PUTNAM VALLEY CENTRAL SCHOOL DISTRICT
PUTNAM VALLEY, NY

MS4PY6 STORMWATER PROGRAM

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RE-DEFINING STORMWATER MANAGEMENT PRACTICES

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1. CONVENTIONAL STORMWATER MANAGEMENT PRACTICES

In the past, conventional wisdom for stormwater management was that stormwater was a problem to solve rather than a valuable resource to conserve. Conventional stormwatwer engineering methods involved the:

Onsite Collection of Stormwater: stormwater was collected through a series of catch basins and inlets at the site.

Piped Offsite Discharge: the collected stormwater was discharged offsite**,** away from developed areas through a network of underground storm sewer pipes.

2. EFFICIENT UTILIZATION OF STORMWATER IN NATURE

Nature by contrast, beneficially stores and utilizes the stormwater as a valuable resource:

Onsite Infiltration of Rainwater: in nature, stormwater is dispersed across native vegetation and undeveloped forested lands, where infiltration of the stormwater occurs generally where it falls.

Groundwater Recharge: onsite infiltration of the rainwater replenishes local groundwater and underlying aquifers.

Natural Soil Filtration Process: natural soil filtration removes pollutants that may be collected as the rainwater is dispersed across the landscape.

Decomposition in Nutrient Rich Soils: Plants, animals and their waste products decompose and provide acidic balance to the native soils. Tiny organisms, bacteria and fungi, worms and other natural soil organisms, break down the pollutants carried by the rainwater into nitrogen,

phosphorous, potassium and other minerals, essential for the healthy growth of native flora, fauna and the forest ecosystem.

Evapotranspiration (ET): is the process by which water is transferred from the earth surface into the atmosphere. ET is the sum of water surface evaporation, soil moisture evaporation, plant surface evaporation, and plant transpiration. Plant transpiration is a process in which trees and other plants absorb water through their roots and transfer it into the atmosphere through leaf pores. ET is extremely beneficial to the environment, especially in arid regions of the country, where rainfall is needed to prevent severe drought conditions.

Photosynthesis: plants produce their own food through photosynthesis. This process occurs whereby plants absorb carbon dioxide and water and manufacture carbohydrates in the green pigment chlorophyll utilizing sunlight as energy. In turn, plants release oxygen as a waste product and store starch in their root systems. Water is a key ingredient which plants use to make their food, and minerals (including nitrogen, potassium, phosphorus, calcium and iron). Minerals are absorbed from the soil and used by the plants.

3. SUSTAINABILITY OF OUR WATER RESOURCES

Like the air we breathe, water is a vital natural resource and an important part of our daily lives and we must protect it now, so that it never becomes an endangered resource. This natural resource consists of thousands of acres of wetlands, creeks, streams, man-made drinking water reservoirs, recreational lakes, inland and coastal transportation canals and our oceans. All of these water resources are located within a watershed or drainage basin that is separated by topographical divides. Some of these watersheds flow into rivers and lakes, while others drain into coastal estuaries and oceans. Within each major watershed are smaller watersheds that are all interconnected and form a part of the larger watershed. As our populations continue to grow; people, farms, business, agriculture and industry utilize more water for their needs and the sustainability of our water resources becomes more challenging.

4. IMPACTS OF INCREASING DEVELOPMENT

Increasing development, resulting in increasing impervious surfaces, accelerates the rate and volume of stormwater runoff. As trees are replaced by impervious surfaces, the natural stormwater management and treatment functions are lost, resulting in increased runoff, flooding, erosion and pollution. Impervious surfaces reduce natural absorption, soil filtration and infiltration and groundwater recharge. Site grading and drainage devices, such as storm sewers and concrete-lined channels, eliminate natural depressions and convey stormwater at a much faster rate. The impacts of increasing development result in:

Basement and Street flooding: impervious surfaces increase the frequency and severity of basement and street flooding.

Increased Pollution: Pollutants carried by the runoff from construction activities may contain sediment, heavy metals and petroleum-based hydrocarbons. Excessive application of fertilizers to our lawns and gardens often cause unwanted algae growth and depletion of oxygen in rivers and lakes. The excessive application of salt often adds significant amounts of chlorides to our water supplies. Sewage overflows from poorly

maintained septic fields can cause the contamination of surface and groundwater resources, resulting in beach closings and elevated pathogen levels in our precious drinking water supplies.

5.THE EFFECTS OF CLIMATE CHANGES

Changes in our climate, due to the increasing industrial development, the increasing use of fossil fuels and deforestation have led to:

Severe Drought Conditions: many states, especially in the west, continue to experience severe multi-year drought conditions.

Global Warming: as recently reported worldwide, the climate change is affecting excessive rainfall in parts of the globe and dwindling supplies in other parts due to global warming.

Atmospheric Pollutants: acid rain continues to pollute stormwater runoff.

Fossil Fuels: coal, natural gas and oil, are the largest greenhouse gas emitters. Coal generated electric power plants place heavy demands on our water resources. Onshore and offshore drilling incidents near drilling platforms kill birds and marine life, and often result in land and coastal contamination. Often rail and ocean shipment accidents result in explosions, fires and the release of chemical pollutants to the environment.

6. THE INNOVATIVE ALTERNATIVES TO STORMWATER MANAGEMENT

The following innovative stormwater management practices, mimic nature and are effective in reducing the runoff quantity as well as improving the quality of the discharged water:

Green Roofs: are layers of living vegetation installed on top of buildings and garages. They help manage stormwater by filtering rainwater through the soil and the root uptake zone. The water that leaves the roof is reduced in quantity and the filtration though the root zone removes pollutants present in the rainwater. Green roofs insulate the building, reducing cooling and heating costs. In addition, green roofs extend the life of roofs approximately two to three times its normal life.

Downspouts, Rain Barrels and Cisterns: traditionally downspouts collect rainwater and discharge the rainwater directly into storm sewer systems. Alternative stormwater management encourages the careful disconnection of the downspouts so that the roof runoff can flow directly into vegetated areas. The rainwater can be allowed to flow across the lawn or is routed via a surface swale into a rain garden or onsite detention or retention facility. The runoff can also be temporarily stored in a rain barrel or a cistern, and utilized as needed to irrigate lawns and landscaped areas in between storm events.

Permeable Paving: permeable paving may include porous concrete, stone or perforated plastic or other materials which promote the absorption of rain and snowmelt. Permeable paving is suitable for parking lots, driveways, access lanes, emergency and fire lanes. Some can support grass or other suitable vegetation, providing a green appearance. For permeable paving to be effective, it must be installed over sandy or permeable soils. The alternative, if permeable soils are not present, is to install a porous underdrain system that can re-direct the collected stormwater to a nearby waterway.

Bioretention Systems: are shallow landscaped depressions utilized to promote absorption and infiltration of stormwater runoff. Runoff from parking lots and other paved areas is re-directed to the bioretention system, ponds on the surface and gradually infiltrates into the soil bed. Stormwater pollutants are removed by adsorption, filtration and bacterial decomposition. Treated water is infiltrated into the surrounding soil or is collected by an underdrain system and discharged directly to a stormwater system or nearby receiving waters.

Filter Strips: are densely vegetated areas that accept sheet flow runoff from adjacent paved and impervious surfaces. They slow down runoff, filter sediment and other pollutants and enhance infiltration of surface runoff. Filtered water is discharged into surrounding soils, swales, stormwater systems or nearby surface waters.

Vegetated Bioswales: are filter strips along a ditch or drainage channel planted with native vegetation. Swales have gently sloping sides and convey stormwater down a gently sloping gradient. Swales can be augmented with check dams and other techniques to slow down the velocity of the discharged runoff. Vegetated swales handle concentrated flows during severe storm events and are used to direct water to a destination such as wetlands, stormwater systems or nearby surface waters.

Rain Gardens: are similar to the larger-scale bioretention system. Typical locations of rain gardens are residential yards and community common areas. Rain gardens, which consist of shallow depressions, receive water from nearby roofed areas and parking lots. Rain gardens, typically planted with native wetland and prairie vegetation, improve water quality by filtering pollutants in the plant bed, through plant absorption and soil bacterial decomposition. Treated water is infiltrated into the surrounding soil or is collected by an underdrain system and discharged directly to a stormwater system or nearby receiving waters.

Wetlands and Naturalized Detention Areas: Conventional detention /retention basins store stormwater onsite and release the runoff gradually to a downstream drainage or water body. Naturalized detention areas mimic a natural lake or wetland by utilizing native plants along the perimeter of the water body. The wetland flat slopes at the perimeter of the water body and utilize a combination of vegetated and open water areas in the wetland basin. The design usually incorporates shallow zones of emergent vegetation at the edge of the wetland basin. Wetlands prevent flooding by temporarily storing the stormwater runoff and releasing the runoff gradually to downstream drainage areas.

Natural Landscaping: natural landscaping utilizes native vegetation, specifically prairie, wetland and woodland plants, in lieu of turf grasses and ornamental plantings. A site that is naturally landscaped will produce substantially less stormwater runoff than a conventional landscape site. Native vegetation enhances both absorption and evaporation of soil moisture due to the extensive root system which extends 5 to 10 feet or more into the soil. The reduced maintenance of natural landscaping not only saves money, but also reduces air, water and noise pollution.