Appendix A Regulatory-Permit Index

Regulatory Authority

The control of soil erosion and sediment is an essential element of water quality and soil health. As such, this is recognized most prominently in the regulatory structure of the Clean Water Act (CWA) as codified in 40 Code of Federal Regulations (CFR) Part 450 and Connecticut's Soil Erosion and Sediment Control Act (§22a-325 through §22a-329 of Connecticut's General Statutes, CGS). The requirements of these regulatory sections are implemented through Federal, State and local authority outlined in Figure A- 1 below.

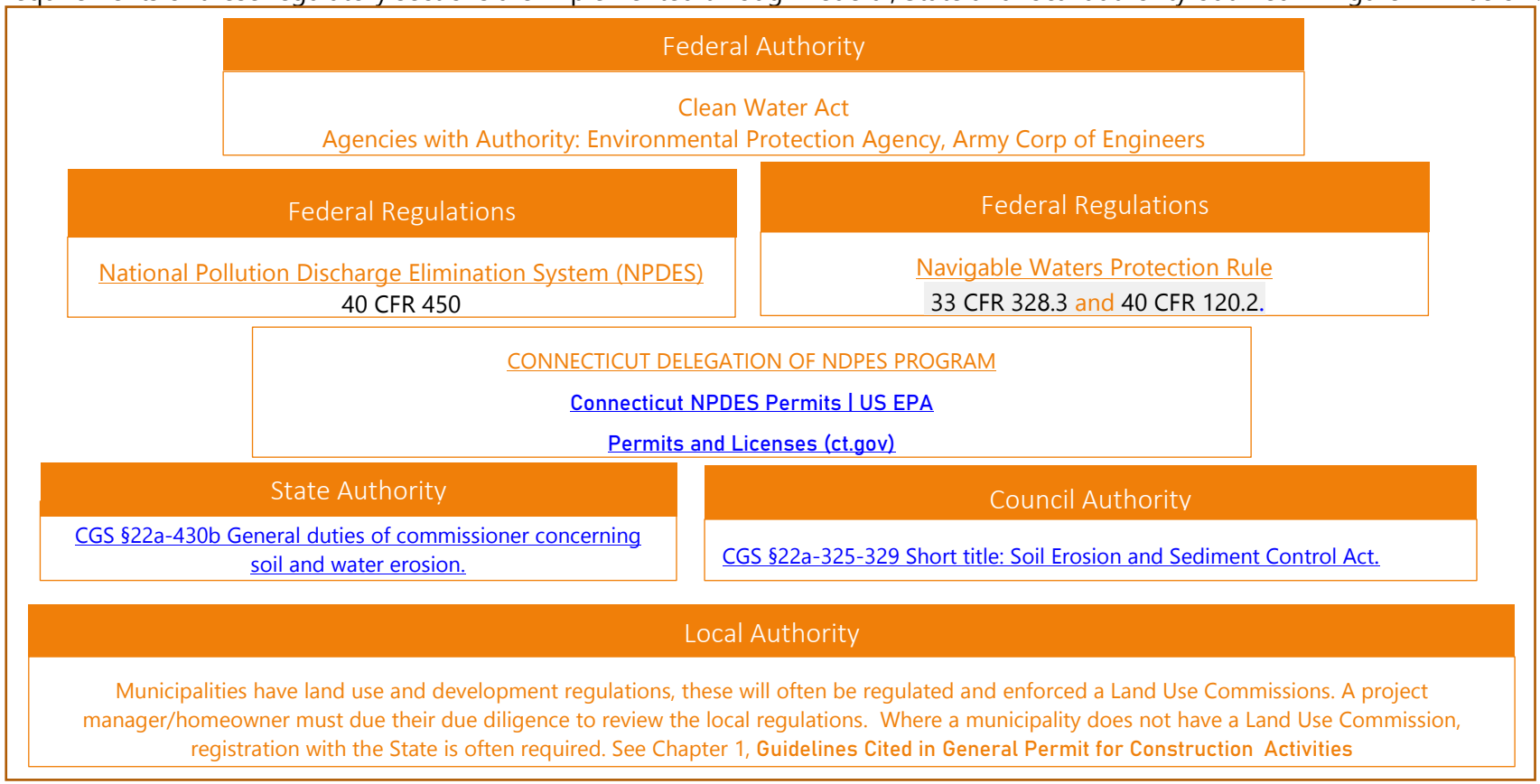


Figure A- 1 Regulatory Authority for Soil Erosion and Sediment Control

Selection of Example Permits

This section describes the primary permitting processes that are or have elements applicable to soil erosion and sediment control in Connecticut. One of the primary permit processes that include soil erosion and sediment control is the Discharge of Stormwater Dewatering Wastewaters from Construction Activities, as noted in Chapter 1. However, there are a significant number of other permit processes that have soil erosion and sediment control requirements, those applicable to the state processes are noted below. This list a set of example permits whereby the requirements are related to soil erosion and sediment control but is not all encompassing. Additionally this list is subject to change per evolving interpretations, policy and legislation please see CT DEEP's permitting page and Army Corp of Engineers for the most up to date permit information. Additionally, as noted previously it is also paramount that a project manager, or project engineer perform due diligence in assessing the local requirements.

Permit: Discharge of Stormwater and Dewatering Wastewaters from Construction Activities

This general permit applies to all discharges of stormwater and dewatering wastewater from construction activities which result from the disturbance of one or more total acres of land area on a site **regardless of project phasing**.

Permit: General Permit for the Discharge of Stormwater Associated with Industrial Activity

This general permit applies to all discharges from any conveyance which is used for collecting and conveying stormwater and which is directly related to manufacturing, processing or material storage areas at an industrial activity. Registration is required to be submitted in order for the discharges to be authorized by this general permit.

Permit: General Permit for the Discharge of Stormwater from Department of Transportation Separate Storm Sewer Systems

This general permit applies to the discharges of stormwater and non-stormwater associated with the Department of Transportation.

Permit: General Permit for Coastal Maintenance

This general permit applies to the maintenance of various coastal structures and activities within the tidal, coastal, and navigable waters of the state below the elevation of the coastal jurisdiction line and, where specifically allowed, in tidal wetlands. These maintenance activities include: marina and mooring boundary reconfiguration, remedial activities required by order, FEMA residential flood hazard mitigation, reconstruction of permitted structures, DOT maintenance activities, beach grading, removal of derelict structures, cultch placement, minor seawall repair, catch basin cleaning, flap gate repair, habitat restoration activities, temporary construction access and DEEP boat launch repairs.

Permit: General Permit for the Discharge of Stormwater Associated with Commercial Activity

This general permit applies to all discharges from any conveyance which is used for collecting and conveying stormwater and which is directly related to retail, commercial, and/or office services whose facilities occupy ***five acres or more*** of contiguous impervious surface. Registration is required to be submitted in order for the discharges to be authorized by this general permit.

Permit: General Permit for the Discharge of Stormwater From Small Municipal Separate Storm Sewer Systems Reissuance with Modifications

This general permit applies to all municipalities that have Urbanized Areas as determined by the U.S. Census Bureau. Specifically, it applies to a town's separate storm sewer system and how the town manages their system and what measures they take to reduce or eliminate the discharge of pollutants to that system. Registration is required to be submitted in order for the discharges to be authorized by this general permit.

Permit: General Permit for the Discharge of Groundwater Remediation Wastewater

This general permit applies to the discharges of any groundwater remediation wastewater or well rehabilitation wastewaters and groundwater remediation recirculating system wastewater.

Permit: General Permit for Minor Coastal Structures

These minor structures include: 4/40 docks, access stairs, non-harbor moorings, osprey platforms and perch poles, buoys and navigational markers, harbor moorings, swim floats, pump-out facilities and experimental activities and scientific monitoring devices. Registrations are required to be submitted and approved in writing by the Department in order for the 4/40 docks, access stairs and non-harbor moorings to be authorized by this general permit.

Permit: General Permit for Water Resource Construction Activities

This general permit authorizes the following activities that require permitting through the DEEP under the Inland Wetlands and Watercourses Act, and Connecticut Water Diversion Policy Act, subject to certain conditions, if they are within the jurisdiction of the Commissioner: trail construction, public works projects, infrastructure repairs, and conservation activities. Statewide activities such as: beach maintenance, boat launch maintenance, drainage maintenance are also covered under this general permit. Furthermore, this general permit authorizes, subject to certain conditions, activities for which an authorization has been granted under Category 1 or Category 2 of the Department of Army (US Army Corps of Engineers) General Permit State of Connecticut.

The following categories require written authorization from the Commissioner: Trail Construction, Infrastructure Repairs, Public Works Projects, and Maintenance Plans. The following categories are filing only: Activities Authorized Under Category 1 or Category 2 of the Department of Army.

Permit: General Permit to Conduct Maintenance, Repairs, and Alterations to Dams

This permit authorizes limited amounts of minor maintenance and repair activities on all dams including removing debris and sediment, replacing weir boards, installing security and safety fencing, replacing sealant in construction joints, establishing grass cover on existing riprapped embankments, maintenance of existing toe drain systems, seepage measurement devices, replacing less than 10 square yards of riprap, exercising and maintenance of gates and valves, cutting and removing woody vegetation (no removal of 3" or larger root systems), restoration of grass cover, filling up to 10 animal burrows, quantity limited concrete and masonry repairs allowed each year. No DEEP filing or registration is required, however, a notice to the municipality using the DEEP notice form is required.

Permit: General Permit to Conduct Maintenance, Repairs, and Alterations to Dams (GP-015)

This permit authorizes two levels of limited minor repairs and alterations to dams and removal of remnants of dams. Work authorized under Section 3(a)1 of this permit to the limits specified may be done on dams less than 15 feet high and storing less than 50 acre-feet of water without professional engineering oversight including replacing up to 25 square yards of riprap, restoring eroded areas, filling up to 15 animal burrows, quantity limited concrete and masonry repairs. Section 3(a)2 of this permit authorizes increased amounts of work on any size dam with professional engineering oversight including Installing up to 200' of toe drains, minor repairs to trash racks, gates, valves (no excavation), placing up to 75 square yards of riprap, removing tree root systems (low tree density), filling up to 20 animal burrows; minor concrete and masonry repair, sliplining up to a 36" diameter outlet pipe, grouting voids, installing bridges over spillways not requiring a center support, digging test pits, drilling soil borings, and installing piezometers. Section 3(a)3 of this permit authorizes removal of remnants of dams no longer impounding water or collecting sediment. A filing using the DEEP GP-015-3(a)1 NO PE form or GP-015-3(a)2 and 3(a)3 PE form, a notice to the municipality using the DEEP notice form, and a filing fee of up to $200 is required.

Permit: General Permit to Conduct Maintenance, Repairs, and Alterations to Dams (GP-016)

This permit authorizes limited amounts of minor repairs and alterations to dams and some minor dam removal activities including installing up to 400' of toe drains, repair or replacement of trash racks, gates, and valves, placing up to 150 square yards of riprap, removing tree root systems (moderate tree density), filling up to 25 animal burrows, repairs to or construction of concrete portions of dams (limited concrete volume by formula), repointing or repairing masonry (square foot limit), sliplining outlet pipes (no size limit), grouting voids, installing bridges over spillways which may require center support, digging test pits, drilling soil borings, installing piezometers. Dam removal activities authorized include removal of low or moderate hazard class dams meeting certain criteria, and projects to provide fish passage. A filing using the DEEP GP-016-3(a) Approval filing form, a notice to the municipality using the DEEP notice form, a reply approval, and a filing fee of up to $250 is required.

Appendix B RUSLE

Excerpt from the USDA ARS, National Sedimentation Laboratory:
https://www.ars.usda.gov/midwest-area/west-lafayette-in/national-soil-erosion-research/docs/rusle/

The Revised Universal Soil Loss Equation (RUSLE) [is a computer program that] predicts long-term, average-annual erosion by water for a broad range of farming, conservation, mining, construction, and forestry uses.

The Revised Universal Soil Loss Equation (RUSLE) is an update to Agricultural Handbook No. 537, containing a computer program to facilitate the calculations. RUSLE also includes the analysis of research data that were unavailable when Agricultural Handbook 537 was completed. Although the original Universal Soil Loss Equation (USLE) has been retained in RUSLE, the technology for factor evaluation has been altered and new data have been introduced with which to evaluate the terms for specified conditions.

Both RUSLE1.06c and RUSLE2 were developed and are maintained principally by the USDA-Agricultural Research Service (ARS), the USDA-Natural Resources Conservation Service (NRCS), and the University of Tennessee.

RUSLE began development at the National Soil Erosion Research Laboratory in the early 1990's. It is now maintained by the ARS National Sedimentation Laboratory in Oxford Mississippi.

Further information, the most up to date version and tutorials can be found on the ARS National Sedimentation Laboratory Website, https://fargo.nserl.purdue.edu/rusle2_dataweb/

Appendix C Agency Contact Information

US Army Corps of Engineers

General Questions: 1-202-761-0011
New England District
Attention: CENAE-OD-R
696 Virginia Road
Concord, MA, 01742-2751
P: 1-978-318-8238 & Toll Free: 1-800-343-4789
F: 978-318-8303
Website: New England District, U.S. Army Corps of Engineers

US Environmental Protection Agency

Headquarters
Environmental Protection Agency
1200 Pennsylvania Avenue, N. W
Washington, DC 20460

Region 1 Office
5 Post Office Square – Suite 100
Boston, MA 02109-3912
P: 1-888-372-7341
W: http://www.epa.gov/region01/

EPA Long Island Sound Office

	Stamford Government Center 888 Washington Blvd. Stamford, CT 06904-2152 P: 1-203-977-1541 W: https://longislandsoundstudy.net/

Connecticut Regulations and Statutes

Statutes: *https://www.cga.ct.gov/current/pub/titles.html*	Regulations and all associated documentation, including comment period instructions and submittals: https://eregulations.ct.gov/eRegsPortal/

Connecticut State Agencies & Councils

Primary Directory of Connecticut	https://portal.ct.gov/Government/Departments-and-Agencies

CT State Library

	231 Capitol Ave, Hartford, CT 06106 Phone: 1-860-757-6500 Website: https://ctstatelibrary.org/

USDA Natural Resources and Conservation Service

Website: https://usda.gov

1185 New Litchfield Street Torrington CT 06790

NRCS CT State Office	344 Merrow Road, Suite A Tolland, CT 06084-3917 P: 1-860-871-4011
NRCS Danielson Office	USDA, Natural Resources Conservation Service 71 Westcott Road, Danielson, CT 06239 Phone: 1-860-779-0557
NRCS Hamden Office	USDA, Natural Resources Conservation Service 51 Mill Pond Road, Hamden, CT 06514-1703 Phone: 1-203-287-8038
NRCS Norwich Service Center	USDA, Natural Resources Conservation Service Yantic River Plaza, 238 West Town Street, Norwich, CT 06360 Phone: 1-860-887-3604
NRCS Torrington Service Center	USDA, Natural Resources Conservation Service 1185 New Litchfield Street, Torrington, CT 06790 P: 1-860-626-8852
NRCS Windsor Service Center	USDA, Natural Resources Conservation Service 100 Northfield Drive, 4th Floor, Windsor, CT 06095 Phone: 1-860-688-7725

CT Agricultural Experiment Station

123 Huntington Street

New Haven, CT 06511

P: 203-974-8500

Toll-Free: 1-877-855-2237

Website: https://portal.ct.gov/CAES

CT Council on Soil and Water Conservation

Email: ctcouncilswc@gmail.com

http://www.ctcouncilonsoilandwater.org/

CT Council on Environmental Quality

79 Elm Street Hartford, CT 06106

Phone: 1-860-424-4000

Website: https://portal.ct.gov/ceq

CT Department of Agriculture

450 Columbus Blvd.
Suite 701
Hartford, CT 06103
P: 1-860-713-2500
Toll Free: 1-800-861-9939
Website: https://portal.ct.gov/DOAG

CT Department of Administrative Services

450 Columbus Boulevard
Hartford, CT 06103
P: 1-860-713-5100
Website: https://portal.ct.gov/DAS

CT Department of Economic and Community Development

450 Columbus Boulevard
Hartford, CT 06103
P: 1-860-500-2300
Website: https://portal.ct.gov/DECD

CT Department of Energy and Environmental Protection

79 Elm Street

Hartford, CT 06106-5127

P: 1-860-424-3000

W: https://portal.ct.gov/DEEP

CT Department of Public Health

410 Capitol Ave.

Hartford, CT 06134

P: 1-860-509-8000

Website: https://portal.ct.gov/DPH

CT Department of Transportation

2800 Berlin Turnpike

P.O. Box 317546

Newington, CT 06131-7546

P: 1-860-594-2000

Office of Environmental Planning

P: 1-860-594-2946

Website: https://portal.ct.gov/dot

CT Cooperative Extension System

1376 Storrs Rd, Unit 4066

Phone: 1-860-486-2917

Email: cahnrdean@uconn.edu

Website: https://cahnr.uconn.edu/extension/

Extension Specialist Directory:
https://cahnr.uconn.edu/extension/specialists/

CT Secretary of State

P.O Box 150470

165 Capitol Avenue Suite 1000

Hartford CT 06115-0470

Phone: 1-860-509-6200

Website: https://portal.ct.gov/sots

Connecticut Business Registration System

https://business.ct.gov/New-Business-Registration-System?language=en_US

CT Siting Council

New Britain, CT 06051

P: 1-860-827-2935

Email address: siting.council@ct.gov

Website: https://portal.ct.gov/CSC

Conservation Districts

https://www.conservect.org/

Connecticut River Coastal Conservation District
deKoven House
27 Washington Street
Middletown, CT 06457
P: 1-860-346-3282
Email: *ctrivercoastal@conservect.org*

Eastern Connecticut Conservation District
139 Wolf Den Road
Brooklyn, CT 06234
P: 1-860-774-9600 ext: 13

238 West Town Street
Norwich CT 06360
P: 1-860-319-8806

North Central Conservation District
24 Hyde Avenue
Vernon, CT 06066-4503
Phone: 1-860-875-3881

Southwest Conservation District
Northern Research Station
51 Mill Pond Rd
Hamden, CT 06514
Phone: 1-203-859-7014
Email: SWCD@conservect.org

Northwest Conservation District
1185 New Litchfield St
Torrington, CT 06790
P: 1-860-626-7222
E: info@nwcd.org
W: https://nwcd.org/

Appendix D – Design Storms

Introduction

Many of the erosion and sediment control measures contained in these Guidelines are designed to convey peak rates of runoff and/or withstand associated flow velocities without erosion or flood damage for storm events of various sizes, which are also called "design storms." Design storms are defined in terms of.

1. rainfall depth and duration
2. recurrence interval (i.e., the likelihood or probability of the occurrence of a certain size storm event)
3. rainfall distribution (i.e., how rain falls during a storm event)

Design Storm Rainfall Depth and Duration

Design storm rainfall depth and duration shall correspond to the 24-hour precipitation depth with a specified recurrence interval as defined by the National Oceanic and Atmospheric Administration (NOAA) Atlas 14 precipitation frequency estimates, as amended,[81],[81] or equivalent regional or state rainfall probability information developed from NOAA Atlas 14[81]. Erosion and sediment control measures should be designed based on, at a minimum, the 50th percentile (median) NOAA Atlas 14 precipitation depth[81], which is the

Updated Design Storm Rainfall

NOAA Atlas 14 replaces Technical Paper No. 40 (TP-40), which was developed by the U.S. Weather Bureau in 1961 and later updated by NWS HYDRO-35 in 1977, as the definitive source of design rainfall in Connecticut. The version of NOAA Atlas 14 for the northeastern United States, including Connecticut, was released in 2015 and revised in 2019. NOAA Atlas 14 contains precipitation frequency estimates for selected durations and frequencies with associated lower and upper bounds of the 90% confidence interval (5% lower and 95% upper confidence limits). NOAA Atlas 14 is a significant improvement over the TP-40 precipitation estimates since it generally includes more observation locations, more sophisticated statistical analysis methods, a much longer period of record, and more recent precipitation data, thereby accounting for observed increases in extreme precipitation as the climate has become warmer and wetter. NOAA Atlas 14 has also been adopted by CT DEEP as the source of design storm precipitation in the Construction Stormwater General Permit and in the CTDOT Transportation MS4 Permit. CTDOT has incorporated the use of NOAA Atlas 14 precipitation frequency estimates in the CTDOT Drainage Manual. The NOAA Atlas 14 results are published online through the Precipitation Frequency Data Server.

[81] NOAA Atlas 14 Volume 10 Version 3, Precipitation-Frequency Atlas of the United States, Northeastern States. NOAA, National Weather Service, 2015, revised 2019. https://www.weather.gov/media/owp/oh/hdsc/docs/Atlas14_Volume10.pdf

primary value reported by the online Precipitation Frequency Data Server (PFDS). The review authority may require at their discretion the use of greater 24-hour precipitation depths such as the upper bound of the 90% confidence interval (also reported by the PFDS) to account for larger and more intense observed storm events.

- NOAA Atlas 14[82] Precipitation frequency estimates should be selected for the project site based on the site address, latitude/longitude coordinates, or by clicking on the approximate center of the site.
- "Precipitation depth" and "Partial duration" time series type should be selected from the dropdown menus.
- Select precipitation depths from the storm duration row labeled "24-hour" (see **Figure D-1**).
- County-wide average 24-hour precipitation depths derived from NOAA Atlas 14[81] may also be used, provided that the county-wide average values are representative of the project site and the values are based on the latest version of NOAA Atlas 14[81]. Such values have been incorporated as standard options in hydrologic analysis software such as HydroCAD. However, site-specific precipitation estimates obtained from the NOAA Atlas 14[81] Precipitation Frequency Data Server are preferred.

[82]If a more recent generation of precipitation statistics is available from NOAA, that as the most reliable method to determine the appropriate hydrology should replace the references to NOAA Atlas 14.)

POINT PRECIPITATION FREQUENCY (PF) ESTIMATES

WITH 90% CONFIDENCE INTERVALS AND SUPPLEMENTARY INFORMATION
NOAA Atlas 14, Volume 10, Version 3

PF tabular | PF graphical | Supplementary information | Print page

PDS-based precipitation frequency estimates with 90% confidence intervals (in inches)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.332 (0.259-0.415)	0.405 (0.315-0.506)	0.523 (0.406-0.656)	0.621 (0.479-0.784)	0.756 (0.565-1.00)	0.858 (0.629-1.16)	0.965 (0.686-1.36)	1.08 (0.730-1.57)	1.25 (0.813-1.88)	1.39 (0.881-2.13)
10-min	0.471 (0.367-0.588)	0.573 (0.447-0.717)	0.740 (0.574-0.929)	0.879 (0.679-1.11)	1.07 (0.800-1.42)	1.22 (0.890-1.65)	1.37 (0.971-1.93)	1.54 (1.03-2.22)	1.78 (1.15-2.67)	1.97 (1.25-3.02)
15-min	0.554 (0.432-0.692)	0.675 (0.525-0.843)	0.872 (0.677-1.09)	1.04 (0.800-1.31)	1.26 (0.942-1.67)	1.43 (1.05-1.94)	1.61 (1.14-2.26)	1.81 (1.22-2.61)	2.09 (1.35-3.13)	2.32 (1.47-3.56)
30-min	0.761 (0.593-0.950)	0.922 (0.718-1.15)	1.19 (0.921-1.49)	1.41 (1.09-1.78)	1.71 (1.27-2.26)	1.93 (1.42-2.62)	2.17 (1.54-3.06)	2.44 (1.64-3.52)	2.82 (1.83-4.23)	3.14 (1.99-4.81)
60-min	0.968 (0.755-1.21)	1.17 (0.912-1.46)	1.50 (1.17-1.88)	1.78 (1.37-2.24)	2.15 (1.61-2.85)	2.44 (1.79-3.30)	2.74 (1.95-3.86)	3.07 (2.07-4.44)	3.56 (2.30-5.33)	3.95 (2.50-6.06)
2-hr	1.28 (1.00-1.59)	1.53 (1.20-1.90)	1.95 (1.52-2.42)	2.29 (1.78-2.87)	2.76 (2.08-3.64)	3.11 (2.30-4.20)	3.49 (2.51-4.92)	3.93 (2.66-5.65)	4.59 (2.99-6.85)	5.15 (3.27-7.84)
3-hr	1.49 (1.18-1.84)	1.78 (1.40-2.20)	2.25 (1.77-2.80)	2.65 (2.07-3.31)	3.19 (2.42-4.19)	3.60 (2.67-4.84)	4.03 (2.92-5.67)	4.55 (3.09-6.51)	5.34 (3.48-7.93)	6.01 (3.82-9.11)
6-hr	1.89 (1.50-2.31)	2.26 (1.80-2.77)	2.87 (2.28-3.54)	3.38 (2.67-4.19)	4.09 (3.12-5.33)	4.60 (3.45-6.17)	5.17 (3.77-7.24)	5.85 (3.98-8.32)	6.89 (4.51-10.2)	7.79 (4.97-11.7)
12-hr	2.32 (1.86-2.82)	2.81 (2.25-3.42)	3.61 (2.89-4.41)	4.27 (3.40-5.26)	5.19 (3.99-6.73)	5.87 (4.42-7.81)	6.60 (4.84-9.19)	7.49 (5.13-10.6)	8.86 (5.81-13.0)	10.0 (6.42-15.0)
24-hr	2.72 (2.21-3.28)	3.35 (2.71-4.05)	4.38 (3.53-5.32)	5.23 (4.20-6.39)	6.41 (4.98-8.28)	7.28 (5.54-9.65)	8.23 (6.09-11.4)	9.41 (6.46-13.2)	11.3 (7.41-16.4)	12.9 (8.25-19.1)
2-day	3.08 (2.52-3.69)	3.86 (3.16-4.63)	5.14 (4.18-6.19)	6.20 (5.02-7.52)	7.66 (6.01-9.87)	8.73 (6.71-11.6)	9.92 (7.44-13.8)	11.5 (7.90-16.0)	14.0 (9.21-20.2)	16.2 (10.4-23.9)
3-day	3.35 (2.75-4.00)	4.21 (3.46-5.04)	5.63 (4.61-6.75)	6.80 (5.53-8.21)	8.42 (6.64-10.8)	9.60 (7.42-12.7)	10.9 (8.23-15.2)	12.6 (8.74-17.6)	15.5 (10.2-22.3)	18.0 (11.6-26.5)
4-day	3.59 (2.97-4.28)	4.52 (3.73-5.38)	6.03 (4.95-7.21)	7.28 (5.94-8.76)	9.00 (7.11-11.5)	10.3 (7.95-13.5)	11.7 (8.81-16.2)	13.5 (9.35-18.7)	16.5 (10.9-23.8)	19.2 (12.4-28.2)
7-day	4.29 (3.56-5.07)	5.32 (4.42-6.29)	7.00 (5.79-8.32)	8.40 (6.90-10.0)	10.3 (8.20-13.1)	11.7 (9.13-15.3)	13.3 (10.1-18.2)	15.3 (10.6-21.1)	18.5 (12.3-26.5)	21.4 (13.9-31.3)

Figure D. 1 Precipitation Frequency (NOAA Atlas 14)

Figure D- 1 24-hour Design Storm Rainfall Depths from NOAA Atlas 14 Precipitation Frequency Data Server

Design Storm Rainfall Distribution

The design storm rainfall distribution shall correspond to the Natural Resources Conservation Service (NRCS) Type D regional rainfall distribution, which is derived from the NOAA Atlas 14 rainfall data (referred to as "NOAA_D" rainfall distribution). Other equivalent regional rainfall distributions specifically developed for use in Connecticut, or a site-specific rainfall distribution based on NOAA Atlas 14 data, may be used for design purposes at the discretion of the review authority.

Design Storm Recurrence Interval

The recurrence interval (sometimes called the return period) is the average number of years between precipitation events of a certain size based on the probability that the precipitation event will be equaled or exceeded in any given year. For example, a storm with a 2-year recurrence interval (i.e., the "2-year storm") is expected to occur, on average, once every 2 years and has a 50% chance (1 in 2 probability) of occurring in any given year. These Guidelines contain design storm recurrence intervals specific to various types of erosion and sediment control measures, typically ranging from the 2-year to 100-year frequency storms

Updated Rainfall Distribution

The NOAA_D rainfall distribution replaces the NRCS Type III regional distribution, which has historically been used in Connecticut and other Atlantic coastal areas, as well as the Northeast Regional Climate Center (NRCC) regional rainfall distributions developed in 2015. In 2018, Connecticut NRCS began recommending the use of the NOAA_D regional rainfall distribution throughout Connecticut. The NRCS NOAA_D rainfall distribution is available as a standard rainfall distribution in hydrologic analysis software such as WinTR-55. In HydroCAD, the NRCC_D distribution is available as a pre-defined rainfall distribution for Connecticut, while NOAA_D is not. NOAA_D may be created as a user-defined rainfall distribution in HydroCAD. The NOAA_D rainfall distribution is available online in text format.

Climate Change Considerations for Design Storms

While precipitation frequency estimates published in NOAA Atlas 14 reflect observed increases in extreme precipitation over the last several decades, NOAA Atlas 14 does not account for anticipated future increases in extreme precipitation due to projected climate change. The NOAA Atlas 14 analysis methods assume stationarity in both the historical data used in making the estimates and in future conditions. This assumption may not be appropriate under changing (i.e., non-stationary) climatic conditions. NOAA is working with several research universities to develop precipitation frequency estimates that account for non-stationary climate assumptions and factor in climate projections.

Several Northeastern U.S. states have also begun to develop and implement updated design storm precipitation estimates to account for projected future increases in extreme rainfall. The approach typically involves the use of downscaled General Circulation Model (GCM) output to estimate future increases in extreme precipitation, or relative increases in extreme precipitation based on the ratio of downscaled precipitation estimates under baseline (i.e., current or recent historic) and future conditions. Some uncertainly exists in the downscaled future precipitation estimates, particularly after mid-century, given their dependence on the potential for greenhouse gas emission reductions locally and globally. The University of Connecticut through the Connecticut Institute for Resilience & Climate Adaptation (CIRCA) is conducting ongoing research on this topic to better inform climate resilient design for the State of Connecticut.

When designing permanent post-construction stormwater management measures, project proponents should consider the use of greater design storm rainfall depths, in excess of the current NOAA Atlas 14 median values, to account for projected future increases in extreme precipitation. Future precipitation estimates should be based on the latest climate change projections for Connecticut and a planning horizon corresponding to a minimum 50-year service life for the proposed stormwater infrastructure.

Appendix E- Soil Classification System

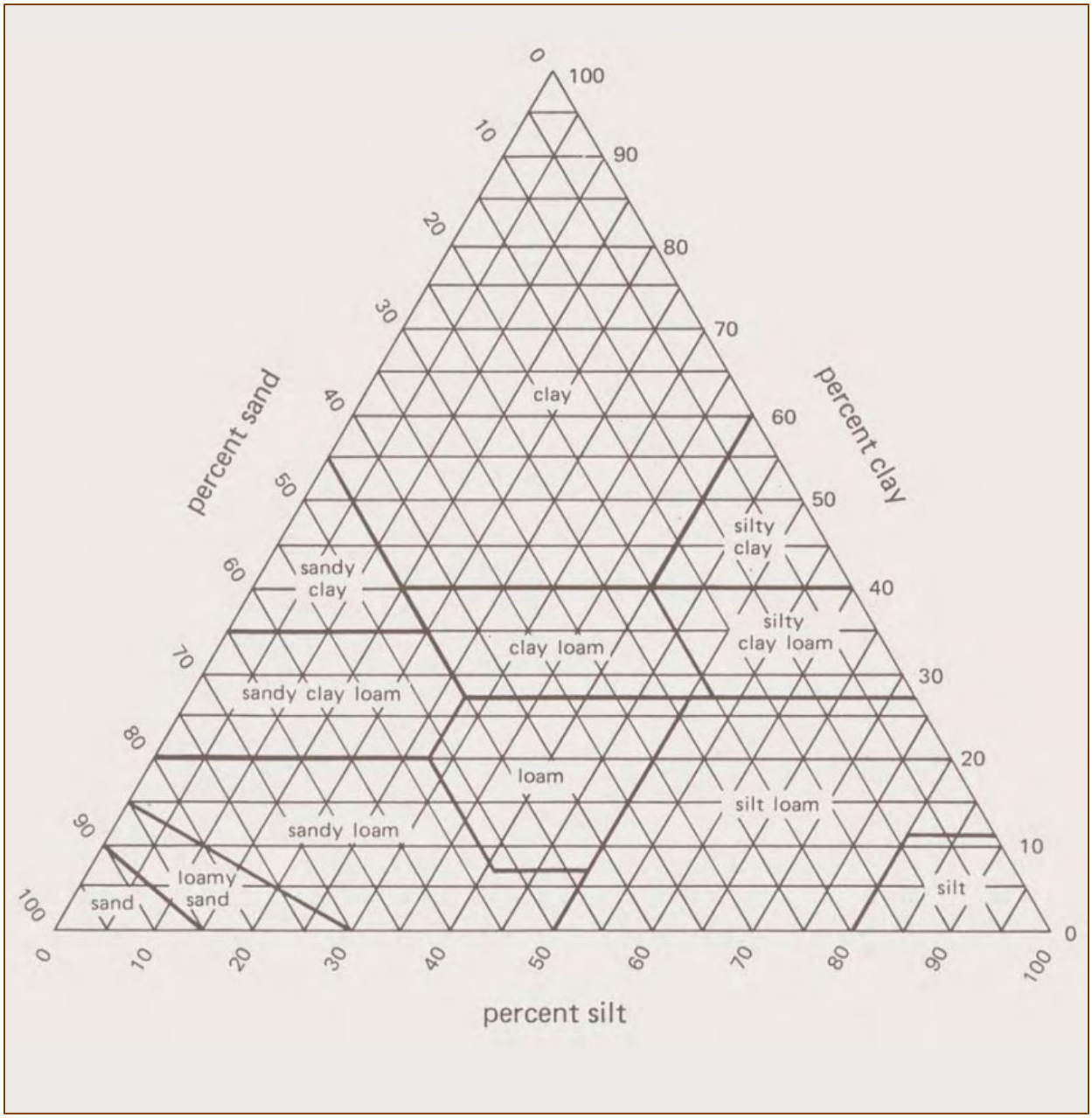
Soil is an aggregate of loose mineral and organic particles being distinguished from rock, which exhibits strong permanent cohesion between the mineral particles. The primary components of soil are gravel, sand, silt, and clay. Organic material is commonly present in surface samples of soil. A soil's properties are dependent upon its composition from these components. A number of soil classification systems have been established by different organizations to be used for specific purposes. They include:

- Textural Soil Classification System (USDA)
- American Association of State Highway Transportation Officials System (AASHTO)
- Unified Soil Classification System (USCS)
- American Society for Testing and Materials System (ASTM)
- Federal Aviation Agency System (FAA)
- Geologic Soil Classification System
- Agronomic Soil Classification System

Only the first three in this list will be discussed here. These systems index various qualities of the soil, depending on need. Indexing of the soil is needed to apply some of the qualitative and quantitative property relationships contained in these classification systems. Indexed properties are of two types: grain properties and aggregate properties. Grain properties include particle size distribution, density and mineral composition. Particle size distribution is determined by a sieve test for coarse soils and a dispersion test for fine soils. Aggregate soil properties are weight-volume relationships. The aggregate properties are derived from the percentages of solid material in the soil sample in relation to the air-filled and water-filled voids. The aggregate soil properties include soil porosity, void ratio, water content, degree of saturation, soil density, dry density, bulk density, compacted density, percent pore space and the density index. The most commonly used indexed property is particle size. The actual classification of a soil will depend on the percentage of each constituent (i.e. gravel, sand, silt and clay).

The Textural Soil Classification System by the USDA uses a qualitative description of each soil's texture and ignores the presence of gravel. A mechanical analysis is performed in the laboratory and a percentage obtained for each of the soil constituents. Total amount of sand, from coarse to very fine, is used, along with silt and clay contents, to determine the soil textural name from the USDA textural triangle (see Figure E- 1) or USDA's interactive Soil Texture Calculator. This system is commonly used for agricultural and farming practices. Since this system provides only a general qualitative description, other methods have been developed which more fully reflect the mechanical properties of the soil.

Figure E- 1 USDA Textural Triangle



The AASHTO System and Unified System classify soils specifically for their engineering properties. The AASHTO system classifies soils according to the properties that affect roadway construction and maintenance. The fraction of mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. Soils in Group A-1 are coarse grained and low in silt and clay. Soils in Group A-7 are fine grained. Highly organic soils are classified on the basis of visual inspection and assigned a Group A-8 classification. The AASHTO classification system is summarized inFigure E- 2.

AASHTO classification procedure:

Using the test data proceed through Figure E- 2 from left to right. The correct group will be found by the process of elimination. The first group from the left consistent with the test data is the correct classification. The A-7 group is subdivided into two subgroups A-7-5 and A-7-6, depending on the plastic limit. For plastic limit;

$w_p = w_l - I_p$, less than 30, the classification is A-7-6

$w_p = w_l - I_p$, greater than or equal to 30, the classification is A-7-5

NP means non-plastic

Figure E- 2 AASHTO Soil Classification

Table 5.1. AASHTO Classification System

General Classification	*Granular materials (35% or less passing No. 200 Sieve (0.075 mm)*							*Silt-clay Materials More than 35% passing No. 200 Sieve (0.075 mm)*			
Group Classification	*A—1*		*A—3*	*A—2*				*A—4*	*A—5*	*A—6*	*A—7*
	A—1—a	*A—1—b*		*A—2—4*	*A—2—5*	*A—2—6*	*A—2—7*				*A—7—5 A—7—6*
(*a*) Sieve Analysis: Percent Passing											
(*i*) 2.00 mm (No. 10)	50 max										
(*ii*) 0.425 mm (No. 40)	30 max	50 max	51 min								
(*iii*) 0.075 mm (No. 200)	15 max	25 max	10 max	35 max	35 max	35 max	35 max	36 min	36 min	36 min	36 min
(*b*) Characteristics of fraction passing 0.425 mm (No. 40)											
(*i*) Liquid limit				40 max	41 min	40 max	41 min	40 max	41 min	40 max	41 min
(*ii*) Plasticity index	6 max		N.P.	10 max	10 max	11 min	11 min	10 max	10 max	11 min	11 min*
(*c*) Usual types of significant Constituent materials	Stone Fragments Gravel and sand		Fine Sand	Silty or Clayey Gravel Sand				Silty Soils		Clayey Soils	
(*d*) General rating as subgrade.	Excellent to Good							Fair to Poor			

* If plasticity index is equal to or less than (liquid Limit—30), the soil is A—7—5 (*i.e.* PL > 30%)
If plasticity index is greater than (Liquid Limit—30), the soil is A—7—6 (*i.e.* PL < 30%)

The Unified System classifies soils according to their suitability for construction material, including its stability, permeability, resistance to erosion, compressibility and ability to bear loads without deformation. It considers grain-size distribution, plasticity index, liquid limit, and organic matter content in the soil. The Unified System is based on that portion of soil having particles smaller than 3 inches in diameter. Soil classes include coarse-grained soils (GW, GP, GM, GC, SW, SP, SM, SC), fine-grained soils (ML, CL, OL, MH, CH, OH), and highly organic soils (PT). Borderline soils require a dual classification symbol. Figure E- 3 summarizes the classification description of each class.

Figure E- 3 Unified Soil Classification System

Major Divisions			Group Symbol	Group Name
Coarse Grained Soils More than 50% Retained on No 200 Sieve	Gravel, More than 50% Retained on No 4 Sieve	Clean Gravel	GW	Well-Graded Gravel, Fine to Coarse Gravel
			GP	Poorly-Graded Gravel
		Gravel with Fines	GM	Silty-Gravel
			GC	Clayey-Gravel
	Sand, More than 50% of Coarse Fraction Passes No 4 Sieve	Clean Sand	SW	Well Graded Sand, Fine to Coarse Sand
			SP	Poorly Graded Soil
		Sand with Fines	SM	Silty-Sand
			SC	Clayey-Sand
Fine Grained Soils More than 50% Passes on No 200 Sieve	Silt and Clay Liquid Limit Less than 50	Inorganic	ML	Silt
			CL	Clay
		Organic	OL	Organic Silt, Organic Clay
	Silt and Clay Liquid Limit 50 or More	Inorganic	MH	Silt of High Plasticity, Elastic Silt
			CH	Clay of High Plasticity, Fat Clay
		Organic	OH	Organic Clay, Organic Silt
Highly Organized Soils			PT	Peat

Appendix F – Definitions and Abbreviations

Abbreviation / Term	Definition
2:1	Expression of slope gradient of run to rise where for every 2 units of horizontal distance there is a 1-unit vertical rise, referred to as two to one.
Abutment	Support for a bridge, taking the horizontal thrust from the bridge in addition to its weight.
A.c.	Acre or acres (also abbreviated as Ac.).
Access road	A vehicular travel way constructed to provide ingress and egress to an area.
Acoe	See USACOE
Acre-foot	A term used to denote a volume of water that will cover one acre to the depth of one foot. One acre-foot contains 325,851 gallons of water. Sometimes referred to as "Ac. ft."
Aggregate	Granular material such as sand, gravel, crushed gravel, or crushed stone. Aggregate is classified by size and gradation. See CTDOT Standard Specification Section M.01.01 for gradation of aggregate.

Ansi	American National Standards Institute.
Apa	Aquifer Protection Area.
Apron	A lining extending downstream from a hydraulic structure to prevent erosion and scour.
Aquifer	A porous water-bearing formation of permeable rock, sand, or gravel capable of yielding economically significant quantities of groundwater.
Artesian	A groundwater condition where a confined aquifer transfers static water pressures over some distance and can be under pressure.
Articulating concrete block	A type of slope stabilization structure consisting of a manufactured system consisting of concrete blocks that form open cells and that can be filled with plantable soil, sand, aggregate, etc.
Astm	American Standards of Testing and Materials.
Auxiliary spillway	See emergency spillway.
Balled & bur lapped	Nursery plant stock dug for transplanting in which soil around the roots is undisturbed; the ball of earth is then bound in burlap or similar mesh fabric.
Bare root	Nursery plant dug for transplanting from which the soil is removed from the roots.

Barrel	A length of pipe, conduit or culvert laid horizontally through a roadway or dam embankment.
Base flow	The portion of stream flow that is not due to storm runoff but is the result of groundwater discharge or discharge from lakes or similar permanent impoundments of water.
Bed load	Sand, silt, gravel, or soil and rock detritus carried by a stream, river, or other similar flowing waterbody on or immediately above its bed. The bed load is part of the sediment load composed of relatively coarse material. The movement of bed load is executed by rolling, sliding along the bed, or saltation (bouncing along the bed or moving by the impact of bouncing particles) of bed particles.
Bedding	Material used under and around a structure (e.g., a culvert) to form a stable base for the structure.
Berm	A man-made deposit of material that is raised above the natural surface of the land and used to contain, divert, or store water, sometimes referred to as a bench.
Borrow area	An area from which soil or rock is taken to build an embankment, earth dam, or other construction.
Bmp	Best Management Practice.
Break grade	To change grade, as in a tile line, ditch, or channel.

Cellular confinement system	A type of slope stabilization structure consisting of a manufactured three-dimensional sheet or mat with cells that are filled with materials such as plantable soil, sand, or aggregate, providing weight and shear resistance while still maintaining vegetation.
Cfr	Code of Federal Regulations.
Cfs	Cubic feet per second, the rate of fluid flow at which 1 cubic foot of fluid passes a measuring point in one second.
Cgs	Connecticut General Statutes.
Channel	A drainageway that possesses a definite bed and banks which confine flowing water.
Channel capacity	Capacity of a channel constructed or natural, when flowing full or at design flow. Usually defined in terms of "Q" usually expressed as cfs.
Channel grade	
Stabilization structure	A permanent open structure used to control the grade and head cutting in natural or artificial channels.
Channel stabilization	Erosion prevention and stabilization of velocity distribution in a channel using jetties, drops, revetments, vegetation, or other measures.
Chute	An open conduit for the purpose of transporting water down a slope or across obstructions. Same as flume.
Circa	Connecticut Institute for Resilience & Climate Adaptation.

Cjl	Connecticut Coastal Jurisdiction Line.
Clay	A mineral soil consisting of particles less than 0.005 to 0.002 millimeters in equivalent diameter, depending on the soil classification.
Closed drain	That portion of a subsurface drain that rises to the surface to receive surface water.
Cofferdam	A temporary wall constructed to exclude water from an excavation, formed by sheet piling, earth, sandbags, or other similar materials that are structurally capable of withstanding the water pressure without failure.
Colloid	In soil, organic or inorganic matter having particle sizes ranging from 0.0001 to 0.000001 millimeter.
Compost filter sock	A three-dimensional tubular filtration device constructed by filling a mesh tube with a compost filter media. See filter sock.
Concrete	A mixture of coarse aggregate, fine aggregate, water and Portland-pozzolan cement, also referred to as Portland cement concrete.
Construction entrance	A stone stabilized pad sometimes associated with a mud rack, automotive spray, or other measures located at points of vehicular ingress and egress on a construction site used to reduce the tracking of sediment off site onto paved surfaces.

Construction general permit	Connecticut Department of Energy and Environmental Protection General Permit for the Discharge of Stormwater and Dewatering Wastewaters from Construction Activities.
Construction phasing	Divides a construction project into multiple phases, which are distinct and complete sets of activities that have a specific functional goal wherein the work to be completed in one phase is not dependent upon the execution of work in a later phase in order to make it functional.
Construction sequencing	A site-specific work schedule that coordinates the timing of site development related land-disturbance activities and the implementation of temporary and permanent erosion and sediment control measures during any particular phase to minimize soil erosion and sedimentation.
Continuity equation	In hydrology, an axiom stating that the rate of flow past one section of a water conveyance system is equal to the rate of flow past another section of the same water conveyance system plus or minus any additions or subtractions between the two sections.
Contour	An imaginary line on the surface of the earth connecting points of the same elevation or a line drawn on a map connecting points of the same elevation.
Control section	A constriction or obstruction used in the design of hydraulics structures,

	such as spillways or grade stabilization structures, at which depths upstream are subcritical and downstream are supercritical.
Core trench	Excavation for a core wall in the construction of an earth embankment.
Cover	Vegetation or other material providing soil protection.
Creep	The very slow, generally continuous downslope movement of soil and debris under the influence of gravity. The movement of sand grains along the land surface.
Crest	The top of a dam, dike, spillway, or weir, frequently restricted to the overflow portion.
Critical depth	The depth of water flowing in an open channel or conduit under conditions of critical flow.
Critical flow	The flow condition at which the discharge is a maximum for a given specific energy, or at which the specific energy is a minimum for a given discharge.
Cross section	A view of a vertical plane as cut through the ground surface (sometime subsurface) for determining contours, quantities of earthwork, channel capacity, etc.
Cross-sectional area	The area of a cross section or a section of the stream at right angle to the main (average) direction of flow of a stream and bounded by the

	stream's wetted perimeter and free surface.
Crz	Critical Root Zone.
Csm	Cubic feet per second per square mile.
CT	Connecticut.
CT DEEP	Connecticut Department of Energy and Environmental Protection.
CT DOT	Connecticut Department of Transportation.
CTDOT #3 stone	A gradation of aggregate found in CTDOT Standard Specifications Section M.01.01.
Ctdot drainage manual	Connecticut Department of Transportation Hydraulics and Drainage Manual, as amended.
CTDOT standard specifications	Document entitled "State of Connecticut Department of Transportation, Standard Specifications for Roads, Bridges and Incidental Construction", as amended.
Ct dph	Connecticut Department of Public Health.
Cu. Yds. Or c.y.	Cubic yards; a term expressing volume, especially of earth fill.
Cut	Portion of land surface or area from which earth or rock has been removed or will be removed by excavation; the depth below original ground surface to excavated surface.
Dam	A barrier to confine or raise water for storage or diversion, to create a

	hydraulic head, or for retention of soil, rock, or other debris.
Dbh	Diameter at Breast Height.
Dcia	Directly Connected Impervious Area. DCIA is impervious area with a direct hydraulic connection to a storm drainage system or a waterbody via continuous paved surfaces, gutters, drainpipes, or other conventional conveyance and detention structures that do not reduce runoff volume.
Deposition	Transported material deposited because of decreased transport capacity of water or wind.
Detention facility	A surface water runoff storage facility that is normally dry but designed to hold surface water temporarily during and immediately after runoff event to reduce downstream peak discharges.
Dewatering	The removal of water by pumping, infiltration, open air drying, or other methods; drainage of the soil profile.
Dewatering of earth materials	A procedure that uses a perimeter earthen berm and/or excavation to create a containment area where excessively wet soil is placed to allow for the draining of water or evaporation of excessive moisture.
Dike	An embankment to confine or control water.
Discharge	1. Rate of flow, specifically fluid flow. 2. A volume of fluid passing a point per unit time, commonly expressed as cubic feet per second, million gallons per day, gallons per minute,

	or cubic meters per second (commonly referred to in hydraulic equations as Q).
Disturbed area	Area where vegetation, topsoil, or overburden is removed or where topsoil, spoil, and other material is placed.
Diversion	A channel and/or supporting ridge, or other man-made structure constructed to change the direction of water from one area to another.
Downstream	In a direction toward which a watercourse or drainageway is flowing.
Drainage area	The land which drains water to a given point. Synonymous with watershed, drainage basin or catchment area, typically measured in acres, hectares, or square miles.
Drainage basin	See drainage area.
Drainage coefficient	A term expressing the rate at which water runs off from a drainage area. drainage pattern. Arrangement of a system of surface or subsurface drains or overland flow paths.
Drainageway	A man-made or natural channel or course along which water moves in draining an area.
Drop inlet	An L-shaped conduit placed in an earth-filled dam, used to drop water from one level to another for gradient control and channel stabilization.

Drop inlet spillway	Overfall hydraulic structure in which water flows down into a vertical riser conduit.
Drop spillway	A spillway, usually less than 20 feet (6 meters) high having a vertical downstream face, and water drops over the face without touching the face.
Dust control	The control of dust on construction sites, construction roads and other areas where dust is generated to prevent the movement of dust from exposed soil surfaces.
E&s	Erosion and sediment control.
E&S measure	A defined procedure intended for controlling the detachment of soil, the movement of water, and/or the deposition of sediment; erosion and sediment control measure.
Embankment	A man-made deposit of material that is raised above the natural surface of the land and used to contain, divert or store water; support roads or for other similar purposes.
Emergency spillway	Auxiliary outlet to a water impoundment which transmits floodwater exceeding the capacity of the principal spillway.
Epa	U.S. Environmental Protection Agency.
Erosion	The wearing away of land surface by running water, wind, ice, or other geological agents, including such processes as gravitational creep. erosion and sediment control. The

	device placed, constructed on, or applied to the landscape that prevents or curbs the detachment of soil, its movement, and/or deposition.
Eutrophication	The process by which waters become over-enriched by nutrients, primarily nitrogen and phosphorus, to a point where excessive algal growth occurs.
Fascine	A group or bundle of twigs, whips, or branches which are staked into rows of shallow trenches, on the contour, then filled with soil. A soil bioengineering technique to stabilize slopes by slowing water movement down the slope, increasing infiltration, trapping slope sediments, and increasing soil stability with root systems.
Fhwa	Federal Highway Administration.
Fiber roll	A coconut fiber (coir log), straw, or excelsior woven roll (wood excelsior fibers) encased in netting of jute, nylon, or burlap used to dissipate energy along bodies of water. See filter sock.
Filter	A layer or combination of layers of pervious materials designed and installed in such a manner as to provide drainage, yet prevents the movement of soil particles due to flowing water.
Filter cloth	Synthetic fabrics used as a filter, usually beneath riprap or between materials with significant differences in grain size, to prevent the movement of fine material through

	course material but at the same time allowing the passage of water.
Filter sock	A temporary sediment barrier consisting of a mulch-filled tube of flexible netting material. Common types of filter socks include straw wattles, compost filter socks, and fiber rolls.
Filter strip	A strip or area of vegetation for removing sediment, organic material, nutrients, and chemicals from runoff or wastewater.
Flash board	A plank generally held horizontally in vertical slots on the crest of a dam or check structure to control the upstream water level.
Floodplain	Any land area susceptible to being inundated by water, usually adjacent to a stream, river or waterbody and usually associated with a particular design flooding frequency (e.g., 100-year floodplain).
Flume	An open conduit for the purpose of transporting water down a slope or across obstructions. Same as chute.
Fps	Feet per second.
Freeboard	Vertical distance between the maximum water surface elevation anticipated in the design and the top of a water control structure provided to prevent overtopping of the structure because of unforeseen conditions.
Ft/s	Feet per second.

Ft.	Feet.
Fugitive dust	Solid airborne particulate matter emitted from any source other than through a stack (see Regulations of Connecticut State Agencies section 22a-174-1(31).
Gabions	Flexible wire mesh baskets composed of rectangular cells filled with riprap or other hard, durable rock.
Geotextile	Fabric or synthetic material placed (1) between the soil and a pipe, gabion, stone, or retaining wall to enhance water movement and /or retard soil movement, (2) as a blanket or mat to add reinforcement and/or separation (3) to provide an aboveground sediment barrier.
Geotextile silt fence	A temporary sediment barrier consisting of a geotextile fabric pulled taut and attached to supporting posts and entrenched used to intercept and retain sediment from disturbed areas.
Grade	1. The slope of a road, channel, or natural ground. 2. Any surface prepared for the support of construction such as that for paving or laying conduit. 3. Ground surface elevation.
Gradient	Change of elevation, velocity, or other characteristic per unit of length; slope.
Grading	Act of altering the ground surface to a desired grade or contour by

	cutting, filling, leveling, and/or smoothing.
Gravel filter	Graded sand and gravel aggregate placed around a drain to prevent the movement of fine materials into the structure.
Groundwater	Water occurring in the zone of saturation in an aquifer or soil.
Grub	The clearing of stumps, roots, trees, bushes, and undergrowth.
Gully erosion	The erosion process whereby water accumulates in narrow channels, and removes the soil from this narrow area to depths ranging from 1 foot to as much as 97 feet in a relatively short period of time.
Hardpan	A hardened soil layer in the lower A or B soil horizon (the lower topsoil area or just below) caused by cementation of soil particles.
Hardy	Capable of living over winter without artificial protection.
Head	The height of water above any plane of reference.
Head cutting	An erosive process where the stream bottom is eroded in the direction of the head of the stream.
Hec 1	Computer program with associated manual entitled "Flood Hydrograph Package" developed by the US Army Corps of Engineers, Hydrologic Engineering Center, dated May 1991, Version 4.0.

Hec 2	Computer program with associated manual entitled "Water Surface Profiles" developed by the US Army Corps of Engineers, Hydrologic Engineering Center, dated May 1991, Version 4.6.2.
Hec 15	Hydraulic Engineering Circular No. 15 by the Federal Highway Administration entitled Design of Roadside Channels with Flexible Linings, dated April 1988.
Hydraulic gradient	The slope of the hydraulic grade line; the slope of the free surface of water flowing in an open channel.
Hydroseeding	A method of broadcasting seed and sometimes lime, fertilizer, and mulch together in a mixture of water.
Impoundment	Generally, an artificial collector or storage of water, as a reservoir, pit, dugout, or sump.
Infiltration rate	A soil characteristic determining or describing the maximum rate at which water can enter the soil under specified conditions.
Inland wetland	A wetland as that term is defined in section 22a-38 of the Connecticut General Statutes.
Inlet protection	A temporary, somewhat permeable barrier, installed around storm drainage inlets in the form of a fence, berm, or excavation around an opening, trapping and filtering water and thereby reducing the sediment content of sediment laden water by settling.

Internal drainage	Drainage of the soil profile; may be either natural or augmented by man.
Invert elevation	The vertical bottom inside elevation of a pipe, sewer, or other conduit or orifice in a pond or similar waterbody which defines the water level.
Land grading	Reshaping of the ground surface by excavation or filling or both, to obtain planned grades to control surface runoff and reduce erosion potential.
Landscape mulch	Application of a mulch that protects the soil surface on a long-term basis and promotes the growth of landscape plantings.
Landscape planting	Planting trees, shrubs, or ground covers for stabilization of disturbed areas.
Lbs.	Pounds.
Level spreader	A temporary discharge outlet to disperse or spread runoff as sheet flow over a vegetated area to promote infiltration and to prevent channelization and erosion. Level spreaders consist of a long linear shallow trench or low berm and a broad stable discharge structure constructed at zero grade (i.e., level lip) over which water flows as sheet flow across a stabilized, well-vegetated flat or gently sloped area without causing erosion
Liming	The application of lime to reduce soil acidity and to supply calcium for plant growth.

Live crib walls	A combination of structural elements and vegetation. The structure is a hollow box-like structure made with an interlocking arrangement of untreated logs or timber members spiked together and anchored into the slope and filled with suitable earth fill materials. The vegetation is usually layers of live branch cuttings, which root inside the structure and extend into the slope. A soil bioengineering technique used to protect exposed or eroded streambanks from the erosive forces of flowing water and stabilize the toe of slope, and to reduce steepness and provide stability where space is limited and a vertical structure is needed.
Live staking	A stake or pole fashioned from live woody material (usually willow or poplar cuttings) that root easily and grow rapidly under certain conditions. A soil bioengineering technique used to create a living root mat that stabilizes the soil by reinforcing and binding soil particles together and by contributing to the reduction of excess soil moisture.
Living shoreline	A set of shoreline erosion control practices, ranging from non-structural vegetated approaches to hybrid hard structural/restorative natural methods, that address erosion, inundation, and water quality in a manner that improves or protects the ecological condition of the coastline. Such practices are designed to restore, enhance, maintain, or create natural coastal or

	riparian habitat (e.g., intertidal flats, tidal marsh, beach/dune systems, and bluffs), functions, and processes and to mitigate flooding or shoreline erosion through a continuous land-water interface.
Low impact development (lid)	A site design strategy that maintains, mimics, or replicates predevelopment hydrology through the use of numerous site design principles and small-scale treatment practices distributed throughout a site to manage runoff volume and water quality at the source.
M	Meters.
Major storm	A storm predicted by the National Oceanic and Atmospheric Administration (NOAA) National Weather Service with warnings of flooding, severe thunderstorms, or similarly severe weather conditions or effects.
Manning's formula	A formula used to predict the velocity and/or elevation of water in an open channel under uniform flow conditions (see permanent lined waterway, vegetated waterway and subsurface drain measures).
Meanders	A series of sinuous curves or loops during a mature stream, produces as the stream swings from side to side in flowing across its floodplain.
Min.	Minutes.
Mm	Millimeter.
Mulch for seed	Application of a mulch that will protect the soil surface on a temporary basis and promote the

	establishment of temporary or permanent seedings.
Natural rate of erosion	The rate at which erosion takes place as a result of the combined effects of natural climatic occurrences and not because of the activities of man.
Noaa atlas 14	NOAA Atlas 14, Volume 10, Version 3, Precipitation-Frequency Atlas of the United States, Northeastern States, as amended.
Npdes	National Pollution Discharge Elimination System.
Nrcs	USDA Natural Resources Conservation Service (formerly known as the USDA Soil Conservation Service or SCS).
Orifice	A opening with a closed perimeter through which water flows.
Outfall or outlet	Point where confined water flows from a conduit into an open channel or body of water or where one body of water drops away into another body of water.
Outlet channel	A conveyance system constructed or altered primarily to carry water from manmade structures such as terraces, conduits, and diversions.
Outlet protection	Structurally lined aprons or other acceptable energy dissipating devices placed between the outlets of pipes or paved channel sections and a stable downstream channel.
Owner of record	The person or party having a fee interest in the land and who may

	bear liability for the environmental conditions on the property.
P.a.	Public Act (state).
P.l.	Public Law (federal).
Peak discharge	The maximum instantaneous rate of flow during a storm, usually in reference to a specific design storm event.
Perennial stream	A stream that flows year-round.
Permanent diversion	A channel constructed across a slope with a supporting earthen ridge on the lower side.
Permanent lined waterway	A permanent waterway, including chutes and flumes, with an erosion resistant lining composed of concrete, stone, or other appropriate durable material.
Permanent seeding	Establishment of permanent stand of grass and/or legumes by seeding and mulching exposed soils with a seed mixture appropriate for long term stabilization.
Permanent slope drain	A permanent open or enclosed structure or series of structures consisting of pipe(s), culvert(s) and/or manhole(s) used to convey water from a higher elevation to a lower elevation.
Permanent turf reinforcement mat	A manufactured mat composed of non-biodegradable polymer or synthetic fibers mechanically, structurally, or chemically bound together to form a continuous matrix used where design flows exceed the stability of the soils and/or proposed vegetation.

Permeability	A generic term for the property that describes the rate at which gases and liquids can flow through the soil and porous media (e.g., a geotextile).
Permissible velocity	The highest velocity at which water is conveyed in a channel or other conduit and not cause scour or erosion.
Ph	A measure of the hydrogen ion concentration in a solution, expressed as the logarithm (base ten) of the reciprocal of the hydrogen ion concentration in gram moles per liter. On the pH scale (0 - 14), a value of 7 represents neutral conditions; decreasing values, below 7, indicate increasing hydrogen ion concentration (acidity); increasing values, above 7, indicate decreasing hydrogen ion concentration (alkalinity).
Phase	A distinct and complete set of activities that have a specific functional goal wherein the work to be completed in the phase is not dependent upon the execution of work in a later phase in order to make it functional.
Phreatic line	The line marking the upper surface of the zone of water saturation in the soil.
Piping	Removal of soil material through subsurface flow channels or "pipes" developed by seepage water.
Planting stock	Young plants or cuttings, either nursery grown or naturally occurring.

Portable sediment tank	A tank or container into which sediment laden water is pumped in order to trap and retain the sediment before discharging the water or to transport the sediment laden water to an approved location for further treatment.
Post-construction stormwater management	Controlling and providing retention and/or treatment for water that drains off a site during and after a period of rainfall or snow for the purpose of improving water quality and controlling water quantity.
Ppm	Parts per million.
Precast concrete	A plain or reinforced concrete element cast in other than its final position.
Preconstruction meeting	A meeting that is held prior to the initiation of construction between concerned parties for the purpose of reviewing the contract with the contractor(s) and to identify special concerns, regulatory permit requirements and restrictions.
Psi	Pounds per square inch.
Pump intake and outlet protection	Structures or other protective devices into which or on which intake and discharge hoses are placed during pumping operations; used to reduce the amount of sediment taken up by a pump during dewatering operations and to prevent soil erosion due to scouring and the resuspension of detained sediments at the point of pump discharge.
Pumping settling basin	An enclosed sediment barrier or excavated pit constructed with a

	stable inlet and outlet such that sediment laden water from pumping operations is de-energized and temporarily stored, allowing sediments to be settled and/or filtered out before being released from the construction site.
Pure live seed	The product of the percentage of germination plus the hard seed and percentage of pure seed divided by 100.
Q	Engineering term used to define flow discharge rate or flow capacity, usually given as a volume over time (i.e., cubic feet per second, gallons per day, etc.).
Raindrop erosion	The detachment and airborne of small soil particles caused by the impact of raindrops on soil.
Rainfall amount	The amount of specified rainfall, such as daily, annual or for a storm, usually expressed by depth of the rain water which accumulates on a horizontal surface without infiltration and evaporation.
Rainfall frequency	The frequency, usually expressed in years, at which a given rainfall intensity and duration can be expected to be equaled or exceeded.
Rainfall intensity	The rate of rainfall of any given time interval, usually expressed in units of depth per time.
Rcp	Reinforced concrete pipe.
Recurrence interval	The average number of years between precipitation events of a certain size based on the probability that the precipitation event will be

	equaled or exceeded in any given year.
Reinforced concrete	Concrete containing reinforcement, including prestressed steel, and designed on the assumption that the two materials act together in resisting forces.
Retaining wall	A wall that provides stability to a slope, constructed of mortared block or stone, cast-in-place concrete, timber, reinforced earth, gabions, precast concrete modular units or similar structures.
Retention facility	A post-construction stormwater management facility that holds stormwater runoff on-site (via infiltration or reuse) through the use of structural stormwater Best Management Practices (BMPs) or non-structural LID site planning and design strategies.
Revetment	A facing of stone, bags, blocks, pavement, etc., used to protect or armor a bank against erosion.
Rill	A small channel eroded into soil surface by runoff which can be filled easily and removed by normal tillage.
Rill erosion	An erosion process in which numerous small channels from several inches up to 1 foot in depth are formed.
Riparian land	Land situated along the bank of a stream or other body of water.

Riprap	A permanent, erosion-resistant ground cover of large, loose, angular stone.
Riser	A vertical pipe extending from the bottom of a pond that is used to control the discharge rate for a specified design storm.
Root ball	The intact ball of earth or growing medium containing the roots of a nursery plant.
Root zone	Depth of soil that plant roots readily penetrate and in which the predominant root activity occurs.
Roughness coefficient	A factor in velocity and discharge formulas representing the effect of channel roughness on energy losses in flowing water.
Runoff	That portion of the precipitation (excess rainfall, snow melt or irrigation) on a drainage area that is discharged from the area in the form of flow across the surface of the ground.
Rusle	Revised Universal Soil Loss Equation.
Sand	A mineral soil generally consisting of soil particles ranging from 5.0 to 0.5 milimeters in diameter.
Scale	The ratio of a distance on a photograph or map to its corresponding distance on the ground (e.g., 1:24,000 or 1 inch = 200 feet).
Scarify	To break the surface of the soil with a narrow-bladed implement.

Scour	To abrade and wear away; used to describe the wearing away of channels or stream beds.
Scs	Soil Conservation Service (now known as the USDA Natural Resources Conservation Service or NRCS).
Sediment load	Amount of sediment carried by running water or wind.
Sedimentation	Deposition of waterborne or windborne particles resulting from a decrease in transport capacity.
Sedimentation basin	A surface water runoff storage facility intended to trap suspended solids, suspended and buoyant debris, and adsorbed or absorbed potential pollutants which are carried by surface water runoff.
Seeding	A process of establishing a stand of vegetation using seed or other vegetative material capable of establishing itself.
Seepage	The movement of water into, through, and out of the soil (generally observed at its discharge point from the soil).
Sequence	The logical order of progressive series of activities that will result in the completion of a single-phase project or an individual phase of a multi-phased project.
Settling efficiency	The percentage of particles of a prescribed size trapped in a sediment basin under design conditions.

Sheet erosion	The removal of a thin, uniform layer of soil from the land surface by the overland flow of water.
Sheet flow	Runoff which flows over the ground surface as a thin, even layer, not concentrated in a channel.
Side slope	The slopes of any cut or fill section, such as dams, ditches, diversions, and channels. Usually given as a ratio of horizontal distance to vertical distance or in degrees.
Silt	A mineral soil generally consisting of soil particle ranging between 0.076 and 0.002 millimeter in size.
Slash	The residue (e.g., tree tops and branches) left on the ground after logging or accumulating as a result of storm, fire, girdling, or delimbing.
Slope	The degree of deviation of a surface from horizontal, measured as a percentage, as a numerical ratio, or in degrees.
Slough	A failed earthen surface, as in land slide.
Sodding	Stabilizing fine-graded disturbed areas with the use of cut pieces of turf.
Soil	The unconsolidated minerals and material on the immediate surface of the earth that serve as a natural medium for the growth of plants.
Soil amendment	Any material, such as lime, compost, or fertilizer, that is worked into the

	soil to make it more amenable to plant growth.
Soil bioengineering	The use of live and dead plant materials in combination with natural and synthetic support materials (e.g., rock, wood, concrete, and geotextiles) for slope stabilization, erosion reduction, and vegetative establishment.
Soil erosion	Detachment and movement of soil from the land surface by water or wind (see erosion).
Soil horizon	A layer of soil differing from adjacent genetically related layers in physical, chemical, and biologic properties or characteristics.
Solar array	An on-the-ground installation of arrays of photovoltaic cell panels, supporting structures and related equipment to produce electricity.
Spillway	An open or closed channel or both, used to convey excess water from a reservoir or other storage facility.
Spoil	Excess soil or rock excavated from a channel, ditch basin or other area that will not be reused on the project site.
Spreader	A device for distributing water uniformly in or from a channel.
Sq. Ft. Or ft2	Square feet.
Standpipe	A vertical pipe or box connected to a horizontal pipe or box which controls the level of water in a detention or sediment trap or basin.

Stilling basin	An open structure or excavation at the foot of an overfall, drop, or spillway to reduce the energy of the water discharge.
Stone check dam	A temporary stone dam placed across a swale, waterway or channel used to reduce the velocity of concentrated storm water flows, thereby reducing erosion of the swale, waterway, or channel.
Stone slope protection	Applying stone aggregates for permanent protection on slopes where vegetative soil cover measures are either impractical or difficult to establish.
Stormwater	The water which drains off a catchment area during and after rain or snowfall; waters consisting of precipitation runoff.
Stormwater runoff	The water and associated material draining into streams, lakes or sewers as a result of a precipitation or snowmelt.
Straw bale barrier	A temporary sediment filter consisting of a row of entrenched and anchored bales of straw used to intercept and detain small amounts of sediment from small disturbed areas. (Hay bales no longer appear in this section as sediment control devices. More current technical information on hay bales and other sediment barrier options reflects the limitations and problems in the use of hay bales as a sediment control measure. Hay bales are comprised primarily of grasses that still have grain or seeds attached. If not

	certified as noxious weed-free, hay bales can have undesirable impacts by spreading invasive plants. Therefore, straw bales have replaced hay bales in this manual as the preferred material for baled sediment barriers.)
Straw wattle	A straw-filled tubes of flexible netting materials. Commonly used filler materials include wheat and rice straw. See filter sock.
Stream deflector	A structure placed within a stream channel that are used to divert flows away from a road, structure, utility, or unstable streambank.
Subgrade	The soil prepared and compacted to support a structure or a pavement system.
Substrate	The undisturbed natural soil base used to support a structure.
Subsurface drain	An underground water conveyance system consisting of a perforated conduit, such as pipe, tubing, tile, or a stone filled trench installed beneath the ground to intercept and convey groundwater.
Sump	Pit, tank or reservoir in which water is collected, stored, or withdrawn.
Surface roughening	Providing a rough soil surface with horizontal depressions created by operating a tillage or other suitable implement on the contour, or by leaving slopes in a roughened condition by not fine grading them, used to promote the establishment of vegetative cover with seed, reduce

	stormwater runoff velocity, increase infiltration, and reduce sheet erosion and provide for sediment trapping.
Surface runoff	Precipitation that falls onto the surfaces of roofs, streets, ground, etc., and is not absorbed or retained by that surface, but collects and runs off.
Surface water	All water whose surface is exposed to the atmosphere.
Suspended load	The relatively fine part of the sediment load that is distributed throughout the flow cross section and stays in suspension for appreciable lengths of time. The particle suspension is the result of vertical velocity fluctuations characteristic of turbulent flow. The suspended load consists mainly of clay, silt, and sand.
Swale	A type of drainageway consisting of a shallow longitudinal depression that conveys stormwater. It is commonly heavily vegetated and is normally without flowing water.
Swcd	Soil and Water Conservation District.
Swpcp	Stormwater Pollution Control Plan.
Swqm	Connecticut Stormwater Quality Manual.
Tackifier	Any granular, powder, liquid, liquid concentrate, or jelled substance that when mixed with water, applied to a target, and allowed to dry and cure, will provide sufficient adhesive

	characteristics to cause mulch materials to adhere to one another.
Tacking	The process of binding mulch fibers together by the addition of a sprayed chemical compound.
Tailwater	Water located or discharged immediately downstream of a hydraulic structure on a stream.
Temporary diversion	A temporary channel with a berm of tamped or compacted soil placed in such a manner to divert flows.
Temporary erosion control blanket	A manufactured blanket composed of biodegradable/photodegradable, natural or polymer fibers and/or filaments that have been mechanically, structurally, or chemically bound together to form a continuous matrix used as temporary surface protection to newly seeded and/or disturbed soils to absorb raindrop impact and to reduce sheet and rill erosion and to enhance the establishment of vegetation.
Temporary fill berm	A very temporary berm of soil placed at the top of an unprotected fill slope.
Temporary lined channel	A channel designed to convey flows on a short-term basis and is lined with a flexible impermeable geomembrane or other erosion resistant covering.
Temporary lined chute	A temporary structure made of concrete, bituminous concrete, riprap, sacked concrete, gabions, half round pipes, revetment erosion control mats with cement grout or

	similar materials used to carry concentrated runoff down a slope.
Temporary pipe slope drain	A flexible or rigid conduit used to conduct water from the top of a slope to the toe of the slope.
Temporary sediment basin	A temporary dam, excavated pit, or dugout pond with a controlled outlet(s) such that a combination of wet and dry storage areas are created.
Temporary sediment trap	A temporary ponding area with a stone outlet formed by excavation and/or constructing an earthen embankment used to detain sediment-laden runoff from small disturbed areas long enough to allow the majority of the sediment to settle out.
Temporary seeding	Establishment of temporary stand of grass and/or legumes by seeding and mulching soils that will be exposed for a period greater than 1 month but less than 12 months.
Temporary soil protection	Application of a degradable material that will protect the soil surface on a temporary basis without the intention of promoting plant growth.
Temporary stream crossing	A temporary bridge or culvert(s) across a watercourse for use by construction traffic.
Terrace	An embankment or combination of an embankment and channel constructed across a slope to control erosion by diverting surface runoff instead of allowing it to flow uninterrupted down a slope.

Test pit	A general term for any type of hole, pit, shaft, etc. dug or drilled for subsurface reconnaissance.
Three dimensional Geosynthetic	
Turf reinforcement	A permanent turf reinforcement mat.
Tidal wetland	Those areas which border on or lie beneath tidal waters whose surface is at or below an elevation of one foot above local extreme high water (see section 22a- 29(2), CGS for regulatory definition).
Time of concentration	Time required for water to flow from the most remote point of a watershed to the design point.
Topsoiling	The application of topsoil to promote the growth of vegetation following the establishment of final grades.
Total suspended solids (TSS)	The concentration of suspended solids in a liquid (mg/l).
Tpz	Tree Protection Zone.
Tr-20	Computer program with associated manual by the USDA-NRCS referenced as Technical Release #20 used to calculate stormwater peak flows (dated 1984 or latest version).
Tr-55	Publication with ancillary computer program by the USDA-NRCS referenced as Technical Release #55 detailing techniques used to solve for peak flows in small watersheds (1986 or latest version).
Tracking	Using tracked equipment on cut and fill slopes and embankments to establish a series of indentations

	parallel to the contour of the slope that will retain seed and moisture.
Trap efficiency	The amount (expressed as a percent) of the total sediment delivered to the basin that will remain in the sediment basin. It is a function of residence time, characteristics of the sediment, nature and properties of inflow, and other factors.
Trash rack	A structural device (i.e., screen or grate) used to prevent debris from entering a spillway, channel, drain, pump, or other hydraulic structure.
Tree protection	The protection of desirable trees from mechanical and other injury during construction.
Tree revetment	Tree trunks and branches (without the root wad) overlapped and anchored to the earth with cables or earth anchors. A soil bioengineering technique used to stabilize banks by absorbing energy, reducing velocity, capturing sediment, and enhancing conditions for colonization of native species.
Tree well	A device constructed to maintain the original grade around an existing tree and allow air to the roots.
Trunk	The portion of a stem or stems of a tree before branching begins.
Turbidity	A measure of the light-scattering ability of a material suspended in water, visually the cloudiness of a liquid, caused by suspended solids.
Turbidity curtain	A temporary impervious barrier installed in a stream, river, lake, or

	tidal area which will retain silts, sediment and turbidity within the construction area used to promote the settling of suspended solids in water.
Turf	A layer of soil containing a dense growth of grass and its matted roots, also may be referred to as sod.
Underdrain	See subsurface drain.
Upstream	Toward, at, or from a point nearer the source of a watercourse; in a direction from which a watercourse or drainageway is flowing.
Usacoe	United States Army Corps of Engineers.
Usda	United States Department of Agriculture.
Usgs	United States Geological Survey.
Vegetated filter	A maintained area of well-established herbaceous or woody vegetation through which small volumes of sediment-laden water pass and are filtered.
Vegetated waterway	A natural or constructed channel or swale shaped or graded in earth materials and stabilized with non-woody vegetation for the non-erosive conveyance of water.
Velocity	Speed at which an object or medium moves. Usually measured as a function of distance over time (i.e., feet per second).
Water bar	A channel with a supporting berm on the down slope side constructed

	across a construction access road, driveway, log road, or other access way.
Watershed	All the surface area of land that contributes runoff to a common point. Usually measured in acres, hectares, or square miles. Same as drainage area may be referred to as drainage basins or catchment area.
Water table	The upper surface or top of the saturated portion of the soil or bedrock, indicates the uppermost extent of groundwater.
Waterway	A type of drainageway that is a natural course or constructed channel for con- ducting the flow of water that carries only intermittent flows. Examples of waterways include but are not limited to drainageways that serve as a collector of a series of swales, outlet for diversions and collectors of runoff from large, impervious areas such as commercial parking lots and shopping centers.
Weir	A horizontal edge, surface, or dam used to regulate the water level to cause ponding, diversion, pumping, or downstream eddies.
Wet storage	The volume in a sediment basin or sediment trap that is located below the invert of the lowest outlet structure for the basin that will create a pool for settling suspended sediment during a runoff event.
Wind erosion	Detachment and transportation of soil by wind.

X:y	Expression of slope gradient of run to rise where x equals the number of distance units horizontal for every y number of distance units vertical. (see 2:1).