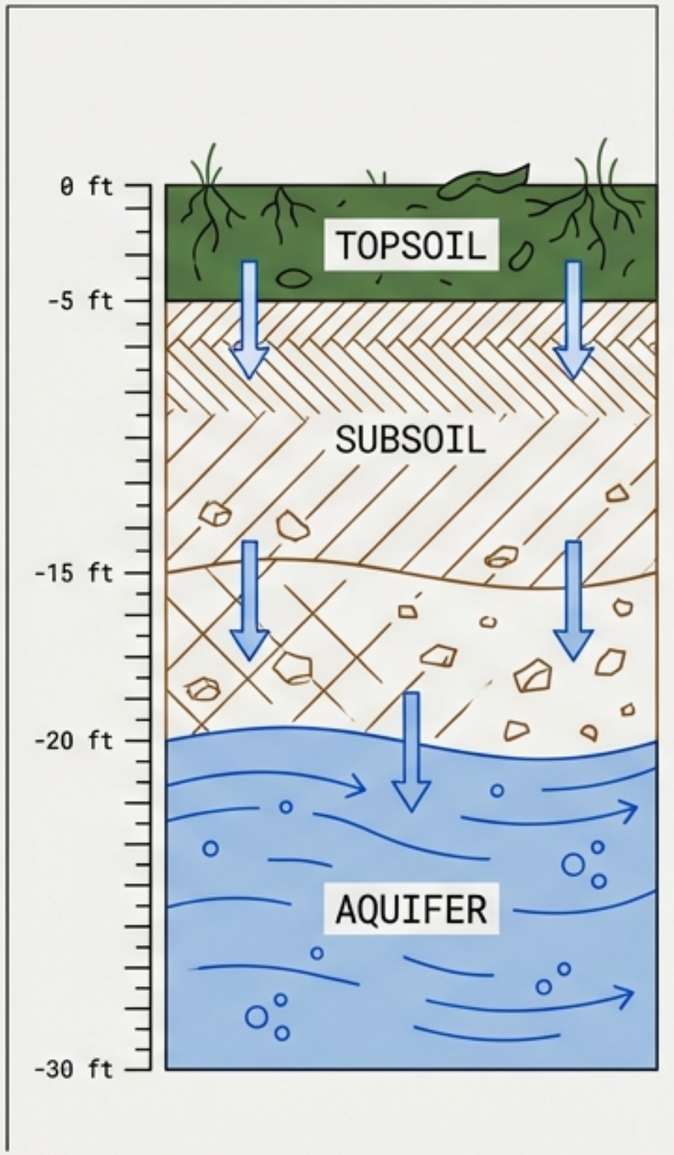
Groundwater Recharge Compliance in New Jersey

From N.J.A.C. 7:8 Standards to NJGRS Computational Design

AUDIENCE:	Site Planners, Designers, Engineers
SCOPE:	Subchapter 5 Design and Performance Standards
METHODOLOGY:	New Jersey Geological Survey Report GSR-32 / NJGRS
DOCUMENT TYPE:	Technical Guidance Deck



ENGINEERING COMPLIANCE SERIES // VOL. 1

Development disrupts the hydrologic cycle by severing infiltration pathways

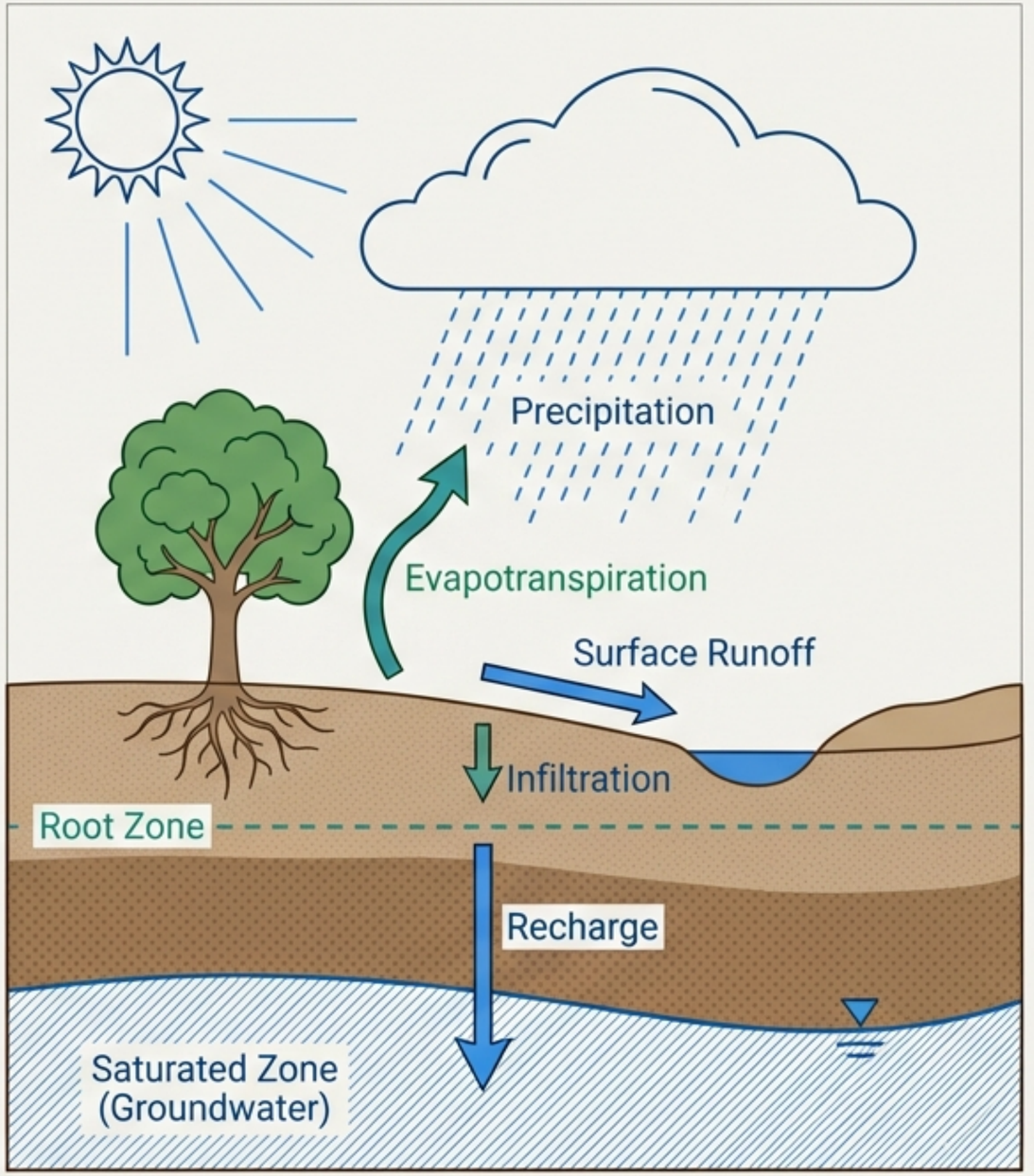
Groundwater recharge is defined specifically as precipitation that infiltrates into the soil and moves downward **below the root zone** of surface vegetation.

The Critical Distinction

It is not merely water entering the soil; it is water that escapes evapotranspiration and enters the saturated zone (aquifers).

The Impact

Converting permeable soils to impervious surfaces or compacting soil reduces this rate. This adversely impacts stream base flows, wetlands health, and water supply well yields.



Subchapter 5 mandates one of two specific pathways for compliance

REQUIREMENT 1: PRESERVATION

Demonstrate through hydrologic and hydraulic analysis that the site and its stormwater management measures maintain **100 percent of the average annual pre-construction groundwater recharge volume** for the site.

Source: N.J.A.C. 7:8-5.4(b)1.i

REQUIREMENT 2: INFILTRATION

Demonstrate through hydrologic and hydraulic analysis that the increase of stormwater runoff volume from pre-construction to post-construction for the **2-year storm** is **infiltrated**.

Source: N.J.A.C. 7:8-5.4(b)1.ii

NOTE: COMPLIANCE WITH EITHER REQUIREMENT SATISFIES THE STANDARD.

Selecting the correct BMP is the first step in successful design

Table 5-1: Green Infrastructure BMPs for Groundwater Recharge

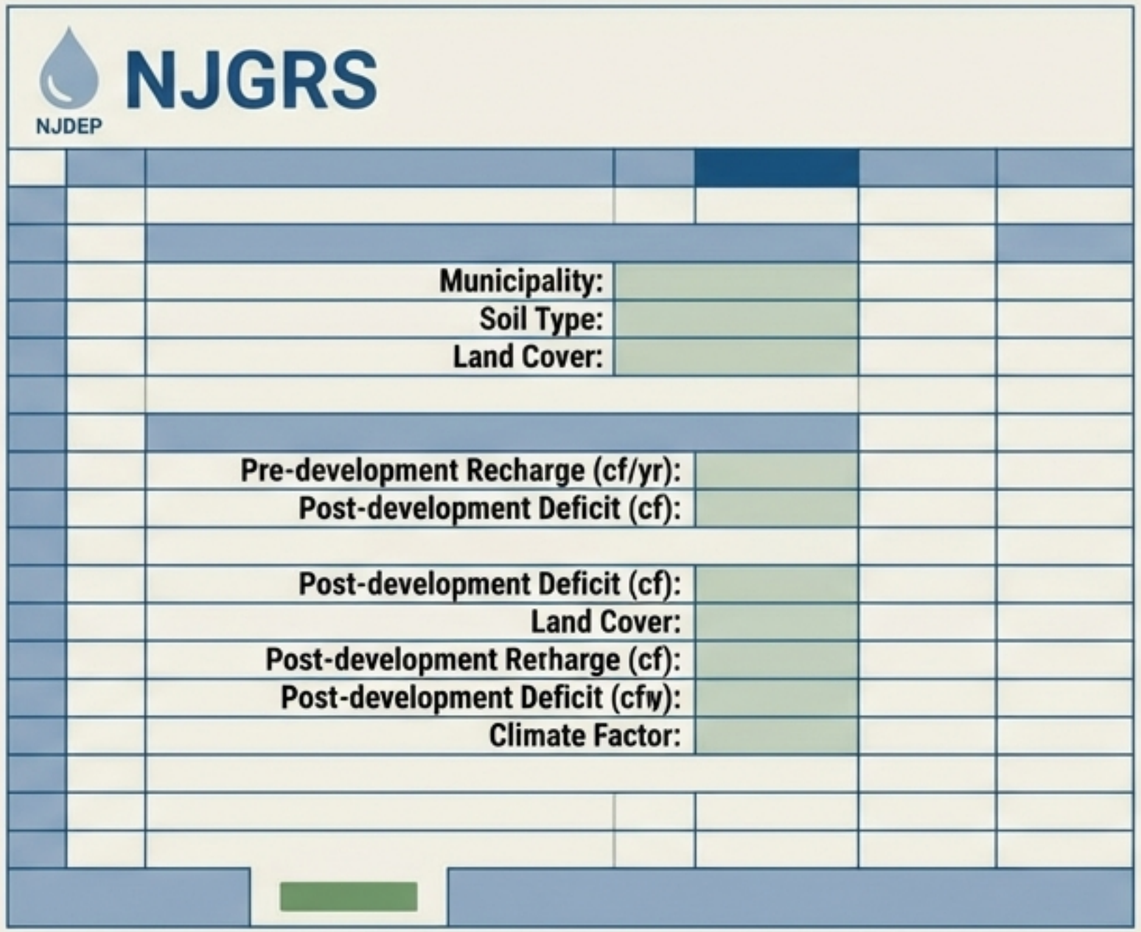
Best Management Practice	Groundwater Recharge	Min. Separation from Water Table
Cistern	No	-
Green Roof	No	-
Vegetative Filter Strip	No	-
Pervious Paving System	Yes*	2 ft
Small-Scale Bioretention Basin	Yes*	2 ft
Dry Well	**Yes**	**2 ft**
Small-Scale Infiltration Basin	**Yes**	**2 ft**
Small-Scale Sand Filter	**Yes**	**2 ft**

Must be designed to infiltrate into subsoil (Note b).

Selection Constraint:

All recharge BMPs require a minimum vertical minimum vertical separation of 2 feet from the seasonal high-water table to ensure proper function and prevent groundwater contamination.

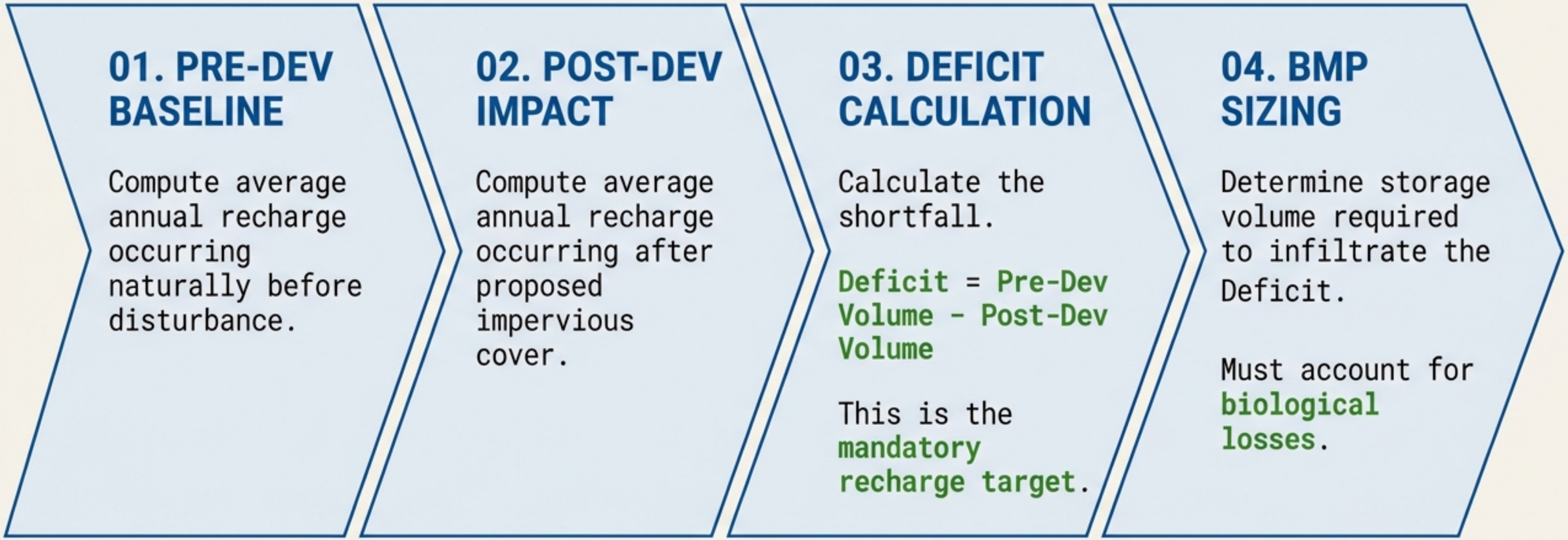
The NJGRS Spreadsheet standardizes the complex calculation of annual volume



- **The Tool:**
  The New Jersey Groundwater Recharge Spreadsheet (NJGRS) is the NJDEP-approved Excel tool for demonstrating compliance with Requirement 1 (Annual Volume).
- **Theoretical Basis:**
  Codified based on the 1993 Geological Survey Report *GSR-32: A Method for Evaluating Ground Water Recharge Areas in New Jersey*.
- **Key Input Parameters:**
  > Municipality-specific Precipitation Data
  > Soil Type (Geologic factor)
  > Land Cover (Vegetation factor)
  > Climate Factor
- **Function:**
  Calculates the pre-development baseline and quantifies the post-development deficit in cubic feet.

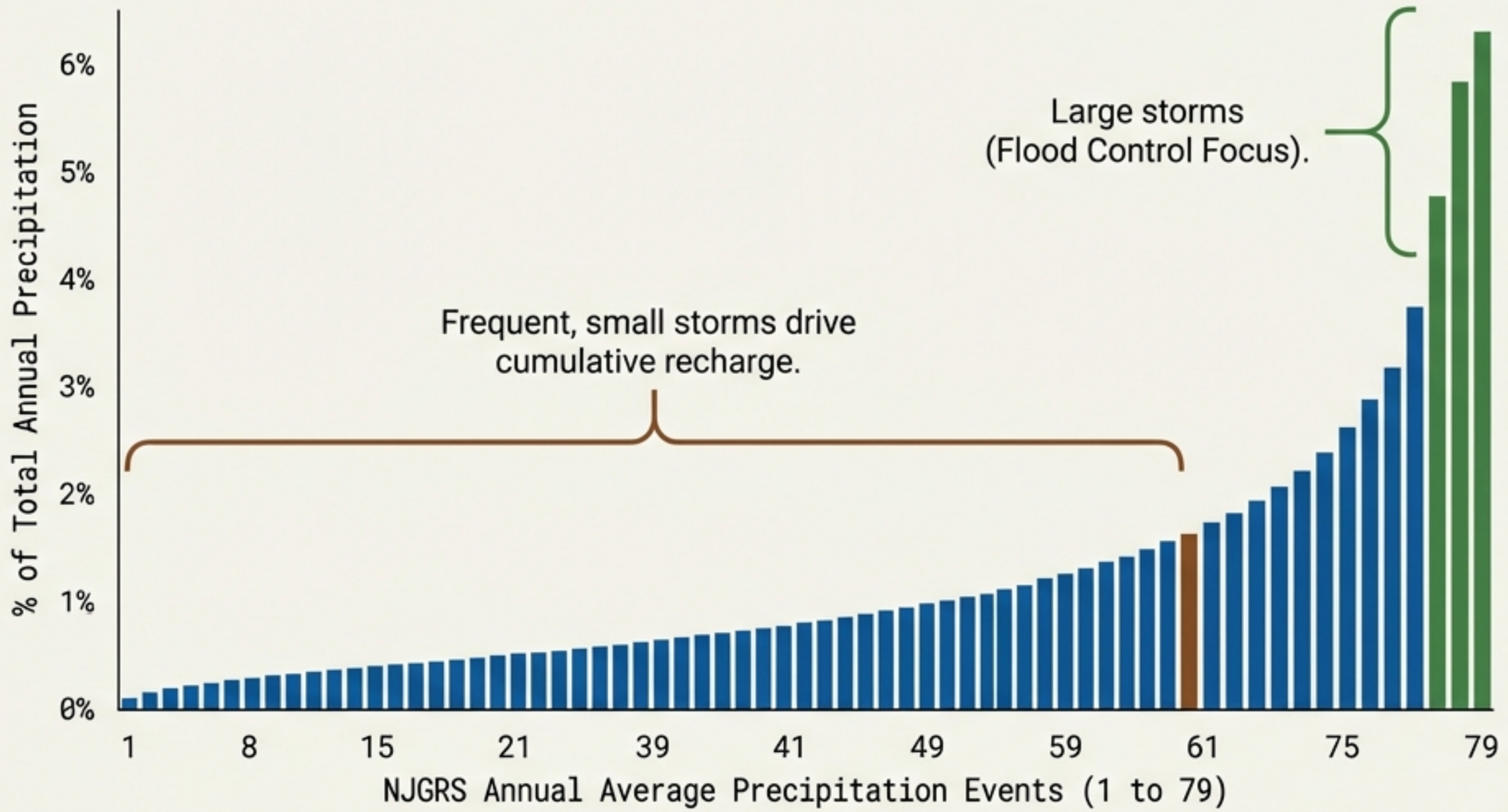
NOTE: ACCURATE DATA ENTRY IS CRUCIAL FOR COMPLIANCE DEMONSTRATION.

Achieving compliance follows a four-step computational logic



Workflow summary based on NJGRS analytic procedures.

Computations rely on a continuous simulation of 79 distinct precipitation events



The "Design Storm" Fallacy

Unlike flood control, which sizes for a single catastrophic event, recharge is a cumulative annual process.

The Data Set:

NJGRS utilizes 52 years of daily data (1948-1999) from 92 stations.

The Method:

The tool simulates an "Annual Average Series" of 79 specific events per year. The BMP must be efficient enough to capture the volume of the frequent small drizzles, not just the rare hurricanes.

NOTE: ACCURATE DATA ENTRY IS CRUCIAL FOR COMPLIANCE DEMONSTRATION.

The model accounts for surface storage and evapotranspiration losses

Small Events (< 0.04 inches)

Assumption: 100% Loss.
Precipitation is consumed by surface storage, cracks, and initial wetting. **Runoff = 0.**

Mid-Range Events (0.04 - 1.25 inches)

$$Q = 0.95 * (P - 0.0408) * 0.90$$

NJGRS Regression Equation: Where P is precipitation depth.
This accounts for infiltration losses during runoff generation.

Large Events (> 1.25 inches)

$$Q = (P - 0.04)^2 / (P + 0.16)$$

Standard NRCS Runoff Equation: Uses Curve Number (CN) of 98.

Case Study: New Jersey Turnpike Interchange 14A Improvements

PROJECT DETAILS

- **Location:** Hudson County, Jersey City
- **Scope:** Widening, new ramps, and toll plaza improvements.
- **Challenge:** Complex mix of new impervious surfaces and restoration of open space.
- **Goal:** Determine net groundwater recharge deficit.

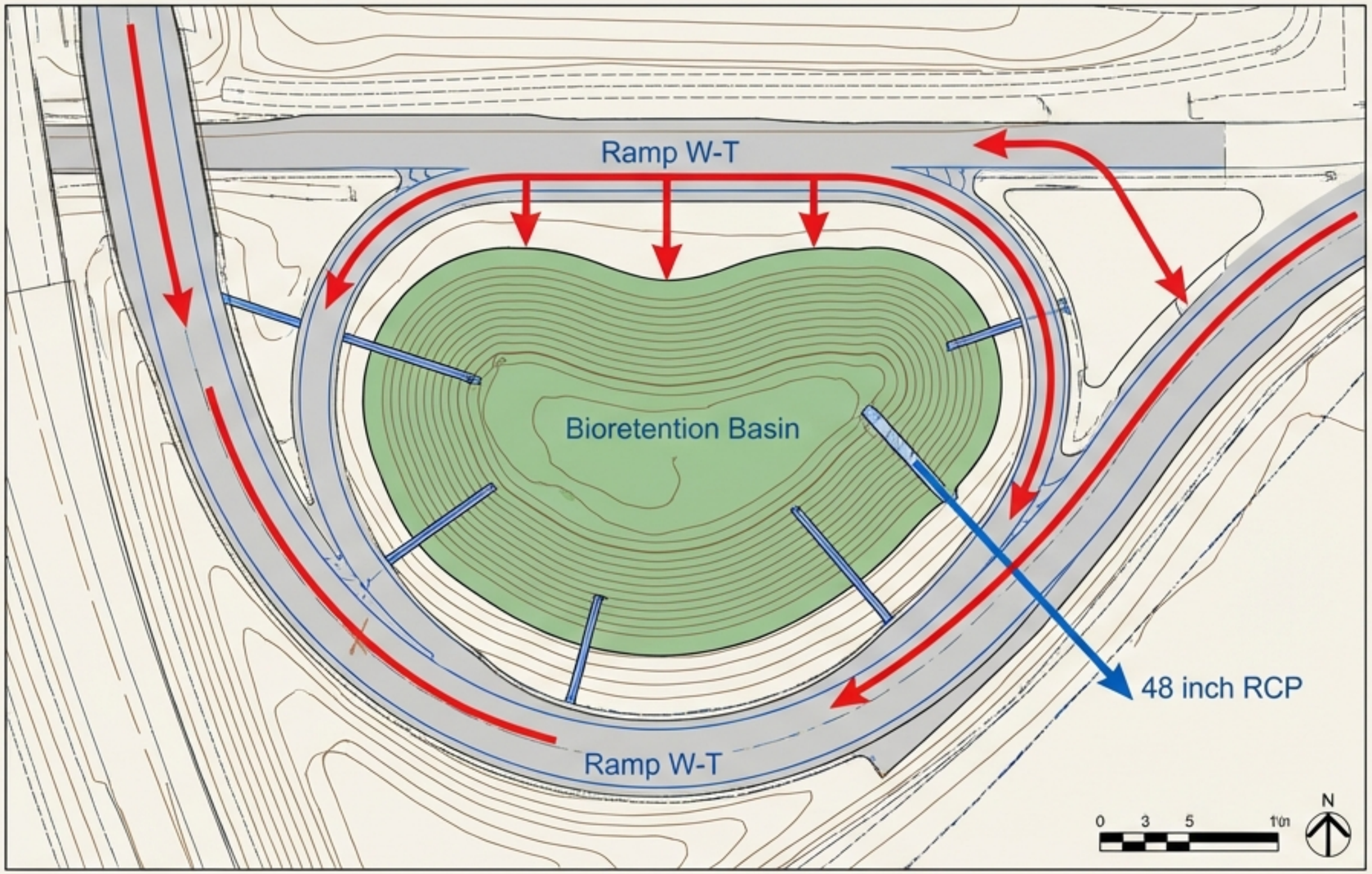
Calculating the Deficit: The annual volume requirement

	A	B	C	D	E	F	G
1	**Annual Groundwater Recharge Analysis**						
2							
3	**Pre-Developed Conditions**				**Post-Developed Conditions**		
4	**Land Cover**	**Area (acres)**	**Annual Recharge (cu.ft)**		**Land Cover**	**Area (acres)**	**Annual Recharge (cu.ft)**
5	Impervious	27.0	0		Impervious	29.2	0
6	Open Space	11.3	441,291		Open Space	10.5	408,311
7	Woods	7.3	297,502				
8							
9	**Total Pre-Dev Recharge: 769,139 cu.ft.**				**Total Post-Dev Recharge: 706,225 cu.ft.**		
10							
11							
12							

Post-Development Annual Recharge Deficit = **62,914 cubic feet**

This is the precise volume the BMP must infiltrate annually.

Design Solution: Bioretention Basin within the interchange loop



Strategy: Runoff from the new impervious ramps is directed into a specialized infiltration facility situated in the non-buildable loop space.

Type: Small-Scale Bioretention Basin.

Function: Collects runoff, filters it through soil media, and infiltrates it into the subsoil.

Verification: Sizing the BMP to balance the deficit

CALCULATION CHECK

Annual Recharge BMP Sizing Worksheet

INPUTS

BMP Area: **894 sq. ft.**

Effective Depth: **12.0 inches**

Post-D Deficit Input: **62,914 cu.ft.**

RESULTS

Annual BMP Recharge Volume: **62,914 cu.ft.**

Efficiency: **93.3%**

SYSTEM STATUS

CALCULATION CHECK MESSAGES

- ✔ Volume Balance -> **OK**
- ✔ dBMP Check -> **OK**
- ✔ dEXC Check -> **OK**

Conclusion: The design successfully mitigates the hydrologic impact, satisfying N.J.A.C. 7:8 requirements.