Permeable Interlocking Concrete Pavements and Stormwater

Glossary & Terms

Concrete Paver Terms

Albedo: The ratio of outbound reflected solar radiation from a pavement surface to inbound radiation.

Aspect Ratio: The overall length of a paver divided by its thickness. Example: A 4 in. (100 mm) wide by 8 in. (200 mm) long by 3⅛ in. (80 mm) thick paver has an aspect ratio of 2.5. Compare to Plan Ratio.

ASTM C 936: American Society for Testing and Materials, Standard Specification for Solid Concrete Interlocking Paving Units. This product standard defines dimensions, dimensional tolerances, maximum absorption, minimum compressive strength, maximum abrasion and freeze-thaw durability through various test methods.

Compressive Strength: The measured maximum resistance of a concrete paver to loading expressed as force per unit cross-sectional area such as pounds per square inch or newtons per square millimeter (megapascals).

Concrete Grids: Concrete units (generally small slabs) that have up to 50 percent open area. The units are generally no larger than 16 in. by 24 in. and are lattice style or castelated. Aggregate or grass can be placed in the openings to promote infiltration of stormwater. Grids are generally used for intermittent parking, access lanes, abating runoff and/or controlling erosion. See ASTM C 1319, Standard Specification for Concrete Grid Paving Units for product standards.

Concrete Pavers: Concrete paving units, rectangular, square or dentated, capable of being placed with one hand into a laying pattern. The surface area is typically 100 sq. in. and the overall length to thickness is 4 or less. Compare to Paving Slab.

Efflorescence: A white deposit of calcium carbonate on concrete surfaces. It results from the reaction of calcium hydroxide with carbon dioxide from the air. The calcium hydroxide is a byproduct when cement hydrates. It is slightly soluble in water and migrates to the surface through capillary action. The calcium hydroxide remains on the surface, reacts with carbon dioxide, which forms calcium carbonate and water.This conversion, depending on weather conditions, will dissipate over time. Calcium carbonate is the most common type of efflorescence. The presence of efflorescence does not compromise the structural integrity and is not indicative of a flawed product.

Plan Ratio: The overall length of a paver divided by its width. Compare to Aspect Ratio.

Tactile Pavers: A paver detectable by sight impaired persons due to change in color or texture from surrounding surfaces. Changes in texture are achieved with detectable warnings.

Engineering Terms

AASHTO —American Association of State Highway and Transportation Officials
AADTT - Average Annual Daily Truck Traffic

California Bearing Ratio (CBR): A standardized soils test defined as the ratio of: (1) the force per unit area required to penetrate a soil mass with a 3 in. sq. (19 cm sq.) circular piston (approximately 2 in. (51 mm) diameter) at the rate of 0.05 in. (1.3 mm)/min, to (2) that required for corresponding penetration of a standard material. The ratio is usually determined at 0.1in. (2.5 mm) penetration, although other penetrations are sometimes used. See ASTM D 1883.

Elastic Deformation: A reaction from applied loads where pavement returns to its original position after the load is removed. Compare to permanent deformation under Rutting.

Equivalent Single Axle Loads (ESALs): Summation of equivalent 18,000 pound-force (80 kN) single axle loads used to combine mixed traffic to a design traffic load for the design period; also expressed as Equivalent Axle Loads or EALs.

Layer Coefficient: From the AASHTO pavement design procedure; a dimensionless number that expresses the material strength per inch (25 mm) of thickness of a pavement layer (surface, base, or sub-base).

> Example: The layer coefficient of 3⅛ in. (80 mm) thick pavers and 1 in. (25 mm) bedding sand is 0.44 per in. (25 mm), therefore, the Structural Number (SN) = 4⅛ x 0.44 = 1.82.

Life-cycle Cost Analysis: A method of calculating all costs anticipated over the life of the pavement including construction costs. Discounted cash-flow methods are generally used, typically with calculation of present worth and annualized cost. Factors that influence the results include the initial costs, assumptions about maintenance and periodic rehabilitation, pavement user and delay costs, salvage value, inflation, discount rate, and the analysis period. A sensitivity analysis is often performed to determine which variables have the most influence on costs.

Mechanistic Design: Elastic analysis of structural response of applied loads through modeling of stresses and strains in a pavement structure.

Modified Proctor Test: A variation of the Standard Proctor Test used in compaction testing which measures the density-moisture relationship under a higher compaction effort. See ASTM D 1557.

Modulus of Elasticity or Elastic Modulus: The ratio of stress to strain for a material under given loading conditions.

Resilient Modulus (Mr) is used to characterize stress-strain behavior of subgrade soils subjected to traffic loadings in the design of pavements. It is a measure of material stiffness and provides a mean to analyze stiffness of materials under different conditions, such as moisture, density and stress level. Mr is typically determined through laboratory tests by measuring stiffness of a cylinder specimen subject to a cyclic axle load. It is also a required input parameter to mechanistic-empirical pavement design method and is defined as a ratio of applied axle deviator stress and axle recoverable strain.

Nuclear Density Testing: The use of a nuclear densitygauge to accurately and quickly assess the density and moisture content of soils and dense-graded aggregate in the field. The machine uses a probe inserted into the soil or base that emits very low intensity radiation. See ASTM D 2922.

Pavement Performance: The trend of service ability under repetitive loads. The total number of vehicle or ESAL applications withstood by a pavement before it reaches failure, rehabilitation, or a lower level of serviceability.

Pavement Structure: A combination of subbase, base course, and surface course placed on a subgrade to support traffic loads and distribute it to the roadbed.

Plastic Limit: (1) The water content corresponding to an arbitrary limit between the plastic and the semisolid states of consistency of a soil. (2) Water content at which a soil will just begin to crumble when rolled into a thread approximately 1/8 in. (3.2 mm) in diameter

Proctor Compaction Test: A test which measures the relationship of soil density with respect to soil moisture content under a standard compaction effort. This test identifies the maximum density obtainable at optimum moisture content. See ASTM D 698.

Poisson's Ratio: The ratio of transverse (lateral) strain to the corresponding axial (longitudinal) strain resulting from uniformly distributed axial stress below the proportional limit of the material; the value will average about 0.2 for concrete.

Present Serviceability Index (PSI): A rating, usually between 0 (completely non-functional) and 5 (new/perfect) that generalizes several measurements of the condition of pavement. It is a convenient method of rating the overall condition and usefulness of a pavement over time and is from AASHTO pavement design methods.

Progressive Stiffening: The tendency of pavements to stiffen over time. Interlocking concrete pavement stiffens as it receives increasing traffic loads thereby offering increased structural contribution structure; also referred to as "lockup."

Rutting: Permanent deformation from repetitive traffic loading that exceeds the ability of the pavement structure to maintain its original profile.

Skid Resistance: A measure of the frictional characteristics of a surface with respect to tires.

Structural Curve Number (SN) — A calculation used by AASHTO to assesses the structural capacity of a pavement handle loads. It calculates the sum of the strength of stiffness for each layer used to construct the pavement. The range typically falls between 30 and 80.

Pavement Terms:

Choke Course: A layer of aggregate placed or compacted into the surface of another layer to provide stability and a smoother surface. The particle sizes of the choke course are generally smaller than those of the surface into which it is being pressed.

Coarse Aggregate: Aggregate predominantly retained on the U.S. Standard No. 4 (4.75 mm) sieve; or that portion of anaggregate retained on the No. 4 (4.75 mm) sieve.

Compaction: The process of inducing close packing of solid particles such as soil, sand, or aggregate.

Dense-Graded Aggregate Base: A compacted crushed stone base whose gradation yields very small voids between the particles with no visible spaces between them. Most dense-graded bases have particles ranging in size from 11/2 in. or 3/4 in. (19 mm) down to fines passing the No. 200 sieve.

Drainage Coefficient: Factor used to modify layer coefficient of pavements. It expresses how well the pavement structure can handle the adverse effect of water infiltration. See Layer Coefficient.

Embodied Energy: The energy used through the life-cycle of a pavement material or product to extract, refine, process, fabricate, transport, install, commission, utilize, maintain, remove, and ultimately recycle or dispose of pavement materials.

Geogrids: Geogrids are two dimensional or three dimensional.The two dimensional type are flat and have small, "TV screen" shaped openings. The material is generally placed between the soil and the base to reduce rutting. Three dimensional geogrids are 4 to 8 in. (100 to 200 mm) high and provide stability under loads for cohesionless soils.

Geotextiles: Woven or non-woven fabrics made from plastic fibers used for separation, reinforcement, or drainage between pavement layers.

Interlock: Frictional forces between paving units that prevent them from rotating, or moving horizontally or vertically in relation to each other; also defined as the inability of a concrete paver to move independently of its neighbors. The friction forces enable load transfer among the paving units. The three kinds of load transfer are vertical interlock, horizontal interlock and rotational interlock.

- **Vertical interlock** is achieved by shear transfer of loads to surrounding units through sand in the joints.
- **Horizontal interlock** is primarily achieved through the use of laying patterns that disperse forces from braking and accelerating vehicles. The most effective laying patterns for maintaining horizontal interlock are herringbone patterns.
- **Rotational interlock** is maintained by the pavers being of sufficient thickness, placed closely together, and being restrained by a stationary edge such as a curb.

Open-graded Aggregate Base: A compacted crushed stone (granular) base whose gradation has relatively large spaces between the particles. It can be used as a drainage course in base design, or as a reservoir medium for storing stormwater in permeable pavements.

Permeable Pavement structure: A combination of courses of material placed on a sub-grade to make a pavement

- **Surface course:** Pavement layer that directly receives the traffic load; this layer presents pavement's surface qualities such as accessibility, travel quality, appearance, and resistance to direct traffic abrasion
- **Base Course:** Layer placed below a surface course to extend pavement thickness; may be called simply base
- **Sub-base:** Layer of open-graded stone (typically ASTM #2) placed between the base course of ¾" stone and the subgrade
- **Sub-grade:** The in-situ soil underlying a pavement structure and bearing its ultimate load

Reservoir: Any portion of pavement that stores or transmits water; a reservoir may overlap or be combined with other pavement layers such as base and sub-base; sometimes called reservoir base, drainage layer, or drainage blanket

Screenings: A residual product not suitable for bedding sand. It is a by-product from the crushing of rock, boulders, cobble, gravel, blast-furnace slag or concrete. Most of the aggregate passes the No. 4 (4.75 mm) sieve; typically limestone or granite.

Segmental Pavement: A pavement whose surface consists of discrete units typically made of concrete, clay, or stone.

Slip Resistance: Resistance against pedestrian slipping; defined as the ratio of a minimum tangential force necessary to initiate sliding of a pedestrian's shoe or related device over a surface. Non-mobility impaired persons require minimum coefficient of friction values ranging from 0.2-0.3. Wheelchair users require friction values ranging from 0.5-0.7. Crutch users and those with artificial limbs require values from 0.7 to 1.0. Clean concrete pavers generally have values exceeding 0.7.

Soil Separation Fabric: A layer of fabric typically placed between the subgrade and the base to reduce rutting, also called a geotextile.

Soil Stabilization: Chemical or mechanical treatment designed to increase or maintain the stability of a mass of soil or otherwise to improve its engineering properties. Lime, fly ash or cement are typical chemical stabilization materials. Geotextiles and geogrids are typical mechanical materials for soil stabilization.

Soldier Course: A paver course where widths abut against the edge restraint.

Stabilized Base: An aggregate base with cement, asphalt or other material added to increase its structural capacity. The soil subgrade can be stabilized with cement, lime, fly ash or other materials.

Wearing course: Pavement surfacing consisting of segmental concrete pavements and joint sand on a sand bedding layer.

Wearing surface: The pavement surface in contact with traffic.

Soil Types

ASTM #9 stone: ¼" stone open graded stone
ASTM #8 stone: ⅜" stone open graded stone
ASTM #57 stone: ¾" stone open graded stone
ASTM #2 stone: 2 ½" open graded stone

Hydrological Soil Group: The soils classification system developed by the U.S. Soil Conservation Service, now the Natural Resources Conservation Service that categorizes soils into four groups, A through D, based on runoff potential.

A: Soils having high infiltration rates even when thoroughly wetted and consisting chiefly of deep, well drained to excessively well-drained sands or gravels.
B: Soils having moderate infiltration rates even when thoroughly wetted and consisting chiefly of well drained soils with moderately fine to moderately coarse textures.
C: Soils having slow infiltration rates even when thoroughly wetted and consisting chiefly of soils with a layer that impedes downward movement of water, or soils with moderately fine to fine textures.
D: Soils with high runoff potential. Soils having very slow infiltration rates. Consisting chiefly of clay soils with a high swelling potential,

Clay Soils: A fine-grained soil with more than 50% pass the No. 200 sieve with a high plasticity index in relation to its liquid limit, according the Unified Soil Classification System.

Crushed Stone: A product used for pavement bases made from mechanical crushing of rocks, boulders, or large cobblestones at a quarry. All faces of each aggregate have welldefined edges resulting from the crushing operation.

Granular - sand and gravel consisting of grains down to .002 inch.

Gravel: Aggregate ranging in size from ¼ in. and larger. It can be quarried or mined from a bank and typicall is comprised of a variety of gradations within the size of the range.

Organic - loam, peat made up of moss, leaves and vegetable matter and top soil.

Sand: A naturally occurring granular material commonly divided into five sub-categories based on size: very fine sand (1⁄16 - ⅛ mm diameter), fine sand (⅛ mm - ¼ mm), medium sand (¼ mm - ½ mm), coarse sand (½ mm - 1 mm), and very coarse sand (1 mm - 2 mm

Sediment —Soils transported and deposited by water, wind, ice, or gravity.

Silt: A soil with no more than 50% passing the No. 200 (0.075 sieve) that has a low plasticity index in relation to the liquid limit, according to the Unified Soil Classification System.

Stormwater Terms

Adsorbtion The process by which molecules of a substance collect on the surface of another substance, but do not enter the solid's minute spaces as in absorption. In the case of PICPs, hydrocarbons, adsorbed to the aggregate in the base, are biodegraded to some degree overtime by microbes present in aggregate.

Aquifer A porous water-bearing formation of permeable rock, sand or gravel capable of yielding economically significant quantities of groundwater.

Baseflow The portion of streamflow that is not due to storm runoff but is the result of groundwater discharge or discharge from lakes or similar permanent impoundments of water.

Best Management Practice (BMP) A structural device or practice designed to mitigate the effects of storm water runoff to attenuate flooding, reduce erosion and reduce pollution. BMP's include a variety of **low impact development** practices such as bioretention, sand filters, and infiltration trenches.

- **Bioretention -**A structural storm water practice that uses soils and vegetation to treat pollutants in urban runoff and to encourage infiltration of storm water into the ground.

- **Bio Retention Basins -** Bioretention basins are landscaped depressions or shallow basins used to slow and treat on-site stormwater runoff. Stormwater is directed to the basin and then percolates through the system where it is treated by a number of physical, chemical and biological processes. The slowed, cleaned water is allowed to infiltrate native soils or directed to nearby stormwater drains or receiving waters.

- **Bio Retention Cells:** A pre-cast structures used to slow and treat on-site stormwater runoff by a number of physical, chemical and biological processes. The slowed, cleaned water is allowed to infiltrate native soils or directed to nearby stormwater drains or receiving waters similar to basins.

- **Grass Swales -** A grassed swale is a graded and engineered landscape feature appearing as a linear, shallow, open channel with trapezoidal or parabolic shape. The swale is vegetated with flood tolerant, erosion resistant plants.

- **Porous Pavement -** Pervious pavement is designed to allow percolation or infiltration of stormwater through the surface into the soil below where the water is naturally filtered and pollutants are removed. In contrast normal pavement is an impervious surface that sheds rainfall and associated surface pollutants forcing the water to run off paved surfaces directly into nearby storm drains and then into streams and lakes.
  - Porous Asphalt
  - Pervious Concrete
  - Permeable Interlocking Concrete Pavers (PICP)

- **Rain Gardens -** Rain Gardens are gardens containing flowering plants and grasses (preferably native species of both) that can survive in soil soaked with water from rain storms. However they are not gardens that have standing water. Rain Gardens collect and slow stormwater run off and increase its infiltration into the soil.

Cation: A positively charged atom or group of atoms in soil particles that, through exchange with ions of metals in stormwater runoff, enable those metals to attach themselves to soil particles.

Check Dams Small temporary dams constructed across a swale or drainage ditch to reduce the velocity of concentrated stormwater flows.

Cisterns Containers that store larger quantities of rooftop stormwater runoff and may be located above or below ground. Cisterns can also be used on residential, commercial, and industrial sites. See also Rain Barrel.

Combined Sewer Combined sewers collect both stormwater runoff and sanitary wastewater **Overflows (CSOs)** in a single set of sewer pipes. When combined sewers do not have enough capacity to carry all the runoff and wastewater or the receiving water pollution control plant cannot accept all the combined flow, the combined wastewater overflows from the collection system into the nearest body of water, creating a CSO.

Curve Number (CN)—A numerical representation developed by U.S. Soil Conservation Service (SCS) which quantifies the relationship between rainfall and runoff of a given area's hydrological soil group, plant cover, impervious cover, interception and surface storage. A curve number is used to convert rainfall depth into runoff volume and has a range from 10 to 100; lower numbers indicate low runoff potential while larger numbers are for increasing runoff potential.

Detention Pond —The temporary storage of stormwater runoff in an area with objective of decreasing peak discharge rates and providing a settling basin for pollutants.

Evapotranspiration is the movement of water to the air through a combination of evaporation of water within PICP and transpiration of moisture from plants.

Exfiltration: The downward movement of water through an open-graded, crushed stone base into the soil beneath.

Filter Strip A strip or area of vegetation for removing sediment, organic material, nutrients and chemicals from runoff or wastewater. They are typically located downgradient of stormwater outfalls and level spreaders to reduce flow velocities and promote infiltration/filtration.

First Flush: The first big rain after an extended dry period, which flushes out the accumulated pollutants in the storm drain system.

Green Bldg: Building that consumes only as much as it produces with no or no waste that negatively impacts the environment. The **"ideal"** building generates more than it conserves to provide a positive impact to the environment.

Groundwater: Water that is underground in cracks and spaces in soil, sand and rocks. The layers of soil, sand and rocks are also known as aquifers. Groundwater is used for drinking water by more than 50 percent of the US population, including almost all residents of rural areas.

Groundwater Recharge The process by which water that seeps into the ground, eventually replenishing groundwater aquifers and surface waters such as lakes, streams, and the oceans. This process helps maintain water flow in streams and wetlands and preserves water table levels that support drinking water supplies.

Groundwater Recharge: The post-development design recharge volume (i.e., on a storm event **Volume (GRV)** basis) required to minimize the loss of annual pre-development groundwater recharge. The GRV is determined as a function of annual pre-development recharge for site-specific soils or surficial materials, average annual rainfall volume, and amount of impervious cover on a site.

Heavy Metals Metals such as copper, zinc, barium, cadmium, lead, and mercury, which are natural constituents of the Earth's crust. Heavy metals are stable and persistent environmental contaminants since they cannot be degraded or destroyed.

Hydraulic Conductivity The rate at which water moves through a saturated porous media under a unit potential-energy gradient. It is a measure of the ease of water movement in soil and is a function of the fluid as well as the porous media through which the fluid is moving.

Hydrocarbons Inorganic compounds consisting of carbon and hydrogen, including petroleum hydrocarbons derived from crude oil, natural gas, and coal.

Hydrologic Cycle The distribution and movement of water between the earth's atmosphere, land, and water bodies.

IDDE - Illicit Discarge Detection and Elimination is a program to detect, eliminate, and prevent illicit discharges to municipal storm drain systems.

Impervious Cover: Surfaces that do not allow rainfall to infiltrate into the soil such as pavements, roofs, sidewalks, driveways, etc.

Infiltration Rate: The rate at which water moves through a soil tested in the field. Measured in inches per hour or meters per second. See ASTM D 3385 and 5093 and compare to Permeability

LEED - Leadership in Energy & Environmental Design (LEED) is an internationally recognized green building certification system, providing third-party verification that a building or community was designed and built using strategies intended to improve performance in metrics such as energy savings, water efficiency, CO_2 emissions reduction, improved indoor environmental quality, and stewardship of resources and sensitivity to their impacts.

LID - Low Impact Development - An approach to land development that uses various land planning and design practices and technologies for simultaneously conserving and protecting natural resource systems and reducing infrastructure costs.LID practices include:

- Grass Swales
- Vegetated Strips
- Bio-retention Ponds
- Indigenous plants – native species -
- Rain Gardens
- Reduced pavement widths
- No Curbs
- Curvi-linear roadway
- **Permeable Pavements !!!!**

MS4s -Municipal Separate Storm Sewer System: A MS4 is a conveyance or system of conveyances that is:

- Owned by a state, city, town, village, or other public entity that discharges to waters of the U.S.;
- Designed or used to collect or convey stormwater (including storm drains, pipes, ditches, etc.);
- Not a combined sewer; and
- Not part of a Publicly Owned Treatment Works (sewage treatment plant

NPDES: The federal National Pollutant Discharge Elimination System (NPDES) stormwater permitting program developed by the U.S. Environmental Protection Agency (EPA).

Nitrate One of the forms of nitrogen found in aquatic ecosystems. It is produced during nitrification and denitrification by bacteria. Nitrate is the most completely oxidized state of nitrogen commonly found in water, and is the most readily available state utilized for plant growth.

Non-Point Source Pollution: Pollution that does not come from a single, identifiable source. Water pollution caused by rainfall washing over and through land surfaces and carrying with it pollutants from the human environment. Includes materials that wash from roofs, streets, yards, driveways, sidewalks and other land areas. Collectively, this is the largest source of stormwater pollution.

Non-Routine Maintenance Corrective measures taken to repair or rehabilitate stormwater controls to proper working condition. Non-routine maintenance is performed as needed, typically in response to problems detected during routine maintenance and inspections.

Non-Structural Controls Pollution control techniques, such as management actions and behavior modification that do not involve the construction or installation of devices

Observation Well: A perforated pipe inserted vertically into an open-graded base to monitor infiltrate rate of water into the underlying soil.

One/One Hundred Year Storm: A rainfall event that occurs at least once a year and has a 100% chance of occurring within a given year/an event that occurs once in 100 years or has a 1% chance of occurring within a given year.

Outfall: A flow of water from one drainage system into a larger system, or into a body of water like a lake.

Point Source Pollution: Pollution from a single identifiable source such as a factory or a sewage-treatment plant. Most of this pollution is highly regulated at the state and local levels.

Peak Discharge Rate: The maximum instantaneous flow from a detention or retention pond, open-graded base, pavement surface, storm sewer, stream or river; usually related to a specific storm event.

Permeability: Measured in the laboratory, the rate of water movement through a soil column under saturated conditions, usually expressed as k in calculations per specific ASTM or AASHTO tests, and typically expressed in inches per hour or meters per second. See ASTM D 2434. Compare to Infiltration

Permeable Paving Materials Materials that are alternatives to conventional pavement surfaces and that are designed to increase infiltration and reduce stormwater runoff and pollutant loads. Alternative materials include modular concrete paving blocks, modular concrete or plastic lattice, cast-in-place concrete grids, and soil enhancement technologies. Stone, gravel, and other low-tech materials can also be used as alternatives for low traffic applications such as driveways, haul roads, and access roads.

Point Source Any discernible, confined and discrete conveyance, including but not limited to, any pipe, ditch, channel, tunnel, conduit, well, discrete fissure, container, rolling stock, concentrated animal feeding operation, landfill leachate collection system, vessel or other floating craft from which pollutants are or may be discharged.

Porosity: The volume of voids in an open-graded base divided by the total volume of the base.

Porous Pavement Porous pavement is similar to conventional asphalt or concrete but is formulated to have more void space for greater water passage through the material.

Pretreatment Techniques used in stormwater management to provide storage and removal of coarse materials, floatables, or other pollutants before the primary treatment practice.

Retention Pond: A body of water that collects runoff and stays full permanently. Runoff flowing into the pond that exceeds its capacity is released into a storm sewer, stream, lake, or river. Retention ponds do not provide re-charge and serve to delay outflow without pretreatment other than allowing sedimentation to occur

Runoff coefficient: Ratio of surface runoff to rainfall. Expressed as a number from 0.1 to 1.

Sand Filter: A packed-bed filter of sand or other granular material used to provide advanced secondary treatment of settled wastewater or septic tank effluent. Sand/media filters consist of a lined (e.g. impervious PVC liner on sand bedding) excavation or structure filled with uniform washed sand that is placed over an underdrain system. The wastewater is dosed onto the surface of the sand through a distribution network and allowed to percolate through the sand to the underdrain system, which collects the filter effluent for further processing or discharge.

Sediment: Soils transported and deposited by water, wind, ice or gravity.

Setback: The minimum distance that design elements must be placed from other elements. For example, houses usually have front, side and rear yard setbacks from streets and other buildings.

Sheetflow: The movement of rainwater across the surface of the landscape in response to topographic conditions.

Soil Infiltration Capacity The maximum rate at which water can infiltrate into the soil from the surface.

Stormwater: Water that is not absorbed in the ground. It runs over impervious surface picking up pollutant materials along the way and runs into storm drains and ultimately into waterways. Stormwater is not treated before it is discharged into waterways.

Sustainable Design – Meeting needs of the present without compromising the needs of the future.

Stormwater Pollution Identifies potential sources of pollution and outlines specific management **Prevention Plan (SWPPP)** activities designed to minimize the introduction of pollutants into stormwater.

Structural Controls Devices constructed for temporary storage and treatment of stormwater runoff.

SWALE: A small linear topographic depression used to move water from one location to another.

TMDL – Total Maximum Daily Loads: is a regulatory term in the U.S. Clean Water Act (CWA), describing a value of the maximum amount of a pollutant that a body of water can receive without significantly impairing the health of the water.

Time of concentration: The time required for water to flow from the most remote point of a watershed or catchment to an outlet.

Evaportranspiration: The return of moisture to the atmosphere from the evaporation of water from soil and transpiration from vegetation.

Transpiration: The process by which water absorbed through plant roots is returned to the atmosphere from the leaves.

Total Kjeldahl Nitrogen (TKN) The sum of the ammonia nitrogen and the organic bounded nitrogen; nitrates and nitrites are not included.

Total Maximum Daily A calculation of the maximum amount of a pollutant that a water body **Load (TMDL)** can receive and still meet water quality standards, and an allocation of that amount to the pollutant's sources, including a margin of safety.

Total Nitrogen The sum of total Kjeldahl nitrogen, nitrate, and nitrite. Nitrogen is typically the growth-limiting nutrient is estuarine and marine systems.

Total Organic Carbon A measure of the organic matter content. The amount of organic matter content affects biogeochemical processes, nutrient cycling, biological availability, chemical transport and interactions and also has direct implications in the planning of wastewater treatment and drinking water treatment.

Total Phosphorus Sum of orthophosphate, metaphosphate (or polyphosphate) and organically bound phosphate. Phosphorus is typically the growth-limiting nutrient is freshwater systems.

Total Suspended Solids The total amount of particulate matter that is suspended in the water column.

Technical Release A watershed hydrology model developed by the Soil Conservation **Number 55 (TR-55)** Service (now Natural Resources Conservation Service) used to calculate runoff volumes, pe

Underground Detention Facilities Vaults, pipes, tanks, and other subsurface structures designed to temporarily store stormwater runoff for water quantity control and to drain completely between runoff events. They are intended to control peak flows, limit downstream flooding, and provide some channel protection.

Underground Infiltration Systems Structures designed to capture, temporarily store, and infiltrate the water quality volume over several days, including premanufactured pipes, vaults, and modular structures. Used as alternatives to infiltration trenches and basins for space-limited sites and stormwater retrofit applications.

Urban Heat Island: An urban area that, due to denuded landscape, impermeable surfaces, surfaces with low albedo, massive buildings, heat-generating cars and machines, and pollutants, is measurably hotter than surrounding rural areas.

Urban Stormwater Runoff Stormwater runoff from developed areas.

Vadose zone The portion of Earth between the land surface and the top of the phreatic zone i.e. the position at which the groundwater is at atmospheric pressure. Hence the vadose zone extends from the top of the ground surface to the water table

Vegetated Buffer An area or strip of land in permanent undisturbed vegetation adjacent to a water body or other resource that is designed to protect resources from adjacent development during construction and after development by filtering pollutants in runoff, protecting water quality and temperature, providing wildlife habitat, screening structures and enhancing aesthetics, and providing access for recreation.

Vegetated Roof Covers Multilayered, constructed roof systems consisting of a vegetative layer, media, a geotextile layer, and a synthetic drain layer installed on building rooftops. Rainwater is either intercepted by vegetation and evaporated to the atmosphere or retained in the substrate before being returned to the atmosphere through transpiration and evaporation. Also referred to as green roofs.

Watershed: A watershed is land that collects water and drains it into a river system or lake.

Water Balance Equation describing the input, output, and storage of water in a watershed or other hydrologic system.

Water Quality Flow (WQF) The peak flow associated with the water quality volume calculated using the NRCS Graphical Peak Discharge Method.

Water Quality Swales Vegetated open channels designed to treat and attenuate the water quality volume and convey excess stormwater runoff. Dry swales are primarily designed to receive drainage from small impervious areas and rural roads. Wet swales are primarily used for highway runoff, small parking lots, rooftops, and pervious areas.

Water Quality Volume (WQV) The volume of runoff generated by one inch of rainfall on a site.

Watershed Management Integrated approach addressing all aspects of water quality and related natural resource management, including pollution prevention and source control.

Xeriscaping Landscaping to minimize water usage (“xeri” is the Greek prefix meaning ”dry”) by using plants that are adapted to the local climate and require minimal watering, fertilizer, and pesticide application, and improving soils by adding soil amendments or using mulches to reduce the need for watering by increasing the moisture retained in the soil.