the depth of the drainfield, resulting in increased depth to limiting zone.

Table 6.1.1 Study Area Needs Analysis Summary

Study Area	Study Area Parcels	Variance or Advanced Treatment System Required						Conventional On-Lot System Feasible				
		Enviro. Constraint	Potential Water Supply Solution	Perc Rate	Depth to Limiting Layer	Subtotal Variance / Non Standard	% Study Area Parcels	Standard System	Elevated Sand Mound	Sub-surface Sand Filter	Subtotal On-Lot	% Study Area Parcels
Develop. District	81	0	15	0	22	37	1.4%	36	3	2	41	1.5%
Passer	52	1	22	0	0	23	0.8%	19	8	0	27	1.0%
Pleasant Valley	75	15	26	0	3	44	1.6%	1	29	0	30	1.1%
Route 309	56	13	13	0	5	31	1.1%	10	14	0	24	0.9%
Springtown	306	97	0	0	2	99	3.6%	138	48	0	186	6.8%
Zion Hill	103	6	23	0	16	45	1.7%	29	24	3	56	2.1%
Outlying	2,045	89	137	3	214	443	16.3%	1,113	415	33	1,561	57.4%
Total:	**2,718**	**221**	**236**	**3**	**262**	**722**	**26.6%**	**1,346**	**541**	**38**	**1,925**	**70.8%**

* The Sum of the two "% of Study Area Parcels" columns does not equal 100% as a result of parcels with Tax Assessors records and no corresponding GIS shape files.

6.2.2 Environmental Constraints

In areas where regulatory setback requirements are not met due to lot size and/or proximity to environmentally sensitive areas, additional safety measures are prudent. In most cases, where existing usage is not proposed to increase and there is no evidence of a public health threat, it is recommended that variances be issued by the County Health Department for repairs/replacement of existing systems or new systems. In areas that have one or more constraints that may be a public health concern, secondary treatment with disinfection is recommended.

6.2.3 Water Supply Well Separation

The majority of Springfield Township uses individual wells to supply drinking water. As such, maintaining sufficient separation between the septic system and the drinking water well is critical from a public health perspective. In areas where insufficient separation exists, a public water supply solution may be the most protective solution. Where this is not feasible, secondary treatment plus disinfection is recommended.

6.2.4 Soils With Slow Percolation Rates

Slow percolation rates are indicative of soils with excessive fines and/or clay. These soils do not drain well and have a greater potential to fail.

Current regulations scale the loading rate as a function of percolation rate. This is done to reduce the loading on soils that have a greater potential to clog. Adding a simple treatment unit between the septic tank and the drainfield is recommended. Anaerobic Upflow Filters (AUF) are a simple, cost effective method of BOD and TSS reduction. For areas where the percolation rate exceeds 90 mpi and no other constraint exists, an AUF may be sufficient. Where percolation rates exceed 120 mpi, secondary treatment is recommended. Drip irrigation is preferred in addition to secondary treatment in these areas.

6.2.5 Discussion of Failure Criteria & Needs

An on-lot system can fail in one of two general ways - functional and performance. Functional failures are characterized by noticeable, visible signs of failure, such as breakout or ponding. Performance failures are characterized by inadequate treatment. These types of failures may result in bacterial and/or nutrient contamination of water resources. Performance failures are more difficult to identify and generally require relocation or increased treatment.

The needs identified in Section 3, for which specific treatment and dispersal technologies are recommended, are not intended to designate failing systems. Individual system failures can only be identified through inspections and sampling programs. Properties identified as having needs are based on available data and analytical methods used, and only represent areas of concern, not specific properties with failing systems.

6.2.6 Summary

Sections 6.2.1 – 6.2.4 describe the family of solutions that are technically feasible for each need type. Table 6.2.1 summarizes this analysis.

Table 6.2.1 Treatment & Dispersal Options

Need Type	Treatment Options						Dispersal Options			
	2 Compartment Septic Tank & Effluent Tee Filter[1]	Anaerobic Upflow Filter[2]	Sub-Surface Sand Filter	Recirculating Sub-Surface Media Filter/ or CO-OP RFS II	Other Recirculating Media Filters	Ultraviolet Disinfection Systems	Standard Trench or Bed	Elevated Sand Mound	Drip Irrigation	Spray Irrigation[3]
Environmentally Constrained	X		X	X	X	X	X		X	X
Insufficient Well/Septic Separation	X			X	X	X	X		X	
Slow Percolation Rates	X	X	X	X	X				X	
Depth to Limiting Layer	X		X	X	X			X	X	X
All Areas	X						X		X	

[1] 2 Compartment Spetic Tanks & Effluent Tee Filters are recommended for all systems, regardless of needs type. They are to be used in addition to other treatment options.

[2] AUFs are not necessary when other secondary treatment options are used.

[3] Requires secondary treatment and disinfection, generally not recommended for individual systems.

6.3. NEED BASED TREATMENT TYPE SELECTION

Section 6.2 identified the family of solutions that are appropriate for each need category. Advanced treatment options for additional nitrogen and phosphorous removal, presented in Section 5, were examined. In addition, nutrient enrichment does not appear to be an issue in most reaches of Cook's Creek at this time. However, this situation may change and may require use of nitrogen or phosphorous reduction techniques for those portions of the creek identified by water sampling as having nitrate or phosphate levels that would jeopardize the classification of Cook's Creek as an Exceptional Quality Watershed. A septic system that lies within an environmentally constrained area may not necessarily pose a threat to public health or the environment. A determination must be made as to if an individual property will require additional treatment. If it is determined that no potential public health threat exists, it is recommended that variances be granted by the Bucks County Board of Health. Table 6.3.1 presents the recommended treatment and dispersal types for each needs category where new construction or existing system failure require an on-lot solution under challenging conditions or location.

Table 6.3.1. Recommended Technology Options for On-lot Systems

Site Condition	Recommended Treatment Option	Recommended Dispersal Option
All areas	✓ **Two compartment septic tank** ✓ **Effluent tee filters**	✓ **Standard Trench/Bed System**
Soils with shallow depth to limiting zone	✓ **Secondary Treatment**	✓ **Elevated Sand Mound** ✓ **Drip Irrigation**
Environmentally Constrained Areas	✓ **Secondary Treatment as Needed**	✓ **Standard Trench/Bed System**
Areas with septic – drinking water well separation issue	✓ **Secondary Treatment** ✓ **UV Disinfection**	✓ **Standard Trench/Bed System**
Soils with slow percolation rates	✓ **AUF** ✓ **Secondary Treatment**	✓ **Drip Irrigation**

Section 7 presents a breakdown of the strengths and limitations for the different secondary treatment systems, geared toward community sized treatments systems. The same discussion is applicable for individual on-lot systems where secondary treatment is required.

6.4. General Best Practices

"The following best practices were recommended for review and comment as potential requirements for on-lot systems:

1. *Two Compartment Septic Tanks and Effluent Tee Filters*

   Two compartment septic tanks and effluent tee filters are essential to ensure proper drainfield function and are covered in detail in Section 5.1.1. Access openings with risers to grade must be installed over both the influent and effluent ends. All septic tanks and risers should be tested for water tightness before backfilling.

2. *Flow Diversion Valves*

   Installation of flow diversion valves is a prudent practice to avoid excess disturbance upon installation of new drain fields or to allow switching between the primary and reserve drain fields. A properly valved distribution box can act as a flow diversion valve.

3. *Inspection Ports*

Inspection ports are essential for operation, maintenance, and inspection of all components of the wastewater system. Inspection ports should be installed to grade for all components that do not have access openings already installed, such as distribution boxes and drainfields. Drainfield monitoring wells, installed to the depth of the drainfield distribution piping, are needed to check for ponding.

4. *Ground-Based Effluent Disposal Only*

Subsurface discharge using the appropriate technology is the only recommended method of effluent disposal. Stream discharge should not be permitted unless there is no alternative. Requirements for stream discharge are detailed in Section 5.1.3.

5. *Maintenance and Inspection Procedures*

Maintenance and inspection are critical components of a management program for on lot systems. Chapter 9 covers maintenance and inspection in detail.

6. *Property Transfer Inspections*

Property transfer inspections are covered in Chapter 9.

7. *Plumbing Fixtures to Reduce Wastewater Volume*

Low volume fixtures are useful for reducing hydraulic surging and loading of drainfields.

8. *Reduction of Disinfectants and Phosphates in Waste Stream*

Using UV instead of chlorine is recommended to reduce disinfectants in waste streams. Requiring the use of phosphate-free laundry and dishwashing detergents is an effective way to reduce phosphates in septic system effluents. Where there is a demonstrated need for further reduction in phosphates, passive phosphorus removal technologies are available.

7. TECHNOLOGY SCREENING FOR COMMUNITY TREATMENT SYSTEMS

For areas where secondary treatment is needed, each alternative must be evaluated for a given site in terms of its appropriateness in solving the problem, its costs, and its environmental impacts. This section presents a screening of alternatives for collection, treatment, disinfection and dispersal for the WWTFs associated with community systems. A more detailed analysis of economic and non-economic factors is presented in Section 8.

7.1. COLLECTION SYSTEMS OVERVIEW

Section 5 detailed the collection system alternatives. The study areas within the Township are relatively small. The Designated Development District, Route 309 and Springtown are the most likely areas where community treatment may be considered.

7.1.1 Recommended Collection System Alternatives

Pressure-fed systems require pumps and/or valve assemblies for each property. This complicates the design and increases operation and maintenance requirements. In cases where multiple pump stations and long, flat sewer reaches would be necessary, these complicating factors are frequently offset by advantages such as shallower burial depth, smaller diameter pipes and no need for area pump stations. Due to the relative small size of the study areas within the Township a vacuum system is not considered a viable option.

In areas where all pressure systems are selected, a STEP system that utilizes existing or new septic tanks is the recommended technology choice. For all other areas, gravity-based sewers (STEG or conventional gravity), with pressure systems (STEP or Grinder Pump) installed on individual properties as needed, are the recommended technology choice for wastewater conveyance to the treatment facility.

It is our experience that for communities such as Springfield, STEG/STEP are the most cost effective solution.

7.2. TREATMENT SYSTEMS OVERVIEW

Aerobic processes utilize microbial uptake to remove BOD and TSS as well as to convert ammonia to nitrate. These processes come in the following three basic configurations:

- Fixed Film Processes – Single Pass and Recirculating
- Suspended Growth (Activated Sludge) Systems
- Integrated Fixed Film and Activated Sludge Systems

Additional nutrient removal is not likely to be required in Springfield. For any areas where nutrient removal may be required, the options are as follows:

- Active carbon feed for nitrogen removal through denitrification
- Passive carbon feed for nitrogen removal through denitrification
- Active metal (iron or aluminum) salt feed for phosphorus removal by precipitation
- Passive metal addition (reductive iron dissolution) for phosphorus removal by mineralization

7.3. Treatment

The potential treatment technologies and their applicable flow ranges for WWTFs were presented in Table 5.4.1.

7.3.1 Recommended Fixed Film Technology

Experience has shown that for the flow rates less than 50,000-100,000 gpd, RMFs are proven to be a simple, effective and economical, treatment alternative to conventional treatment facilities. From a treatment perspective, fixed film technology minimizes sludge handling issues, requires less operator attention and is inherently more stable with respect to varying flows and loads. For these reasons, RMFs are the preferred fixed film technology.

The following 2 types of RMFs are most applicable to potential facilities in Springfield Township:

- RSF using locally available filter media (sand or gravel)
- RMF using a high-rate synthetic filter media

The various high-rate RMF manufacturers utilize proprietary media with a high surface to volume ratio. This allows for a much higher surface loading rate when compared to conventional RSFs. These systems are modular with a much smaller (approximately 5 times smaller) footprint than conventional RSFs. This makes high-rate synthetic RMFs attractive where space is a consideration and where sand or alternative RSF filter media is not readily available or costly. Simplicity of design, ease of operation, reliability and lower capital cost make RMFs the most likely choice for wastewater treatment for Springfield Township.

7.3.2 Recommended Suspended Growth Technology

As discussed in Section 5, suspended growth systems require a high degree of operator attention, without which the potential for upsets is greatly increased. MBR systems offer an added measure of security by using a membrane barrier instead of a clarifier, preventing solids washout during process upsets. This added measure of reliability makes the MBR the preferred and only technically viable suspended growth technology for the low flows in Springfield Township. The major drawbacks for MBR systems are a much higher reliance on operator skill and involvement along with higher O&M costs. The higher O&M costs are due to increased operator time and high power costs.

7.4. DISPERSAL

Alternatives for dispersal / reuse of treated effluent include:

- Standard trench/bed systems
- Drip irrigation
- Water reuse for non-potable purposes
- Various combinations of the above

Table 6.2 outlined the dispersal options for each needs category for on-lot system. Elevated sand mounds are not considered viable for larger systems, as the cost and footprint of the mound would be prohibitive.

7.5. TECHNOLOGY SCREENING SUMMARY

In summary, the alternatives analysis for each WWTF will consist of the following options:

Collection:

- STEG w/ STEP, as needed
- Conventional Gravity w/ grinder pumps as needed.

Treatment Systems:

- RMFs using locally available filter media
- RMFs using a high-rate synthetic filter media
- MBR

Disinfection:

- UV System

Dispersal:

- Conventional trenches or beds
- Drip irrigation
- Water Reuse

7.6. RECOMMENDED TECHNOLOGY

Based on industry and LAI's experience with wastewater systems applicable to the range of flows anticipated in Springfield Township, fixed film processes are preferred. For smaller, highly variable influent flows and loads, fixed film processes are more reliable, less complicated and more economical on a life-cycle basis. The Recirculating Subsurface Media Filter and the CO-OP RFS III, as described in PADEP's Alternate Systems Guidance document, are locally approved examples of recirculating fixed film processes. It is likely that the other commercially available systems, such as the ones described in Section 5, are approvable.

For the scenarios in which enhanced nutrient removal is required, the passive nitrogen and phosphorus systems are recommended, as increased operator oversight, chemical storage and increased sludge production (for phosphorus removal only) are undesirable drawbacks of the active feed systems.

7.7. GENERAL BEST PRACTICES

The following best practices were recommended for review and comment as potential requirements for community systems:

1. *Concrete or Fiber-Reinforced-Plastic (FRP) tanks*

   Concrete and FRP tanks are both acceptable for use in community systems. All tanks should be tested for water tightness and tank section seams below the high ground water elevation should be avoided whenever possible.

2. *Control of Sewage Treatment and Discharge Independent of Inflow Variations*

   The use of flow equalization tanks is essential for dampening variations in influent flows and loads. Flow equalization volume of a minimum of 33% of full design flow should be installed as part of all community systems. Chemical feed systems can in most cases be avoided. Where necessary, all chemical feed systems must be flow-paced via a representative flow meter.

3. *Redundancy of Active Mechanical Components*

   Where flows exceed 2,000 gpd, full redundancy for all pumps and other major unit processes should be provided such that all components of the treatment systems can function at design flow with the largest unit out of service.

4. *Programmable Solid State Controls*

   Flexibility in design and operation of systems is an important part of proper operation. Control panels should be designed such that key operational parameters are clearly displayed and easily changed. Alarm and timer settings, flow limits and flow function are some of the features that should be easily accessed and adjusted by the operator.

5. *Continuous Remote Monitoring of System Components*

   Control panels should have telemetry capabilities that allow for immediate notification of multiple parties in the event of an alarm condition. The system operator should have the ability to remotely access and control key process parameters.

6. *Automated Sludge Wasting Pump to Transfer Sludge*

   This is only applicable to aerobic treatment processes, which are not recommended for flows less than 50,000 gpd.

7. *Inspection Ports*

   Inspection ports are essential for operation, maintenance, and inspection of all components of the wastewater system. Inspection parts should be installed to grade for all components that do not have access openings already installed, such as distribution boxes and drainfields. Drainfield monitoring wells, installed to the depth of the drainfield distribution piping, are needed to check for ponding that has not yet resulted in breakout.

8. *Ground-Based Effluent Disposal Only*

   Subsurface discharge using the appropriate technology is the only recommended method of effluent disposal. Stream discharge should not be permitted unless there is no alternative. Requirements for stream discharge are detailed in Section 5.1.3.

9. *Denitrification Capability*

   Where there is a demonstrated need for reduced nitrogen levels in the system effluent, addition of denitrification processes should be required. See Section 5.5.1 for technology options.

10. Periodic Maintenance and Inspection

Maintenance and inspection are covered in Chapter 9.

11. Effluent Testing

Maintenance and inspection are covered in Chapter 9.

12. Plumbing Fixtures to Reduce Wastewater Volume

Low volume fixtures are useful for reducing hydraulic surging and loading of drainfields.

13. *Reduction of Disinfectants and Phosphates in Waste Stream*

Using UV instead of chlorine is recommended to reduce disinfectants in waste streams. Requiring the use of phosphate-free laundry and dishwashing detergents is an effective way to reduce phosphates in septic system effluents. Where there is a demonstrated need for further reduction in phosphates, passive phosphorus removal technologies are available.

8. TECHNICALLY VIABLE WASTEWATER MANAGEMENT OPTIONS FOR STUDY AREAS

8.1. OVERVIEW

Each study area has specific needs that favor specific technologies for collection (if applicable), treatment and dispersal/reuse. LAI has developed alternatives that are technically feasible, with respect to the individual needs of each study area.

Table 8.1.1 illustrates the developed and undeveloped parcels and code and estimated actual wastewater flows for each study area.

Table 8.1.1: Wastewater Flows by Study Area

Study Area	Parcels			Wastewater Flow (gpd)	
	Dev.	Undev.	Total	Code[(1)]	Estimated Actual[(2)]
Springtown	241	65	306	56,925[(2)]	56,925
Zion Hill	84	19	103	36,590	20,582
Passer	43	9	52	18,200	10,238
Pleasant Valley	66	9	75	25,400	14,288
Develop. District	59	22	81	25,305	14,234
Route 309	30	26	56	17,205	9,678
Outlying	1,545	500	2,045	666,700	374,344
Total:	2,068	650	2,718	846,325	500,288

(1) Using code flow of 400 for 3 or less bedrooms and 100 for each additonal bedroom over 3.
(2) Using 225 gpd/residential unit.

8.2. SPRINGTOWN

Table 3.2.5, outlining the study area needs definition, is repeated here.

Table 3.2.5: Needs Definition- Springtown

	Springtown Study Area Parcels	Variance or Advanced Treatment System Required[1]						Conventional On-Lot System Feasible				
		Enviro. Constraint	Potential Water Supply Solution	Perc Rate	Depth to Limiting Zone	Total	% Study Area Parcels	Standard System	Elevated Sand Mound	Sub-surface Sand Filter	Total On-Lot	% Study Area Parcels
Developed	241	72	0	0	2	74	24.2%	121	44	0	165	53.9%
Undeveloped	65	25	0	0	0	25	8.2%	17	4	0	21	6.9%
Total	306	97	0	0	2	99	32.4%	138	48	0	186	60.8%

[1] For repairs or new construction. Does not apply to existing systems that are not identified as failing.
[2] The Sum of the two "% of Study Area Parcels" columns does not equal 100% as a result of parcels with Tax Assessors records and no corresponding GIS shape files.

8.2.1 On-Lot Alternative

Many of the lots in Springtown are environmentally constrained, however there is little evidence of failing systems, as defined in Section 6.2.5. The majority of the environmental constraints are due to setback requirements from wetlands, streams and floodplains. Provided that soils and depth to limiting zone are compliant with PADEP requirements, environmental constraints do not necessarily constitute a threat to public health or the environment. Variances to setback requirements are recommended and could be issued by the Bucks County Health Department.

For the five properties located in Zone 1 of a public water supply well, additional treatment or relocation outside of the Zone 1 is recommended.

There does not appear to be a need for a community collection/treatment/dispersal system, provided that appropriate levels of treatment are selected for each needs type, as failing systems are remediated or new systems installed.

8.2.2 Community System Alternative

8.2.2.1 Collection System

A gravity collection system is feasible, with a minimum of 2 pump stations required. Conventional and STEG systems are both technically viable. A STEG system is recommended due to its generally lower cost and the high groundwater conditions that are present in parts of Springtown. High groundwater favors the smaller diameter, shallower collection system piping associated with STEG systems. Dewatering during installation and potential inflow and infiltration (I/I) are minimized with shallower, smaller pipes and the minimization of manholes associated with STEG systems.

8.2.2.2 Treatment System

The design flow for the Springtown Study Area is approximately 57,000 gpd with no anticipated buildout flow projected. While this flow is large enough to consider conventional treatment systems, RMF systems are technically viable and more reliable and easier/less expensive to maintain. As discussed in Sections 5-7, RMFs are the recommended technology choice, where applicable. Disinfection is not likely necessary if subsurface disposal is used.

8.2.2.3 Dispersal

Potential dispersal sites inside Springtown are limited, and have either excessive slopes or are environmentally constrained. There are potential dispersal sites outside the Study Area. Alternative dispersal techniques are not needed, as it is assumed that a suitable dispersal site will be located if the community system alternative is chosen. We have identified potential dispersal areas downstream of Springtown Village.

8.3. ZION HILL

As mentioned in Sections 2 and 3, the majority of the parcels in Zion Hill are connected to the MTASA sewer system. While connection of the remaining properties to the MTASA sewer system would be the best solution for properties with identified needs, there is no available capacity to connect additional properties. For the remaining properties, the needs analysis is summarized in Table 8.3.1.

Table 8.3.1: Needs Analysis for Non-Sewered Properties in Zion Hill

	Zion Hill Study Area Parcels (No Connection to MTASA)	Variance or Advanced Treatment System Required[1]						Conventional On-Lot System Feasible				
		Enviro. Constraint	Potential Water Supply Solution	Perc Rate	Depth to Limiting Zone	Total	% Study Area Parcels	Standard System	Elevated Sand Mound	Sub-surface Sand Filter	Total On-Lot	% Study Area Parcels
Developed	33	0	1	0	4	5	9.8%	22	5	1	28	54.9%
Undeveloped	18	2	3	0	5	10	19.6%	2	6	0	8	15.7%
Total	51	2	4	0	9	15	29.4%	24	11	1	36	70.6%

[1] For repairs or new construction. Does not apply to existing systems that are not identified as failing.

8.3.1 On-Lot Alternative

Given the restrictions on connections to the existing sewer, on-lot alternatives are the only likely alternative. Depth to limiting zone and one property that may have a well/septic separation issue are the identified needs in Zion Hill. The technically viable treatment options include the following:

- Secondary treatment and drip irrigation where depth to limiting zone will not allow for a mounded system.
- Elevated sand mound where depth to limiting zone is restrictive, but not prohibitive of this type of system.
- Subsurface sand filters are applicable to sites where percolation rates are slow but not prohibitive, and depth to limiting zone is not an issue.

8.3.2 Community System Alternative

Due to the small number of lots with identified needs, a community system alternative is not considered technically viable for the Zion Hill study area.

8.4. PASSER

Table 3.2.13, outlining the study area needs definition, is repeated here.

Table 3.2.13: Needs Definition- Passer

	Passer Study Area Parcels	Variance or Advanced Treatment System Required[1]						Conventional On-Lot System Feasible				
		Enviro. Constraint	Potential Water Supply Solution	Perc Rate	Depth to Limiting Zone	Total	% Study Area Parcels	Standard System	Elevated Sand Mound	Sub-surface Sand Filter	Total On-Lot	% Study Area Parcels
Developed	43	0	18	0	0	18	34.6%	17	8	0	25	48.1%
Undeveloped	9	1	4	0	0	5	9.6%	2	0	0	2	3.8%
Total	52	1	22	0	0	23	44.2%	19	8	0	27	51.9%

[1] For repairs or new construction. Does not apply to existing systems that are not identified as failing.
[2] The Sum of the two "% of Study Area Parcels" columns does not equal 100% as a result of parcels with Tax Assessors records and no corresponding GIS shape files.

8.4.1 On-Lot Alternative

Small lot size and shallow, but not prohibitive, depth to limiting zone are the identified needs issues in Passer. The potential exists for insufficient separation between the drinking water wells and the septic systems. The technically viable options in Passer are:

- Secondary treatment with UV for septic systems currently located within 50' of a drinking water well where well relocation is not possible.
- Elevated Sand Mounds where depth to limiting zone is shallow but not prohibitive.

8.4.2 Community System Alternative

Should septic/well separation issues prove to be prevalent, a community water supply system should be explored, as it may be the appropriate alternative. There does not appear to be a need for a community wastewater solution.

Environmental Engineers/Consultants
LOMBARDO ASSOCIATES, INC.

8.5. PLEASANT VALLEY

Table 3.2.17, outlining the study area needs definition, is repeated here.

Table 3.2.17: Needs Definition- Pleasant Valley

	Pleasant Valley Study Area Parcels	Variance or Advanced Treatment System Required[1]						Conventional On-Lot System Feasible				
		Enviro. Constraint	Potential Water Supply Solution	Perc Rate	Depth to Limiting Zone	Total	% Study Area Parcels	Standard System	Elevated Sand Mound	Sub-surface Sand Filter	Total On-Lot	% Study Area Parcels
Developed	66	8	25	0	3	36	48.0%	1	28	0	29	38.7%
Undeveloped	9	7	1	0	0	8	10.7%	0	1	0	1	1.3%
Total	75	15	26	0	3	44	58.7%	1	29	0	30	40.0%

[1] For repairs or new construction. Does not apply to existing systems that are not identified as failing.
[2] The Sum of the two "% of Study Area Parcels" columns does not equal 100% as a result of parcels with Tax Assessors records and no corresponding GIS shape files.

8.5.1 On-Lot Alternative

Environmental constraints, well/septic separation and depth to limiting zone are the primary issues in Pleasant Valley. The technically viable alternatives for these needs are as follows:

- Secondary treatment as needed to accommodate environmental constraints for new construction and remediation of failed systems.
- Secondary treatment plus UV disinfection where insufficient well/septic separation exists and where depth to limiting zone is prohibitive.
- Elevated Sand Mounds where depth to limiting zone is shallow but not prohibitive.

Given the proximity to Cooks Creek, the shallow depth to limiting zone and other environmental constraints, proper inspection, design, maintenance and management of on-lot systems in this study area is critical.

8.5.2 Community System Alternative

Should a more detailed analysis of properties reveal a significant well/septic separation problem, a community water supply solution may be the most viable alternative. If any expansion or change in intensity of use is proposed, a community wastewater solution may be preferred.

8.5.2.1 Collection System

Standard or mounded systems with existing septic tanks are the current practice in Pleasant Valley. Bedrock is very shallow throughout the area, making the smaller diameter, shallower piping associated with STEG systems preferred. Depending on the location of any community treatment and dispersal site, 1-2 pump stations will be required.

8.5.2.2 Treatment System

The total wastewater flow for Pleasant Valley is approximately 26,000 gpd. For this size system, RMFs are the recommended treatment technology, as discussed in Sections 5-7.

8.5.2.3 Dispersal

Dispersal sites may be somewhat challenging given the shallow depth to bedrock and environmental constraints in Pleasant Valley. Drip irrigation may be necessary should depth to limiting zone be an issue. Otherwise a standard trench/bed system should be used.

8.6. DESIGNATED DEVELOPMENT AREA

Table 3.2.21, outlining the study area needs definition, is repeated here.

Table 3.2.21: Needs Definition- Development District

	Development District Study Area Parcels	Variance or Advanced Treatment System Required[1]						Conventional On-Lot System Feasible				
		Enviro. Constraint	Potential Water Supply Solution	Perc Rate	Depth to Limiting Zone	Total	% Study Area Parcels	Standard System	Elevated Sand Mound	Sub-surface Sand Filter	Total On-Lot	% Study Area Parcels
Developed	59	0	14	0	15	29	35.8%	28	2	0	30	37.0%
Undeveloped	22	0	1	0	7	8	9.9%	8	1	2	11	13.6%
Total	81	0	15	0	22	37	45.7%	36	3	2	41	50.6%

[1] For repairs or new construction. Does not apply to existing systems that are not identified as failing.
[2] The Sum of the two "% of Study Area Parcels" columns does not equal 100% as a result of parcels with Tax Assessors records and no corresponding GIS shape files.

8.6.1 On-Lot Alternative

Based on the number of properties that appear to have insufficient depth to limiting zone, it does not appear viable to maintain the current practice of on-lot treatment and dispersal. Given that the Comprehensive Plan identifies this area for development, community sewer and water are needed. A more detailed analysis may determine the existing systems, with appropriate upgrades, can remain on-lot systems. However, it is unlikely that this area can support expansion with on-lot systems.

8.6.2 Community System Alternative

Total wastewater flow in the Development District is approximately 26,000 gpd. However, the buildout potential identified in the Comprehensive Plan is between 150-620 dwelling units. This translates to design wastewater flows between 34,000 – 140,000 gpd.

8.6.2.1 Collection System

A more detailed analysis of any proposed service area is needed. The Designated Development area has flat areas with high groundwater surrounded by areas with steep slopes. A complete gravity system is unlikely to be technically viable. A combination of STEP and STEG or conventional Sewer and Grinder pumps is likely needed.

8.6.2.2 Treatment System

At buildout flows conventional systems begin to be technically viable. RMFs remain technically viable, and they also have the advantage of being modular systems that can easily be expanded as demand increases.

8.6.2.3 Dispersal

Potential dispersal sites exist within the study area, as well as nearby. It is critical for planning purposes that these sites be evaluated for subsurface dispersal capacity as soon as possible, as this component of the wastewater system, unless water reuse or connection to a non-Springfield sewer system is practical, will dictate the ability of the area to support development. Existing capacity may not be sufficient to support the planned growth for this study area.

8.7. ROUTE 309 STUDY AREA

Table 3.2.25, outlining the study area needs definition, is repeated here.

Table 3.2.25: Needs Definition- Route 309

	Route 309 Study Area Parcels	Variance or Advanced Treatment System Required[1]						Conventional On-Lot System Feasible				
		Enviro. Constraint	Potential Water Supply Solution	Perc Rate	Depth to Limiting Zone	Total	% Study Area Parcels	Standard System	Elevated Sand Mound	Sub-surface Sand Filter	Total On-Lot	% Study Area Parcels
Developed	30	5	7	0	2	14	25.0%	8	8	0	16	28.6%
Undeveloped	26	8	6	0	3	17	30.4%	2	6	0	8	14.3%
Total	56	13	13	0	5	31	55.4%	10	14	0	24	42.9%

[1] For repairs or new construction. Does not apply to existing systems that are not identified as failing.
[2] The Sum of the two "% of Study Area Parcels" columns does not equal 100% as a result of parcels with Tax Assessors records and no corresponding GIS shape files.

8.7.1 On-Lot Alternative

The Route 309 study area shares the same challenges as the neighboring Development District. High groundwater, environmental constraints and potential well/septic separation issues are prevalent. There are at least two direct discharge systems in this study area. While there is no evidence of a threat to public health and the environment, the high degree of limiting issues makes proper management of these systems critical.

8.7.2 Community System Alternative

Due to the number of factors affecting the viability of on-lot systems, a community system may be preferred. If the Development District grows as planned, secondary growth in the Route 309 study area is highly likely. It is unlikely that on-lot systems can support growth.

8.7.2.1 Collection System

As with the Development District, relatively flat areas with high groundwater and steeply sloped areas are common. These features favor pressurized systems, such as STEP and grinder pump systems.

8.7.2.2 Treatment System

Flow data was not available for all commercial properties in the Route 309 study area. Estimates were made for properties with incomplete commercial flow data. The estimated design flow for this study area is 18,000 gpd. In this flow range, RMFs are technically viable and are the recommended treatment alternative.

8.7.2.3 Dispersal

There are potential dispersal sites within and nearby the study area. As with the Development District, it is critical to determine the subsurface dispersal capacity of these sites should a community system be selected.

8.8. OUTLYING AREAS

Table 3.2.29, outlining the study area needs definition, is repeated here.

Table 3.2.29: Needs Definition- Outlying Areas

	Outlying Areas Parcels	Variance or Advanced Treatment System Required[1]						Conventional On-Lot System Feasible				
		Enviro. Constraint	Potential Water Supply Solution	Perc Rate	Depth to Limiting Zone	Total	% Study Area Parcels	Standard System	Elevated Sand Mound	Sub-surface Sand Filter	Total On-Lot	% Study Area Parcels
Developed	1,545	35	104	2	166	307	15.0%	853	335	27	1,215	59.4%
Undeveloped	500	54	33	1	48	136	6.7%	260	80	6	346	16.9%
Total	2,045	89	137	3	214	443	21.7%	1,113	415	33	1,561	76.3%

[1] For repairs or new construction. Does not apply to existing systems that are not identified as failing.
[2] The Sum of the two "% of Study Area Parcels" columns does not equal 100% as a result of parcels with Tax Assessors records and no corresponding GIS shape files.

8.8.1 On-Lot Alternative

As the Outlying Areas represent all areas of Springfield Township not within any other study area, community collection and treatment is not technically viable. Unless future analysis reveals the need to create new study areas, on-lot systems will continue to serve these areas. Every potential need is represented here, so the discussions of needs and corresponding technically viable collection, treatment and dispersal alternatives detailed in Sections 5-7 apply on a site-by-site basis here.

9. INSTITUTIONAL & MANAGEMENT OPTIONS

9.1. OVERVIEW

Based on the analyses presented in this report, on-lot solutions are technically viable throughout Springfield Township. While there are some properties that present challenges, as a whole they do not represent a threat to public health or the environment, provided the additional treatment and dispersal techniques recommended in Section 8 are implemented.

The primary concern in continuing with on-lot wastewater treatment is managing proper operations and maintenance (O&M) of all on-lot systems. PADEP has procedures in place for ensuring that alternative and advanced treatment systems are properly maintained. However, standard on-lot systems do not have structured oversight for the limited maintenance that is required.

It is recommended that a management program be implemented to oversee inspections, operations and maintenance of on-lot systems.

The following discussion outlines typical policies and activities performed as part of an on-lot management program. This discussion is intended to be a "menu" of policies and activities. While regular inspection and maintenance is recommended, none of the following are intended to be specific recommendations.

9.2. EDUCATIONAL MATERIALS

Public education is an important function of an on-lot management program. To this end, the Township will make available the U.S. EPA, PADEP and other sources of educational materials suitable for distribution to the general public describing the importance of proper maintenance and operation of on-lot systems and the impact of such systems on public health and the environment.

9.3. INSPECTIONS

On-lot systems require little O&M beyond regular pumping and cleaning of the effluent tee filter, provided that the system was properly installed and has not been structurally compromised. Regular inspections prevent failing systems from discharging improperly treated effluent for a prolonged period of time. The following sections outline options for requirements for inspection and maintenance of on-lot systems.

9.4. INSPECTION AT TIME OF TRANSFER

Implementing a structured inspection and maintenance program is ideal. At a minimum, properties should be inspected within two years prior to the time of transfer of title. An inspection conducted up to three years before the time of transfer may be used if the inspection report is accompanied by system pumping records demonstrating that the system has been pumped at least once during that time.

The following transactions are not be considered transfers of title:

1. Taking a security interest in a property, including but not limited to issuance of a mortgage;

2. Refinancing a mortgage or similar instrument, whether or not the identity of the lender remains the same;

3. A change in the form of ownership among the same owners, such as placing the facility within a family trust of which the owners are the beneficiaries, or changing the proportionate interests among a group of owners or beneficiaries;

4. Adding or deleting a spouse as an owner or beneficiary; or a transfer between spouses during life, out right or in trust; or the death of a spouse;

5. The appointment of or a change in a guardian, conservator, or trustee.

9.4.1 Associations or Cooperative Corporations

The cooperative corporation or condominium association is responsible for the inspection, maintenance and upgrade of any system or systems serving the units. Each system located on the facility shall be inspected at least once every three years instead of at time of transfer of title.

9.4.2 Exclusions

Inspection of a system is not required at the time of transfer of title in the following circumstances:

1. A certificate of compliance for a new system has been issued within three years prior to the time of transfer and system pumping records demonstrate that the system was pumped at least once during the third year; or

2. The owner of the facility or the person acquiring title has signed an enforceable agreement to upgrade the system or to connect the facility to a sanitary sewer or a shared system within the next two years following the transfer of title;

If a comprehensive local plan of on-lot system inspections is implemented that ensures each system is inspected a minimum of once every 3 years, inspection at the time of transfer of title is not required. Transfer of title inspections are not necessary when a program ensuring regular maintenance is in place.

9.4.3 Inspection Prior to Change or Expansion of Use and/or Design Flow

An inspection is required prior to any change in the type of establishment, increase in design flow, or expansion of use of the facility served for which a building permit or occupancy permit from the local building inspector is required.

If the system is a cesspool, or if the system is failing, then the system shall be upgraded prior to the change in the type of establishment, increase in design flow or expansion of use of the facility. For increases in the design flow, the system shall be upgraded to new construction standards.

Changes in building footprint (dimensions) that do not result in an increase of design flow do not require upgrades. The system inspection will assess and determine the location, preferably by GPS, of all system components, including the reserve area. The proposed construction shall not be placed upon any of the system components or within any applicable setback distances.

If official records are available to make a determination regarding location of system components, an inspection is not required for footprint changes.

9.4.4 Shared Systems

Shared systems shall be inspected every three years. When a facility is divided or the ownership of two or more facilities is combined, all systems serving the facility or facilities shall be inspected.

9.5. INSPECTION REQUIREMENTS

At a minimum, the septic tank and distribution box, if present, or cesspool, if present, shall be located, uncovered and inspected, and reasonable professional efforts shall be made to locate and identify other components and features

An inspection shall consist of the collection and recording of the following information:

1. A general description of the system components and layout;
2. Quantification of the source/type of sanitary sewage. This should include type of use (domestic or commercial/industrial) as well as the design flow and whether or not the facility being served is occupied at the time of the inspection;

3. An analysis of the failure criteria factors, if the system has a design flow of 10,000 gpd or greater;

4. Water use records for the previous two years for facilities served by public water supply, if available from the supplier;

5. A description of the septic tank including:
   - approximate age, size, and condition of the tank;
   - distance between bottom of grease/scum layer and the bottom of the outlet baffle;
   - distance between the top of the scum layer and the top of the outlet tee;
   - thickness of the grease/scum layer;
   - depth of the sludge layer and distance from sludge to outlet tee;
   - physical condition of inlet and outlet tees;
   - any evidence of leakage into or out of tank; and
   - any evidence of backup of effluent.

6. A characterization of the distribution box, and of dosing tanks with pumps, if any, including:
   - any evidence of solids carryover;
   - leakage into or out of the distribution box;
   - whether the flow is equally divided; and
   - any evidence of backup.

7. A description of the condition of the soil absorption system including:
   - any signs of hydraulic failure;
   - condition of surface vegetation;
   - level of ponding within disposal area;
   - encroachments into disposal area; and
   - other sources of hydraulic loading.

8. The location of private water supply well (if any) in relation to system components; and

9. A copy of pump-out records.

The inspector shall make reasonable professional efforts to determine the location and condition of all system components and relevant physical features.

9.6. FAILURE CRITERIA APPLICABLE TO ALL SYSTEMS

If one of the following are observed during an inspection, the system is considered to be failing and will require repair or upgrade.

9.6.1 Criteria Applicable to all Systems:

1. There is backup of sewage into the facility served by the system or any component of the system as a result of an overloaded and/or clogged soil absorption system or cesspool;
2. There is a discharge of effluent directly or indirectly to the surface of the ground through ponding, surface breakout or damp soils above the disposal area or to a surface water of the Commonwealth;
3. The static liquid level in the distribution box is above the level of the outlet invert;
4. The liquid depth in a cesspool is less than six inches from the inlet pipe invert or the remaining available volume within a cesspool above the liquid depth is less than ½ of one day's design flow;
5. The septic tank or cesspool requires pumping more than four times a year;
6. Septic tank and/or the tight tank is cracked or is otherwise structurally unsound, indicating that substantial infiltration or exfiltration is occurring or is imminent;
7. A cesspool, privy or any portion of the soil absorption system extends below the high groundwater elevation;
    - Within 100 feet of a surface water supply or tributary to a surface water supply;
    - Within a Zone I of a public well;
    - Within 50 feet of a private water supply well;
    - Less than 100 feet but 50 feet or more from a private water supply well, unless a well water analysis, conducted at a laboratory, indicates an absence of fecal coliform bacteria and ammonia nitrogen and nitrate nitrogen is equal to or less than five ppm.

9.6.2 Criteria Applicable to Cesspools and Privys

A cesspool or privy is considered to be failing if any portion of the system is located in:

1. Within 100 feet of a surface water supply or tributary to a surface water supply;
2. Within a Zone I of a public well;
3. Within 50 feet of a private water supply well;
4. Less than 100 feet but 50 feet or more from a private water supply well, unless a well water analysis, conducted at a laboratory that is certified by the Department for the parameters analyzed, indicates an absence of fecal

coliform bacteria, and the presence of ammonia nitrogen and nitrate nitrogen is equal to or less than 5 ppm.

5. Within 50 feet of a surface water;
6. Within 50 feet of a bordering vegetated wetland or a salt marsh.

In making a determination, the following factors shall be considered:

1. the condition, design, and treatment provided by the existing system;
2. the vertical separation of the existing soil absorption system from groundwater;
3. the horizontal separation of the existing soil absorption system from the water body;
4. the soil characteristics of the site; and
5. the condition of the waterbody or wetland, including any sensitive use areas such as beaches or shellfish beds.
6. A cesspool serving a facility with a design flow of 2,000 gpd or greater is failing to protect public health, safety, welfare and the environment.

9.7. SYSTEM PUMPING AND ROUTINE MAINTENANCE

Every septic tank, tight tank, or cesspool shall be pumped whenever necessary to ensure proper functioning of the system. Pumping is required whenever the top of the sludge or solids layer is within 12 inches or less of the bottom of the outlet tee or the top of the scum layer is within two inches of the top of the outlet tee or the bottom of the scum layer is within two inches of the bottom of the outlet tee. Pumping frequency is a function of use, although pumping is typically necessary at least once every three years.

Whenever a system component is pumped, documentation shall be submitted by the system pumper to the Township within 14 days from the pumping date.

Grease traps shall be inspected monthly by the owner/operator and shall be cleaned by a licensed septage hauler whenever the level of grease is 25% of the effective depth of the trap, or at least every three months, whichever is sooner. The owner/operator shall keep all inspection and pumping records.

9.8. EMERGENCY REPAIRS

Emergency repair or replacement of system components shall be limited to the following:

1. Pumping of a septic tank, tight tank, or cesspool as frequently as necessary to prevent backup or breakout; and

2. Repair or replacement of one or more structural components of a system, excluding the soil absorption system, which is otherwise in compliance, such as a clogged building sewer or distribution line, damaged building sewer, septic tank or distribution box, or broken tee which is determined to be the probable cause of the system failure and for which no modification or alteration of the system design is required; and shall be completed within 30 days.

The emergency repair shall be limited to pumping if pumping alleviates the imminent danger to the public health, safety, welfare or the environment. If pumping does not alleviate the imminent danger to the public health, safety, welfare, or the environment, the Disposal system Installer may repair or replace one or more structural components of a system, provided that:

1. The system is otherwise in compliance;
2. Any structural component that is repaired or replaced shall be in compliance with or upgraded;
3. Disposal system Installer has determined the structural component being repaired or replaced is the probable cause of the condition constituting an imminent danger to the public health, safety, welfare or the environment; and
4. No modification or alteration of the system design is required.

Only a Permitted Disposal System Installer may conduct an emergency repair.

All emergency repairs other than pumping shall be preceded by at least 24-hour notice to the Bucks County Health Department. All emergency repairs other than pumping shall be followed within 14 days of commencement of the emergency repair by an application for a Disposal System Construction Permit, local upgrade approval, or an application for a variance, if needed. The applicant may backfill any excavation required for the emergency repair unless directed otherwise by the Bucks County Health Department. All pumping activity shall be reported to the Bucks County Health Department and the Township.

Any upgrade or expansion of a system which is not an emergency repair shall be designed, approved, and constructed in accordance.

10. ENVIRONMENTAL REPORT

The Act 537 Wastewater Management Plan Update presents a comprehensive description of the natural resources of Springfield Township along with demographics, land use, development and human practices. The Plan incorporates background information on:

- Land Use & Zoning
- Demographics
- Population
- Historic Resources
- Development Status
- Soils
- Geology
- Groundwater
- Topography
- Potable Water Supplies
- Wetlands & Floodplains
- Hydrology & Watersheds
- Threatened & Endangered Species
- Water Quality

and provides an integrated GIS database on a parcel by parcel basis of the above information as it pertains to wastewater management. The Plan addresses the following issues:

- Community Profile
- Wastewater Needs Definition
- Wastewater Management Options
- Needs Based Technology Screening
- Technically Viable Options for Study Areas
- Institutional & Management Options

The wastewater systems needs analysis concluded that, except for the 5 septic systems that are sited in Zone I of one of Springtown's water supply well which require corrective action, there is no evidence of an immediate need for improvements to the existing wastewater facilities. Continued water quality data collection should be performed in Cooks Creek to ascertain if nutrient levels would jeopardize the classification of Cook's Creek as an Exceptional Quality Watershed, as well as the other watersheds. For potential future growth in the Development District and the adjacent Route 309 study areas, a community wastewater system will likely be required in the future.

The proposed wastewater management approach for the Township is an enhanced management solution, whereby existing and new on-lot systems are subject to a regular inspection and maintenance program to ensure they are functioning properly and protecting water quality and public health.

10.1. PROPOSED WASTEWATER SYSTEM IMPROVEMENTS

The 5 septic systems located within Zone I of one of Springtown's drinking water supply well will need to be either relocated or have the highest level of treatment and disinfection installed. Improvements to individual on-lot systems will have a positive environmental impact. Construction will need to use Best Management Practices to minimize short-term impacts.

SUMMARY

The recommended wastewater management strategy is to continue with on-lot systems with the exception of Zone I area improvement. For the remaining properties, there are no material alterations proposed, and therefore no impacts.

Should the Development District and the Route 309 study areas desire community systems, the impacts of the proposed collection, treatment and dispersal options selected will be evaluated at that time.

11. GLOSSARY OF TERMS

BOD – Biochemical Oxygen Demand. A laboratory measurement of wastewater that is one of the main indicators of the quantity of pollutants present; a parameter used to measure the amount of oxygen that will be consumed by microorganisms during the biological reaction of oxygen with organic material.

TSS – Total Suspended Solids. A measure of the amount of solid material in suspension within a waste stream.

Primary Treatment – the first stage of wastewater treatment that removes settleable or floating solids only; generally removes 40% of the suspended solids and 30-40% of the BOD in the wastewater.

Secondary Treatment – a type of wastewater treatment used to remove dissolved and suspended pollutants through biological treatment processes. The two basic categories of secondary treatment are suspended growth and fixed film.

Fixed Film Treatment Systems – Secondary treatment achieved through percolating wastewater through media, typically sand, rock or a synthetic material.

Suspended Growth Treatment Systems – Secondary treatment achieved through maintaining particles in suspension in an aerobic environment.

RMF – Recirculating Media Filter. A type of secondary, fixed-film process that recirculates wastewater over media and blends recirculated water with raw wastewater prior to discharging to the next treatment process.

RSF – Recirculating Sand Filter. The most simple type of RMF, where sand is used as the media.

MBR – Membrane Bio-Reactor. A type of suspended growth system that uses membrane filtration instead of final settling

UV Disinfection – The use of ultraviolet radiation to inactivate pathogens in a treated waste stream.

Drip Irrigation – A slow rate, shallow dispersal system where treated wastewater is dispersed through emitters into the root zone near the ground surface.

STEP System – Septic Tank Effluent by Pump. A type of collection system that takes effluent from septic tanks and pumps the wastewater to the desired location.

STEG System – Septic Tank Effluent by Gravity. A type of collection system that takes effluent from septic tanks and drains by gravity to the desired location.

Grinder Pump System – A type of collection system that takes raw wastewater (no septic tank) and uses a small basin containing a grinder pump (the grinder pump station) to convey raw wastewater to the desired location.

Effluent Tee Filter – Filtration device that installs directly into the outlet tee on the effluent end of the septic tank.

APPENDIX A – DATA MANAGEMENT & ESTABLISHING DATA PRIMACY

A.1. RAW DATA

Lombardo Associates, Inc. (LAI) received the following three electronic files from Bucks County containing information related to properties within Springfield Township:

1. Bucks County Planning Department Shape Files and associated database
2. Bucks County Assessors Real Estate Database
3. Bucks County Bureau of Environmental Health, On-Lot Sewage Systems Database

Bucks County Planning Department Shape Files

On April 11, 2008 LAI received all of the available Bucks County GIS data which included a parcel shape file and data attributes for Springfield Township. There were 2,647 parcels. Table A-1 presents the metafile for the Shape Files.

Bucks County Assessors Real Estate Database

The Assessors Real Estate Database, which LAI received on March 20, 2008 from Pam Semensky, contained 2,839 entries. There were 347 duplicates, resulting in 2,492 unique entries. Table A-2 presents the metafile for the Assessors database.

Bucks County Bureau of Environmental Health, On-Lot Sewage Systems Database

LAI received the On-Lot Sewage Database files from Bucks County on July 7, 2008. Through review of the original File Input form and discussion with the Bucks County Environmental Sanitation Division, Springfield Township Sewage Enforcement Officer, Mr. Art Carlson, LAI was able to interpret several critical fields in the database. Table A-3 presents the metafile for the On-Lot Sewage Systems Database. Table A-4 presents the data LAI determined to be relevant to further analysis.

In order to aggregate the information into a unified database, it required controlled data manipulation and vigorous cross-examination. There were unique entries to each database that did not correlate with other databases. The methodology for aggregation and database merge results are summarized below.

The unique Parcel Identification Number (PID) for each parcel was created by merging the five unique tax map identifiers (township, map, parcel, subzone1 and subzone2) into a single number. The number of digits (maximum of 14) for each unique identifier is illustrated on Table A-5. The PID summarizes the tax information so that the location of the parcel within Springfield Township can be identified and is the crucial pivot from which all datasets were merged.

Table A-1. Planning Department Shape Files Metafile

	Field Name	Sample Value	Description
Parcels Dataset	OBJECTID	1	Arcview Shape file object ID
	TWP_NUM	42	Township Number
	MAP_NUM	001	Tax Map Number
	LOT_NUM	038	Tax Map Lot Number
	Springfiel	42-001-038	Tax Map ID Number
	MUNI_NAME	Springfield Township	Municipality Name
	Shape_Leng	3,302	Geodatabase Perimeter Length Calculation
	Shape_Le_1	3,302	Geodatabase Perimeter Length Calculation
	Shape_Area	624,311	Parcel Area in Sq. Ft.

	Field Name	Sample Value	Description
Zoning Dataset	OBJECTID_1	1	Arcview Shape file object ID
	OBJECTID	2393	Arcview Shape file object ID
	OBJECTID_2	849	Arcview Shape file object ID
	ZoningAbbr	RP	Zoning Abrevation
	Zoning	Resource Protection	Zoning Name
	Acre	2,169	Zoning Area in Acres
	Municipali	Springfield Township	Municipality Name
	Shape_Leng	51,700	Geodatabase Perimeter Length Calculation
	Shape_Area	105,528,620	Zoning Area in Sq. Ft.

	Field Name	Sample Value	Description
Buildings Dataset	OBJECTID	1	Arcview Shape file object ID
	AREA	919	Building Area in Sq. Ft.
	PERIMETER	125	Building Perimeter in L.F.
	BLDGS_	841	Appears to a County Building ID Extracted from a CAD File
	BLDGS_ID	841	Appears to a County Building ID Same as Previous Field
	BLDG_TYPE	1	Coding for type of Building. Numerical Valves 1-6
	SHAPE_Leng	125	Geodatabase Perimeter Length Calculation
	SHAPE_Area	919	Geodatabase Calculation Building Area in Sq. Ft.

	Field Name	Sample Value	Description
Parking Areas Dataset	OBJECTID	1	Arcview Shape file object ID
	vector_GIS		Parking Area in Sq. Ft.
	PERIMETER		
	PARKING_		Appears to a Parking Lot ID Extracted from a CAD File
	PARKING_ID		Appears to a Parking Lot ID Same as Previous Field
	PK_TYPE		Coding for type of Parking Lot. Numerical Valves 1-3
	SHAPE_Leng		Geodatabase Perimeter Length Calculation
	SHAPE_Area		Geodatabase Calculation Parking Lot Area in Sq. Ft.

	Field Name	Sample Value	Description
Edge of Pavement Dataset	OBJECTID	1	Arcview Shape file object ID
	FNODE_	46	ArcGIS Coverage Topology Segment ID
	TNODE_	53	ArcGIS Coverage Topology Segment ID
	LPOLY_	1	ArcGIS Coverage Topology Segment ID
	RPOLY_	2	ArcGIS Coverage Topology Segment ID
	LENGTH	9,382	EOP Length Calculation in Meters
	ROADS_	71	Appears to a EOP ID Extracted from a CAD File
	ROADS_ID	71	Appears to a EOP Same as Previous Field
	RD_TYPE	1	Coding for type of Road Type. Numerical Valves 1-5. The Valve 4 is missing
	HIDDEN	0	Appears to a CAD file Linetype designation
	SHAPE_Leng	3,253	Geodatabase EOP Length Calculation in Ft.

	Field Name	Sample Value	Description
Roadway Centerlines Dataset	OBJECTID	154	Arcview Shape file object ID
	PREFIXDIRE		Field is Empty
	STREETNAME	Slifer Valley	Street Name Upper and Lowercase
	STREETTYPE	Rd	Street Type Upper and Lowercase
	SUFFIXDIRE		Field is Empty
	PSEUDO_NAM		Actual Street Name vs Route Name
	FULLNAME	Slifer Valley Rd	Full Street Name Upper and Lowercase
	L_F_ADD	2201	ArcGIS Coverage Topology Segment ID
	L_T_ADD	2279	ArcGIS Coverage Topology Segment ID
	R_F_ADD	2200	ArcGIS Coverage Topology Segment ID
	R_T_ADD	2278	ArcGIS Coverage Topology Segment ID
	PREFIX		
	NAME	SLIFER VALLEY	
	TYPE_		
	SUFFIX		
	POSTAL_L	18036	Assume Postal Address Left Side
	POSTAL_R	18036	Assume Postal Address Right Side
	SPEED	35	Speed Limit
	ONE_WAY		One Way Streets have a "y" Valve
	len	1,387	Street Centerline Length
	Shape_Leng	1,387	Geodatabase EOP Length Calculation in Ft.

	Field Name	Sample Value	Description
Streams Dataset	FNODE_		ArcGIS Coverage Topology Segment ID
	TNODE_		ArcGIS Coverage Topology Segment ID
	LPOLY_		ArcGIS Coverage Topology Segment ID
	RPOLY_		ArcGIS Coverage Topology Segment ID
	LENGTH		Stream Centerline Length
	HYDRO_		Appears to a Hydro ID Extracted from a CAD File
	HYDRO_ID		Appears to a Hydro Same as Previous Field
	HY_TYPE		Coding for type of Parking Lot. Numerical Valves 1-3
	HIDDEN		Appears to a CAD file Linetype designation
	len		Stream Centerline Length
	Shape_Leng		Geodatabase Stream Length Calculation in Ft.

	Field Name	Sample Value	Description
Rail Lines Dataset	OBJECTID	1	Arcview Shape file object ID
	FNODE_	4	ArcGIS Coverage Topology Segment ID
	TNODE_	2	ArcGIS Coverage Topology Segment ID
	LPOLY_	-1	ArcGIS Coverage Topology Segment ID
	RPOLY_	-1	ArcGIS Coverage Topology Segment ID
	LENGTH	1,611	Rail Line Centerline Length
	RAILROAD_	1	Appears to a Railroad Line ID Extracted from a CAD File
	RAILROAD_I	1	Appears to a Railroad Line Same as Previous Field
	RR_TYPE	2	Coding for type of Rail Lines. Numerical Valve of 2 for all
	HIDDEN	0	Appears to a CAD file Linetype designation
	SHAPE_Leng	1,180	Geodatabase Rail Lines Length Calculation in Ft.

	Field Name	Sample Value	Description
Town Boundary Dataset	OBJECTID_1	1	Arcview Shape file object ID
	OBJECTID	52	Arcview Shape file object ID
	NAME	Springfield	Name of Municipality
	ACRES	19,608	Township Area in Acres
	CODE	42	Numeric Municipality Code
	TYPE	Township	Type of Municipality
	SQUARE_MIL	31	Township Area in Sq. Miles
	Shape_Leng	153,000	Geodatabase CalculationTownship Permiter in L.F.
	Shape_Area	854,095,472	Geodatabase CalculationTownship Area in Sq. Ft.

Table A-2. Assessors Database Metafile

FIELD NAME	LAI DESCRIPTION	SAMPLE DATA	NOTES
TYPE	UNKNOWN	R	
MUN	Municipality Code	42	
MAP	Map Code	4	
PARCEL	Parcel Number	127	
SUBONE	Lot Number	-1	
LOT	Formated Lot Number	001	
TRUEPARCEL_LOT	Combination of MUN, MAP, PARCEL, and SUBONE	42-04-173-001	
SUBTWO	Reiteration of Lot		Most of these are blank
TRAILER	UNKNOWN		
CODE	UNKNOWN		
OWNERNAME1	Homeowner's last name	GOODMAN	
OWNERNAME2	Homeowner's first name	SANDRA J	
STREET #	Homeowner's street number	1979	
OWNERADDRESS	Homeowner's street address	TUMBLEBROOK RD	
CITY	City	COOPERSBURG	
ST	State	PA	
ZIP	Zip Code	18036	
TOTLAND VALUE	Total Land Value	9600	
TOTBLDG VALUE	Total Building Value	14520	
LANDUSE	Land Use	1050	
CLASS CDE	UNKNOWN	R	
CLASS	UNKNOWN	R	
ZONING	Zoning Codes	RP	
ZONE	Zoning Codes	RP	
ZONINGNAME	Known corresponding zoning areas based on data provided	RESOURCE PROTECTION	
LIV UNIT	UNKNOWN	1	
HOUSE #	HOUSE #	1979	
STREET	STREET	TUMBLEBROOK RD	
ADDRESS	HOUSE # & STREET Concatenated	1979 TUMBLEBROOK RD	
ACRES	ACRES	5.11	
SQ FT	Square Feet	222591.6	
TOPOGRAPHY	TOPOGRAPHY		Most of these values are blank
UTILENTRY1	Utility Entry	5	
UTILENTRY2	Utility Entry	6	
UTILENTRY3	Utility Entry		
ERECTED CC	First digit of the year built	1	
DATE ERECTED	Following digits of year built	975	
YEAR BUILT CALC	Concatenated ERECTED CC & DATE ERECTED	1975	
BEDROOMS	BEDROOMS	3	
BLD UNITS	Building Units		Most of these are blank
BASEMENT	BASEMENT		Most of these are blank
APT UNITS	Apartment Units		Most of these values are '0'
OTH BLDGS	Other Buildings		Most of these values are blank
SALE DATE	SALE DATE	19681015	
SALE AMOUNT	SALE AMOUNT	0	
BOOK	UNKNOWN	1913	
PAGE	UNKNOWN	694	
DEED DATE	DEED DATE	19681015	
LEGAL DESC1	Legal description		
LEGAL DESC3	Legal description		
TOTAL ROOMS	TOTAL ROOMS	8	
FULL BATHS	FULL BATHS	2	
HALF BATHS	HALF BATHS	0	
TOTAL LIVING AREA	TOTAL LIVING AREA	1776	
POOL	POOL		Most of these are blank
DETACHED GARAGE	DETACHED GARAGE		Most of these are blank
GEN BLD #	General Building Number		Most of these are blank
BLD NUMB	Building Number		Most of these are blank
SFX	UNKNOWN		
YEAR BUILT	YEAR BUILT	0	Most of these values are '0'
BLD STR TYPE	UNKNOWN	0	Most of these values are '0'
IDENT UNITS	UNKNOWN	0	Most of these values are '0'
YR REMOD	UNKNOWN	0	Most of these values are '0'
GROSS SQ FT	GROSS SQ FT	0	Most of these values are '0'
BASE GFLA	UNKNOWN	0	Most of these values are '0'
BSMT RT	UNKNOWN	0	Most of these values are '0'

Table A-3. On-Lot Sewage Database Metafile

		ONSITE SEWAGE DISPOSAL MASTER FIELD NAMES			CASE FILE DESCRIPTION	SAMPLE DATA
A	PID	TAX MAP	FC			42001009
B		PROJECT	NUMBER			42LOT001
C		SERIAL	NUMBER			199400217
D		REC	CODE	1	OWNER	0
				2	AGENT	
				3	CORPORATION	
E		PROG	CODE			1
F	Owner / Property Information	APPL	LAST NAME		APPLICANT'S LAST NAME	MEYLE
G		APPL	FIRST NAME		APPLICANT'S FIRST NAME	RICK W
H		APPL	TYPE		APPLICATION TYPE	1
I		APPL	ADDR 1			3132 OLD BETHLEHEM PIKE
J		APPL	CITY			COOPERSBURG
K		APPL	STATE			PA
L		APPL	ZIP			18036
M		APPL	SITE 1		APPLICATION SITE	BETWEEN TROLLEY BRIDGE & BLUE
N		APPL	SITE 2			SPRINGFIELD TOWNSHIP
O		FC	LAST NAME			NONE
P		FC	FIRST NAME			
Q		FC	TYPE			2
R		FC	ADDRESS 1			
S		FC	CITY			
T		FC	STATE			
U		FC	ZIP			0
V		DATE	FILED			19940516
W		DATE	APPL FILE			19940805
X	Lot Information	APPL	PARCEL TYPE			1
		1		1	RESIDENTIAL	
		2		2	SUBDIVISION	
		3		3	RURAL RESIDENCE	
		4		4	COMMERCIAL/INDUSTRIAL	
Y		FC	PARCEL TYPE			0
Z		WATER	SUPPLY			1
		1		1	PRIVATE	
		2		2	PUBLIC	
		3		3	OTHER	
AA		TYPE	SEWAGE SYS			1
		1		1	INDIVIDUAL	
		2		2	COMMUNITY	
AB		REASON	FOR APPL			2
		1		1	NEW	
		2		2	REPAIRS	
		3		3	EXPIRED/REISSUE	
		4		4	TRANSFER	
		5		5	RURAL RESIDENCE	
AC		PRIMARY	TREATMENT			1
		1		1	SEPTIC TANK	
		2		2	AEROBIC TANK	
AD		SECONDARY	TREATMENT			10
		1		1	STANDARD TRENCH	
		2		2	SEEPAGE BED	
		3		3	ELEVATED SAND TRENCH	
		4		4	SUBSURFACE SAND	
		5		5	ELEVATED SAND BED	
		6		6	GRAVEL MOUND	
		7		7	TRENCH/BED PRESS DOSE	
		8		8	ALT/EXP	
		9		9	HOLDING TANK	
		10		10	COMPONENET REPL	
AE		EMP	ASSIGN APPL			155
AF		DATE	ASSIGN APPL			19940516
AG		DATE	APPL WITHDRAWN			0
AH		PERMIT	ISSUED DATE			19940518
AI		PERMIT	ISSUED EMP			155
AJ		PERMIT	ISS AFT HEARING			0
AK		PERMIT	DENIED			??????
AL		PERMIT	DENIED DATE			0
AM		PERMIT	DENIED EMP			0
AN		PERMIT	SPCL CONDITIONS			1
				1	SPECIAL CONDITIONS	

AO		PERMIT	SOIL SERIES			MLB
AP		DATE	PERMIT REVOKED			0
AQ		PERMIT	REVOKED EMP			0
AR		DATE	PERMIT EXPIRED			0
AS		PERMIT	EXPIRED EMP			0
AT		DATE	PERMIT CANCELED			0
AU		PERMIT	HEARING DATE			0
AV		TEST	HOLES DATE		SOIL TEST DATE	0
AW		TEST	HOLES EMP		SOIL TEST EMPLOYEE #	0
AX		ACCEPT	TEST HOLES			0
AY		ACCEPT	HOLE RLST			0
AZ		UNACCEPT	TEST HOLES			0
BA		UNACCEPT	HOLE RLST 1			0
BB		UNACCEPT	HOLE RLST 2			0
BC		UNACCEPT	HOLE RLST 3			0
BD	Soil Information	UNACCEPT	HOLE RLST 4			0
BE		SOIL	CELL #			
BF		TEST	SOIL 1		SOIL TEST	
BG		TEST	SOIL 2		SOIL TEST	
BH		TEST	SOIL 3		SOIL TEST	
BI		TEST	SOIL 4		SOIL TEST	
BJ		TEST	SOIL 5		SOIL TEST	
BK		TEST	SOIL 6		SOIL TEST	
BL		TEST	SOIL 7		SOIL TEST	
BM		TEST	SOIL 8		SOIL TEST	
BN		FOLLOW UP	OBS DATE			0
BO		FOLLOWUP	OBS EMP			0
BP		PERC TEST	DATE			0
BQ		PERC	TEST EMP			0
BR		PERC	TEST RLST			0
BS		PERC FOLLOW UP	DATE			0
BT		PERC FOLLOWUP	EMP			0
BU		SITE	EVAL DATE			0
BV		SITE	EVAL EMP			0
BW		VER	DATE			0
BX		VER	EMP			0
BY		PROGRESS	DATE			19940805
BZ		PROGRESS	EMP			155
CA		COMPLI INSP	DATE			19941102
CB		COMPLI INSP	EMP			155
CC		CERTIFICATE	DATE			19941102
CD		CERTIFICATE	EMP			155
CE		CERT	DENIED DATE			0
CF		CERT	DENIED EMP			0
CG		FOLLOWUP	INSP DATE			0
CH		FOLLOW UP	INSP EMP			0
CI		MALFUNCT	CORRECT DATE			0
CJ		COMPLAINT	INVEST DATE			0
CK		COMPLAINT	INVEST EMP			0
CL		OTHER	INSP DATE			0
CM		OTHER	INSP EMP			0
CN		LAST	FM DATE			19941122
CO		CURRENT	CONTACT CYCLE			0
CP		LAST	CONTACT DATE			19941102
CQ		LAST	CONTACT EMP			155
CR		SITE	KEY			42001009 199400217
CS		TAX	MUN			42
CT		APPL	LNAME			MEYLE
CU		APPL	FNAME			RICK W
CV		PERMIT	CANCELED EMP			0
CW		PERMIT	TRANSFD EMP			0

Table A-4. On-Lot Sewage Database Condensed Metafile

		ONSITE SEWAGE DISPOSAL MASTER FIELD NAMES			CASE FILE DESCRIPTION	SAMPLE DATA
A	PID	TAX MAP	FC			42001009
C	PID	SERIAL	NUMBER			199400217
D	PID	REC	CODE	1	OWNER	0
	PID			2	AGENT	
	PID			3	CORPORATION	
V		DATE	FILED			19940516
W		DATE	APPL FILE			19940805
X	Lot Information	APPL	PARCEL TYPE			1
	Lot Information	1		1	RESIDENTIAL	
	Lot Information	2		2	SUBDIVISION	
	Lot Information	3		3	RURAL RESIDENCE	
	Lot Information	4		4	COMMERCIAL/INDUSTRIAL	
Y	Lot Information	FC	PARCEL TYPE			0
Z	Lot Information	WATER	SUPPLY			1
	Lot Information	1		1	PRIVATE	
	Lot Information	2		2	PUBLIC	
	Lot Information	3		3	OTHER	
AA	Lot Information	TYPE	SEWAGE SYS			1
	Lot Information	1		1	INDIVIDUAL	
	Lot Information	2		2	COMMUNITY	
AB	Lot Information	REASON	FOR APPL			2
	Lot Information	1		1	NEW	
	Lot Information	2		2	REPAIRS	
	Lot Information	3		3	EXPIRED/REISSUE	
	Lot Information	4		4	TRANSFER	
	Lot Information	5		5	RURAL RESIDENCE	
AC	Lot Information	PRIMARY	TREATMENT			1
	Lot Information	1		1	SEPTIC TANK	
	Lot Information	2		2	AEROBIC TANK	
AD	Lot Information	SECONDARY	TREATMENT			10
	Lot Information	1		1	STANDARD TRENCH	
	Lot Information	2		2	SEEPAGE BED	
	Lot Information	3		3	ELEVATED SAND TRENCH	
	Lot Information	4		4	SUBSURFACE SAND	
	Lot Information	5		5	ELEVATED SAND BED	
	Lot Information	6		6	GRAVEL MOUND	
	Lot Information	7		7	TRENCH/BED PRESS DOSE	
	Lot Information	8		8	ALT/EXP	
	Lot Information	9		9	HOLDING TANK	
	Lot Information	10		10	COMPONENET REPL	
AH		PERMIT	ISSUED DATE			19940518
AV	Soil Information	TEST	HOLES DATE		SOIL TEST DATE	0
AW	Soil Information	TEST	HOLES EMP		SOIL TEST EMPLOYEE #	0
BF	Soil Information	TEST	SOIL 1		SOIL TEST	
BG	Soil Information	TEST	SOIL 2		SOIL TEST	
BH	Soil Information	TEST	SOIL 3		SOIL TEST	
BI	Soil Information	TEST	SOIL 4		SOIL TEST	

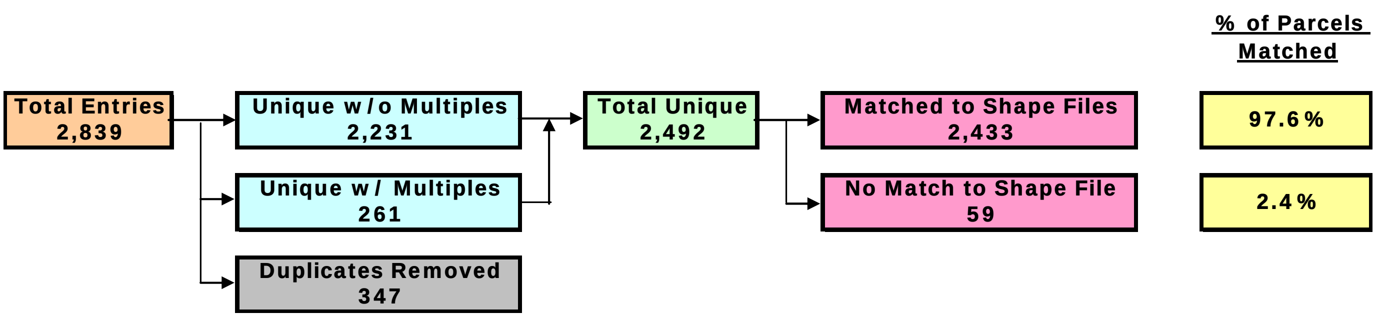
Table A-5. PID Concatenation

PIDEDIT				
Springfiel (42-XXX-XXX-XXX-XXX)				
TWP_NUM	MAP_NUM	LOT_NUM		
MUN	MAP	PARCEL	SUBONE	SUBTWO
	MAP-EDIT	PARCELEDIT1	SUBONEEDIT	SUBTWOEDIT
42	024	013	017	009

A.2. ASSESSORS REAL ESTATE & PARCEL SHAPE FILE MERGE

The first merge performed by LAI was between the Assessors Real Estate Database and the Bucks County Planning Commission Parcel shape files. Using the PID as the pivot, LAI successfully matched 2,433 data strings, leaving 214 parcels without Real Estate data, as summarized in Figure A-1.

Figure A-1. Parcel Summary



The Assessors and Parcel database merge produced a database that was condensed to include the information listed in the Table A-7 metafile.

A.3. ON-LOT SEWAGE SYSTEMS DATABASE MERGE

A.3.1. ESTABLISHING DATA PRIMACY

Upon inspection of the On-Lot Sewage data it was discovered that there were three distinct challenges to overcome before data primacy could be established and the data could be formatted for a merge. The original On-Lot Sewage data set, containing 2,621 entries, was scrutinized and reduced to 1,244 entries with unique PIDs through the following processes.

Table A-7. Assessors & Parcel Merged & Condensed Database Metafile

Sorting	Column Headings	Description	Sample Data
Unique ID Information	OBJECTID		
	TWP_NUM	Township ID	42
	MAP_NUM	Map ID	1
	LOT_NUM	Lot Number	
	MUN	Municipal ID	42
	MAP	Map Code	1
	MAP-EDIT		1
	PARCEL	Parcel Number	4
	PARCELEDIT1		4
	SUBONE		5
	SUBONEEDIT		5
	SUBTWO		
	SUBTWOEDIT		
	PIDEDIT	PID concatenated	42-004-176-006
	Springfiel	PID concatenated	42-004-176-006
	LEGAL DESC1	Legal Description	@42-21-15-4,18 (1) 94.77A
	LEGAL DESC3	Legal Description	
Parcel Spacial Information	Shape		
	Shape_Leng		826.4394488
	Shape_Length		826.4394217
	Shape_Area		35072.83051
	ACRES		0
	LANDUSE		2219
	CLASS CDE	Class Code	F
	CLASS	Class Code	F
	ZONING	Zoning Codes	VC
	ZONE	Zoning Codes	VC
	MUNI_NAME	Municipality Name	Springfield Township
	GROSS SQ FT	Gross Area	0
Parcel Building Information	CODE		1
	OWNERNAME1	Homeowner's last name	ZISKO
	OWNERNAME2	Homeowner's first name	ROBERT W & STEPHANIE S
	STREET #	Homeowner's street number	1800
	OWNERADDRESS	Homeowner's street address	SHALE RD
	CITY	City	QUAKERTOWN
	ST	State	PA
	ZIP	Zip Code	18951
	HOUSE		0
	STREET		WALNUT ST
	TYPE		R
	TRAILER		
	BEDROOMS		3
	BLD UNITS	Building Units	
	BASEMENT		
	APT UNITS	Apartment Units	0
	OTH BLDGS		
	LIV UNIT		0
	MULTI_OWN		0
	TOTAL ROOMS		6
	FULL BATHS		3
	HALF BATHS		0
	TOTAL LIVING AREA		2140
	POOL		
	DETACHED GARAGE		
	GEN BLD	General Building Number	
	BLD NUMB SFX	Building Number	
	BLD STR TYPE		0
	IDENT UNITS		0
	BASE GFLA		0
	BSMT RT		4

Value of Parcel	TOTLAND VALUE	Total Land Value	0
	TOTBLDG VALUE	Total Building Value	0
	SALE AMOUNT		1
	YR REMOD		0
Topography	TOPOGRAPHY		
	TOPO1		0
	TOPO 2		0
	UTILENTRY1		1
	UTILENTRY2		
	UTILENTRY3		
Important Dates	ERECTED CC		
	DATE ERECTED		
	SALE DATE		
	DEED DATE		
	YEAR BUILT		
	BOOK		
	PAGE		
	DUPLICATE		

Multiple entries for a common PID

These were separated from the unique entries and primacy was established based on which rows contained asset inventory information with the most recent permit date.

Table A-8. Summary of On-Lot Sewage Multiple Entries

Total Unique Onsite Sewage Parcels	1,244	% of Total
Parcels with 1 Entry	**552**	**44%**
Parcels with 2 Entries	368	30%
Parcels with 3 Entries	178	14%
Parcels with 4 Entries	81	7%
Parcels with 5 Entries	28	2%
Parcels with 6 Entries	16	1%
Parcels with >6 Entries	21	2%
Subtotal Multiple Entries	**692**	**56%**

Entries which contained a PID with text (i.e. "LOT") or an ampersand ("&")

These entries were adjusted to match the case file format. Entries with a LOT number were translated into numeric expression (i.e. LOT5 became subzone 005). Entries with an ampersand were divided into respective generations stemming from the common prefix.

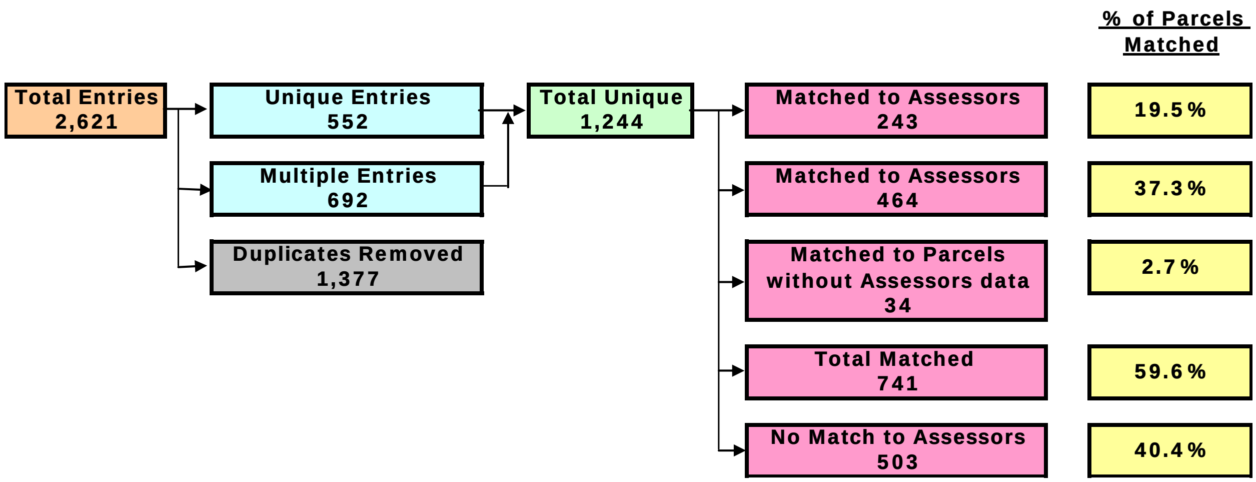
Entries which had a numeric PID that contained misplaced zeros or extra digits

These entries were concatenated to match the PID format.

A.3.2. MERGED DATABASES

The second merge between the 2,433 "Assessors & Parcel" matches and the On-Lot Sewage Systems Database's 1,244 unique entries produced 707 matches and 537 non-matches. LAI also performed a merge between the 214 Bucks County Planning Commission shape files that did not have Assessors information and the On-Lot Sewage Systems Database, which produced 34 additional matches. The results of these merges are illustrated below:

Figure A-2. On-Lot Sewage Data Summary



A.4. SUMMARY

Figure A-3 illustrates the data merge methodology, with Figure A-4 illustrating the data distribution. Due to data quality issues, the databases have the following handicaps:

Assessors Real Estate Database

1.

On-Lot Sewage Systems Database

1.

Building Ortho Photos

1. Building outlines match to aerial photos- highly variable from good to poor
2. Building outlines missing for parcels in XXX watershed

Figure A-3. Final Data Merge Methodology

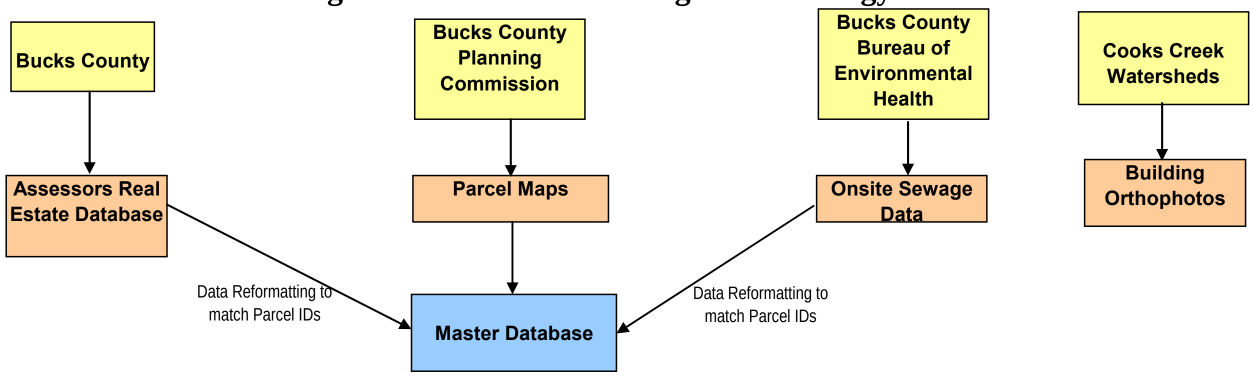
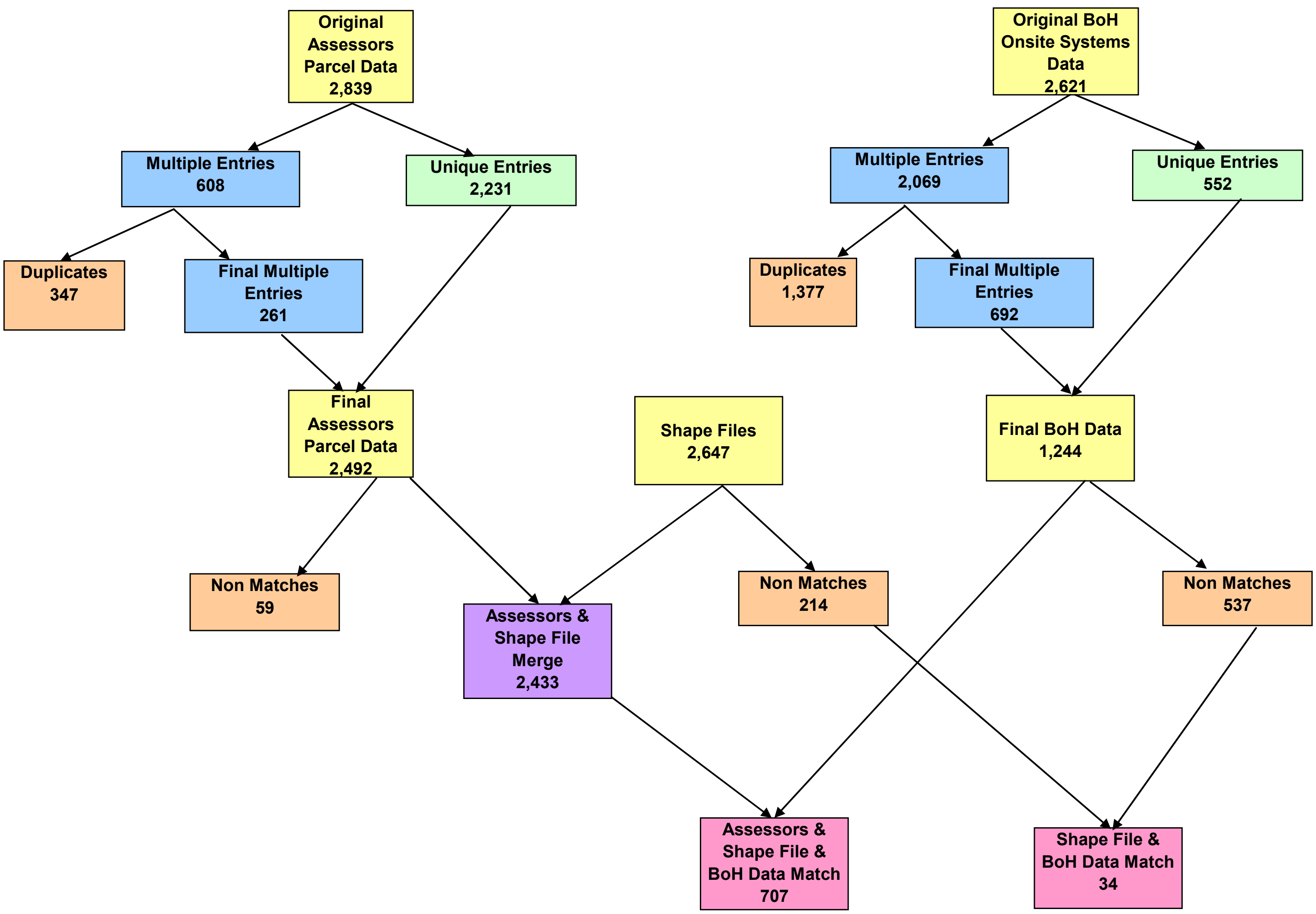


Figure A-4. Final Data Distribution



APPENDIX B– DATABASE MERGE RESULTS

B.1. SHAPE FILE & ASSESSORS DATABASE MERGE SUMMARY (2,433 PARCELS)

B.1.1. CLASS SUMMARY

CLASS		# Parcels	% Total
A		4	0.2%
C		64	2.6%
E		55	2.3%
EX		1	0.0%
F		481	19.8%
FA		34	1.4%
FW		10	0.4%
I		9	0.4%
R		1,751	72.0%
R1		1	0.0%
RA		9	0.4%
U		5	0.2%
(blank)		9	0.4%
Grand Total		***2,433***	***100%***

B.1.2. ZONING SUMMARY

ZONING		# Parcels	% Total
A		1	0.0%
AD	Agricultural	391	16.1%
AO		2	0.1%
AP		2	0.1%
D		1	0.0%
DD	Development District	63	2.6%
FC		4	0.2%
HC	Highway Commercial	38	1.6%
PI	Planned Industrial	26	1.1%
PR		2	0.1%
R		2	0.1%
R2		1	0.0%
RD		1	0.0%
RI		3	0.1%
RP	Resource Protection	441	18.1%
RR	Rural Residential	593	24.4%
VC	Village Commercial	123	5.1%
VDC		1	0.0%
VR	Village Residential	212	8.7%
WG		2	0.1%
WS	Watershed	434	17.8%
(blank)		90	3.7%
Grand Total		***2,433***	***100%***

B.1.3. CODE SUMMARY

CODE		# Parcels	% Total
1		2,279	93.7%
2		2	0.1%
3		57	2.3%
5		5	0.2%
(blank)		90	3.7%
Grand Total		***2,433***	***100%***

B.1.4. UTILENTRY1 SUMMARY

UTILENTRY1		# Parcels	% Total
1		27	1.1%
2		103	4.2%
3		8	0.3%
4		2	0.1%
5		1,757	72.2%
7		461	18.9%
(blank)		75	3.1%
Grand Total		***2,433***	***100%***

B.1.5. UTILENTRY2 SUMMARY

UTILENTRY2		# Parcels	% Total
5		11	0.5%
6		1,859	76.4%
(blank)		563	23.1%
Grand Total		***2,433***	***100%***

B.1.6. PROPERTY TYPE SUMMARY

TYPE		# Parcels	% Total
C	Commercial	82	3.4%
R	Residential	2,261	92.9%
(blank)		90	3.7%
Grand Total		***2,433***	***100%***

B.1.7. LIVING UNITS SUMMARY

LIV UNIT	# Parcels	% Total
0	653	26.8%
1	1,717	70.6%
2	52	2.1%
3	6	0.2%
4	5	0.2%
(blank)		0.0%
Grand Total	***2,433***	***100%***

B.1.8. BLDG STR SUMMARY

BLDG STR TYPE		# Parcels	% Total
0		2,370	97.4%
101		10	0.4%
105		4	0.2%
211		5	0.2%
319		2	0.1%
321		2	0.1%
327		1	0.0%
331		1	0.0%
332		3	0.1%
334		2	0.1%
353		2	0.1%
367		2	0.1%
373		7	0.3%
388		1	0.0%
397		7	0.3%
398		3	0.1%
610		2	0.1%
612		1	0.0%
620		7	0.3%
660		1	0.0%
(blank)			0.0%
Grand Total		***2,433***	***100%***

B.1.9. BEDROOMS (#) SUMMARY

BEDROOMS	# Parcels	% Total
0	677	27.8%
1	47	1.9%
2	328	13.5%
3	871	35.8%
4	432	17.8%
5	46	1.9%
6	27	1.1%
7	2	0.1%
8	1	0.0%
10	1	0.0%
12	1	0.0%
(blank)		0.0%
Grand Total	***2,433***	***100%***

B.2. Shape File and Assessors & On-Lot Sewage Database Merge Summary (1,244)

B.2.1. Parcel Type Summary

PARCEL TYPE	Number of Parcels	% Total
0	381	30.6%
COMMERCIAL/INDUSTRI	35	2.8%
RESIDENTIAL	601	48.3%
RURAL RESIDENCE	78	6.3%
SUBDIVISION LOT	149	12.0%
Grand Total	**1,244**	**100%**

B.2.2. Water Supply Summary

WATER SUPPLY	Number of Parcels	% Total
0	405	32.6%
OTHER	2	0.2%
PRIVATE	802	64.5%
PUBLIC	35	2.8%
Grand Total	**1,244**	**100%**

B.2.3. Reason for Application Summary

REASON FOR APPL	Number of Parcels	% Total
0	374	30.1%
EXPIRED/REISSUE	10	0.8%
NEW	423	34.0%
REPAIRS	270	21.7%
RURAL RESIDENCE	89	7.2%
TRANSFER	78	6.3%
Grand Total	**1,244**	**100%**

B.2.4. Sewage System Summary

TYPE SEWAGE SYS	Number of Parcels	% Total
0	405	32.6%
COMMUNITY	6	0.5%
INDIVIDUAL	833	67.0%
Grand Total	**1,244**	**100%**

B.2.5. PRIMARY TREATMENT SUMMARY

PRIMARY TREATMENT	Number of	% Total
NO DESCRIPTION AVAILABLE	487	39.1%
AEROBIC TANK	12	1.0%
SEPTIC TANK	745	59.9%
Grand Total	**1,244**	**100%**

B.2.6. SECONDARY TREATMENT SUMMARY

SECONDARY TREATMENT	Number of	% Total
NO DESCRIPTION AVAILABLE	467	37.5%
ALT/EXP	35	2.8%
COMPONENT REPL	75	6.0%
ELEVATED SAND BED	263	21.1%
ELEVATED SAND TRENCH	2	0.2%
GRAVEL MOUND	25	2.0%
HOLDING TANK	27	2.2%
SEEPAGE BED	78	6.3%
STANDARD TRENCH	258	20.7%
SUBSURFACE SAND	9	0.7%
TRENCH/BED PRESS DOSE	5	0.4%
Grand Total	**1,244**	**100%**

APPENDIX C – DATABASES

The databases are presented in the following sections of Appendix C:

Section:	Database:
1	Parcel Shape Files
2	Assessors Real Estate Database
3	On-Lot Sewage Systems
4	Merged Real Estate & Shape Files
5	Merged Real Estate, Shape Files & On-Lot Sewage Systems

A summary of the Databases is:

- Parcels with Shape Files 2,647
- Parcels with Assessors Real Estate Data 2,492
- Parcels with On-Lot Sewage System Data 1,244

C.1. BUCKS COUNTY SPRINGFIELD TOWNSHIP PARCEL SHAPE FILES (2,647)

C.2. BUCKS COUNTY ASSESSORS REAL ESTATE DATABASE

C.3. BUCKS COUNTY BUREAU OF ENVIRONMENTAL HEALTH, ON-LOT SEWAGE SYSTEMS DATABASE

The On-Lot Sewage Data was developed by Bucks County using the Case File Input Form of Figure D.3.1. Bucks County has been using this system since XXX. Table D.3.2 lists the parcels with On-Lot Sewage Data for which there is a unique PID. Table D.3.3 lists the parcels with single entries. Table D.3.4 lists the parcels with multiple entries.

C.3.1. CASE FILE INPUT FORM

C.3.2. DATABASE WITH UNIQUE PID (1244)

C.3.3. DATABASE SINGLE ENTRY (552)

C.3.4. DATABASE MULTIPLE ENTRIES (692)

C.4. ASSESSORS REAL ESTATE & PARCEL SHAPE FILE MERGE (2,433)

Of the 2,647 Parcel Shape files, 2,433 matched the Assessors Real Estate Database. Table D.4.1. lists the Assessors Real Estate and Parcel Shape file Database merge. Table D.4.2. lists the Assessors Real Estate files that did not match the Parcel Shape files.

C.4.1. ASSESSORS REAL ESTATE AND PARCEL SHAPE FILE MERGE (2,433)

C.4.2. PARCEL SHAPE FILES WITHOUT ASSESSORS REAL ESTATE DATA (214)

C.5. FINAL MATCHED FILES & EXPLANATION OF UNMATCHED

C.5.1. ASSESSORS & SHAPE FILE AND ON-LOT SYSTEMS FINAL MERGE (741)

C.5.2. PARCELS WITH NO TAX DATA MERGE (34)

C.5.3. EXPLANATION OF UNMATCHED

APPENDIX D – MAPS

The following maps, in addition to those cited in the main body of the Plan, have been assembled.

D.1. SPRINGFIELD TOWNSHIP ROADWAYS

APPENDIX E – PADEP & BUCKS COUNTY REGULATIONS AND REFERENCES

http://www.buckscounty.org/government/departments/humanservices/healthdepartment/Environmental/OnSiteSewage.aspx

Bucks County Health Department

-- Main -- BioTerrorism -- Bureau of Personal Health -- Bureau of Environmental Health --

Bureau of Environmental Health

On-site Sewage Disposal Facilities

Scott Cressman, BS, S.E.O., Program Coordinator

On-site Sewage Disposal Facilities
The Department administers the On-site Sewage Program through its "Rules and Regulations Governing Individual and Community On-Lot Sewage Disposal Systems" which are available in Health Department District Offices, or through the link below. There is an "On-site Sewage Disposal Fee Schedule" (ADM-71).

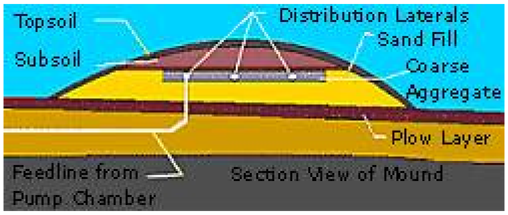
On-site permits and inspections
The Department permits on-site sewage facilities (septic systems), proposed/repaired systems, including spray irrigation systems, drip irrigation, holding tanks, alternate, and experimental systems which qualify under PA Code, Title 25, Chapters 71, 72 & 73.

Requests for on-site inspection for a new system (form SA-52), a repair (form SA-53) or malfunction (form SA-53) can be made by obtaining and completing the appropriate request form and submitting the corresponding fee.

Requests for holding tank permits are made at District Offices by filing the form "Holding Tank Agreement" (form SA-56)", and "Agreement for Temporary Holding Tank Approval" (form SA-57).

New owners of structures may need to complete an "Application for Transfer of On-Site Sewage Disposal System Permit" (form SA-51).

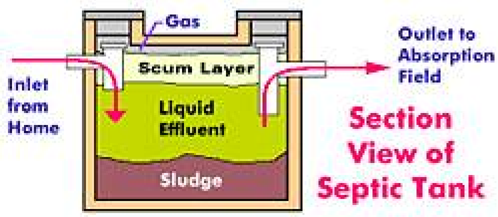
Repair of On-site-Sewage Disposal Facilities



The Department provides assistance to property owners for the diagnosis and repair of malfunctioning on-lot systems. Request assistance by completing the form "On-Site Sewage Disposal Repair Form" (SA-53. 5/96) with the accompanying fee.

The Department responds to written complaints of malfunctioning on-site sewage systems as described in "Policy and Procedure for On-Site Sewage Repairs". All Environmental Complaints must be in writing.

Licensure of Sewage Pumping and Disposal Vehicles
The Department licenses all sewage disposal vehicles for pumping and transporting sewage within Bucks County. These procedures are reported in "Section Five - Licensing of Sewage Transportation Vehicles, Pumping and/or transporting of Sewage Waste materials" which is included in the Department's "Rules and Regulations Governing Individual and Community On-Lot Sewage Disposal Systems".



An application for a Sewage Disposal License requires completing the form "Application for Licensing of Sewage Transportation Vehicles Pumping, Hauling or Transportation of Liquid or Solid Sewage Waste Materials" (form SA-20), for each sewage-hauling vehicle must be filled each year. The form needs to be received by the Main Office of the Department in Doylestown before the end of August of each summer. The appropriate fee is listed on form "On-site Sewage Disposal Fee Schedule" (form ADM-71). An inspection will be scheduled for the vehicles in Doylestown, Quakertown, or at the GROWS Landfill in Falls Township, usually during the month of September.

***On-lot Sewage Rules and Regulations**

APPENDIX F – PADEP & BUCKS COUNTY REGULATIONS AND REFERENCES

http://www.depweb.state.pa.us/watersupply/cwp/view.asp?a=1260&Q=449298&watersupplyNav=|30160|#OLDS

Sewage and Sewage Disposal

- **Act 537 (The Pennsylvania Sewage Facilities Act)**
- **Act 537 Sewage Facilities Planning**
- **Act 537 Program Fees, Grants, and Reimbursements**
- **Act 537 Sewage Facilities - Electronic Forms**
- **Onlot Disposal System**
- **Sewage Enforcement Officers**
- **Sewage Management Programs**
- **Public and Private Sewer Systems**

Act 537 (The Pennsylvania Sewage Facilities Act)

- **An Overview of the Act 537 Sewage Facilities Program**
  (3800-FS-DEP2716, 4/2004)
  Describes the history and processes of the Act 537 sewage facilities program in Pennsylvania.

- **Clean Streams Law**, The Pennsylvania Clean Streams Law.

- **Act 537: Pennsylvania Sewage Facilities Act, With Index**
  (3800-BK-DEP1416)
  Unofficial version of Act 537 used for assistance with learning about the Pennsylvania Sewage Facilities Act.

- **DEP Regulations, Title 25, Chapter 71**, "Administration of Sewage Facilities

Planning Program"

- Updated **Maps**,
  - **Act 537 Official Plan Status Map** (Dec. 04) and related data.
  Depicts the relative age of Act 537 Official Plans throughout the Commonwealth.
  - **Joint Local Agency Service Areas Map** (Feb. 05) and related data. Represents a tabulation of municipalities acting in coordination throughout the Commonwealth.

- **A Guide for Preparing a Municipal Act 537 Plan Update Revisions**
  (362-0300-003, 1/2003)
  Used by DEP, municipal officials and consultants when preparing a comprehensive Act 537 Official Plan or plan update.

- **Act 537 Sewage Disposal Needs Identification** (3800-BK-DEP1949)
  Used by consultants and municipal officials to identify and document sewage disposal needs when preparing an Act 537 Plan.

- **Act 537 Plan Content and Environmental Assessment Checklist**
  (3800-FM-WSFR0003, 11/2002)
  Used by DEP and the regulated community to determine Act 537 Plan content requirements and completeness. Links to the Act 537 Planning Forms page

- **Policy Establishing New Program Direction Policy for Act 537 Comprehensive Planning**
  (362-2206-007, 4/1997)
  Guidance document that describes DEP's position in support of sewage facilities planning in rural municipalities.

- **Municipal Guidance for Reconstructive Planning** (362-2208-002, 11/2002)
  Guidance for municipal officials that discusses methods and actions necessary to address unplanned subdivisions.

- **Review and Coordination of Chapter 94 Reports and Act 537 Planning**
  (362-2206-001, 6/2002)
  Used by municipal officials, consultants and DEP to coordinate the Municipal Wasteload Management Program with the Act 537 Planning Program.

- **Guidelines for the Uniform Environmental Review Process in Pennsylvania**
  (381-5511-111, 11/2003)
  Used by municipal officials and consultants for standard documentation of the environmental effects for projects requesting financial assistance from various federal funding agencies.

- **Water Quality Antidegradation Implementation Guidance**
  (391-0300-002, 11/2003)
  Used by DEP and the regulated community when proposing or evaluating proposed discharges to waters classified as High Quality or Exceptional Value.

- **Manual for Land Application of Treated Sewage and Industrial Wastewater**
  (362-2000-009, 10/1997)
  Used by consulting engineers, hydrogeologists, soil scientists and DEP when proposing and

evaluating land application proposals.

- **Policy and Procedure for Evaluating Wastewater Discharges to Intermittent and Ephemeral Streams, Drainage Creeks and Swales, and Storm Sewers**
  (391-2000-014)
  Used by DEP and the regulated community when evaluating non-stream discharges.

- **Handbook for PennVest Wastewater Projects** (381-5511-113, 8/2003)
  Used by DEP staff to provide quality, timely and consistent service to the public and regulated community when addressing PennVest wastewater projects.

- **Sewage Planning Fact Sheets**

- **Sewage Planning Electronic Forms**

Act 537 Sewage Facilities Planning

Act 537 Program Fees, Grants, and Reimbursements

- **Administration of Fee Collection for Planning Module Reviews**
  (362-2207-008, 10/2001)
  Used by DEP and project sponsors to determine planning module review fees and fee processing methods.

- **Act 537, Sewage Facilities Planning Grants** (362-5512-002, 7/2001)
  This document discusses administration of the Act 537 planning grant (reimbursement) program that awards municipal grants for the purpose of offsetting Act 537 planning costs.

- **Recognition of Selected Cost Items Associated with I & I Studies as a Planning Consideration for Sewage Facilities Planning Grants**
  (362-5512-003, 12/2002)
  Used by DEP and the regulated community when evaluating the impact of inflow and infiltration on a sewer system during planning.

- **Act 537, Sewage Facilities Enforcement Reimbursement**
  (362-5512-001, 7/2001)
  This document discusses administration of the annual reimbursement program for permitting and enforcement activity expenses.

Act 537 Sewage Facilities - Electronic Forms

- **Act 537, Sewage Facilities Program Administration Forms**
  These forms and form packages are used to carry out routine Act 537 program activities

- **Act 537, Sewage Facilities Planning Packages**
  These forms and form packages are used in the new land development planning process.
- **Department-Wide Permit Application Form Packages**
  These form packages may be required to supplement program specific forms and form packages.

Onlot Disposal System (OLDS)

- **DEP Regulations, Title 25, Chapter 73**, "*Standards for Onlot Sewage Treatment Facilities*"
- **Onlot Sewage Program (Home Buyer's / Builders Guide)**
- **Down the Drain: Septic System Sense** (RealVideo Format)
- **Onlot Disposal Operation and Maintenance (Homeowner's Guide)**
- **Impact of the Use of Subsurface Disposal Systems on Groundwater Nitrate Nitrogen Levels**
  (362-2207-004, 3/2003)
  Used by DEP to establish a consistent rationale and policy application for evaluating onlot sewage disposal's impact on groundwater nitrate contamination.
- **Alternate Systems Guidance** (362-0300-007, 2/2004)
  Used by DEP and the regulated community for design and review of OLDS classified as Alternate Systems under DEP Regulations, Section 73.72.
- **Experimental Onlot Wastewater Technology Verification Program**
  (381-2208-001, 7/2004)
  Used by DEP, SEOs, and technology manufacturer's when determining expected performance of new onlot wastewater technologies.
- "*Working with Nature, New Wastewater Technologies for Pennsylvania*" *(6/2000)*
  - **Introduction**
  - **Research and Development Report**
- **Innovative Wastewater Technologies** (10MB PowerPoint Presentation, 2/5/99) Delaware Valley College
  A text and pictorial presentation documenting Phase I of a project designed to identify new wastewater technologies for Pennsylvania.
- NEW **Pennvest Homeowner Loans**, Low interest loans are available from Pennvest for the repair and replacement of malfunctioning onlot sewage disposal systems.

- **Onlot Disposal System Fact Sheets**

Sewage Enforcement Officers (SEO)

- **DEP Regulations, Title 25, Chapter 72**, "*Administration of Sewage Facilities Permitting Program*"
- Search the **Sewage Enforcement Officer Database**
- **SEO Training and Information** General Information; Precertification Academy; Continuing Education; Course Descriptions
- **2007 Examination Schedule** (PDF file), State Board For Certification of Sewage Enforcement Officers
- External Link to **SEO Training Opportunities and Schedules**
- **State Board for Certification of Sewage Enforcement Officers** (SEO)
- **Mine Subsidence Areas and the Siting of Onlot Sewage Systems** (21KB PDF File) A letter from the Deputy Secretary to all SEOs, June 28, 2002.
- **Technical Decision Making in Onlot Sewage System Repair Situations** (362-2208-003, 5/2004) Used by Sewage Enforcement Officers, Municipal Officials and DEP when considering repairs to malfunctioning Onlot sewage Treatment Systems.

Sewage Management Programs (SMP)

- **A Municipal Official's Guide To Managing Onlot Sewage Disposal Systems**
- **A Guide to Developing an Ordinance Creating a Multi-Municipal Local Agency**
- **Registration for Transporting Residential Septage**
- **Sewage Management Program Fact Sheets**

Public and Private Sewer Systems

- **Wastewater Treatment System Operators** Information Center
- **Small Flow Treatment Facilities Manual** (362-0300-002)
  Used by DEP and the regulated community when designing and evaluating Small Flow Treatment Facilities (SFTF) designs.
- **Domestic Wastewater Facilities Manual** (362-0300-001, 10/1997)
  Used by DEP and the regulated community when designing and evaluating sewer system designs.
- **Sewer Systems Fact Sheets**

Wastewater Program Performance Measures

Read information on wastwater systems, program outputs, and program outcomes.

APPENDIX G – SPRINGFIELD TOWNSHIP, ORDINANCES

G.1 Springfield Township Ordinance #107, Providing for the Implementation of the Pennsylvania Sewage Facilities Act

G.2 Milford Township Ordinance #108, Maintenance, Inspection & Repair of Existing, and Future On-Lot Sewage Systems

APPENDIX H – PADEP DRAFT DOCUMENT 362-2206-002, "EXISTING AUTHORITY AND REQUIREMENTS RELATING TO ASSURANCE OF LONG TERM OPERATION AND MAINTENANCE OF SEWAGE FACILITIES"

APPENDIX I – PADEP DRAFT DOCUMENT 362-2206-002, "MINIMUM OPERATION AND MAINTENANCE NEEDS FOR SEWAGE FACILITIES TREATMENT COMPONENTS WHEN USED WITH CONVENTIONAL ONLOT TREATMENT SYSTEMS.

APPENDIX J – USEPA VOLUNTARY NATIONAL GUIDELINES FOR MANAGEMENT OF ONSITE & CLUSTERED WASTEWATER TREATMENT SYSTEMS