Exhibit 6, Requirements for Environmental Impact Assessment Report

Township of Lower Makefield, Pennsylvania

[Added 12-20-2006 by Ord. No. 363]

B. The EIA report shall include text, tables, maps and analyses for the purpose of describing the project site, proposed use(s), environmental characteristics and the environmental effects of the proposal as follows:

(1) Introduction and overview.

(a) Description of the project. An identification of the nature of the proposal through the presentation of the following:

[1] Description of project, including type of units or structures, number of units (i.e., dwelling units) or structures, general description of proposed access, circulation system, potable water and sewer services, utilities, stormwater management approach, and whether the site is to be developed with a traditional layout or clustering.

The Snipes tract is proposed to be developed as a park which will contain three (3) full-size multi-use rectangular fields and one mid-size field. The fields are designed to be used for team sports played on rectangular fields and will accommodate sports such as football, lacrosse, soccer, field hockey, ultimate frisbee and rugby. The plan also includes a pavilion and a structure that will contain a concession stand and restrooms and skate park as a future phase. A trail system is proposed throughout the park. Two access driveways are proposed for the park. One will be on Dolington Road, south of the existing nursery driveway and one will be on Quarry Road, opposite Quarry Hill Road. A loop road will be constructed around the perimeter of the fields. The park will be served with public water and sewer. The park has been designed in accordance with Lower Makefield Township, Bucks County Conservation District, and PA DEP standards for stormwater management and incorporates a series of Best Management Practices, infiltration, and rate and volume controls.

[2] A site development plan.

Refer to the Snipes Tract Athletic Fields plan set. Plan sheets 1-14 Dated November 14, 2016 last revised May 2, 2017.

[3] An identification of the site location and area through the use of a location map drawn at a scale of not more than 2,000 feet to the inch. The location map shall depict all streets, adjoining

properties, zoning district boundaries and municipal boundaries within 2,500 feet of any part of the tract. In the case of development of only a portion of the entire tract, the location map shall also show the relationship of the section to the entire tract.

Refer to Plan Sheet 1 of 14 of the Snipes Tract Athletic Fields plan set.

[4] A statement indicating the existing and proposed ownership of the tract.

Lower Makefield Township is the current owner of the Snipes Tract and will continue to be the owner of the tract.

[5] A statement indicating the proposed staging or phasing of the project and a map depicting the boundaries of each stage or phase of the project. Such boundaries shall be superimposed on a version of the site development plan.

Lower Makefield Township is proposing to construct the entire project, however, due to budgeting constraints, some parts including the skate park, concession stand and pavilion may be deferred.

(b) Purpose and scope. Indicate the purpose and scope of the proposed project. Enumerate the benefits to the public which will result from the proposed project and describe the suitability of the site for the intended use. A description of the proposed project shall be presented to indicate the extent to which the site must be altered, the kinds of facilities to be constructed, how they are to be constructed and the uses intended. The resident population, working population and visitor population shall be projected. The basis of the projections shall be clearly stated in the report.

The purpose and scope of the proposed project is to develop the site as a park to serve the needs of the residents of Lower Makefield Township. The proposed park is the culmination of over 22 years of Park and Recreation planning in the Township.

- *The Lower Makefield 1995 Plan of Action supported additional recreation land in the northern section of the Township to address the shortage of field space.*
- *The Lower Makefield 1997 follow-up to the Plan of Action recommendations identified a need for additional park land.*
- *Lower Makefield Township acquired the Snipes Tract in 2000, and targeted the land to be developed as additional recreational field space.*
- *Lower Makefield Township Park Board formed a subcommittee on 4/2/2004, consisting of members of YMS, Elm Lowne committee, residents, and the LMT Park Board. (LMT Park Board minutes 4/3/2004)*

- *The Lower Makefield Township Snipes Subcommittee presented their recommendations to the Park Board on 5/11/2004. (LMT Park Board minutes 5/11/2004)*
- *The Lower Makefield Township Park Board recommended to the Board of Supervisors that they adopt Snipes Plan C on 11/16/2005.*
- *On 11/21/2005, the Lower Makefield Township Board of Supervisors approved a motion to move forward with engineering of the Snipes Plan.*
- *The Lower Makefield Township Park Board recommended to the Board of Supervisors that they approve Snipes Plan C on 2/17/2006.*

2007 Plan of the Snipes Tract:

- *The Lower Makefield Township Park Board recommended to the Board of Supervisors to include funding for Snipes on 10/17/2006.*
- *The Lower Makefield Township Park Board recommended to the Board of Supervisors that they approve the alternate to Plan C Snipes on 1/23/2007.*
- *Lower Makefield Township Board of Supervisors approved the Sketch Plan for Snipes on 3/21/2007*
- *On 4/9/2007, the Bucks County Courier Times ran a story with the headline "Lower Makefield Officials Unveil Plan for Soccer Complex" along with picture of proposed plan showing 10 soccer fields, playground, and skate park.*

The site will be altered in accordance with the Snipes Tract Athletic Fields plans, and will include removal of existing nursery trees, grading, stormwater management BMP's and facilities, and the construction of the proposed improvements.

The Snipes tract is proposed to be developed as a park which will contain three (3) full-size multi-use rectangular fields and one mid-size field. The fields are designed to be used for team sports payed on rectangular fields and will accommodate sports such as football, lacrosse, soccer, field hockey, ultimate frisbee and rugby. The plan also includes a pavilion and a structure that will contain a concession stand and restrooms and skate park as a future phase. A trail system is proposed throughout the park. Two access driveways are proposed for the park. One will be on Dolington Road, south of the existing nursery driveway and one will be on Quarry Road, opposite Quarry Hill Road. The park will be served with public water and sewer. The park has been designed in accordance with Lower Makefield Township, Bucks County Conservation District, and PA DEP standards for stormwater management and incorporates a series of Best Management Practices, infiltration, and rate and volume controls.

No new residents are proposed as a part of this plan, as no dwelling units are proposed. No additional permanent workers are proposed as a part of this plan. The visitor population to the site will consist of park users, which will include township residents, members of the athletic associations using the fields, officials, coaches, parents/relatives of the athletes, and spectators.

(c) Compatibility. The compatibility or incompatibility of the proposed project shall be described in relation to the following:

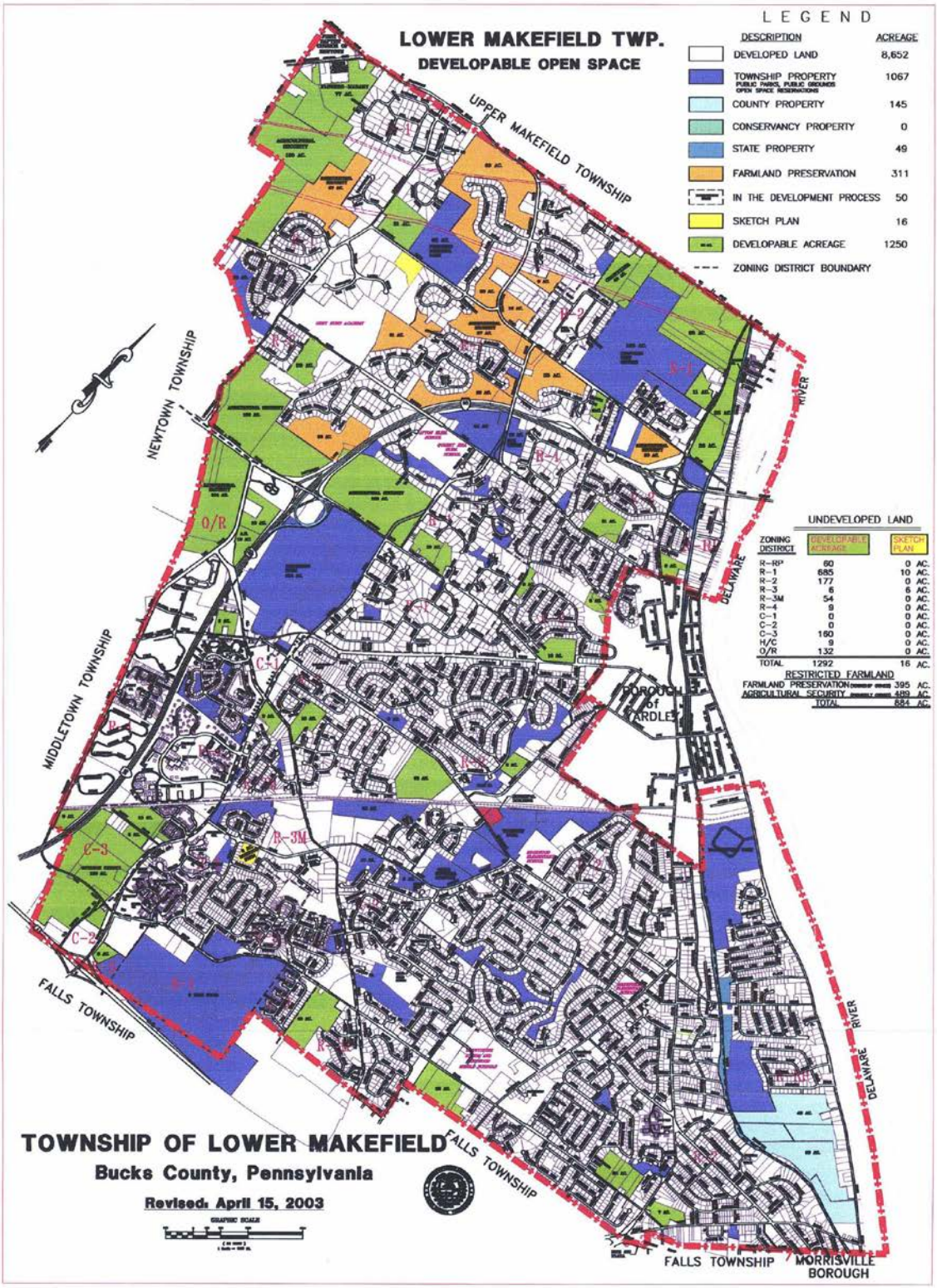
[1] Township Comprehensive Plan, especially the land use and open space elements.

The current Township Comprehensive Plan was adopted in 2003. However, the Township has been working with the Bucks County Planning Commission since 2012 on an update to the 2003 plan. The most current public draft is dated 2015 and is titled "Township of Lower Makefield Comprehensive Master Plan Update." Both have been reviewed and both treat the Snipes Tract and park and recreation in a similar manner. The proposed park plan is compatible with both of these planning documents, as follows:

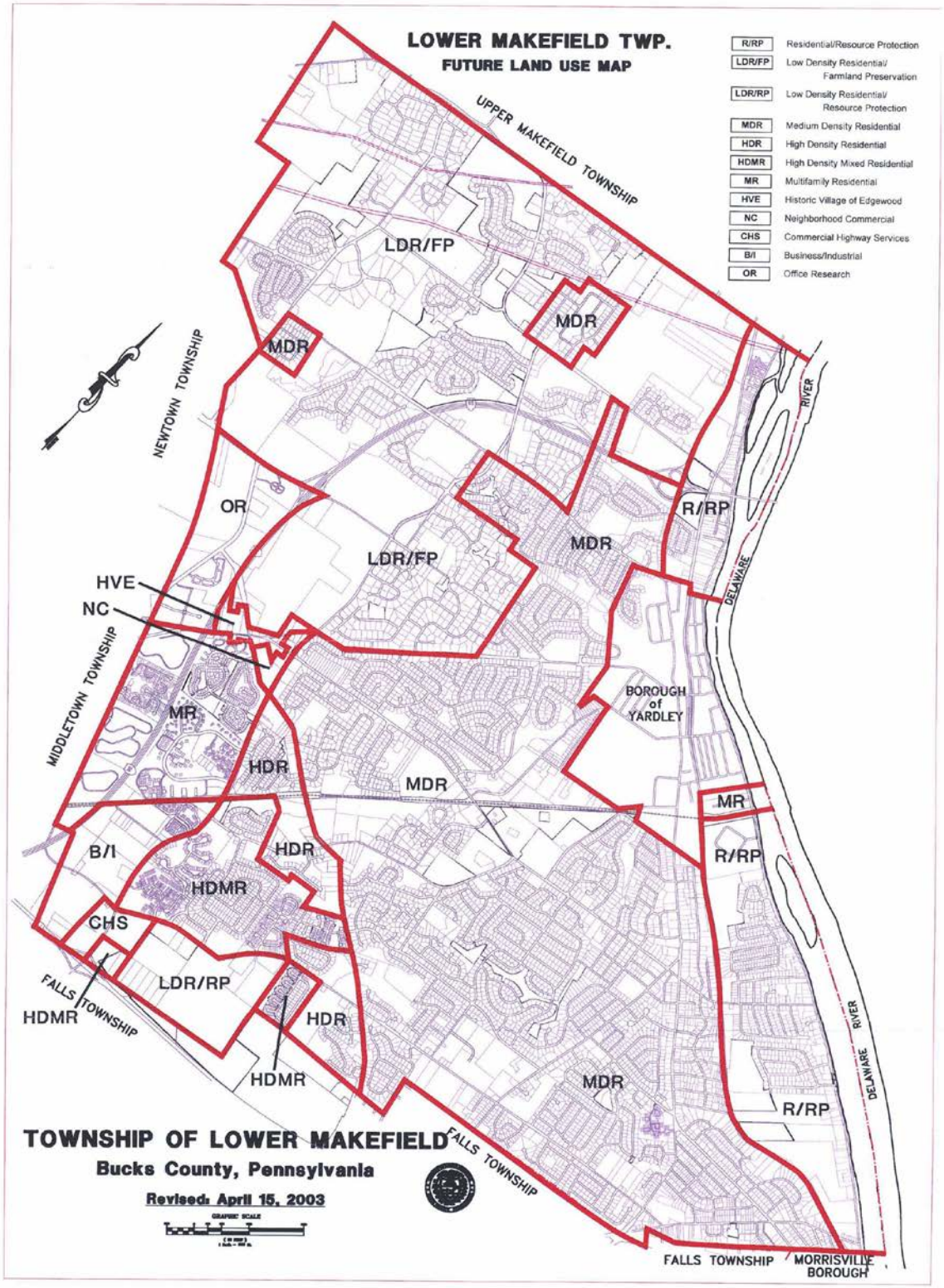
Township of Lower Makefield Comprehensive Master Plan Update 2003:

- *The plan is compatible with the following Community Goals and Policies: (page 9)*
  - *Adequately safeguard the health, safety, and welfare of residents.*
  - *Provide an adequate supply and mix of recreation facilities to serve the existing and projected population of the township.*

- *The plan is compatible with the following Goals for Park and Recreation Planning: (page 63)*
  - *Provide adequate parkland to meet the needs of the Township based on complete build-out of the community.*
  - *Provide a balance of active and passive recreation facilities to meet the needs of citizens of all ages and interests.*
  - *Offer recreation programs and services that enrich the lives of citizens.*
- *The plan is compatible with the "Current Planning Priorities" noted in the document on pages 63-69.*
- *The following maps from the planning document are included, for reference:*
  - *Map 4 – Developable Open Space - This map shows the Snipes Tract as "Township Property"*
  - *Map 5 – Future Land Use Map. This map shows the Snipes Tract as "LDR/FP" which is Low Density Residential / Farmland Preservation.*
  - *Map 6 – Public Facilities, Recreation, and Open Space. This map shows the Snipes Tract as "Township Property."*

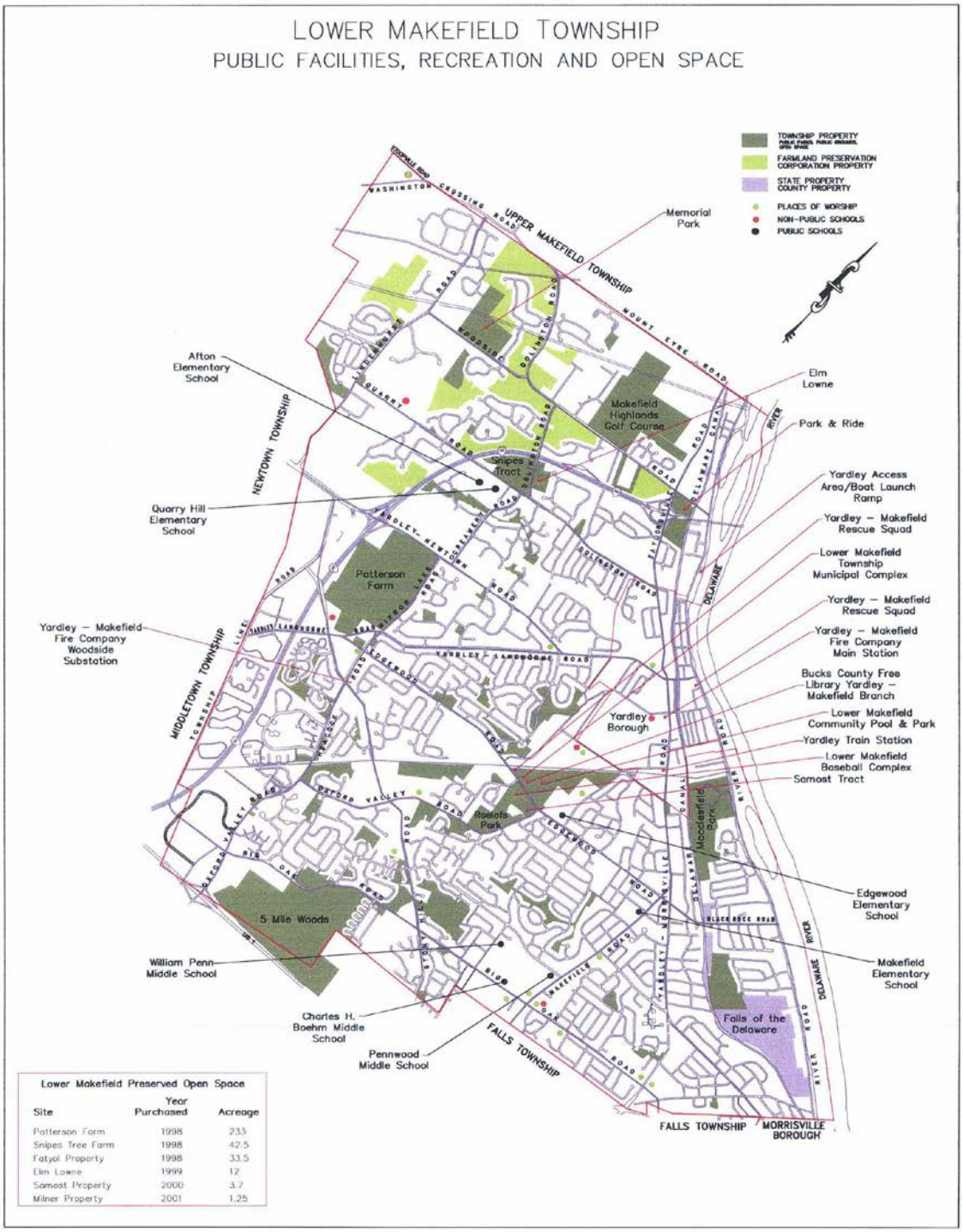

LOWER MAKEFIELD TWP.
DEVELOPABLE OPEN SPACE
LEGEND
DESCRIPTION
ACREAGE
DEVELOPED LAND 8,652
TOWNSHIP PROPERTY 1067
PUBLIC PARKS, PUBLIC GROUNDS OPEN SPACE RESERVATIONS
COUNTY PROPERTY 145
CONSERVANCY PROPERTY 0
STATE PROPERTY 49
FARMLAND PRESERVATION 311
IN THE DEVELOPMENT PROCESS 50
SKETCH PLAN 16
DEVELOPABLE ACREAGE 1250
ZONING DISTRICT BOUNDARY
UPPER MAKEFIELD TOWNSHIP
NEWTOWN TOWNSHIP
MIDDLETOWN TOWNSHIP
FALLS TOWNSHIP
FALLS TOWNSHIP
FALLS TOWNSHIP
MORRISVILLE BOROUGH
BOROUGH of YARDLEY
DELAWARE RIVER
DELAWARE RIVER
UNDEVELOPED LAND
ZONING DISTRICT
DEVELOPABLE ACREAGE
SKETCH PLAN
R-RP 60 0 AC.
R-1 685 10 AC.
R-2 177 0 AC.
R-3 6 6 AC.
R-3M 54 0 AC.
R-4 9 0 AC.
C-1 0 0 AC.
C-2 0 0 AC.
C-3 160 0 AC.
H/C 9 0 AC.
O/R 132 0 AC.
TOTAL 1292 16 AC.
RESTRICTED FARMLAND
FARMLAND PRESERVATION 395 AC.
AGRICULTURAL SECURITY 489 AC.
TOTAL 884 AC.
TOWNSHIP OF LOWER MAKEFIELD
Bucks County, Pennsylvania
Revised: April 15, 2003
GRAPHIC SCALE

MAP 4


LOWER MAKEFIELD TWP.
FUTURE LAND USE MAP
R/RP Residential/Resource Protection
LDR/FP Low Density Residential/ Farmland Preservation
LDR/RP Low Density Residential/ Resource Protection
MDR Medium Density Residential
HDR High Density Residential
HDMR High Density Mixed Residential
MR Multifamily Residential
HVE Historic Village of Edgewood
NC Neighborhood Commercial
CHS Commercial Highway Services
B/I Business/Industrial
OR Office Research
UPPER MAKEFIELD TOWNSHIP
NEWTOWN TOWNSHIP
MIDDLETOWN TOWNSHIP
BOROUGH of YARDLEY
FALLS TOWNSHIP
MORRISVILLE BOROUGH
DELAWARE RIVER
TOWNSHIP OF LOWER MAKEFIELD
Bucks County, Pennsylvania
Revised: April 15, 2003
GRAPHIC SCALE

MAP 5

LOWER MAKEFIELD TOWNSHIP
PUBLIC FACILITIES, RECREATION AND OPEN SPACE



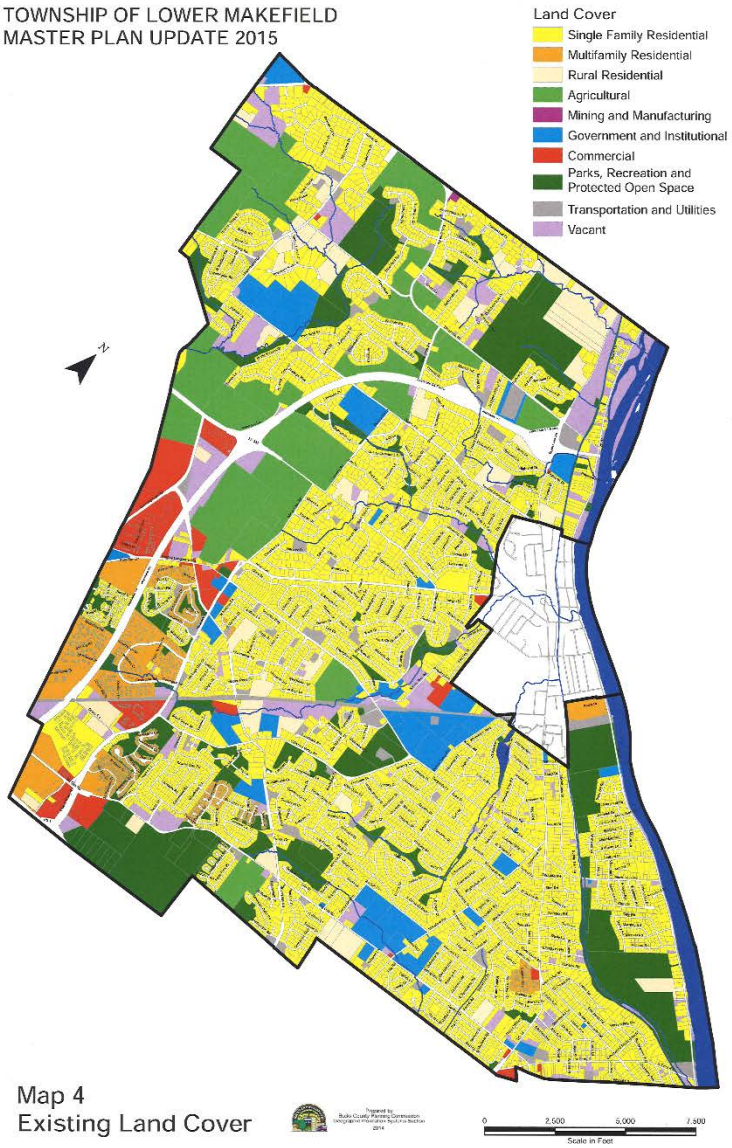
Lower Makefield Preserved Open Space

Site	Year Purchased	Acreage
Patterson Farm	1998	233
Snipes Tree Farm	1998	42.5
Fatyol Property	1998	33.5
Elm Lowne	1999	12
Samost Property	2000	3.7
Milner Property	2001	1.25

MAP 6/7

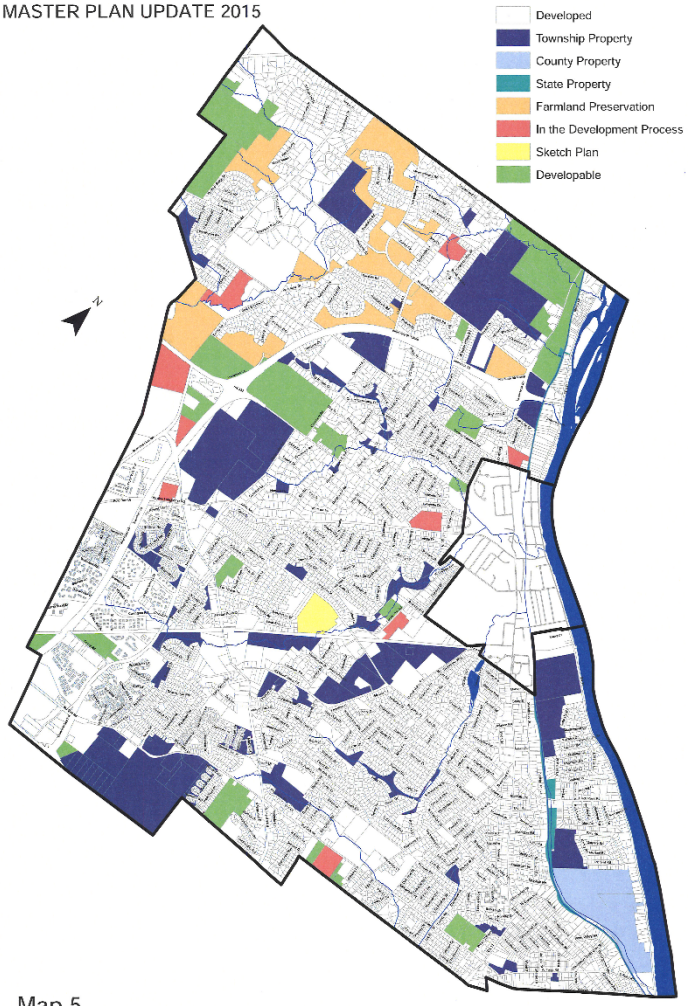
Township of Lower Makefield Comprehensive Master Plan Update 2015 (Draft):

- *The plan is compatible with the following Community Goals and Policies: (page 11)*
  - *Adequately safeguard the health, safety, and welfare of residents*
  - *Provide an adequate supply and mix of recreation facilities to serve the existing and projected population of the township.*
- *The plan is compatible with the following Goals for Park and Recreation Planning: (page 82)*
  - *Provide adequate parkland to meet the needs of the township based on complete build-out of the community.*
  - *Provide a balance of active and passive recreation facilities to meet the needs of citizens of all ages and interests.*
  - *Offer recreation programs and services that enrich the lives of citizens.*
- *The plan is compatible with the "Current Planning Priorities" noted in the document on pages 82-83.*
- *The document specifically refers to the Snipes Tract with respect to the section regarding planning for new recreation areas. (page 85)*
  - *"Snipes Tract – A 33-acre tract at Quarry and Dolington roads in the northern section of the township. Planned park and recreation improvements for the site include athletic fields, a tot plan area, a skate park, covered pavilions, and bikepath connections along Quarry and Dolington Roads."*
- *The following maps from the planning document are included, for reference:*
  - *Map 4 – Existing Land Cover - This map shows the Snipes Tract as "Agricultural."*
  - *Map 5 – Developable Lands. This map shows the Snipes Tract as "Township Property."*
  - *Map 6 – Future Land Use. This map shows the Snipes Tract as "LDR/FP" which is Low Density Residential / Farmland Preservation.*
  - *Map 7 – Public Facilities, Recreation and Open Space. This map shows the Snipes Tract as Township Property.*
  - *Map 8 – Walkway System. This map shows proposed walkway and bicycle path along the Quarry Road and Dolington Road.*



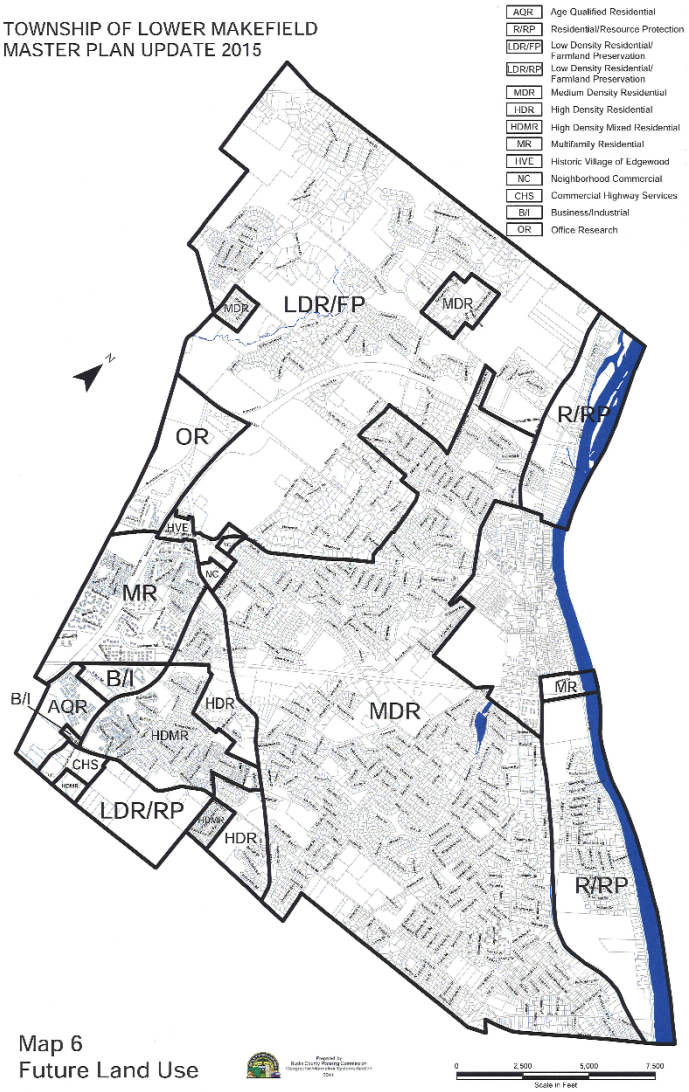
Map 4
Existing Land Cover

TOWNSHIP OF LOWER MAKEFIELD
MASTER PLAN UPDATE 2015

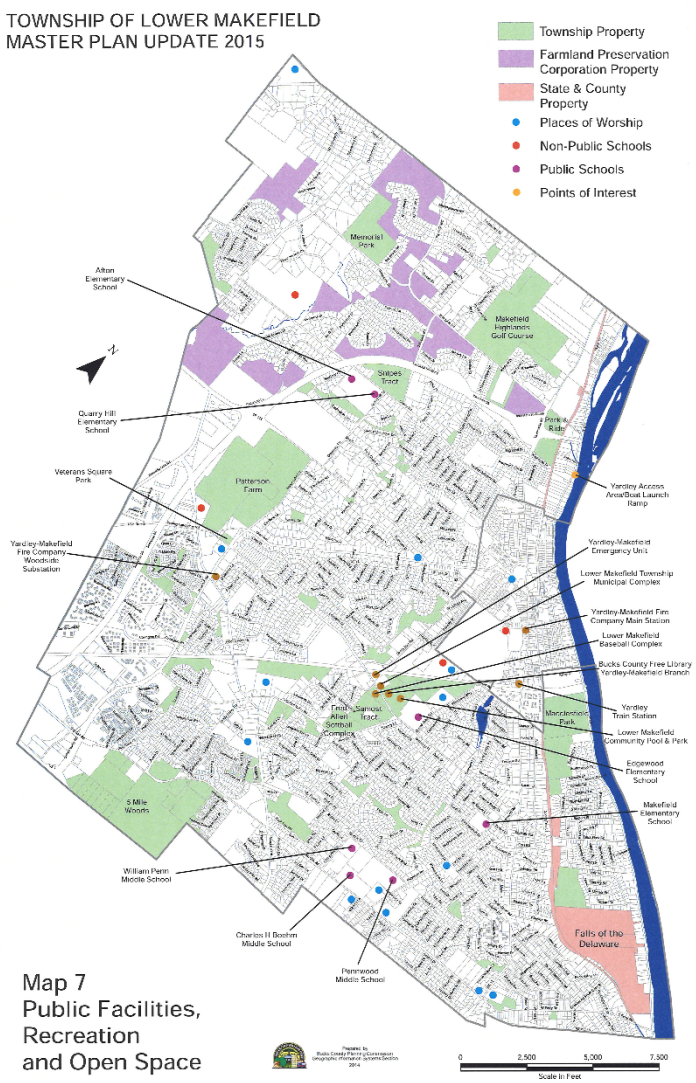


Map 5
Developable Lands

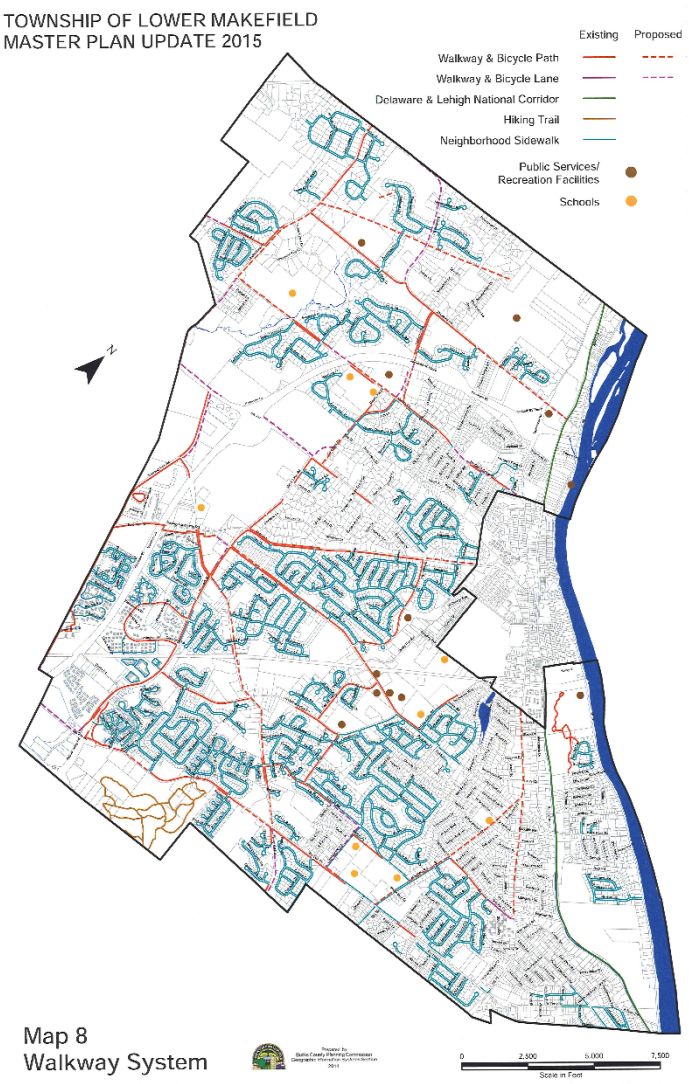
TOWNSHIP OF LOWER MAKEFIELD
MASTER PLAN UPDATE 2015



Map 6
Future Land Use



Map 7
Public Facilities, Recreation and Open Space



Map 8
Walkway System

[2] Comprehensive Plan of adjacent municipalities whenever a project is located along or within 2,000 feet of the municipal boundaries.

N/A, and the subject site is not located within 2,000 feet of the municipal boundaries.

[3] Bucks County Comprehensive Plan and Solid Waste Management Plan (for solid waste facilities only.)

The plan is compatible with the Bucks County Comprehensive Plan of 2011. Specifically,

- *The plan is compatible with the following, which is listed as one of the five top planning priorities for the county: (page 97)*
  - *Continue to expand county parkland via both the expansion of existing parks and acquiring land for future parks, particularly in rapidly developing portions of the county.*
- *The plan is compatible with the following strategies and actions cited in the County Comprehensive Plan: (page 101)*
  - *Provide for active and passive recreational areas to promote the health and well-being of residents of all ages and physical abilities.*
  - *Support municipal greenway and trail acquisition and development projects.*

(d) Photographs. An identification of the character and appearance of the site through the presentation of photographs or copies thereof. Such photographs shall provide a representation of what the site looks like from ground level. Photographs should be properly identified or captioned and shall be keyed to a map of the site.

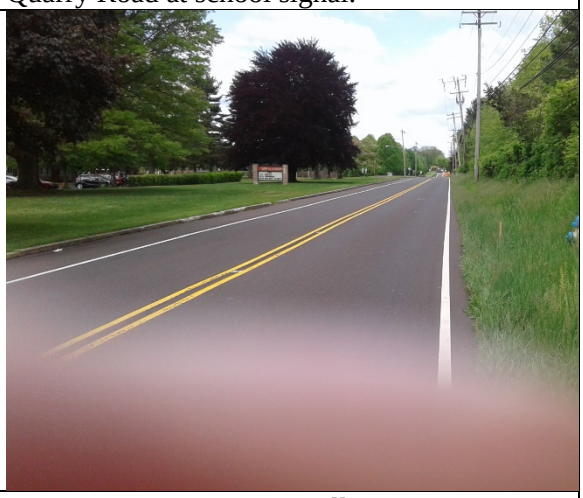
	
North corner on Dolington Road	North corner parallel I-95
	
North corner parallel Dolington Road	Entrance to site on Dolington Road
	
Entrance off Dolington to site	Entrance on Dolington Road facing Quarry Road

	
Dolington Road toward Quarry Road	Dolington Road shoulder toward Quarry Road Intersection
	
Dolington and Quarry intersection	Quarry Road toward Taylorsville Road
	
Quarry Road toward I-95	Creamery Road

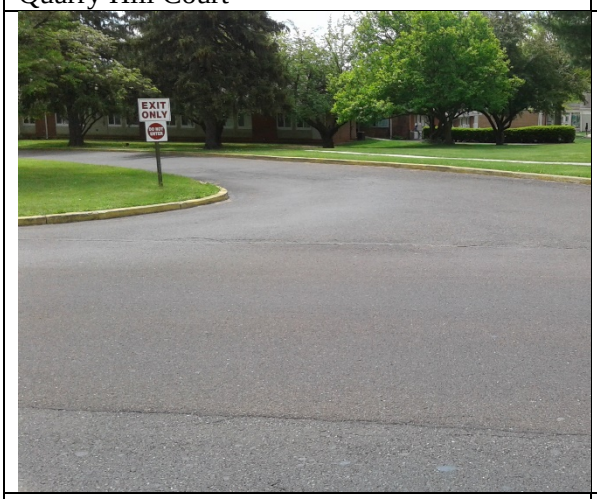
Quarry toward I-95

Quarry Road at school signal.

Quarry Hill Court



Quarry to I-95 at Quarry Hill



Entrance to Quarry Hill Elementary

Quarry Road at corner of property

	
Entrance to site at Quarry Hill Elementary	On Site North of Access Road
	
On site toward house	On site
	
On site	

(2) Environmental inventory.

(a) Physical resources inventory. An identification of physical resources associated with the natural environment of the tract including such features as geology, topography, soils, hydrology and the like. The identification of physical resources shall include a narrative description of the qualitative aspects of each of the resources mentioned above. In addition, these resources shall be mapped at a scale of not smaller than 100 feet to the inch as specified below and may be either incorporated into the EIA report or submitted as attachments to the report.

Physical resources inventory - Refer to Plan Sheet 3 of 14.

[1] Topographic features: a map depicting the topographical characteristics of the tract. Such map shall contain contours with at least two-foot intervals and shall hatch slopes ranging from 8% to 15%, 15% to 25% and greater than 25%. This subsection shall also include the mapped surface drainage characteristics of the site as required under § 178-93, Subsection B.

Topographic features –The site consists of gently rolling slopes, predominately in the 0-8% slope category. The high point of the site is in the western portion of the site approximately at elevation 196 and the low point is located near the intersection of Quarry and Dolington Roads, at approximately elevation 148.

[2] Surface waters and one-hundred-year floodplain:

[a] Describe existing watercourses and water bodies that are partially or totally on the site and their relationship to the area of land disturbance. Surface waters include features such as creeks, runs and other streams, ponds, lakes and other natural bodies of water, springs, wetlands and any man-made impoundments. Calculate the one-hundred-year floodplain using the existing surface runoff from the site and the associated watershed, assuming the full build-out of the watershed using existing zoning maximum impervious coverage. Floodplain areas delineated as a special flood hazard area on the applicable National Flood Insurance Program Flood Insurance Rate Map (FIRM) prepared by the Federal Emergency Management Agency (FEMA) shall be mapped. When the natural drainage pattern will be significantly altered, an analysis shall be conducted which will investigate flow, depth, capacity and water quality of the receiving waters. Existing drainage structures shall be mapped and the capacity of the drainage network shall be determined.

No surface waters or areas of one-hundred -year floodplain exist on the site.

[b] The applicant shall also collect dry-weather (nonstorm event) data of any waterbodies within the site or within 1,000 feet downstream or down-gradient of the site. Water sample collection and analysis shall include total

suspended solids (TSS), nitrates, total Kjehldahl nitrogen (TKN), ammonia, total phosphorus (TP), and dissolved oxygen (DO). Existing conditions of these waterbodies shall include existing stratification and water temperatures. All data shall be collected at a frequency, time of year and depth as determined by a qualified stream ecologist (for streams) or limnologist (for impoundments). All data shall be provided within this report, including a quality assurance/quality control program.

No waterbodies exist on the site.

[c] When the natural drainage pattern will be significantly altered, an analysis shall be conducted which will investigate flow, depth, capacity and water quality of the receiving waters. When required, floodplain areas will be mapped in consultation with the Department of Environmental Protection or the Federal Emergency Management Agency (FEMA). Existing drainage structures shall be mapped and the capacity of the drainage network shall be determined.

N/A – The natural drainage pattern is not proposed to be significantly altered.

[3] Soils: a map depicting the soil characteristics of the tract. Such map shall depict all soil types and shall include a table identifying soil characteristics pertinent to the proposed project such as prime agricultural soils, depth to bedrock, depth of water table, flood hazard potential, and limitations for septic tank filter fields. List and describe each soil type located on the site. If applicable, percolation data shall be provided. Where the proposed area of land disturbance will involve soils with moderate or severe limitations (as per the USDA, Natural Resources Conservation Service Soil Survey of Bucks County, Pennsylvania, dated September 2002 or as amended), relative to the type of project proposed, a complete mapping of all soil types on the site shall be required indicating where those moderate and severe limitations exist. This section provides the soils logs as required by § 178-93, Subsection B.

Soils: a map depicting the soil characteristics of the tract.

The Natural Resource / Existing Features Plan, Sheet 3 of 14, provides the complete mapping of all soils on the site. Along with the soil boundaries, there is a table titled 'Major Soil Properties and Estimated Degree of Limitation. This table provides the map

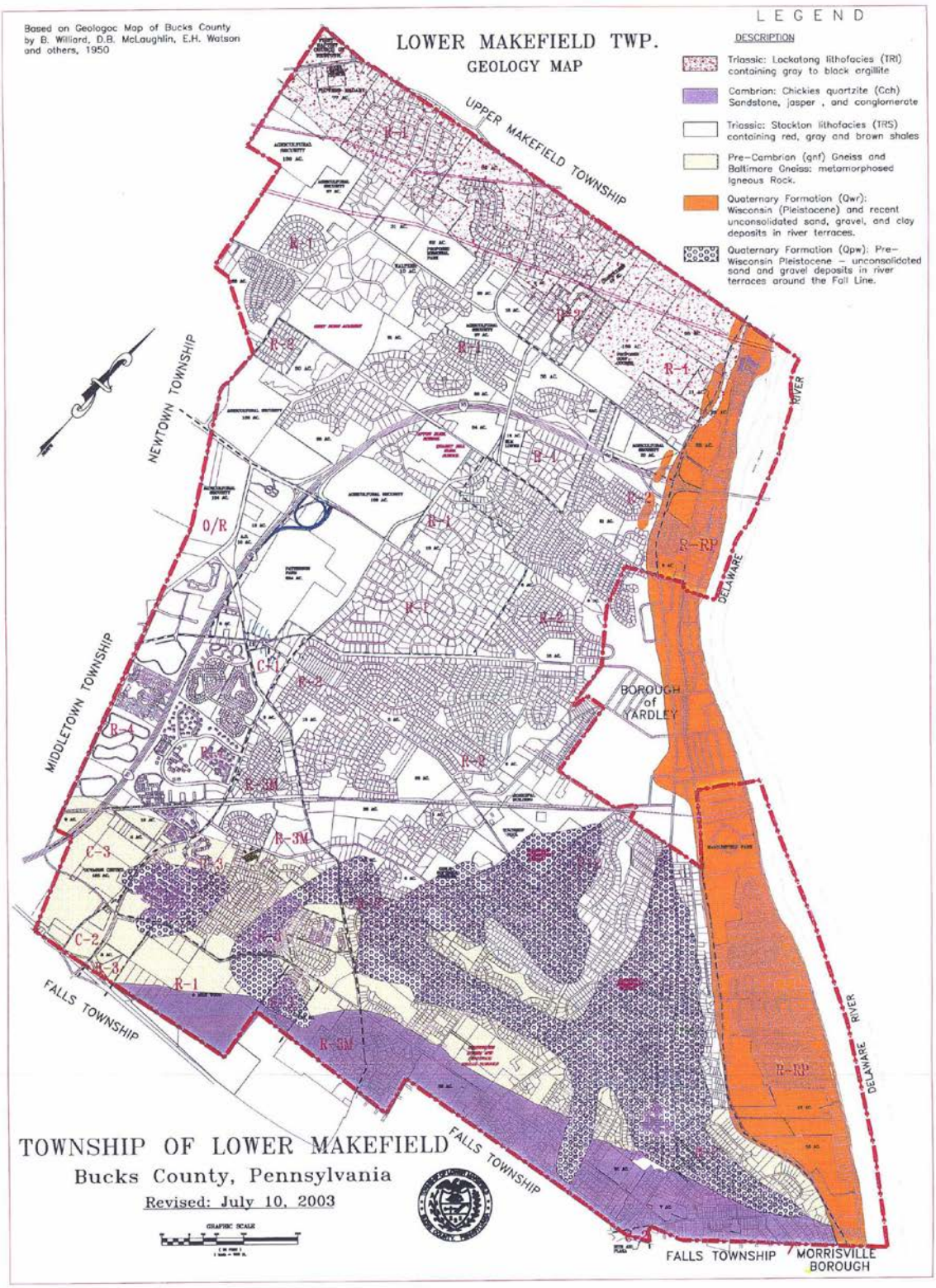
symbol, soil name with average surface slopes, hydrologic soil group, depth to high water table (ft.) and bedrock (in.), and soils limitations for each soil type that is present on the site.

The Township of Lower Makefield 2003 Comprehensive Master Plan mapping indicates that the FoB soils within the project site are identified as being Prime Agricultural Soils.

The Final Draft Plan of the Township of Lower Makefield Comprehensive Master Plan Update 2015 mapping indicates that the majority of the project site, and much of the Township north of Yardley-Langhorne Road, has large areas of prime agricultural soils (Classes I, II, and III, accordingly to the US Department of Agriculture) and soils of statewide importance that traditionally have been farmed, and contribute to the state and local farming economy and production.

[4] Geology: a map depicting the geological characteristics of the tract. Such map shall define the location and boundaries of the rock formations at or influencing the tract and features such as faults and/or fractures.

Triassic rock formations underlie most of the Township, inclusive of the Snipes Tract property. These include the two most common rock formations in Bucks County: the Lockatong Lithofacies and the Stockton Lithofacies. The Stockton formation, one of the best sources of groundwater in Bucks County, is composed of sandstone and red shale. The quality of the groundwater is generally good, and wells rarely exceed 500 feet in the Stockton areas.


Based on Geologoc Map of Bucks County by B. Willard, D.B. McLaughlin, E.H. Watson and others, 1950
LOWER MAKEFIELD TWP.
GEOLOGY MAP
LEGEND
DESCRIPTION
Triassic: Lockatong lithofacies (TRl) containing gray to black argillite
Cambrian: Chickies quartzite (Cch) Sandstone, jasper , and conglomerate
Triassic: Stockton lithofacies (TRS) containing red, gray and brown shales
Pre-Cambrian (gnf) Gneiss and Baltimore Gneiss: metamorphosed igneous Rock.
Quaternary Formation (Qwr): Wisconsin (Pleistocene) and recent unconsolidated sand, gravel, and clay deposits in river terraces.
Quaternary Formation (Qpw): Pre-Wisconsin Pleistocene – unconsolidated sand and gravel deposits in river terraces around the Fall Line.
UPPER MAKEFIELD TOWNSHIP
NEWTOWN TOWNSHIP
MIDDLETOWN TOWNSHIP
BOROUGH of YARDLEY
FALLS TOWNSHIP
FALLS TOWNSHIP
MORRISVILLE BOROUGH
DELAWARE RIVER
DELAWARE RIVER
TOWNSHIP OF LOWER MAKEFIELD
Bucks County, Pennsylvania
Revised: July 10, 2003
GRAPHIC SCALE

MAP 1

[5] Hydrogeology and subsurface drainage: a map depicting the hydrological characteristics of the tract. Such map shall depict aquifers, including depth, aquifer recharge areas, and, where warranted (such as if the site will be withdrawing from groundwater), existing wells within 1,000 feet of the site. Well information shall include depth of well, its capacity, and water quality. This subsection shall include the subsurface drainage features of the site as required under § 178-93, Subsection B.

The aquifer beneath the site and within 1,000 feet of the site is the Triassic Age Stockton Formation which consists of a mixture of sandstones and shales. Primary flow of groundwater through the aquifer is through joints and fractures. Water enters the aquifer through moderately drained silt loam soils. The majority of the site is likely a recharge area. Groundwater generally follows the direction of surface water which would send groundwater to the southeast. The dip of bedding of the Stockton Formation sedimentary deposits is to the northwest at approximately 15 degrees from horizontal. The dip of bedrock opposes and restricts natural drainage of groundwater which aids to retain groundwater. Typically, groundwater rises to within 20 feet of the surface in this upland setting. No perennial streams are found on or within proximity of the site.

A computer inventory of wells within 1,000 feet of the site, using the Pennsylvania Groundwater Information System, known as PaGWIS, did not reveal any documented private water supply wells. This is primarily because the study area is provided by public water. No public water supply wells are known to exist within 1,000 feet of the site. Generally, the Stockton Formation aquifer produces good well yields with good water quality that can be slightly corrosive.

There are no known or suspect threats to groundwater quality within a 1,000-foot radius of the site.

There are no significant subsurface natural or man-made drainage features, existing or proposed, within the site.

(b) Ecological resources inventory: an identification of biological resources associated with the natural environment of the tract, including such features as vegetation and wildlife. The identification of biological resources shall include a narrative description of each of the resources mentioned above. In addition, these resources shall be mapped at a scale of not smaller than 100 feet to the inch as specified below and may be either incorporated into the EIA report or submitted as attachments to the report.

Ecological resource inventory – Refer to Plan Sheet 3 of 14. Bucks County Native Wildlife common to undeveloped open space.

[1] Forest and woodlands, grasslands and specimen trees: a map depicting the vegetation characteristics of the tract. Such map shall define the locations and boundaries of the woodland and forest areas of the tract and shall note the types of vegetation associations which exist in terms of their species and sizes. In addition, all trees 10 inches in caliper or greater shall be accurately located and identified on the map, whether they are freestanding trees or tree masses.

The site was historically farmland and was most recently used as a nursery. As seen in the following aerial photos, the site was farmland in 1938, 1958, and 1971.

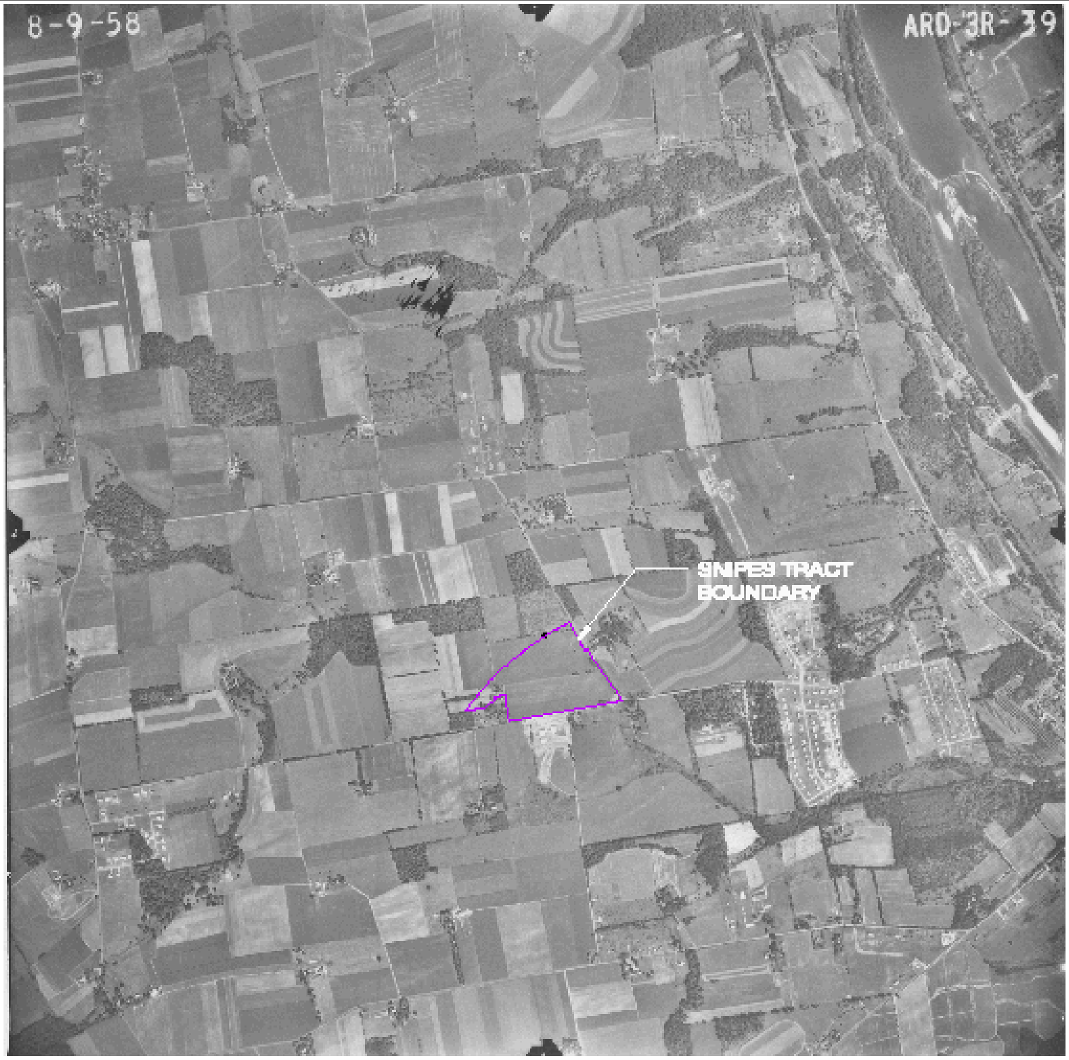
At some point after 1971, the site became a nursery and was actively used as a nursery with trees, primarily Christmas trees, grown as a cash crop. On August 20, 2000, the Township entered into a Settlement Agreement with the owner of the property to acquire the site for "municipal purposes, which said purposed shall include but not be limited to recreation and open space." The Settlement Agreement included and acknowledgment that the property "has been used as a tree farm by the Owners for many years" and included provisions for the Owners to continue to harvest trees through March 31, 2003. There is evidence on the site of tree harvesting and many holes exist where trees have been harvested. The site currently contains a number of trees that had been planted during the time that the site was used as an active nursery/tree farm.

AERIAL SOURCE:
FLYING COMPLETE: 04/1938
PRODUCED BY: USDA AGRICULTURAL ADJUSTMENT ADMINISTRATION
CONTRACTOR: AERO SERVICE CORP., PHILADELPHIA,PA

FLIGHT DATE: 01/03/1938
SCALE: 1:20000

COUNTY ID: ARD
ROLL ID: 2 PHOTO #: 8
INDEX: 3 OF 6

SNIPES TRACT ATHLETIC FIELD LOWER MAKEFIELD TOWNSHIP BUCKS COUNTY PA		1938 AERIAL IMAGE			
LOWER MAKEFIELD TOWNSHIP 1100 EDGEWOOD ROAD YARDLEY, PA 19067		Boucher & James, Inc. CONSULTING ENGINEERS DOYLESTOWN • STROUDSBURG • LEHIGH VALLEY CORPORATE HEADQUARTERS: 1456 FERRY RD. BLDG. 500 DOYLESTOWN, PA 18901			
DR. BY: TMW	CK. BY: MWE	SCALE: 1" = 2,000'	DATE: MAY 8, 2017	JOB No. 1677054L	SHEET: 1 OF 3



AERIAL SOURCE:
FLYING COMPLETE: 10/1958
PRODUCED BY: USDA COMMODITY STABILIZATION SERVICE
CONTRACTOR: KEYSTONE MAPPING CO., INC., YORK,PA

FLIGHT DATE: 08/09/1958
SCALE: 1:20000

COUNTY ID: ARD
ROLL ID: 3R PHOTO #: 39
INDEX: 3 OF 6

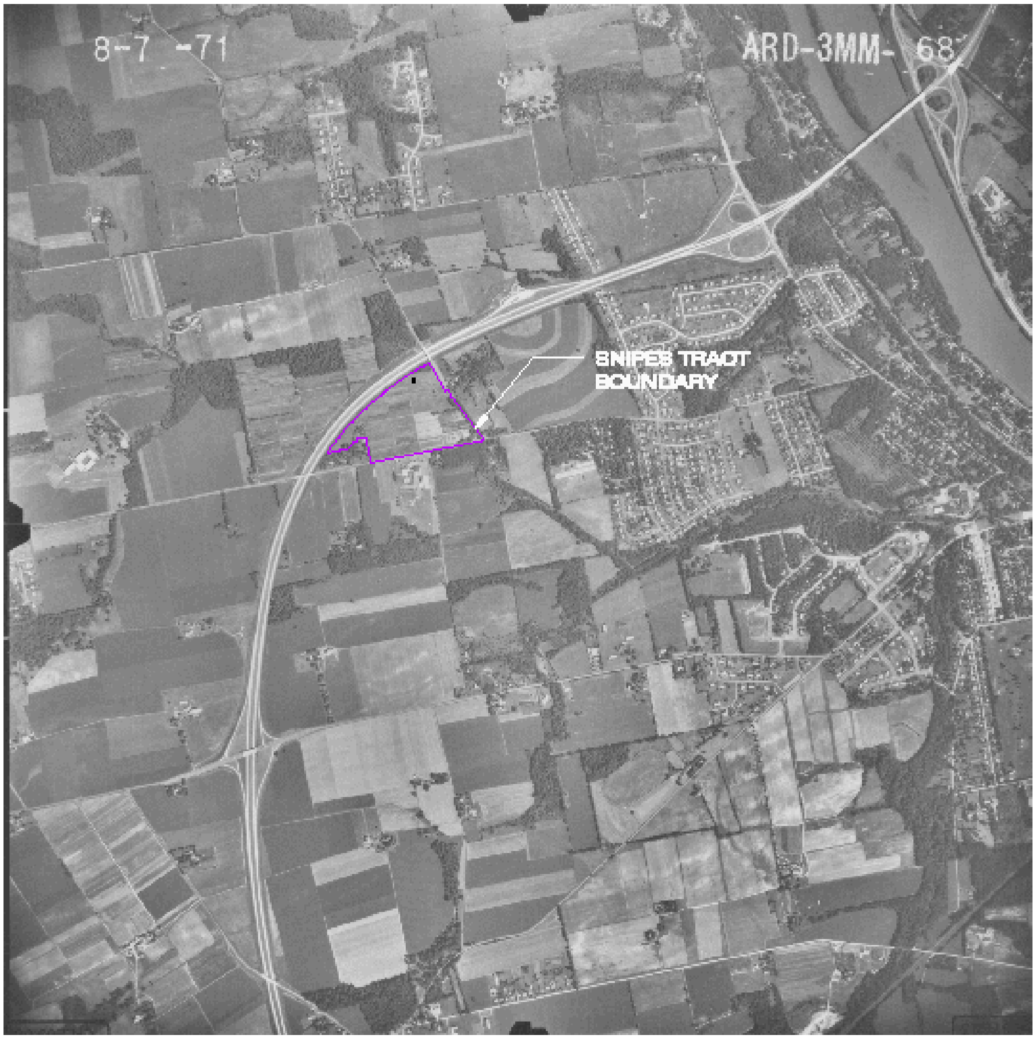
SNIPES TRACT ATHLETIC FIELD
LOWER MAKEFIELD TOWNSHIP
BUCKS COUNTY PA

LOWER MAKEFIELD TOWNSHIP
1100 EDGEWOOD ROAD
YARDLEY, PA 19067

1958 AERIAL IMAGE

Boucher & James, Inc.
CONSULTING ENGINEERS
DOYLESTOWN ◆ STROUDSBURG ◆ LEHIGH VALLEY
CORPORATE HEADQUARTERS: 1456 FERRY RD. BLDG. 500
DOYLESTOWN, PA 18901

DR. BY:	CK. BY:	SCALE:	DATE:	JOB No.	SHEET:
TMW	MWE	1" = 2,000'	MAY 8, 2017	1677054L	2 OF 3



AERIAL SOURCE:
FLYING COMPLETE: 10/1971
PRODUCED BY: USDA AGRICULTURAL STABILIZATION AND CONSERVATION SERVICE
CONTRACTOR: KEYSTONE AERIAL SURVEYS, INC., PHILADELPHIA,PA

FLIGHT DATE: 08/07/1971
SCALE: 1:20000

COUNTY ID: ARD
ROLL ID: 3MM PHOTO #: 68
INDEX: 1 OF 5

SNIPES TRACT ATHLETIC FIELD LOWER MAKEFIELD TOWNSHIP BUCKS COUNTY PA	1971 AERIAL IMAGE
LOWER MAKEFIELD TOWNSHIP 1100 EDGEWOOD ROAD YARDLEY, PA 19067	Boucher & James, Inc. CONSULTING ENGINEERS DOYLESTOWN ✦ STROUDSBURG ✦ LEHIGH VALLEY CORPORATE HEADQUARTERS: 1456 FERRY RD. BLDG. 500 DOYLESTOWN, PA 18901

DR. BY:	CK. BY:	SCALE:	DATE:	JOB No.	SHEET:
TMW	MWE	1" = 2,000'	MAY 8, 2017	1677054L	3 OF 3

P:\2016\1677054\Dwg\Final Dwgs\Historical Aerials.dwg {} Tabname :1971 {} May 08, 2017 – 1:54pm {} tvallese

[2] Habitats: a map depicting characteristics associated with wildlife habitats. Such map may draw upon vegetation, hydrology and soil maps in order to express habitat characteristics associated with terrestrial and aquatic wildlife on the tract and the relationship of the overall habitat(s). Habitats to be mapped and described shall include forest, grasslands, forest/grassland transition areas, wetlands and riparian areas. As part of this section, it is required that the applicant provide proof of a request for a Pennsylvania Natural Heritage Program (formerly Pennsylvania Natural Diversity Inventory), and copies of the application (including the map for wetlands) for a jurisdictional determination (JD) for freshwater wetlands from the US Army Corps of Engineers.

Habitats. A PNDI search was performed for the subject site and all required clearances were obtained from the PA Fish and Boat Commission. There are no wetlands or watercourses located on the site.

Pennsylvania Fish & Boat Commission

established 1866

Division of Environmental Services
Natural Diversity Section
450 Robinson Lane
Bellefonte, PA 16823
814-359-5237

November 22, 2016

IN REPLY REFER TO
SIR# 46851

Boucher & James, Inc.
Kim Mcleod
1456 Ferry Road
Quakertown, Pennsylvania 18951

RE: Species Impact Review (SIR) – Rare, Candidate, Threatened and Endangered Species
PNDI Search No. 614582_2
Snipes Athletic Fields
BUCKS County: Lower Makefield Township

Dear Kim Mcleod:

This responds to your inquiry about a Pennsylvania Natural Diversity Inventory (PNDI) Internet Database search "potential conflict" or a threatened and endangered species impact review. These projects are screened for potential conflicts with rare, candidate, threatened or endangered species under Pennsylvania Fish & Boat Commission jurisdiction (fish, reptiles, amphibians, aquatic invertebrates only) using the Pennsylvania Natural Diversity Inventory (PNDI) database and our own files. These species of special concern are listed under the Endangered Species Act of 1973, the Wild Resource Conservation Act, and the Pennsylvania Fish & Boat Code (Chapter 75), or the Wildlife Code.

An element occurrence of a rare, candidate, threatened, or endangered species under our jurisdiction is known from the vicinity of the proposed project. However, given the nature of the proposed project, the immediate location, or the current status of the nearby element occurrence(s), no adverse impacts are expected to the species of special concern.

This response represents the most up-to-date summary of the PNDI data and our files and is valid for two (2) years from the date of this letter. An absence of recorded species information does not necessarily imply species absence. Our data files and the PNDI system are continuously being updated with species occurrence information. Should project plans change or additional information on listed or proposed species become available, this determination may be reconsidered, and consultation shall be re-initiated.

If you have any questions regarding this review, please contact Kathy Gipe at 814-359-5186 and refer to the SIR # 46851. Thank you for your cooperation and attention to this important matter of species conservation and habitat protection.

Sincerely,

Christopher A. Urban, Chief
Natural Diversity Section

CAU/KDG/dn

(c) Land use and existing features inventory: an identification of the land use conditions and characteristics associated with the tract, such as current and past use, land cover and the relationship of these to adjacent tracts. Describe any existing features on the site that are not considered to be part of the natural environment. This may include, but not necessarily be limited to roads, housing units, accessory structures, utility lines, etc. The identification of land use conditions and characteristics shall include a narrative description of the above. In addition, the following maps, drawn at a scale not smaller than 100 feet to the inch, shall be incorporated into the EIA report or submitted as attachments to it.

Refer to Plan Sheet 3 of 14 of the Snipes Tract Athletic Fields Plan Set.

The site was historically farmland and was most recently used as a nursery. As seen in the following aerial photos, the site was farmland in 1938, 1958, and 1971. At some point after 1971, the site became a nursery and was actively used as a nursery with trees grown as a cash crop. There is evidence on the site of tree harvesting and many holes exist where trees have been harvested. The site currently contains a number of trees, primarily evergreen species, that had been planted during the time that the site was used as an active nursery/tree farm. The site also contains an existing driveway, several nursery roads/trails, and a salt storage shed.

[1] A map depicting the land cover characteristics of the tract. Such map shall define existing features including paved or other impervious surfaces, woodland and forest areas, cultivated areas, pasture, old fields, lawns and landscaped areas and the like.

Refer to Plan Sheet 3 of 14 of the Snipes Tract Athletic Fields Plan Set.

[2] A map depicting any encumbrances to the tract. Such map shall define easements and other areas where certain use privileges exist.

Refer to Plan Sheet 2 of 14 of the Snipes Tract Athletic Fields Plan Set.

[3] A map depicting the land uses within 500 feet of the proposed tract. Such map may be at the same scale as the location map.

Refer to Plan Sheet 1 of 14 of the Snipes Tract Athletic Fields Plan Set.

(d) Historic and archeological resources inventory: an identification of the man-made resources associated with or within 500 feet of the tract which are older than 50 years. Areas, structures and/or routes and trails included on the National Register of Historic Places, the Pennsylvania Inventory of Historic Places, the Historic American Building Survey, the Heritage Conservancy and any which may be identified by the Township

Historical Commission and Historic Architectural Review Board shall be identified. The identification of historic resources shall include a narrative description of the above. In addition, a map drawn at a scale of not smaller than 100 feet to the inch depicting historic resources shall be incorporated into the EIA report or submitted as an attachment to the report. Included with this section shall be evidence of submission of a request to the Pennsylvania Historical and Museum Commission to review the site and its existing structures and land use.

Historic and archeological resources inventory.

Elm Lowne is located across Dolington Road from the Snipes Tract, and is within 500 feet of the site. As shown on Map 9 – Historic Resources, in the Township of Lower Makefield Master Plan Update 2015, Elm Lowne is eligible for listing in the National Register, but is not currently listed.

(e) Aesthetic resources inventory: an identification of the visual resources associated with the tract, such as areas which have a particular amenity value and areas which offer interest in viewing the tract. The identification of visual resources shall include a narrative description of the above. In addition, a map drawn at a scale of not smaller than 100 feet to the inch depicting visual resources shall be incorporated into the EIA report or submitted as an attachment to the report.

The vegetation that has developed along Quarry Road provides a rural feel to that portion of the site, although there is a PECO substation surrounded by some arborvitaes near the intersection of Quarry Road and Dolington Road. The area along Dolington Road has some larger trees on the embankment near that intersection, although the remainder of that frontage has a chain link fence up to I-95.

(f) Community services inventory: an identification of the community facility services that are expected to be required as a result of this project, and if the tract already utilizes community services (redevelopment). The community service needs assessment shall indicate in narrative form the type of services which will be in demand, including schools, parks and recreation facilities, libraries, hospitals, police, fire protection, ambulance, and rescue services.

Community services inventory.

The proposed park is a community service and will provide active and passive recreational opportunities for Township residents.

(g) Existing available utilities and utility needs inventory: an identification of the existing utilities available within, adjacent to, and within 1,000 feet of the tract; a discussion of utility needs associated with the users of the proposed project. The utility needs assessment shall indicate in narrative form the type of installations which will be in demand.

Utilities shall be discussed in terms of the ability of existing utility installations to accommodate the demands of the future users, the needs for additional or expanded utility installations, the ability to achieve an

adequate potable quantity of water whenever individual wells are proposed, the ability to achieve an adequate system for on- site sewage disposal whenever such a system is proposed and the ability to achieve an adequate system for storm drainage and stormwater management. The following utility types shall be addressed:

[1] Electricity;

Electricity: PECO owns and maintains utility poles carrying electric along Dolington Road. The Snipes Tract will require electric service to the site for the following purposes:

- *Sports field lighting*
- *Parking lot security lighting*
- *Concession stand / Restrooms lighting*
- *Pavilion lighting*
- *Irrigation Well(s)*

The electric service requested will be stepped down to accommodate the end use(s) within the site. Any future needs within the site will be able to be accommodated by the electric service currently requested.

[2] Natural gas;

Not Applicable for this site.

[3] Water;

Water service will be provided via an extension of the public water system (PA American Water) and watermain, existing main is within the right-of-way of Quarry Road, onto the site with one service line to the concession stand building. Sports field irrigation will be provided via on-site well(s).

[4] Sewer;

The Act 537 planning module is in progress. Yardley Borough Sewer Authority has approved the requested EDUs and connection to the existing sewer system within the right-of-way of Creamery Road off of Quarry Road. The proposed sewer line will be brought on-site with pipes and manholes with one sewer lateral servicing the concession stand building.

[5] Cable.

Not Applicable for this site.

(h) Transportation infrastructure inventory: an identification of the relationship of the transportation and circulation system needs of the proposed project to the existing street or highway network. A discussion of this relationship shall be in narrative form and shall indicate factors such as methods to be used for traffic control within the tract and at

points of ingress to and egress from it and expected traffic volumes generated from the project, including their relationship to existing traffic volumes on existing streets for both peak-hour and non-peak-hour traffic conditions. In addition, there shall be a discussion of the physical condition of existing streets which will service the proposed project and what improvements are proposed to remedy any physical deficiencies.

Transportation infrastructure inventory: an identification of the relationship of the transportation and circulation system needs of the proposed project to the existing street or highway network.
Access to the site is to be served by two full access driveways; one located on Dolington Road (SR 2075) and one located on Quarry Road. Stop signs will be located at each entrance onto the public streets for traffic exiting the site. There is one internal loop road that circulates traffic around the three full sized fields and connecting with itself at a T-intersection. There will be a stop sign for motorists wishing to turn left to re-circulate or right to exit out of the Dolington Road entrance/exit. The entrance drive off of Quarry Road will come into the loop road at a T-intersection with stop signs on both approaches to the intersection on the loop road.
Trip generations from the site are provided below:

- *Weekday AM Peak Hour → **5 Total Trips** – 3 Entering and 2 Exiting*
- *Weekday PM Peak Hour → **71 Total Trips** – 48 Entering and 23 Exiting*
- *Saturday Peak Hour → **121 Total Trips** – 58 Entering and 63 Exiting*

Trip Distribution for new trips are provided below:

- *To/From North → Via Dolington Road – **10%***
- *To/From South → Via Mirror Lake Road – **15%***
- *To/From East → Via Dolington Road – **15%***
- *To/From East → Via Yardley Newtown Road – **20%***
- *To/From West → Via Quarry Road – **10%***
- *To/From West → Via Yardley Newtown Road – **30%***

Under 2019 projected conditions, the study area intersections will operate at the same overall intersection level of service as under 2019 base conditions, during weekday AM and PM, and Saturday midday peak hours.
All approaches and turning movements at the site driveway intersections will operate at LOS B or better under 2019 projected conditions during the weekday AM and PM, and Saturday midday peak hours.
All proposed driveway location sight distances will exceed PennDOT's desirable and safe stopping sight distance criteria.
Traffic Planning and Design, Inc. recommends the following roadway improvements as outlined at the study area intersections:

- *Upgrade existing geometry at Dolington Road and Quarry Road intersection.*
- *Add a southbound right turn lane and northbound left turn lane onto Dolington Road access.*
- *Add a westbound right turn lane onto Quarry Road access.*

- *Add additional pedestrian facility crossing Quarry Road at the Site Access and Creamery Road intersection.*

See the text of the Traffic Study (DRAFT) prepared by Traffic Planning and Design, Inc. in Appendix A for further details.

(i) Solid waste inventory: identification of the short- and long-term solid waste to be generated as a result of the project. Specifically, a description of the construction-related waste to be generated as a result of the project, anticipated tonnage, and expected disposal facility or facilities. In addition, a description of the types of waste to be generated once the project is completed and occupied.

The solid waste generated from the site will be minimal and done so in accordance with all Township and State regulations.
Short-term waste generated during construction will be minimal as the bulk of the construction will be earth excavation and placement within the site. An estimated 11,000 cubic yards of dirt will be removed off-site and stored at a location approved to accept fill material. Some trees will be cut down and mulched on-site as part of the site development.
Long-Term solid waste generated will consist of a women's restroom (four (4) toilets and two (2) sinks), a men's restroom (one (1) toilet, three (3) urinals, and two (2) sinks), a drinks and snacks concession stand, and several garbage cans throughout out the site. Solid waste from operations will be handled similar to all of the other parks within the Township.

(j) Air quality and noise inventory.

The site is bordered by I-95 to the north. The ambient noise level for the site would be the level of noise generated by the traffic on I-95.

[1] Identification and description of existing air quality with and within 1,000 feet of the site. Where available, existing air quality data from local monitoring stations shall be used in the assessment.

[2] A description of ambient noise data for the area shall be prepared. The analysis should use the on-site and surrounding land uses and employment of readily available documentation of expected noise levels in decibels.

(k) Night sky views and land use lighting inventory: identification of the existing night sky view quality and land use light generation, including land uses with and within 500 feet of the tract.

Night sky quality in proximity of the site is currently impacted by the lights emanating from traffic along I-95, and existing lighting from the elementary schools and residential uses in the area.

(3) Environmental impact, alternatives, mitigation analysis. The applicant shall describe the environmental impacts of each of the following inventoried items. Each item as described within Section (2) above shall be addressed for the following:

(a) Impacts: The implications of the proposed project in terms of the type of beneficial or adverse effects which may result from it and the duration of these effects in terms of their short-term or long-term nature. To indicate such effects, there shall be a discussion of the implications of the proposed project to the resources, conditions and characteristics as described above. In addition to a narrative presentation of implications, the applicant shall display where the project adversely affects the tract's resources, conditions or characteristics through the use of a map drawn at a scale of not smaller than 100 feet to the inch, wherein the areas adversely affected from proposed development are highlighted. Such map may be either incorporated into the EIA report or submitted as an attachment to the report. Further, the applicant must demonstrate and specify in the EIA report how and where the findings in the EIA report and its attachments are reflected in the project. The applicant may summarize the impacts to various resources on one map, provided the illustration is clear to the reviewer.

Beneficial Impacts:

- *Provides park and recreation amenities and both active and passive recreation opportunities for Township residents.*
- *Provides open space.*

Potential Adverse Impacts:

- *Loss of agricultural soils.*
- *Loss of habitat*

(b) Alternatives analysis: alternatives within the project which would preclude, reduce or lessen potential adverse impact or produce beneficial effects. To indicate such alternatives, the applicant shall submit exhibits or diagrams which will depict the type or alternatives described in narrative forms. The applicant shall comment on how alternatives such as revised location, redesign, layout or siting of buildings, roads, and other structures and the reduction in the size of the proposed structures or number of structures would affect the impacts or effects of the project.

One alternative would be the "no-build" option, which would not be appropriate for this site, as the land was purchased for park and recreation use and improvements. The proposed improvements and use of the land is consistent with Township planning documents and is also consistent with the Township of Lower Makefield Comprehensive Plan Update of 2003, the Draft Township of Lower Makefield Township Comprehensive Master Plan Update of 2015, and the Bucks County Comprehensive Plan of 2011.

Several alternatives were considered for the use of the site, and from 2004 to 2006, Lower Makefield Township worked with the Park Board, sports organizations, Township Committee members, the Police and residents to develop recreational plans for athletic fields on the site. Several alternative layouts were developed for the development of the site, and in 2006 the Township adopted a plan that proposed 10 athletic fields, a

skatepark, a playground, concession/restroom building, two pavilions, and 350 parking spaces (see Snipes Plan C on 2/17/2006). The current proposed layout significantly reduces the amount of earth disturbance, impervious surfaces, removal of vegetation, and traffic generation.

(c) Mitigation analysis. Measures to mitigate adverse effects shall be addressed. To indicate such measures, the applicant shall submit exhibits or diagrams which will depict the type of remedial, protective and mitigative measures described in narrative form. These measures shall include those required through existing procedures and standards and those unique to a specific project, as follows:

The site has been designed to minimize site grading and overall site disturbance and several Stormwater management BMP's have been incorporated into the design to further mitigate any potential negative impacts. All improvements have been designed in accordance with State, County, and Township regulations and guidelines for stormwater management, erosions and sedimentation control, post construction Stormwater management, and water quality control.

[1] Mitigation measures which pertain to existing procedures and standards are those related to current requirements of the State, County and/or Township for remedial or protective actions such as sedimentation and erosion control, stormwater runoff control, water quality control and air quality control.

The site has also been designed to minimize site grading and overall site disturbance and several Stormwater management BMP's have been incorporated into the design to further mitigate any potential negative impacts. All improvements have been designed in accordance with State, County, and Township regulations and guidelines for stormwater management, erosions and sedimentation control, post construction Stormwater management, and water quality control.

[2] Mitigation measures related to impacts which may be unique to a specific project are those related to efforts such as revegetation, screening, fencing, emission control, traffic control, noise control, relocation of people and/or businesses and land acquisition.

The plan was designed with buffers and vegetative screening to minimize potential negative impacts. Trees are proposed to remain wherever possible, and existing trees are proposed to be transplanted and utilized as buffer plantings along Dolington Road. Additional buffer plantings are proposed to further mitigate any negative impacts on surrounding residential properties.

(d) Irreversible impacts analysis: any irreversible environmental changes which would occur due to the proposed project, should it be implemented. To indicate such changes, the use of nonrenewable resources during the initial and continued phases of the project shall be

discussed. Further, the loss of environmental resources shall be indicated through a presentation of the quantity of loss and related qualitative effects. The following inventory items shall be analyzed for impacts, alternatives and mitigation, and irreversible impacts for both the time of construction and the completed and occupied project.

[1] Physical resources impacts.

[a] Topographic features. Within the scope of this analysis, at a minimum, the applicant shall provide information as to maximum depth of excavation and fills, total volumes of soils to be moved, and any soil that is anticipated to be imported to or exported from the site. The applicant shall address if any significant ridges are to be removed, or valleys are to be filled, and if watersheds are to be changed.

There is approximately 17,150 cubic yards of cut and fill estimated for the construction of this project. Approximately 11,000 cubic yards of cut is estimated to be trucked offsite to a site approved to accept fill material. There are no significant ridges to be removed, nor are there any significant valleys to be filled on this site. The point of interest for the drainage of stormwater from this site will not be changed as a result of the site improvements. Site drainage will be directed towards the intersection of Quarry Road and Dolington Road as it naturally drains today.

[b] Surface waters and one-hundred-year floodplain. Within the scope of this analysis, at a minimum, the applicant shall provide an analysis of the changes in, not only peak flow rates, but volumes of runoff that will be conveyed to the surface waters and one-hundred-year floodplain. The applicant shall also address the requirements for any filling activities within the one-hundred-year floodplain.

Storm Event (Year)	Rainfall (inches)	Pre-development Conditions (cfs)	Post-development Discharge (cfs)	Postdev Reduction From Pre-dev Condition (%)
1	2.64	4.91	2.53	48.5%
2	3.36	13.27	4.73	64.4%
5	4.32	28.95	10.38	64.1%
10	5.28	47.69	29.88	37.3%
25	6.24	68.65	46.56	32.2%
50	7.20	91.14	56.59	37.9%
100	8.40	120.75	67.15	44.4%

The volume reduction requirement for the NPDES Permit is to remove the difference in volume of runoff between the proposed condition and the pre-developed condition for the 2-yr storm event. In summary the difference in volume, structural volume requirement from worksheet 5, is 41,788 cubic feet. The total structural volume provided for the proposed stormwater design is 42,118 cubic feet through the use of infiltration trenches. The net excess volume reduction is 330 cubic feet. NPDES worksheets 1-5 and 10 are provided below.

Volume Reduction Worksheets:

Appendix D. Worksheets

Worksheet 1. General Site Information

INSTRUCTIONS: Fill out Worksheet 1 for each watershed

Date: November 16, 2016

Project Name: Snipes Tract Athletic Fields

Municipality: Lower Makefield Township

County: Bucks County

Total Area (acres): 36.26 acres

Major River Basin: Delaware River

Watershed: Delaware River South

Sub-Basin: Buck Creek

Nearest Surface Water(s) to Receive Runoff: Buck Creek

Chapter 93 – Designated Water Use/Existing Water Use: WWF (Warm Water Fishes, MF (Migratory Fishes)

Impaired according to Category 4 or 5 of the Integrated Water Quality Monitoring and Assessment Report? Yes ☐ No ☒

List Causes of Impairment:

Is there an established TMDL that applies: Yes ☐ No ☐

Total Maximum Daily Loads (TMDLS)

Is project subject to, or part of:

Municipal Separate Storm Sewer System (MS4) Requirements? Yes ☒ No ☐

Existing or planned drinking water supply? Yes ☐ No ☒

If yes, distance from proposed discharge (miles):

Approved Act 167 Plan? Yes ☒ No ☐

Existing River Conservation Plan? Yes ☐ No ☒

Worksheet 2. Sensitive Natural Resources from PA Stormwater Best Management Practices Chapter 5

INSTRUCTIONS

1. Provide Sensitive Resources Map according to non-structural BMP 5.4.1 in Chapter 5. This map should identify wetlands, woodlands, natural drainage ways, steep slopes, and other sensitive natural areas.

2. Summarize the existing extent of each sensitive resource in the Existing Sensitive Resources Table (below, using Acres). If none present, insert 0.

3. Summarize Total Protected Area as defined under BMPs in Chapter 5.

4. Do not count any area twice. For example, an area that is both a floodplain and a wetland may only be considered once.

EXISTING NATURAL SENSITIVE RESOURCE	MAPPED? Yes/no/n/a	TOTAL AREA (Ac.)	PROTECTED AREA (Ac.)
Waterbodies			
Floodplains			
Riparian Areas			
Wetlands			
Woodlands			
Natural Drainage Ways			
Steep Slopes, 15% - 25%	Yes	0.16	0.08
Steep Slopes, over 25%			
Other: Steep slopes 8% to 15%	Yes	0.97	0.485
Other:			
TOTAL EXISTING:		1.13	0.565

Worksheet 3. Nonstructural BMP Credits from PA Stormwater Best Management Practices Manual (SW BMP Manual)

PROTECTED AREA

1.1 Area of Protected Sensitive/Special Value Features (see WS 2) 0.57 **Ac.**

1.2 Area of Riparian Forest Buffer Protection (see WS 2) 0 **Ac.**

3.1 Area of Minimum Disturbance/Reduced Grading (See Chapter 8, page 21 – SW BMP Manual) 9.88 **Ac**

TOTAL 10.45 **Ac**

Site Area	Minus	Protected Area	=	Stormwater Management Area
35.4	-	10.45	=	24.96

This is the area that requires stormwater management

VOLUME CREDITS

3.1 Minimum Soil Compaction (See Chapter 8, page 22 – SW BMP Manual)

Lawn	891,839 ft^2	x 1/4" x 1/12	=	18,580 ft^3
Meadow	ft^2	x 1/3" x 1/12	=	ft^3

3.3 Protect Existing Trees (See Chapter 8, page 23 – SW BMP Manual)

For Trees within 100 feet of impervious area:

Tree Canopy	12,391 ft^2	x 1/2" x 1/12	=	516 ft^3

5.1 Disconnect Roof Leaders to Vegetated Areas (See Chapter 8 page 25 – SW BMP Manual)

For runoff directed to areas protected under 5.8.1 and 5.8.2

Roof Area	ft^2	x 1/3" x 1/12	=	ft^3

For all other disconnected roof areas

Roof Area	5,425 ft^2	x 1/4" x 1/12	=	113 ft^3

5.2 Disconnect Non-Roof impervious to Vegetated Areas (See Chapter 8, page 26 – SW BMP Manual)

For Runoff directed to areas protected under 5.8.1 and 5.8.2

Impervious Area	ft^2	x 1/3" x 1/12	=	ft^3

For all other disconnected roof areas

Impervious Area	163,895 ft^2	x 1/4" x 1/12	=	3,414 ft^3

TOTAL NON-STRUCTURAL VOLUME CREDIT* 22,624 ft

**For use on Worksheet 5*

Worksheet 4. Change in Runoff Volume for 2-YR Storm Event

PROJECT: Snipes Tract Athletic Fields
Drainage Area: _____
2-Year Rainfall: _____ in

Total Site Area: _____ acres
Protected Site Area: _____ acres
Managed Area: _____ acres

Existing Conditions:

Cover Type/Condition	Soil Type	Area (sf)	Area (ac)	CN	S	Ia (0.2*S)	Q Runoff[1] (in)	Runoff Volume[2] (ft^3)
Woodland								
Meadow								
Impervious								
TOTAL:								

Developed Conditions

Cover Type/Condition	Soil Type	Area (sf)	Area (ac)	CN	S	Ia (0.2*S)	Q Runoff[1] (in)	Runoff Volume[2] (ft^3)
TOTAL:								

2-Year Volume Increase (ft3):

2-Year Volume Increase = Developed Conditions Runoff Volume – Existing Conditions Runoff Volume

1. Runoff (in) = $Q = (P-0.2S)^2 / (P+0.8S)$ where
   P = 2-Year Rainfall (in)
   S = (1000/ CN)-10
2. Runoff Volume (CF) = Q x Area x 1/12
   Q = Runoff (in)
   Area = Land use area (sq. ft)

Note: Runoff Volume must be calculated for EACH land use type/condition and HSGI. The use of a weighted CN value for volume calculations is not acceptable.

Worksheet 5. Structural BMP Volume Credits

PROJECT: Snipes Tract Athletic Fields
SUB-BASIN: Buck Creek/ Delaware River South

Required Control Volume (ft^3) – *from Worksheet 4*: 55,717 cf

Non-structural Volume Credit (ft^3) – *from Worksheet 3*: - 13,929 cf
(maximum is 25% of required volume)

Structural Volume Reqmt (ft^3) 41,788 cf

(Required Control Volume minus Non-structural Credit)

Proposed BMPs from PA Stormwater Best Management Practices Manual Chapter 6		Area (ft^2)	Volume Reduction Permanently Removed (ft^3)
6.4.1	Porous Pavement		
6.4.2	Infiltration Basin		
6.4.3	Infiltration Bed		
6.4.4	Infiltration Trench	9,630 sf	42,118 cf
6.4.5	Rain Garden/Bioretention		
6.4.6	Dry Well / Seepage Pit		
6.4.7	Constructed Filter		
6.4.8	Vegetated Swale		
6.4.9	Vegetated Filter Strip		
6.4.10	Berm		
6.5.1	Vegetated Roof		
6.5.2	Capture and Re-use		
6.6.1	Constructed Wetlands		
6.6.2	Wet Pond / Retention Basin		
6.7.1	Riparian Buffer/Riparian Forest Buffer Restoration		
6.7.2	Landscape Restoration / Reforestation		
6.7.3	Soil Amendment		
6.8.1	Level Spreader		
6.8.2	Special Storage Areas		
Other			

Total Structural Volume (ft^3): 42,118 cf
Structural Volume Requirement (ft^3): 41,788 cf
DIFFERENCE 330 cf

Worksheet 10 – Water Quality Compliance for Nitrate		
Does the site design incorporate the following BMPs to address nitrate pollution? A summary "yes" rating is achieved if at least 2 Primary BMPs for nitrate are provided across the site or 4 secondary BMPs for nitrate are provided across the site (or the equivalent) "provided across the site" is taken to mean the specifications for that BMP set forward in Sections 5 and 6 are satisfied. Proposed BMPs from PA Stormwater Best Management Practices Manual Chapter 5 & 6		
	Yes	**No**
Primary BMPs for Nitrate:	☒	☐
NS BMP 5.4.2 – Protect/Conserve/Enhance Riparian Buffers	☐	☒
NS BMP 5.5.4 – Cluster Uses at Each Site	☒	☐
NS BMP 5.6.1 – Minimize Total Disturbed Area	☒	☐
NS BMP 5.6.3 – Re-Vegetate/Re-Forest Disturbed Areas (Native Species)	☐	☒
NS BMP 5.9.1 – Street Sweeping/Vacuuming	☒	☐
Structural BMP 6.7.1 – Riparian Buffer Restoration	☐	☒
Structural BMP 6.7.2 – Landscape Restoration	☒	☐
	☐	☐
Secondary BMPs for Nitrate:	☒	☐
NS BMP 5.4.1 – Protect Sensitive/Special Value Features	☒	☐
NS BMP 5.4.3 – Protect/Utilize Natural Drainage Features	☒	☐
NS BMP 5.6.2 – Minimize Soil Compaction	☒	☐
Structural BMP 6.4.5 – Rain Garden/Bioretention	☐	☒
Structural BMP 6.4.8 – Vegetated Swale	☐	☒
Structural BMP 6.4.9 – Vegetated Filter Strip	☒	☐
Structural BMP 6.6.1 – Constructed Wetland	☐	☒
Structural BMP 6.7.1 – Riparian Buffer Restoration	☐	☒
Structural BMP 6.7.2 – Landscape Restoration	☒	☐
Structural BMP 6.7.3 – Soils Amendment/Restoration	☐	☒

See the text of the Post Construction Stormwater Management Report dated November 18, 2016 last revised March 2, 2017 in Appendix B for further details.

[c] Soils. Within the scope of this analysis, at a minimum, the applicant shall address the ability of the existing soils to infiltrate stormwater, and negative impacts of soil compaction as a result of construction. The applicant shall also discuss whether the on-site soils are considered to be prime agricultural soils or soils of statewide importance as identified by the United States Department of Agriculture, and if these soils exist, how continuous areas of these soils are to be preserved through the design of the project (i.e., clustering and preserving open space).

See Appendix E: Geotechnical Report and Soil Infiltration Test Results found in the Post Construction Stormwater Management Report dated November 18, 2016 last revised March 2, 2017.

[d] Geology. Within the scope of this analysis, at a minimum, the applicant shall address the requirements for the methods of the removal of bedrock, and how the grading of the tract requires excavation within bedrock.

In the event that bedrock is encountered during site grading, excavation via backhoe ripping will be utilized to the extent possible. Further investigation is underway to determine the existence or lack of existence of bedrock in the areas of the storwater features that require the most excavation. In the event that backhoe ripping is not possible to achieve the required depths, design changes will be investigated to eliminate the need to excavate bedrock.

[e] Hydrogeology and subsurface drainage. Within the scope of this analysis, at a minimum, the applicant shall address the impacts of this project on aquifer recharge, and recharge of waterways, streams, and wetlands; in addition, a discussion on how the applicant proposes to maintain the subsurface drainage characteristics of the site, and protect groundwater quality.

Aquifer recharger, or stormwater infiltration, will be achieved through a series of subsurface infiltration trenches. These infiltration trenches have been tested for infiltration rates that were used in the design of the trenches. Per NPDES requirements the volume difference between the existing and proposed 2-yr runoff volumes will be infiltrated back into the groundwater through the infiltration trenches.

[2] Ecological resources.

[a] Forest and woodlands, grasslands and specimen trees. Within the scope of this analysis, at a minimum, the applicant shall address the impact of forest clearing and fragmentation of forests. The applicant shall also discuss the impacts to grasslands and specimen trees and how the development has been designed to preserve these resources.

No adverse impacts. The site was historically farmland and was more recently used as a nursery/tree farm. The trees on the site that will be removed or relocated as part of this plan are trees that were planted as part of the nursery/tree farm, as a cash crop to be harvested and do not constitute a woodland or forest. Care has been taken to minimize tree removal and to provide opportunities for trees to be relocated, where practical.

[b] Habitats. Within the scope of this analysis, at a minimum, the applicant shall address the impacts to habitats, including fragmentation through forest clearing, filling of wetlands, and impacts of stormwater runoff on the quality of existing habitats.

There will be a loss of habitat on the site, but this has been minimized, as a substantial portion of the northern, western, and southern portions of the site will remain undisturbed, and contiguous.

[3] Land use and existing features.

[a] Within the scope of this analysis, at a minimum, the applicant shall address the impacts of the project on the local land uses within the community, including compatibility with surrounding land uses, and its impacts on the quality of life within the community.

The proposed park will provide a positive impact on the local land uses within the community. The park will provide recreation amenities and both active and passive recreation opportunities and open space for the residents of the surrounding residential communities and also for the students attending the adjacent elementary schools, in addition to other residents of the Township. The park should have an overall positive impact on the quality of life within the community.

[b] Displacement of viable farms: of specific importance, is the impact on the agricultural operations of a site, and whether the project will temporarily or permanently reduce or eliminate the farming operations of the tract. The applicant must describe mitigative efforts to preserve the farming aspect of the tract, if feasible.

The proposed park does not displace any currently viable farms, as the site was purchased in 2000 to provide recreational amenities for the Township.

[4] Historic and archeological resources. Within the scope of this analysis, at a minimum, the applicant shall address the requirements to impact historic or archeological resources, demolition of such resources, and justification to demolish or relocate such resources. Discussion about preservation of such resources and creating public awareness and education of historic and archeological resources as key component of the completed project shall be completed.

The proposed park will have no impact on historic or archeological resources. The closest resource is Elm Lowne, and no disturbance or impacts are anticipated as part of this park plan.

[5] Aesthetic resources. Within the scope of this analysis, at a minimum, the applicant shall describe the impacts to aesthetic resources such as viewsheds and visual character of the project compared to the existing land use (agricultural, rural, suburban, etc.).

No negative impacts to aesthetic resources are anticipated. Additional buffering and landscaping is proposed. A significant portion of the viewshed of along Quarry Road will be preserved to maintain the rural character of that portion of the site.

[6] Community services. Within the scope of this analysis, at a minimum, the applicant shall discuss the ability of the community, with its current state of services to accommodate the project, and the requirements for increasing the staff and resources of the community to accommodate the project. The discussion shall address each of the following in detail: schools, parks and recreation facilities, libraries, hospitals, police, fire protection, ambulance, and rescue services. A letter from each of the community services shall be obtained with their individual capacity to provide such services to the project.

No negative impacts are anticipated to community services. The park will provide additional community services in the form of park and recreational opportunities for residents of the Township.

[7] Existing available utilities and utility needs. Within the scope of this analysis, at a minimum, the applicant shall discuss the impacts of the project on the infrastructure and available capacity of existing utilities to service the project. Certificates from the utilities confirming that adequate capacity exists to serve the proposed development shall be included.

A request to extend the water line from the existing onsite water valve near the intersection of Quarry Road and Dolington Road was

made to Pennsylvania American Water on January 6, 2017. A final approval is still being sought.

The Yardley Borough Sewer Authority provided a Capacity Certification Letter, dated April 13, 2017, stating that the current sanitary sewer system has sufficient capacity available to receive sewage flows of 800 GPD from the proposed project. The letter also states that generation of said waste load will not create a hydraulic or organic overload or a 5-year projected overload.

An electric service request to PECO is the process of being compiled.

[8] Transportation infrastructure. Within the scope of this analysis, at a minimum, the applicant shall discuss the transportation requirements of this project, and its impacts on the surrounding community. A traffic impact analysis must be performed by a qualified transportation professional.

Refer to the Traffic Impact Study, as prepared by Traffic Planning and Design, Inc.

[9] Solid waste. Within the scope of this analysis, at a minimum, the applicant shall discuss the impacts of this project on the solid waste transportation services and their disposal facilities to accommodate the project during construction and following project completion and occupation. The maximization of recycling and minimization of waste generation shall be addressed.

During construction, there will be minimal impact on solid waste transportation services. All construction waste will be dealt with by the site contractor as part of their contract. Following construction and during occupation the impact on solid waste transportation services will be minimal. Trash collection and disposal will be handled by the Township as it is for all other Township parks and facilities. Notes pertaining to the handling of site trash and recycling disposal can be found on the Post Construction Stormwater Managements Details Sheet, Sheet 12 of 14.

[10] Air quality and noise. Within the scope of this analysis, at a minimum, the applicant shall address the changes in air quality and noise levels as a result of the project. For the construction stage, the applicant shall discuss pollution control requirements of construction equipment, dust control, noise abatement, and limitations of working hours. For the completed and occupied project, a discussion regarding air and noise pollution generation for day-to-day operations on and around the project, and pollution and noise controls for manufacturing.

During construction, all adherences will be made to follow the Noise Ordinances of the Township. No night work will be taking place for this project. The Erosion and Sedimentation Control Plan,

Sheet 6 of 14, along with the Erosion and Sedimentation Control Details, Sheet 7 of 14, contain all information pertaining to site controls during construction.
For the completed and occupied project, there will be minimal air and noise pollution. The use of the site will be for athletic events. There will be no loud speaker system associated with the fields.

[11] Night sky views and land use lighting. Within the scope of this analysis, at a minimum, the applicant shall address the impacts of the project on night sky views and the adjacent properties (light pollution) within 500 feet of the tract. The applicant shall describe mitigative efforts of lighting impacts, such as the use of lighting time restrictions and light fixtures manufactured to limit night sky pollution and glare on adjacent properties. In the case of redevelopment, the applicant must describe the methods for which the impacts of the existing tract's lighting will be modified to lessen the impacts on the night sky view and adjacent properties.

No irreversible impacts are anticipated to the night sky views due to the lighting proposed as part of the park. All lighting fixtures are downward facing and are affixed with cut-off shields. All fixtures specified are manufactured to limit night sky pollution and glare on adjacent properties. In addition, lighting will be limited to times during which the park is in use.

(4) Existing environmental contamination. The applicant shall complete a Phase One Environmental Assessment (EA) of the tract and provide the results as part of this EIA report. The EA shall conform to the requirements of ASTM E1527-00, as amended and the PADEP Act 2 (Land Recycling). All tracts that are revealed as part of the EA to have been historically used for row crops, orchards or nurseries, in addition to any other Phase 2 activities that may be required, shall be tested for historic pesticides, lead and arsenic. Testing for such historic agricultural pesticides shall be conducted at a frequency of one sample per two acres up to the first 10 acres and one sample per five acres thereafter. All samples shall be collected at a depth of zero inches to six inches. Analysis shall consist of lead, arsenic, and TCL (target compound list) pesticides. The EA and historic pesticide test results shall be included as an attachment to this report.

As a part of the Settlement Agreement executed by Lower Makefield Township and the property owners on 8/21/2000, the following warrant was made to the Township:

"The Owner warrants to the Township, that as of the date of this Agreement, to the best of the Owner's knowledge, information and belief, the Property does not contain any hazardous or toxic waste and/or substances as that term is defined by the Pennsylvania Department of Environmental Protection, the United States Environmental Protection Agency, or any other appropriate public entity. Furthermore, the Owner warrants and represents to the best of their knowledge, information and belief, that the Property does not contain any underground tanks and that no farm or other dump is located on the Property. The representations made by the Owner as set forth in this paragraph shall survive the closing of title."

Boucher & James, Inc.
CONSULTING ENGINEERS
AN EMPLOYEE OWNED COMPANY
INNOVATIVE ENGINEERING

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559 Main Street, Suite 230
Bethlehem, PA 18018
610-419-9407
Fax 610-419-9408

www.bjengineers.com

May 11, 2017

Lower Makefield Township
Board of Supervisors
1100 Edgewood Road
Yardley PA 19067

SUBJECT: PHASE I ENVIRONMENTAL ASSESSMENT
SHORT REPORT – SNIPES TRACT SITE
T.M.P. #S 20-016-001-001 & 20-016-002
LOWER MAKEFIELD TOWNSHIP, BUCKS COUNTY
PROJECT 16-77-054L

Dear Supervisors:

As requested, **Boucher & James, Inc.** has completed the research required of a Phase I Environmental Assessment for the above noted 36.2-acre site. It is our professional opinion there is no evidence of a "Recognized Environmental Condition" (as that term is defined in ASTM Standard Practice E 1527-13) existing in connection with the site. ASTM Standard E1527-13 Section 3.2.78 describes a "recognized environmental condition" as: *"... the presence or likely presence of any hazardous substances or petroleum products in, on, or at a property: (1) due to any release to the environment; (2) under conditions indicative of a release to the environment; or (3) under conditions that pose a material threat of a future release to the environment. De minimis Conditions are not Recognized Environmental Conditions."* No "Historical Recognized Environmental Conditions" or "Controlled Recognized Environmental Conditions" (defined in ASTM Standard Practice E 1527-13) were identified in connection with the site. "De minimus Environmental Conditions", being two solid waste piles and an abandoned water supply well, were identified. There will be a limited and definable expense required to properly dispose of the solid waste.

One waste pile was observed on the north side of the site and one waste pile was observed on the west side of the site. The waste totals approximately one pickup truck load in volume. The waste includes metal and plastic debris, four car tires, car seats, and a 55-gallon drum of a solid material. The materials are considered "municipal" type waste required, under PA DEP solid waste regulations, to be disposed in a regulated manner. The materials do not appear to have caused chemical contamination of the site and are primarily a solid waste concern.

A buried water supply well appears to exist on the southeast corner of the site. The well cap is less than one foot below grade. The well has a sanitary seal with a metal delivery pipe. If the well will not be used in future, the well should be properly abandoned per State and County regulations.

I declare that, to the best of my professional knowledge and belief, I meet the definition of Environmental Professional as defined in §312.10 of 40 CFR 312. I have the specific qualifications based on education, training, and experience to assess a property of the nature, history, and setting of the subject property. I have developed and performed the all appropriate inquiries in conformance with the standards and practices set forth in 40 CFR Part 312.

Thank you for using **Boucher & James, Inc.** for your environmental needs.

Sincerely,

Philip S. Getty
Environmental Hydrogeologist

PSG/kam

Enclosure

P:\2016\1677054\1677054L\Documents\Environmental Phase I Report\Documents\BoucherPhI_Snipes_Short Report.doc

SNIPES TRACT SITE
PHASE I ENVIRONMENTAL ASSESSMENT SHORT REPORT LIMITATIONS

Purpose: This letter report concludes the findings of a Phase I or Level I Environmental Assessment of the above noted property. The letter report is a summary of the information normally gathered to prepare a full Phase I Environmental Assessment Report. The Phase I Environmental Assessment investigation is designed to identify 'recognized environmental conditions' which may cause damage to property or health outside of a building. Specifically, the procedure followed the guidelines as defined by ASTM Standard E 1527-13 and Federal Standard 40 CFR 312. These standards are devised to satisfy one of the requirements to qualify for the innocent landowner defense to CERCLA liability as defined in 42 USC Section 9601(35)(B). This information acquired, if prepared into a formal report, would be comprehensive enough to meet the requirements of most lending institution's Phase I Environmental Assessment report requirements and the Pennsylvania Department of Environmental Protection (PA DEP) "Environmental Investigation Guidelines" interim recommendations for completion of a Phase I Preliminary Site Evaluation.

Special Terms and Conditions: This Phase I Environmental Assessment focuses on review of available information concerning potential, man-made, factors that could cause a health hazard through ingestion or contact by life outside of buildings, such as contaminated groundwater or soil. Unlike a Phase II Environmental Assessment, this audit does not involve the collection of samples or laboratory analysis. Evaluation of non-scope considerations, such as asbestos-containing building materials, biological agents, culture and historic resources, ecological resources, health and safety, industrial hygiene, radon, lead-based paint, lead in drinking water, wetlands, regulatory compliance, endangered species, indoor air quality (excluding impacts to indoor air from releases of hazardous substances into the environment) and mold are non-scope considerations of a Phase I Assessment per ASTM standard E 1527-13, section 13.1.5 and appendices X1 and X5, and Federal Standard 40 CFR 312 and are not addressed in this report. Recommendations that may be provided are also considered non-scope considerations. The assessment does not evaluate structural concerns associated with the support capacity of the underlying soil and/or fill.

Limitations and Exceptions of the Assessment: This study is limited to the location under investigation and the influence of the site by and to neighboring properties. The evaluation does not investigate regulatory compliance of site operations nor waste disposal tracking from the property. The report is also limited by budgetary and time constraints specified within the scope of our proposal, seasonal conditions and reliability of information available at the time of study.

Limiting Conditions and Methodology Used: Soil, groundwater and tank leak testing, not within the limits of this study, may reveal additional information unforeseen at this time. The masking effects of vegetative and weather related conditions may also limit observations made at the time of our site visit. Better resolution of aerial photograph quality and photographs from other periods may provide additional information beyond the scope of this project. The scope of this study and the credibility of those persons interviewed must be realized when interpreting the findings. **Boucher & James, Inc.** has completed this study following environmental laws and regulations which are currently evolving, and therefore, does not guarantee that the conclusions drawn will prevail over time.

(5) Potential to contaminate tract or surrounding lands. The applicant shall describe any hazardous materials that shall be used for the construction or as part of the operations of the completed and occupied project. A description of the materials, with Material Safety and Data Sheets (MSDS) shall be included with this report. Any regulatory approvals necessary to utilize such materials shall be listed. Hazardous or potentially hazardous materials to be used will include products to be used for the on-site use, distribution or sale of fuel, HVAC systems, pesticides and herbicides, fire suppression, cleaning or manufacturing. Discussion of the avoidance of contamination of soil, air, groundwater and surface water resources shall be included within this section of the report.

Management and disposal of construction waste is address on Plan Sheets 6, 7, & 12 of the Plan Set.

No hazardous materials will be used for the construction or as part of the operations of the completed and occupied project.

(6) Low-impact development (LID). The applicant shall indicate whether the project meets the Township's goals and objectives for LID as outlined within the Subdivision and Land Development Ordinance. Specifically, the applicant shall describe the overall project approach, including but not limited to, following the guidelines as set forth in Chapter 173, Stormwater Management – Delaware River South Watershed, or Chapter 174, Stormwater Management – Neshaminy Creek Watershed. If the applicant has decided that LID standards are not to be employed, including clustering development and preserving open space, a detailed description shall be submitted that describes how avoiding LID techniques benefits the community and better protects the environment and health and safety of the public.

The design meets or exceeds all requirements of the Delaware River South Watershed Act 167 Stormwater Management Ordinance. To the maximum extent possible the site was designed to maintain as much of the existing wooded areas of the site (BMP 5.4.1). There are substantial portions of wooded areas maintained on the north, west and south portions of the site (BMP 5.4.1). The project is protecting/utilizing natural flow pathways on much of the site (BMP 5.4.3). The three main athletic fields are clustered adjacent to each other with the minimum separation for safe competition (BMP 5.5.1). Stormwater is proposed to be infiltrated through subsurface infiltration trenches (BMP 6.4.4), to aid in recharging the groundwater, and the roof runoff is disconnected (BMP 5.8.1), routed over lawn. The three main athletic fields are tiered to reduce the amount of cut and fill necessary to achieve final grades. As a result of this design the total disturbance minimized (BMP 5.6.1). Natural depression storage areas are found within the trees in the western portion of the site. These natural depressions, and all the above mentioned BMPs, are being considered as integral aspects of low impact development for this project.

(7) Transmission line, pipeline, or railroad rights-of-way. All transmission line, pipeline, or railroad rights-of-way, with or within 1,000 feet of the property shall be identified on a location map with a maximum scale of 1,000 feet to the inch. The applicant shall describe any minimum distance requirements or impacts anticipated from electrical fields or notifications to residents in the

event of explosions or the release of liquid, airborne particulates, or gas containing hazardous materials or substances.
There are no transmission lines, pipelines, or railroad rights-of-way within 1,000 feet of the site.

(8) Displacement of people and business. The applicant shall describe the impacts of this project on the community with regard to the displacement of peoples and business in order to construct the project, and the mitigating efforts to limit such displacement.

There will be no displacement of people or business due to the construction of this park.

(9) Fiscal impact. An identification of the economic and fiscal characteristics related to the proposed project. The characteristics which shall be presented in narrative form shall include a profile of the Township, County and School District revenues which the proposed use may generate and the Township, County and School district costs it will create. Such information shall be related to initial and completed project conditions.

This property is tax exempt and there is no fiscal impact on the State and County. There's no negative cost impact on the School District because there are no new students generated by this project. The Lower Makefield Board of Supervisors has budgeted $2million to construct this project and has secured a bond for the financing. The Township will incur costs to operate and maintain the Park. These costs will be offset through the use of user fees paid by the respective athletic organizations.

(10) Licenses and permits. An identification of all licenses, permits or other approvals required by law for the development and the status of each.

- E&S Approval Issued 3/8/17
- NPDES Issued 3/17/17
- PA ACT 537:

Yardley Borough Sewer Authority Capacity Certification letter April 13, 2017

Morrisville Authority Sewer Treatment Plant capacity approval forthcoming prior to submission to PA DEP.

PENNDOT HOP Plans and Application are being prepared by the Township Traffic Engineer.

(11) Resumes of key preparers of EIA report. All persons who participate in preparing the report shall be identified and their qualifications stated. All sources of information shall be identified when presented and a bibliography shall be attached to the report. All work in the report shall be in conformity with recognized engineering, architectural and planning practices and principles.

Mark W. Eisold, P.E.
Managing Director

LICENSES:
Professional Engineer, Pennsylvania, 1990

PROFESSIONAL AFFILIATIONS:
American Public Works Association
American Society of Civil Engineers, National Chapter
Chi Epsilon Civil Engineering National Honor Society

Experience:

Mr. Eisold is serving Boucher & James, Inc. in the capacity of Director of Municipal Engineering Services. His responsibilities include representing and managing all work for several municipal/governmental clients. Mr. Eisold is supported by a team of engineers, designers, CAD operators, construction inspectors, and administrative staff.

Education:

University of Delaware - Bachelor of Civil Engineering, 1985
Villanova University - Graduate Civil Engineering Course Work
Hydraulics and Hydrology, 1986 - Soil Mechanics, 1987
LaSalle University - Master of Business Administration, 1998

Areas of Expertise:

- Manage, coordinate and oversee all municipal engineering work for multiple municipal clients.
- Provide advisory consultation to municipal staff and elected officials.
- Attend planning commission and municipal meetings as requested by municipal clients.
- Design and permitting of municipal infrastructure improvement projects relative to roadway, stormwater management and drainage, sanitary sewer, park and open space areas.
- Prepare bid plans and specifications and coordinate bid process for award of municipal projects.
- Prepare applications and perform administration for grant funded projects.
- Manage and coordinate all construction operations for municipal infrastructure projects.
- Manage and coordinate all construction observation operations for municipal and development projects.
- Review and process payment and construction escrow release recommendations.
- Review land development and subdivision plans for residential, commercial industrial and institutional projects.
- Review and provide technical guidance for municipal ordinance updates.

Judith Stern Goldstein, ASLA, R.L.A.
Managing Director

PROFESSIONAL REGISTRATION:
Registered Landscape Architect – Pennsylvania

PROFESSIONAL AFFILIATIONS:
American Society of Landscape Architects
Pennsylvania/Delaware Chapter of ASLA
Pennsylvania Chapter of American Planning Association

Experience:

Ms. Goldstein is serving Boucher & James, Inc. in the capacity of Director of Landscape Architecture and Planning Services. Ms. Goldstein represents several Municipalities as their principal Planner. She has been involved with all aspects of site design including plan review, site design and planning of commercial, residential, industrial and institutional land developments, design of park and open space systems and the detailed design and construction documentation of landscape architectural elements. Ms. Goldstein has also prepared Zoning Ordinances and Subdivision and Land Development Ordinances, and has provided expert witness testimony.

Education:

University of Pennsylvania - Bachelor of Arts - Design of the Environment, 1984
University of Pennsylvania - Master of Landscape Architecture, 1986

Areas of Expertise:

- Manage, coordinate, and oversee all municipal planning and landscape architecture work for multiple municipal clients. Provide advisory consultation to municipal staff and elected officials.
- Review subdivision and land development plans for compliance with municipal ordinances and general planning standards and conventions.
- Preparation of reports and studies such as Comprehensive Plans, Trails Plans, Park and Recreation Plans, Open Space Plans, Corridor Study Plans, Rivers Conservation Plans, Environmental Impact Studies, and Fiscal Impact Studies. Conduct Community Visioning Sessions.
- Review community and/or municipal goals and objectives and prepare new Zoning and Subdivision and Land Development Ordinances and amendments
- Review community and/or municipal goals and objectives and prepare plans for park and recreation areas, including site analyses, Park Masterplans and reports, detailed construction documents, and construction observation.
- Offer expert witness testimony for municipalities for Conditional Use Hearings, Zoning Hearing Board proceedings, and Curative Amendment Challenges, as requested.

Maryellen Saylor, P.E., C.F.M.
Municipal Engineer

PROFESSIONAL REGISTRATIONS:
Professional Engineer, Pennsylvania
Professional Engineer, New Jersey
Certified Floodplain Manager, Association of State Floodplain Managers

PROFESSIONAL AFFILIATIONS:
Association of State Floodplain Managers

Experience:

Ms. Saylor is serving Boucher & James, Inc. in the capacity of Municipal Engineer. Her responsibilities include the review of subdivision and land development projects for compliance with ordinance requirements as well as general engineering practices. She is also responsible for the design of various municipal projects.

Education:

Pennsylvania State University –Bachelor of Science in Civil Engineering, 1983

Areas of Expertise:

- Manage and coordinate municipal engineering work for multiple municipal clients.
- Design and permitting of municipal infrastructure improvement projects relative to roadway, paving and rehabilitation programs, stormwater management and drainage improvements, sanitary sewer extension and park facilities, park and open space preservation areas.
- Prepare bid plans and specifications and coordinate bid process for award of municipal projects including yearly paving programs, recreational facilities design, stormwater management improvement projects.
- Assist municipalities with the updated FEMA National Flood Insurance Program (NFIP), Flood Insurance Study (FIS) and Flood Insurance Rate Map (FIRM).
- Assist municipalities with Flood Plain Ordinance Update to bring the municipality ordinance into compliance with FEMA requirements.
- Assist municipalities with participation in NFIP Community Rating System (CRS) to reduce flood insurance premiums for property owners.
- Construction administration/observation of various municipal projects.
- Prepare applications and perform administration for grant funded projects.
- Review and process payment and construction escrow release recommendations.
- Review land development and subdivision plans for residential, commercial industrial and institutional projects.
- Review and provide technical guidance for municipal ordinance updates.

Geoffrey J. Attanasio, P.E.
Municipal Engineer

PROFESSIONAL REGISTRATION:
Professional Engineer, Pennsylvania

Experience:

Mr. Attanasio is currently serving Boucher & James, Inc. in the capacity of Municipal Engineer. Mr. Attanasio has roadway design, stormwater management and project management experience for a variety of projects from preliminary engineering through final design. He has worked closely with local land use code, zoning and land development standards, comprehensive plans, and other policies and regulations pertaining to municipal design and review. He has experience in municipal construction inspection and governmental construction observation. His responsibilities include site design and approvals of municipal projects, contract document preparation, and municipal roadway construction and maintenance design. Mr. Attanasio is supported by a team of designers, CAD operators and administrative staff.

Education:

University of Delaware - Bachelor of Civil Engineering, 2003

Areas of Expertise:

- Review land development and subdivision plans and reports for residential, commercial, industrial and institutional projects.
- Prepare bid plans and specification and coordinate bid process for award of municipal projects.
- Perform all aspects of design of municipal projects including site layout and grading, stormwater management, utility layout and design, erosion and sediment control, details and cost estimates.
- Attend planning commission and municipal meetings as requested by municipal clients.
- Design and permitting of municipal infrastructure improvement projects relative to roadway, stormwater management and drainage, sanitary sewer, park and open space areas.
- Manage PennDOT and Pennsylvania Turnpike Commission projects: client and subcontractor coordination.
- Design horizontal and vertical geometry, stormwater management, drainage, erosion and sediment pollution control, traffic control, and signing and pavement marking.
- Prepare right-of-way plans, preliminary and final roadway plans, drainage and stormwater management, erosion and sediment pollution control plans, cost estimates, and utility coordination.

Philip S. Getty, P.G.
Environmental Hydrogeologist

PROFESSIONAL REGISTRATIONS:
Professional Geologist, Pennsylvania

PROFESSIONAL AFFILIATIONS:
National Ground Water Association
Southeastern Pennsylvania Water Well Drillers Association
Central Bucks County Chamber of Commerce Architectural and Environmental Committee

Experience:

Mr. Getty has professional experience in the environmental and geotechnical fields. He has been involved in a broad range of municipal work such as impact assessments of quarries, landfills, community sewage systems and water resource management studies related to well and stream supplies. He also has a personal interest in the environment regarding habitat preservation and sustainable development.

Education:

West Virginia University - Master of Science Degree - Geology, 1980
Hydrology, geomorphology, mining geology
The Pennsylvania State University - Bachelor of Science Degree - Geology, 1978

Areas of Expertise:

- Sinkhole: evaluations and management plans for limestone areas.
- Geotechnical: soil compaction, foundation, landslide and sinkhole/mine subsidence evaluations.
- Groundwater: well installation, water resource management, groundwater contamination cleanup, water treatment, well yield rehabilitation, building drainage remediation, stream restoration, stormwater infiltration, well interference testing, wetland piezometer, stream flow weirs.
- Property Assessments: underground tank closures, soil/water evaluation/cleanup, Phase I, II, II Environmental Assessments (Audits), Act 2 Release from Liability Process, US EPA Superfund Studies, waste minimization.
- Sewage: on-site septic system design/repair, nitrate plume studies, spray/drip irrigation site evaluations, monitoring wells, computer mounding predictions, preliminary hydrologic studies.
- Geophysical Surveys: borehole camera / caliper / loggers, metal detection: magnetometer /electromagnetic surveys, pollution plume detection: resistivity/electromagnetic surveys, depth to rock/voids: ground penetrating radar/gravity seismic/electromagnetic surveys.
- Remote Sensing: aerial photograph surveys/interpretation, LIDAR evaluations, GIS data management, computer automated recording/telemetry monitoring: water levels, air conditions, equipment operation, flow meters.
- Environmental Impact Studies: project manager of geologic, environmental, wetland, rare plants/animals (such as bog turtles) and archeological evaluations.

APPENDIX A

Traffic Impact Study

Snipe Tract Park
TRANSPORTATION IMPACT STUDY

FOR SUBMISSION TO:

Lower Makefield Township, Bucks County, PA
& PennDOT District 6-0

Prepared For:
Lower Makefield Township
1100 Edgewood Road
Yardley, Pennsylvania 19067

May 2, 2017
TPD # LOMT.00047

Prepared By:
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EXECUTIVE SUMMARY

The purpose of this study is to examine the potential traffic impact associated with the proposed Snipe Tract Park development on the roadway network in Lower Makefield Township, Bucks County, PA. Based on this evaluation, the following conclusions were reached:

1. The project scope and the extent of the study area intersections included in this TIS are as follows:

    - Yardley Newtown Road (S.R. 0332) & Mirror Lake Road (S.R. 2087)
    - Yardley Newtown Road (S.R. 0332) & Creamery Road
    - Quarry Road & Creamery Road
    - Quarry Road & Dolington Road (S.R. 2075)
    - Quarry Road & Quarry Hill Court

2. The project site is located on the west side of Dolington Road, north of the intersection of Quarry Road & Dolington Road. The proposed site will consist of 3 soccer fields and a half practice field. To be conservative, TPD analyzed the development as 4 soccer fields.

3. Access to the site will be served by two (2) full access driveways; one located on Dolington Road (S.R. 2075) and one located on Quarry Road.

4. Under 2019 projected conditions, the study area intersections will operate at the same overall intersection level of service (ILOS) as under 2019 base conditions, during the weekday A.M., P.M., and Saturday midday peak hours.

5. All approaches and turning movements at the site driveway intersections will operate at LOS B or better under 2019 projected conditions during the weekday A.M., P.M., and Saturday midday peak hours.

6. All proposed driveway location sight distances will exceed PennDOT's Desirable and Safe Stopping Sight Distance (SSSD) criteria.

7. Upon full build-out of the site, the proposed development is expected to generate 5 new vehicle-trips during the weekday A.M. peak hour, 70 new vehicle-trips during the weekday P.M. peak hour and 121 new vehicle-trips during the Saturday midday peak hour.

8. Traffic Planning and Design Inc. (TPD) recommends the following roadway improvements as outlined at the study area intersections:

    a. Upgrade existing geometry at Dolington Road (S.R. 2075) and Quarry Road intersection.

    b. Add a southbound right turn lane and northbound left turn lane onto Dolington Road access.

    c. Add a westbound right turn lane onto Quarry Road access.

    d. Add additional pedestrian facility crossing Quarry Road at the Site Access and Creamery Road intersections.

9. Levels of Service (LOS) for the study area intersections have been summarized in matrix form. **Table I** details the overall intersection ILOS for each study area intersection.

TABLE I
OVERALL INTERSECTION LEVEL OF SERVICE SUMMARY

Intersection	Weekday A.M. Peak Hour			Weekday P.M. Peak Hour			Sat Midday Peak Hour			Meets LOS Requirements?
	Existing	Opening Year 2019		Existing	Opening Year 2019		Existing	Opening Year 2019		
		Base	Projected		Base	Projected		Base	Projected	
Yardley Newtown Road (S.R. 0332) & Mirror Lake Road (S.R. 2087)	**A (8.3)**	**A (8.3)**	**A (8.3)**	**A (9.1)**	**A (9.1)**	**A (9.3)**	**A (8.9)**	**A (9.0)**	**A (9.0)**	Yes
Yardley Newtown Road (S.R. 0332) & Creamery Road	**B (18.0)**	**B (18.8)**	**B (18.9)**	**C (21.1)**	**C (22.5)**	**C (24.9)**	**B (10.4)**	**B (10.1)**	**B (11.1)**	Yes
Quarry Road & Creamery Road	**C (18.5)**	**C (24.3)**	**D (25.1)**	**A (7.6)**	**A (7.8)**	**A (8.3)**	**A (6.6)**	**A (6.6)**	**A (8.2)**	Yes
Quarry Road & Dolington Road (S.R. 2075)	**A (3.4)**	**A (3.5)**	**A (3.6)**	**A (4.3)**	**A (4.4)**	**A (5.1)**	**A (4.1)**	**A (3.8)**	**A (5.7)**	Yes
Dolington Road (S.R. 2075) & Site Driveway	--	--	**A (0.2)**	--	--	**A (1.5)**	--	--	**A (2.9)**	Yes
Quarry Road & Site Driveway/Quarry Hill Court	**A (3.2)**	**A (3.2)**	**A (3.3)**	**A (1.3)**	**A (1.3)**	**A (1.6)**	**A (0.6)**	**A (0.5)**	**A (1.8)**	Yes

Base = No-Build scenario / Projected = Build scenario
Unsignalized ILOS calculated in accordance with Figure 5 of Policies and Procedures for Transportation Impact Studies.

INTRODUCTION

Traffic Planning and Design, Inc. (TPD) has completed a Transportation Impact Study (TIS) for the proposed Snipe Tract Park in Lower Makefield Township, York County, Pennsylvania. The project site is located on the west side of Dolington Road, north of the intersection of Quarry Road & Dolington Road, as shown in **Figure 1**. The land use context of the site and surrounding area is defined as Suburban Corridor in the Smart Transportation Guidebook, dated March 2008. As shown in **Figure 2**, the proposed site will consist of 3 soccer fields and 1 practice field. To be conservative, TPD analyzed the development as 4 soccer fields.

This report has been prepared in accordance with PennDOT's *Policies and Procedures for Transportation Impact Studies*, dated January 28, 2009.

Site Access Locations

Access to the site will be served by one full access driveway located on Dolington Road.

EXISTING ROADWAY NETWORK

A field review of the existing roadway system in the study area was conducted. The existing roadway characteristics within the study area are summarized in **Table 1**. Photographs of the study area intersections are included in **Appendix A.**

TABLE 1
ROADWAY CHARACTERISTICS WITHIN STUDY AREA

Roadway	Ownership	Functional Classification/ Roadway Type	Predominant Directional Orientation	Average Daily Traffic	Posted Speed Limit
Yardley Newtown Road	State (S.R. 0332)	Minor Arterial	East-West	6,872	45 mph
Mirror Lake Road	State (S.R. 2087)	Minor Arterial	North-South	5,169	40 mph
Creamery Road	Township	Local Road	North-South	n/a	35 mph
Dolington Road	State (S.R. 2075)	Minor Arterial	North-South	2,268	40 mph
Quarry Road	Township	Minor Arterial	East-West	1,857	25 mph
Quarry Hill Court	Township	Local Road	North-South	n/a	25 mph

Land Use Context

In Chapter 4 of the *Smart Transportation Guidebook*, dated March 2008, there is guidance pertaining to defining the land use context(s) for a given area. Based upon review of this information, the land uses surrounding the proposed site best fits the Suburban Corridor designation, as described below:

> ***Suburban Corridor,*** *"...characterized by big box stores, commercial strip centers, restaurants, auto dealerships, office parks, and gas stations. These uses are sometimes interspersed with natural areas and occasional clusters of homes. Buildings are usually set back from the roadway behind surface parking."*

Roadway Type

In Chapter 5 of the Smart Transportation Guidebook, there is guidance pertaining to defining the transportation context(s) for a given area. Comparing the existing condition roadway characteristics to the various options presented in Table 5.1 of the *Smart Transportation Guidebook*, the study area roadways best fit the following categories, as described below:

Community Collector, traffic volumes of 5,000 to 15,000 vehicles per day, intersection spacing of 300 to 660 feet, a desired operating speed of 25-55 mph, and a description as follows: *"often similar in appearance to a community arterial. Typically classified as Major Collector."*

- Yardley Newtown Road (S.R. 0332)
- Mirror Lake Road (S.R. 2087)

Neighborhood Collector, traffic volumes of <6,000 vehicles per day, intersection spacing of 300 to 660 feet, a desired operating speed of 25-35 mph, and a description as follows: *"similar in appearance to local roadways. Typically classified as Minor Collector."*

- Dolington Road (S.R. 2075)

Local Road, traffic volumes of <3,000 vehicles per day, intersection spacing of 000 to 660 feet, a desired operating speed of 20-30 mph.

- Creamery Road
- Quarry Road
- Quarry Hill Court

Bicycle and Pedestrian Facilities

Based on observations during field visits at the study area intersections, sidewalks and crosswalks or paved shoulders currently accommodate pedestrian and/or bicycle traffic in the vicinity of the proposed development. Pedestrian crossing signals, push buttons, and crosswalks are present on the eastbound and westbound approaches at the intersection of Yardley Newtown Road (S.R. 0332) & Creamery Road.

Sidewalk is present along the east side of Quarry Road to accommodate both elementary schools; Afton and Quarry Hill. The sidewalk shifts over to the west side once Quarry Road switches to Dolington Road (S.R. 2075).

EXISTING TRAFFIC CONDITIONS

Manual Turning Movement Counts

Manual traffic counts were conducted on 15-minute intervals during the weekday morning (7:00 to 9:00 A.M.), weekday evening (4:00 to 6:00 P.M.) and Saturday midday (11:00 A.M. to 1:00 P.M.) peak periods. Data pertaining to heavy vehicles, pedestrians and transit vehicles were observed during the manual counts. Peak hours and count dates for the study area intersections are identified in **Table 3**.

TABLE 3
MANUAL TRAFFIC COUNT INFORMATION

Intersection	Date of Traffic Counts	Time Period	Intersection Peak Hour[1]
Yardley Newtown Road (S.R. 0332) & Mirror Lake Road (S.R. 2087)	Thursday, June 2, 2016	Weekday A.M.	7:30 to 8:30 A.M.
		Weekday P.M.	5:00 to 6:00 P.M.
	Saturday, June 4, 2016	Saturday Midday	12:00 P.M. to 1:00 P.M.
Yardley Newtown Road (S.R. 0332) & Creamery Road	Thursday, June 2, 2016	Weekday A.M.	8:00 to 9:00 A.M.
		Weekday P.M.	5:00 to 6:00 P.M.
	Saturday, June 4, 2016	Saturday Midday	12:00 P.M. to 1:00 P.M.
Quarry Road & Creamery Road	Thursday, June 2, 2016	Weekday A.M.	8:00 to 9:00 A.M.
		Weekday P.M.	5:00 to 6:00 P.M.
	Saturday, June 4, 2016	Saturday Midday	12:00 P.M. to 1:00 P.M.
Quarry Road & Dolington Road (S.R. 2075)	Thursday, June 2, 2016	Weekday A.M.	8:00 to 9:00 A.M.
		Weekday P.M.	5:00 to 6:00 P.M.
	Saturday, June 4, 2016	Saturday Midday	12:00 P.M. to 1:00 P.M.
Quarry Road & Site Driveway/Quarry Hill Court	Tuesday, November 1, 2016	Weekday A.M.	8:00 to 9:00 A.M.
		Weekday P.M.	5:00 to 6:00 P.M.
	Saturday, October 29, 2016	Saturday Midday	12:00 P.M. to 1:00 P.M.

1 Peak Hour consists of the four consecutive 15-minute intervals where the highest traffic volumes occur.

Existing condition traffic volumes for the weekday A.M., weekday P.M., and Saturday peak hours are illustrated in **Figures 4-6**, respectively. Manual traffic count data sheets are provided in **Appendix B**.

BASE (NO-BUILD) CONDITIONS

Annual Background Growth

A background growth factor for the roadways in the study area was developed based on growth factors for August 2016 to July 2017 obtained from the PennDOT Bureau of Planning and Research (BPR). The PennDOT BPR suggests using a background growth trend factor of 1.35% per year in York County for urban non-interstate roadways. As such, the background growth factor was applied annually to yield overall growth percentages of 4.05% (1.35% per year, compounded over 3 years) for the 2019 opening year.

2019 Base (No-Build) Conditions Volume Development

The additional traffic volumes due to background growth and background developments were added to the existing traffic data to produce 2019 base (no-build) condition traffic. The 2019 base condition volumes for the weekday A.M., weekday P.M. and Saturday midday peak hours are illustrated in **Figures 7-9**.

PROPOSED SITE ACCESS

Access to the site will be served by two (2) full access driveways; one located on Dolington Road (S.R. 2075) and one located on Quarry Road.

Sight Distance Analysis

A sight distance analysis was prepared for the proposed site driveways. In general, recommended safe sight distances depend upon the posted speed limit and roadway grades. The existing sight distances at the proposed driveways were measured in accordance with PennDOT Publication 282 Highway Occupancy Permit Guidelines and compared to PennDOT's desirable sight distance standard, which is identified in 67 PA Code

Chapter 441.8(h), "Access to and Occupancy of Highways by Driveways and Local Roads." In addition, measured sight distances at the proposed driveways were compared to PennDOT's safe stopping sight distance standard, which is calculated by the following equation:

$$\mathbf{SSSD = 1.47VT + V^2/[30(f \pm g)]}$$

SSSD = safe stopping sight distance (acceptable sight distance)
V = Vehicle Speed
T = Perception Reaction Time of Driver (2.5 seconds)
f = Coefficient of Friction for Wet Pavements
g = Percent of Roadway Grade Divided by 100

Table 4 show the measured, desirable, acceptable (SSSD), and required sight distances at the site driveways for vehicles entering and exiting the site.

TABLE 4
SIGHT DISTANCE ANALYSIS
SITE DRIVEWAY TO DOLINGTON ROAD (S.R. 2075)

	Direction	Speed	Grade[1]	Sight Distances (feet)		
				DES	SSSD	EXIST
Exiting Movements	To the left	40 mph	-6%	538	352	**800**
	To the right	40 mph	+1%	460	309	**650**
Enter Left Turns	Approaching same direction	40 mph	+1%	373	309	**500**
	Approaching opposite direction	40 mph	-6%	373	352	**800**

DES = PennDOT Desirable Sight Distance
SSSD = PennDOT Acceptable Sight Distance
EXIST = Existing (measured) Sight Distance
1 = Roadway Grade Approaching Driveway

TABLE 5
SIGHT DISTANCE ANALYSIS
SITE DRIVEWAY TO QUARRY ROAD

	Direction	Speed	Grade[1]	Sight Distances (feet)		
				DES	SSSD	EXIST
Exiting Movements	To the left	25 mph	+1%	250	145	**500+**
	To the right	25 mph	-2%	195	150	**500+**
Enter Left Turns	Approaching same direction	25 mph	-2%	190	150	**500+**
	Approaching opposite direction	25 mph	+1%	190	145	**500+**

DES = PennDOT Desirable Sight Distance
SSSD = PennDOT Acceptable Sight Distance
EXIST = Existing (measured) Sight Distance
1 = Roadway Grade Approaching Driveway

As shown in **Tables 4 and 5** above, the measured sight distances at the site driveways exceed PennDOT's desirable sight distance requirements.

TRIP GENERATION

The trip generation rates for the proposed development were obtained from the manual *Trip Generation*, Ninth Edition, 2012, an Institute of Transportation Engineers (ITE) Informational Report. The statistics in *Trip*

Generation are empirical data based on more than 4,800 trip generation studies. The data are categorized by Land Use Codes, with total vehicular trips for a given land use estimated using an independent variable and statistically generated rates or equations.

For the proposed development, Land Use Code 488 Soccer Complex from *Trip Generation* was used to calculate the number of vehicular trips the development will generate during the following time periods: (1) average weekday; (2) weekday A.M. peak hour; (3) weekday P.M. peak hour; (4) Saturday midday peak hour. **Table 6** shows the rates/equations and directional percentages for the analyzed time periods.

TABLE 6
ITE TRIP GENERATION DATA

Land Use	ITE #	Size (X)	Time Period	Equation/Rate	Enter %
Soccer Complex	488	4	Weekday AM Peak Hour	T=1.12*(X)	57%
			Weekday PM Peak Hour	T=17.70*(X)	67%
			Saturday Peak Hour	T=30.34*(X)	48%
			Average Weekday	T=71.33*(X)	50%

T = number of site-generated vehicular trips;
X = independent variable

The calculated trip generation for the proposed development for the opening year is shown in **Table 7.**

TABLE 7
TRIP GENERATION SUMMARY

Land Use	Time Period	New Trips		
		Total	Enter	Exit
Soccer Complex	Weekday AM Peak Hour	5	3	2
	Weekday PM Peak Hour	71	48	23
	Saturday Peak Hour	121	58	63
	Average Weekday	286	143	143

Based on the trip generation analysis summarized in **Table 7**, the proposed development will generate approximately **5 new** trips during the weekday A.M. peak hour, **71 new** trips during the weekday P.M. peak hour, and **121 new** trips during the Saturday midday peak hour.

TRIP DISTRIBUTION

New Trips

The distribution of trips generated by the proposed development was based on the local road network, the existing traffic patterns, the proposed use of the site, and the site driveway locations. The new trips for the proposed development were distributed to the local roadway network based on the percentages shown in **Table 8**. The pass-by trips for the proposed development were distributed to the local road network based on the existing traffic volumes passing the proposed site driveways.

TABLE 8
TRIP DISTRIBUTION PERCENTAGES – New Trips

Direction - To/From	Assignment (To/From)	Distribution Percentage
North	Via Dolington Road (S.R. 2075)	10%
South	Via Mirror Lake Road (S.R. 2087)	15%
East	Via Dolington Road (S.R. 2075)	15%
East	Via Yardley Newtown Road (S.R. 0332)	20%
West	Via Quarry Road	10%
West	Via Yardley Newtown Road (S.R. 0332)	30%

The assignment of site-generated trips for the proposed development during the weekday A.M., P.M., and Saturday midday peak hours are shown in **Figures 10-12**.

PROJECTED (BUILD) CONDITION TRAFFIC VOLUMES

The site-generated trips for the proposed development were added to the 2019 base (no-build) condition traffic volumes to develop 2019 projected (build) condition traffic volumes.

Projected condition traffic volumes for the opening year of 2019 for the weekday A.M., P.M., and Saturday midday peak hours are shown in **Figures 13-15**.

DRIVEWAY CLASSIFICATION

Driveways intersecting state roads are classified in the Pennsylvania Code, Title 67, Chapter 441. Low volume driveways are used by 25 to 750 vehicles per day. A medium volume driveway is used by 750 to 1500 vehicles per day. High volume driveways are used by more than 1500 vehicles per day. Based on the anticipated site trip generation and the assignment of site traffic, the classifications of the site driveways intersecting the state road Dolington Road (S.R. 2075) is listed in **Table 9.**

TABLE 9
DRIVEWAY CLASSIFICATIONS

State Road	Driveway	Weekday Trips	Weekday Vehicles	Driveway Type
Dolington Road (S.R. 2075)	Full-Access Intersection	136	68	Low Volume
Quarry Road	Full-Access Intersection	150	75	Low Volume

Note: A "trip" equals an entering or an exiting vehicle. Therefore, weekday vehicles = weekday trips/2.

LEVELS OF SERVICE FOR AN INTERSECTION

For analysis of intersections, level of service is defined in terms of delay, which is a measure of driver discomfort and frustration, fuel consumption, and lost travel time. LOS criteria is stated in terms of control delay per vehicle for a one-hour analysis period. Control delay includes initial deceleration delay, queue move-up time, stopped delay, and final acceleration delay. The criteria are shown in **Table 10**. Delay, as it relates to level of service, is a complex measure and is dependent upon a number of variables. For signalized intersections, these variables include the quality of vehicle progression, the cycle length, the green time ratio, and the volume/capacity ratio for the lane group in question. For unsignalized intersections, delay is related to the availability of gaps in the flow of traffic on the major street and the driver's discretion in selecting an appropriate gap for a particular movement from the minor street (straight across, left or right turn).

TABLE 10
LEVEL OF SERVICE CRITERIA
UNSIGNALIZED AND SIGNALIZED INTERSECTIONS [1]

Level of Service	Control Delay Per Vehicle (Seconds)	
	Signalized	Unsignalized
A	< 10	< 10
B	> 10 and < 20	> 10 and < 15
C	> 20 and < 35	> 15 and < 25
D	> 35 and < 55	> 25 and < 35
E	> 55 and < 80	> 35 and < 50
F	> 80 or v/c > 1.0	> 50 or v/c > 1.0

[1] *Obtained from Exhibits 18-4 and 19-1 of the Transportation Research Board's Highway Capacity Manual 2010*

CAPACITY ANALYSIS METHODOLOGY

Capacity analyses were conducted for the weekday A.M., P.M., and Saturday midday peak hours at the study area intersections. These analyses were conducted according to the methodologies contained in the 2010 *Highway Capacity Manual* (HCM) using *Synchro 8* software, a Trafficware product.

The following conditions were analyzed, as applicable:

- Existing conditions;
- 2019 Base conditions (Build-out year without development);
- 2019 Projected conditions (Build-out year with development).

It should be noted that based on methodologies contained in Chapter 10 of PennDOT's Publication 46, TPD adjusted the following 2010 HCM default values in the *Synchro 8* capacity analysis. These adjustments were made at the signalized intersections within the study area for all time periods based on the study area location being classified as Suburban:

In addition, capacity analyses were conducted at the proposed site driveway intersections under the 2018 projected conditions. The capacity analysis worksheets are included in **Appendix C**. The PennDOT-approved signal plans are included in **Appendix D**.

PennDOT's Transportation Impact Study Guidelines outlined in Strike-Off Letter 470-09-4, dated February 12, 2009 contain the following criteria regarding levels of service:

- Page 29 of the Guidelines state that if evaluation of the With Development Horizon Year Scenario to the Without Development Horizon Year Scenario indicates that the overall intersection level of service has dropped, the applicant will be required to mitigate the level of service if the increase in overall intersection delay is greater than 10-seconds. If the overall intersection delay increase is less than or equal to 10-seconds, mitigation of the intersection will not be required.
- Page 29 of the Guidelines state that for mitigation scenarios, applicants are expected to mitigate the overall intersection LOS to the original Without Development LOS; the 10-second delay variance is not applied to mitigation scenarios. Applicants may be required to address available storage and queue lengths at critical movements or approaches even if the overall LOS requirements are met.
- Page 31 of the Guidelines state that if signalization is the preferred alternative for mitigation, overall intersection LOS C in rural areas and LOS D in urban areas is acceptable.
- Page 31 of the Guidelines states new signalized or unsignalized intersection established to serve as access to the development shall be designed to operate at minimum LOS C for rural areas, and minimum LOS D for urban areas.

LEVELS OF SERVICE IN THE STUDY AREA

Level of service (LOS) matrices for the study area intersections are shown in **Table 11** for the weekday A.M., weekday P.M., and Saturday midday peak hours. Per PennDOT standards, the signal timings at the signalized study area intersections have been optimized under base conditions and projected conditions.

TABLE 11
LEVEL OF SERVICE DELAY (SECONDS) SUMMARY

Intersection	Movement	Weekday A.M. Peak Hour			Weekday P.M. Peak Hour			Saturday Midday Peak Hour		
		Existing Condition	Year 2019		Existing Condition	Year 2019		Existing Condition	Year 2019	
			Base	Projected		Base	Projected		Base	Projected
Yardley Newtown Road (S.R. 0332) & Mirror Lake Road (S.R. 2087)	EB T	A	A	A	A	A	A	A	A	A
	EB R	A	A	A	A	A	A	A	A	A
	WB L/T	A*	A*	A*	B*	B*	B*	A*	A*	A*
	NB L	C	C	C	C	C	C	C	C	C
	NB R	C	C	C	C	C	C	C	C	C
	ILOS	**A (8.3)**	**A (8.3)**	**A (8.3)**	**A (9.1)**	**A (9.1)**	**A (9.3)**	**A (8.9)**	**A (9.0)**	**A (9.0)**
Yardley Newtown Road (S.R. 0332) & Creamery Road	EB L	A	A	A	A	B	B	A	A	A
	EB T	A	A	A	B	B	B	A	A	A
	WB T/R	B	B	B	B	B	B	A	B	B
	SB L/R	D	D	D	D	D	D	C	B	B
	ILOS	**B (18.0)**	**B (18.8)**	**B (18.9)**	**C (21.1)**	**C (22.5)**	**C (24.9)**	**B (10.4)**	**B (10.1)**	**B (11.1)**
Quarry Road & Creamery Road	WB L/T	B	B	B	A	A	A	A	A	A
	NB L	F (86.2)	F (119.4)	F (125.1)	C	C	C	B	B	B
	NB R	B	B	B	B	B	B	A	A	A
	ILOS	**C (18.5)**	**C (24.3)**	**D (25.5)**	**A (7.6)**	**A (7.8)**	**A (8.6)**	**A (6.6)**	**A (6.6)**	**A (7.0)**
Quarry Road & Dolington Road (S.R. 2075)	EB L/T	A	A	A	A	A	A	A	A	A
	SB L/R	B	B	B	B	B	B	B	B	B
	ILOS	**A (3.4)**	**A (3.5)**	**A (3.5)**	**A (4.3)**	**A (4.4)**	**A (4.7)**	**A (4.1)**	**A (3.8)**	**A (4.5)**
Dolington Road (S.R. 2075) & Site Driveway	EB L	--	--	A	--	--	B	--	--	A
	EB R	--	--	A	--	--	A	--	--	A
	NB L/T	--	--	A	--	--	A	--	--	A
	ILOS	**--**	**--**	**A (0.0)**	**--**	**--**	**A (0.8)**	**--**	**--**	**A (1.7)**
Quarry Road & Site Driveway/Quarry Hill Court	EB L/T/R	A	A	A	A	A	A	A	A	A
	WB L/T/R	B	B	A	A	A	A	A	A	A
	NB L/T/R	B	B	B	B	B	B	A	A	A
	SB L	--	--	E	--	--	C	--	--	B
	SB T/R	--	--	A	--	--	B	--	--	A
	ILOS	**A (3.2)**	**A (3.2)**	**A (3.3)**	**A (1.3)**	**A (1.3)**	**A (1.6)**	**A (0.6)**	**A (0.5)**	**A (1.8)**

Base = No-Build scenario / Projected = Build scenario
**=Advanced left turn/through phase. HCM analysis not applicable*

As shown in **Table 11**, all study area intersections will operate at the same overall intersection level of service (ILOS) under base conditions (no-build) and projected conditions (build), or fall within PennDOT's allowable 10-second variance in intersection delay.

All approaches and turning movements at the site driveway intersections will operate at **LOS E or better** under 2019 projected conditions during the weekday A.M., P.M., and Saturday midday peak hours. All levels of service at the study area intersection comply with the requirement outlined in PennDOT's TIS Guidelines.

95TH PERCENTILE QUEUE ANALYSIS

Queue analyses were conducted at the study area intersections using *Synchro 8* software. For this analysis, the 95th percentile queue is defined as the queue length that is exceeded in 5% of the signal cycles. As an example, for a signal with a 90-second cycle, this means that the 95th percentile queue length will be exceeded during 2

of the 40 signal cycles that occur during the peak hour. The queue analysis results are summarized in **Table 12** for the analyzed peak hours.

TABLE 12
95TH PERCENTILE QUEUE ANALYSIS

Intersection	Movement	Storage Length	Weekday A.M. Peak Hour		Weekday P.M. Peak Hour		Saturday Midday Peak Hour	
			Year 2019		Year 2019		Year 2019	
			Base	Projected	Base	Projected	Base	Projected
Yardley Newtown Road (S.R. 0332) & Mirror Lake Road (S.R. 2087)	EB T	--	148	148	200	213	123	135
	EB R	115	28	28	78	78	38	38
	WB L/T	--	224*	224*	343*	368*	153*	171*
	NB L	140	133	133	98	98	110	110
	NB R	--	123	123	210	215	155	165
Yardley Newtown Road (S.R. 0332) & Creamery Road	EB L	110	118	123	160	170	58	73
	EB T	--	60	60	238	238	78	85
	WB T/R	--	253	253	203	213	140	158
	SB L/R	--	298	300	343	383	118	145
Quarry Road & Creamery Road	WB L/T	--	25	25	25	25	25	25
	NB L	90	248	253	35	40	25	25
	NB R	--	38	40	25	33	25	25
Quarry Road & Dolington Road (S.R. 2075)	EB L/T	--	25	25	25	25	25	25
	SB L/R	--	30	30	25	33	25	35
Dolington Road (S.R. 2075) & Site Driveway	EB L	--	--	25	--	25	--	25
	EB R	--	--	25	--	25	--	25
	NB L/T	--	--	25	--	25	--	25
Quarry Road & Site Driveway/Quarry Hill Court	EB L/T/R	--	--	25	--	25	--	25
	WB L/T/R	--	35	35	25	25	25	25
	NB L/T/R	--	25	25	25	25	25	25
	SB L	--	--	25	--	25	--	25
	SB T/R	--	--	25	--	25	--	25

**=Advanced left turn/through phase. HCM analysis not applicable*

As shown in **Table 12,** all of the projected condition queues will be accommodated within the existing storage lengths, or if comparable to the base (no-build) queue with construction and full build-out of the proposed development. Queue analysis worksheets are included with the capacity analysis worksheets provided in **Appendix D**.

SITE CIRCULATION REVIEW

Site Access

Access to the site is to be served by two full access driveways; one located on Dolington Road (S.R. 2075) and one located on Quarry Road. The addition of the Quarry Road access was added to the project to provide a second option for motorists who are looking to access the western portion of the site.

Pedestrian Accommodations

With the proposed access to Quarry Road, it would allow for players/students and parents from nearby residential developments and schools access to the site in lieu of walking up Dolington Road. Also, to

alleviate existing parking issues at the nearby schools during school events, motorists will be allowed to park in the complex and cross Quarry Road.

Event Operation/Emergency

Due to the site having distinct traffic patterns, having two access points for the site will reduce the amount of site congestion when games are starting or ending. Along with reducing congestion, two access points are optimal during emergency situations in the event one of the accesses becomes blocked.

AUXILIARY TURN LANE ANALYSIS

Methodology

TPD evaluated auxiliary turn lane warrants at the intersection of Dolington Road (S.R. 2075) and Site Drvieway. The warrant analysis was conducted according to the methodologies contained in Chapter 11 of PennDOT's *Publication 46* and Strike-Off Letter 470-08-07, and where warrants were satisfied, the storage length was determined using the 95th percentile queues calculated using *Synchro 8* software for signalized intersections.

Findings:

Dolington Road (S.R. 2075) and Site Driveway

Based on the aforementioned methodology, auxiliary turn lane warrants **are not satisfied** for a northbound left-turn lane during the weekday A.M., weekday P.M., and Saturday midday peak hours for the site driveway. To help with overall operation and possible onsite queuing caused by tournaments, **TPD recommends installing a right-turn lane and left turn lane at the site driveway.**

Quarry Road and Site Driveway

Based on the aforementioned methodology, auxiliary turn lane warrants **are not satisfied** for a westbound left-turn lane during the weekday A.M., weekday P.M., and Saturday midday peak hours for the site driveway. To help with overall operation and possible onsite queuing caused by tournaments, **TPD recommends installing a right-turn lane at the site driveway.**

Auxiliary turn lane warrant analysis worksheets are contained in **Appendix E**.

TRAFFIC SIGNAL WARRANT ANALYSIS

Methodology

A traffic signal warrant analysis was conducted at the intersections of Quarry Road & Creamery Road and Quarry Road & Dolington Road (S.R. 2075) in accordance with PennDOT Publication 212, *Official Traffic Control Devices*, Subchapter D, "Highway Traffic Signals.

TPD examined traffic and pedestrian volumes at the intersection to determine if any of the following warrants are currently satisfied:

- Warrant 2, Four-Hour Vehicular Volume Warrant;
- Warrant 3, Peak Hour Volume Warrant.

Findings:

Quarry Road and Creamery Road

Warrant 2 - Four-Hour Vehicular Volume

Warrant 2, Four-Hour Volume, is satisfied when for each of any four hours of an average day, the volumes are plotted on a graph which is provided as part of the warrant. If the plotted points all fall above the curve on the graph, then the warrant is met. **Warrant 2 is not satisfied for Quarry Road and Creamery Road.**

Warrant 3 - Peak Hour Volume

Warrant 3, Peak Hour Volume, is intended for application when traffic conditions are such that for one hour of the day minor street traffic suffers undue delay in entering or crossing the major street. To determine if the warrant is met, the volumes for both roadways are plotted on a graph which is provided as part of the warrant. If the plotted point falls above the curve on the graph, then the warrant is met. **Warrant 3 is not satisfied for Quarry Road and Creamery Road.**

Quarry Road and Dolington Road (S.R. 2075)

Warrant 2 - Four-Hour Vehicular Volume

Warrant 2, Four-Hour Volume, is satisfied when for each of any four hours of an average day, the volumes are plotted on a graph which is provided as part of the warrant. If the plotted points all fall above the curve on the graph, then the warrant is met. **Warrant 2 is not satisfied for Quarry Road and Dolington Road (S.R. 2075).**

Warrant 3 - Peak Hour Volume

Warrant 3, Peak Hour Volume, is intended for application when traffic conditions are such that for one hour of the day minor street traffic suffers undue delay in entering or crossing the major street. To determine if the warrant is met, the volumes for both roadways are plotted on a graph which is provided as part of the warrant. If the plotted point falls above the curve on the graph, then the warrant is met. **Warrant 3 is not satisfied for Quarry Road and Dolington Road (S.R. 2075).**

The warrant analysis worksheets are included in **Appendix F.**

ALTERNATIVES ANALYSIS – INTERSECTION CONTROL

TPD conducted capacity analysis for the intersections of Quarry Road & Dolington Road (S.R. 2075) and Quarry Road & Creamery Road for realignment of Dolington Road (S.R. 2075) to create a four-way intersection with Creamery Road. The results of the capacity analysis are summarized in **Table 13** below.

TABLE 13
LEVEL OF SERVICE DELAY (SECONDS) SUMMARY
2019 PROJECTED CONDITIONS

Intersection	Movement	Two-way Stop Controlled	All-way Stop Controlled
Weekday A.M. Peak Hour			
Quarry Road & Dolington Road (S.R. 2075)/Creamery Road	EB L/T/R	A (8.5)	C (21.6)
	WB L/T/R	A (9.5)	C (15.7)
	NB L	F (71.9)	C (15.7)
	NB T/R	B (14.5)	B (12.9)
	SB L/T/R	D (31.0)	B (13.2)
	ILOS	**C (19.3)**	**C (16.9)**
Weekday P.M. Peak Hour			
Quarry Road & Dolington Road (S.R. 2075)/Creamery Road	EB L/T/R	A (8.4)	B (11.3)
	WB L/T/R	A (8.9)	B (13.8)
	NB L	D (27.9)	B (11.2)
	NB T/R	C (21.4)	B (13.5)
	SB L/T/R	D (26.1)	B (11.6)
	ILOS	**B (14.8)**	**B (12.6)**
Saturday Midday Peak Hour			
Quarry Road & Dolington Road (S.R. 2075)/Creamery Road	EB L/T/R	A (8.3)	A (9.0)
	WB L/T/R	A (8.4)	A (9.9)
	NB L	B (13.9)	A (9.4)
	NB T/R	B (12.7)	A (9.8)
	SB L/T/R	C (15.4)	A (9.6)
	ILOS	**A (9.9)**	**A (9.6)**

As shown in **Table 13**, an all-way stop would provide the best overall intersection level of service (ILOS). Due to the existing intersection configuration that operates under acceptable levels after the site is in use, **TPD does not recommend the realignment of Dolington Road.**

RECOMMENDATIONS AND CONCLUSIONS

The recommendations and conclusions for this Transportation Impact Study are identified in the Executive Summary.

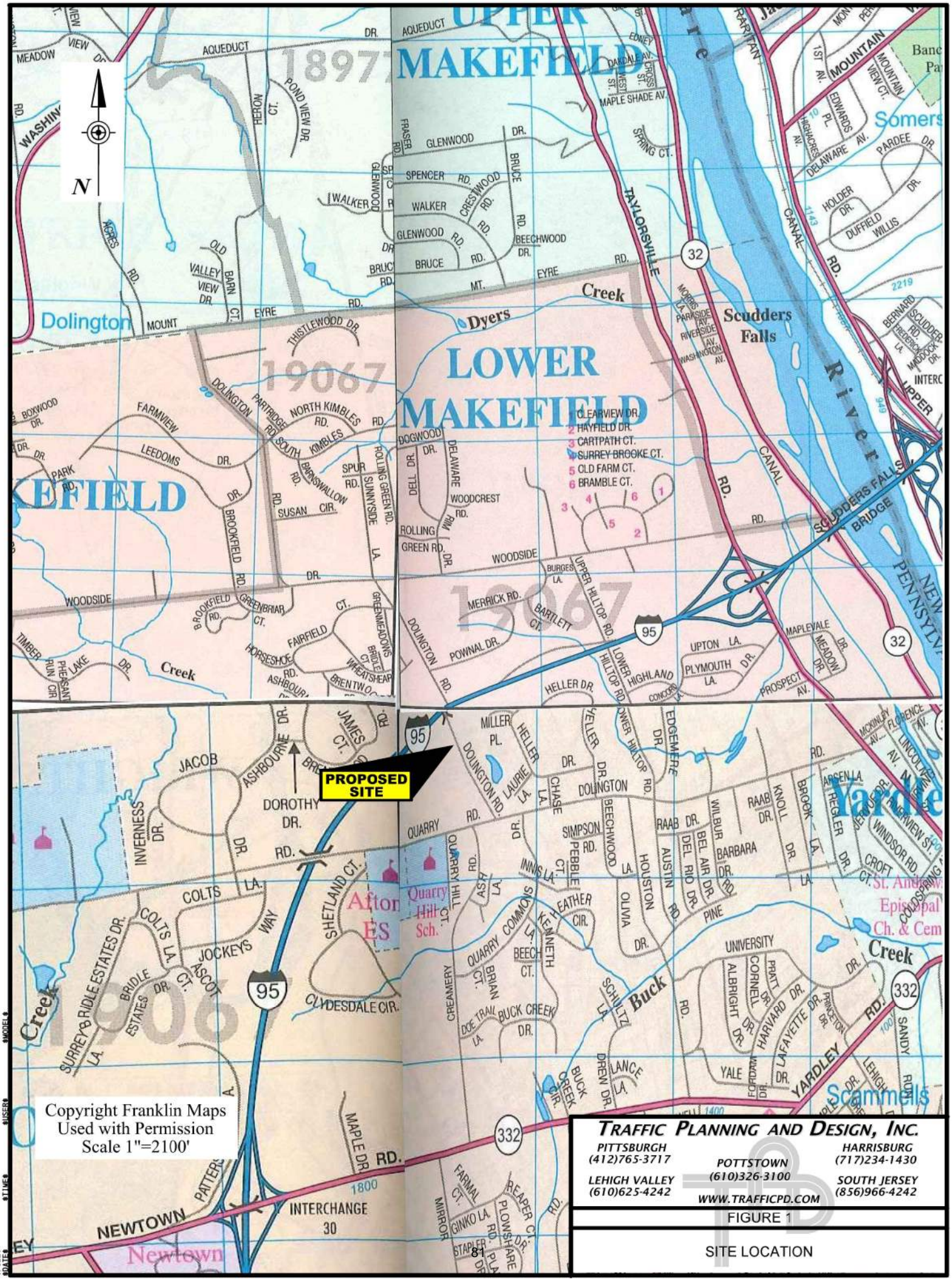

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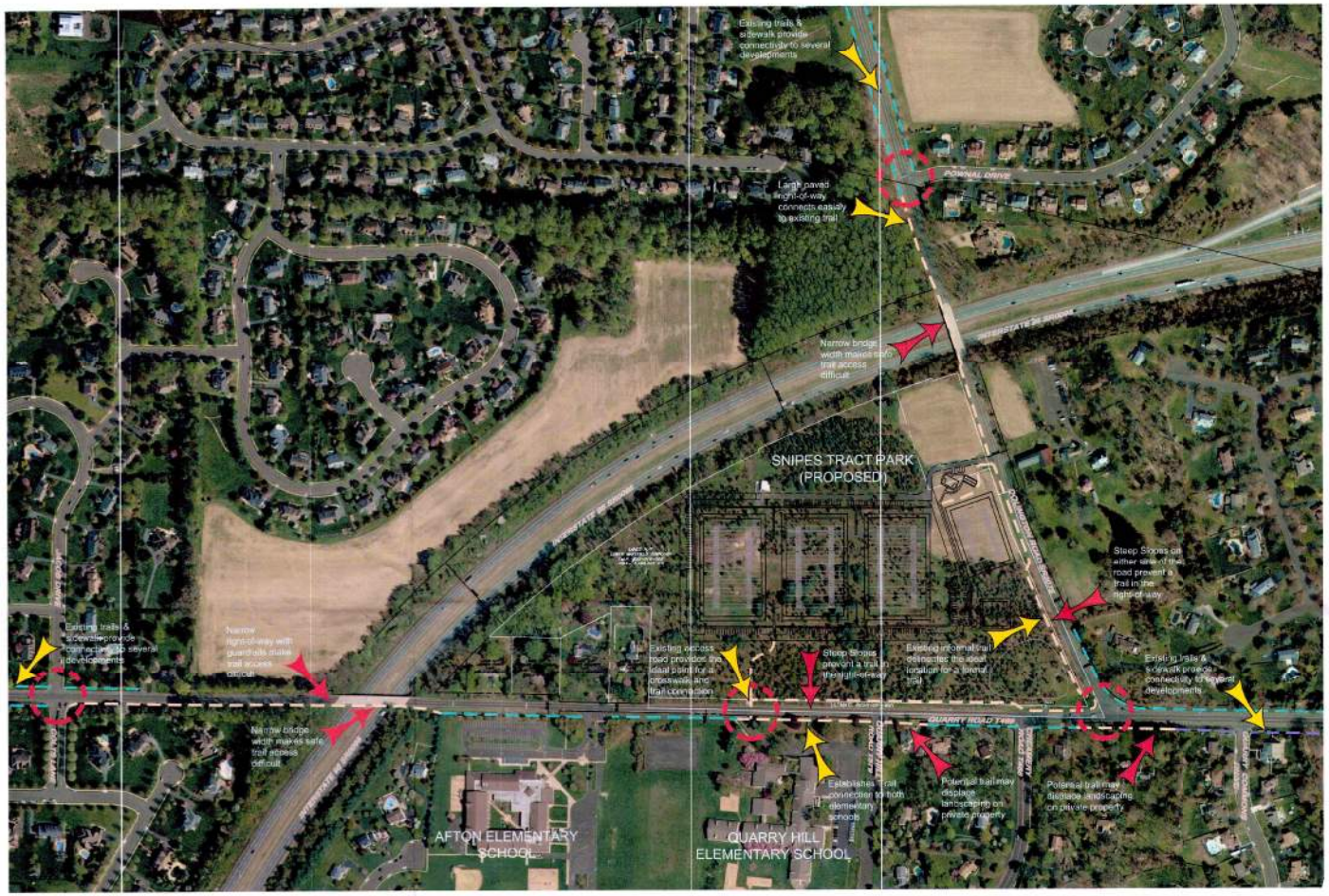
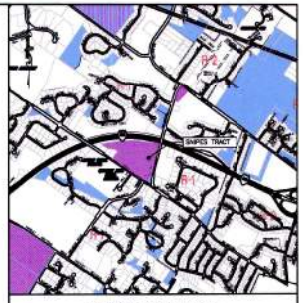
FIGURE 1

SITE LOCATION

$FILE$
$DATE$ $TIME$ $USER$ $MODEL$





LOCATION MAP

SCALE: 1"=2000'
SOURCE: LOWER MAKEFIELD TOWNSHIP STREET MAP

LEGEND

- EXISTING ASPHALT PEDESTRIAN TRAIL (8' WIDE)
- EXISTING CONCRETE PEDESTRIAN SIDEWALK (5' WIDE)
- POTENTIAL PEDESTRIAN CONNECTIONS
- OPPORTUNITY
- CONSTRAINT
- EXISTING INTERSECTION, INTERVENTION REQUIRED FOR PEDESTRIAN SAFETY

GENERAL NOTES

Aerial photography has been obtained from 2015 PASDA Southeast PA Aerial Photography.

The existing information contained herein was obtained from field observation on April 29, 2016.

KEY:

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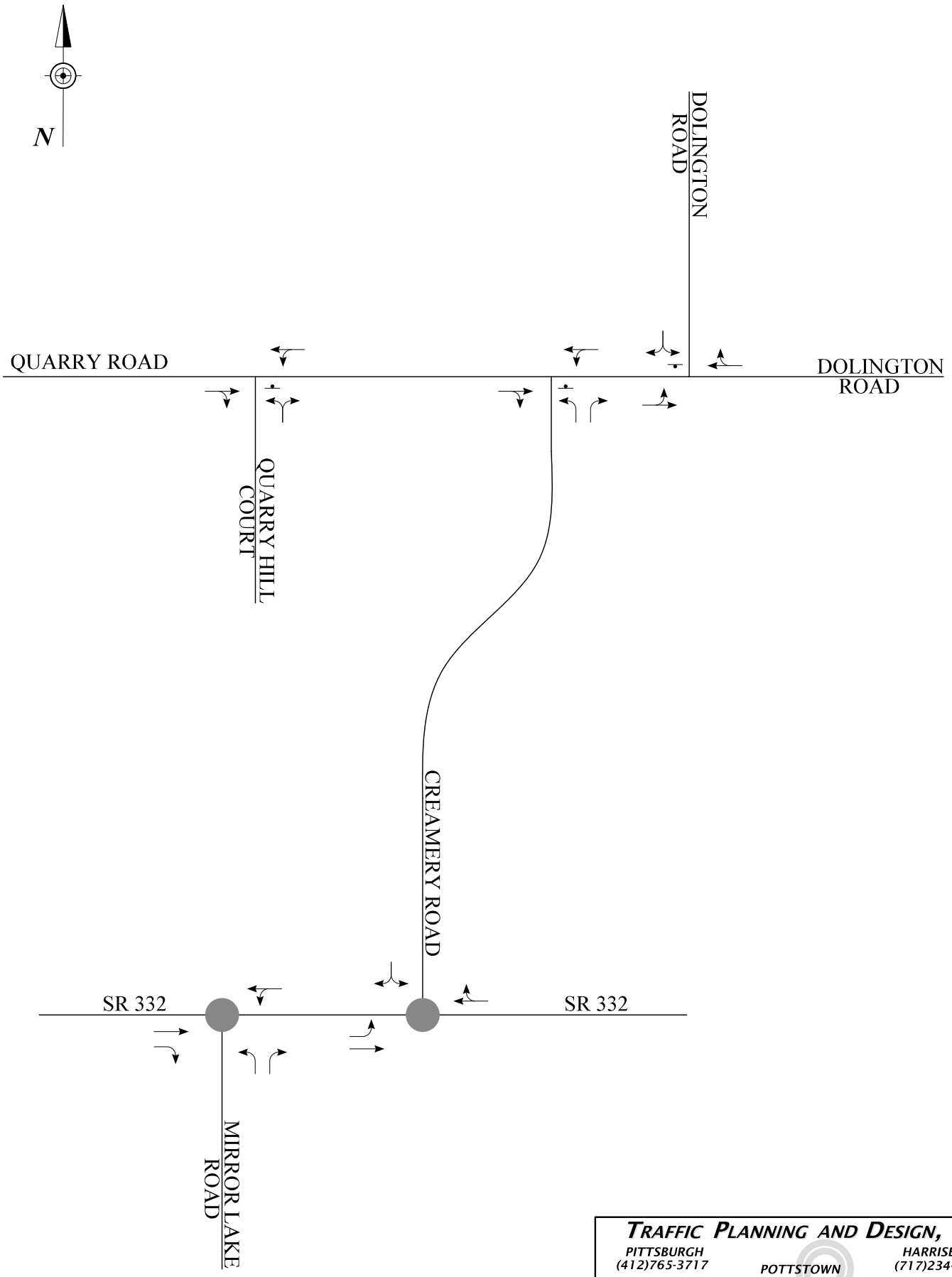
FIGURE 2

SITE PLAN



KEY:

STOP CONTROLLED

SIGNALIZED INTERSECTION

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FIGURE 3

LANE CONFIGURATIONS AND INTERSECTION CONTROL

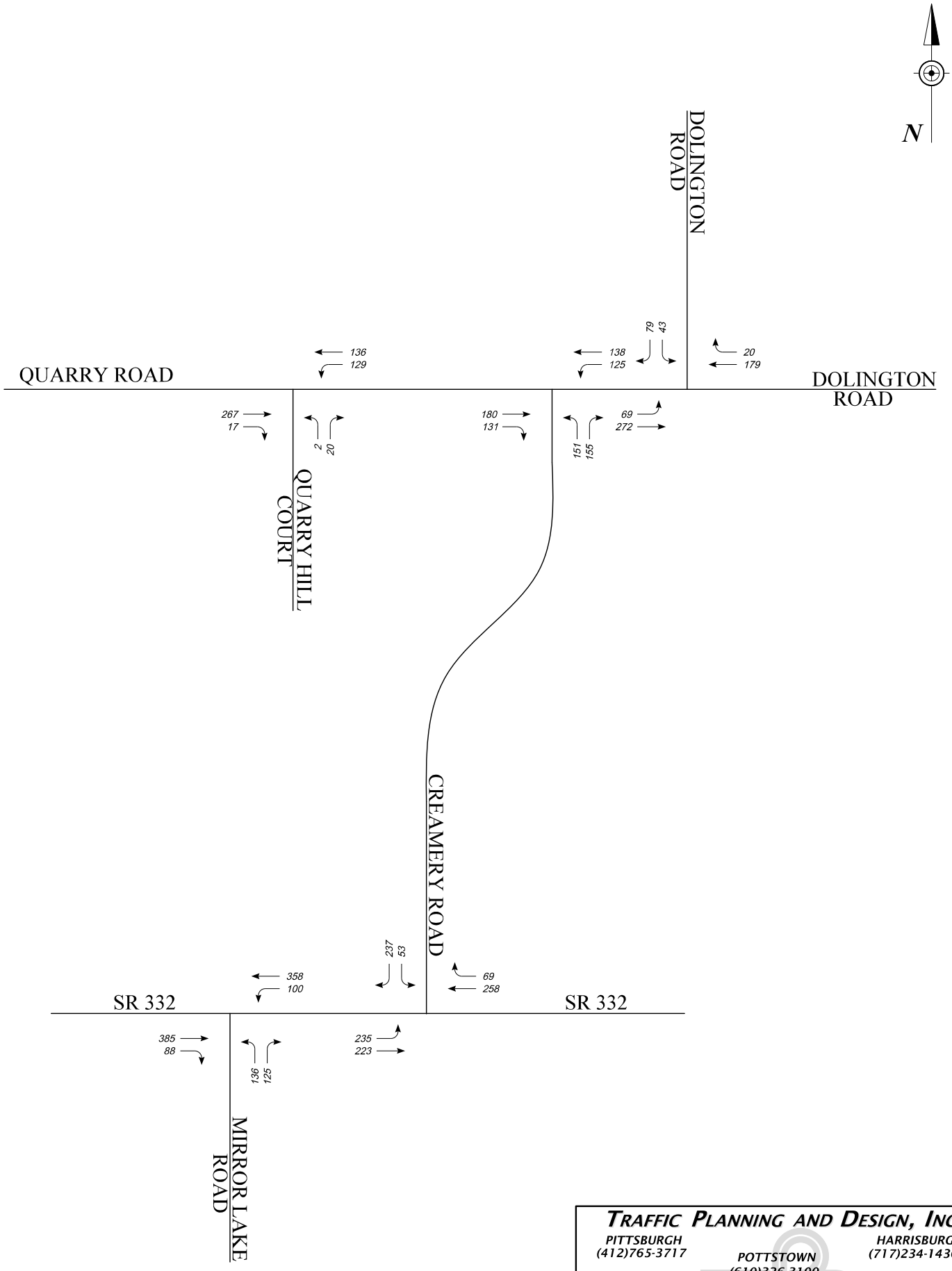

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FIGURE 4

EXISTING CONDITIONS
WEEKDAY A.M PEAK HOUR
TRAFFIC VOLUMES

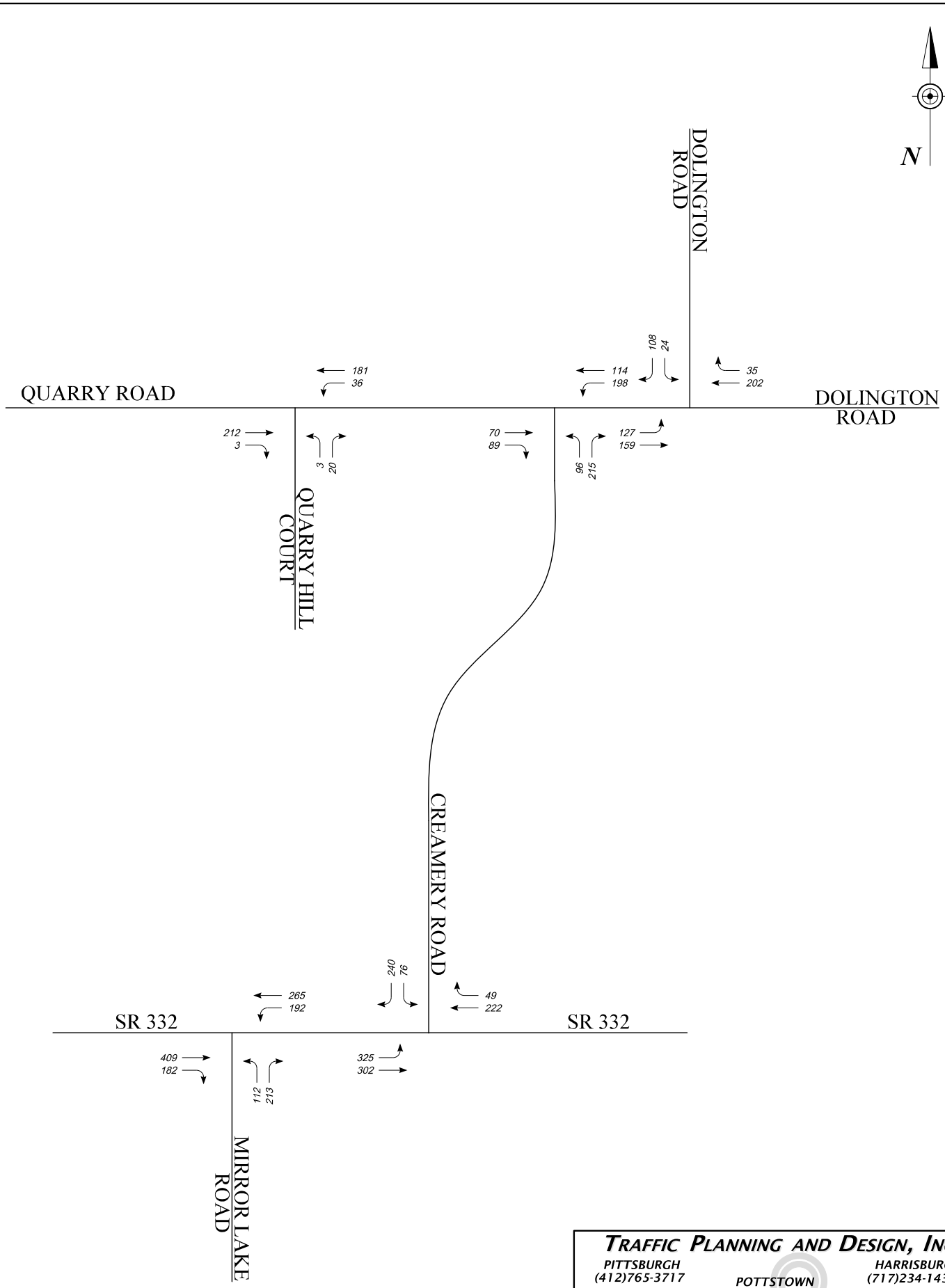

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FIGURE 5

EXISTING CONDITIONS
WEEKDAY P.M PEAK HOUR
TRAFFIC VOLUMES

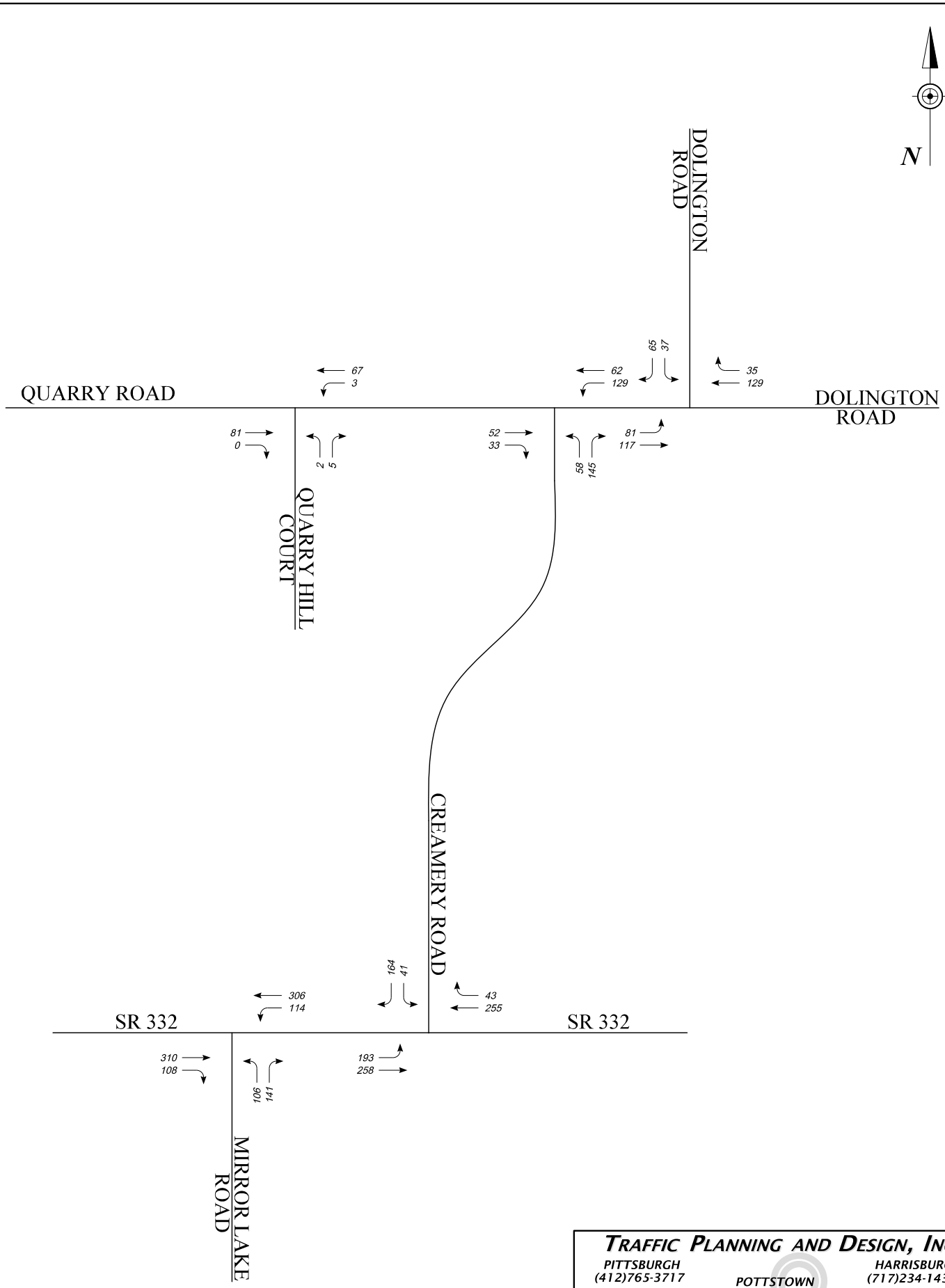

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FIGURE 6

EXISTING CONDITIONS
MIDDAY SAT PEAK HOUR
TRAFFIC VOLUMES

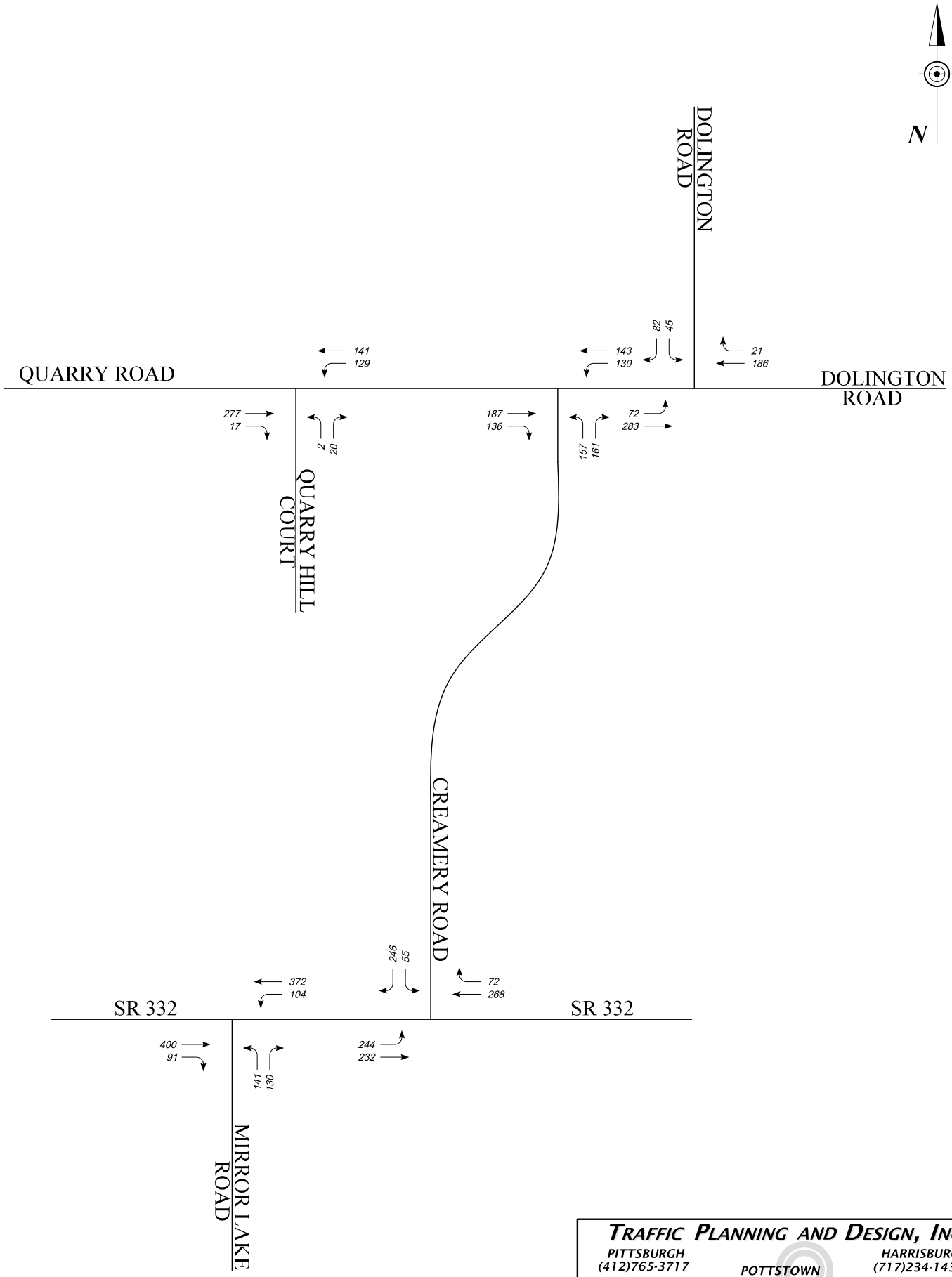

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FIGURE 7

2019 BASE CONDITIONS
WEEKDAY A.M PEAK HOUR
TRAFFIC VOLUMES

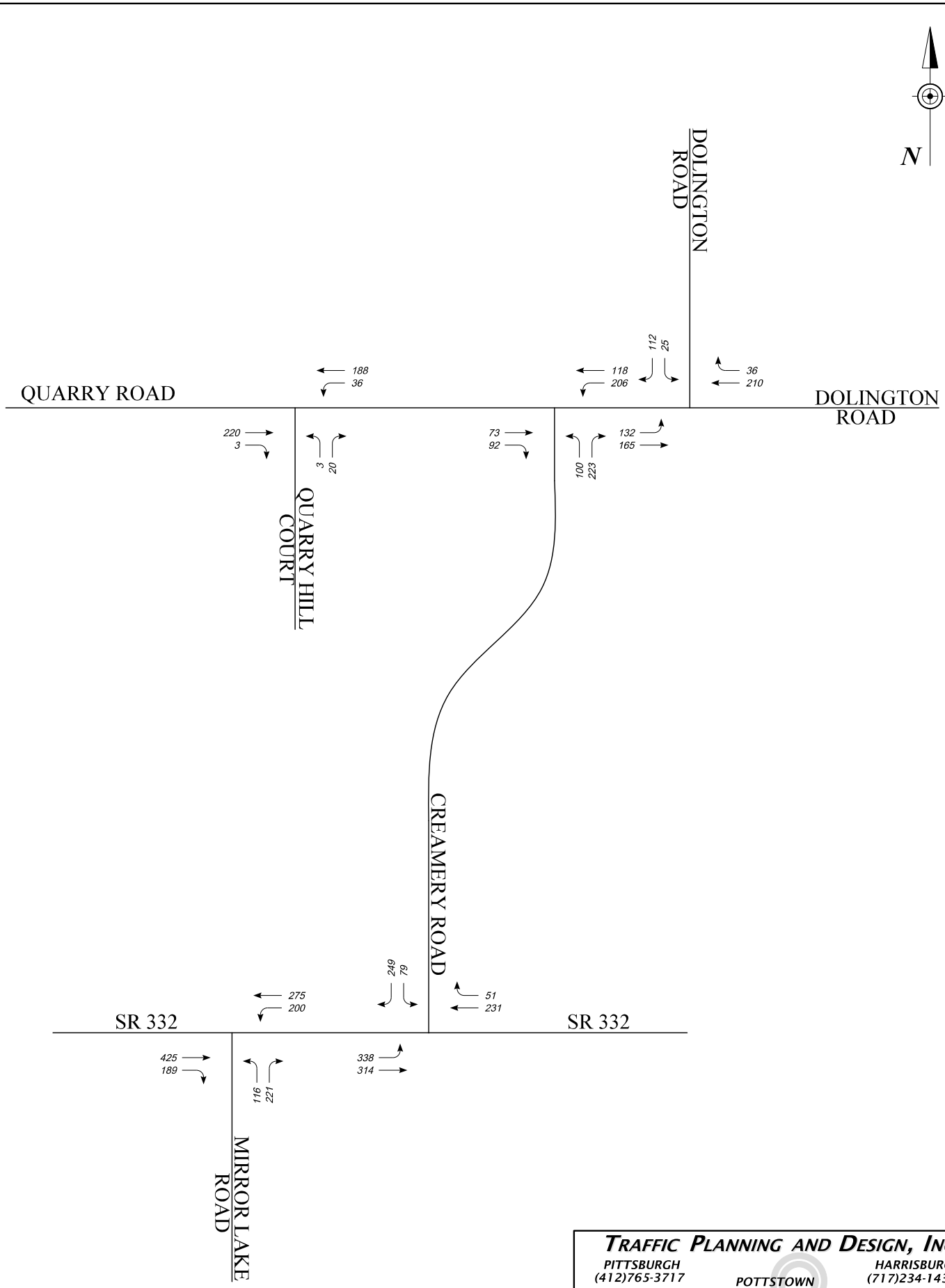

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FIGURE 8

2019 BASE CONDITIONS
WEEKDAY P.M. PEAK HOUR
TRAFFIC VOLUMES

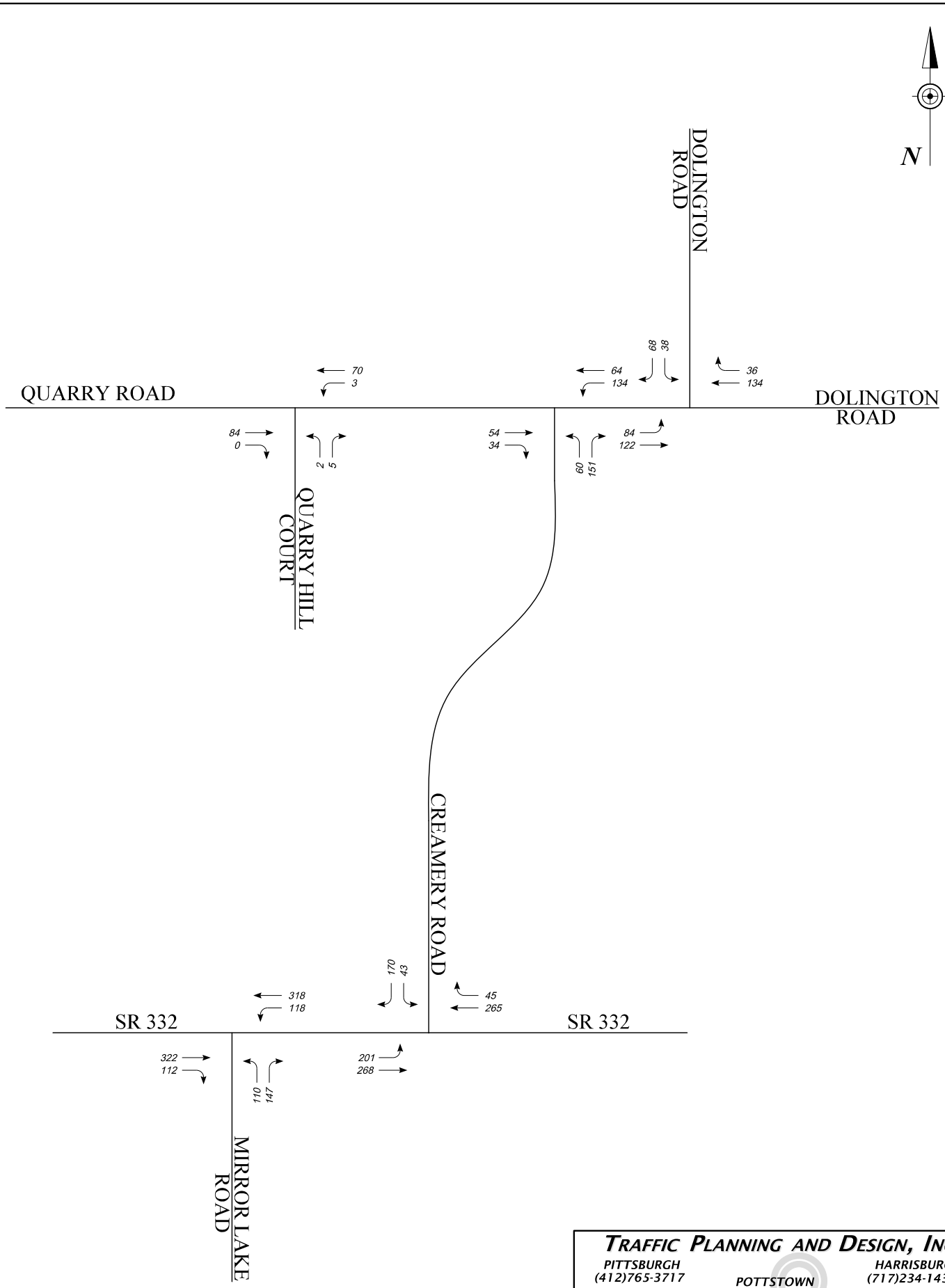

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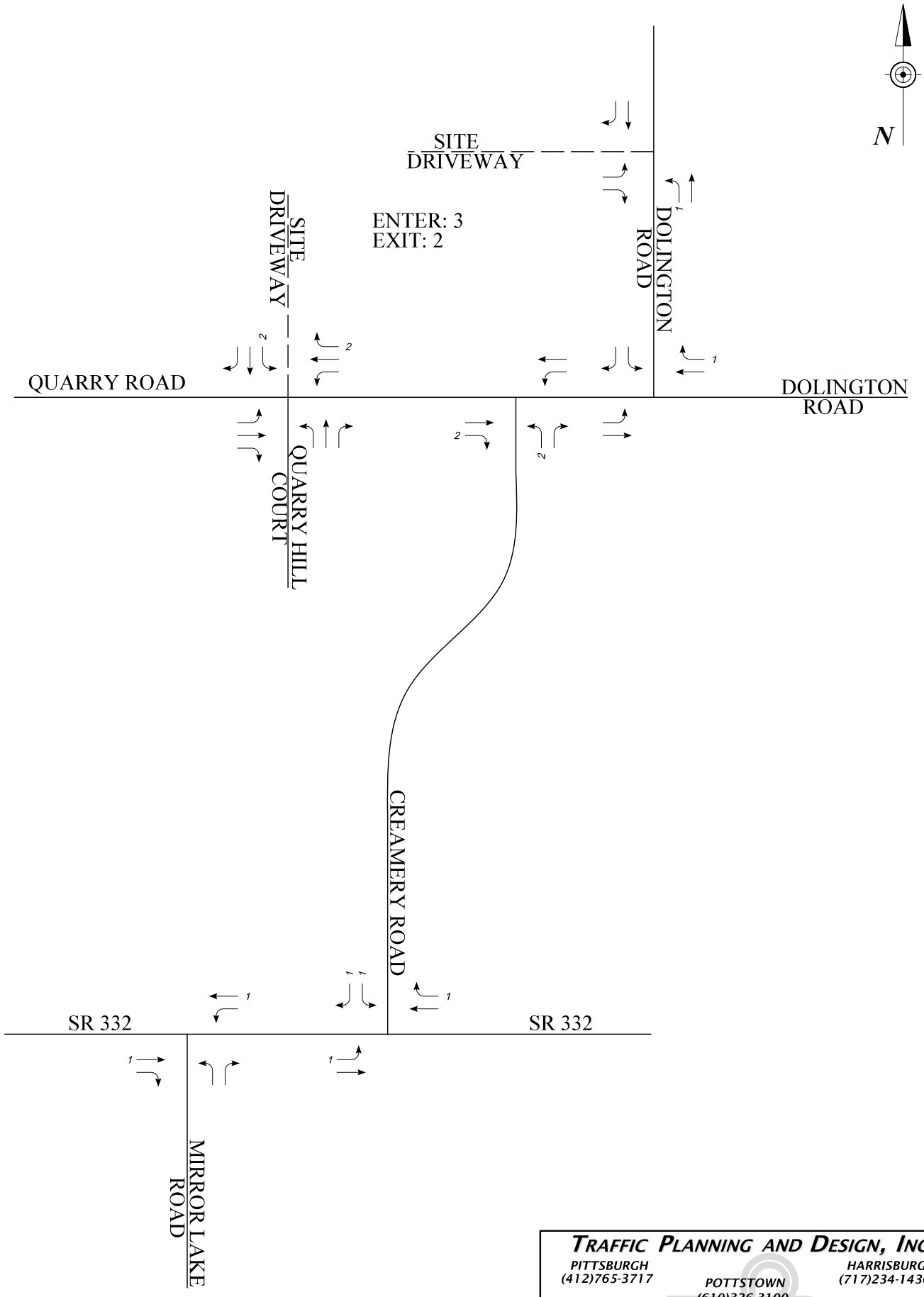
FIGURE 9

2019 BASE CONDITIONS
SAT MIDDAY PEAK HOUR
TRAFFIC VOLUMES



KEY:

- - - - - - PROPOSED DRIVEWAY

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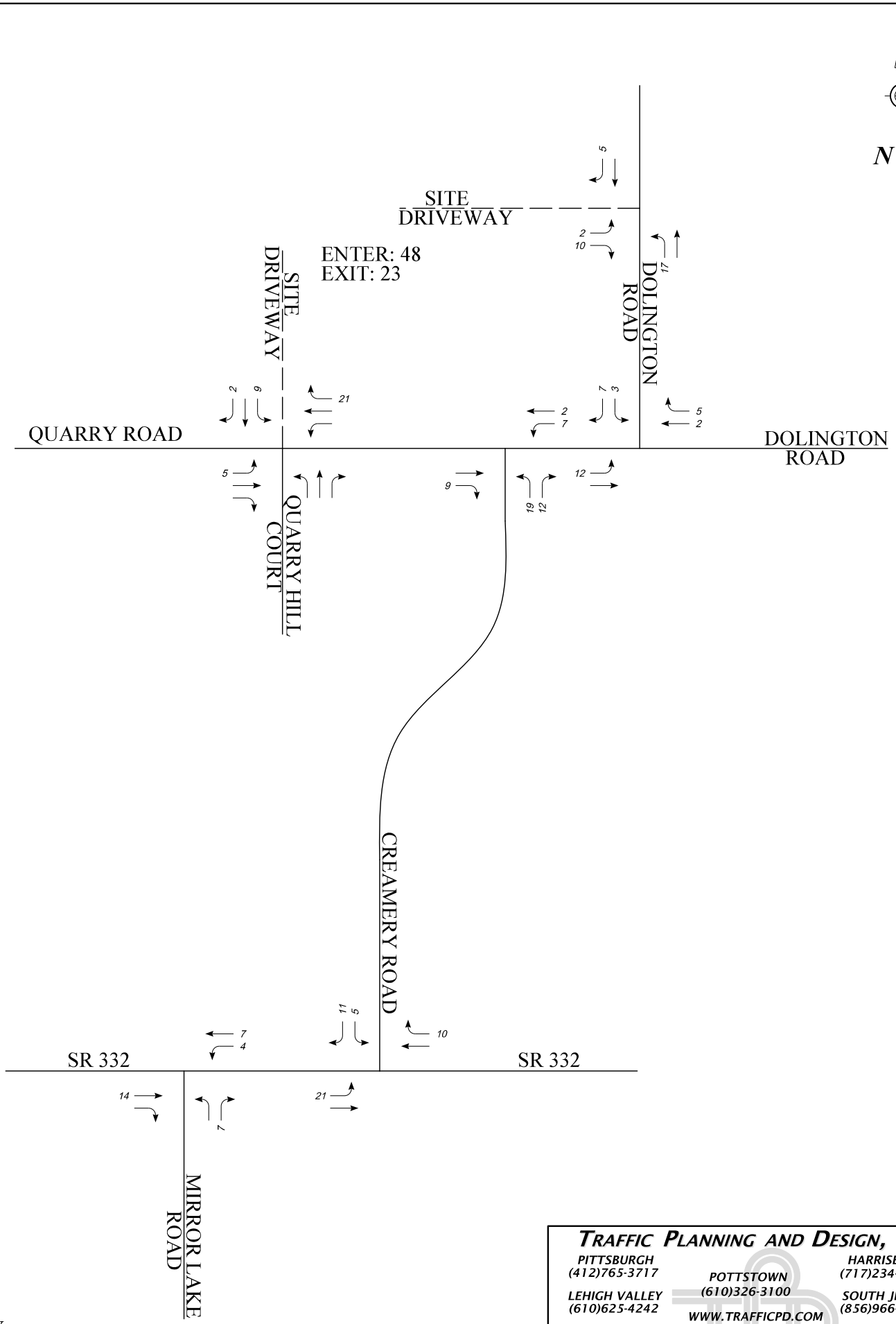
FIGURE 10

TRIP DISTRIBUTION
WEEKDAY A.M. PEAK HOUR
NEW TRIPS



KEY:

– – – – – – **PROPOSED DRIVEWAY**

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FIGURE 11

TRIP DISTRIBUTION
WEEKDAY P.M. PEAK HOUR
NEW TRIPS

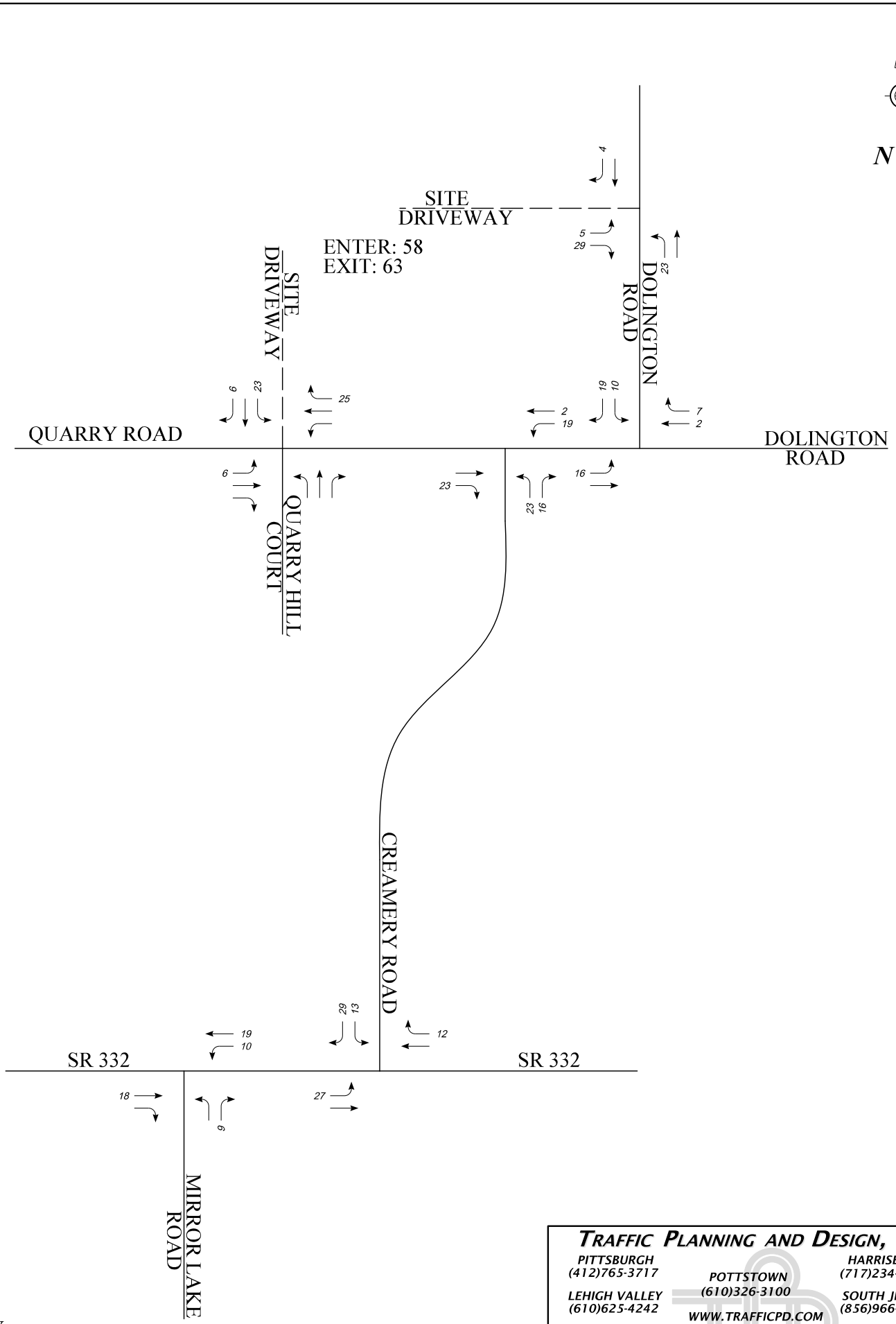

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FIGURE 12

TRIP DISTRIBUTION
SAT MIDDAY PEAK HOUR
NEW TRIPS

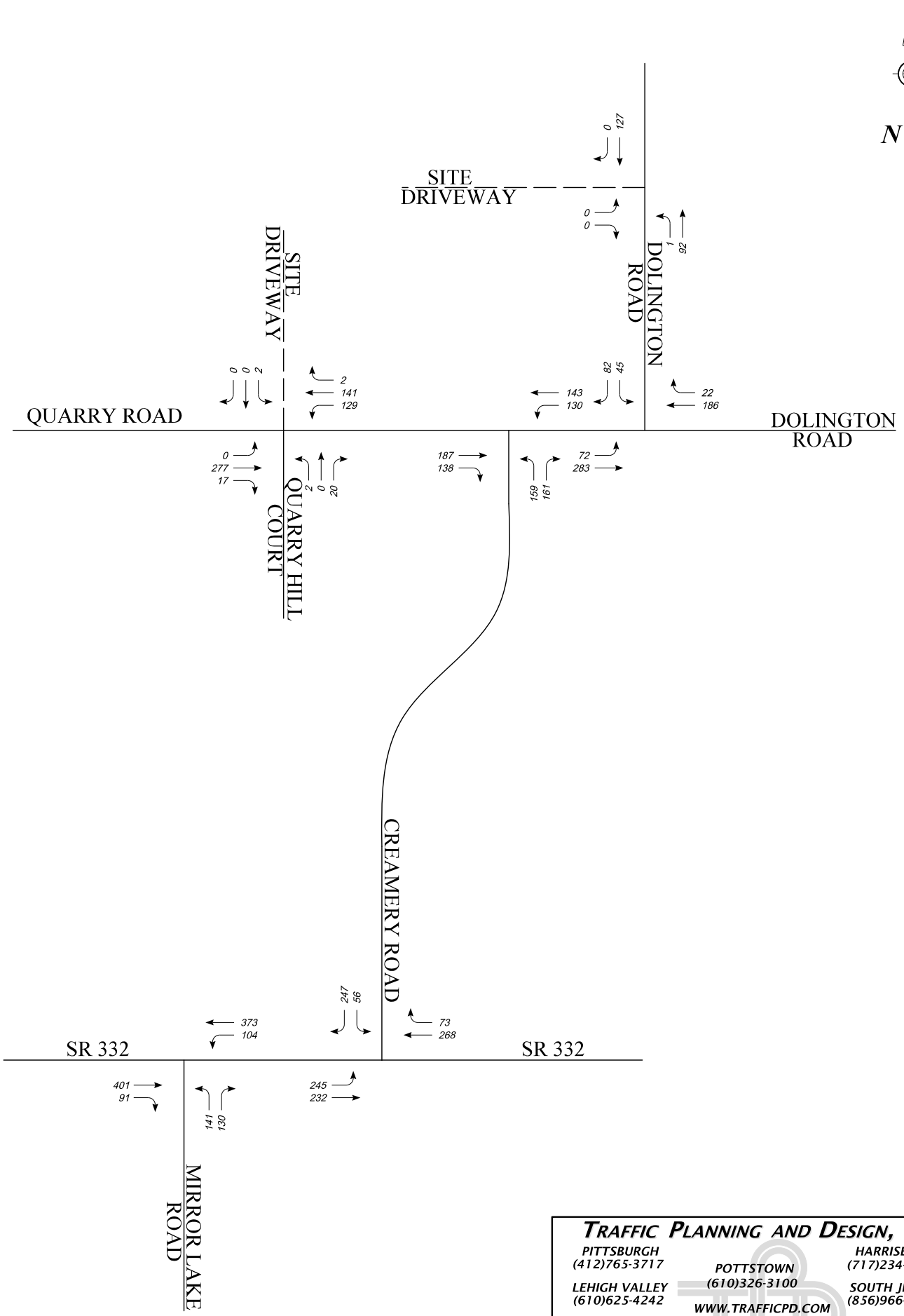

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FIGURE 13

2019 PROJECTED CONDITIONS
WEEKDAY A.M. PEAK HOUR
TRAFFIC VOLUMES

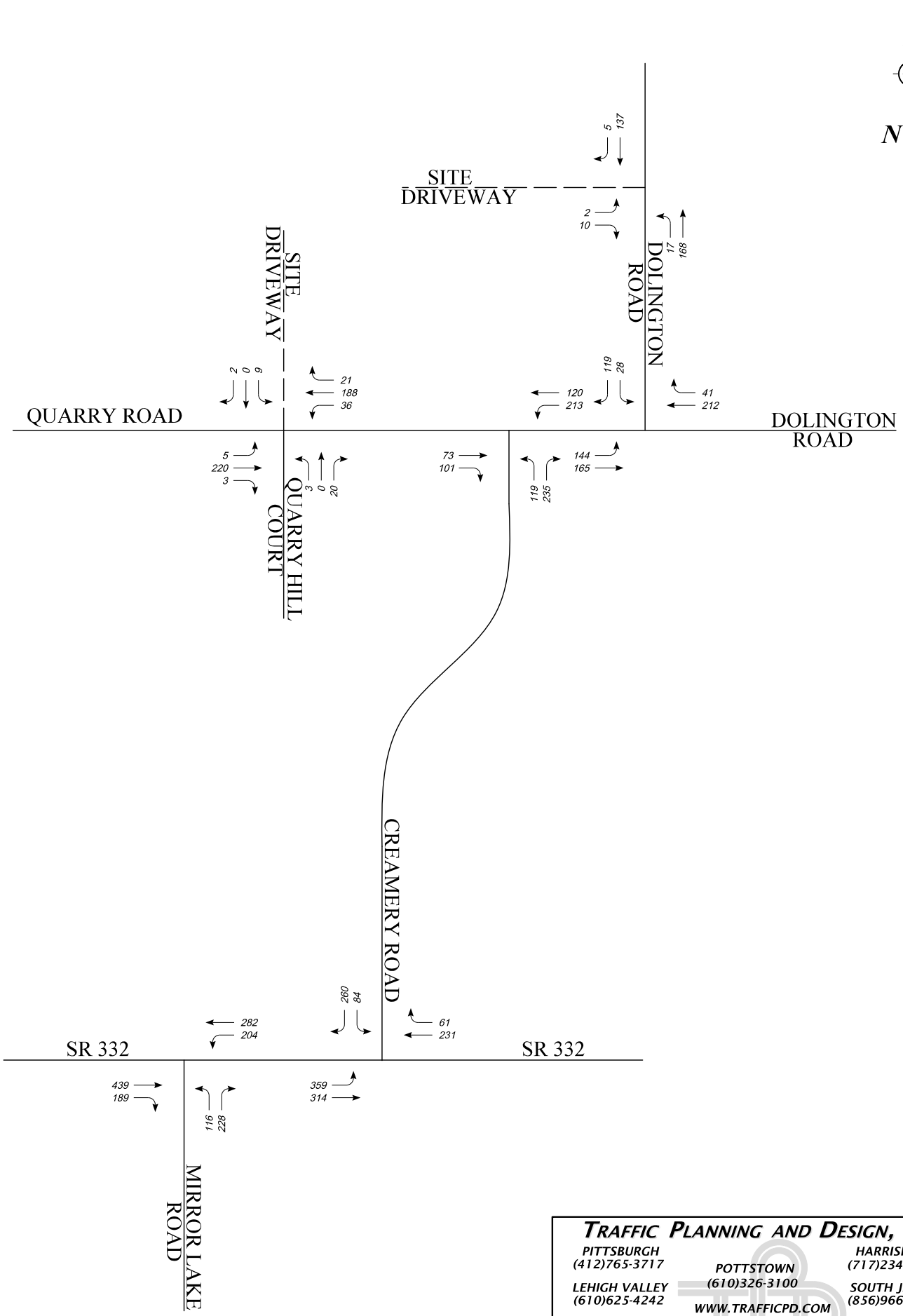

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FIGURE 14

2019 PROJECTED CONDITIONS
WEEKDAY P.M. PEAK HOUR
TRAFFIC VOLUMES

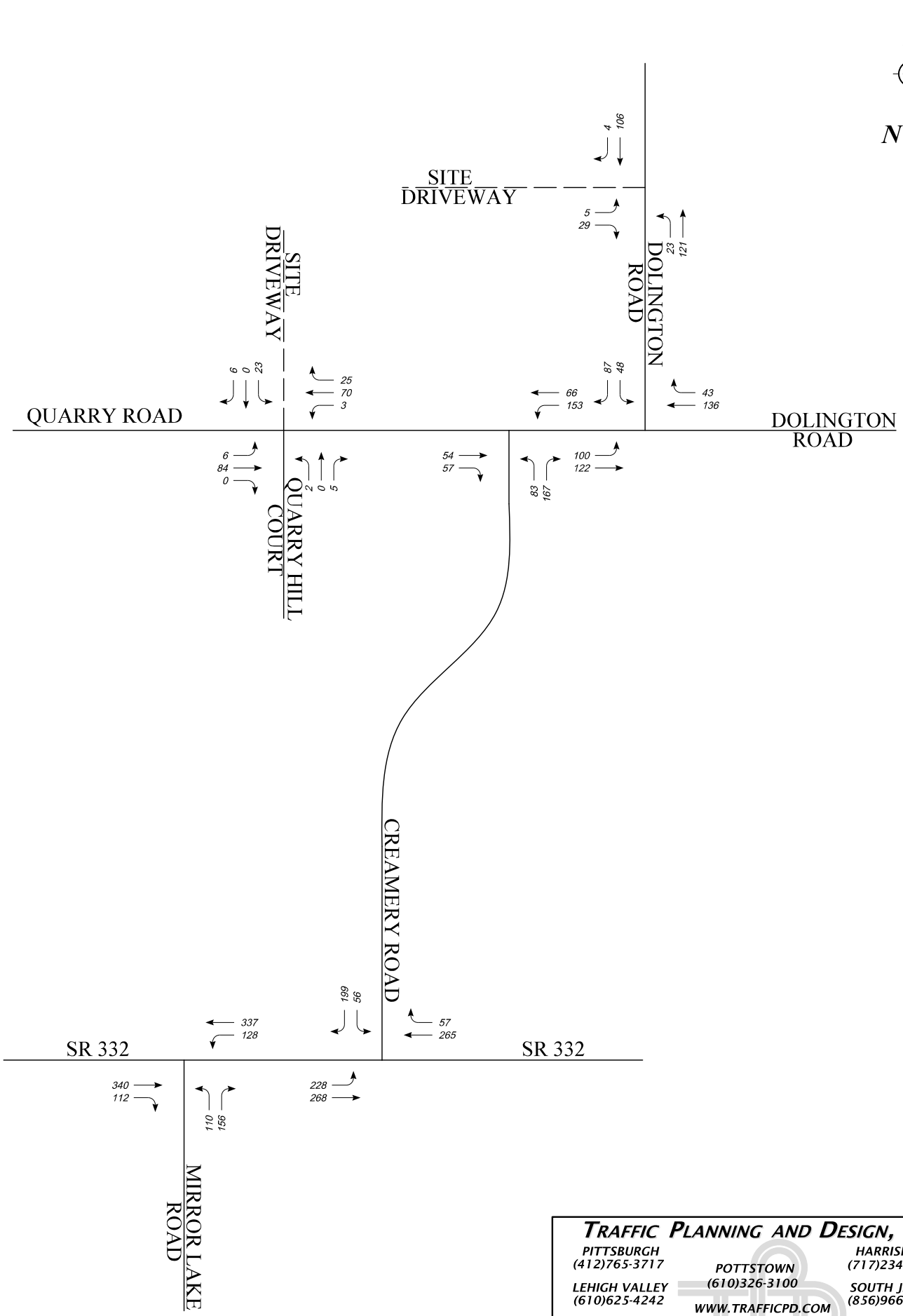

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FIGURE 15

2019 PROJECTED CONDITIONS
SAT MIDDAY PEAK HOUR
TRAFFIC VOLUMES

APPENDIX B

Post Construction Stormwater Management Report

POST CONSTRUCTION STORMWATER MANAGEMENT REPORT

SNIPES TRACT ATHLETIC FIELDS

DOLINGTON ROAD AND QUARRY ROAD
LOWER MAKEFIELD TOWNSHIP
BUCKS COUNTY, PENNSYLVANIA

PROJECT NO. 1677054L

Prepared for:
LOWER MAKEFIELD TOWNSHIP
1100 EDGEWOOD ROAD
YARDLEY, PENNSYLVANIA 19067

NOVEMBER 18, 2016
Revised MARCH 2, 2017
Prepared by:

BOUCHER & JAMES, INC.
Consulting Engineers

Corporate Office Fountainville Professional Building 1456 Ferry Road, Building 500 Doylestown, PA 18901 (215) 345-9400 Fax (215) 345-9401	Plan prepared by and under direction of: Maryellen Saylor, P.E. of the Corporate Office
Regional Office 559 Main Street, Suite 230 Bethlehem, PA 18018 (610) 419-9407	SEAL

IMPORTANT
A copy of this report must be on the site at all times during construction.

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SITE DESCRIPTION & ANALYSIS ..... Page 2

PROJECT DESCRIPTION..... Page 2

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POTENTIAL FOR THERMAL IMPACTS ADDRESSED .....Page 3

RESULTS SUMMARY TABLES & DESIGN CRITERIA ..... Page 4

COMPUTATION METHODS .....Page 5

SOILS TYPES, DESCRIPTIONS, AND LIMITATIONS.....Page 5

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ATTACHMENTS

- ✓ Predevelopment Drainage Area Map
- ✓ Post Construction Stormwater Management Plans

POST CONSTRUCTION STORMWATER MANAGEMENT PLAN

SITE DESCRIPTION & ANALYSIS

T.M.P. 20-016-001 & 20-016-002 LOWER MAKEFIELD TOWNSHIP

PROJECT DESCRIPTION

At the request of Lower Makefield Township, a stormwater management and erosion control study was conducted for the land development of a 36.26 acre property. The site is located within the Township owned Snipes Tract on Dolington Road (State Route SR 2075) and Quarry Road (Township Road Number T469), northwest of and adjacent to the intersection of the two roads in Lower Makefield Township, Bucks County, PA. The area of the site is 36.26 acres, the property being Tax Map Parcels 20-016-001-001 and 20-016-002. Access to the site is presently provided via an existing drive from Dolington Road. **The site presently consists of a paved entrance drive, a gravel loop road, open grassed areas, former tree nursery areas, a Township salt shed and a buffer of trees along Interstate 95 and the existing adjacent residential properties. The Township proposes the construction of a municipal athletic field complex, which will include one entrance drive each from Dolington Road and Quarry Road, an internal loop road with parking areas, one small and three large athletic fields, a pavilion, a concession stand with restrooms, a future skatepark, a walking trail system, and stormwater management facilities on the site.** The site is proposed to be served by public water and sewer. The site will continue to be accessed by an existing drive from Dolington Road and a proposed drive from Quarry Road. The proposed earth disturbance of the site is approximately 24.99 acres. The disturbance of trees will be minimized with the proposed project design. The locations and functions of the proposed detention basin and infiltration trenches have been carefully planned to effectively manage the stormwater, while recharging the ground. The protection of the natural resources is one of the main priorities of the development of this site. This study provides relevant site information, including existing and proposed stormwater runoff flow rates and volumes, to assist in evaluating the proposed project.

WATERSHED DESCRIPTION & HYDROLOGY

The pre-developed site consists of a paved entrance drive, a gravel loop road, open grassed areas, former tree nursery areas, and a buffer of trees along Interstate 95 and the existing adjacent residential properties. The drainage areas of the site were analyzed as woodlands, orchard, grass, bare earth, and paved areas. One portion of the site drains southeastward towards Quarry Road, and then to the intersection with Dolington Road to the existing offsite drainage ditch. The remaining area drains eastward towards Dolington Road and then to the intersection with Quarry Road to the existing offsite drainage ditch. The post-developed site will keep the existing drainage patterns generally in place. The proposed storm sewer has been disconnected to discharge overland through rip rap aprons into the detention basin. Infiltration trenches are proposed for ground recharge, stormwater management and water quality before discharging into the detention basin. The proposed development of the site will reduce the runoff rates to the

adjacent roads and downstream offsite drainage ditch. There will be no adverse impacts to the downstream properties with the proposed improvements. **The closest waterway is Buck Creek. The Chapter 93 receiving Water Classification is WWF, MF (Warm Water Fishes, Migratory Fishes)**. The amount of stormwater that is discharged through the BMP'S is **2.2 acre-feet** during a **2 year storm**.

There are no naturally occurring geologic formations or soil conditions, such as Karst or Carbonate geology, that may have the potential to cause pollution during earth moving activities.

PCSM COMPLETENESS REVIEW CHECKLIST NOTES

The PCSM Plan is separate from the E&S Plan, is labeled "Post Construction Stormwater Management Plan" and shall be the Final Plan for Construction. The PCSM Plan has been designed/ prepared to:

- **Preserve the integrity of the stream channels and maintain and protect the physical, biological and chemical qualities of the receiving stream.**
- **Prevent an increase in the rate of stormwater runoff.**
- **Minimize any increase in stormwater runoff volume.**
- **Minimize impervious areas.**
- **Maximize the protection of existing drainage features and existing vegetation.**
- **Minimize land clearing and grading.**
- **Minimize soil compaction.**
- **Utilize other structural or nonstructural BMP's that prevent or minimize changes in stormwater runoff.**

The **Present Land Use for the past five (5) years** have been a leaf and mulch storage yard for the Township Public Works Department and an abandoned tree nursery. The **Past Land Uses for the past 50 years** have been agriculture and a tree nursery.

POTENTIAL FOR THERMAL IMPACTS ADDRESSED

1. Restricting the disturbance of onsite wooded areas and planting of trees (for shade and reduction of temperature).
2. Removing compacted bare ground, stone and paved areas onsite and replacing the areas with grassed athletic fields, which will promote infiltration, velocity of flow reduction and water temperature reduction.
3. Disconnection of storm sewer and roof drains to reduce the velocity of flow and allow for infiltration.
4. Construction of a stormwater detention basin to collect, cool and potentially infiltrate runoff before it is discharged at a controlled rate.
5. Construction of four (4) infiltration trenches to collect, store, cool and infiltrate stormwater runoff.

RESULTS SUMMARY: PEAK RUNOFF RATE TO INTERSECTION OF QUARRY ROAD AND DOLINGTON ROAD

Storm Event (Year)	**Rainfall (inches)**	Pre-development Conditions (cfs)	Post-development Discharge (cfs)	Postdev Reduction From Pre-dev Condition (%)
1	2.64	4.91	2.53	48.5%
2	3.36	13.27	4.73	64.4%
5	4.32	28.95	10.38	64.1%
10	5.28	47.69	29.88	37.3%
25	6.24	68.65	46.56	32.2%
50	7.20	91.14	56.59	37.9%
100	8.40	120.75	67.15	44.4%

The site is located in the Delaware River South Watershed. The peak rate of runoff to the intersection of Quarry Road and Dolington Road will be decreased from actual existing conditions to proposed conditions by **64.4%** for the **2-year** and **44.4%** for the **100-year storms**.

The **critical stages of implementation of the PCSM,** for which a licensed professional or designee shall be present on-site, are the installation of the infiltration trenches, the detention basin, the riprap aprons at the endwalls and the installation of the permanent orifice plate for the detention basin outlet structure.

The following permanent PCSM BMPs shall be installed:

- Four (4) Infiltration trenches
- Stormwater detention basin
- Three (3) Riprap aprons at the storm sewer outfalls
- Landscape Restoration

COMPUTATION METHODS

The design of the stormwater management proposed for this project has been performed with the aid of the Hydraflow Hydrographs Extension for AutoCAD Civil 3D 2009 software package. Hydraflow was developed by Autodesk, Inc., San Rafael, California. The runoff hydrographs were calculated utilizing the Soil Conservation Service (SCS), or also known as the National Resource Conservation Service (NRCS) method within the Hydraflow software.

The PCSM stormwater management calculations demonstrate that rate, volume and water quality were met in accordance with the Delaware River South Watershed Act 167 Plan, dated May 11, 2011.

SOILS CHARACTERISTICS AND LIMITATIONS

	Limitations						
Soil Series & Map Symbol	**Bldg w/out Basements**	**Bldg w/ Basements**	**Small Commercial Bldgs**	**Hydrologic Soil Group**	**Depth to Seasonal High Water Table**	**Depth to Bedrock**	**Erodibility**
Abbottstown Silt Loam, 3 to 8% (AbB)	Very Limited, Depth to saturated zone	Very Limited, Depth to saturated zone	Very Limited, Depth to saturated zone	D	6" - 18"	40"- 60"	Slight - Moderate
Fountainville Silt Loam, 3 to 8% (FoB)	Very Limited, Depth to saturated zone Limited, Depth to bedrock	Very Limited, Depth to saturated zone Limited, Depth to bedrock	Very Limited, Depth to saturated zone Limited, Depth to bedrock	C	18" - 30"	40"- 60"	Slight-Moderate
Penns-Lansdale Complex 3 to 8% (PnB)	Not Limited	Not Limited	Not Limited	B	>78"	20"- 40"	Slight-Moderate

SOILS USE LIMITATIONS RESOLUTIONS

CHARACTERISTIC	RESOLUTION
ERODIBLE	Stabilize immediately after grading. Shape earthwork to reduce concentrated flow areas across bare earth. Provide and maintain effective erosion controls downstream of soil.
HIGH WATER TABLE/ DEPTH TO SATURATION ZONE	Provide adequate underdrain. Avoid basement construction. Any ponded water should be pumped to an adequate erosion and sedimentation control facility. For example, to a sedimentation basin/trap or to a dirt bag.
PONDING	Provide dewatering during construction activities. Provide adequate underdrain/floodproofing for permanent structures.
CUTBANKS CAVE	Use proper slope stabilization, minimize cutbank slope
DEPTH TO HARD BEDROCK	Blasting may be required if bedrock is encountered which is not rippable.
SLOPE	Minimize slope of proposed grading. Use proper slope stabilization.
FROST ACTION	Avoid winter grading.
PIPING/ SEEPAGE	Provide dewatering during construction activities. Provide adequate underdrain/floodproofing for permanent structures. Avoid basement construction. Any ponded water should be pumped to an adequate erosion and sedimentation control facility. For example, to a sedimentation basin/trap or to a dirt bag.
THIN LAYER	Use onsite soils better suited for embankments.