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Standard Guidelines for the Design of Urban Stormwater Systems

ASCE/EWRI 45-05

Standard Guidelines for Installation of Urban Stormwater Systems

ASCE/EWRI 46-05

Standard Guidelines for the Operation and Maintenance of Urban Stormwater Systems

ASCE/EWRI 47-05

This document uses both the
International System of Units (SI)
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American Society of Civil Engineers

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The following Standards have been issued:

- ANSI/ASCE 1-82 N-725 Guideline for Design and Analysis of Nuclear Safety Related Earth Structures
- ANSI/ASCE 2-91 Measurement of Oxygen Transfer in Clean Water
- ANSI/ASCE 3-91 Standard for the Structural Design of Composite Slabs and ANSI/ASCE 9-91 Standard Practice for the Construction and Inspection of Composite Slabs
- ASCE 4-98 Seismic Analysis of Safety-Related Nuclear Structures
- Building Code Requirements for Masonry Structures (ACI 530-02/ASCE 5-02/TMS 402-02) and Specifications for Masonry Structures (ACI 530.1-02/ASCE 6-02/TMS 602-02)
- ASCE/SEI 7-05 Minimum Design Loads for Buildings and Other Structures
- ANSI/ASCE 8-90 Standard Specification for the Design of Cold-Formed Stainless Steel Structural Members
- ANSI/ASCE 9-91 listed with ASCE 3-91
- ASCE 10-97 Design of Latticed Steel Transmission Structures
- SEI/ASCE 11-99 Guideline for Structural Condition Assessment of Existing Buildings
- ASCE 12-05 Guideline for the Design of Urban Subsurface Drainage
- ASCE 13-05 Standard Guidelines for Installation of Urban Subsurface Drainage
- ASCE 14-05 Standard Guidelines for Operation and Maintenance of Urban Subsurface Drainage
- ASCE 15-98 Standard Practice for Direct Design of Buried Precast Concrete Pipe Using Standard Installations (SIDD)
- ASCE 16-95 Standard for Load Resistance Factor Design (LRFD) of Engineered Wood Construction
- ASCE 17-96 Air-Supported Structures
- ASCE 18-96 Standard Guidelines for In-Process Oxygen Transfer Testing
- ASCE 19-96 Structural Applications of Steel Cables for Buildings
- ASCE 20-96 Standard Guidelines for the Design and Installation of Pile Foundations
- ASCE 21-96 Automated People Mover Standards—Part 1
- ASCE 21-98 Automated People Mover Standards—Part 2
- ASCE 21-00 Automated People Mover Standards—Part 3
- SEI/ASCE 23-97 Specification for Structural Steel Beams with Web Openings
- ASCE/SEI 24-05 Flood Resistant Design and Construction
- ASCE 25-97 Earthquake-Actuated Automatic Gas Shut-Off Devices
- ASCE 26-97 Standard Practice for Design of Buried Precast Concrete Box Sections
- ASCE 27-00 Standard Practice for Direct Design of Precast Concrete Pipe for Jacking in Trenchless Construction
- ASCE 28-00 Standard Practice for Direct Design of Precast Concrete Box Sections for Jacking in Trenchless Construction
- SEI/ASCE/SFPE 29-99 Standard Calculation Methods for Structural Fire Protection
- SEI/ASCE 30-00 Guideline for Condition Assessment of the Building Envelope
- SEI/ASCE 31-03 Seismic Evaluation of Existing Buildings
- SEI/ASCE 32-01 Design and Construction of Frost-Protected Shallow Foundations
- EWRI/ASCE 33-01 Comprehensive Transboundary International Water Quality Management Agreement
- EWRI/ASCE 34-01 Standard Guidelines for Artificial Recharge of Ground Water
- EWRI/ASCE 35-01 Guidelines for Quality Assurance of Installed Fine-Pore Aeration Equipment
- CI/ASCE 36-01 Standard Construction Guidelines for Microtunneling
- SEI/ASCE 37-02 Design Loads on Structures During Construction
- CI/ASCE 38-02 Standard Guideline for the Collection and Depiction of Existing Subsurface Utility Data
- EWRI/ASCE 39-03 Standard Practice for the Design and Operation of Hail Suppression Projects
- ASCE/EWRI 40-03 Regulated Riparian Model Water Code
- ASCE/EWRI 42-04 Standard Practice for the Design and Operation of Precipitation Enhancement Projects
- ASCE/SEI 43-05 Seismic Design Criteria for Structures, Systems, and Components in Nuclear Facilities
- ASCE/EWRI 44-05 Standard Practice for the Design and Operation of Supercooled Fog Dispersal Projects
- ASCE/EWRI 45-05 Standard Guidelines for the Design of Urban Stormwater Systems
- ASCE/EWRI 46-05 Standard Guidelines for the Installation of Urban Stormwater Systems
- ASCE/EWRI 47-05 Standard Guidelines for the Operation and Maintenance of Urban Stormwater Systems

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FOREWORD

The *Standard Guidelines for the Design of Urban Stormwater Systems* is an independent document intended to complement the design procedures of the ASCE Manuals and Reports on Engineering Practice No. 77, *Design and Construction of Urban Stormwater Management Systems*. These standard guidelines are companions to the *Standard Guidelines for the Installation of Urban Stormwater Systems* and the *Standard Guidelines for the Operation and Maintenance of Urban Stormwater Systems*. These standard guidelines were developed by the Urban Drainage Standards Committee, which is responsible to the Environmental and Water Resources Institute of the American Society of Civil Engineers.

The material presented in this publication has been prepared in accordance with recognized engineering principles. These standard guidelines should be used only under the direction of an engineer who is competent in the field of urban subsurface drainage. The publication of the material contained herein is not intended as a representation or warranty on the part of the American Society of Civil Engineers, or of any other person named herein, that this information is suitable for any general or particular use, or promises freedom from infringement of any patent or patents. Anyone making use of this information assumes all liability from such use.

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Standard Guidelines for the Design of Urban Stormwater Systems

1.0 SCOPE

The intent of these standard guidelines is to present design guidance for urban stormwater systems. The collection, management, and conveyance of urban surface waters are within the purview of these standard guidelines for applications such as airports, roads, and other transportation systems; and industrial, commercial, residential, and recreation areas. This document is intended for guidance during the design phase.

These standard guidelines do not address applications such as agricultural drainage, landfills, and injection systems. Combined Sewer Overflows (CSOs) are also not addressed because they are environmentally unacceptable as a new standard of practice in the United States.

Both SI units and customary units are used throughout the guidelines for the narrative, figures, and tables. The formulas are written in dual units or written separately to show the use of either SI units or customary units.

2.0 DEFINITIONS

This section defines specific terms for use in this standard. Referenced documents can be used to enhance the understanding of the terms contained in this standard.

AOS—Apparent opening size of geotextiles sometimes referred to as EOS (effective opening size).

Aquifer—Geologic formation or group of formations through which water flows or within which water is stored.

Base Drainage System—Permeable drainage blanket under a paved roadway, parking area, and so on.

CBR—California Bearing Ratio.

Chimney Drain—Interceptor drain frequently used in dams, embankments, and similar constructions to control seepage within the earthen structure.

Collector Drain—Product or system intended for collecting and transporting.

Colloidal Fines—Clay particles smaller than two microns.

Drainable Water—Water that readily drains from soil under the influence of gravity.

Evapotranspiration—Combined process of moisture evaporation from the soil and transpiration from plants.

Frost Action—Freezing and thawing of soil moisture.

Geocomposite—Geosynthetic materials for collecting and transporting water while maintaining soil stability.

Geology—Surface formations.

Geomembrane—Sheet material intended to form an impervious barrier.

Geosynthetic—Synthetic material or structure used as an integral part of a project, structure, or system. Within this category are surface drainage and water control materials such as geomembranes, geotextiles, and geocomposites.

Geotextile—Woven or nonwoven thermoplastic sheet material intended to allow the passage of water, but not fines, and without collecting fines at the soil—textile interface.

Hydraulic Conductivity—See Permeability.

Hydrology—Movement of water in nature.

Impermeable Barrier Layer—Soil stratum with permeability less than 10% of the average soil permeability between the layer and the ground surface.

Infiltration—Movement of water into the soil.

Longitudinal Drainage System—Drainage system essentially parallel to a roadway, parking area, and so on.

Perched Water Table—Localized condition of free water held in a pervious stratum because of an underlying impervious stratum.

Percolation Rate—Downward movement of water through soil.

Permeability—Rate at which water passes through a porous medium.

Permittivity—Measure of the ability of a geotextile to permit water flow perpendicular to its plane.

Phreatic Surface—Upper service of an unconfined body of groundwater.

Relief Drain—Any product or construction that accelerates the removal of drainable surface water.

Seepage—Movement of drainable water through soil and rock.

Sink—Relatively small surface depression that allows surface drainage to enter the surface water system.

Soil Texture—Relative proportions of sand, silt, and clay particles in a soil mass.

Subsurface Water—All water beneath the ground or pavement surface. Usually referred to as groundwater.