

**onondaga**  
**creek**  
CONCEPTUAL REVITALIZATION PLAN  
appendix i: best management practices

## Appendix I. Best Management Practices: Management measures and practices to control nonpoint source pollution into receiving waters.

### **Purpose**

The following list outlines management measures and practices adapted from recently published U.S. Environmental Protection Agency (USEPA) guidance documents. The purpose of this appendix is to provide an educational reference to support recommendations made in the conceptual revitalization plan for Onondaga Creek. The USEPA guidance documents provide a holistic approach to nonpoint source pollution management, describing both structural and non-structural approaches, which is compatible with the spirit of the OCRP plan.

**This appendix is not intended to represent a definitive guide to local, federal or New York State regulations, specifications or criteria regarding stormwater runoff, permitting requirements, or stormwater pollution prevention plans (SWPPP).** The information contained herein does not specify binding nonpoint source pollution management measures required for individual sites. For many sites, whether urban or rural, certain site-specific state regulations and guidelines may be required. **Questions about guidelines for, or compliance with, any government regulations or requirements should be referred to appropriate local, state and federal agencies.** Guidelines and requirements are constantly changing due to a number of factors, including regulatory changes, and as experience is gained with existing techniques and new technologies for controlling nonpoint source pollution emerge (NYSDEC, 2003).

The USEPA measures are promulgated as means to manage runoff and reduce nonpoint source pollution of surface and ground waters. The management measures establish performance expectations and in some cases, specify actions to prevent or reduce nonpoint pollution (USEPA, 2005a). The following definitions clarify terminology used by USEPA.

Definitions:

*Best Management Practices (BMPs)* – “A method that has been determined to be the most effective, practical means of preventing or reducing pollution from nonpoint sources.” (USEPA, 2005b, p Glossary-1)

*Management measure* – “A group of cost effective practices implemented cooperatively to achieve more comprehensive goals, such as reducing the loads of sediment from a field to receiving waters.” (USEPA, 2005b, p Glossary-2)

*Nonpoint source (NPS)* – “Diffuse pollution source; a source without a single point of origin or not introduced into a receiving stream from a specific outlet. The pollutants are generally carried off the land by stormwater. Common nonpoint sources are agriculture, forestry, urban areas, mining, construction, dams, channels, land disposal, saltwater intrusion, and city streets.” (USEPA, 2005b, p Glossary-3)

### **Onondaga Creek Watershed Recommendations**

The utilization of performance-based best management practices (BMPs) is recommended as part of the watershed recommendations for Onondaga Creek. All practices should be designed and evaluated on a site-specific basis. Different measures may be required depending on whether the site is urban or rural, new development,

redevelopment or restorative. Process-oriented measures should lead to implementation of practices and improvement of aspect or parameter of concern. If specification-based BMPs must be used, such as in the case to meet stormwater regulations, the Center for Watershed Protection (CWP) recommends designing BMPs to “**achieve the 75th percentile removal efficiency, rather than the median**” (2007, p 4). The utilization of median pollutant removal efficiencies to select BMPs results in design standards for mid-range performance, and subsequently mediocre BMP performance in practice (CWP, 2007).

Green infrastructure approaches are recommended for managing runoff in the Onondaga Creek watershed. Many are incorporated in the USEPA’s management measures listed; see urban management measures 4, 5 and 10 (pages 6-8, 11-12). These approaches mimic natural hydrologic processes to infiltrate, evapotranspire or reuse on-site runoff, and are useable anywhere soils and vegetation can be integrated into the landscape, including urban areas. Green infrastructure approaches include **reforestation, green roofs, rain gardens, pocket wetlands, permeable pavement, vegetated filter strips and riparian buffers**. A second type of green infrastructure practice, ‘decentralized harvesting’, includes **rain barrels and cisterns** that capture and re-use rainwater on-site, usually from rooftops. A host of benefits can be realized by employing green infrastructural techniques that fit well with the goals of creek revitalization. On-site use or filtering of rainwater keeps runoff from contributing to combined sewer overflows or discharging directly to waterways via storm sewers. Reduced volumes, cleaner water, municipal cost savings, and increased energy efficiency are additional benefits. (USEPA, 2008) The USEPA’s *Managing Wet Weather with Green Infrastructure Action Strategy* (2008) is referenced below, along with several other documents describing green infrastructure approaches.

Finally, monitoring and evaluation of all nonpoint source pollution management practices are recommended for the Onondaga Creek watershed. Monitoring and evaluation steps are included in many of the management measures listed below.

### **Acceptable Practices**

BMPs listed in **blue text** correspond with the USEPA’s *National Menu of Best Management Practices for Stormwater Phase II Rule*, developed for and based on Phase II’s six minimum control measures. The USEPA website<sup>1</sup> has informative links to BMPs for each of the six minimum control measures. BMPs highlighted in turquoise, green and yellow correspond with the *New York State Stormwater Management Design Manual’s* list of acceptable stormwater management practices or alternative approaches for redevelopment projects. The significance of each color is described below:

- ◆ = Stormwater management practices acceptable for water quality;
- ◆ = Structural practices suitable for pretreatment or as supplemental practices;
- ★ = Acceptable alternative approaches to stormwater management for redevelopment projects. (CWP, 2003)

The reason for including an interpretation of overlapping recommended practices is to illustrate, for educational and planning purposes, areas where particular stormwater BMPs potentially meet both New York State and federal stormwater guidelines, based on review of the documents referenced at the end of this appendix. The literature review conducted by OEI was not comprehensive and resultant interpretations do not reflect any use other than that relevant to the Onondaga Creek Conceptual Revitalization Plan. **Appropriate local, state and federal stormwater regulatory agencies should be consulted regarding all final decisions about acceptable practices.**

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<sup>1</sup> <http://cfpub.epa.gov/npdes/stormwater/menuofbmps/index.cfm>

Management measures are split into several NPS categories found on the USEPA website<sup>2</sup>; the following categories are selected as most relevant to Onondaga Creek Conceptual Revitalization Plan:

- Agriculture
- Urban
- Wetland/Riparian Management

**A. National Management Measures for the Control Nonpoint Pollution from Agriculture (adapted from USEPA, 2003).**

“Implement Management Practice Systems” (0) is not considered a management measure, but is included in the USEPA document as a separate chapter. It is included here as it may be considered helpful for Onondaga Creek.

**0. Implement Management Practice Systems**, using site-specific design that usually combines both structural and agronomic practices to protect water resources; and can include the following NRCS conservation practices:

- 0.1. Channel vegetation
- 0.2. Conservation cover
- 0.3. Constructed wetland
- 0.4. Contour buffer strips
- 0.5. Critical area planting
- 0.6. Floodwater diversion
- 0.7. Forest site preparation
- 0.8. Grassed waterway
- 0.9 Heavy use area protection
- 0.10. Hedgerow planting
- 0.11 Irrigation system – micro
- 0.12 Irrigation system – sprinkler
- 0.13. Manure transfer
- 0.14. Mulching
- 0.15. Nutrient management
- 0.16. Prescribed grazing
- 0.17. Residue management, seasonal
- 0.18. Riparian forest buffer
- 0.19. Sediment basin
- 0.20. Well decommissioning
- 0.21. Wetland restoration

**Management Measure 1. Nutrient management**

- 1.1 Develop, implement and periodically update a nutrient management plan to
  - 1.1.1 Apply nutrients at necessary rates for realistic crop yields
  - 1.1.2 Improve nutrient application timing
  - 1.1.3 Increase nutrient use efficiency

**Management Measure 2. Pesticide management**

- 2.1 Inventory pest problems, previous pest control measures and cropping history
- 2.2. Evaluate site physical and soil characteristics, including runoff or leaching potential

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<sup>2</sup> <http://www.epa.gov/owow/nps/categories.html>

- 2.3 Use integrated pest management strategies
- 2.4 For pesticide selection, consider persistence, toxicity, runoff and leaching potential
- 2.5 Calibrate pesticide applications equipment periodically

**Management Measure 3. Erosion and sediment control**

- 3.1 Design and install a Resource Management System for erosion, including a combination of management and physical practices to settle pollutants from runoff, using two general strategies or a combination of both:
  - 3.1.1 Implement field practices to minimize soil detachment, erosion and transport of sediment from the field (preferable strategy)
  - 3.1.2 Route field runoff through practices that filter, trap or settle soil particles

**Management Measure 4. Animal feeding operations (AFO) management**  
(AFO owners are expected to develop site-specific Comprehensive Nutrient Management Plans by 2009, according to USDA- USEPA Unified National Strategy for Animal Feeding Operations, 1999)

- 4.1 Divert clean water from contact with feedlots and manure
- 4.2 Prevent seepage from AFO to ground and surface water
- 4.3 Provide adequate storage for liquid and dry manure
- 4.4 Apply manure in accordance with nutrient management plan (see 2)
- 4.5 Address lands receiving wastes, using management measures to trap, store and 'process' materials that might move during precipitation events
- 4.6 Keep records that track manure quantity, utilization and disposal
- 4.7 Manage carcasses of dead animals to prevent adverse affects to ground/surface waters ('mortality management')
- 4.8 Consider full range of environmental constraints and requirements when siting a new or expanding facility, including proximity to surface waters

**Management Measure 5. Grazing management**

- 5.1 Improve/maintain selected plant(s) and plant community, while simultaneously improving/maintaining water quality/quantity, using one or more of the following practices:
  - 5.1.1 Maintain vegetated cover to prevent accelerated soil erosion
  - 5.1.2 Manage grazing practice for positive effects to vegetation and water quality
  - 5.1.3 Minimize soil compaction and other detrimental effects to ensure optimum water infiltration
  - 5.1.4. Maintain or improve riparian and upland area vegetation
  - 5.1.5 Protect streambanks from erosion
  - 5.1.6 Manage manure deposition away from water bodies and to enhance nutrient cycling
  - 5.1.7 Promote ecological and stable plant communities on both upland and bottomland sites

**Management Measure 6. Irrigation water management**

- 6.1. Operate irrigation systems so that timing and amount of water match crop needs
- 6.2 Control field discharge and deep percolation when irrigation waters contain chemicals for crops ('chemigation')

## **B. Management Measures to Control Nonpoint Source Pollution from Urban Areas (adapted from USEPA, 2005a)**

### **Management Measure 1: Develop, Implement, and Enhance a Runoff Management Program Framework and Objectives**

#### Management Practices

- 1.1 Establish Legal Authority to Effectively Implement Program
  - 1.1.1 Examine existing laws and regulations
  - 1.1.2 Develop or improve ordinances for water quality enhancement
  - 1.1.3 Explore market-based regulatory approaches
- 1.2 Develop an Institutional Structure for Runoff Management Program
  - 1.2.1 Establish a watershed baseline
  - 1.2.2 Set up an institutional structure
  - 1.2.3 Determine budgetary resources available for watershed planning
  - 1.2.4 Project future land use change in the watershed/subwatershed
  - 1.2.5 Develop subwatershed plan
  - 1.2.6 Adopt and implement the watershed plan
  - 1.2.7 Revisit and update the watershed and subwatershed plan
- 1.3 Provide Adequate Funding and Staffing
  - 1.3.1 Taxes and fees
  - 1.3.2 Bonds
  - 1.3.3 Leases
  - 1.3.4 Intergovernmental transfers and assistance
  - 1.3.5 Public-private partnerships
- 1.4 Foster Input from Technical Experts, Citizens, and Stakeholders
  - 1.4.1 Technical committees
  - 1.4.2 Citizen committees
  - 1.4.3 Stakeholder committees
- 1.5 Establish Intergovernmental Coordination
- 1.6 Develop Training and Education Programs and Materials

### **Management Measure 2: Develop and Implement a Watershed Assessment Program**

#### Management Practices

- 2.1 Characterize Watershed Conditions
  - 2.1.1 Establish a reference condition
  - 2.1.2 Model pollutant sources and loads
  - 2.1.3 Model receiving water quality
- 2.2 Assess Cumulative Effects
- 2.3 Estimate the Effectiveness of Treatment Programs
- 2.4 Establish a Set of Watershed Indicators
- 2.5 Establish Water Quality Indicators
- 2.6 Establish Physical and Hydrological Indicators
- 2.7 Establish Biological Indicators
- 2.8 Establish Programmatic Indicators
- 2.9 Develop a Suite of Social Indicators

### **Management Measure 3: Develop Watershed Protection Program**

#### Management Practices

- 3.1 Resource Inventory and Information Analysis
  - 3.1.1 Identify environmentally sensitive, critical conservation areas

- 3.1.2 Identify and protect drinking water sources
- 3.2 Development of Watershed Management Plan
- 3.3 Implement the Plan
  - 3.3.1 Develop ordinances or regulations requiring nonpoint source pollution controls for new development and redevelopment
  - 3.3.2 Plan infrastructure
  - 3.3.3 Revise local zoning ordinances
    - 3.3.3.1 Performance-based zoning
    - 3.3.3.2 Overlay zones
    - 3.3.3.3 Bonus or incentive zoning
    - 3.3.3.4 Large-lot zoning
    - 3.3.3.5 Farmland preservation zoning
    - 3.3.3.6 Watershed-based zoning
    - 3.3.3.7 Urban growth boundaries
  - 3.3.4 Establish limits on impervious surfaces, encourage open space, and promote cluster development
  - 3.3.5 Revitalize existing developed areas
  - 3.3.6 Establish setback (buffer zone) standards
    - 3.3.6.1 Buffer ordinance
    - 3.3.6.2 Vegetative and use strategies within management zones
    - 3.3.6.3 Provisions for buffer crossings
    - 3.3.6.4 Integration of structural runoff management practices where appropriate
    - 3.3.6.5 Development of buffer education and awareness programs
  - 3.3.7 Establish slope restrictions
  - 3.3.8 Promote urban forestry
  - 3.3.9 Use site plan reviews and approval
  - 3.3.10 Designate an entity or individual responsible for maintaining the infrastructure, including urban runoff management systems
  - 3.3.11 Use official mapping
  - 3.3.12 Require environmental impact assessment statements
- 3.4 Cost of Planning Programs
- 3.5 Land or Development Rights Acquisition Practices
  - 3.5.1 Fee simple acquisition/conservation easements
  - 3.5.2 Leases, deed restrictions, and covenants
  - 3.5.3 Transfer of development rights
  - 3.5.4 Purchase of development rights
  - 3.5.5 Land trusts
  - 3.5.6 Agricultural and forest districts
  - 3.5.7 Cost and effectiveness of land acquisition programs

#### **Management Measure 4: Site Development**

##### Management Practices

- 4.1 Site Planning Practices
  - 4.1.1 Select site designs that preserve or minimize impacts to predevelopment site hydrology and topography
  - 4.1.2 Protect environmentally sensitive areas
  - 4.1.3 Practice site fingerprinting
  - 4.1.4 Use cluster development
  - 4.1.5 Create open space
- 4.2 On-Lot Impervious Surfaces

- 4.2.1 Reduce the hydraulic connectivity of impervious surfaces
- 4.2.2 Practice rooftop greening★
- 4.2.3 Relax frontage and setback requirements
- 4.2.4 Modify sidewalk standards
- 4.2.5 Modify driveway standards
- 4.3 Residential Street and Right-of-Way Impervious Surfaces
  - 4.3.1 Decrease street pavement width and length
  - 4.3.2 Decrease street right-of-way width
  - 4.3.3 Use alternative cul-de-sac designs
- 4.4 Parking Lot Impervious Surfaces
- 4.5 Xeriscaping Techniques

## **Management Measure 5: New Development Runoff Treatment**

### Management Practices

- 5.1 Infiltration Practices◆
  - 5.1.1 Infiltration basins<sup>3</sup>◆
  - 5.1.2 Infiltration trenches◆
    - 5.1.2.1 Dry well<sup>4</sup>◆
  - 5.1.3 Pervious pavement★◆
- 5.2 Vegetated Open Channel Practices◆
  - 5.2.1 Grass channels◆
  - 5.2.2 Dry Swale◆
  - 5.2.3 Wet Swale◆
- 5.3 Filtering Practices
  - 5.3.1 Filtration basins and sand filters◆
    - 5.3.1.1 Surface sand filter◆
    - 5.3.1.2 Underground sand filter◆
    - 5.3.1.3 Perimeter sand filter◆
    - 5.3.1.4 Organic media filter◆
    - 5.3.1.5 Multi-chambered treatment train
    - 5.3.1.6 Exfiltration/partial exfiltration
  - 5.3.2 Media filtration units
  - 5.3.3 Bioretention systems◆
    - 5.3.3.1 Rain Gardens★
- 5.4 Detention and Retention Practices
  - 5.4.1 Detention ponds and vaults◆
    - 5.4.1.1 Dry pond (also 'dry detention pond')◆
  - 5.4.2 Retention ponds◆
    - 5.4.2.1 Micropool Extended Detention Pond◆
    - 5.4.2.2 Wet Pond◆
    - 5.4.2.3 Wet Extended Detention Pond◆
    - 5.4.2.4 Multiple Pond System◆
    - 5.4.2.5 Pocket Pond◆
  - 5.4.3 Constructed wetlands◆
    - 5.4.3.1 Shallow Wetland◆
    - 5.4.3.2 Extended Detention Wetland◆
    - 5.4.3.3 Pond/Wetland System◆

<sup>3</sup> Note that the EPA stormwater BMPs menu website does not recommend infiltration basins in areas of karst topography. US EPA 2005a notes a number of soil conditions where infiltration practices are not suitable (p 5-10).

<sup>4</sup> Well suited for treating rooftop runoff, as an on-lot storage practice, see USEPA 2005a, p 5-50 and NYSDEC 2003, p 5-3.



5.4.3.4 Pocket Wetland♦

5.5 Other Practices

- 5.5.1 Water quality inlets
  - 5.5.1.1 Deep sump catch basins♦
  - 5.5.1.2 Oil/grit separators♦
- 5.5.2 Hydrodynamic devices★♦
- 5.5.3 Baffle boxes
- 5.5.4 Catch basin inserts♦
- 5.5.5 Alum
- 5.5.6 Vegetated filter strips♦
- 5.5.7 Street surface and subsurface storage<sup>5</sup>♦
- 5.5.8 On-lot storage practices<sup>6</sup>
  - 5.5.8.1 Cisterns★
  - 5.5.8.2 Stormwater planters★
  - 5.5.8.3 Rain barrels<sup>7</sup>★
  - 5.5.8.4 Green rooftops★
- 5.5.9 Microbial disinfection

**Management Measure 6: New and Existing On-Site Wastewater Treatment Systems (Individual or Small Community Septic Systems)**

Management Practices

- 6.1 Use Permitting and Installation Programs that Protect Surface and Ground Water
  - 6.1.1 Planning activities
    - 6.1.1.1 Comprehensive planning
    - 6.1.1.2 Wastewater treatment continuum concept
    - 6.1.1.3 Centralized sewage treatment
  - 6.1.2 System selection, site evaluation, design, and installation
    - 6.1.2.1 Performance-based programs
    - 6.1.2.2 Modeling system performance and impacts
    - 6.1.2.3 Applying system siting criteria
    - 6.1.2.4 Site evaluations that assess suitability for specific technologies
  - 6.1.3 Education, training, licensing, and/or certification programs
  - 6.1.4 Inspection of new on-site wastewater treatment systems
  - 6.1.5 Installation of conventional or alternative systems
    - 6.1.5.1 Pollutant removal processes for conventional systems
    - 6.1.5.2 Septic tanks
    - 6.1.5.3 Subsurface wastewater infiltration systems
    - 6.1.5.4 Leaching chambers
    - 6.1.5.5 Alternative systems
    - 6.1.5.6 Elevated systems
    - 6.1.5.7 Intermittent sand/media filters
    - 6.1.5.8 Recirculating sand/media filters
    - 6.1.5.9 Anaerobic upflow filters
    - 6.1.5.10 Cluster systems
    - 6.1.5.11 Constructed wetlands
    - 6.1.5.12 Sequencing batch reactors
    - 6.1.5.13 Aerobic treatment units

<sup>5</sup> The assumption is that two terms, 'subsurface storage' and 'in-line storage', are equivalent in meaning. USEPA Stormwater BMP menu website notes use limitations with in-line storage.

<sup>6</sup> This is a partial list. See dry well (5.1.2.1) and USEPA 2005a, p 5-50.

<sup>7</sup> Assumption that NYSDEC, 2003, use of the term 'cistern' includes rain barrels, see p 9-16.

- 6.1.5.14 Fixed film systems
- 6.1.5.15 Pressure distribution systems
- 6.1.5.16 Evapotranspiration
- 6.1.5.17 Spray irrigation
- 6.3.1.5.18 Disinfection devices
- 6.1.5.19 Water separation systems
- 6.1.5.20 Vaults or holding tanks
- 6.2 Operation and Maintenance Programs
  - 6.2.1 Development of system inventories and assessment of maintenance needs
  - 6.2.2 Management, operation, and maintenance policies
    - 6.2.2.1 Voluntary Management
    - 6.2.2.2 Regulatory Management
    - 6.2.2.3 Direct management
  - 6.2.3 Inspection and monitoring programs
    - 6.2.3.1 System inspections
    - 6.2.3.2 Improving system effectiveness through water conservation and pollutant reduction
  - 6.2.4 Management of residuals to ensure that they do not present significant risks to human health or water resources

## **Management Measure 7: Bridges and Highways**

### **Management Practices**

- 7.1 Use Site Planning and Design Practices that Reduce Environmental Impacts of Highways and Bridges
- 7.2 Soil Bioengineering and Other Runoff Controls for Highways
  - 7.2.1 Live stakes
  - 7.2.2 Fascines
  - 7.2.3 Brushlayers
  - 7.2.4 Branchpacking
  - 7.2.5 Live gully repair
  - 7.2.6 Live cribwalls
  - 7.2.7 Vegetated rock gabions
  - 7.2.8 Vegetated rock walls
  - 7.2.9 Joint planting
  - 7.2.10 Other runoff and sediment controls for highways
- 7.3 Structural Runoff Controls for Bridges
  - 7.3.1 Scupper drains with runoff conveyance systems
  - 7.3.2 Other runoff treatment practices
- 7.4 Bridge Operation and Maintenance Controls
  - 7.4.1 Enclosures
  - 7.4.2 Containment and collection
- 7.5 Nonstructural Runoff Control Practices
  - 7.5.1 **Implement street sweeping**
  - 7.5.2 Consider alternatives to curbs
  - 7.5.3 Install catch basin inserts
  - 7.5.4 Control litter and debris on roadsides
  - 7.5.5 Manage pesticide and herbicide use
  - 7.5.6 Reduce fertilizer use
  - 7.5.7 Reduce direct discharges
  - 7.5.8 Practice dewatering
  - 7.5.9 Practice spill prevention and control

- 7.5.10 Properly handle and dispose of concrete and cement
- 7.5.11 Manage contaminated soil and water
- 7.5.12 Practice environmentally friendly winter road maintenance

## **Management Measure 8: Construction Site Erosion, Sediment, and Chemical Control**

### Management Practices

#### 8.1 Erosion and Sediment Control Programs

- 8.1.1 Prepare erosion and sediment control plans
- 8.1.2 Provide education and training opportunities for construction personnel
- 8.1.3 Establish plan review and modification procedures
- 8.1.4 Assess ESC practices after storm events
- 8.1.5 Ensure ESC plan implementation

#### 8.2 Erosion Control Practices

- 8.2.1 Schedule projects so clearing and grading are done during the time of minimum erosion potential
- 8.2.2 Phase construction
- 8.2.3 Practice site fingerprinting
- 8.2.4 Locate potential pollutant sources away from steep slopes, water bodies, and critical areas
- 8.2.5 Route construction traffic to avoid existing or newly planted vegetation
- 8.2.6 Protect natural vegetation with fencing, tree armoring, and retaining walls or tree wells
- 8.2.7 Protect environmentally sensitive areas
- 8.2.8 Stockpile topsoil and reapply as a soil amendment to reestablish vegetation
- 8.3.2.9 Cover or stabilize soil stockpiles
- 8.2.10 Use wind erosion controls
- 8.2.11 Intercept runoff above disturbed slopes and convey it to a permanent channel or storm drain
- 8.2.12 On long or steep, disturbed, or man-made slopes, construct benches, terraces, or ditches at regular intervals to intercept runoff
- 8.2.13 Use retaining walls
- 8.2.14 Provide linings for urban runoff conveyance channels
- 8.2.15 Use check dams
- 8.2.16 Seed disturbed areas
- 8.2.17 Use mulches
- 8.2.18 Use sodding for permanent stabilization
- 8.2.19 Install erosion control blankets
- 8.2.20 Use chemicals such as PAM to stabilize soils
- 8.2.21 Use wildflower cover

#### 8.3.3 Sediment Control Practices

- 8.3.3.1 Install sediment basins
- 8.3.3.2 Use modified risers and skimmers
- 8.3.3.3 Install sediment traps
- 8.3.3.4 Use silt fence
- 8.3.3.5 Install compost filter berms
- 8.3.3.6 Establish inlet protection
- 8.3.3.7 Designate and reinforce construction entrances
- 8.3.3.8 Install vegetated filter strips
- 8.3.3.9 Use vegetated buffers

### 8.3.4 Develop and Implement Programs to Control Chemicals and Other Construction Materials

- 8.3.4.1 Develop and implement a materials management program
- 8.3.4.2 Develop and implement a spill control plan
- 8.3.4.3 Develop and implement a waste disposal program

## **Management Measure 9: Reduce Nonpoint Source Pollutants through Pollution Prevention**

### Management Practices

#### 9.1 Household Chemicals

- 9.1.1 Educate the public on proper storage and disposal of household chemicals
- 9.1.2 Conduct storm drain marking
- 9.1.3 Encourage responsible car washing practices

#### 9.2 Lawn, Garden, and Landscape Activities

- 9.2.1 Lawn conversion
- 9.2.2 Soil building
- 9.2.3 Grass selection
- 9.2.4 Mowing and thatch management
- 9.2.5 Yard waste management
- 9.2.6 Minimal fertilization
- 9.2.7 Weed control and tolerance
- 9.2.8 Pest management
- 9.2.9 Point-of-sale education
- 9.2.10 Sensible irrigation

#### 9.3 Commercial Activities

- 9.3.1 Detect and eliminate illicit connections
- 9.3.2 Encourage good housekeeping practices at commercial facilities
- 9.3.3 Provide training and education for employees and customers
- 9.3.4 Devise spill prevention, control, and clean-up plans
- 9.3.5 Conduct an environmental audit
- 9.3.6 Practice safe equipment washing and maintenance
- 9.3.7 Use care when performing construction, repairs, or remodeling
- 9.3.8 Proper disposal of pet waste

#### 9.4 Trash

#### 9.5 Nonpoint Source Pollution Education for Citizens

- 9.5.1 Use multilingual nonpoint source messages
- 9.5.2 Use classroom education to deliver nonpoint source messages

## **Management Measure 10: Reduce Runoff from Existing Development/Redevelopment**

### Management Practices

#### 10.1 Identify, Prioritize, and Schedule Retrofit Opportunities

- 10.1.1 Evaluate existing data
- 10.1.2 Choose appropriate management practices based on site conditions
- 10.1.3 Incorporate low-impact development practices into existing development★
- 10.1.4 Identify undeveloped and privately owned land for acquisition
- 10.1.5 Use routine maintenance as an opportunity for retrofitting existing infrastructure

#### 10.2 Implement Retrofit Projects as Scheduled

- 10.2.1 Retrofit existing runoff management facilities◆
- 10.2.2 Modify the upstream end of road culverts◆

- 10.2.3 Modify storm drainage pipe outfalls◆
- 10.2.4 Add retention structures to channelized streams
- 10.2.5 Install runoff management practices in or adjacent to large parking areas ◆
- 10.2.6 Construct new practices in highway rights-of-way
- 10.2.7 Install trash-capturing devices
- 10.2.8 Install inlet and grate inserts
- 10.3 Restore and Limit the Destruction of Natural Runoff Conveyance Systems
  - 10.3.1 Disconnect impervious areas ★
  - 10.3.2 Encourage overland sheet flow
  - 10.3.3 Increase flow path
  - 10.3.4 Use open swales in place of traditional storm drain systems◆
  - 10.3.5 Establish vegetation throughout the site
  - 10.3.6 Reestablish ground water recharge◆
  - 10.3.7 Protect sensitive areas
- 10.4 Restore Natural Streams
  - 10.4.1 Partially restore the predevelopment hydrologic regime◆
  - 10.4.2 Stabilize channel morphology.
  - 10.4.3 Restore instream habitat structure
  - 10.4.4 Reestablish riparian cover
  - 10.4.5 Protect critical stream substrates
  - 10.4.6 Promote recolonization of the aquatic community
  - 10.4.7 Daylight streams
- 10.5 Preserve, Enhance, or Establish Buffers
- 10.6 Redevelop Urban Areas to Decrease Runoff-Related Impacts
  - 10.6.1 Encourage infill development
  - 10.6.2 Assess vacant, abandoned lots and areas of potentially contaminated soils to promote redevelopment

### **Management Measure 11: Operation and Maintenance of Urban Runoff Management Practices**

#### Management Practices

- 11.1 Establishing a Runoff Control Operation and Maintenance Program
  - 11.1.1 Establish a runoff control operation and maintenance ordinance
  - 11.1.2 Make provisions for maintenance in the design and construction of management practices
  - 11.1.3 Identify mechanisms for program funding
  - 11.1.4 Plan regular inspections
  - 11.1.5 Schedule maintenance, cleaning and debris removal to avoid sediment accumulation
  - 11.1.6 Make provisions for monitoring treatment criteria
  - 11.1.7 Implement training and certification programs to provide educational opportunities for management practice operators
  - 11.1.8 Disposal of residuals
- 11.2 Runoff Source Control Operation and Maintenance
- 11.3 Runoff Treatment Control Operation and Maintenance

### **Management Measure 12: Evaluate Urban Runoff Management Program Effectiveness**

#### Management Practices

- 12.1 Assess the Runoff Management Program Framework
  - 12.1.1 Qualitative measures

- 12.1.2 Quantitative measures
- 12.1.3 Quality assurance/quality control
- 12.2 Track Management Practice Implementation
  - 12.2.1 Track permits
  - 12.2.2 Use operation and maintenance records
  - 12.2.3 Use geographic information systems
  - 12.2.4 Develop surveys
  - 12.2.5 Consider expert evaluations
- 12.3 Gauge Improvements in Water Quality Resulting from Management
  - 12.3.1 Conduct trend monitoring
  - 12.3.2 Conduct effectiveness monitoring
- 12.4 Develop and Implement a Schedule to Improve the Management Program Framework

**C. National Management Measures to Protect and Restore Wetlands and Riparian Areas for the Abatement of Nonpoint Source Pollution (adapted from USEPA, 2005c)**

**1. Management Measure for Protection of Wetlands and Riparian Areas**  
Management Practices

- 1.1 Wetland Evaluation for NPS Control Potential
- 1.2 Assessment of Functions and Values When Implementing NPS management practices
- 1.3 Use Permitting, Licensing, Certification, and Nonregulatory Approaches to Protect Wetland Functions ('Programmatic Approaches')
- 1.4 Use Appropriate Preliminary Treatment Practices to Prevent Adverse Impacts on Wetland Functions

**2. Management Measure for Restoration of Wetlands and Riparian Areas**  
Management Practices

- 2.1 Plan Restoration Project Location Adjacent to or Part of Naturally Occurring Aquatic Ecosystems
- 2.2 Provide Hydrogeomorphic Regime Similar to Wetland/Riparian Area Being Restored
- 2.3 Restore Native Plant Species and Soil Substrate

**3. Management Measure for Vegetated Treatment Systems**  
Management Practices

- 3.1 Construct Vegetated Filter Strips in Upland Areas Adjacent to Water Bodies Subject to Suspended Solids and/or Nutrient Runoff
- 3.2 Engineer/Manage Constructed Wetlands to Avoid Negative Impacts on Surrounding Ecosystems or Ground Water

BMPsList\_v02bb

**References:**

All documents listed can be downloaded from the Internet, either via the hyperlinks below or by entering the title into an Internet search engine.

Center for Watershed Protection. 2007 September. [National Pollutant Removal Performance Database, Version 3](#). Ellicott City, MD: Center for Watershed Protection.



Center for Watershed Protection. 2003 August. [New York State Stormwater Management Design Manual](#). Prepared for New York State Department of Environmental Conservation. Ellicott City, MD: Center for Watershed Protection.

USEPA, et al. 2008 January. [Managing Wet Weather with Green Infrastructure Action Strategy](#). Washington, D.C.: USEPA.

USEPA. 2005a December. [National Management Measures to Control Nonpoint Source Pollution from Urban Areas](#). EPA-841-B-05-004. Washington, D.C.: USEPA Office of Water.

USEPA. 2005b October. [Draft Handbook for Developing Watershed Plans to Restore and Protect Our Waters](#). EPA 841-B-05-005. Washington, D.C.: USEPA Office of Water, Nonpoint Source Control Branch.

USEPA. 2005c July. [National Management Measures to Protect and Restore Wetlands and Riparian Areas for the Abatement of Nonpoint Source Pollution](#). EPA 841-B-05-003. Washington, D.C.: USEPA Office of Water, Nonpoint Source Control Branch.

USEPA. 2003 July. [National Management Measures to Control Nonpoint Source Pollution from Agriculture](#). EPA-841-03-004. Washington, D.C.: USEPA Office of Water.

**Further reading:**

Kloss, C., Cararusse, C. and Stoner, N. 2006 June. [Rooftops to Rivers: Green Strategies for Controlling Stormwater and Combined Sewer Overflows](#), New York, NY: Natural Resources Defense Council.

USEPA. 2007 December. [Reducing Stormwater Costs through Low Impact Development \(LID\) Strategies and Practices](#). EPA-841-F-07-006. Washington, D.C.: USEPA Nonpoint Source Control Branch.

USEPA. 2005 December. [Using Smart Growth Techniques as Stormwater Best Management Practices](#). EPA-231-B-05-002. Washington, D.C.: USEPA Development, Community and Environment Division: Office of Policy, Economics and Innovation.