

Online Training Course Outline

Stormwater 101 Program of Study (2.5 Hours)

Element: **Course Introduction: Stormwater Regulations and Program Overview**

Duration: **12 Min. (recorded video)**

Description of Class:

This introduction explains what the Stormwater 101 training program covers and why it matters. The program is modeled using the City of Houston's stormwater collection system, as an example, one of the largest in the country, and is built to be useful to systems of any size. Students are reminded to always follow their own organization's policies, procedures, and safety requirements. The class then walks through the federal rules that govern stormwater collection systems, starting with the Clean Water Act, and the six minimum control measures every MS4 program must address. Real cases from cities across the country show what happens when a system falls out of compliance. The introduction closes with an overview of the modules in the program.

Learning Objectives:

- Students will understand the federal rules that govern stormwater collection systems, including the Clean Water Act and MS4 permits.
- Students will be able to identify the six minimum control measures required in every MS4 stormwater program.
- Students will understand why staying in compliance matters and the consequences cities face when they do not.

Topics covered include:

- Program background: examples are based on the City of Houston stormwater system
- Importance of following your organization's policies, procedures, and SOPs
- Why the Clean Water Act was created
- Federal rules governing stormwater collection systems
- NPDES and MS4 permits (Phase I and Phase II)
- Stormwater Management Program (SWMP)
- The six minimum control measures
- Keeping current with federal, state, and local requirements
- Consent decrees and the cost of non-compliance
- Case studies: Colorado Springs, Cincinnati, ALCOSAN, St. Louis MSD, and Atlanta
- Overview of the program modules

Element: **Module 1: Introduction to Stormwater Design and Function**

Duration: **27 Min. (recorded video)**

Description of Class:

This module introduces how a stormwater collection system is designed and how it functions. It begins with where stormwater comes from, covering the water cycle, rain and snowmelt, and why the small supply of usable fresh water must be protected. Students learn what a watershed is, how pollutants enter the storm sewer, and how a stormwater system differs from a sanitary sewer. The module then explains how engineers size a storm system for a chosen rain event, why water stands in the street after a heavy rain, and what terms like "100-year flood" mean. It closes with discussing combined sewer overflows and a few major safety hazards workers face in a stormwater system: displaced air blowing off manhole lids, confined space entry, and hydrogen sulfide gas.

Learning Objectives:

- Students will understand where stormwater comes from, what a watershed is, and how to recognize pollution entering the storm system.
- Students will understand how a stormwater system is designed and how it differs from sanitary and combined sewer systems.
- Students will be able to recognize key stormwater safety hazards, including displaced air, confined spaces, and hydrogen sulfide.

Topics covered include:

- The water cycle and forms of precipitation
- Fresh water availability
- What a watershed is
- Pollutants and illegal dumping
- Storm sewer vs. sanitary sewer
- Components of a stormwater collection system
- System design and the Rational Method
- Allowable spread and why water stands in the street
- Understanding 10-, 100-, and 500-year storms
- Combined sewer overflows (CSOs)
- Safety: displaced air, PPE, confined space entry, and hydrogen sulfide

Element: **Module 2: Components of a Stormwater System**

Duration: **34 Min. (recorded video)**

Description of Class:

This module takes a closer look at the components, or assets, that make up a stormwater collection system, using the City of Houston system as an example. Students learn how to identify each component in the field, what it does, and how it is maintained so they can report problems accurately to their supervisors. The class covers maintenance holes, pipe materials, the different inlet types, and the filters and baskets used to catch debris. It explains how runoffs behave on natural ground compared to paved urban areas and why clean inlets and properly graded ditches are critical to preventing flooding. The module closes with a review of vortex separators, detention and retention ponds, underpass pump stations, outfalls with backflow gates, and outfall storm netting.

Learning Objectives:

- Students will be able to identify the major components of a stormwater collection system, including maintenance holes, pipe types, and inlet types.
- Students will understand how runoff behaves in urban areas and why clean inlets, culverts, and properly graded ditches prevent flooding.
- Students will understand the purpose and basic maintenance of vortex separators, ponds, pump stations, outfalls, and storm netting.

Topics covered include:

- Basic stormwater terminology
- Maintenance holes: parts, purpose, and lid markings
- Pipe types: corrugated, plastic, steel, clay, concrete, and fiberglass
- Inlet types: A, B, double B, C, E, and slotted inlets
- Inlet baskets and filtration inserts
- Runoff on natural ground vs. urban areas
- Roadside and off-road ditches and culverts
- Vortex separators and cleaning with the fluidizing method
- Detention and retention ponds
- Underpasses and pump stations
- Outfalls, flap gates, and tidal gates
- Outfall storm netting

Element: **Module 3: Stormwater Investigation and 311 Response**

Duration: **11 Min. (recorded video)**

Description of Class:

This module provides an example of how citizen complaints about drainage can be handled, from the first 311 call to the field investigation and final report. Students are shown an example of the basic 311 service request process, what to do when they arrive on site, and how to communicate professionally with residents, explaining that they represent the city every time they knock on a door. The class then covers how to find the source of a drainage problem, starting with a visual inspection of inlets, culverts, and ditches and moving underground with a pole camera when needed. It also explains how to recognize problems that could belong to private property owners or other agencies. The module closes with an example of how to write a clear, complete report that supervisors and citizens can both rely on.

Learning Objectives:

- Students will understand the basics of a 311-service request process and their role in investigating drainage complaints.
- Students will be able to communicate professionally with residents and locate the source of a drainage problem in the field.
- Students will be able to document their findings in a clear, complete report and identify who is responsible for the repair.

Topics covered include:

- The 311 helpline and service request process
- Resident contact and door tags
- Communication skills and representing the city
- Visual inspection of inlets, culverts, and ditches
- Working downstream to find the obstruction
- Pole camera inspections
- Private property drainage issues
- Documenting findings: footage, times, and photos
- Deciding responsibility and next steps

Element: **Module 4: Stormwater Inspection**

Duration: **16 Min. (recorded video)**

Description of Class:

This module covers the planned inspection of a stormwater system, which is different from responding to a citizen complaint. Inspection crews work through the system on a regular cycle, such as every five years, gathering information that is used to plan cleaning, repairs, and future design. Students learn what assets are, how a drainage area is chosen, and how to set up traffic control safely before work begins. The module also discusses the visual inspection above ground and the pole camera inspection below ground, including how to use GIS maps and asset ID numbers. It closes with an introduction into how to code and rate pipe condition, debris, and roots so the information can be used to prioritize work.

Learning Objectives:

- Students will understand the purpose of asset inspection and how the information supports asset management.
- Students will be able to safely set up and perform visual and pole camera inspections of a drainage area.
- Students will be introduced to coding and rating of pipe condition, debris, and roots to help prioritize cleaning and repair.

Topics covered include:

- Inspection vs. 311 investigations
- What assets are and why they are inspected
- Choosing a drainage area
- Traffic control and work zone safety
- Visual inspection above ground
- Pole camera equipment and operation
- GIS mapping and asset ID numbers
- Opening maintenance holes safely
- Defect coding systems, including NASSCO PACP
- Pipe condition ratings: good, fair, and poor
- Debris and root codes

Element: **Module 5: Stormwater Cleaning**

Duration: **27 Min. (recorded video)**

Description of Class:

This module covers how stormwater assets are cleaned when the system stops cleaning itself. Students learn the most common causes of system failure, including debris in catch basins, root intrusion, sediment in outfalls, and ditches and culverts that are out of grade. The class introduces the combination cleaning unit and stresses the serious dangers of high-pressure water, including hose failures and improperly spliced fittings. It then walks through cleaning catch basins, pipes, culverts, vortex separators, underpass inlets, and pump station wet wells, along with nozzle selection and root cutters. The module closes with dumping and decanting the truck and tips for improving daily production, including dynamic filling from a hydrant.

Learning Objectives:

- Students will be able to recognize the common causes of stormwater system failure and when an asset needs cleaning.
- Students will be introduced to use of combination cleaning units and the dangers of high-pressure water.
- Students will be introduced to the appropriate cleaning methods for catch basins, pipes, culverts, separators, and pump stations while maximizing daily production.

Topics covered include:

- Why a self-cleaning system still needs cleaning
- Common system failures: debris, roots, sediment, and ditches
- The combination cleaning unit
- High-pressure water and hose safety
- Cleaning catch basins and inlets
- Nozzle selection and cleaning pipes and culverts
- Root cutters
- Cleaning vortex separators with the fluidizing method
- Underpass inlets and pump station cleaning
- Pump cavitation
- Confined space entry for wet wells
- Dumping and decanting the truck
- Dynamic filling to improve production

Element: **Module 6: Stormwater Repair**

Duration: **22 Min. (recorded video)**

Description of Class:

This module covers the repair crew's job: fixing what the cleaning crews cannot clean so the water can flow again. Students learn why knowing the system's components matters for ordering materials and talking with the public. The class walks through the basics of the repair process from investigating the job and building a job plan to required notifications, contacting citizens, making the repair, and restoring the site. It stresses planning the right equipment, materials, and PPE so crews are not left waiting while on the job. Safety is a major focus, discussing traffic control, road plates, trench boxes for excavations over five feet, and the deadly force of an overinflated pneumatic plug. The module closes with common repairs to inlets, rings and covers, washouts, and pipe.

Learning Objectives:

- Students will be introduced to the stormwater repair process, from investigating the job and building a job plan to restoring the site.
- Students will be able to plan the equipment, materials, PPE, and notifications a repair requires.
- Students will be able to recognize the major hazards of repair work, including traffic, trench collapse, and pneumatic plug failure.

Topics covered include:

- The role of the repair crew
- Knowing system components and their codes
- Field activities and contacting citizens
- Building a job plan
- Utility locates (811) and lane closure permits
- Equipment and materials
- Personal protective equipment and confined space entry
- Traffic control and road plates
- Trench safety and trench boxes
- Pneumatic plug dangers
- Inlet, ring and cover, and pipe repairs
- Repairing to specification