

How Do Impervious Surface Development and Population Growth Affect Stormwater Management?



Kaitlyn Spangler, Michelle Kaminski, Elizabeth Shutt,
Karika Gnep, Sarah Kissel

In conjunction with: Spring Creek Chapter of Trout Unlimited and
the Spring Creek Watershed Association

Scope of Research

Couldn't address Centre County as a whole

Each township has distinctive geographical features

Narrowed it down to an in-depth University Park Stormwater Management

Compare to another neighboring township, Harris

Methodology

Literature Review using Census Data, OPP Website, and Township Data

Comparative Analysis

Objective

Consolidate information from various sources as a platform for future interventions

University Park Stormwater Management Efforts

(Def'n) Stormwater Runoff: The surface hydrologic response from a precipitation event that occurs when water cannot soak into the ground, “running off” into the nearest lake, river, stream, or ocean.



Sources of Illicit Discharges in Stormwater Runoff, State College, PA

Source: (Stormwater, 2015) from <http://www.opp.psu.edu/services/stormwater>

Historical Background

The Commonwealth of Pennsylvania chartered Penn State University as one of the nation's first College of Agricultural Sciences in 1855.

Founding President: Evan Pugh

Pushed Congressional passage of Morrill Land-Grant Act in 1862

Land-Grant Act in 1862: mandated curriculum specialization in agriculture and the mechanized arts

1880's Penn State expanded its curriculum to create a more diverse institution

Expansion included: the College of Engineering, Eberly College of Science and the College of Liberal Arts

Population Growth in State College, PA

In State College:

Between 1990-2000:

- State College experienced a decrease in population: - 1.46%

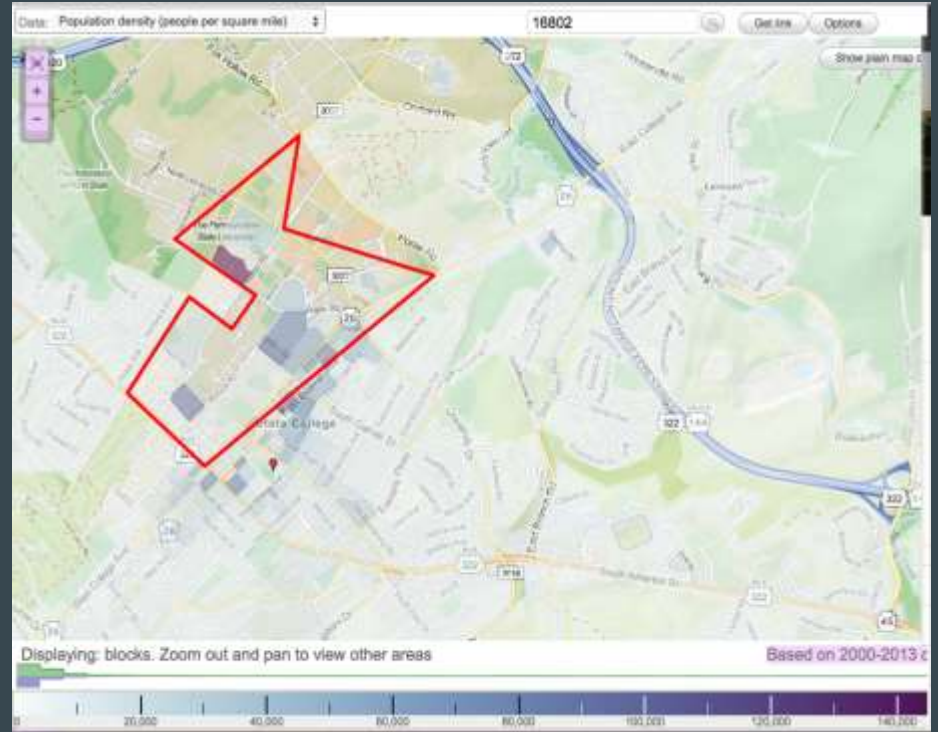
Between 2000 - 2010:

- Penn State University Park's population experienced a 9.4% increase (from 40,571 to 44,817 students)
- Number of housing units in State College has increased by 4.16% (from 12,488 to 13,007 units)
- Centre County's population increased by 13.4% (from 135,758 to 153,990 residents)

The State College Population

The effects of population growth:

An increase in population leads to an increase in the amount of impervious surfaces because of households, businesses and attractions



State College Population Density (2000 - 2013)
Source: www.citydata.com

Modern Development In University Park

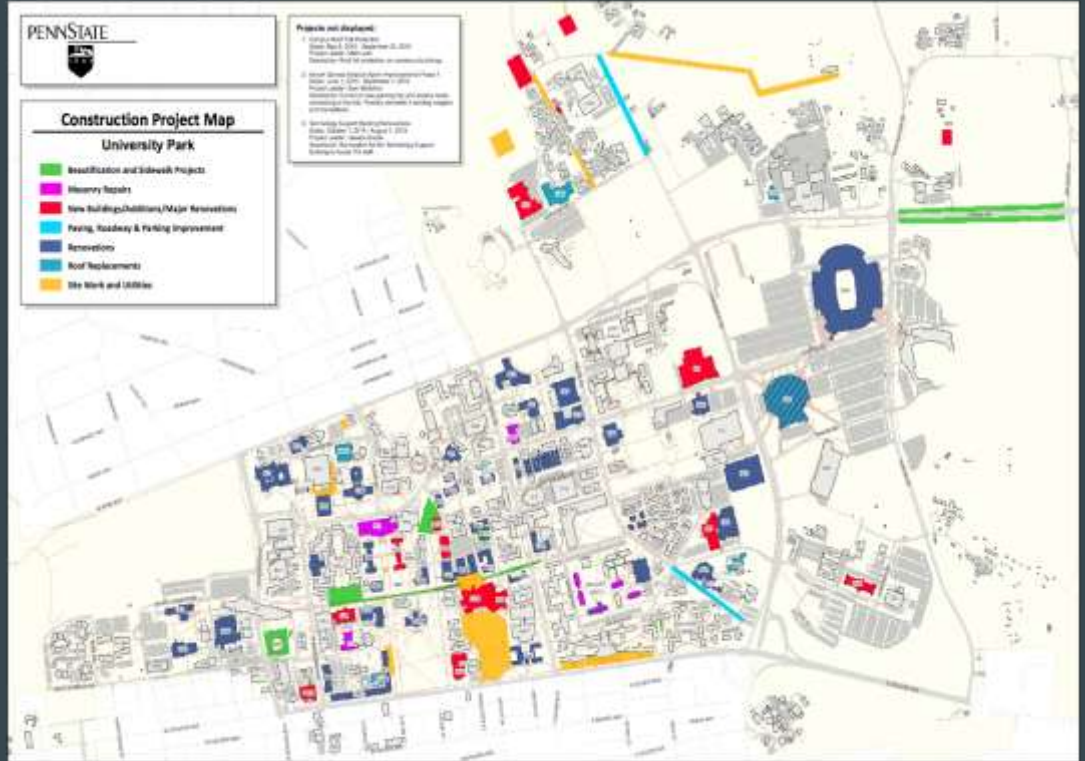
The Office of Physical Plant (OPP) Construction Plan Between 2014-2018

New Building

Side road/Side Walk

parking structure

building rooftop



Source: "New Stormwater Projects at UP", 2015

Impervious Surface Concerns at University Park

- Increasing in air and ground water pollution
- Irregulation in temperature of the water discharge
- Increasing harm to the biodiversity and human health
- Indirect connection caused by the spilled collected by drain outlet or paint and oil directly dump in the drain



Source: "Stormwater", 2013

4 University Park Drainage Basins:



Source: "Drainage Area Information for MS4 Permit", 2014

Flow from Drainage Basins:

**From Spring Creek → Bald Eagle Creek →
West Branch of Susquehanna River → Susquehanna River →
Chesapeake Bay**

Impervious Area of Drainage Basins

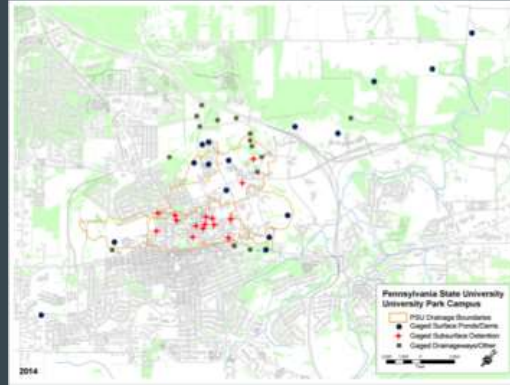
Drainage Basin	Basin Area (acres)	Impervious Area (acres)	Percent Impervious
Bathgate	232.9	82.7	35.5%
Fox Hollow	452.9	115.1	25.4%
Main Campus	386.6	192.9	49.9%
West Campus	186.0	30.6	16.5%

Source: Penn State Stormwater Magazine, 2009

University Park Stormwater Management Efforts

Current University Park Projects:

- Sarni Detention Pond
- Subsurface Detention Pond Gaging
- Surface Water Gaging
- Duck Pond Thermal Studies
- Foods Pond Outlet Modification
- Thompson Run Trash Rack
- Green Roofs
- Big Hollow Dye Tracing Program

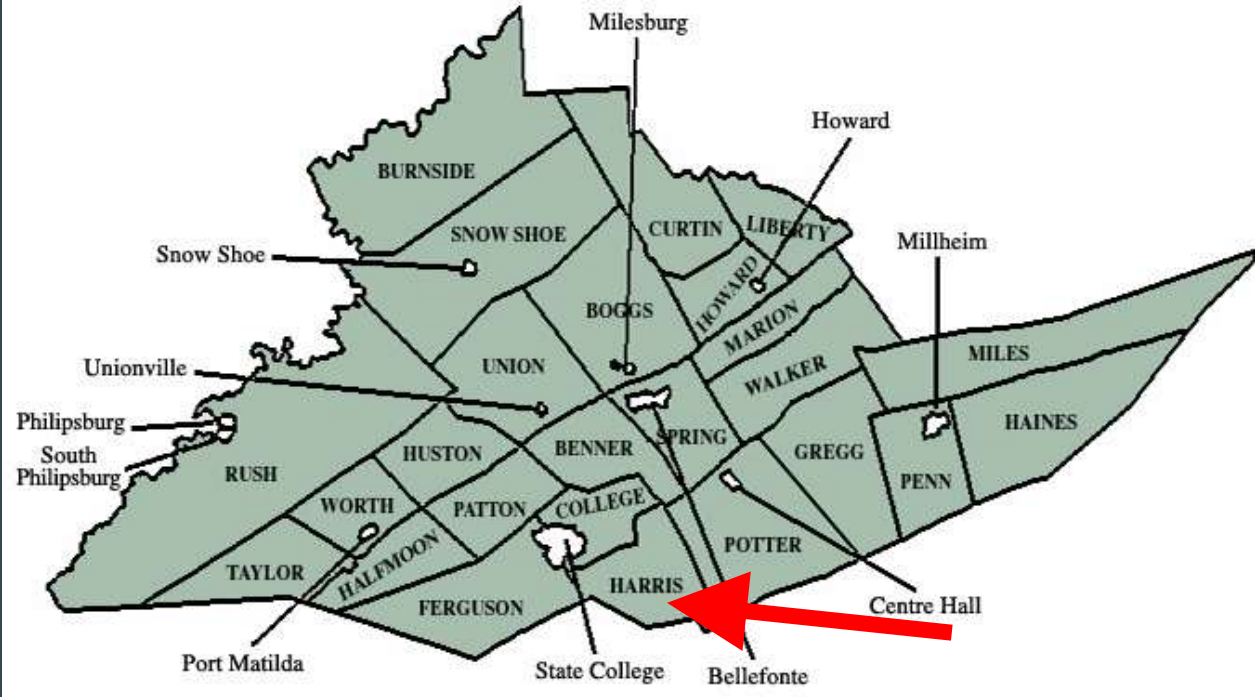


Location of Construction Projects on University Park Campus



1 of 32 Subsurface Detention Ponds to reduce peak runoff rates and filter trash

Harris Township



Source: "Harris Township Stormwater Ordinance, n.d.

Harris Township and University Park and the MS4 Partnership

Harris Township Quick Facts:

- Population, 2010: 4,873 people
- Population, 2014: 5,184 people
- Percentage change in population, 2010-2014: 6.7%
- Population Per Square Mile, 2010: 156.1 persons

Source: <http://www.census.gov/quickfacts/table/PST045214/4202732792/embed>

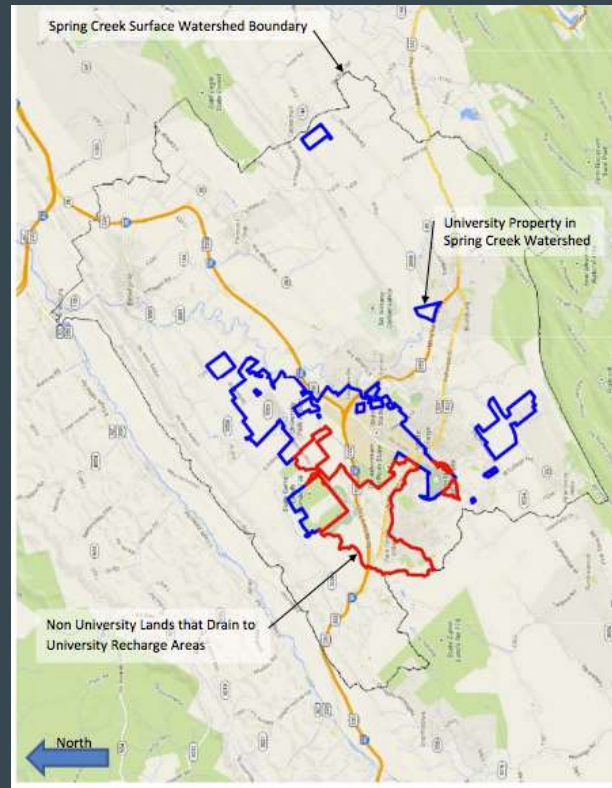
MS4 Program (Municipal Separate Storm Sewer Systems)

Criteria for acquiring MS4 permit:

1. Public Education
2. Public Involvement
3. Illicity Discharge Detection and Elimination
4. Construction site runoff control
5. Post-construction stormwater management in new development and redevelopment
6. Pollution prevention and good housekeeping for municipal operations and maintenance



Source: "University MS4 Program, 2015



University Property versus Non-University Areas that Drain to University Recharge Areas

Source: Penn State, University Park Campus Drainage Areas in the MS4 Permit <http://www.opp.psu.edu/services/stormwater/drainage-area-in-ms4-permit>

Solutions for University Park and Harris Township

University Park

- Access to a network of modern technologies, students, faculty, and cutting-edge research
- Currently Penn State is in the third phase of the program: Illicit Discharge Detection and Elimination
- Penn State's Master Plan
 - Designates 860 acres of land as "Environmental Resource"
- Water Resource Protection (WRP) Zones

Harris Township

- Buffer Area or natural filter cannot be disturbed during construction
- Man-made channel and swale must be able to convey the pre and post development runoff
- Need a permit to build or construct on sensitive land/area
- Peak Runoff rate controlled to help analysis the change in the downstream runoff

Results

- The population in State College is increasing, and, as it does, the amount of impervious surfaces increases
- There is an increased demand for technological innovation and township cooperation: i.e., consolidating maps of development and watershed
- Need for emphasis on MS4 Partnership
- Need for community involvement: i.e. surveys of understanding
- Ultimately, we need to conserve Spring Creek Watershed for the people, animals, and land that it affects

Sources

Carline, R., Dunlap, R., Detar, J., & Hollender, B. (2011). The Fishery of Spring Creek: A Watershed Under Siege. *Pennsylvania Fish and Boat Commission Technical Report, 1*.

Census 2010. (2009-2015). Retrieved November 18, 2015 from <http://www.statecollegepa.us/copyright.aspx>

“Grounds/Master Plan.” *Penn State University*. N.p., n.d. Web. 18 Nov. 2015. <http://sustainability.psu.edu/live/what-penn-state-doing/environment/grounds>

Harris Township Stormwater Ordinance . Retrieved November 18, 2015 from <http://harristownship.org/wp-content/uploads/2015/01/Stormwater-Ordinance.pdf>

Fennessey, L. (Ed.). (2009). *Penn State Stormwater*. Retrieved from <http://www.opp.psu.edu/services/eng-resources/Stormwater%20Magazine.pdf>

New Stormwater Projects at UP. (2014, September 8). Retrieved November 18, 2015 from <http://www.opp.psu.edu/services/stormwater/new-stormwater-projects-at-up>

Office of Physical Plant (2014, October 3) . Retrieved November 18, 2015 <http://www.opp.psu.edu/planning-construction>

“Our History.” *Penn State University*. N.p., n.d. Web. 18 Nov. 2015. <http://www.psu.edu/this-is-penn-state/our-history>

QuickFacts Beta, Harris Township Center County, Pennsylvania 2014 (2010-2014). Retrieved November 18, 2015 <http://www.census.gov/quickfacts/table/PST045214/4202732792/embed>

State College, Pennsylvania. (2015). Retrieved November 18, 2105 from <http://www.city-data.com/city/State-College-Pennsylvania.html>

Stormwater. (2013, February 22). Retrieved November 18, 2015, from <http://www.opp.psu.edu/services/stormwater>

University MS4 Program. (2015, June 10). Retrieved November 18, 2015 from <http://www.opp.psu.edu/services/stormwater/ms4>