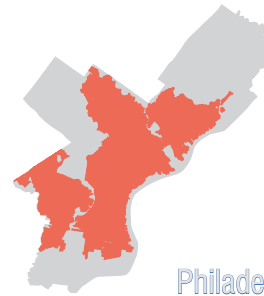


Site Design for Stormwater Management

Site overview



Philadelphia's Combined Sewer Area

Impervious surfaces

A quick site overview can identify a number of potential stormwater management opportunities. This playground is shown as an example.

This aerial image from GoogleEarth reveals that this site will probably contain a number of stormwater management opportunities. First, we see a large amount of impervious surfaces (playground, tennis courts, driveway). Second, the property is adjacent to the street and sidewalk and may be able to manage runoff from the public right-of-way on site.

Since this site is within the Combined Sewer Area (see Green City, Clean Waters), it may be considered for funding as a PWD green stormwater infrastructure (GSI) project.

The next several pages will walk through a site analysis and conceptual design for a GSI project that PWD would be able to pursue. It is important that the project meet certain criteria in order to receive funding. These criteria are consistent for open space projects within the CSA, so this example may be relevant for a wide range of project sites.



Playground

Tennis courts

Driveway

Street/sidewalk

Site inventory

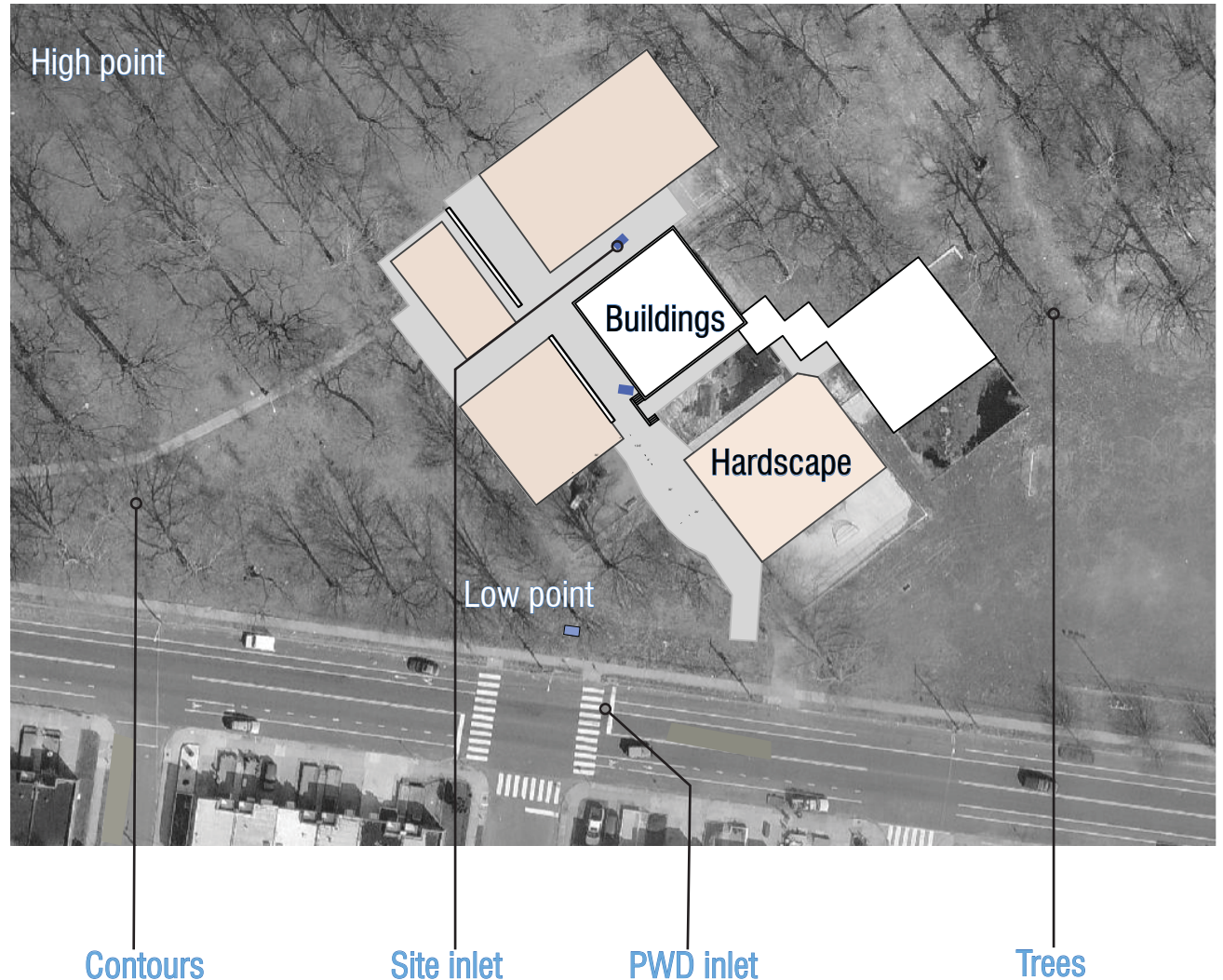
Develop a site inventory including all relevant features for design work.

For a stormwater management project, site features that should be documented include:

- buildings
- walls
- surface edges and areas
- vegetation
- low points
- high points
- contours
- property lines
- stormwater inlets (on-site and within the right-of-way)
- known utilities
- trees
- sports field striping if present

It is also important to understand how the site is being used (circulation, activity, program) and how future development plans may impact the project. Every project will have unique circumstances. The example shown is only particular to one site.

Important features



Drainage areas

Understanding how rainwater behaves on site is critical to design of management systems.

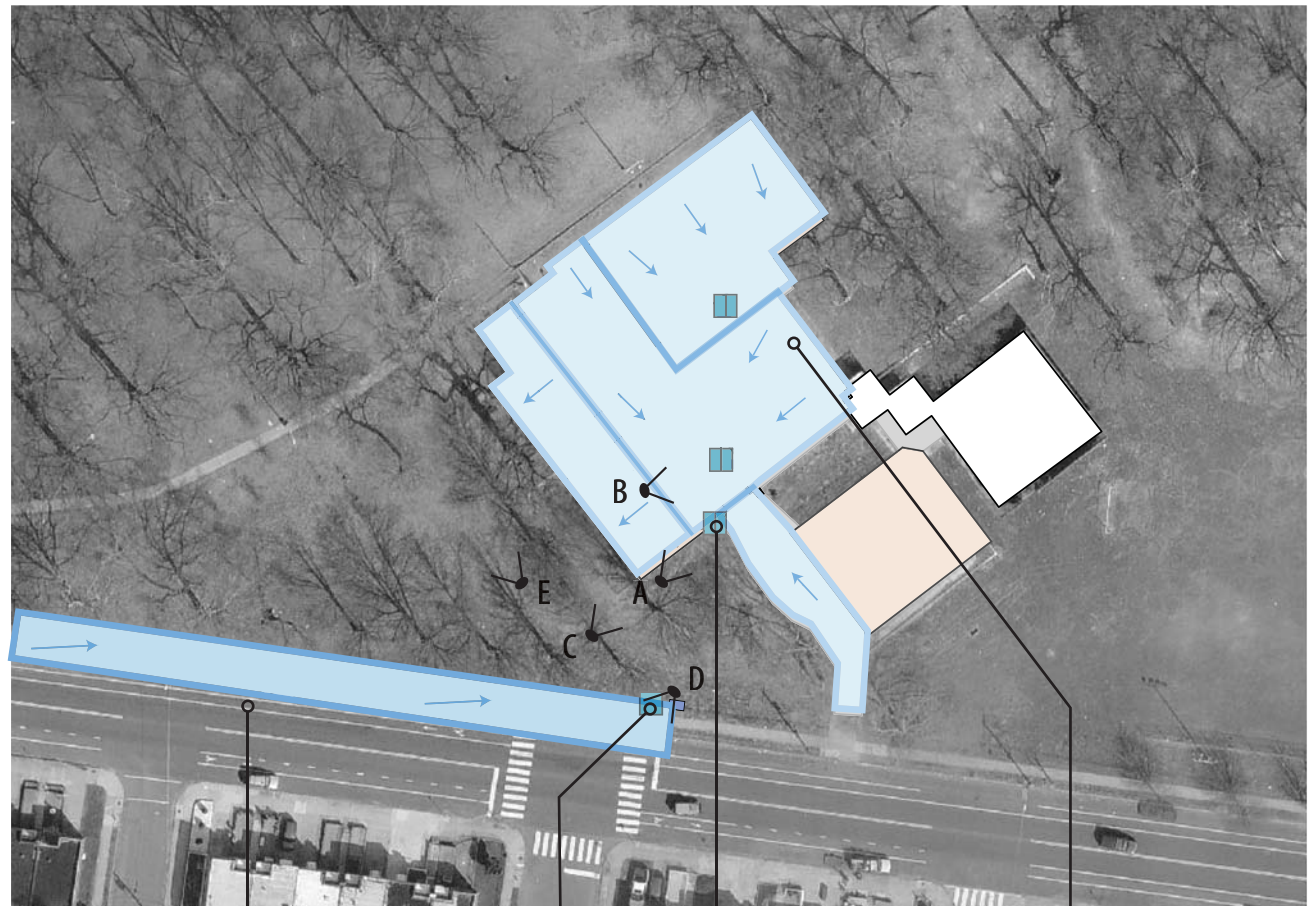
Utilize topographic contours and site observations to determine high points, low points, and the direction of rainwater flow. Visiting the site during or just after a rain event is often helpful. Site inlets and ponding water can also give a hint as to where low points are located.

Draw existing drainage areas. A drainage area is the area characterized by all of the runoff ending at a single low area. For many sites, areas will drain into site inlets. A single site can include several drainage areas. Include building roofs when planning to disconnect.

Be sure to include drainage areas for both the site and the right-of-way (street/sidewalk). Runoff from the right-of-way can often be directed into a GSI feature within the site. Assume that water cannot be directed into the site when it is more than 2' uphill and look for the shortest distances.



Direction of stormwater flow



Right-of-way drainage area PWD inlet Site inlet Site drainage areas

Locate GSI

Determine the location and size of GSI systems on the site.

Cluster and combine drainage areas when possible (divert water from upland drainage areas to collect at lower drainage areas), allowing for the minimum number of GSI projects and more centralized maintenance.

Locate where GSI projects will be on the site. Generally, they should occur at the low points of a drainage area where there are no major site constraints. Avoid locating the GSI within the canopy of healthy, mature trees and within 10' of any building or structure.

Size the GSI. A simple rule for estimating the GSI area is 1/10 the drainage area. This is based on a calculation that designs for a 1" storm and includes 2' of soil depth. For more information on how to size the GSI, see the PWD Stormwater Manual.

Consider overflow. Since the GSI will be sized to handle rainfall from a certain storm event, when rainfall exceeds that volume there will need to be a method of overflow. Most PWD projects tie back into existing inlets in order to rely on the current system as overflow.



Proposed locations



Rain garden

Tree trench

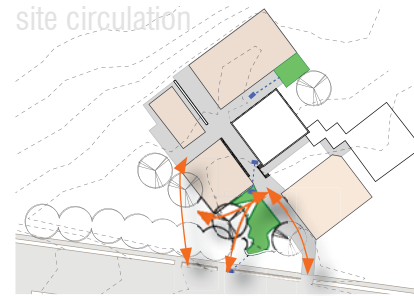
Design GSI

Understanding how rainwater behaves on site is critical to design of management systems.

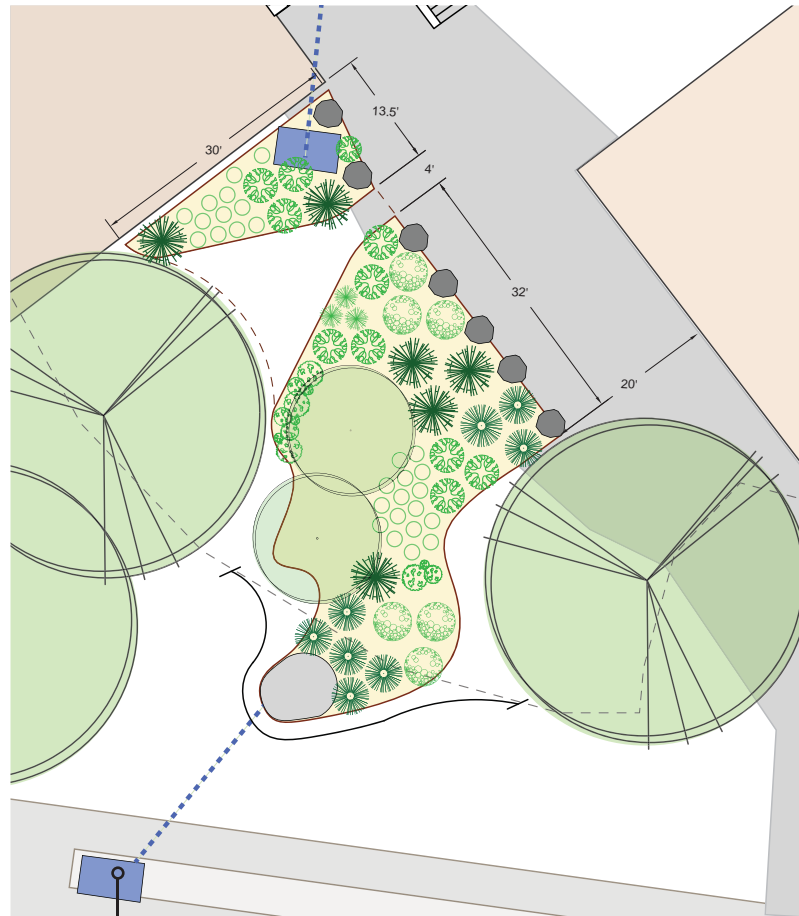
Select the type of GSI. Tree trenches, rain gardens, planter boxes, vegetated swales, and subsurface stone beds each offer different advantages. Surface treatments (vegetated) are preferable whenever possible. See the PWD Stormwater Manual for details. Consider desired amenities such as shade, flowers, playing surface, and others.

Design outline for the project. Consider circulation for pedestrians, bicyclists, and vehicles. The example has a continuous subsurface bed with the surface treatment divided into two in order to provide pedestrian thoroughfare.

Create a planting palette. The PWD Stormwater Manual lists plants recommended for GSI separated into different wetness zones. Keep in mind that most PWD-owned projects allow for minimal maintenance and therefore plant species should be drought-resistant, flood tolerant, and require minimal care such as pruning or pest management. Also consider bloom times, fall color, fragrance, and wildlife value.



Rain garden



Overflow connection

Suggested Plant Palette

SHADE PLANT LIST	SCIENTIFIC NAME
Maple leaf viburnum	<i>Viburnum acerifolium</i>
Blue mist fothergilla	<i>Fothergilla gardenii</i>
Prague viburnum	<i>Pragense viburnum</i>
SUN PLANT LIST	SCIENTIFIC NAME
Paper bark birch	<i>Betula papyrifera</i>
Paper bark maple	<i>Acer griseum</i>
Black haw viburnum	<i>Viburnum prunifolium</i>
Arrow wood viburnum	<i>Viburnum dentatum</i>
Spice bush	<i>Lindera benzoin</i>
New England aster	<i>Symphyotrichum novae-angliae</i>
Cardinal flower	<i>Lobelia cardinalis</i>
UPLAND GRASS LIST	SCIENTIFIC NAME
Perennial foxtail	<i>Eremurus spp.</i>
Purpletop	<i>Tridens flavus</i>
Switchgrass	<i>Panicum virgatum</i>
Blue wood aster	<i>Symphyotrichum cordifolium</i>
Big bluestem	<i>Andropogon gerardii</i>
Panic-grass	<i>Panicum dichotomiflorum</i>
Old witch-grass	<i>Panicum capillare</i>