
	Title: YALE OFFICE OF FACILITIES PROCEDURE MANUAL Chapter: 01 - Yale Design Standard Division: 33 46 00 Stormwater Management	Section: 33 46 00 Requirements for Stormwater Management
		Date: 10/2025
		Author: Office of Facilities

PART 1 - INTRODUCTION

- 1.1 Principles of Stormwater Management prioritize restoration of watershed function through low-impact stormwater management strategies. Green infrastructure (including raingardens, porous pavement, or vegetated bioswales) support University objectives including pollution prevention, increased biodiversity, enhanced greenspace, lower flood risk, replenishment of groundwater reserves, reduction of urban heat island effect, lowered building energy demands, protection of water resources, limitation of erosion, and reduced stress on municipal sewer and storm systems. In alignment with the principles described in the *Yale Sustainable Stormwater Management Plan* (see this [link](#)) provide stormwater mitigation strategies that:
- A. Recognize stormwater as a resource and manage it to enhance its positive effects on the environment and to reduce associated risks to Yale assets and infrastructure.
 - B. Prioritize restoration of watershed function. Watershed function is restored with low-impact stormwater management strategies, including natural features, landscapes, and green infrastructure systems. Design teams shall implement stormwater management strategies following a fundamental order of priority:
 1. infiltration of stormwater where it falls,
 2. storage for infiltration or reuse,
 3. temporary detention and gradual release of treated stormwater to the storm sewer, and
 4. temporary detention and gradual release of treated stormwater to the combined storm and sewer system.
 - C. Prevent Pollution by
 1. reducing volume of CSOs (Combined Sewer Overflows) in areas of combined storm and sanitary sewer systems
 2. reducing total storm water volume and rate at separate storm sewer systems
 3. providing water quality treatment for storm water runoff prior to discharge to separate storm sewer systems
 - D. Meet the requirements of DEEP's Municipal Separate Storm Sewer System (MS4) General Permit required through the federal Clean Water Act. (see this [link](#)).
 - E. Prevent flooding on and off campus in alignment with the City of New Haven's Natural Hazard Mitigation Plan developed to protect people and properties at risk from natural disasters such as inland flooding.
- 1.2 In alignment with the findings and recommendations described in the Yale University Stormwater Planning Studies (2024) design stormwater mitigation strategies that:
- A. Consider future predicted storm events and design site and building systems that are resilient to the predicted impacts
 - B. Reduce campus flood risk by prioritizing strategies that protect the campus community, prevent operational disruption, and reduce damage to valuable assets and the overall physical environment

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PART 2 - GENERAL DESIGN REQUIREMENT

- 2.1 Proposed design shall be in alignment with Section: 32 01 01 Exterior Improvements Landscape Design – including Site Evaluation and Sustainability Assessment, Site Design Intent and Campus Integration, and Site Protection from Construction Activity. For projects including new or renovations to a parking lot refer to Section 32 10 01 Parking Lots.
- 2.2 Preference in all cases is for a landscape-based approach to mitigate stormwater (i.e. use of green infrastructure). Overarching goal is for all impervious surfaces to connect to green infrastructure.
- 2.3 Green infrastructure design shall specify plant materials and construction details to achieve infiltration rates to capture anticipated stormwater for optimizing water quality treatment and retention goals.
- 2.4 Design teams shall inspect and assess all downspouts for disconnection from storm sewer or combined storm and sewer system to redirect stormwater flow to landscape-based stormwater capture wherever possible.
- 2.5 Proposed design shall be in alignment with Section: 01352 Sustainable Design Requirements - Follow LEED BD+ C requirements, specifically following the recommendations of Sustainable Sites Rainwater Management Credit for the current version of the USGBC’s LEED Rating System:
 - A. Projects shall strive to achieve the maximum 3 points under the Rainwater Management Credit, currently published as follows:

The 90th percentile event volume (approximately 1-inch) must be retained (i.e. infiltrated, evapotranspired, or collected and reused) using low-impact development (LID) and green infrastructure (GI) practices. GI and LID strategies can either be structural or non-structural

PART 3 - SPECIFIC DESIGN REQUIREMENTS

- 3.1 Low Impact Development and Green Infrastructure
 - A. Low impact development (LID) and green infrastructure is preferred in all cases. Design teams shall take a holistic approach in meeting the specified regulations by developing strategies that encourage a district approach through multiple projects while considering the best possible options to reduce stormwater runoff for the intended project.
 - B. Design teams shall implement stormwater management strategies following a fundamental order of priority:
 1. infiltration of stormwater where it falls,
 2. storage for infiltration or reuse,
 3. temporary detention and gradual release of treated stormwater to the storm sewer,
 4. temporary detention and gradual release of treated stormwater to the combined storm and sewer system.

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3.2 Requirements for Retention, Detention and Flow Mitigation

- A. Verify mandated retention requirements as they vary by municipality. Retention requirements can be found in each municipality’s Stormwater Management Plan in fulfillment of DEEP’s Municipal Separate Storm Sewer System (MS4) General Permit. Required through the federal Clean Water Act, CT DEEP established the MS4 General Permit to protect water quality and reduce the discharge of pollutants from a municipality’s storm sewer system. These plans were updated in July 2017. The MS4 General Permit requires that all new development or redevelopment projects with greater than one acre of soil disturbance retain the volume of runoff generated by one inch of rainfall on the site.
- B. Section 60 of New Haven’s Zoning Ordinance (See City of New Haven Zoning Ordinance and City of New Haven Stormwater Management Plan, latest edition) goes beyond the one-acre requirement by including sites that disturb one half or more acres of total land area on site and requires the preparation of a Stormwater Management Plan consistent with the Stormwater Management Criteria - including but not limited to criteria that stormwater management systems be designed to collect, retain, and treat the first 1-inch of rain on-site, so as to trap floating material, oil, and litter.
- C. Greater New Haven Water Pollution Control Authority (GNHWPCA) manages New Haven’s combined sewer system and separate sanitary sewers. One of the goals of GNHWPCA is to reduce the volume of CSOs. Toward this goal, for new construction projects to be permitted within areas serviced by a combined system, GNHWPCA requires that “the post-development stormwater runoff for a 2-year, 6-hour storm frequency (rainfall = 2.13 inches) shall be detained by underground infiltration / detention systems designed by a professional engineer licensed in the state of Connecticut.” (See GNHWPCA sewer service area maps and GNHWPCA Permitting and Design Criteria Manual, latest edition).
- D. Post development runoff rates and volumes shall not exceed pre-development rates and volumes for the 2-, 10-, 25-, 50-, and 100-year storms (assume current NOAA storms).


3.3 Green Infrastructure and Stormwater BMP Sizing Requirements

- A. Design green infrastructure retention capacity to meet regulatory requirements per Section 3.2 and sustainable design requirements per Section 2.5.
 - 1. The volume associated with the stormwater retention requirements shall be retained and infiltrated, evapotranspired, and/or reused – with no overflow.
 - 2. For surface green infrastructure features, such as bioretention, the retention capacity shall be considered the capacity below the overflow in the surface depression plus the capacity in the sub-surface stone reservoir below the outlet.
 - 3. For subsurface strategies, the retention capacity shall be considered the capacity below the overflow orifice.
 - 4. Provide adequate measures for emergency overflow and/or large storm bypass to prevent surcharge of stormwater into upstream buildings and site drainage systems.

3.4 Grate Capacity and Closed Drainage System Design Requirements

- A. Design inlets and pipes to collect and convey stormwater in accordance with all applicable regulatory requirements and current best practice storm events (i.e., Rational Method, 25-year, 1-hour storm), without surcharge.

Model the closed drainage system using larger storm events (Rational method 100-year, 1-hour storm) and identify system vulnerabilities such as surcharge of drainage structures to grade. Confirm surcharged structures will cause no adverse impacts to buildings, critical infrastructure, valuable assets, campus operations,

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etc. If necessary, design passive strategies to protect vulnerable areas from adverse impacts, including but not limited to site mitigation strategies (berms, grading, conveyance, etc.) and building mitigation strategies (flood doors, dry floodproofing, backflow preventers, etc.).


3.5 Design for Future Predicted Impacts of Climate Change

- A. Requirements for All Campus Areas: Consider future predicted storm events and design site and building systems that that are resilient to the predicted impacts of future design storm events.
 - 1. Evaluate the function of green infrastructure and stormwater BMPs for future predicted design storm events. Evaluate if the systems have adequate capacity to convey the future predicted design storms without causing surcharge or flooding conditions that impact buildings, critical infrastructure, valuable assets, campus operations, etc. Consider increasing the current NOAA 100-year storm event by 20% and/or simulating recent extreme events such as Hurricane Ida to perform this evaluation.
 - 2. Evaluate and confirm any potential flood impacts to buildings, critical infrastructure, valuable assets, campus operations, etc. If necessary, design passive strategies to protect vulnerable areas from predicted flood impacts, including but not limited to site mitigation strategies (berms, grading, conveyance, etc.) and building mitigation strategies (flood doors, dry floodproofing, backflow preventers, etc.).
- B. Additional requirements for Flood Prone Areas
 - 1. In areas prone to inland flooding (as defined by Section 2.14 of Chapter: Introduction and General Guidelines), the closed drainage and stormwater systems should also be evaluated assuming the City of New Haven drain or combined sewer main is surcharged to the crown elevation of the pipe. Evaluate potential vulnerabilities such as surcharge of drainage structures to grade. If necessary, design passive strategies to protect the building and critical assets from flooding impacts including the use of site and building mitigation strategies.
 - 2. In coastally influenced flood prone areas, the closed drainage system should be designed assuming the downstream mains are tidally influenced. Closed drainage systems should be modeled as if the mains are experiencing high tide during a Nor'Easter.

3.6 Design for Operations and Maintenance

- A. For surface green infrastructure systems, the design should consider sediment forebays, pea stone diaphragms, and other similar pretreatment methods to prevent trash, debris, and sediment from entering the systems.
- B. For subsurface stormwater BMPs, the design should consider deep-sump and hooded catch basins/area drains, hydrodynamic separators, and other similar pretreatment methods to prevent trash, debris, and sediment from entering the systems. Covers for catch basins, hydrodynamic separators, and pretreatment devices should be easily accessible for vacuum trucks to provide maintenance.
- C. Area drains located in landscape beds should be designed to have dome grates to minimize the amount of soil and mulch entering the closed drainage system.
- D. Subsurface stormwater BMPs should be designed to have maintenance access at a minimum of four points, one at each corner of the system. The access points should be designed in such a way to allow for inspection of sediment accumulation and cleaning of the system.

3.7 Project design teams should evaluate the use of manufactured storage chambers or manufactured treatment structures with Yale facilities to determine if the required maintenance practices are appropriate for their location.

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3.8 Required Submittal

- A. Design teams will provide various concept options incorporating system descriptions and required maintenance. The options are to vary by ratio of water designed to infiltrate where it falls utilizing green infrastructure options versus grey storm water systems for evaluation of best approach to meet Yale’s sustainability initiatives. Include estimate of volume of water diverted from the municipal system and retained per BMP (Best Management Practices).
- B. Stormwater summary report including backup calculations documenting stormwater retention, peak rate mitigation, and water quality performance; as well as a narrative of how the project team considered potential impacts of future predicted rainfall events in the design.
- C. Post construction operations and maintenance plans, including commissioning of any rainwater harvesting systems are required.
- D. Soil percolation test verification to ensure infiltration capacity.
- E. Design teams will provide to Yale representative all data required to complete indexing of stormwater management practices on the Yale campus. The tracking of stormwater projects is intended to afford a comprehensive view of stormwater practices implemented at Yale on a project- by-project basis, providing data to consider holistic impacts of individual projects over time.
- F. Data to be provided in a format to align with the 2017 MS4 General Permit. Under said permit municipalities are required to annually track the total acreage of Directly Connected Impervious Areas (DCIA) that is disconnected from the MS4 as a result of redevelopment or retrofit projects within their municipality. Impervious surfaces are considered disconnected when the required portion of stormwater is retained through infiltration or reused for other purposes without a surface or storm sewer discharge. Starting on July 1, 2021, municipalities shall reduce 1% of their total DCIA acreage per year to the maximum extent possible, incorporating all DCIA disconnections implemented in the city since July 1, 2012. (see BOD to record stormwater data).

Date	Description of Change	Pages / Sections Modified	ID
5/2021	Entire document	-	MVC, KC, CJ
10/2025	Entire document	-	SO, JP, CJ