3.0 Introduction

Chapter 3, Site Design and Stormwater Management Integration, guides the designer in successfully incorporating stormwater management into development site designs, while meeting the Philadelphia Water Department (PWD) Stormwater Regulations (Stormwater Regulations) and stormwater management design criteria for Stormwater Retrofits. The site design procedure is based on Pennsylvania Department of Environmental Protection recommendations, with minor modifications adapted to conditions in Philadelphia.

3.0.1 How to Use This Chapter

Before using this Chapter, the designer should first review the Stormwater Regulations outlined in **Chapter 1** ☛ water.phila.gov/development/stormwater-plan-review/manual/chapter-1. Having determined the applicable Stormwater Regulations, the designer should follow the guidance in Chapter 3 from beginning to end. The Chapter 3 Sections are as follows:

Section 3.1 ☛ water.phila.gov/development/stormwater-plan-review/manual/chapter-3/3-1-site-assessment-and-stormwater-management-strategies/ – Site Assessment and Stormwater Management Strategies

Section 3.2 ☛ water.phila.gov/development/stormwater-plan-review/manual/chapter-3/3-2-stormwater-management-design – Stormwater Management Design

Section 3.3 ☛ water.phila.gov/development/stormwater-plan-review/manual/chapter-3/3-3-infiltration-testing-and-soil-assessment-for-smp-design – Infiltration Testing and Soil Assessment for SMP Design

Section 3.4 ☛ water.phila.gov/development/stormwater-plan-review/manual/chapter-3/3-4-how-to-show-compliance – How to Show Compliance

Section 3.5 ☛ water.phila.gov/development/stormwater-plan-review/manual/chapter-3/3-5-integrated-stormwater-management-examples – Integrated Stormwater Management Examples

This Chapter does not provide detailed design requirements for specific stormwater management practices (SMPs). For detailed SMP design requirements, the designer is referred to **Chapter 4** ☛ water.phila.gov/development/stormwater-plan-review/manual/chapter-4.

3.0.2 Integrated Site and Stormwater Management Assessment and Design Process Overview

This Chapter outlines a step-by-step process for integrating robust and cost-effective stormwater management into site designs in ways that achieve PWD's key stormwater management goals of minimizing the harmful effects of flooding and maintaining the health of Philadelphia's streams and rivers. Figure 3.0-1 provides an overview of this process and the following Sections represent underlying goals for the designer to keep in mind as they move through the process.

Figure 3.0-1: Chapter 3 Process Flow Chart

Perform Site Assessment in accordance with **Section 3.1** to map critical site features and identify key opportunities and constraints.

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Review Section 3.1 to understand the relationship between Stormwater Management Design Strategies, the Stormwater Regulations outlined in Chapter 1, and the different project Review Paths described in Chapter 2.

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Assess opportunities to use Non-Structural Design strategies outlined in **Section 3.1.4** to protect and use existing site features, minimize impervious cover, and reduce earth disturbance.

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Assess opportunities to use Disconnected Impervious Cover (DIC) outlined in **Section 3.1.5** to reduce the amount of Directly Connected Impervious Area (DCIA) to be managed.

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Develop an approach to managing remaining DCIA, using a systems approach to SMP design per guidance in **Section 3.2** as well as guidance on Infiltration Testing and Soil Assessment for SMP Design in **Section 3.3.** Consider approaches per the SMP Hierarchy outlined in **Table 3.2-2** and consult Chapter 4 for more specific design requirements for individual SMPs.

Making Stormwater a "Before-Thought"

The most important aspect of PWD's process for stormwater design is to start early, before the development plan and site layout are finalized. By considering green stormwater management approaches in the initial stages of the site design planning process, a comprehensive strategy can be integrated more efficiently, effectively, and creatively. Starting early allows designers to find smart ways to incorporate green stormwater management approaches including PWD's highest-preference SMPs (**Section 3.2.2** ☛ water.phila.gov/development/stormwater-plan-review/manual/chapter-3/3-2-stormwater-management-design#3.2.2) and other approaches such as disconnected impervious cover (DIC) (**Section 3.1.5** ☛ water.phila.gov/development/stormwater-plan-review/manual/chapter-3/3-1-site-assessment#3.1.5) and non-structural design (**Section 3.1.4** ☛ water.phila.gov/development/stormwater-plan-review/manual/chapter-3/3-1-site-assessment#3.1.4), into the design process. Waiting until the site layout is finalized before considering stormwater management leaves the designer with options that are less appealing, have limited environmental benefit, and are often more expensive to build and maintain.

Considering the Power of Green

An increasing body of research shows that incorporating green features into an urban environment can have economic benefits for developments, including increased property values, reduced crime, positive changes in consumer behavior, and higher resale values. Sites with green features are often regarded as more welcoming and inviting places. Green stormwater management is becoming a powerful tool in the marketplace as it can provide development sites with a range of benefits not offered by more conventional stormwater management approaches. As discussed in the **Introduction** ☛ water.phila.gov/development/stormwater-plan-review/manual/introduction, the City of Philadelphia is committed to a balanced "land-water-infrastructure" approach in achieving its watershed management goals of fishable, swimmable waters. Every land development project plays a critical role in this city-wide effort to realize a collective future as a vibrant, sustainable, and modern city.

Dedicating space for green stormwater management approaches can be challenging (particularly on small or highly constrained lots), but before excluding "green," the designer should consider all outcomes and base decisions on full life cycle costs. Incorporating green stormwater management is PWD's strongly preferred approach for stormwater management and can help streamline the approval process through Expedited Post-Construction Stormwater Management Plan (PCSMP) Reviews (**Section 2.4** ☛ water.phila.gov/development/stormwater-plan-review/manual/chapter-2/2-4-expedited-pcsmp-reviews). Preserving open space or using SMPs, such as bioinfiltration/bioretention basins or green roofs, to manage stormwater can add value to a development, while meeting the Stormwater Regulations. Green approaches toward stormwater management can also be used to achieve compliance with landscaping requirements within the Philadelphia Zoning Code; contribute towards requirements of third-party project certifications such as the United States Green

Quick Tip

PWD acknowledges that infrastructure-based approaches (such as detention facilities) are not the entire solution. Implementing a range of land-based stormwater management techniques and restoration of aquatic habitats achieves a more balanced "land-water-infrastructure" approach that can help restore stream habitats lost to urbanization, as well as comply with the Stormwater Regulations in a cost-effective manner.

Building Council (USGBC) Leadership in Energy and Environmental Design (LEED) certification program; and help achieve other project-specific goals such as improving aesthetics, providing shade, creating habitat, protecting and enhancing viewsheds, and maintaining safety. Furthermore, green stormwater management approaches have been shown to increase a city's climate resilience through reductions in urban heat impacts and flooding as well as prove local air and water quality benefits. If additional information is desired regarding green stormwater infrastructure's role in climate resiliency, the designer is referred to the Green Infrastructure Leadership Exchange's Climate Resilient Resources Guide.

This Chapter provides guidance on PWD's highest-preference SMPs (**Section 3.2.2** ☛ water.phila.gov/development/stormwater-plan-review/manual/chapter-3/3-2-stormwater-management-design#3.2.2) and other environmentally friendly approaches to stormwater management such as non-structural design and DIC. The designer is encouraged to use the guidance in this Chapter to find creative ways of greening a project site while meeting the Stormwater Regulations. The designer is encouraged to contact PWD Stormwater Plan Review for assistance with incorporating green approaches to stormwater management.

Viewing Stormwater as a Resource

Stormwater is not wastewater – it's a resource! Stormwater can be collected, stored, and reused on sites for many purposes, including reclaimed water for toilet flushing and source-water for industrial use. These approaches are good for the environment, but can also make economic sense in reducing the need to purchase potable water, and can be incorporated effectively into an overall strategy for Stormwater Regulation compliance. The designer should consider potential reuse applications early in the design process in a collaborative discussion among the building and site design teams. The designer is referred to **Section 4.5** ☛ water.phila.gov/development/stormwater-plan-review/manual/chapter-4/4-5-cisterns, Cisterns, for more information on rainwater harvesting.

Taking a Site-Wide Approach

In order to help the designer take a site-wide approach to stormwater management, PWD offers enhanced tools such as new guidance on placing SMPs in series and Stormwater Management Banking and Trading. Understanding these options is critical when evaluating where and how much stormwater will need to be managed, addressing applicable Stormwater Regulations across multiple SMPs, and reserving various portions of a site for stormwater management. A designer unfamiliar with placing SMPs in series or Stormwater Management Banking and Trading is referred to Sections **3.2.3** ☛ water.phila.gov/development/stormwater-plan-review/manual/chapter-3/3-2-stormwater-management-design#3.2.3 and **3.2.4** ☛ water.phila.gov/development/stormwater-plan-review/manual/chapter-3/3-2-stormwater-management-design#3.2.4, respectively, for suggestions on getting started.

3.0.3 Interactions between Design Strategies, Stormwater Regulations, and Review Paths

In using Chapter 3, the designer should understand that some design decisions regarding specific stormwater management strategies can also impact the applicability of the Stormwater Regulations and the appropriate Review Path of a project. As a result, the designer may need to revisit **Chapter 1** ☛ water.phila.gov/development/stormwater-plan-review/manual/chapter-1 and **Chapter 2** ☛ water.phila.gov/development/stormwater-plan-review/manual/chapter-2 to make sure these initial determinations remain valid.

There is not a "one-to-one" relationship between the review process outlined in **Chapter 2** ☛ water.phila.gov/development/stormwater-plan-review/manual/chapter-2 and the site assessment and design process outlined in Chapter 3. Guidance throughout Chapter 3 assists the designer with preparing Conceptual Review Phase and PCSMP Review Phase Submission Packages to PWD. The designer preparing a Conceptual Review Submission Package is referred to guidance throughout Chapter 3 in conducting site assessments and developing an initial stormwater management strategy and Conceptual Stormwater Management Plan. The designer preparing PCSMP Review Submission Packages will find **Section 3.2** ☛ water.phila.gov/development/stormwater-plan-review/manual/chapter-3/3-2-stormwater-management-design, **Section 3.3** ☛ water.phila.gov/development/stormwater-plan-review/manual/chapter-3/3-3-infiltration-testing-and-soil-assessment-for-smp-design, and **Section 3.4** ☛ water.phila.gov/development/stormwater-plan-review/manual/chapter-3/3-4-how-to-show-compliance particularly helpful in understanding the technical requirements associated with specific stormwater management strategies.

Applicable Stormwater Regulations and Review Path vary depending on site characteristics, such as site location and amount of earth disturbance. The designer should pay specific attention to changes in the proposed earth disturbance and directly connected impervious area (DCIA) throughout the design process, as well as the potential applicability of Expedited PCSMP Reviews.

Earth Disturbance

The amount of earth disturbance associated with a development project, in part, determines the applicable Stormwater Regulations (**Chapter 1** ☛ water.phila.gov/development/stormwater-plan-review/manual/chapter-1), as well as the appropriate Review Path (**Chapter 2** ☛ water.phila.gov/development/stormwater-plan-review/manual/chapter-2). In this Chapter, the designer will find guidance in using non-structural design techniques that could result in a reduction in earth disturbance. If the level of earth disturbance associated with a project significantly changes as the result of working through the guidance in this Chapter, the designer should revisit Chapters 1 and 2 to assess potential changes in applicability.

Directly Connected Impervious Area

Adjustments in a DCIA associated with a development project can impact the applicable Stormwater Regulations. If a project's DCIA significantly changes as the result of working through the guidance in this Chapter, the designer should revisit **Chapter 1** ☛ water.phila.gov/development/stormwater-plan-review/manual/chapter-1 and **Chapter 2** ☛ water.phila.gov/development/stormwater-plan-review/manual/chapter-2 to assess whether the changes in DCIA alter either the applicable Stormwater Regulations or Review Path for the project.

Expedited PCSMP Reviews

A project that proposes a combination of non-structural design, DIC, and/or bioinfiltration/bioretention basins for Stormwater Regulation compliance may be eligible for an Expedited PCSMP Review. As the designer works through Chapter 3, opportunities for modifications in the initial site layout or stormwater management strategy may allow the project to qualify for an Expedited PCSMP Review. The designer is directed to **Section 2.4** ☛ water.phila.gov/development/stormwater-plan-review/manual/chapter-2/2-4-expedited-pcsmp-reviews for more guidance on the types of, and requirements for, Expedited PCSMP Reviews.