Protocol and Practice: Stormwater Management in New Jersey

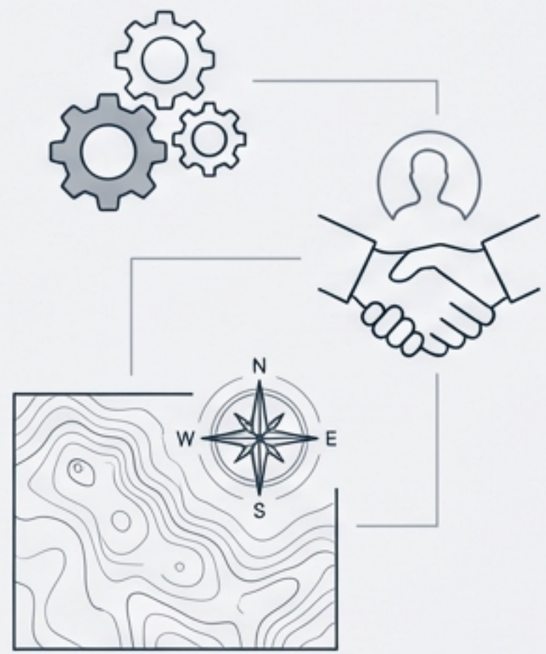
A comprehensive review of design considerations , the 10-step regulatory workflow, and built case studies.

Balancing engineering ethics, regulatory compliance, and hydraulic rigor.

The Engineering Lifecycle: From Concept to Concrete

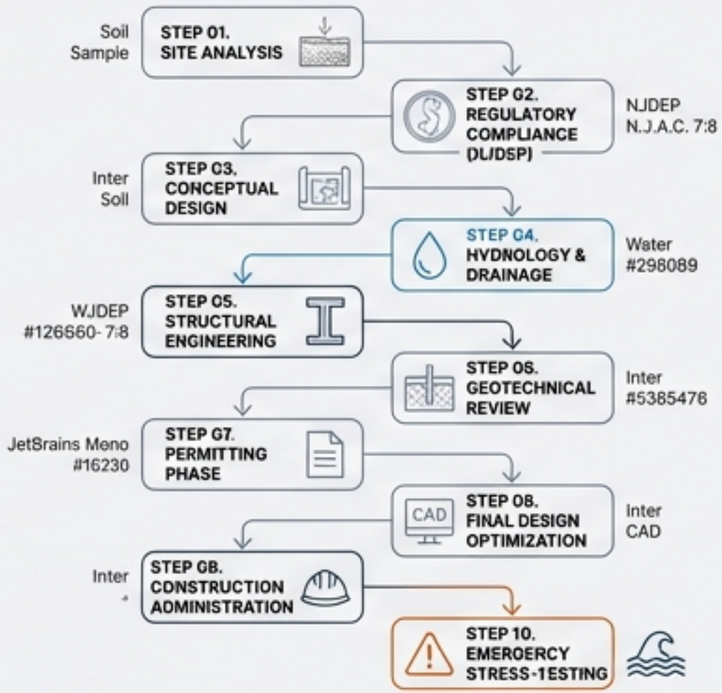
1 The Considerations

Defining the scope through ethics, client needs, and site assessment.



2 The Procedure

A rigorous 10-step workflow specific to New Jersey regulations, moving from site analysis to emergency stress-testing.



3 The Application

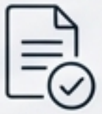
Verified results featuring Rutgers University infrastructure and the NJ Turnpike Interchange 14A.

The Foundation: Initial Design Considerations

Professional Inputs

- Engineering ethics
- Client needs
- Professional communications

Regulatory & Project Feasibility



- Rules and regulations
- Environmental impact assessment
- Site assessment & planning
- Alternative analysis

Design & Economics

- BMP type and placement
- Cost/benefit estimating
- Life cycle analysis
- Preliminary & Final design

Phase I: Site Analysis and Planning Strategy

01

Step 01

Determine applicable rules, regulations, goals, and objectives.

02

Step 02

Apply Low-Impact Development (LID) principles and non-structural strategies. Prioritize placement of buildings, roads, and BMPs accordingly.

03

Step 03

Identify specific points of runoff discharge into existing storm drainage systems or receiving waters.

04

Step 04

Delineate the catchment area for each specific discharge point.

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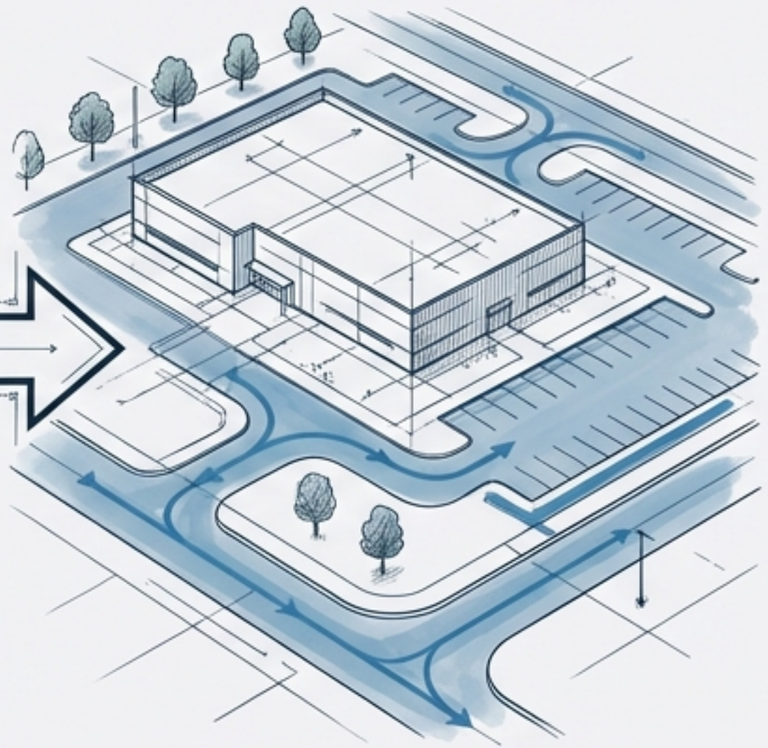
Phase II: Establishing the Hydrologic Baseline

Pre-Development (Existing)

Step 05: Comparative Modeling

1. Runoff Volume
2. Runoff Peak Rate
3. Groundwater Recharge

Post-Development (New)



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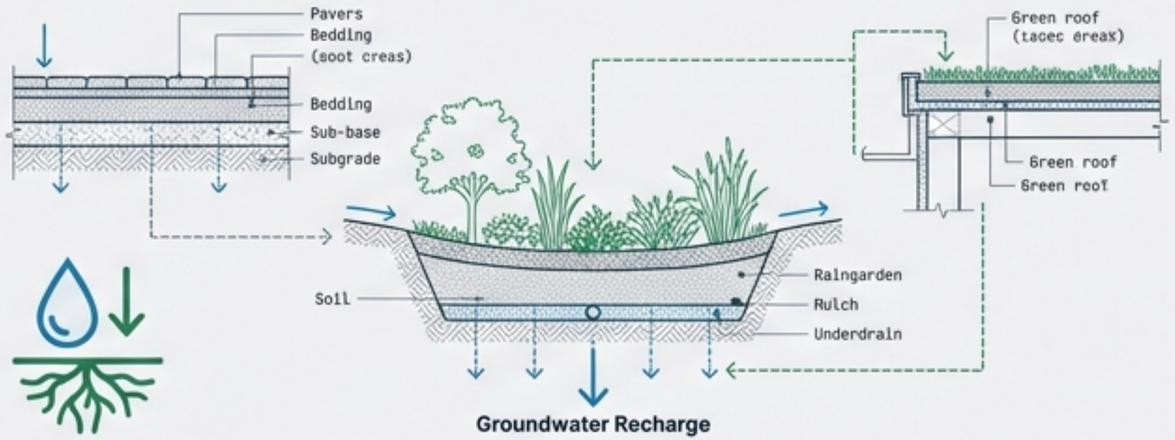
Phase III: Sizing for Ecology and Water Quality

Step 06: Groundwater Recharge

Goal: Meet recharge requirements for post-development.

Standard: Use all storm events in an average precipitation year (the design year).

Requirement: Use small-scale Green Infrastructure (GI) BMPs without needing waivers.

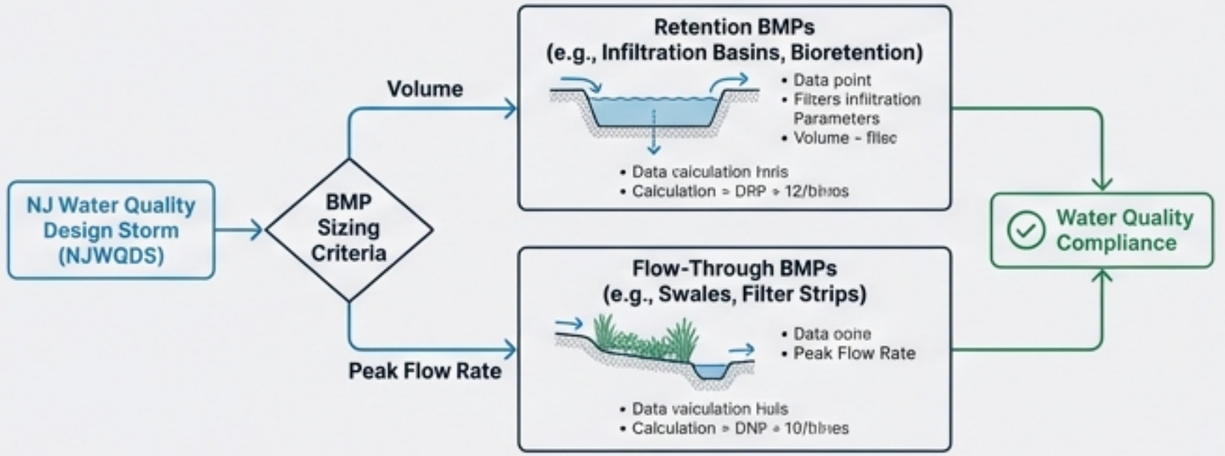


Step 07: Water Quality

Goal: Meet water quality standards.

Standard: Use the NJ Water Quality Design Storm (NJWQDS).

Critical Decision: Determine if individual BMPs should be sized based on Volume or Peak Flow Rate.



Phase IV: Flood Control and Network Design

Step 08: Water Quantity (Flood Control)

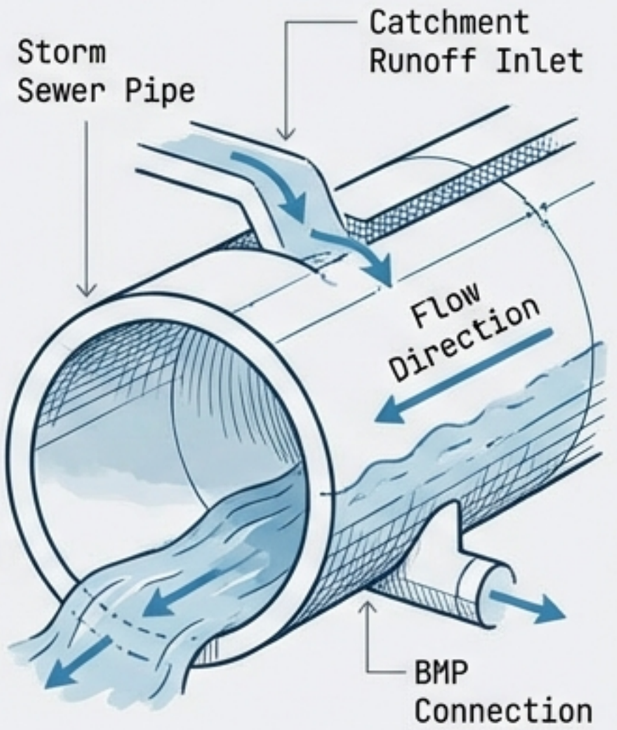
- 2-year NRCS 24-hour storm
- 10-year NRCS 24-hour storm
- 100-year NRCS 24-hour storm

Note: Must be adjusted for climate change. Use small-scale or large-scale GI BMPs.

Step 09: Storm Sewer Network

Sizing Standard: Use the larger of local authority spec or landowner spec (e.g., 25-year storm).

Constraint: Ensure runoff from the catchment enters each BMP under all design storm conditions.



Phase V: Emergency Management and Stress Testing

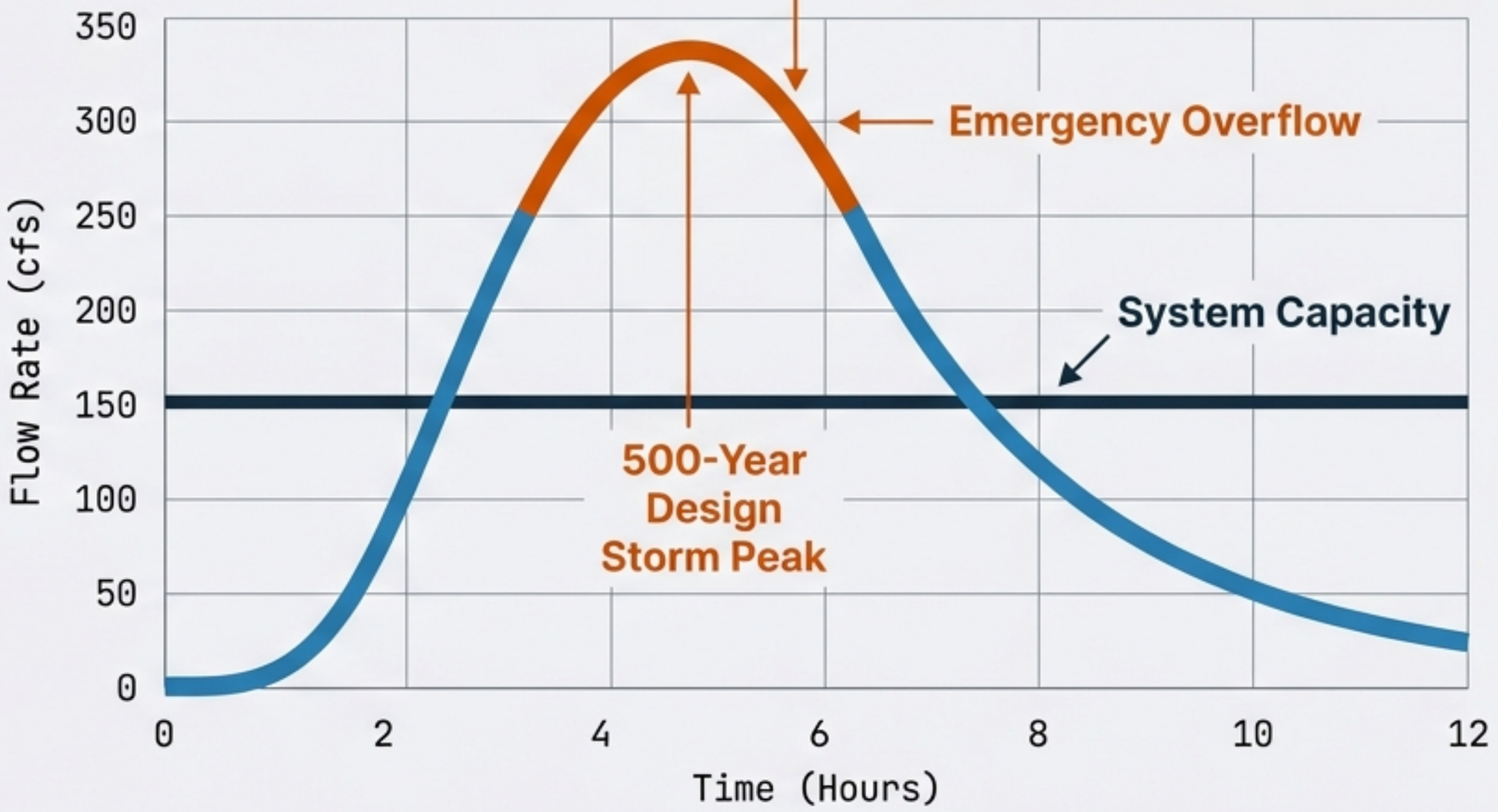
THE STANDARD: Exceed the largest design storm.

Example: 500-year storm event.

Step 10: Hydraulic Stress Testing

Action: Conduct hydraulic modeling for emergency management scenarios.

Scope: Test individual BMPs, the drainage system, and the entire new development site.



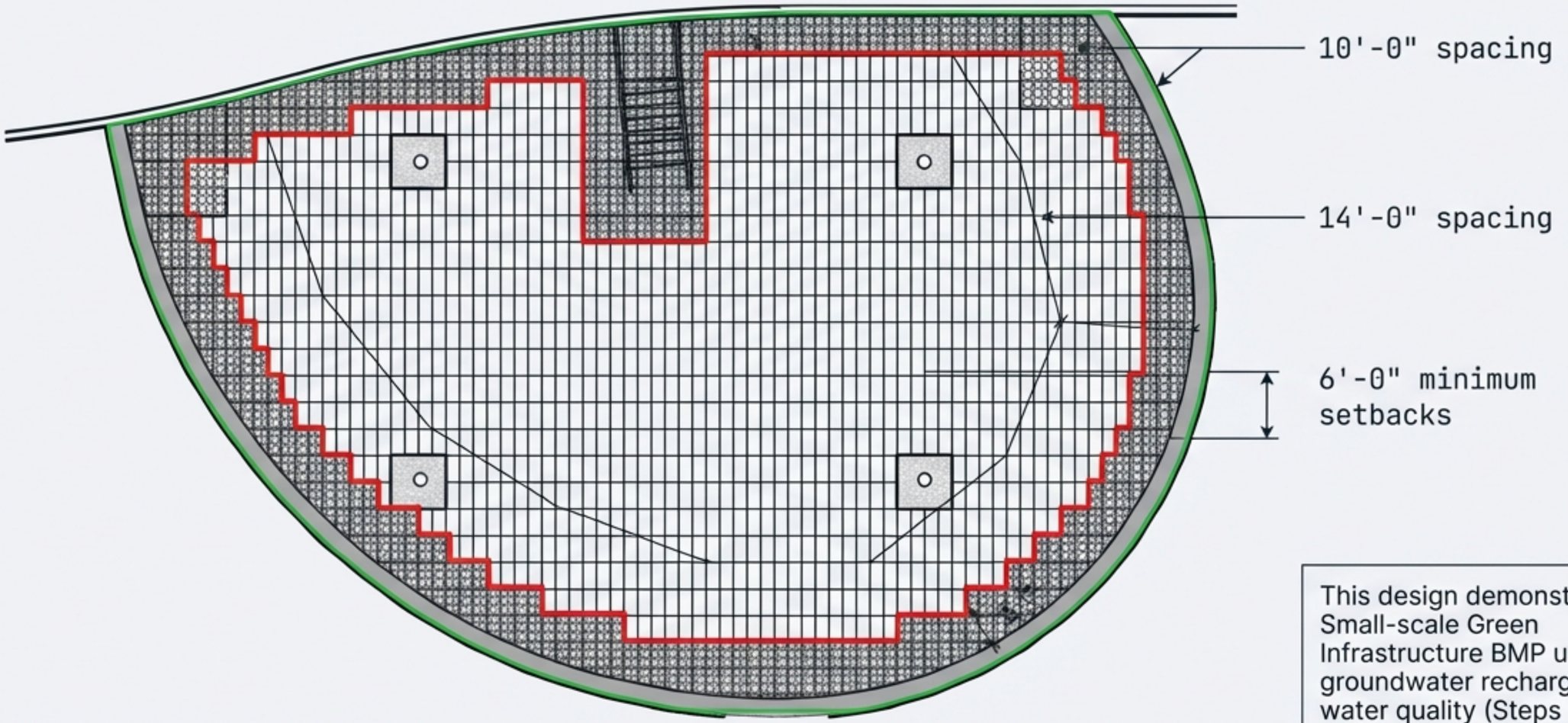
From Procedure to Reality: Design Examples

Applying the NJ workflow to institutional and infrastructure projects

1. **Rutgers Richard Weeks Hall** (Green Roof)
2. Rutgers **New Chemistry Building** (Hybrid BMPs)
3. **NJ Turnpike Interchange 14A** (High-**Traffic Infrastructure**)

Case Study: Rutgers Richard Weeks Hall

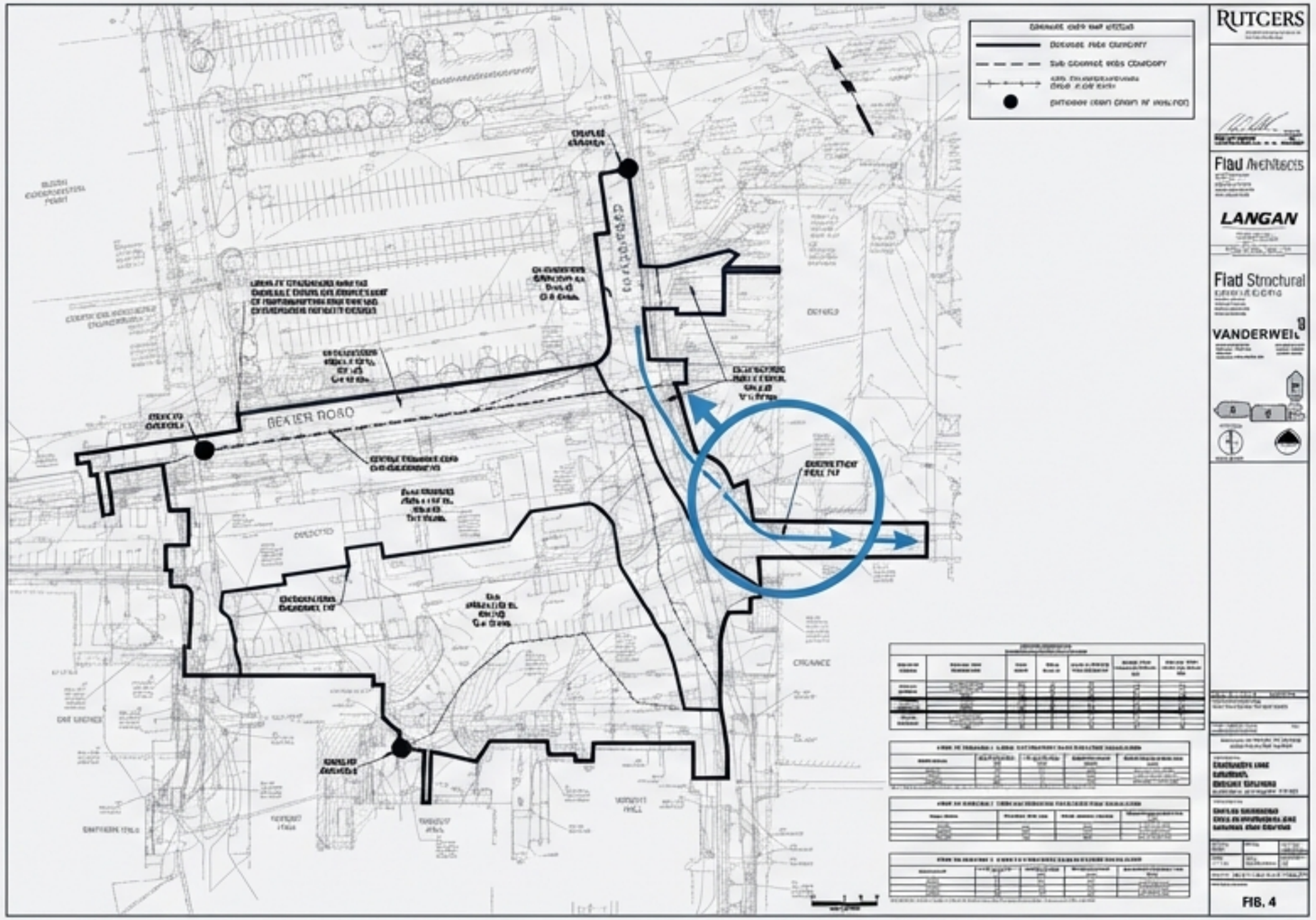
Green Roof Design (2016)



This design demonstrates a Small-scale Green Infrastructure BMP used for groundwater recharge and water quality (Steps 6 & 7).

Case Study: Rutgers New Chemistry Building

Existing Conditions and Baseline Analysis



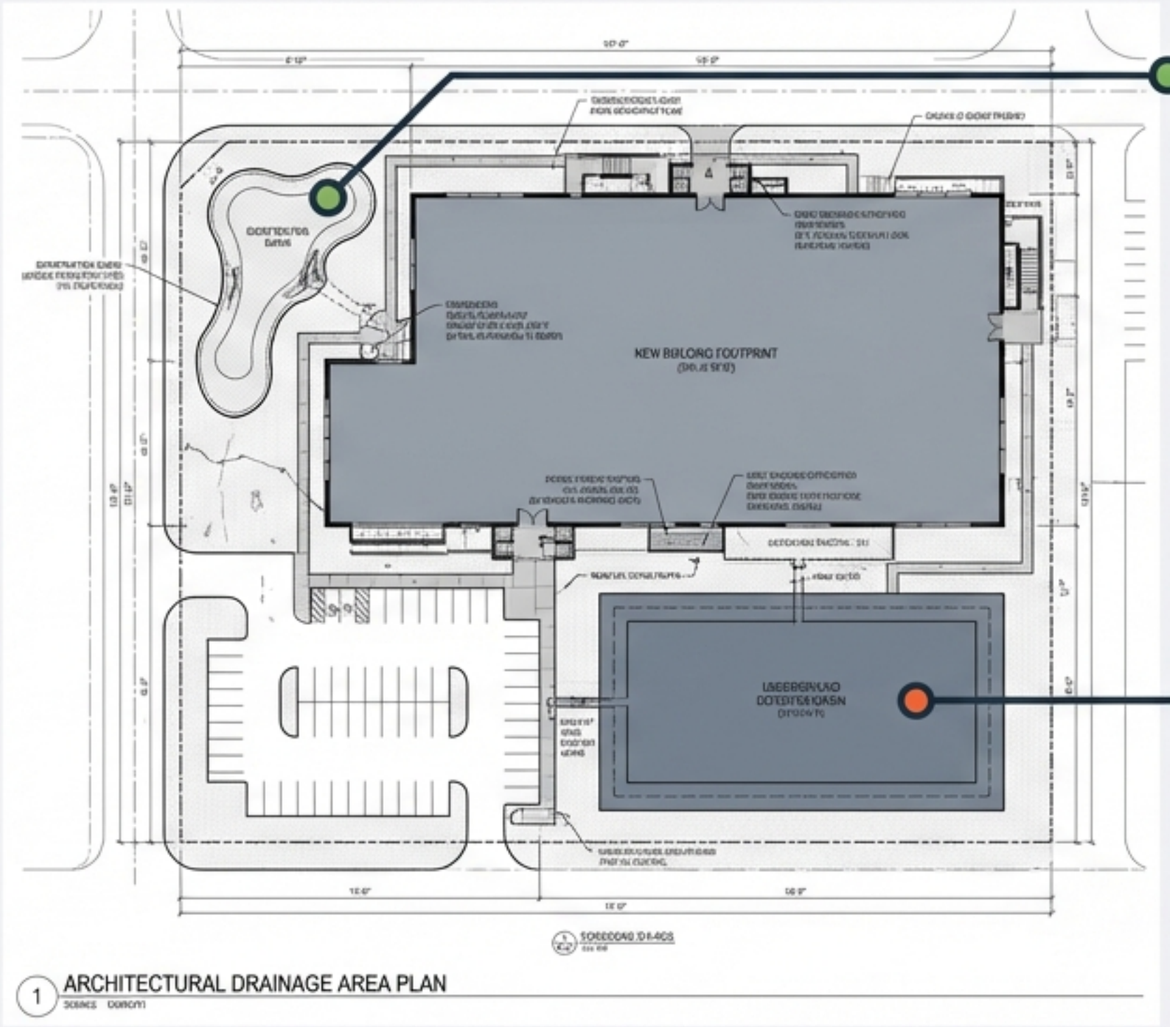
Context

A complex university site requiring baseline analysis.

Goal

This map defines the catchment boundaries and discharge points, satisfying Steps 3 and 4 of the procedure.

Solution: Hybrid Bioretention and Detention



Bioretention Basin (Green Infrastructure)

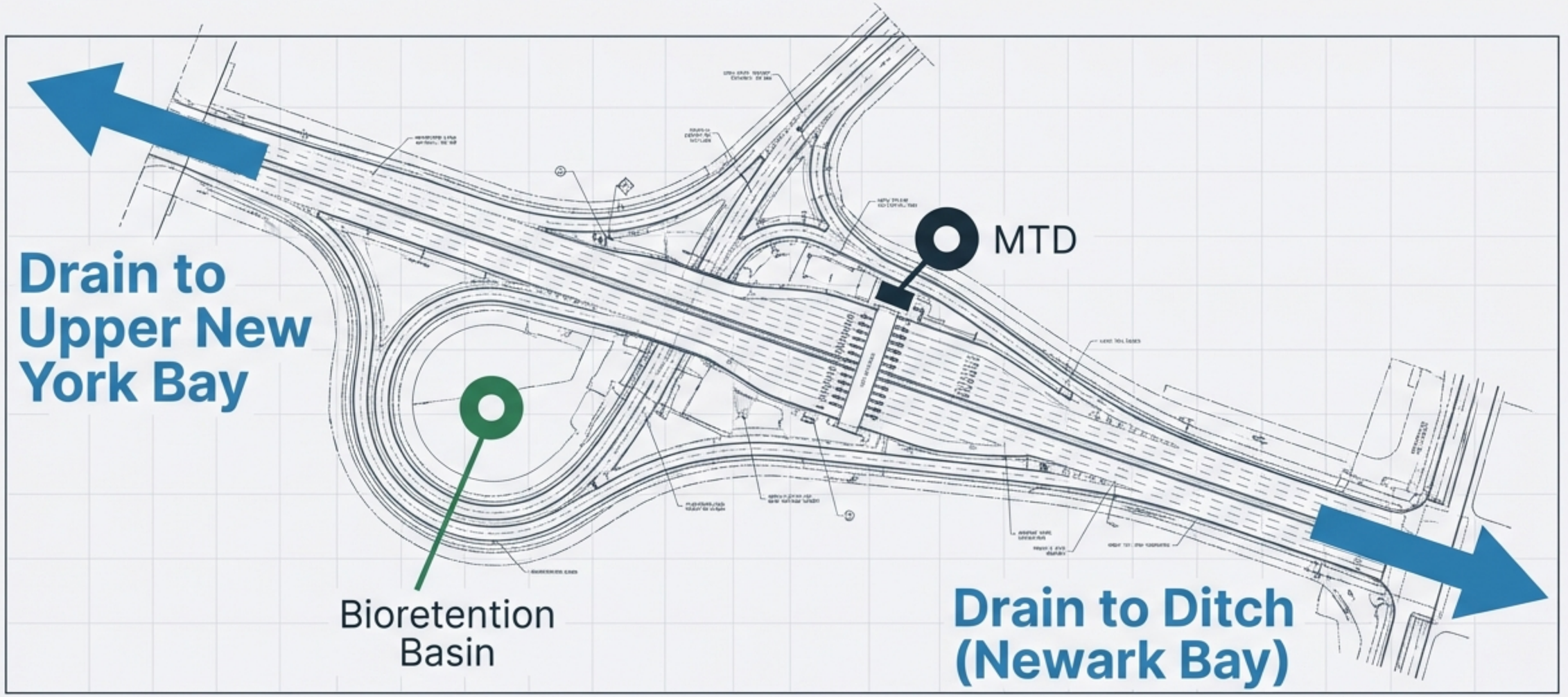
Underground Detention Basin (Flood Control)

The Hybrid Approach:

1. Surface: Visible treatment for quality/recharge.
2. Sub-surface: Hidden volume management for flood control.

Case Study: NJ Turnpike Interchange 14A

Managing Runoff in High-Traffic Zones



Installation: Integrating Infrastructure

Bioretention Basin located inside the ‘Ramp ET’ loop.

Utilizes dead space for ecological benefit.

Manufactured Treatment Device (MTD) near Toll Plaza.

Compact solution for space-constrained industrial zones.

Summary: The Impact of Rigorous Design

Comprehensive Planning

Success starts with ethics, regulations, and site assessment, not just calculations.

Scalable Safety

The 10-step protocol ensures safety from the “average year” rain (**Recharge**) to the **“500-year” disaster** (**Emergency**).

Versatile Application

As seen in the case studies, these principles adapt to rooftops, university campuses, and major highways.

Robust stormwater design protects infrastructure resilience while maintaining environmental integrity.